Univerzitet u Beogradu
Fakultet sporta i fizičkog vaspitanja

Efekti primene fizičke aktivnosti na antropološki status dece, omladine i odraslih

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CONFERENCE PROCEEDINGS

Effects of Physical Activity Application to Anthropological Status with Children, Youth and Adults

Ministry of Education, Science and Technological Development, Republic of Serbia

FACULTY OF SPORT AND PHYSICAL EDUCATION UNIVERSITY OF BELGRADE

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Univerzitet u Beogradu
Fakultet sporta i fizičkog vaspitanja
Beograd, 11-12 decembar 2015.

MEĐUNARODNA NAUČNA KONFERENCIJA

EFEKTI PRIMENE FIZIČKE AKTIVNOSTI NA ANTROPOLOŠKI STATUS DECE, OMLADINE I ODRASLIH

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INTERNATIONAL SCIENTIFIC CONFERENCE

EFFECTS OF PHYSICAL ACTIVITY APPLICATION TO ANTHROPOLOGICAL STATUS WITH CHILDREN, YOUTH AND ADULTS

Conference Proceedings

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PREDGOVOR

Međunarodna naučna konferencija nam je omogućila da predstavimo aktuelne rezultate sopstvenih istraživanja i uspostavimo aktivnu komunikaciju sa tokovima istraživačkih trendova u graničnim oblastima praćenja efekata fizičke aktivnosti. Od 2011. godine, na osnovu obaveze iz projekta III 47015, realizujemo međunarodnu konferenciju pod istim nazivom: „EFEKTI PRIMENE FIZIČKE AKTIVNOSTI NA ANTROPOLOŠKI STATUS DECE, OMLADINE I ODRASLIH".

Formirano je zainteresovano jezgro istraživača koji redovno učestvuju u radu Konferencije i time daju podršku konceptu interdisciplinarne saradnje. Paralelni projekti (III-47015, III-47008 i 175037) koje realizuju nastavnici i saradnici sa više fakulteta u nekoliko timova koriste ovu Konferenciju kao mesto ukrštanja rezultata i sučeljavanja različitih istraživačkih ideja, na osnovu čega smo došli do Zbornika radova sa naše Međunarodne naučne konferencije.

Ranije opredeljenje dobija svoj puni smisao jer kroz rad Konferencije postižemo da se šira naučna javnost upozna sa poslednjim naučnim istraživanjima kojima se procenjuju efekti primene fizičke aktivnosti na antropološki status dece, omladine i odraslih, kao i mogućnosti primene dobijenih nalaza u praksi fizičkog vaspitanja, sporta, rekreacije i radu specijalizovanih ustanova.

Međunarodna naučna konferencija održana 2015. godine je donela nekoliko noviteta koje bi trebalo da zadržimo i za sledeće skupove:

- pored Ministarstva nauke, prosvete i tehnološkog razvoja podržalo nas je i Ministarstvo omladine i sporta u organizaciji Konferencije.
- pozivni predavačima su pored uvodnih tema imali po jedno dodatno predavanje za studente Doktorskih i Master diplomskih studija čime dajemo doprinos negovanju istraživačkog opredeljenja na ovim nivoima studija.

Strukturu konferencije činile su 4 odvojene sesije, kao i poster sesija, za koje je prijavljeno 74 rada, dok je na samoj Konferenciji predstavljeno 70 radova. Ponosni smo jer su u Međunarodni naučni odbor i recenzentski kolegijum uključeni eminentni naučni i stručni autoriteti iz 8 zemalja.

Naučni odbor je, prema kriterijumima koji su raspisani u pozivu za međunarodnu naučnu konferenciju, prihvatio radove na srpskom i engleskom jeziku u izvornoj formi koju su autori dostavili. Nekoliko radova nije prihvaćeno, a kod jedne trećine radova bila je potrebna korekcija. Konačno, sam Zbornik radova sastoji se od 44 rada in extenso koje su autori izložili na Konferenciji i koji su prošli dodatnu recenziju.

Predsednik Naučnog odbora
Prof. dr Goran Kasum

PREFACE

The International Scientific Conference enabled us to present current results of our research and establish active exchange about current tendencies in border areas of monitoring of physical activity effects. Since 2011, based on the project no. III 47015, we organize an international conference with the same topic: "EFFECTS OF PHYSICAL ACTIVITY APPLICATION TO ANTHROPOLOGICAL STATUS WITH CHILDREN, YOUTH AND ADULTS".

A core group of interested researches was formed and they regularly attend the conference and thus support interdisciplinary cooperation, Additional, ongoing projects (III-47015, III-47008 and 175037) realized by the teachers and associates from several faculties in a few teams use the Conference as the spot of intersection of results and discussions of various research ideas, and thus contributed to the Conference proceedings of our International Scientific Conference.

The earlier commitment gets its full meaning because, through the Conference work, we achieve that broader scientific community becomes familiar with the latest scientific research used to assess the effects of physical activity application to anthropological status of children, youth and adults, as well as the possibility of implementation of these findings in the practice of physical education, sports, recreation and work of specialized institutions.

The 2015 International Conference introduced several novelties that we should keep even for the next meetings:

- Beside the Ministry of Science, Education and Technological Development we were supported by the Ministry of Youth and Sport
- The invited lecturers, besides the plenary lectures, provided an additional lecture each for our master and doctoral students, which contributed to cherishing research dedication at this level of studies.

The Conference was composed of 4 main areas, and poster sessions, which reported 74 work, while at the Conference presented 70 papers. We are proud because the International Scientific Committee and Review collegium included eminent scientific and professional authorities from 8 countries.

The Scientific Board, according to the criteria from the invitation for the international conference, accepted papers in Serbian and English language in their original form, as received by the authors. Few papers were rejected and one third of papers required corrections. Finally, the Conference Proceedings included 44 papers in extenso presented at the Conference and additionally reviewed.

President of the Scientific Board

prof. Goran Kasum Ph.D

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RAZLIKE U EKPLOZIVNOJ SNAZI MIŠIĆA FUDBALERA I NESPORTISTA SREDNJEŠKOLSKOG UZRASTA

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UVOD

Savremena fudbalska igra obuhvata različite motoričke aktivnosti cikličnog i acikličnog tipa., tj., pokrete različitog obima i intenziteta. Sa biomehaničkog aspekta, pokreti u fudbalskoj igri kao što su udarci lopte, dueli, okreti, zamasi, sprintevi, promene pravca kretanja, udarci lopte glavom, zahtevaju dobru osnovu eksplozivne sile i snage mišića. Viši nivo ekplozivne snage fudbalera u odnosu na protivničkog igrača ogleda se u većoj brzini i ubrzanju, boljoj agilnosti (zaustavljanju, polasku, okretu, usporavanju), boljoj sposobnosti građenja lopte i odolevanja napadima protivnika, boljoj skočnosti igrača što pozitivno utiče na igru glavom, smanjenje rizika od povreda, itd. kao parametar koji ima značajan uticaj na sportsko postignuće u velikom broju individualnih i kolektivnih sportova, poželjno je da se eksplozivna snaga mišića utvrđena prilikom vertikalnog skoka dijagnostifikuje u redovnim vremenskim intervalima tokom trenažnog procesa. Prema Ostojić i sar. (2010), za dobijanje vrednosti vertikalnog skoka moguće je koristiti široku paletu dijagnostičke opreme, pri čemu je za dobijanje valjanih rezultata neophodno poštovati definisanu metodologiju testiranja. Problem je što mnogi igrači nemaju utvrđen nivo eksplozivne snage, barem ne direktnim putem, tj., savremenim, valjanim i pouzdanim uređajima. Postoje takođe, problemi sitematizaciji dostupnih istraživanja sa fudbalerima u kojoima se kao dobar pokazatelj eksplozivne snage mišića koristi vertikalni skok. Naime, takva istraživanja se ne mogu međusobno porediti usled metodoloških razlika, heterogenosti populacije ispitanika u odnosu na starost, različit nivo takmičenja, vrstu vertikalnog skoka, itd. Različiti modaliteti vertikalnog skoka utvrđuju različite parametre skočnosti, čime se omogućuje detaljnija analiza trenutnih sposobnosti i ukazivanje na eventualne slabosti koje je poželjno naglasiti u trenažnom procesu. Novija istraživanja eksplozivne snage mišića utvrđene primenom vertikalnog skoka kod fudbalera adolescenata, uglavnom potvrđuju pretpostavku o razlici u snazi mišića u odnosu na igračku poziciju u timu (Pivovarniček, Pupiš, Tonhauserova, i Tokarova, 2013; Sporiš, Jukić, Ostojić, i Milanović, 2009; Gissis i sar., 2006). Brojna istraživanja pokazuju značajno viši nivo visine skoka i snage mišića vrhunskih fudbalera u poređenju sa sportistima nižeg nivoa takmičenja competition (Haugen, Tonnessen, i Seiler, 2013; Ostojić, Stojanović, i Ahmetović, 2010; Ostojić, 2004). Osnovni cilj ovog istraživanja bio je da se kvantifikuju varijable ispoljene eksplozivne snage donjih ekstremiteta primenom skoka sa počučnjem (prema engl. Counter movement jump, CMJ), da se utvrde razlike u ispoljenoj ekplozivnoj snazi između fudbalera prema poziciji u timu, kao i razlike između fudbalera i nesportista.

METOD

Uzorak od 32 ispitanika, učenika Srednje ekonomske škole iz Niša, podeljen je na subuzorak fudbalera (prema igračkoj poziciji u timu: napadači, igrači sredine terena i odbrambeni igrači, N=16), koji se u odnosu na uzrast, takmiče u Kvalitetnoj ligi Srbije, i subuzorak nesportista (N=16), koji se ne bave sportom ni profesionalno, niti rekreativno. Fudbaleri su bili prosečne starosti 15,75±1,00 godina, a nesportisti 15,38±0,79 (Mean±Std.Dev.). Osnovni kriterijum za učešće u istraživanju bio je

dužina bavljenja fudbalom u trajanju od najmanje tri godine (kod sportista), kao i odsustvo oboljenja i povreda koji bi mogli negativno da utiču na zdravstveni status ispitanika i rezultate istraživanja (i kod sportista i kod nesportista). Istraživanje je sprovedeno uz pismeni pristanak svih ispitanika o učešću u predloženom projektu.

Antropometrijske karakteristike su procenjene sledećim varijablama:

- TELMAS(telesna masa izražena u kg),
- TELVIS (telesna visina izražena u cm) i
- BMI (indeks telesne mase, prema engl. Body mass index).

Upotrebom bežičnog akcelerometra Myotest, utvrđene su vrednosti sledećih varijabli eksplozivne snage donjih ekstremiteta:

- HEIGHT (visinaskoka izražena u cm),
- LEGPOWER (snagaprilikom skoka izražena u W/kg),
- LEGFORCE (sila prilikom skokaizražena u N/kg) i
- LEGVELOCITY (brzina prilikom skoka izražena u cm/s).

Istraživanje transverzalnog tipa sprovedeno je u okviru nacionalnog projekta „Razlike i uticaji maksimalne snage mišića na gustinu koštanog tkiva između sportista i nesportista srednjoškolskog uzrasta“ (OI179024), odobrenog i finansiranog od strane Ministarstva prosvete, nauke i tehnološkog razvoja Republike Srbije. Neposredno pre testiranja, ispitanici su sproveli „zagrevanje“, koje je podrazumevalo lagano trčanje u trajanju od 10-tak minuta i dinamičko istezanje u trajanju od 5 do 7 min. U cilju utvrđivanja eksplozivne snage donjih ekstremiteta, neposredno pred protokol skoka sa počučnjem, oko struka ispitanika postavljen je poseban pojas na koji je pričvršćen uređaj Myotest. Ispitanici su izvodili skokove, ukupno pet, na tvrdoj podlozi, bez zamaha ruku, kako bi svi ispitanici skakali pod istim uslovima i bez dodatnog impulsa koji bi mogao da utiče na vrednosti merenih varijabli (Bubanj, i sar., 2011). Vrednosti varijabli eksplozivne snage, očitavane su sa displeja uređaja Myotest. U cilju statističke obrade dobijenih podataka upotrebljen jepaket SPSS version 11, a dobijeni rezultati su prikazani deskriptivnom statistikom (tabelarno i grafički). Za utvrđivanje statistički značajnih razlika u vrednostima varijabli eksplozivne snage korišćena je analiza varijanse, tj.One-way ANOVA metoda.

REZULTATI

Deskriptivne statistike

Tabela 1. Deskriptivna statistika

Grupa	Fudbaleri				Nesportisti				Ukupno			
	Mean	Std. Dev.	Min.	Max.	Mean	Std. Dev.	Min.	Max.	Mean	Std. Dev.	Min.	Max.
TELVIS (u cm)	178,19	4,34	169,00	187,00	180,81	9,84	160,00	199,00	179,50	7,60	160,00	199,00
TELMAS (u kg)	66,09	4,39	59,00	73,50	71,00	8,52	52,00	85,00	68,55	7,12	52,00	85,00
BMI	20,84	1,51	18,16	22,91	21,69	1,77	18,81	25,83	21,26	1,67	18,16	25,83
JUMPHEIGHT (u cm)	34,78	3,69	28,30	41,10	27,34	5,26	16,50	34,30	31,06	5,85	16,50	41,10
JUMPPOWER (u W/kg)	46,29	8,16	28,40	57,40	47,26	7,98	26,30	55,20	46,78	7,96	26,30	57,40
JUMPFORCE (u N/kg)	29,87	4,01	22,10	38,20	30,41	4,13	19,80	35,50	30,14	4,01	19,80	38,20
JUMPVELOCITY (u cm/s)	240,38	25,37	184,00	272,00	230,44	23,32	179,00	259,00	235,41	24,50	179,00	272,00

Normalnost raspodele podataka je testirana testom Kolmogorov-Smirnova (tabela 2).

Tabela 2. Kolmogorov-Smirnov test

	JUMPHEIGHT (u cm)	JUMPPOWER (u W/kg)	JUMPFORCE (u N/kg)	JUMPVELOCITY (u cm/s)
Fudbaleri	,742	,881	,994	,296
Nesportisti	,994	,423	,909	,964

Na osnovu dobijenih značajnosti zaključuje se da je raspodela svih podataka normalna, kako u grupi fudbalera, tako i u grupi nesportista, te se pristupilo utvrđivanju razlika, parametrijskom procedurom. Razlike u prosečnim vrednostima parametara ekplozivne snage između fudbalera i nesportista, testirane su t-test-om za nezavisne uzorke (tabela 3).

Tabela 3. T-test za nezavisne uzorke.

	Grupa	N	Mean	Std. Deviation	t	sig
JUMPHEIGHT (u cm)	Fudbaleri	16	34,77	3,68	4,632	**,000**
	Nesportisti	16	27,33	5,25		
JUMPPOWER (u W/kg)	Fudbaleri	16	46,29	8,16	-,337	,738
	Nesportisti	16	47,25	7,98		
JUMPFORCE (u N/kg)	Fudbaleri	16	29,86	4,00	-,378	,708
	Nesportisti	16	30,41	4,12		
JUMPVELOCITY (u cm/s)	Fudbaleri	16	240,37	25,37	1,153	,258
	Nesportisti	16	230,43	23,32		

nivo značajnosti: p<0,05

Na osnovu značajnosti t-testa može se zaključiti da statistički značajne razlike postoje samo u vrednostima parametra JUMPHEIGHT (sig=**0,000**), i to u korist fudbalera. U ostalim merenjima nema statistički značajnih razlika između fudbalera i nesportista. Razlike u prosečnim vrednostima parametara ekplozivne snage između fudbalera prema poziciji u timu testirane su ANOVA metodom. Dobijeni su sledeći rezultati (tabela 4).

Tabela 4. ANOVA metoda.

	Odbrana		Sredina		Napad		F	sig
	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation		
JUMPHEIGHT (u cm)	33,40	3,54	31,15	3,77	34,06	3,58	,781	,478
JUMPPOWER (u W/kg)	45,68	11,89	44,00	17,10	51,44	4,21	,530	,601
JUMPFORCE (u N/kg)	28,01	5,01	30,30	7,08	31,2	3,92	,597	,565
JUMPVELOCITY (u cm/s)	234,57	39,63	220,50	50,99	250,20	12,31	,723	,504

Na osnovu dobijenih značajnosti može se tvrditi da ne postoje razlike u prosečnim vrednostima eksplozivne snage između fudbalera koji igraju na različitim pozicijama u timu.

DISKUSIJA

Prema Malina, Eisenmann, Cumming, Ribeiro, i Aroso (2003), telesna visina i masa značajno doprinose visini vertikalnog skoka kod fudbalera starosti od 13 do 15 godina. Obzirom da su subuzorci fudbalera i nesportista u okviru ovog istraživanja ujednačeni po polu, uzrastu, telesnoj visini i masi (fudbaleri 15,75±1,00 godina, 178,19±4,34cm i 66,09±4,39 kg; nesportisti 15,38±0,79 godina, 180,81±9,84cm i 71,00±8,52 kg, Mean±Std.Dev.), utvrđene razlike u visini skoka mogu da se pripišu regularnom trenažnom procesu. Sa druge strane, upoređujući same fudbalere prema poziciji u timu, Stroyer, Hansen, i Klausen (2004) navode da su razlike između fudbalera prisutne već u pubertetu, i da su u odnosu na nivo takmičenja i igračku poziciju u timu, genetski uslovljene. Tourny-Chollet, Leroy, Léger, i Beuret-Blanquart (2000), kao i Reilly, Bangsbo, i Franks (2000), navode da postoje razlike u snazi mišića kod fudbalera prema poziciji u timu, što u okviru ovog istraživanja nije potvrđeno. Ipak, prema istraživanju Reilly i sar. (2000), značajno manja snaga mišića utvrđena je kod igrača sredine terena u odnosu na igrače na ostalim pozicijama. Oberg, Ekstrand, Möller, i Gillquist (1984) su takođe, utvrdili razlike u snazi fudbalera prema poziciji u timu, tj., značajno veću snagu pregibača i opružača u zglobu kolena kod napadača u odnosu na golmane ($P<0.001$) i napadača u odnosu na odbrambene igrače ($P<0.001$). Haugen, Tonnessen, i Seiler (2013) istraživali su razlike u visini vertikalnog skoka (skoka sa počučnjem) kod 939 fudbalera nacionalne selekcije Norveške za period od 1995. do 2010. godine, prosečne starosti 22,1±4,3 godina. Ustanovljeno je da su igrači sredine terena ostvarili niže vrednosti skoka u odnosu na igrače svih ostalih pozicija u timu, u proseku za 2 cm ($p<0,05$). Sporiš, Jukić, Ostojić, i Milanović (2009) utvrdili su da napadači poseduju najviši nivo eksplozivnih sposobnosti mišića u odnosu na sve ostale igrače na terenu. Istraživanjem je obuhvaćeno 270 fudbalera (po 80 iz odbrane, sredine i napada, kao i 30 golmana). Primenom metode ANOVA, utvrđena je statistički značajna razlika u eksplozivnoj snazi mišića ispoljenoj vertikalnim skokom, između igrača napada i odbrane, kao što je navedeno u korist napadača, a čak su i golmani ispoljili veće vrednosti eksplozivne snage u odnosu na igrače sredine terena. Gissis et al. (2006) utvrdili su visinu vertikalnog skoka kod mladih fudablera Grčke (N=54) podeljenih u grupe: fudbalera mlade reprezentacije Grčke (N=18), kvalitetnih mladih fudbalera (N=18) i fudbalera rekreativaca (N=18). Ustanovljena je razlika u visini skoka ($p<0,05$) u korist nacionalne fudbalske selekcije u odnosu napreostale dve grupe. Razlika između kvalitetnih mladih fudbalera i fudbalera rekreativaca nije ustanovljena. Pivovarniček, Pupiš, Tonhauserova, & Tokarova, (2013) su u istraživanju koje je obuhvatilo 36 fudbalera Slovačkog nacionalnog tima starosti do 21 godine, ispitivali visinu skoka prilikom skoka sa počučnjem i skoka iz čučnja sa zamahom ruku. Prosečna visina skoka iznosila je 39,0±4,2 cm (Mean±Std.Dev.). Najvišavrednostvisine skoka utvrđena je kod napadača (39,9±4,8 cm), potom kod odbrambenih igrača (39,6±5,4 cm), golmana(39,2±4,0 cm) i najzad, veznih igrača (38,0±3,8 cm). Sa druge strane, Mujika, Santisteban, Impellizzeri & Castagna (2009) nisu utvrdili statistički značajnu razliku ($p>0,05$) u visini vertikalnog skoka (skoka sa počučnjem sa i bez zamaha rukama), između vrhunskih fudbalera seniorskog i juniorskog uzrasta (N=17). Dakle, među dostupnim istraživanjima preovlađuju ona u kojima se navodi da kod fudbalera postoje razlike u eksplozivnoj snazi mišića u odnosu na poziciju u timu, i to već u periodu adolescencije. Izostanak razlika u eksplozivnoj snazi prema poziciji u timu, među fudbalerima Radničkog iz Niša, ukazuje na neophodnost precizno određenog programa treninga eksplozivne snage, naravno vodeći računa o zdravstvenom statusu svakog fudbalera ponaosob.

ZAKLJUČAK

Na osnovu ciljeva istraživanja, sprovedene metodologije i dobijenih rezultata može se zaključiti da da statistički značajne razlike postoje samo u vrednostima parametra JUMPHEIGHT, i to u korist fudbalera. Razlike između fudbalera koji igraju na različitim pozicijama u timu nisu utvrđene. Dobijeni rezultati poslužiće trenerima, a i samim ispitanicima u kreiranju budućeg trenažnog rada, odnosno sprovođenja odgovarajućih programa sa ciljem razvoja eksplozivne snage mišića.

Zahvalnost

Rad pod nazivom „razlike u ekplozivnoj snazi mišića fudbalera i nesportista srednješkolskog uzrasta“ proizašao je iz nacionalnog projekta OI 179024 „Razlike i uticaji maksimalne snage mišića na gustinu koštanog tkiva između sportista i nesportista srednjoškolskog uzrasta“. Autori se zahvaljuju na saradnji učenicima i zaposlenim u Srednjoj ekonomskoj školi u Nišu, gde se projekat sprovodi, kao i Ministarstvu prosvete, nauke i tehnološkog razvoja Republike Srbije, koje je odbrilo i finansira projekat.

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THE DIFFERENCES IN THE EXPLOSIVE MUSCLE STRENGTH OF FOOTBALL PLAYERS AND NON-ATHLETES IN HIGH SCHOOL AGE

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INTRODUCTION

The contemporary football game features different motoric activities of acyclical and cyclical type, i.e., the movements of different size and intensity. From the biomechanical aspect, the movements in the football game such as goal kicks, duels, turns, swings, sprints, dribbles, headers, require a good muscle strength and explosive force. The higher level of explosive force of footballers in relation to rivals mirrors the higher velocity and acceleration, better agility (stopping, starting, turning, slowing down), better ability of ball obstruction and resistance to the attacks of rivals, better jumping of the players which positively influences headers, reduces injury risks, etc. As a parameter which significantly influences sport achievement in a great number of individual and collective sports, it is desirable for the explosive muscle strength determined during vertical jump, to be diagnosed in regular time intervals during the training process. According to Ostojić et al. (2010), it is possible to use a wide spectre of diagnostic equipment to determine values of the vertical jump, while it is necessary to respect the testing methodology in order to get valid results. The problem is that many players do not have determined parameters of explosive strength, at least not in a direct way, i.e., by contemporary valid and reliable devices. There are also certain difficulties in making a systematization of available research with football players, where vertical jump is carried out as a good indicator of explosive muscle strength. Namely, such research can not be mutually compared in a complete way because of the methodological differences, the heterogeneity of population examinees regarding age, different level of competition, a type of vertical jump, etc. Different modalities of vertical jump determine different parameters of jumping, which take a more detailed analysis of current abilities possible and they, as well, point to possible weaknesses which are desirable to be emphasized in the training process. Recent research of explosive muscle strength determined in adolescent football players by vertical jump, confirms mainly the assumption about the difference in muscle strength in relation to the team game position (Pivovarniček, Pupiš, Tonhauserova, & Tokarova, 2013; Sporiš, Jukić, Ostojić, & Milanović, 2009; Gissis et al., 2006). Numerous studies show a significantly higher values of jump height and maximal muscle strength in the top athletes compared to the athletes of lower rank of competition (Haugen, Tonnessen, & Seiler, 2013; Ostojić, Stojanović, & Ahmetović, 2010; Ostojić, 2004). The main aim of the current research was to quantify variables of the achieved explosive strength of lower extremities by applying Counter movement jump (CMJ), to determine difference in achieved explosive strength between football players regarding their position in team, as well as the differences between football players and non-athletes.

METHOD

The sample of 32 examinees, high-school students of Secondary Economics School in Nis, is divided into subsample of football players (according to the position in team: attackers, middle line players, defenders, N=16), who, according to their age, compete in a quality Serbian league and a

subsample of non-athletes (N=16), who don't go in for sport, either professionally, or recreationally. The avegare age in football players was 15,75±1,00 years, and 15,38±0,79 years in non-athletes (Mean±Std.Dev.). The basic criterium to participate in research was the time of practicing football which is at least three years (with athletes), as well as the absence of illness and injuries which could influence the health status of examinees and the results of research in a negative way (with athletes and non-athletes). The research was conducted with the written consent of all examinees to participate in the proposed project.

The anthropometric characteristics are estimated by the following variables:

- BODYMASS (expressed in kg),
- BODYHEIGHT (expressed in cm) and
- BMI (Body Mass Index).

Using wireless accelerometer Myotest, the values of the following variables of the explosive strength of the lower extremities are determined:

- JUMPHEIGHT (expressed in cm),
- JUMPPOWER (expressed in W/kg),
- JUMPFORCE (expressed in N/kg) and
- JUMPVELOCITY (expressed in cm/s).

Immediately, before testing, the examinees had a "warm-up" which consisted of jogging for 10 minutes and dynamic stretching which lasted for 5 to 7 mnutes. In order to determine explosive strength of lower extremities, immediately before CMJ, a special belt with the Myotest device was fastened around the waist of the examinees. The examinees performed jumps, five in total, on hard surface without the swing of arms, so that all of them would jump under the same conditions and without additional impulses which could influence the values of measured variables (Bubanj, et al., 2011). The values of the explosive strength variables were read from the display of the Myotest device. In order to statistically process achieved data, version 11 of the package SPSS was used, and the achieved results were shown by descriptive statistics (tables and graphs). To determine statistically significant differences in the explosive strength values, one way ANOVA method was used.

RESULTS

Table 1. Descriptive statistics

Group	Football players				Non-atheletes				Total			
	Mean	Std. Dev.	Min.	Max.	Mean	Std. Dev.	Min.	Max.	Mean	Std. Dev.	Min.	Max.
BODYHEIGHT (in cm)	178,19	4,34	169,00	187,00	180,81	9,84	160,00	199,00	179,50	7,60	160,00	199,00
BODYMASS (in kg)	66,09	4,39	59,00	73,50	71,00	8,52	52,00	85,00	68,55	7,12	52,00	85,00
BMI	20,84	1,51	18,16	22,91	21,69	1,77	18,81	25,83	21,26	1,67	18,16	25,83
JUMPHEIGHT (in cm)	34,78	3,69	28,30	41,10	27,34	5,26	16,50	34,30	31,06	5,85	16,50	41,10
JUMPPOWER (in W/kg)	46,29	8,16	28,40	57,40	47,26	7,98	26,30	55,20	46,78	7,96	26,30	57,40
JUMPFORCE (in N/kg)	29,87	4,01	22,10	38,20	30,41	4,13	19,80	35,50	30,14	4,01	19,80	38,20
JUMPVELOCITY (in cm/s)	240,38	25,37	184,00	272,00	230,44	23,32	179,00	259,00	235,41	24,50	179,00	272,00

The normal distribution of date tested by Kolmogorov-Smirnov test (table 2).

Table 2. Kolmogorov-Smirnov test

	JUMPHEIGHT (in cm)	JUMPPOWER (in W/kg)	JUMPFORCE (in N/kg)	JUMPVELOCITY (in cm/s)
Football players	,742	,881	,994	,296
Non-athletes	,994	,423	,909	,964

According to determined significances, it could be concluded that the distribution to all of data is normal, as in the group of football players, as well as in the group of non-athletes, which justified further use of parametric procedure. The differences in the average values of explosive strength variables between football players and non-athletes was tested by t-test for independent samples (Table 3).

Table 3. T-test for independent samples

	Group	N	Mean	Std. Deviation	t	sig
JUMPHEIGHT (in cm)	Football players	16	34,77	3,68	4,632	**,000**
	Non-athletes	16	27,33	5,25		
JUMPPOWER (in W/kg)	Football players	16	46,29	8,16	-,337	,738
	Non-athletes	16	47,25	7,98		
JUMPFORCE (in N/kg)	Football players	16	29,86	4,00	-,378	,708
	Non-athletes	16	30,41	4,12		
JUMPVELOCITY (in cm/s)	Football players	16	240,37	25,37	1,153	,258
	Non-atheletes	16	230,43	23,32		

Level of significance: p<0,05

According to the significance of t-test (table 3), it could be concluded that statistically significant differences exist in the variable JUMPHEIGHT (sig=**0,000**), in behalf of football players. In other parameters there are not statistically significant differences between football players and non-athletes. The differences in average explosive strength variables among football players according to their position in team were tested by ANOVA method. The following results are accomplished (Table 4).

Table 4. ANOVA method

	Defence		Middle line		Attack		F	sig
	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation		
JUMPHEIGHT (in cm)	33,40	3,54	31,15	3,77	34,06	3,58	,781	,478
JUMPPOWER (in W/kg)	45,68	11,89	44,00	17,10	51,44	4,21	,530	,601
JUMPFORCE (in N/kg)	28,01	5,01	30,30	7,08	31,2	3,92	,597	,565
JUMPVELOCITY (in cm/s)	234,57	39,63	220,50	50,99	250,20	12,31	,723	,504

According to the determined significances, it could be concluded that there are no differences in explosive strength among football players who play in different positions in team.

DISCUSSION

According to Malina, Eisenmann, Cumming, Ribeiro, & Aroso et al. (2003), body height and body mass contribute significantly to the vertical jump height with football players of 13 to 15 years of age. Since the subsamples of football players and non-athletes within this research are of the same sex, similar age, body height and and body mass (football players 15,75±1,00 years, 178,19±4,34 cm and 66,09±4,39 kg; non-athletes 15,38±0,79 years, 180,81±9,84 cm and 71,00±8,52 kg, Mean±Std. Dev.), determined differences in jump height could be assigned the regular training process. On the other side, if comparing the very football players according to their positon in team Stroyer, Hansen, & Klausen (2004) cite that the differences among football players are aleready present in puberty and that differences are genetically conditioned, as far as the level of competition and position in team are concerned. Tourny-Chollet, Leroy, Léger, & Beuret-Blanquart (2000), as well as Reilly, Bangsbo, & Franks (2000), claim that there are differences in explosive muscle strength with football players regarding their position in team, which within this research is not confirmed. However, according to the research of Reilly et al. (2000), a significantly lower level of muscle strength is determined with the "middle line" players regarding players at other positions. Oberg, Ekstrand, Möller, & Gillquist (1984) also determined differences in football players' strength regarding their position in team, i.e., a significantly greater strength while flexing and stretching in the knee joint with attackers compared to goal keepers ($P<0.001$) and attackers compared to defenders ($P<0.001$). Haugen, Tonnessen, & Seiler (2013) researched differences in the height of vertical jump (CMJ) with 939 football players in the Norwegian national team for the period of 1995-2010, the average age 22,1±4,3 years. It is determined that the football players of the middle line achieved lower values of jumping height compared to the players at other positions in team, in the average for 2 cm ($p<0,05$). Sporiš, Jukić, Ostojić, & Milanović (2009) determined that attackers have the heighest level of the explosive muscle abilities compared to other players on the pitch. The research included 270 football players (80 from defense, middle line and attack, as well as 30 goal keepers). By using the ANOVA method, a statistically significant difference in the explosive muscle strength was achieved in vertical jump, beteen the attackers and defenders, as it is said, in behalf of attackers; even goal keepers showed higher values of explosive strength compared to the players of the middle line. Gissis et al. (2006) determined the height of vertical jump with younger football players of Greece (N=54) divided into groups: football players of young Greek national team (N=18), quality young football players (N=18) and recreational football players (N=18). The difference in jump height ($p<0,05$) was determined in behalf of national football team compared to other two groups. The difference between quality young football players and recreational football players is not determined. Pivovarniček, Pupiš, Tonhauserova, & Tokarova, (2013) conducted research with 36 football players of the Slovak national team, 21 years of age; they examined the height of vertical jump with the arms swing. The average jump height was 39,0±4,2 cm (Mean±Std.Dev.). The jump was determined with attackers (39,9±4,8 cm), then with defenders (39,6±5,4 cm), goal keepers (39,2±4,0 cm) and at last, middle line players (38,0±3,8 cm). On the other hand, Mujika, Santisteban, Impellizzeri & Castagna (2009) did not determine statistically significant difference ($p>0,05$) in vertical jump height (vertical jump with and without the arm swing), among top football players of senior and junior age (N=17). So, results of previous research, mostly confirm existance of differences in the explosive muscle strength among football players compared to their position in team, even in the age of adolescence. The absence of differences in the explosive strength according to the position in team, among football players from Niš, point to the necessity of the precisely determined training program of explosive strength, taking into account the health status of every football player himself.

CONCLUSION

According to the aims of research, conducted methodology and results, it could be concluded that difference between football players and non-athletes exist in variable JUMPHEIGHT, in behalf of football players. No difference in explosive strength was determined among football players who play at the different postions in team. The obtained results could be used by trainers, as well as by examinees in creating the future training process, i.e., by conducting appropriate programs with the aim of developing explosive muscle strength.

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METRIJSKE KARAKTERISTIKE MERNIH INSTRUMENATA ZA UTVRĐIVANJE EKPLOZIVNE SNAGE MIŠIĆA

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UVOD

Za evaluaciju eksplozivne snage mišića, tokom vremena su razvijene brojne kategorije testova koje je moguđe primeniti u labaratorijskim i terenskim uslovima. Posebnu grupu testova snage mišića i anaerobnih sposobnosti čine testovi pojedinačnih ili serijskih vertikalnih skokova (Lara, Abián, Alegre, Jiménez, i Aguado, 2006). U određivanju visine vertikalnog skoka mogu se koristiti različite metode, recimo tradicionalne metode, kao što su „dohvat" obeleženih rastojanja između markera, analiza pokreta pomoću računarskih sistema i druge (Nuzzo, Anning, i Scharfenberg, 2011). Sa aspekta biomehanike, utvrđivanje snage mišića dinamometrom odnosno tenziometrijskom platformom, sa jedne strane, predstavlja zlatni standard u kvantifikaciji parametara eksplozivne snage mišića. Sa druge strane, savremeni nekontaktni uređaji, predstavljaju inovativan pristup u proceni eksplozivne snage mišića. Metodologije istraživanja sa navedenim uređajima, primenjene u laboratorijskim ili terenskim uslovima, nalaze se u fokusu interesovanja istraživača, trenera i sportista (Bubanj, Bubanj, Stanković, i Đorđević, 2010). Stoga je važno da se obezbedi da evaluacija eksplozivne snage mišića pri istraživanjima bude validna i pouzdana, kako upotrebom tenziometrijske platforme, tako i nekontaktnih uređaja (Glatthorn, Gouge, Nussbaumer, Stauffacher, Impellizzeri, i Maffiuletti, 2011). U kineziološkim merenjima greške merenja najčešće nastaju kao rezultat merenja različitih merilaca, različitih merenja istog merioca, variranja merene karakteristike u toku dana (npr., telesna visina varira oko 1 cm u toku dana), merenja različitom mernom aparaturom, nejednako baždarene merne aparature, slučajnih grešaka pri primeni bilo kojeg mernog instrumenta. Na smanjenje greške merenja moguće je uticati dobrom uvežbanošću merilaca, pridržavanjem standardiziranog postupka merenja, kvalitetnom mernom opremom koja se redovno baždari, te sprovođenjem merenja u isto vreme ili u vrlo kratkom vremenskom razmaku (Sportexpert, n.d.). Tenziometrijska platforma (HBO, Nemačka) je merni instrument koji registruje vektor sile (koji deluje na površinu platforme) u funkciji vremena. Platforma je značajna i ima široku primenu u utvrđivanju sile reakcije podloge, udarnog (-ih) impulsa tj., interakcije između sportiste i sprave. Tenziometrijska platforma se koristi za utvrđivanje snage mišića tokom vertikalnih skokova. Pomoću nje moguće je, pored standardnih parametara, pratiti dinamiku i razvoj sile, ubrzanje tokom izvođenja skoka i druge parametre (Ostojić, Stojanović, M., i Ahmetović, et al., 2010). Myotest (Švajcarska) je akcelerometar sa pripadajućim softverom koji omogućava utvrđivanje odgovarajućih varijabli prilikom različitih vrsta vertikalnih skokova. Pričvršćuje se na Veltrec pojas koji se nalazi oko struka ispitanika i tokom izvođenja vertikalnog skoka beleži vertikalno ubrzanje tela. Dizajniran je, između ostalog i za procenu visine vertikalnog skoka (Casartelli, Müller, R., i Maffiuletti, 2010). Osnovni cilj ovog istraživanja bio je da se utvrde valjanost i pouzdanost, kao metrijske karakteristike mernih instrumenata tenziometrijske platforme HBO (Nemačka) i akcelerometra Myotest (Švajcarska), i ujedno kvantifikuju parametri eksplozivne snage donjih ekstremiteta, fudbalera srednješkolskog uzrasta.

METOD

Uzorak od 16 ispitanika, učenika Srednje ekonomske škole iz Niša, sačinjavali su fudbaleri (N=16), koji treniraju najmanje tri godine (što je bio jedan od osnovnih kriterijuma za učešće u istraživanju) i koji se u odnosu na uzrast takmiče u kvalitetnoj ligi Srbije. Ispitanici su bili prosečne starosti 15,75±1,00 godina, telesne visine 178,19±4,34 cm, telesne mase 66,09±4,39 i indeksa telesne mase 20,84±1,51 (Mean±Std.Dev.). Drugi kriterijum za učešće u istraživanju bio je odsustvo oboljenja i povreda koji bi mogli negativno da utiču na zdravstveni status ispitanika i rezultate istraživanja. Istraživanje je sprovdeno uz pismeni pristanak svih ispitanika za učešće u predloženom projektu, koji podrazumeva da su ispitanici prethodno upoznati sa ciljem i zadacima istraživanja.

Upotrebom tenziometrijske platforme HBO, utvrđene su vrednosti sledećih varijabli eksplozivne snage donjih ekstremiteta:

1) MSRPODS_T i 2) MSRPODS_R (maksimalna sila reakcije podloge na prvom i ponovljenom merenju u fazi odskoka, izražena u N),

3) MSRPDOS_T i 4) MSRPDOS_R (maksimalna sila reakcije podloge na prvom i ponovljenom merenju u fazi doskoka, izražena u N),

5) UBRZODS_T i 6) UBRZODS_R (ubrzanje tela na prvom i ponovljenom merenju u fazi odskoka, izraženo u m/s^2) i

7) UBRZDOS_T i 8) UBRZDOS_R (ubrzanje tela na prvom i ponovljenom merenju u fazi doskoka, izraženo u m/s^2).

Upotrebom bežičnog akcelerometra Myotest, utvrđene su vrednosti sledećih varijabli eksplozivne snage donjih ekstremiteta:

9) VISSKOK_T i 10) VISSKOK_R (visina skoka na prvom i ponovljenom merenju, izražena u cm),

11) SNAGASKOK_T i 12) SNAGASKOK_R (snaga prilikom skoka na prvom i ponovljenom merenju, izražena u W/kg),

13) SILASKOK_T i 14) SILASKOK_R (sila prilikom skoka na prvom i ponovljenom merenju, izražena u N/kg) i

15) BRZSKOK_T i 16) BRZSKOK_R (brzina prilikom skoka na prvom i ponovljenom merenju, izražena u cm/s).

Neposredno pre testiranja, ispitanici su sproveli „zagrevanje“, koje je podrazumevalo lagano trčanje u trajanju od 10-tak minuta i dinamičko istezanje u trajanju od 5 do 7 minuta. U cilju utvrđivanja eksplozivne snage donjih ekstremiteta, neposredno pred protokol skoka sa počučnjem, oko struka ispitanika postavljan je poseban pojas na koji je pričvršćen uređaj Myotest. Ispitanici su izvodili skokove sa počučnjem (Bubanj, et al., 2011), ukupno 10 tj., po pet u test i retest seriji, na tenziometrijskoj platformi i bez zamaha ruku (postavljenim o bokove), kako bi svi skakali pod istim uslovima i bez dodatnih impulsa, koji mogu da utiču na vrednosti merenih varijabli. Dve serije skokova odvojene su međusobno pauzom u trajanju od 10 min zbog odmora. Vrednosti varijabli eksplozivne snage, očitavane su ekrana računara vezanog za tenziometrisku platformu i sa displeja uređaja Myotest. U cilju statističke obrade dobijenih podataka upotrebljen je paket SPSS version 11, a dobijeni rezultati su prikazani deskriptivnom statistikom (tabelarno i grafički). Valjanost je ispitivana faktorskom analizom. Pouzdanost mernih instrumenata je testirana Test-retest metodom, kao i analizom pouzdanosti, tj. Cronbach-ovim α-koeficijentom za određivanje mere pouzdanosti motoričkog testa pod hipotezom da sve čestice podjenako učestvuju u određivanju glavnog predmeta merenja.

REZULTATI

U Tabeli 1. Prikazan je broj observacija, minimalna imaksimalna vrednost, srednja vrednost i standardna devijacija posmatranih varijabli.

Tabela 1. Deskriptivna statistika

Uređaj		N	Minimum	Maximum	Mean	Std. Dev.
HBO (TEST)	MSRPODS_T (N)	16	981,00	1569,60	1285,72	200,20
	MSRPDOS_T (N)	16	1432,26	1854,09	1597,80	106,25
	UBRZODS_T (m/s^2)	16	5,41	13,34	9,65	2,76
	UBRZDOS_T (m/s^2)	16	12,75	17,54	14,40	1,32
Myotest (TEST)	VISSKOK_T1 (cm)	16	27,20	39,40	33,04	3,56
	SNAGASKOK_T (W/kg)	16	19,80	58,00	47,06	11,38
	SILASKOK_T (N/kg)	16	19,20	37,40	29,60	5,14
	BRZSKOK_T (cm/s)	16	145,00	269,00	235,94	36,35
HBO (RETEST)	MSRPODS_R (N)	16	981,00	1530,36	1329,87	153,11
	MSRPDOS_R (N)	16	1324,35	1893,33	1613,13	145,46
	UBRZODS_R (m/s^2)	16	5,94	13,86	10,36	2,40
	UBRZDOS_R (m/s^2)	16	10,88	18,12	14,62	1,91
Myotest (RETEST)	VISSKOK_R (cm)	16	28,30	41,10	34,78	3,69
	SNAGASKOK_R (W/kg)	16	28,40	57,40	46,29	8,16
	SILASKOK_R (N/kg)	16	22,10	38,20	29,87	4,01
	BRZSKOK_R (cm/s)	16	184,00	272,00	240,38	25,37

Valjanost je ispitivana faktorskom analizom (tabela 2). Dobijeni su sledeći rezultati. Faktorskom analizom su izdvojena dva faktora koja objašnjavaju ukupno 69,87% varijanse svih merenja.

Tabela 2. Faktorska analiza

Merenje	Faktor 1	Faktor 2
UBRZODS (m/s^2)	,351	**,812**
MSRPODS (N)	,558	**,728**
UBRZDOS (m/s^2)	-,097	**,685**
MSRPDOS (N)	,483	**,509**
SNAGASKOK (W/kg)	**,955**	-,231
BRZSKOK (cm/s)	**,909**	-,311
SILASKOK (N/kg)	**,811**	-,230
VISSKOK (cm)	**,526**	-,346
Karakteristična vrednost	3,35	2,24
% varijanse	41,87	28,00

Na osnovu rasporeda varijabli po faktorima, može se zaključiti su varijable idealno raspoređene po faktorima. Prvi faktor predstavlja merenja akcelerometrom, dok je drugi faktor određen varijalama tenziometrijske platforme.

Naredne dve tabele predstavljene su radi oslikavanja pouzdanosti akcelerometrijskog sistema Myotest-a i tenzijometrijske platforme. Pouzdanost mernih instrumenata testirana je najpre Test-retest metodom (tabela 3).

Tabela 3. Test-retest metoda pouzdanosti

	Myotest				HBO			
	HEIGHT (cm)	POWER (W/kg)	FORCE (N/kg)	VELOCITY (cm/s)	MSRPODS (N)	MSRPDOS (N)	UBRZODS (m/s^2)	UBRZDOS (m/s^2)
R (test-retest)	**,893****	**,857****	**,849****	**,928****	**,862****	**,817****	**,810****	**,730****
sig.	**,000**	**,000**	**,000**	**,000**	**,000**	**,000**	**,000**	**,001**

Na osnovu vrednosti i značajnosti Pirsonovog koeficijenta korelacije može se zaključiti da je i kod akcelerometra i kod tenziometrijske platforme prisutna visoka pouzdanost, doduše, nešto niža kod tenziometrijske platforme u odnosu na akcelerometar. Pouzdanost je testirana i metodom Cronbach's alpha. Dobijeni su rezultati slični prethodnoj analizi (tabela 4).

Tabela 4. Vrednost Cronbach's alpha koefeicijenta

	Myotest	HBO
Cronbach's Alpha	,818	,689

Kod akcelerometra je pouzdanost visoka, dok je kod tenziometrijske platforme pouzdanost takođe dobra, ali nešto niža.

DISKUSIJA

S obzirom na cilj merenja, valjanost mernih instrumenata može se posmatrati sa dva osnovna stajališta: 1) ako je cilj merenja utvrđivanje stanja, odnosno nivoa pojedinih antropoloških karakteristika nekog ispitanika, tada se radi o tzv. dijagnostičkoj valjanosti; 2) ako je cilj merenja prognoza uspešnosti u nekoj aktivnosti na temelju rezultata prikupljenih nekim mernim instrumentom, tada se radi o tzv. pragmatičnoj ili prognostičkoj valjanost. Pouzdanost je metrijska karakteristika koja se odnosi na tačnost mjerenja, tj. na nezavisnost merenja od nesistematskih pogrešaka. Problem pouzdanosti veže se uz problem konzistentnosti (doslednosti) rezultata u ponovljenim merenjima. U svakom mernom postupku na rezultate deluju, osim veličine predmeta merenja, i neki sistematski i nesistematski faktori. Sistematski faktori mogu izazivati stalni porast ili pad rezultata (npr., učenje, umor, razvoj, itd.), te ih je moguće kontrolisati i ukloniti. Njihov se uticaj može tumačiti kao stvarna promena u veličini predmeta merenja, te nisu zanimljivi teoriji pouzdanosti. Nesistematski faktori uzrokuju slučajne varijacije rezultata merenja, te utiču na nepouzdanost merenja, jer promene koje ti faktori izazivaju nisu posledica promene predmeta merenja. Upravo njihovim uzrocima i posledicama bavi se teorija pouzdanosti (Sportexpert, n.d.). U aktuelnom istraživanju cilj je bio da se utvrdi valjanost i pouzdanost tenzometrijske platforme HBO i akcelerometra Myotest, što je rezultatima i utvrđeno, kao i da se kvantifikuju vrednosti eksplozivne snage primenom vertikalnog skoka, tj utvrdi stanje kao osnova za dalji razvoj i napredovanje fudbalera srednješkolskog uzrasta iz Niša. Na internetu ne postoje dostupne informacije o istraživanjima iz prostora eksplozivne snage mišića, koja su sprovedena na uzorku sportista upotrebom tenziometrijske platforme HBO (Nemačka). U skladu sa tim, aktuelno istraživanje predstavlja doprinos u afirmaciji ispitivanih metrijskih karakteristika navedenog uređaja. Sa druge strane, postoje dostupna istraživanja navedenih metrijskih karakteristika, na uzorku sportista i primenom vertikalnog skoka, čiji rezultati takođe, potvrđuju valjanost i pouzdanost akcelerometra Myotest (Choukou, Laffaye, i Taiar, 2014; Mauch, Rist, i Kaelin, 2014; Castagna i sar., 2013; Casartelli i sar., 2010). Inače, primena vertikalnih skokova u svrhu procene eksplozivne sile mišića nogu prisutna je u profesionalnoj literaturi, ali i kineziološkoj praksi više od 80 godina (Sargaent, 1921). Brojna stručna literatura, knjige, priručnici i druge publikacije predlaže primenu testova vertikalne skočnosti u svrhu procene eksplozivne mišićne snage (Astrand, iRodahl, 1986), kao i za identifikovanje

bilateralne razlike u snazi mišića nogu (Menzel i sar., 2013). Vertikalni skok je najefikasniji test u predviđanju uspeha fudbalera, iako na prvi pogled može izgledati da to nije slučaj (Baggett, n.d.). Tokom proteklih godina, fudbalska igra je postala brža, intenzivnija i agresivnija, nego li što je to ranije bio slučaj (Reilly, 2000). U fudbalu performanse igrača u velikoj meri zavise od snage mišića nogu (Bangsbo, Mohr, i Krustrup, 2006; Wisloff, Castagna, Helgerud, Jones, i Hoff, 2004). Štaviše, nova istraživanja ukazuju na izrazitu povezanost između vertikalnih skokova sa pripremom za ubrzanje i maksimalnom brzinom trčanja, dok u krajnjem vertikalna skočnost utiče na sveukupne performanse fudbalera. Istraživanjima se sugeriše da pliometrijski trening i vertikalni skokovi mogu pomoći u poboljšanju ubrzanja i brzine trčanja kod fudbalera i ostalih sportista.

ZAKLJUČAK

Vertikalni skok predstavlja široko prihvaćenu test proceduru za procenu eksplozivne snage mišića. Ustanovljeno je da se u okviru dijagnostičke opreme, pri utvrđivanju vrednosti eksplozivne snage ispitanika prilikom vertikalnog skoka, mogu koristiti tenziometrijska platforma HBO i akcelerometar Myotest, koji pružaju validne i pouzdane rezultate. U odnosu na tenziometrijsku platformu, Myotest nudi pogodnosti u pogledu prenosivosti, ekonomičnosti i rukovanja. Ovi rezultati mogu da pomognu u planiranju i programiranju budućih faza trenažnog procesa fudbalera srednješkolskog uzrasta iz Niša.

Zahvalnost

Rad pod nazivom „Metrijske karakteristike mernih instrumenata za utvrđivanje ekplozivne snage mišića“ proizašao je iz nacionalnog projekta OI 179024 „Razlike i uticaji maksimalne snage mišića na gustinu koštanog tkiva između sportista i nesportista srednjoškolskog uzrasta“. Zahvalnost na saradnji upućuje se učenicima i zaposlenim u Srednjoj ekonomskoj školi u Nišu, u kojoj se navedeni projekat sprovodi, kao i Ministarstvu prosvete, nauke i tehnološkog razvoja Republike Srbije, koje je odobrilo i finansira projekat.

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METRIC CHARACTERISTICS OF MEASURING INSTRUMENTS FOR THE DETERMINATION OF EXPLOSIVE MUSCLE STRENGTH

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INTRODUCTION

For the evaluation of explosive muscle strength a great number of test categories that could be applied both in laboratory and field conditions had been developed over time (Lara, Abián, Alegre, Jiménez, & Aguado, 2006). In determining the height of the vertical jump different methods could be used. For example, traditional methods, such as „jump-and-reach" of marked distance, motion analysis using computer systems and other (Nuzzo, Anning, & Scharfenberg, 2011). From the aspect of biomechanics, determination of muscle strength by dynamometer or tensiometric platform, on the one hand, represents the gold standard for the quantification of explosive muscle strength parameters. On the other hand, modern contactless devices represent an innovative approach in the evaluation of explosive muscle strength. Research methodologies that utulize mentioned devices, applied in laboratory or field conditions, are in the focus of researchers, coaches and athletes (Bubanj, Bubanj, Stanković, & Đorđević, 2010). It is therefore important to ensure that evaluation of explosive muscle strength in research is valid and reliable, using both contact and non-contact devices (Glatthorn, Gouge, Nussbaumer, Stauffacher, Impellizzeri, & Maffiuletti, 2011). In kinesiology measurements errors usually occur as a result of engagement of different measurer, different measurements of the same measurer, variation of a feature during the day (eg., body height varies about 1 cm during a day), due to different measuring apparatus, uneven calibrated measuring apparatus, random errors in the application of any measuring instrument. Measurement errors can be reduced by well trained measurer, adhering to a standardized measurement procedure, quality measurement equipment that is regularly calibrated and by the measurements that are being performed at the same time or in a very short period of time (Sportexpert, nd). Tensiometric platform (HBO, Germany) is a measuring instrument that registers the vector of force (which acts on the surface of the platform) in a function of time. Platform is device of great significance and is widely used in determination of ground reaction force, impact impulse (-s), ie., the interaction between athletes and apparatus. Tensiometric platform is used to determine muscle strength during vertical jumps. In addition to standard parameters, it enables monitoring of the dynamics and force development, acceleration during the execution of jumps and other parameters (Ostojić, Stojanović & Ahmetović, et al., 2010). Myotest (Switzerland) is an accelerometer with associated software that allows determination of relevant variables during the execution of different vertical jump types. It is attached to Veltrec belt located around the waist of the subject during the vertical jump and it records vertical acceleration of the body. It is designed, among other things, for assessing the height of the vertical jump (Casartelli, Muller, & Maffiuletti, 2010). The main aim of this research was to determine validity and reability of tensiometric platform HBO (Germany) and accelerometer Myotest (Switzerland), as well as to quantify the variables of explosive strength of the lower extremities in footbal players of highschool age.

METHOD

A sample of 16 subjects, high-school students of Economics School in Niš, consisted of football players (N=16), who had been engaged in training proccess at least three years and who compete in a Quality Serbian League. Subjects had an average age of 15.75±1.00 years, body height was 178.19±4.34 cm, body mass was 66.09±4.39, and body mass index was 20.84±1.51 (Mean±Std. dev.). The criterion for participation in the study was the absence of diseases and injuries that could adversely affect the health status of subjects, as well as research results. The research was carried out within the compliance with ethical standards and with the written consent of all subjects to participate in the proposed project, which entails that the subjects had been previously acquainted with objectives and tasks of research. Using tensiometric platform, values of the following explosive strength variables of the lower extremities had been determined: 1) MGRFTOFF_T and 2) MGRFTOFF_R (maximum ground reaction force on the test and re-test measurement at the take off, in N), 3) MGRFLAND_T and 4) MGRFLAND_R (maximum ground reaction force on the test and re-test measurement at the landing, in N), 5) BACCTOFF_T and 6) BACCTOFF_R (body acceleration on the test and re-test measurement at the take off, in m/s^2), 7) BACCLAND_T and 8) BACCLAND_R (body acceleration on the test and re-test measurement at the landing, in m/s^2). Using wireless accelerometer, values of the following explosive strength variables of the lower extremities had been determined: 9) JUMPHEIGHT_T and 10) JUMPHEIGHT_R (jump height on the test and re-test measurement in cm), 11) JUMPPOWER_T and 12) JUMPPOWER_R (jump power on the test and re-test measurement, in W/kg), 13) JUMPFORCE_T and 14) JUMPFORCE_R (jump force on the test and re-test measurement in N/kg), 15) JUMPVELOCITY_T and 16) JUMPVELOCITY_R (jump velocity on the test and re-test measurement in cm/s). Research of the transversal type was carried out in the framework of the national project OI 179024 „The differences and the influences of the maximum muscle strength on the bone mineral density between athletes and non-athletes of high school population“, approved and funded by the Ministry of Education, Science and Technological Development of the Republic of Serbia. Immediately before testing, subjects performed a „warm up", which considered jogging for 10 minutes and dynamic stretching for 5 to 7 minutes. In order to determine the explosive strength of the lower extremities, just before the protocol of the Counter Movement Jump (CMJ), a special belt was placed around subjects' waist, with device Myotest attached to the belt. Subjects performed CMJ (Bubanj et al., 2011), 10 in total, ie., five in test and five in retest series, on the tensiometric platform without arm swing (placed on hips), so that everyone jumped on the same conditions and with no additional impulse which may affect the values of measured variables. In order of rest, two series of jumps were separated by break in duration of 10 minutes. The values of the variables of explosive strength were read from the screen of the computer connected to tensiometric platform HBO and from the display of the device Myotest. For the purpose of statistical analysis of the data obtained, SPSS version 11 had been used, and the results are presented by descriptive statistics (in tables and graphs). Validity was assessed by Factor Analysis. Reliability of measuring instruments was tested by Test-Retest method, as well as by Cronbach's α-coefficient for determining the measure of reliability of motor test under the hypothesis that all particles equally participate in determining the main subject of measurement.

RESULTS

Table 1 shows the number of observations, the minimum and maximum value, mean and standard deviation of the observed variables.

Table 1. Descriptive statistics

Device		N	Min	Max	Mean	Std. Dev.
HBO (TEST)	MGRFTOFF _T (N)	16	981,00	1569,60	1285,72	200,20
	MGRFLAND_T (N)	16	1432,26	1854,09	1597,80	106,25
	BACCTOFF_T (m/s^2)	16	5,41	13,34	9,65	2,76
	BACCLAND_T (m/s^2)	16	12,75	17,54	14,40	1,32
Myotest (TEST)	JUMPHEIGHT_T (cm)	16	27,20	39,40	33,04	3,56
	JUMPPOWER_T (W/kg)	16	19,80	58,00	47,06	11,38
	JUMPFORCE_T (N/kg)	16	19,20	37,40	29,60	5,14
	JUMPVELOCITY _T (cm/s)	16	145,00	269,00	235,94	36,35
HBO (RETEST)	MGRFTOFF _R (N)	16	981,00	1530,36	1329,87	153,11
	MGRFLAND_R (N)	16	1324,35	1893,33	1613,13	145,46
	BACCTOFF_R (m/s^2)	16	5,94	13,86	10,36	2,40
	BACCLAND_R (m/s^2)	16	10,88	18,12	14,62	1,91
Myotest (RETEST)	JUMPHEIGHT_R (cm)	16	28,30	41,10	34,78	3,69
	JUMPPOWER_R (W/kg)	16	28,40	57,40	46,29	8,16
	JUMPFORCE_R (N/kg)	16	22,10	38,20	29,87	4,01
	JUMPVELOCITY _R (cm/s)	16	184,00	272,00	240,38	25,37

Validity was assessed by Factor Analysis (Table 2). Following results were obtained: Factor Analysis extracted two factors that explain 69.87% of the variance of all measurements.

Table 2. Factor Analysis

Measurement	Factor 1	Factor 2
BACCTOFF (m/s2)	,351	**,812**
MGRFTOFF (N)	,558	**,728**
BACCLAND (m/s2)	-,097	**,685**
MGRFLAND (N)	,483	**,509**
JUMPPOWER (W/kg)	**,955**	-,231
JUMPVELOCITY (cm/s)	**,909**	-,311
JUMPFORCE (N/kg)	**,811**	-,230
JUMPHEIGHT (cm)	**,526**	-,346
Characteristic value	3,35	2,24
% variance	41,87	28,00

Based on the schedule of the variables by factors, it could be concluded that the variables are ideally distributed by factors. The first factor represents measurement by the accelerometer, while the second factor is determined by the variables of tensiometric platform.

The following two tables are presented in order of showing the reliability of accelerometer and tensiometric platform. Reliability of measuring instruments was primarly tested by Test-Retest method (Table 3).

Table 3. Test-Retest method of reliability

	Myotest			HBO				
	JUMPHEIGHT (cm)	JUMPPOWER (W/kg)	JUMPFORCE (N/kg)	JUMPVELOCITY (cm/s)	MGRFTOFF (N)	MGRFLAND (N)	BACCTOFF (m/s2)	BACCLAND (m/s2)
R (test-retest)	**,893****	**,857****	**,849****	**,928****	**,862****	**,817****	**,810****	**,730****
sig.	**,000**	**,000**	**,000**	**,000**	**,000**	**,000**	**,000**	**,001**

Based on the value and significance of Pearson's correlation coefficient it could be concluded that high reliability was presented both with accelerometer and with tensiometric platform, although slightly lower with tensiometric platform in relation to the accelerometer. In addition, reliability was tested by Cronbach's alpha method. The obtained results are similar to previous analysis (Table 4).

Table 4. Cronbach's α-coefficient

	Myotest	HBO
Cronbach's Alpha	,818	,689

Reliability of the accelerometer is high, while the reliability of the tensiometric platform is also good, but slightly lower.

DISCUSSION

Considering the purpose of measurement, validity of measuring instruments can be observed from two basic points of view: 1) if the measurements goal is determining of condition, respectively to a level of some anthropological characteristics in subjects, then it comes to the so-called diagnostic validity; 2) if the purpose of measurement is predicition of success in some activity based on the results collected with some measuring instrument, then it comes to the so-called pragmatic or prognostic validity. Reliability is a metric characteristics related to the accuracy of the measurement, ie. on independence of unsystematized measurement errors. The problem of reliability is tied with problem of results consistency in repeated measurements. In every measuring procedure on the results, except the size of the subject that is measured, affecting have and some systematic and non-systematic factors. Systemic factors can cause a constant increase or decrease of results (e.g., learning, fatigue, development, etc.), so they can be controlled and eliminated. Their influence can be interpreted as an actual change in the size of measuring subjects, so they are not interesting for theory of reliability. Non-systematic factors are causing random variation of the measuring results, and have influence on uncertainty of measurement, because the changes that these factors are causing are not consequence of changing the subject (-s) of measurement. Bacause of that, reliability theory deals with their causes and consequences (Sportexpert, n.d.). In the current study aim was to determine the validity and reliability of tensometric platform HBO and accelerometer Myotest, as well as to quantify the value of explosive strength using vertical jump, i.e. to establish the state as a basis for further development and advancement of high school age football players from Niš. On the Internet there is no available information on researches in the area of explosive strength, which are conducted on a sample of athletes using tensiometric platforms HBO (Germany). According to this, the current study is a contribution to the affirmation of the examined metric characteristics of mentioned device. On the other hand, there are available studies on listed metric characteristics, in which vertical jump was applied by athletes and in which results also confirm the validity and reliability of accelerometer Myotest (Choukou, Laffaye, & Taiar, 2014; Mauch, Rist, & Kaelin, 2014; Castagna et al., 2013; Casartelli et al., 2010). Anyway, the use of vertical jumps and force of leg muscles are present in the professional literature, but also in the kinesiology practice for more than 80 years (Sargaent, 1921). Numerous professional literature, books, manuals and other publications

propose the use of vertical jumping tests in the evaluation of explosive muscle strength (Astrand, & Rodahl, 1986), as well as to identify the bilateral differences in the strength of lower extremity muscles (Menzel et al., 2013). The vertical jump is the most effective test in predicting the footbal players' success, although at first sight it may seem that this is not the case (Baggett, n.d). In recent years, football game has become faster, more intense and more aggressive than what was previously the case (Reilly, 2000). In football, the performance of players largely depends on the strength of leg muscles (Bangsbo, Mohr & Krustrup, 2006; Wisløff, Castagna, Helgerud, Jones, & Hoff, 2004). Moreover, new research indicates a strong link between vertical jumps with the preparation for the acceleration and running at maximum speed, while ultimately vertical jumping ability affects the overall performance of football players. The researches are suggesting that plyometric training and vertical jumps can help to improve acceleration and running speed in football players and other athletes.

CONLUSION

The vertical jump is a widely accepted test procedure for the evaluation of explosive muscle strength. It was found that within the diagnostic equipment, in determining the value of subjects explosive power during the vertical jump can use surface tensiometric platform HBO and accelerometer Myotest, which provide valid and reliable results. Compareing to tensiometric platform, Myotest offers benefits in terms of portability, economy and handling. These results may help in the planning and programming of future phases of the training process of high school age football players from Niš.

Acknowledgment

Paper entitled "Metric characteristics of measuring instruments for the determination of explosive muscle strength" derived from the national project OI 179024 „The differences and the influences of the maximum muscle strength on the bone mineral density between athletes and non-athletes of high school population".Gratitude for co-operation is addressed to all the students and employees in prep school for future students of economy in Niš, where this project is implemented, as well as to the Ministry of Science and Technological Development of the Republic of Serbia, which approved and finances actual project.

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RHYTHMIC GYMNASTICS ENSEMBLE ROUTINES – QUALIFICATION FOR THE OLYMPIC GAMES-2016

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INTRODUCTION

Rhythmic gymnastics ensemble routines are a group event included in the Olympic Games (Shishkovska, 2001). The major quotas for participation in the Games in Rio de Janeiro were given in Stuttgart-2015, and the additional are to be determined in January 2016. The leaders in this event ensured their participation and started the last stage of their preparation; the strategy of the teams has been established and shown in the competitive programs in the current Olympic cycle.

The rivalry in this event is extremely high; the technical, tactical, and composition strengths of the teams-finalists are equal and it is hard to determine which teams will win medals (Gancheva, (1988). According to Arkaev, L. Y., N. G. Suchilin (2007) the strategies of the different schools for the preparation of the Olympic teams in rhythmic gymnastics events are manifested through the selection of exercises and the structure of the competitive routines (Dimitrova, 2015).

One of the main components in the rhythmic gymnastics competitive routines is their level of difficulty, determined by the Referees' Code of Rules of FIG, and more precisely, the difficulty of the exercises and combinations included in the routines [Shishkovska, 2001; Referees' Codes of Rules of FIG. 1967 – 2013).

In order to establish the level of difficulty of the ensemble routines of the leading teams worldwide, as part of their strategy for the forthcoming struggle for medals, and to examine the trends and actual situation, we decided to do the present research and to set its aim accordingly.

METHOD

Aim of the research:

Examination of the dynamics in the level of difficulty of the ensemble routines.

Tasks:

1. To establish the composition of the difficult exercises in the competitive routines of the leading world teams.
2. Video analysis of the competitive routines.
3. To make a comparative analysis of the dynamics in the level of difficulty with the finalists of different routines.
4. To compare the differences and the scores in their basic components.

Object of the research:

The competitive routines of the ensembles of:

Italy, Russia, Japan, and Bulgaria – 1-4 position at the world Championship qualification, a routine with five ribbons.

Subject of the research:

The exercises with certain technical difficulty, their scores, and their arrangement in the routines.

Organization of the research:

The research was held in three stages:

I stage – August 2015 – during the World Cup in Sofia-2015.

II stage – September 2015 – video observation of the routines at the World Championship in Stuttgart-2015.

III stage – October 2015 – processing of the information and data collection from the official competitive slips (a compulsory form, approved by FIG) of the observed routines.

Methods of the research:

1. Study, analysis, and summary of the literary sources.
2. Pedagogical observations, video analysis of the routines, and data collection from the official competitive slips of the teams.
3. Math-statistical methods for processing of the information.
4. Analytical – synthetic method.

RESULTS and DISCUSSION

The received quantitative data and the successive analysis allowed us to make a comparison of the results from the different stages of the research.

The official program of the ensembles includes execution of two compositions – first – with one apparatus, and second – with two different apparatuses, preliminary determined by FIG, with duration of 2'15"-2'30". The selection of exercises and their combination in a unified composition is done according to the views and interpretation of the coach-director, who has to bring the technical and physical abilities of the gymnasts into line with the general idea.

The ensemble routines with ribbon are attractive, but the play is characterized with its own specificity, due to the nature of this apparatus, and namely, because of its ability to change its shape.

Ensemble Italy:

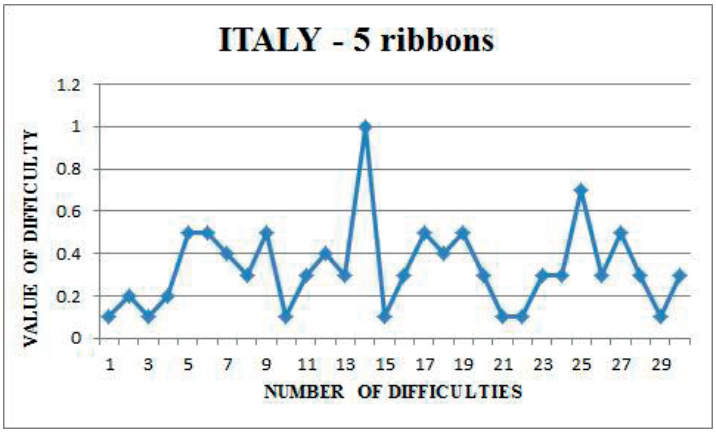

Figure 1.

The team won the world title with this routine. As regards the difficulty (fig. 1), we observe a relatively great number of exercises – 30, and this is due to the fact that a number of low score exercises have been executed. Except two exercises of high score of 1.0 and 0.7, the level of difficulty of the exercises is below the average difficulty register. The strategy chosen for arrangement of the exercises aims at executing a limited number of impressive and difficult exercises and a number of less hard ones, which are related to the exercises with the apparatus. The possible mistake when

executing an exercise of lower score will logically lead to taking away smaller number of points from the final score. The prevention against loss of points, embedded in the composition, is a good approach when inventing the routines, provided that the differences in the scores of the teams in the struggle for medals varies between 0.1 and 0.2 points.

Ensemble Russia:

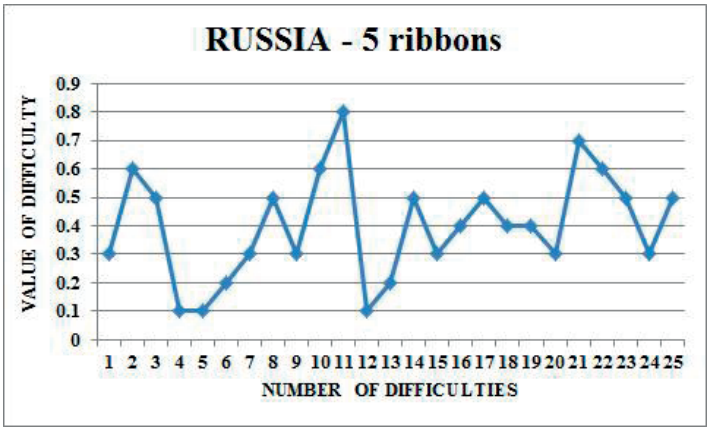

Figure2.

Fig. 2 shows the graph of the exercises, according to their succession and technical score. We can see there are exercises which score varies between 0.1 and 0.8 points. The highest difficulty of a single exercise is 0.8 points, and it is positioned in the middle of the routine. We can say that the level of difficulty has two peaks – 0.6 and 0.8 points, and the level of difficulty in great parts of the routine is of step-like character, and this cycle is clearly expressed in two consecutive series. The predominant exercises have a score of 0.3-0.5 points, but there are also exercises of the lowest score - 0.1.

Ensemble Japan:

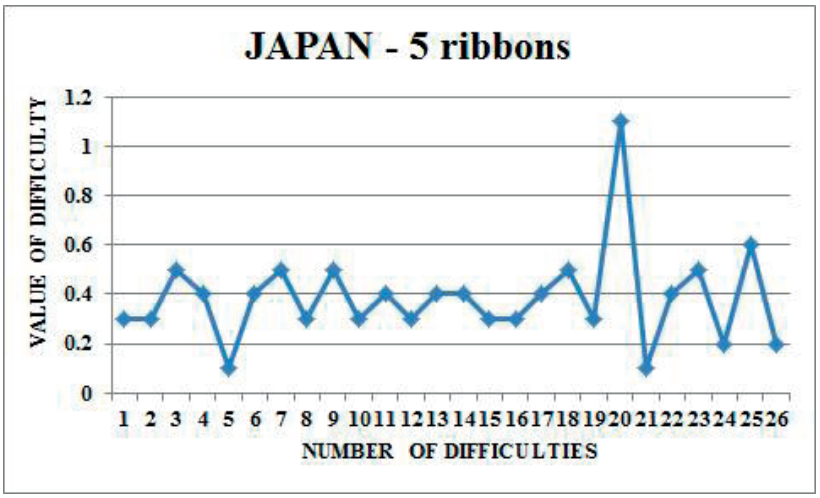

Figure 3.

The team of Japan is the bronze medalist in the competition. The routines are characterized with special features, a great scope of exchanges of the apparatuses, and a specific dynamics of the difficult and spectacular exercises and combinations. The graph of difficulty level on fig. 3 shows that the routine is characterized with specific structure, namely: smaller number of difficulties – 25, smaller number of low score difficulties – only 2; the majority of the exercises received a score of 0.3-0.5 points; the exercise with the top difficulty received 1.1 points. This fact constitutes one of the advantages of the routine, namely, the ability of the gymnasts to execute a number of successive exercises, requiring good technical skills in the play with the apparatuses. The relatively great number of exercises with lower score provides the possibility of revealing the extraordinary technical abilities and physical endurance of the gymnasts, as well as the strategy for achieving the spectacular effect of the composition.

Ensemble Bulgaria:

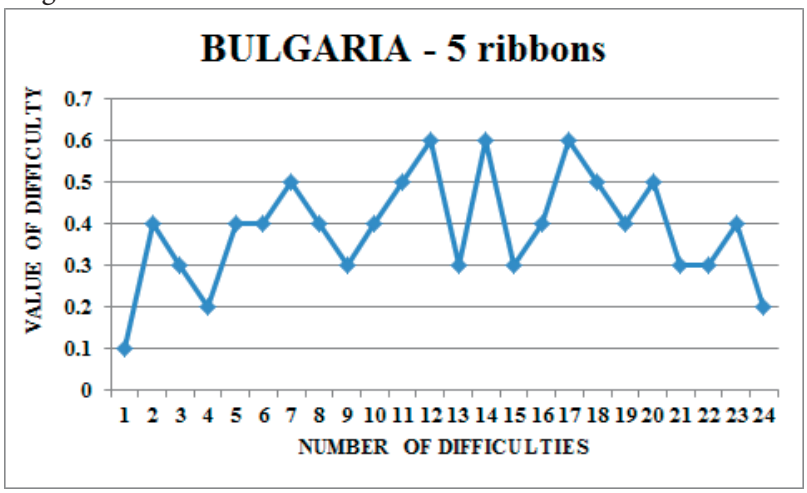

Figure 4.

The graph of difficulty level on fig. 4 shows that 24 exercises have been executed in the routine with one apparatus. A positive trait in the dynamics of difficulty of the routine is the three peaks of difficulty. This fact is indicative of maintaining good dynamics of difficulty in the middle of the competitive routine, but its numeric value is not high – 0.6 points. The difficulty, compared with that of the other teams-rivals is inferior as regards high score exercises, but the three peaks of difficulty in the routine have no analog in the comparison with the other teams. The execution of smaller number of exercises leads to counter proportional relation to their difficulty level and respectively to their technical value.

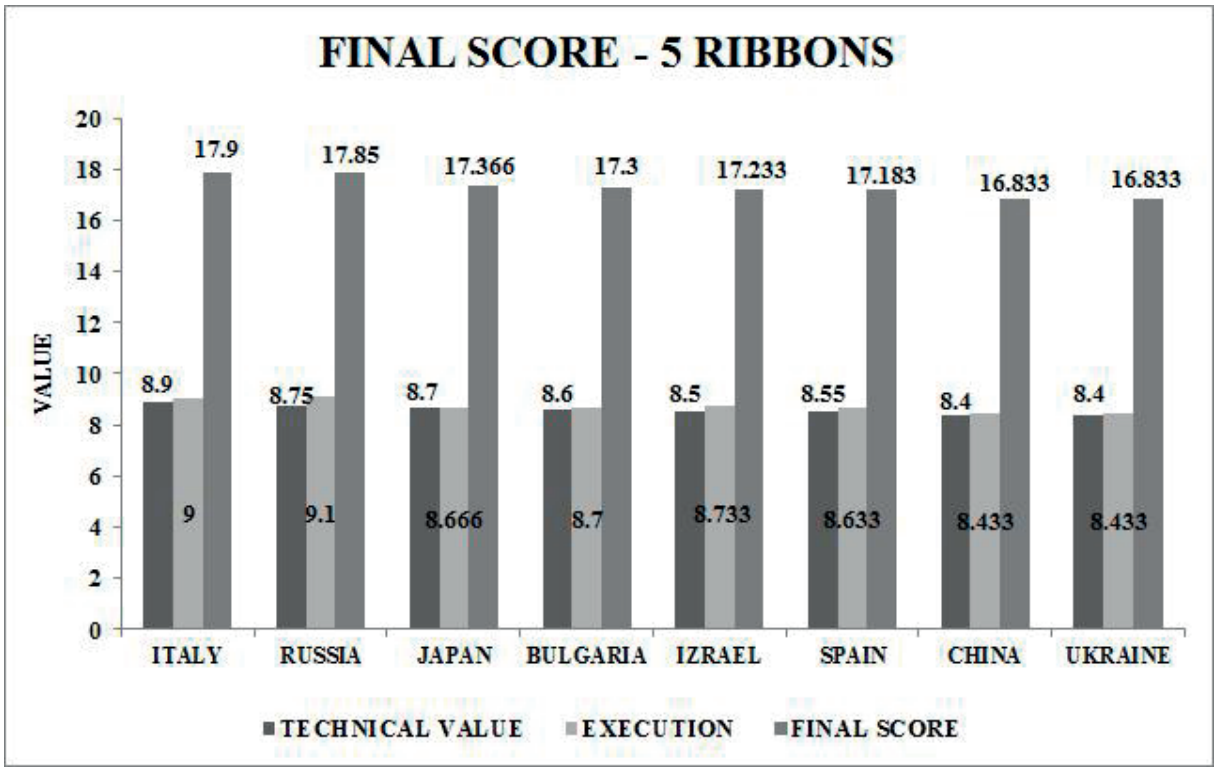

Figure 5.

Fig. 5 shows the scores of the finalists in their three main components – for technical difficulty, for execution, and the final score, determining the standing of the teams and the distribution of medals. It can be seen that the differences in the final score range between 1.067 points and 0.5 points with the score for technical difficulty of the routines. The difference between the highest score

(the team of Italy) and the lowest score (the team of Ukraine) for execution is only 0.667 points. The extremely small differences show there is a very big rivalry and the struggle for medals is very close. The starting score, taken from the competition slips of the teams, is the maximum one, determined by the rules, and is an index for the equal strengths of the teams. The physical and technical preparation of all teams is on a very high level, even for the teams which will struggle for taking quotas at the repechages. The choreographic preparation, the use of combinations of exercises and collaborations among the gymnasts, the play with the apparatuses, and the selection of musical accompaniment are conformable to the peculiarities of the certain school. The tactics, expressed in the composition of the routines, and the psychic endurance of the gymnasts will be crucial for the final score.

CONCLUSION

1. The analysis of the dynamics of the level of difficulty in the competitive routines of the finalists shows that the leading teams build their compositions according to the technical abilities of their gymnasts. There is a trend of including a limited number of high score exercises as a well-considered risk when inventing the routines.

2. It can be seen from the visual score of the difficulty that the position of the high score exercises is in narrow connection with the desired spectacular effect in the overall perception of the composition.

3. The exercises with the highest difficulty level, which the teams execute, have received different scores. The distinguished ensembles along this index are the ones of Italy and Japan, performing combinations of exercises with scores above the maximum, determined by the competitive Code of Rules.

4. The scores of the finalists in the decisive phase of the qualifications show that the teams have equal starting possibilities. The creative approach of the coaches and the psychic endurance of the ensembles, as a whole, are the areas where the competition is held.

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ISPOLJAVANJE BRZINE NAKON PRIMJENE RAZLIČITIH METODA ZA RAZVOJ FLEKSIBILNOSTI

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UVOD

U sportu je veoma često potrebno izvesti određenu kretnju u najkraćem vremenu. Za vrijeme koje je potrebno da se to kretanje izvede zaduženo je veoma kompleksno motoričko svojstvo, koje se naziva brzina. Brzina se dijeli na: latentno vrijeme motorne reakcije, frekfencija pokreta, brzina pojedinačnog pokreta i sprinterska brzina (Nićin, 2000). U većini sportova brzina sa svim svojim segmentima igra veliku ulogu, dok postoje i sportovi u kojoj dominiraju određeni segmenti brzine. U sportovima kao što su timski sportovi, sprinterske discipline trčanja i plivanja, brzina se ispoljava kroz sve svoje oblike i koji se zajednički nazivaju sprinterska brzina, ili kombinovana brzina. Kod ispoljavanja brzine važno je napomenuti da veliki značaj ima i koordinacija pokreta, odnosno, tehnika izvođenja kretnji (Ibid.). U sprinterskom trčanju mišići imaju dvije glavne funkcije: moraju da ubrzaju tijelo u horizontalnom smjeru i moraju da savladaju silu gravitacije u vertikalnom smjeru (Stefanović i Bošnjak, 2011). Prije izvođenja sprinterskog trčanja, primjenom specifičnih vježbi potrebno je sportistu dovesti u fiziološko stanje koje će mu poboljšati sportsku uspješnost i omogućiti da izvede svoju aktivnost na najvišem mogućem nivou (Elam,1986). Trening je osnovna jedinica sportske pripreme koja ima svoju strukturu. Strukturu treninga čine: uvodnopripremni dio, glavni i završni dio treninga. Uvodnopripremni dio treninga sačinjava opšti i specificni dio. Opšti dio započinje sa prirodnim oblicima kretanja (trčanje, hodanje, bacanje i dr.) u skladu sa osnovnim didaktičkim principima: od lakšeg ka težem, od prostog ka složenom i traje 10-15% uvodnog dijela. Specifični dio zavisi od glavnog dijela treninga i treba ga prilagoditi njemu. U njemu se primjenjuju specifične vježbe koje su priprema za ispunjavanje glavnog zadatka. Ovim vježbama se pripremaju mišići, tetive i ligamenti koji su najaktuelniji u vježbanju, pa i najviše podložni povredama, (Koprivica, 2002). U pasivnom zagrijavanju izostaje fizička aktivnost, a porast temperature se izaziva vanjskim izvorima toplote, primjerice toplim kupkama, masažom, dijaterijom ili toplim tuširanjem (Perić, 2005). Aktivno zagrijavanje nalazi široku primjenu u svijetu sporta i fizičkog vježbanja, jer je djelotvornije, dostupnije i lakše primjenljivo. Pretpostavka je da aktivnom zagrijavanju u većini sportova treba dati prednost pred pasivnim zagrijavanjem, dok bi se pasivno zagrijavanje moglo koristiti kao pomoć ili dopuna u zagrijavanju nakon provedenog aktivnog zagrijavanja, tj. kada se žele produžiti ili zadržati efekti postignutog nivoa zagrijanosti sportiste. Postoji nekoliko metoda rastezanja koje se koriste u sportu i rekreaciji. Kukolj (1996) razlikuje: aktivni, pasivni i kombinovani; Alter (1996) razlikuje: statički stretching i balistički stretching (dinamički stretching); Bompa (2000) razlikuje: statičku, PNF i balističku. U ovom istraživanju su primjenjene dvije metode za razvoj fleksibilnosti: statička i dinamička metoda. Statičko rastezanja služi da se mišići rastegnu dok se tijelo nalazi u stanju mirovanja. Sastoji se iz raznih tehnika kojima se posetepeno mišić isteže do određene granice, do tačke najvećeg izduženja/skraćenja mišića, a nikako preko nje. Osećaj treba da je poput blage zategnutosti, ali nikako bol. Taj položaj treba zadržati 15-30 sekundi, pa onda preći na drugu grupu mišića. Statičko rastezanje aktivira specijalizovane receptore osećaja istegnutosti u mišićima. Kada se uradi pravilno, statičko rastezanje snižava prag senzitivnosti ovih receptora, što omogućava mišićima da se opuste, a potom i da se istegnu na veću dužinu. Mnogi trkači praktikuju da statički rastežu i ruke i ramena, jer i ovi dijelovi tijela učestvuju u trčanju, Alter (1996). Dinamčko rastezanje

je slično statičkom u rasponu pokreta, ali ne i u brzini izvođenja. To je rastezanje u kome se mišići ubrzavaju iz skupljenog u rastegnut položaj i unazad, pazeći da se ne pređe raspon pokreta kao i kod statičkog rastezanja. Dinamičko rastezanje daje nešto slabije efekte od statičkog kad je riječ o snižavanju praga osjetljivosti receptora i opuštanju mišića (Ibid.). U ranijim istraživanjima se napominje da statičko rastezanje dovodi do smanjenja snage ekstenzora koljena i skočnosti (Costa i sar., 2010; Yamaguchi i Ishii, 2005), kao i da se negativno odražava na brzinu sprinta čak i ako je bilo kombinovano sa dinamičkim rastezanjem i opštim zagrijavanjem (Sim i sar., 2009; Winchester i sar., 2008). Takođe, Šimić i sar. (2013) sugerišu izbjegavanje statičkog rastezanja tokom zagrijavanja. S obzirom na uvodna razmatranja, provedeno je istraživanje sa ciljem da se uporede moguće razlike u rezultatu postignutom u testovima za procjenu brzine nakon primjene dvije metode rastezanja (dinamičko i statičko rastezanje), radi utvrđivanja koja od navedenih metoda može da doprinese izvođenju sprinterskog trčanja na najvišem mogućem nivou.

METOD

Istraživanje je provedeno u tri etape, gdje se nakon utvrđivanja inicijalnog stanja ispitanika, tokom četrnaest dana provedeni različiti protokoli rastezanja (koliko bi mogao da traje prelazni period trenažnog ciklusa - dva mikrociklusa, tokom koga je poželjno da sportisti oporave organizam, ali ipak da ostanu aktivni i održe zadovoljavajući nivo sposobnosti), nakon čega je provedeno utvrđivanje finalnog stanja ispitanika. Realizacija istraživanja odvijala se na Gradskom stadionu u Banjoj Luci (testovi za procjenu brzine) i u dvorani za fitnes Fakulteta fizičkog vaspitanja i sporta Univerziteta u Banjoj Luci (provođenje dinamičkog i statičkog rastezanja). Istraživanje je obuhvatilo 20 ispitanika muškog pola, studenata Fakulteta fizičkog vaspitanja i sporta Univerziteta u Banjoj Luci, koji su za vrijeme istraživanja imali 20 godina (+/- 6 mjeseci). Razlog zbog čega je izabran ovaj uzorak ispitanika je taj što je istraživanje bilo neizvodivo provesti sa trkačima na kratke staze u Bosni i Hercegovini, kako zbog nemogućnosti odabira dovoljnog broja ispitanika slične fizičke spreme i sportskog staža tako i zbog mogućeg narušavanja trenažnog procesa. Stoga su odabrani ispitanici koji su bili sa iste godine studija, i tokom izvođenja praktične nastave na Fakultetu svi su prolazili isti nivo fizičkog opterećenja, a nisu bili uključeni u neki trenažni proces niti su se bavili sportsko-rekreativnim aktivnostima. U skladu sa ovim, pokušao se isključiti uticaj drugih vidova aktivnosti koje bi uticale na rezultate istraživanja. Prije provođenja istraživanja ispitanici su bili podvrgnuti ljekarskom pregledu, prilikom čega je utvrđeno da su svi bili zdravi i bez povreda lokomotornog aparata. Ispitanici su bili podijeljeni u tri grupe - dvije eksperimentalne i jedna kontrolna grupa (sa prvom eksperimentalnom grupom je primijenjena dinamička metoda rastezanja, sa drugom statička metoda rastezanja, a kod kontrolne grupe nije primijenjena niti jedna metoda rastezanja prije izvođenja testova). Kako bi se dobili vjerodostojni rezultati na osnovu kojih bi se analizirale eventualne razlike u vremenu postignutom u sprinterskom trčanju nakon primjene dva različita protokola rastezanja, korišteno je 9 varijabli za procjenu motoričke sposobnosti brzine (prema Metikoš, Prot, Hofman, Pintar i Oreb, 1989.): 20m iz niskog, visokog i letećeg starta (ns20 m, vs20 m, ls20 m), 40m iz niskog, visokog i letećeg starta (ns40 m, vs40 m, ls40 m) i 60 m iz niskog, visokog i letećeg starta (ns60 m, vs60 m, ls60 m). Budući da se istraživanje provelo na uzorku studenata, a ne na uzorku sportista trkača na kratke staze, a radi dobijanja što validnijih podataka, odabrano je da sve testove izvode iz navedenih početnih pozicija kako bi se eventulne pogreške prilikom izvođenja starta što manje odrazile na podatke koji se dobijaju nakon statističke obrade podataka. Utvrđivanje inicijalnog i finalnog stanja ispitanika obavljeno je na atletskoj stazi Gradskog stadiona u Banjoj Luci u prije podnevnim časovima uz optimalnu temperaturu i vlažnost vazduha. Od dodatne opreme za vrijeme testiranja korištene su fotoćelije marke Ergo timer Globus i startni blokovi. Sva mjerenja su vršena na isti način. Ispitanici su, nakon zauzimanja početne pozicije kretali prema sopstvenom osjećaju. U zavisnosti od početne pozicije, iz koje su izvodili testove, podešavana je aktivacija sistema za mjerenje vremena (prilikom niskog starta, senzor za aktivaciju je bio postavljen ispod zadnje noge u bloku, prilikom visokog starta ispod prednje noge, a prilikom izvođenja letećeg starta sistem se sam aktivirao prilikom protrčavanja ispitanika). Protokol zagrijavanja se sastojao od trčanja umjerenog intenziteta u trajanju od 10 minuta, te su poslije kratke pauze provođene vježbe oblikovanja opšteg karaktera. Poslije završenog uvodno-pripremnog dijela prešlo se na provođenje testova 20m, 40m i 60 m (iz niskog, visokog i letećeg starta). Protokoli zagrijavanja i primjene različitih načina razvoja fleksibilnosti (statičko i dinamičko rastezanje) je primjenjeno u trajanju od 14 dana i primjenjivano je svaki dan. Protokol zagrijavanja se sastojao od trčanja umjerenog intenziteta u trajanju od 10 minuta. Statičko rastezanje se sastojalo od

8 vježbi statičkog rastezanja trupa i natkoljenice koje se izvodilo u 4 serije. Svaka vježba se izvodila u izdržaju koji je trajao 30 sekundi i poslije toga slijedio je odmor u trajanju od 15 sekundi, nakon čega se izvodila sljedeća vježba. Pauza između serija bila je u trajanju od 5 minuta. Ukupno trajanje ove metode za razvoj fleksibilnosti bilo je 45 minuta. Vježbe koje su korištene u ovom načinu rastezanja su: zasuk trupa, lumbalna ekstenzija uz rastezanje trbuha, otklon u lijevu i desnu stranu, pretkolon – zaklon trupa, rastezanje fleksora koljena stojeći na jednoj nozi, rastezanje fleksora koljena sa podignutom nogom na švedski sanduk, rastezanje ekstenzora koljena klečeći na jednom koljenu i rastezanje ekstenzora koljena stojeći na jednoj nozi. Dinamičko rastezanje se takođe sastojalo od 8 vježbi dinamičkog rastezanja trupa i natkoljenice koji se izvodio u 4 serije. Svaka vježba se izvodila po 15 ponavljanja i poslije toga slijedio odmor u trajanju od 15 sekundi nakon čega se izvodila sljedeća vježba. Pauza između serija bila je u trajanju od 5 minuta. Ukupno trajanje ove metode za razvoj fleksibilnosti bilo je 45 minuta. Vježbe koje su korištene u ovom načinu rastezanja su: zasuk trupom, lumbalna ekstenzija uz rastezanje trbuha, otklon u lijevu i desnu stranu, pretkolon – zaklon trupom, rastezanje fleksora koljena stojeći na jednoj nozi, rastezanje fleksora koljena sa podignutom nogom, rastezanje ekstenzora koljena iskorak i rastezanje ekstenzora koljena stojeći na jednoj nozi.

Sva statistička izračunavanja realizovana su pomoću aplikacionog statističkog programa za personalne računare SPSS 17.0. Podaci prikupljeni tokom istraživanja obrađeni su postupcima deskriptivne i komparativne statistike: T-test za zavisne i T-test za nezavisne uzorke.

REZULTATI

Dobijeni rezultati u ovom istraživanju su prikazani tabelarno i daju tražene informacije o postavljenom problemu istraživanja.

Tabela 1. Deskriptivni statistički parametri inicijalnog mjerenja rezultata postignutih u testovima trčanja kod ispitanika svih grupa

grupa	testovi	N	Min	Max	Mean	S.D	KS test
	ns20 m	7	3,00	3,52	3,19	0,21	0,83
	vs20 m	7	2,97	3,48	3,20	0,20	0,94
	ls20 m	7	2,25	2,79	2,43	0,18	0,63
	ns40 m	7	4,98	7,16	5,87	0,80	0,78
Eksperimentalna grupa 1	**vs40 m**	7	4,95	6,61	5,71	0,66	0,78
	ls40 m	7	4,72	6,22	5,18	0,49	0,61
	ns60 m	7	10,78	12,86	11,40	0,70	0,68
	vs60 m	7	10,56	12,74	11,30	0,70	0,76
	ls60 m	7	9,40	11,06	10,04	0,55	0,92
	ns20 m	7	2,98	3,52	3,21	0,20	0,99
	vs20 m	7	2,97	3,48	3,24	0,21	0,70
	ls20 m	7	2,28	2,79	2,43	0,17	0,56
	ns40 m	7	5,16	7,16	5,89	0,78	0,73
Eksperimentalna grupa 2	**vs40 m**	7	4,88	6,61	5,73	0,65	0,75
	ls40 m	7	4,64	6,20	5,33	0,63	0,95
	ns60 m	7	10,62	12,86	11,43	0,74	0,86
	vs60 m	7	10,74	12,74	11,34	0,64	0,29
	ls60 m	7	9,40	11,24	10,13	0,63	0,98
	ns20 m	6	3,18	3,80	3,44	0,26	0,73
	vs20 m	6	3,12	3,95	3,40	0,31	0,84
	ls20 m	6	2,37	2,62	2,50	0,08	0,99
	ns40 m	6	5,75	7,10	6,13	0,49	0,58
Kontrolna grupa	**vs40 m**	6	5,68	6,86	5,98	0,44	0,58
	ls40 m	6	4,60	6,20	5,36	0,70	0,81
	ns60 m	6	10,76	13,00	11,75	0,79	0,99
	vs60 m	6	10,80	12,38	11,63	0,54	0,93
	ls60 m	6	9,56	11,06	10,28	0,48	0,91

Rezultati iz Tabele 1. pokazuju da se prosječne vrijednosti rezultata trčanja na određenim dionicama kreću u rasponima očekivanim za ovu populaciju (Lorger, Ovčarić i Švigir-Potroško, (2010), Babić, Blažević i Radetić-Paić (2010). Vrijednosti KS testa su znatno iznad 0.05 što pokazuje normalnost rasporeda podataka i obezbjeđuje daljnju primjenu parametrijske statistike.

Tabela 2. Deskriptivni statistički parametri finalnog mjerenja rezultata postignutih u testovima trčanja kod ispitanika svih grupa

grupa	testovi	N	Min	Max	Mean	S.D	KS test
Eksperimentalna grupa 1	**ns20 m**	7	2,91	3,69	3,17	0,24	0,62
	vs20 m	7	2,96	3,62	3,17	0,22	0,74
	ls20 m	7	2,03	2,84	2,30	0,26	0,76
	ns40 m	7	4,10	5,50	4,43	0,48	0,22
	vs40 m	7	4,06	4,75	4,34	0,22	0,95
	ls40 m	7	3,37	4,16	3,68	0,26	0,74
	ns60 m	7	8,05	10,13	9,06	0,62	0,96
	vs60 m	7	8,24	10,38	8,97	0,86	0,68
	ls60 m	7	7,31	8,54	7,89	0,54	0,78
Eksperimentalna grupa 2	**ns20 m**	7	3,03	3,69	3,21	0,22	0,37
	vs20 m	7	3,01	3,62	3,18	0,20	0,47
	ls20 m	7	1,95	2,64	2,35	0,23	0,92
	ns40 m	7	4,12	5,50	4,47	0,46	0,13
	vs40 m	7	4,15	4,75	4,35	0,19	0,55
	ls40 m	7	3,37	4,16	3,69	0,24	0,68
	ns60 m	7	8,06	10,52	9,08	0,90	0,96
	vs60 m	7	8,28	10,38	9,04	0,81	0,51
	ls60 m	7	7,35	8,54	8,02	0,42	0,99
Kontrolna grupa	**ns20 m**	6	3,10	3,77	3,39	0,26	0,74
	vs20 m	6	3,17	3,61	3,38	0,18	0,91
	ls20 m	6	1,95	2,64	2,48	0,26	0,97
	ns40 m	6	4,30	6,33	6,10	0,27	0,93
	vs40 m	6	4,29	6,14	5,92	0,24	0,98
	ls40 m	6	4,43	6,19	5,30	0,29	0,96
	ns60 m	6	10,06	12,52	11,65	0,91	0,86
	vs60 m	6	10,64	12,31	11,57	0,68	0,71
	ls60 m	6	8,73	10,82	10,23	0,78	0,38

Rezultati iz Tebele 2. takođe pokazuju da se prosječne vrijednosti rezultata trčanja na određenim dionicama kreću u rasponima očekivanim za ovu populaciju (Lorger, Ovčarić i Švigir-Potroško, (2010), Babić, Blažević i Radetić-Paić (2010). Vrijednosti KS testa su takođe znatno iznad 0.05 što pokazuje normalnost rasporeda podataka i obezbjeđuje daljnju primjenu parametrijske statistike. Detaljnijom analizom prosječnih vrijednosti rezultata testova na finalnom mjerenju primijećeno je da su te vrijednosti niže u odnosu na inicijalno mjerenje kod sve tri grupe. Analizom razlika između aritmetičkih sredina inicijalnog i finalnog mjerenja između sve tri grupe ispitanika utvrdiće se da li postoji statistički značajna razlika nakon 14 dana primjene različitih metoda za razvoj fleksibilnosti.

Tabela 3. Razlike u rezultatima na testovima između eksperimentalne grupe 1 (dinamičko rastezanje) sa eksperimentalnom grupom 2 (statičko rastezanje) i kontrolnom grupom na inicijalnom mjerenju

	Eksperimentalna grupa 2			Kontrolna grupa		
testovi	**t**	**df**	**Sig. (2-tailed)**	**t**	**df**	**Sig. (2-tailed)**
ns20 m	-0,23	12	0,82	-1,92	11	0,08
vs20 m	-0,37	12	0,71	-1,39	11	0,19
ls20 m	-0,06	12	0,95	-0,95	11	0,36
ns40 m	-0,04	12	0,96	-0,67	11	0,51
vs40 m	-0,05	12	0,95	-0,82	11	0,42
ls40 m	-0,50	12	0,62	-0,52	11	0,60
ns60 m	-0,07	12	0,94	-0,84	11	0,41
vs60 m	-0,09	12	0,92	-0,92	11	0,37
ls60 m	-0,27	12	0,78	-0,82	11	0,42

U Tabeli 3. su prikazani rezultati nezavisnog T testa gdje su analizirane razlike u rezultatima testova ispitanika na inicijalnom mjerenju. Na osnovu signifikantnosti može se primjetiti da ne postoji statistički značajna razlika na nivou 0.05, između rezultata testova koji su postignuti kod eksperimentalne grupe 1 (dinamičko rastezanje), eksperimentalne grupe 2 (statičko rastezanje) i kontrolne grupe na inicijalnom mjerenju. Ovo daje potvrdu da su grupe dobro formirane, jer na početku testiranje nije bilo razlike između grupa koje su primjenjivale različite metode za razvoj fleksibilnosti i grupe koja nije koristila niti jednu metodu. Ovim je izbjegnut neželjeni faktor koji bi se odrazio na rezultate finalnog mjerenja.

Tabela 4. Razlika u rezultatima testova između eksperimentalne grupe 1 (dinamičko rastezanje) sa eksperimentalnom grupom 2 (statičko rastezanje) i kontrolnom grupom na finalnom mjerenju

	Eksperimentalna grupa 2			Kontrolna grupa		
testovi	**t**	**df**	**Sig. (2-tailed)**	**t**	**df**	**Sig. (2-tailed)**
ns20 m	-2,23	12	0,02	-2,92	11	0,01
vs20 m	-3,37	12	0,01	-2,39	11	0,02
ls20 m	-4,06	12	0,00	-2,95	11	0,00
ns40 m	-4,04	12	0,00	-2,67	11	0,00
vs40 m	-5,05	12	0,00	-3,82	11	0,00
ls40 m	-5,50	12	0,00	-3,52	11	0,00
ns60 m	-4,07	12	0,00	-3,84	11	0,00
vs60 m	-4,09	12	0,00	-3,92	11	0,00
ls60 m	-3,27	12	0,01	-3,82	11	0,00

Nakon provedenih statističkih procedura koje su prikazane u Tabeli 4. utvrđeno je da se na finalnom mjerenju pokazala statistički značajna razlika (na nivou $p<0.05$) između eksperimentalne grupe 1 i eksperimentalne grupe 2 u intervalu od -2.23 do -4.06 za testove trčanja na 20m, od -4.40 do -5.50 za testove trčanja na 40m i od -3.27 do -4.09 za testove trčanja na 60m, u korist eksperimentalne grupe 1. Takođe, analiza na finalnom mjerenju između eksperimentalne grupe 1 i kontrolne grupe pokazala je da se vrijednost nezavisnog t testa kretala u intervalu od -2.39 do -2.95 za testove

trčanja na 20m, od -2.67 do -3.82 za testove trčanja na 40m i od -3.82 do -3.92 za testove trčanja na 60m. Ove vrijednosti su pokazale statistički značajnu razliku na nivou ($p<0.05$) u korist eksperimentalne grupe 1. Na osnovu ovih rezultata može se konstatovati da su ispitanici nakon primjene dinamičke metode rastezanja koje je trajalo 14 dana, sa frekvencijom vježbanja svaki dan, postigli bolje rezultate u odnosu na ispitanike koji su primjenjivali statičko rastezanje i ispitanike koji nisu primjenjivali metode rastezanja.

Tabela 5. Analizom razlika između aritmetičkih sredina inicijalnog i finalnog mjerenja između sve tri grupe ispitanika

	Eksperimentalna grupa 1			**Eksperimentalna grupa 2**			**Kontrolna grupa**		
Testovi	**t**	**df**	**Sig.**	**t**	**df**	**Sig.**	**t**	**df**	**Sig.**
Pair 1 ns20mi-ns20mf	-3.14	19	0.00	-0.14	19	0.88	-0.24	19	0.78
Pair 2 vs20mi-vs20mf	2.48	19	0.03	0.48	19	0.63	0.48	19	0.63
Pair 3 ls20mi-ls20mf	-3.23	19	0.00	-0.23	19	0.78	-0.20	19	0.80
Pair 4 ns40mi-ns40mf	13.38	19	0.00	0.38	19	0.71	0.31	19	0.74
Pair 5 vs40mi-vs40mf	12.99	19	0.00	0.99	19	0.48	0.91	19	0.42
Pair 6 ls40mi-ls40mf	14.34	19	0.00	0.34	19	0.72	0.31	19	0.74
Pair 7 ns60mi-ns60mf	-24.60	19	0.00	-0.60	19	0.54	-0.58	19	0.52
Pair 8 vs60mi-vs60mf	-20.94	19	0.00	-0.94	19	0.45	-0.84	19	0.39
Pair 9 ls60mi-ls60mf	-21.79	19	0.00	-0.79	19	0.51	-0.73	19	0.50

Konstatacije koje su donešene nakon analize rezultata iz Tabele 4. svoju potvrdu nalaze i nakon detaljnije analize rezultata prikazanih u Tabeli 5. Korištenjem statističke metode zavisni T test, analizirane su razlike u rezultatima koje su ispitanici svake grupe postigli na inicijalnom i finalnom mjerenju. Vrijednosti signifikantnosti na nivou (0,05), su samo kod eksperimentalne grupe 1 znatno niže od ove vrijednosti, dok su kod ostalih te vrijednosti znatno veće od (0,05). Ovo objašnjava da su ispitanici iz eksperimentalne grupe 1, koja je koristila dinamičko rastezanje kao metodu povećanja fleksibilnosti, ostvarili rezultate na finalnom mjerenju koji se statistički značajno razlikuju od rezultata na inicijalnom mjerenju, dok to nije slučaj kod ostale dvije grupe ispitanika. Analizom prosječnih vrijednosti rezultata na svim testovima, može se primijetiti da su one znatno manje na finalnom mjerenju kod ove grupe ispitanika, što navodi na zaključak da se dinamičkom rastezanju kao metodi povećanja fleksibilnosti, može dati prednost u odnosu na statičko rastezanje.

DISKUSIJA

Analiziranjem prosječnih vrijednosti rezultata na inicijalnom i finalnom mjerenju (Tabela 1. i Tabela 2), može se primijetiti da su ispitanici ostvarili rezultate koji se kreću u očekivanim rasponima za ovu populaciju (Lorger, Ovčarić i Švigir-Potroško, (2010), Babić, Blažević i Radetić-Paić (2010). Takođe, iz ovih tabela se može primijetiti da su vrijednosti normalnosti rasporeda znatno iznad 0,05, što je omogućilo primjenu parametrijske statistike prilikom analize razlika u ispoljavanju rezultata nakon primjene različitih metoda rastezanja. Detaljnijom analizom prosječnih vrijednosti rezultata testova na finalnom mjerenju koji su prikazani u Tabeli 2. primijećeno je da su te vrijednosti niže u odnosu na inicijalno mjerenje kod sve tri grupe. Nakon primjene validnih statističkih metoda koje su prikazane u Tabelama 3, 4 i 5, objasnilo se da li postoji statistički značajna razlika nakon 14 dana primjene različitih metoda za razvoj fleksibilnosti. Razlika između postignutih rezultata kod

ispitanika sve tri grupe na inicijalnom mjerenju, su analizirane primjenom nezavisnog T testa na nivou 0,05 koji su prikazani u Tabeli 3. Nije utvrđena statistički značajna razlika između ovih rezultata, a time je i izbjegnut neželjeni faktor koji bi uticao na rezultate finalnog mjerenja. Analiza koja je utvrdila ststistički značajnu razliku u postignutim rezultatima između testiranih grupa, prikazana je u Tabeli 4. Utvrđeno je da se na finalnom mjerenju pokazala statistički značajna razlika (na nivou $p<0.05$) između eksperimentalne grupe 1 i eksperimentalne grupe 2 u intervalu od -2.23 do -4.06 za testove trčanja na 20 m, od -4.40 do -5.50 za testove trčanja na 40 m i od -3.27 do -4.09 za testove trčanja na 60 m, u korist eksperimentalne grupe 1. Takođe, analiza na finalnom mjerenju između eksperimentalne grupe 1 i kontrolne grupe pokazala je da se vrijednost nezavisnog t testa kretala u intervalu od -2.39 do -2.95 za testove trčanja na 20m, od -2.67 do -3.82 za testove trčanja na 40m i od -3.82 do -3.92 za testove trčanja na 60m. Ove vrijednosti su pokazale statistički značajnu razliku na nivou ($p<0.05$) u korist eksperimentalne grupe 1. Dobijeni rezultati ovom analizom naveli su na konstataciju da su ispitanici koji su primjenjivali dinamičko rastezanje u trajanju od 14 dana sa frekvencijom vježbanja svaki dan, ostvarili bolje rezultate na finalnom mjerenju u odnosu na ostale dvije grupe ispitanika. Potvrda ove konstatacije opravdana je i analizom rezultata prikazanih u Tabeli 5. gdje se može primijetiti da se za ispitanike eksperimentalne grupe 1 pokazala statistički značajna razlika između rezultata testova na inicijalnom i finalnom mjerenju, dok to nije bio slučaj sa ostale dvije grupe ispitanika. Uzimajući u obzir sve analize, može se pretpostaviti da će se nakon korištenja dinamičkog rastezanja izvesti sprintersko trčanje na višem nivou u odnosu na korištenje statitčkog rastezanja. Rezultati ovog istraživanja su potvrdili i neka ranija istraživanja koja su se bavila sličnom problematikom (Little, Thomas, Williams, Alun G. (2006), Amiri-Khorasani M, Kellis E., (2013), Chatzopoulos D, Galazoulas C, Patikas D, Kotzamanidis C., (2014), Perrier, E., Pavol, J., Hoffman, A., (2011), Rountas, P., Manousaridou, E., Galazoulas, Ch., Bassa E., Karamousalidis. G., Giannakos, A., (2010), Sayers, A., Farley, R., Fuller, D., Jubenville, C., Caputo, L. (2004)), odnosno, dobili su se slični rezultati istraživanja, gdje se daje prednost dinamičkom načinu rastezanja u odnosu na statički način rastezanja u uvodno-pripremnom dijelu treninga.

Potrebno je naglasiti da su dobijeni rezultati u testovima za mjerenje nivoa brzine, u ovom istraživanju, bili u drugom planu. Naime, rezultati su ispod prosjeka za populaciju sportista trkača na kratke staze, a pretpostavka je da bi bili bolji da su ispitanici trčali u specijalizovanim patikama za trčanje na kratke staze (tzv. sprinterice) kao i da su bili uključeni u trenažni proces trkača na kratke staze tokom koga se sportaši naviknu na pružanje maksimuma prilikom izvođenja dionica. Takođe, izvođenje tehnike sprinterskog trčanja ispitanika, pridonijelo je postignutim rezultatima u trčanju. Sa druge strane, provođenje istraživanja na ispitanicima koji nisu bili uključeni u neki trenažni proces niti u neku sportsko-rekreativnu aktivnost isključilo je mogućnost da je neka druga sposobnost doprinijela do poboljšanja rezultata u trčanju a samim tim su se dobili validni podaci o primjeni dinamičkog i statičkog rastezanja. Kako je već naznačeno, provođenje metoda za povećanje fleksibilnosti trajalo je 14 dana koliko bi mogao da traje prelazni period trenažnog ciklusa - dva mikrociklusa, tokom koga je poželjno da sportisti oporave organizam, ali ipak da ostanu aktivni i održe zadovoljavajući nivo sposobnosti. Sa obzirom na dobijenje rezultate i izvedene zaključke, u ovom istraživanju se pokazalo da bi primjena dinamičkog rastezanja tokom perioda od 14 dana, održala ili poboljšala nivo brzine, bez velike energetske potrošnje. Može se pretpostaviti da bi primjena dinamičkog rastezanja uz druge aktivnosti tokom prelaznog perioda doprinijela održavanju nivoa brzine.

ZAKLJUČAK

Kada se pogleda analiza rezultata dobijenih testiranjem studenata, može se zaključiti da je cilj ovog istraživanja ostvaren, a odnosio se na pokušaj prikazivanja mogućih razlika u ostvarivanju sprinterskog trčanja korištenjem dva različita protokola rastezanja u uvodno-pripremnom dijelu treninga. Analizom dobijenih rezultata uočeno je da postoji razlika u ostvarivanju sprinterskog trčanja nakon primjene dva različita protokola rastezanja (Tabele 4 i 5.). Rezultati testova pokazuju da prednost na dionicama od 20, 40 i 60 metara, gdje se primjenjuje sprintersko trčanje, ima dinamički metod rastezanja nad statičkim. Uporedbom rezultata postignutih u testovima za procjenu nivoa brzine, nakon primjene dvije metode rastezanja (dinamičko i statičko rastezanje), u ovom istraživanju se pokazalo da dinamička metoda razvoja fleksibilnosti može da doprinese izvođenju sprinterskog trčanja na najvišem mogućem nivou, što je samo potvrdilo ranija istraživanja koja su se bavila sličnom tematikom. Shodno tome, u sportovima gdje je zastupljena brzina u svim svojim oblicima i gdje se ona ispoljava duže od 20 metara dinamički metod rastezanja može se preporučiti kao prednost u

odnosu na statički metod rastezanja. Ovo istraživanje i istraživanja sličnog karaktera mogu biti od pomoći sportskim stručnjacima i trenerima prilikom planiranja i programiranja trenažnog procesa - u odabiru vježbi i aktivnosti za podizanje nivoa brzine u bilo kom periodu trenažnog procesa.

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EXPRESSION OF SPEED AFTER APPLICATION OF DIFFERENT METHODS FOR FLEXIBILITY DEVELOPMENT

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INTRODUCTION

In sport, very often is necessary to perform a certain movement in the shortest time. For the time necessary to perform this movement, it is responsabile a very complex motor performance, called speed. Speed is divided into a motor response latency time, frequency of movement, speed of movement of individual and sprint speed (Nićin, 2000). In most sports speed with all their segments plays a major role, while there are sports which dominate certain segments of speed. In sports such as team sports, sprint disciplines of running and swimming speed is manifested through all of its forms and which are collectively known as sprint speed, or the combined rate. When showing speed, it is important to note that great importance and coordination of movements, ie, the technique of movement (Ibid.). The sprint running muscles have two main functions: they must speed up the body in a horizontal direction and must overcome the force of gravity in the vertical direction (Stefanović and Bošnjak, 2011). Before performing sprinting, application specific exercises necessary to bring the athlete in a physiological state that he will enhance sports performance and allow you to carry out their activity at the highest level (Elam, 1986). Training is the basic unit for sports training, which has its own structure. The structure of training are: introductory - preparatory part, main and final part of training. Introductory - preparatory part of training consists general and specific part. General section begins with natural forms of movement (running, walking, throwing, etc.) In accordance with basic didactic principles: from easier to more difficult, from the simple to the complex and it takes 10-15% of introductory part. The specific part depends on the main part of training and needs to adapt to it. It apply specific exercises that are prepared to fulfill the main task. These exercises prepare muscles, tendons and ligaments which are the most current in exercise, including the most vulnerable to injuries (Koprivica, 2002). In passive heating absent physical activity, and elevation of temperature causes external heat sources such as hot baths, massage, or warm showers (Perić, 2005). Active warming is widely used in the world of sports and physical exercise, because it is more efficient, more accessible and more easily applicable. The assumption is that active warming in most sports is preferred to passive heating, while passive warming could be used as an aid or complement to warm up after the active warm-up, when we want to extend or maintain the effects of reforms in warming up of athletes. There are several methods of stretching that are used in sport and recreation. Kukolj (1996) is different: active, passive and combined; Alter (1996) distinguishes: static stretching and ballistic stretching (dynamic stretching); Bompa (2000) is different: static, ballistic and PNF. In this study, we applied two methods for developing flexibility: static and dynamic methods. Static stretching is used to stretch the muscles while body is in standby mode. It consists a variety techniques which are erratically stretching a muscle to a certain extent, to the point of greatest elongation / shortening of muscle, not over it. The feeling should be like a mild tension, but not pain. This position should be maintained for 15-30 seconds, and then move on to another muscle group. Static stretching activates specialized receptors sense streching muscle. When done properly, static stretching reduces threshold of sensitivity of these receptors, allowing muscles to relax, and then to be stretched to a longer length. Many runners practice that static stretch the arms and shoulders, as these parts of the body involved in the running, Alter (1996). The dynamic expansion is similar to the

static range of motion, but not in its execution speed. It's a stretch in which the muscles accelerate collected from the stretched position and back, taking care not to exceed the range of motion as well as static stretching. Dynamic stretching a bit weaker effects of static in terms of lowering the threshold of sensitivity receptors and muscle relaxation (Ibid.). In previous studies, the fact that static stretching leads to a decrease in strength and knee extensor vertical jump (Costa et al., 2010; Yamaguchi and Ishii, 2005), as well as the negative impact on speed of sprint, even if it was combined with dynamic expansion and general heating (Sim et al., 2009; Winchester et al., 2008). Also, Šimić et al. (2013) suggest avoiding static stretching during warm-up. Since introductory considerations, the research aiming to compare the possible differences in results obtained in tests for assessing the speed upon application of two methods of stretching (dynamic and static stretching), in order to determine which of above methods can not contribute to the performance of sprinting highest possible level.

METHOD

The study was conducted in three stages, where is after determination of initial state of respondents, during the fourteen days, conducted different protocols expansion (as it could last for a transitional period of training cycle - two micro cycles, during which it is advisable that athletes recover body, but to stay active and maintain a satisfactory level of ability), after which he spent the final determination of condition of respondents. The realization of research took place at the city stadium in Banja Luka (tests to assess speed) and Indoor Fitness Faculty of Physical Education and Sport, University of Banja Luka (implementation of dynamic and static stretching). The study included 20 male respondents, students of Faculty of Physical Education and Sport, University of Banja Luka, who are, during the study, 20 years old (+/- 6 months). The reason why was chosen this sample of respondents is that research was not feasible to implement with runners on short tracks in Bosnia and Herzegovina, due to the impossibility of selecting a sufficient number of respondents like physical education and sports experience and because of potential distortion of training process. Therefore, selected respondents who were from the same study year, also during the execution of practical training at Faculty , went through the same level of physical activity, and were not involved in any training process, or were praticing any of sports and recreational activities. In line with this, its tried to turn off the influence of other types of activities that would affect on results of research. Before conducting of study, respondents were subjected of medical examination, during which it was found that they were all healthy and injury of locomotors apparatus. The respondents were divided into three groups - two experimental and one control group (with the first experimental group was applied dynamic method of stretching, the second static stretching method, and the control group was not used no method of stretching before performing tests). In order to obtain credible results to analyze possible differences in time achieved in sprint running, after application of two different protocols expansion, was used nine variables to assess the speed of motor skills (the Metikoš, Prot, Hofman, Pintar and Oreb, in 1989.): 20m from the low, high and flying start (ls20 m, hs20m, fs20 m), 40m from the low, high and flying start (ls40 m, hs40m, fs40 m) and 60 m from the low, high and flying start (ls60 m, hs60m, fs60 m). Since research is conducted on a sample of students rather than on sample sportsmen runners in the short term, and in order to obtain as much is possible valid data, has been chosen to perform tests in said initial position in order to possible mistakes during performance start as little impact on data obtained after statistical analysis of data. Determination of initial and final states of the respondents was carried out on the track of the City stadium in Banja Luka in the afternoon hours, prior to the optimum temperature and humidity. From additional equipment during testing were used photocell brand Ergo timer Globe and starting blocks. All measurements were performed in the same way. Respondents, after taking the initial position moving towards its own feel. Depending on starting position, from which they carry out tests, adjusted the activation timing systems (during low start, sensor activation was set up under the back leg in a block, during the high start below the front leg, and when performing a flying start system is actictivating by itself during the run of respondents). Protocol heating consisted of running a moderate intensity for 10 minutes, and after a short break shaping exercises conducted a general character. After completing the introductory-preparatory part, it is now conducting tests 20m, 40m and 60m (from the low, high and flying start). Protocols heating and application of various methods development flexibility (static and dynamic stretching) is applied for 14 days and in use every day. The protocol consisted of a warm-running moderate intensity for 10 minutes. Static stretching consisted of eight exercises static stretching the fuselage and upper leg, which was done in 4 sets. Each exercise was performed to withstand that lasted 30 seconds and after that followed a

break of 15 seconds, after which he performed the following exercise. Pause between sets was for 5 minutes. Total duration of method for developing the flexibility was 45 minutes. Exercises that are used in this mode expansion are: twisting the tr5nk, lumbar extension with abdominal distension, deviation to the left and the right, the first column - shelter troops, stretching flexor knees, standing on one leg, stretch the knee flexors with the leg, the Swedish trunk, stretch extensor knee kneeling on one knee and knee extensor stretch standing on one leg. Dynamic stretching also composed of 8 exercises of dynamic stretching the fuselage and upper leg performed in 4 series. Each exercise was performed at 15 reps and after that followed the break of 15 seconds, after which he performed the following exercise. Pause between sets was for 5 minutes. Total duration of method for developing the flexibility was 45 minutes. Exercises that are used in this mode expansion are: twist hull, lumbar extension with abdominal distension, deviation to the left and the right, the first column - shelter hull, stretching flexor knees, standing on one leg, stretch the knee flexors with a raised foot, knee extensor stretching step and knee extensor stretch standing on one leg. All statistical calculations were done by the application of statistical programs for personal computers SPSS 17.0. Data collected during the study were analyzed using descriptive and comparative statistics: t-test for dependent and T-test for independent samples.

RESULTS

Results obtained in this study are presented in tables and providing requested information about issues research.

Table 1. Descriptive statistical parameters of initial measurement of results achieved in running tests at respondents in all groups

group	tests	N	Min	Max	Mean	S.D	KS test
	ls20 m	7	3,00	3,52	3,19	0,21	0,83
	hs20 m	7	2,97	3,48	3,20	0,20	0,94
	fs20 m	7	2,25	2,79	2,43	0,18	0,63
	ls40 m	7	4,98	7,16	5,87	0,80	0,78
Experimental group 1	**hs40 m**	7	4,95	6,61	5,71	0,66	0,78
	fs40 m	7	4,72	6,22	5,18	0,49	0,61
	ls60 m	7	10,78	12,86	11,40	0,70	0,68
	hs60 m	7	10,56	12,74	11,30	0,70	0,76
	fs60 m	7	9,40	11,06	10,04	0,55	0,92
	ls20 m	7	2,98	3,52	3,21	0,20	0,99
	hs20 m	7	2,97	3,48	3,24	0,21	0,70
	fs20 m	7	2,28	2,79	2,43	0,17	0,56
	ls40 m	7	5,16	7,16	5,89	0,78	0,73
Experimental group 2	**hs40 m**	7	4,88	6,61	5,73	0,65	0,75
	fs40 m	7	4,64	6,20	5,33	0,63	0,95
	ls60 m	7	10,62	12,86	11,43	0,74	0,86
	hs60 m	7	10,74	12,74	11,34	0,64	0,29
	fs60 m	7	9,40	11,24	10,13	0,63	0,98
	ls20 m	6	3,18	3,80	3,44	0,26	0,73
	hs20 m	6	3,12	3,95	3,40	0,31	0,84
	fs20 m	6	2,37	2,62	2,50	0,08	0,99
	ls40 m	6	5,75	7,10	6,13	0,49	0,58
Control group	**hs40 m**	6	5,68	6,86	5,98	0,44	0,58
	fs40 m	6	4,60	6,20	5,36	0,70	0,81
	ls60 m	6	10,76	13,00	11,75	0,79	0,99
	hs60 m	6	10,80	12,38	11,63	0,54	0,93
	fs60 m	6	9,56	11,06	10,28	0,48	0,91

Results from Table 1 show that average value of running results on particular segments range expected for this population (Lorger, Ovčarić and Švigir-Potroško, (2010), Babić, Blažević and Radetić-Paić (2010). The values of the KS test were considerably higher than 0.05 which indicate normality schedule data and provides further application of parametric statistics.

Table 2. Descriptive statistical parameters of final measurement of results achieved in running tests by at respondents in all groups

group	tests	N	Min	Max	Mean	S.D	KS test
	ls20 m	7	2,91	3,69	3,17	0,24	0,62
	hs20 m	7	2,96	3,62	3,17	0,22	0,74
	fs20 m	7	2,03	2,84	2,30	0,26	0,76
	ls40 m	7	4,10	5,50	4,43	0,48	0,22
Experimental group 1	**hs40 m**	7	4,06	4,75	4,34	0,22	0,95
	fs40 m	7	3,37	4,16	3,68	0,26	0,74
	ls60 m	7	8,05	10,13	9,06	0,62	0,96
	hs60 m	7	8,24	10,38	8,97	0,86	0,68
	fs60 m	7	7,31	8,54	7,89	0,54	0,78
	ls20 m	7	3,03	3,69	3,21	0,22	0,37
	hs20 m	7	3,01	3,62	3,18	0,20	0,47
	fs20 m	7	1,95	2,64	2,35	0,23	0,92
	ls40 m	7	4,12	5,50	4,47	0,46	0,13
Experimental group 2	**hs40 m**	7	4,15	4,75	4,35	0,19	0,55
	fs40 m	7	3,37	4,16	3,69	0,24	0,68
	ls60 m	7	8,06	10,52	9,08	0,90	0,96
	hs60 m	7	8,28	10,38	9,04	0,81	0,51
	fs60 m	7	7,35	8,54	8,02	0,42	0,99
	ls20 m	6	3,10	3,77	3,39	0,26	0,74
	hs20 m	6	3,17	3,61	3,38	0,18	0,91
	fs20 m	6	1,95	2,64	2,48	0,26	0,97
	ls40 m	6	4,30	6,33	6,10	0,27	0,93
Control group	**hs40 m**	6	4,29	6,14	5,92	0,24	0,98
	fs40 m	6	4,43	6,19	5,30	0,29	0,96
	ls60 m	6	10,06	12,52	11,65	0,91	0,86
	hs60 m	6	10,64	12,31	11,57	0,68	0,71
	fs60 m	6	8,73	10,82	10,23	0,78	0,38

Results from Table 2 also show that average value of running results on particular segments, range expected for this population (Lorger, Ovčarić and Švigir-Potroško, (2010), Babić, Blažević and Radetić-Paić (2010). The values of KS test are also significantly more than 0.05 which indicates normality schedule data and provides further application of parametric statistics. A more detailed analysis of average values of test results on final measurement, was noted that these values are lower than initial measurement in all three groups. The analysis of difference between arithmetic means of initial and final measurement between all three groups of respondents shall be determined whether there is a statistically significant difference after 14 days of application of different methods for developing flexibility.

Table 3. The differences in test scores between experimental group 1 (dynamic stretching) with experimental group 2 (static stretching) and control group in initial measurement

	Experimental group 2			Control group		
tests	**t**	**df**	**Sig. (2-tailed)**	**t**	**df**	**Sig. (2-tailed)**
ls20 m	-0,23	12	0,82	-1,92	11	0,08
hs20 m	-0,37	12	0,71	-1,39	11	0,19
fs20 m	-0,06	12	0,95	-0,95	11	0,36
ls40 m	-0,04	12	0,96	-0,67	11	0,51
hs40 m	-0,05	12	0,95	-0,82	11	0,42
fs40 m	-0,50	12	0,62	-0,52	11	0,60
ls60 m	-0,07	12	0,94	-0,84	11	0,41
hs60 m	-0,09	12	0,92	-0,92	11	0,37
fs60 m	-0,27	12	0,78	-0,82	11	0,42

Table 3 presents results of an independent T test where they analyzed the differences in the test results of the respondents in the initial measurement. Based on the significance can be seen that there is no statistically significant difference at the 0.05 level, from the test results that have been achieved in experimental group 1 (dynamic stretching), experimental group 2 (static stretching) and control group in the initial measurement. This provides confirmation that groups are well formed, because at beginning of testing there was no difference between groups that have followed different methods for developing flexibility and groups that did not use any method. This avoids the undesirable factor that affected results of final measurements.

Table 4. The difference in test results between experimental group 1 (dynamic stretching) with experimental group 2 (static stretching) and a control group on final measuring

	Experimental group 2			Control group		
tests	**t**	**df**	**Sig. (2-tailed)**	**t**	**df**	**Sig. (2-tailed)**
ls20 m	-2,23	12	0,02	-2,92	11	0,01
hs20 m	-3,37	12	0,01	-2,39	11	0,02
fs20 m	-4,06	12	0,00	-2,95	11	0,00
ls40 m	-4,04	12	0,00	-2,67	11	0,00
hs40 m	-5,05	12	0,00	-3,82	11	0,00
fs40 m	-5,50	12	0,00	-3,52	11	0,00
ls60 m	-4,07	12	0,00	-3,84	11	0,00
hs60 m	-4,09	12	0,00	-3,92	11	0,00
fs60 m	-3,27	12	0,01	-3,82	11	0,00

After statistical procedures that are shown in Table 4 was determined that is on final measurement showed a statistically significant diference ($p < 0.05$) between experimental group 1 and experimental group 2 in range of -2.23 to -4.06 for tests run at 20m, from -4.40 to -5.50 for tests run at 40m from -3.27 to -4.09 for tests run at 60m, in favor of experimental group 1. In addition, analysis of final measurement between experimental groups and 1 control group showed that value of the independent T test ranged from -2.39 to -2.95 for running tests on 20m, from -2.67 to -3.82 for running test on the 40m and from -3.82 to -3.92 for running tests on 60m. These values showed a statistically significant difference at level ($p < 0.05$) in favor of experimental group 1. Based on these results we can conclude that respondents after application of dynamic stretching methods that lasted 14 days, with a frequency of exercise every day, achived better results compared to respondents who applied static stretching and respondents who did not apply any method of stretching.

Table 5. The analysis of difference between the arithmetic mean on nitial and final measurement between three groups of respondents.

	Experimental group 1			Experimental group 2			Control group		
Tests	**t**	**df**	**Sig.**	**t**	**df**	**Sig.**	**t**	**df**	**Sig.**
Pair 1 ls20mi-ls20mf	-3.14	19	0.00	-0.14	19	0.88	-0.24	19	0.78
Pair 2 hs20mi-hs20mf	2.48	19	0.03	0.48	19	0.63	0.48	19	0.63
Pair 3 fs20mi-fs20mf	-3.23	19	0.00	-0.23	19	0.78	-0.20	19	0.80
Pair 4 ls40mi-ls40mf	13.38	19	0.00	0.38	19	0.71	0.31	19	0.74
Pair 5 hs40mi-hs40mf	12.99	19	0.00	0.99	19	0.48	0.91	19	0.42
Pair 6 fs40mi-fs40mf	14.34	19	0.00	0.34	19	0.72	0.31	19	0.74
Pair 7 ls60mi-ls60mf	-24.60	19	0.00	-0.60	19	0.54	-0.58	19	0.52
Pair 8 hs60mi-hs60mf	-20.94	19	0.00	-0.94	19	0.45	-0.84	19	0.39
Pair 9 fs60mi-fs60mf	-21.79	19	0.00	-0.79	19	0.51	-0.73	19	0.50

The statements that were made after analyzing results in Table 4 its confirm findings and after a detailed analysis of the results shown in Table 5. By using statistical methods dependent T test, there are analyzed differences in results that respondents of each group reach initial and final measurements. The values of significance level (0.05), are only in experimental group 1 significantly lower than this value, while the rest of these values significantly higher than (0.05). This explains that respondents in the experimental group 1, which is used as a method of dynamic stretching to increase flexibility, achieved results at final measurement that are differ significantly from results of initial measurement, while this is not case with other two groups. The analysis of average values of results in all tests, it can be noted that they are significantly less on final measuring in this group of respondents, suggesting that dynamic stretching as a method to increase flexibility, may provide an advantage over static stretching.

DISCUSSION

By analyzing the average value of results of initial and final measurements (Table 1 and Table 2), it may be noted that respondents achieved results that are moving in expected range for this population (Lorger, Ovčarić and Švigir-Potroško, (2010), Babić, Blažević and Radetić-Paić (2010). Also, in these tables can be noted that the values of normality schedule well above 0.05, which allowed application of parametric statistics in the analysis of differences in expression of results after application of different methods of stretching. A more detailed analysis of average values of test results on final measurement, as presented in Table 2 it is noted that these values are lower than initial measurement in all three groups. After administration of valid statistical methods as described in Tables 3, 4 and 5, to explain that there statistically significant difference after 14 days of application of different methods for developing flexibility. The difference between results achieved in respondents of all three groups on initial measurement, are analyzed by using independent t-test at the level of 0.05 as shown in Table 3. There was no statistically significant difference between these results, and it is avoided unwanted factor that would affect on results of final measurements. The analysis that determined statistically significant difference in results achieved between tested group, is shown in Table 4. It was found that final measurements showed a statistically significant difference ($p < 0.05$) between the experimental group 1 and experimental group 2 in the range of - 2.23 to -4.06 for running tests on 20 m, from -4.40 to -5.50 for tests run at 40 m from -3.27 to -4.09 for tests running at 60 m, in favor of experimental group 1. Also, analysis of final measuring between experimental group 1 and control group showed that the value of independent T test ranged from -2.39 to -2.95 for running tests at 20m, from -2.67 to -3.82 for running tests at 40m from -3.82 to -3.92 for running tests on 60m. These values showed a statistically significant difference at the level ($p < 0.05$) in favor of experimental group 1. The results obtained in this analysis led to the conclusion that respondents who have applied dynamic stretch for a period of 14 days with the frequency of exercise every day, have better performance on final measurement in relation to the other two groups. Confirmation of this statement is justified by analysis of results shown in Table 5, where it can be noted that for ex-

perimental group 1 showed a statistically significant difference between results of tests on initial and final measurements, while this was not case with other two groups. Taking into account all analysis, it can be assumed that after using a dynamic stretching, sprint running will be performed at a higher level, comparing to use a statistic expansion. Results of this study also confirmed some earlier studies that have dealt with similar issues (Little, Thomas, Williams, Alun G. (2006), Amiri-Khorasani M, Kellis, E., (2013), Chatzopoulos D, Galazoulas C, D Patikas., Kotzamanidis C., (2014), Perrier, E., Pavol J. Hoffman, A., (2011), Rountas, P., Manousaridou, E., Galazoulas, Ch., E. Bass, Karamousalidis. G., Giannakos, A., (2010), Sayers, A. Farley, R. Fuller, D., Jubenville, C. Caputo, L. (2004)), respectively, received similar research results, where preferred method of dynamic expansion in comparing to static method of stretching in introductory-preparatory part of training. It should be noted that achived results in tests for measurement levels of speed, in this study, were on secondary importance. The results are below average for population of sportsmen runners in short term, and it is assumed that they would be better if respondents were running in specialized shoes for running on short term, and to have been involved in training process of runners on short runs, during which athletes is accustomed to providing maximum while performing stocks. Also, the performance of techniques of sprint running of respondents, is contributed to results achieved in running. From the other hand, conducting research on respondents who were not involved in a training process or in some sports activities, exclude the possibility that some another ability is contribute to improved performance in running and, that is also affected to obtain valid data about use of dynamic and static stretching. As already indicated, implementation of methods for increasing flexibilityis lasted 14 days, and that could last for a transitional period of training cycle - two micro cycles, during which it is advisable that athletes recover body, but to stay active and maintain and satisfactory level of ability. With respect to produce reliable results and conclusions drawn, in this study it was shown that application of dynamic stretching over a period of 14 days, maintain or improve level of speed, without large energy consumption. It can be assumed that application of dynamic stretching with other activities during transition period contributed to maintaining the level of speed.

CONCLUSION

When we look at the analysis of results obtained by testing of students, it can be concluded that the aim of this study was realized, and was referred to attempt to show possible differences in exercise of sprint running, by using two different protocols expansion in introductory-preparatory part of training. By analysis of results revealed that there is a difference in achievement of sprinting after applying two different stretching protocols (Tables 4 and 5). Test results show that advantage of sections 20, 40 and 60 meters, where applicable sprinting, a dynamic method of static stretching. Comparing the results obtained in tests for assessing level of speed, after applying two methods of stretching (dynamic and static stretching), in this study it was shown that dynamic method development of flexibility can contribute to performance of sprinting at the highest level, which is only confirmed a previous studies that have dealt with similar issues. Accordingly, in sports where speed is represented in all its forms and where it exerts more than 20 meters dynamic stretching method can be recommended as an advantage over the static method of stretching. This study and studies of similar character may be of help to sports professionals and coaches in planning and programming training process - in selection of exercises and activities to raise speed level at any time in training process.

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STAVOVI UČENIKA MLAĐEG ŠKOLSKOG UZRASTA O ĐAČKOJ TORBI

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UVOD

Đačka torba uvek asocira na školske dane i predstavlja početak jednog važnog perioda u životu. Preteška đačka torba je večiti problem, naročito učenika mlađeg školskog uzrasta. Masa đačke torbe koju nose učenici mlađeg školskog uzrasta u Srbiji prelazi 10% telesne mase učenika i ne kreće se u dozvoljenim preporukama Svetske zdravstvene organizacije. Brojne studije pokazuju da većina dece nose veći teret od 10% svoje telesne mase (Feingold, i Jacobs, 2002; Van Gent, 2003; Korovessis i sar., 2004). U torbi je često po dva kilograma matematike i srpskog jezika, 800 grama sveta oko nas, 600 grama bloka i bojica za crtanje, 500 grama pernice, 700 grama užine i flašice sa vodom, preko jedan kilogram oprema za fizičko, preteški radni listovi i u toku nedelje masa torbe se krece od nekoliko kilograma do 8.5 kilograma. Stručnjaci upozoravaju da torba treba da bude što lakša, kada je prazna može da teži najviše jedan kilogram.

Problem teške đačke torbe povezan je sa različitim tipovima nepravilnog držanja, kao što su kifotična, lordotična, skoliotična, prisutnosti bola u pojedinim delovima kičme i štetnim uticajem na rast i razvoj deteta. Procenat dece s nepravilnim držanjima raste u periodu od šeste do devete godine i taj procenat se kreće od 51 do 62% (Grimmer, i sar., 2002; Hong, i Cheung, 2003; Paušić i sar., 2009).

Mnoga istraživanja provedena po celom Svetu ukazuju da masa đačkih torbi u proseku premašuje tu dopuštenu vrednost, pa se kreće od 10% do 14% (Whittfiel, 2001; Fošnarič, i Delčnjak, 2007). Nedavna istraživanja na mlađem školskom uzrastu u Hrvatskoj pokazala su da se prosečna masa đačke torbe u odnosu na masu učenika kreće od 12,5% do 13,8% (Paušić, i Kujundžić, 2008). U prvom razredu maksimalni odnos mase tela i torbe iznosi 29.17% od dozvoljenog (Paušić, i sar., 2013), dok on ne bi trebao da bude veći od 5% (Milaradović i sar., 2014). Rezultati dobijeni u istraživanju koje je imalo za cilj da istraži uticaj mase torbe na nastanke nepravilnog držanja, ukazuju da je pogoršanje najznačajnije između tačke bez opterećenja (0%) i prve tačke sa opterećenjem (5%) gde deca odmah pri prvom opterećenju menjaju telesno držanje (Prvan i Veršić, 2011). Glava se pomera napred i javlja se bol u vratu (Hundekari i sar., 2013). Kod odraslih do kompenzatornih pokreta prema napred dolazi tek kada masa torbe pređe 27% masu tela (Rahman i sar., 2011). Pored bola u vratu čest je i bol u leđima (Reneman i sar., 2006). Teške torbe mogu da doprinesu i lumbalnom bolu kod dece (Troussier i sar., 1994). Kada masa torbe iznosi više od 15% do 20% mase učenika javlja se bol u leđima i dugotrajna upotreba može dovesti do promene stava i hoda (Mackenzie et al., 2003).

U Italiji najmanje jednom nedeljno 34.8% školske dece nosi torbu čija masa iznosi više od 30% njihove telesne mase, što izaziva bol u leđima (Negrini i sar., 1999). Slična je sitacija i u Americi gde prosečni učenik nosi torbu mase skoro četvrtinu njegovog tela, a svaki treći učenik nosi torbu mase do jedne trećine svoje težine. (Pascoe i Pascoe, 1999). U Nemačkoj odnos mase tela i torbe na prvom nivou školovanja iznosi 11,10%, na drugom 12,5% i na trećem između 12,50% i 14, 30% (Voll, i Klimt,

Rad je realizovan u okviru projekta „Efekti primenjene fizičke aktivnosti na lokomotorni, metabolički, psiho-socijalni i vaspitni status populacije R Srbije“ pod brojem III47015, a kao deo potprojekta “Efekti primenjene fizičke aktivnosti na lokomotorni, metabolički, psiho-socijalni i vaspitni status školske populacije R Srbije” koji se finansira od strane Ministarstva za prosvetu, nauku i tehnološki razvoj R Srbije – Ciklus naučnih projekata 2011-2015

1977). Pasko i sar., (1997) navode da se u Americi odnos mase tela i torbe kreće u intervalu od 17% do 22%. Do sličnih rezultata u Americi došao je i Mackenzie et al. (2003), gde se odnos kretao od 15% do 20%. Masa đačke torbe u istraživanjima (Fošnarič, i Delčnjak, 2007; Paušić i Kujundžić, 2008; Marković i sar., 2011) kreće se preko 15% telesne mase učenika.

Aktuelni problem svakog učenika, porodice, škole, školskih uprava i ministarstava zemalja na svim kontinentima uz mnogobrojne studije istaknutih naučnika navele su na razmišljanje da se ovim istraživanjem utvrde stavovi učenika mlađeg školskog uzrasta prema problemima vezanim za đačku torbu. Navedena istraživanja ukazuju da je problem najizraženiji kod učenika mlađeg školskog uzrasta.

METOD

Istraživanje je transverzalnog karaktera realizovano u 33 seoske i gradske osnovne škola na teritoriji Beogradskog, Šumadijskog, Braničevskog i Pomoravskog okruga u drugom polugodištu školske 2014/2015. Uzorak ispitanika obuhvatio je 307 učenika podeljenih na četiri karakteristična subuzoraka u odnosu na uzrast i to: 18 učenika prvog razreda, 92 drugog, 52 trećeg i 145 učenika četvrtog razreda. Za prikupljanje podataka primenjen je anketni upitnik sa sedam pitanja. Upitnik je popunjavan za vreme redovnih časova nastave fizičkog vaspitanja uz prisustvo učitelja. U prvom razredu učitelj je čitao pitanja i beležio odgovore učenika. U drugom, trećem i četvrtom razredu upitnik su učenici sami popunjavali. Priroda i distribucija dobijenih rezultata odredili su adekvatne statističke procedure. U okviru kvantitativne analize podataka primenjeno je: procentualno izražavanje frekvencija i hi-kvadrat test (χ^2) za testiranje hipoteza o značajnosti razlika.

REZULTATI

Brojčane i procentualne vrednosti u Tabeli 1. ukazuju da 55.6% procenata učenika prvog razreda dolazi pešice u školu, manji broj dovoze roditelji, dok autobusom zbog uzrasta ne dolazi ni jedan učenik.

Tabela 1. Način dolaska učenika u školu

	U školu dolazite:			
Razred	a) Pešice	b) Autom	v) Autobusom	Σ
Prvi	10 (55.6%)	8 (44.4%)	0 (0%)	18 (100%)
Drugi	48 (52.2%)	35 (38.0%)	9 (9.8%)	92 (100%)
Treći	37 (71.2%)	15 (28.8%)	0 (0%)	52 (100%)
Četvrti	113 (77.9%)	22 (15.2%)	10 (6.9%)	145(100%)
Σ	208 (67.8%)	80 (26.1%)	19 (6.2%)	307 (100%)

χ^2=26.522; *df*=2; p= .000

Slična je situacija u drugom razredu gde 52.2% učenika dolazi pešice. U starijem uzrastu situacija je još ubedljivija i u trećem razredu 71.2%, a u četvrtom 77.9% učenika dolazi pešice u školu. Manji broj dolazi autom, a još manji autobusom. Podaci ukazuju na mali broj učenika putnika u istraženim školama. Vrednosti χ^2 testa ukazuju na statistički značajne razlike u načinu dolaska u školu između učenika prvog, drugog, trećeg i četvrtog razreda.

Tabela 2. Udaljenost škole od kuće učenika

	Škola je udaljena od Vaše kuće:				
Razred	a) Do 500 m	b) Od 500 m do 1 km	v) Od 1 km do 3 km	g) Preko 3 km	*Σ*
Prvi	1 (5.6%)	13 (17.2%)	3 (16.7%)	1 (5.6%)	18 (100%)
Drugi	29 (31.5%)	24 (26.1%)	18 (19.6%)	21 (22.8%)	92 (100%)
Treći	26 (50.0%)	13 (25.0%)	8 (15.4%)	5 (9.6%)	52 (100%)
Četvri	65 (44.8%)	41 (28.3%)	29 (20.0%)	10 (6.9%)	145(100%)
Σ	121 (39.4%)	91 (29.6%)	58 (18.9%)	37 (12.1%)	307 (100%)

χ^2=34.565; *df*=9; p=.000

Učenici prvog razreda sa torbom na leđima pešače od 500 metara do 3 kilometra. U drugom razredu pređeni put od kuće do škole i nazad je šarenolik. Najviše je učenika koji pešače do 500 metara, a ima i onih koji prelaze preko tri kilometra. U trećem razredu 50.0% učenika prelazi do 500 metara na putu do škole. Manji je broj koji prelaze do tri i preko tri kilometra. Četvrtaci, u zavisnosti od mesta stanovanja, prelaze od 500 metara do tri kilometra. Najmanji je procenat onih koji prelazi preko tri kilometra. Vrednost χ^2 testa ukazuje na statistički značajne razlike u udaljenosti škole od kuće između učenika prvog, drugog, trećeg i četvrtog razreda osnovne škole.

Tabela 3. Način nošenja đačke torbe

	Đačku torbu nosite:		
Razred	a) Na jedno rame	b) Na dva ramena	*Σ*
Prvi	0 (0%)	18 (100.0%)	18 (100%)
Drugi	6 (6.5%)	86 (93.5%)	92 (100%)
Treći	2 (3.8%)	50 (96.2%)	52 (100%)
Četvri	7 (4.8%)	138 (95.2%)	145(100%)
Σ	15 (4.9%)	292 (95.1%)	307 (100%)

χ^2=9.761; *df*=6; *p*=.135;

Dobijeni rezultati ukazuju da svi učenici prvog razreda nose torbu na oba ramena. Slična situacija sa 93.5% je kod drugaka, trećaka sa 96.2% i četvrtaka sa 95.2%. U čitavom uzorku svega 4.9% učenika mlađeg školskog uzrasta nosi torbu na jedno rame ili u ruci. Dobijeni rezultati su uslovili vrednost χ^2 testa koji ukazuje da ne postoji statistički značajna razlika u nošenju torbe između učenika prvog, drugog, trećeg i četvrtog razreda osnovne škole.

Tabela 4. Pakovanje đačke torbe

	Za školu torbu pakujete:			
Razred	a) Sami	b) Uz pomoć roditelja	v) Brat ili sestra	*Σ*
Prvi	11 (60.2%)	6 (33.3%)	1 (5.6%)	18 (100%)
Drugi	75 (81.5%)	15 (16.3%)	2 (2.2%)	92 (100%)
Treći	50 (96.2%)	1 (1.9%)	1 (1.9%)	52 (100%)
Četvrti	140 (96.6%)	5 (3.4%)	0 (0%)	145(100%)
Σ	276 (89.9)	27 (8.8%)	4 (1.3%)	307 (100%)

χ^2=67.782; *df*=9; *p*=.000

Poražavajuće je saznanje da u prvom razredu 60.2% učenika pakuje samo torbu, dok svaki treći roditelj pomaže detetu u pripremi za školu. U drugom razredu sitacija je ista sa 81.5% učenika koji sami pakuju torbu. U trećem i četvrtom razredu preko 96.0% učenika pakuje samo torbu za školu. Pomoć roditelja, starijeg brata ili sestre skori da i ne postoji. Vrednost χ^2 testa ukazuje da postoji statistički značajna razlika u pakovanju torbe između učenika prvog, drugog, trećeg i četvrtog razreda osnovne škole.

Tabela 5. Radni listovi učenika

	Radne listove iz pojednih predmeta			
Razred	a) Nosite sa sobom, za svaki čas, kada imate te predmete	b) Ostaju kući i povremeno ih nosite	v) Ostaju u školi kod nastavnika	Σ
Prvi	18 (100.0%)	0 (0%)	0 (0%)	18 (100%)
Drugi	66 (71.7%)	11 (12.0%)	15 (16.9%)	92 (100%)
Treći	40 (76.9%)	11 (21.2%)	1 (1.9%)	52 (100%)
Četvrti	120 (82.2%)	6 (4.1%)	19 (13.1%)	145(100%)
Σ	244 (79.5%)	28 (9.1%)	35 (11.4%)	307 (100%)

χ^2=25.000; df=5; p=.000

Kada su u pitanju radni listovi, prvaci ih uvek nose. Većim delom nošenje je povezano sa pakovanjem torbi, gde roditelji ne učestvuju, a učitelji ne upozoravaju dan ranije šta je neophodno za sutrašnje časove, tako da pojedini učenici svakoga dana nose sve knjige i radne listove. Učenici drugog, trećeg i četvrtog razreda nose svoje radne listove. Mali je broj učenika koji su u situaciji da svoje radne listove ostave u školi. Ostavljanje radnih listova u školske ormariće omogućeno je uglavnom učenicima beogradskih škola. Vrednost χ^2 testa ukazuje da postoji statistički značajna razlika u nošenju radnih listova između učenika prvog, drugog, trećeg i četvrtog razreda osnovne škole.

Tabela 6. Neprijatnosti pri nošenju torbe

	Da li Vam torba izaziva bol			
Razred	a) Bole me ramena	b) Bole me leđa	v) Ne osećam nikakav bol	Σ
Prvi	12 (66.7%)	6 (33.3%)	0 (0%)	18 (100%)
Drugi	45 (48.9%)	44 (47.8%)	3 (3.3%)	92 (100%)
Treći	31 (59.65)	21 (40.4%)	0 (0%)	52 (100%)
Četvrti	88 (60.7%)	54 (37.2%)	3 (2.1%)	145(100%)
Σ	176 (57.3%)	125 (40.7%)	6 (2.0%)	307 (100%)

χ^2=5.739; df=6; p=.453

Problem neprijatnosti pri nošenju tereta na nejaka pleća manifestvovan je u vidu bola u vratnom i slabinskom delu kičmenog stuba. Od 307 anketiranih učenika 57.3% oseća bol na ramenima, 40.7% u leđima, a samo 2.0% učenika trećeg i četvrtog razreda ne oseća nikakav bol. Ako se osvrnemo na dolazak u školu uočićemo da su to učenici koji u školu dolaze autom ili autobusom i nisu opterećeni teškom torbom. Vrednost χ^2 testa ukazuje da ne postoji statistički značajna razlika u osećaju bola od strane teške đačke torbe. Bol je podjednako zastupljen kod svih učenika na ramenima i kičmenom stubu.

Tabela 7. Đačka torba učenika

	Smatram da je moja đačka torba:			
Razred	a) Normalne težine	b) Teška	v) Preteška	*Σ*
Prvi	6 (33.3%)	5 (27.8%)	7 (38.9%)	18 (100%)
Drugi	21 (22.8%)	33 (35.9%)	38 (41.3%)	92 (100%)
Treći	19 (36.5%)	28 (53.8%)	5 (9.6%)	52 (100%)
Četvrti	64 (44.1%)	54 (37.2%)	27 (18.6%)	145(100%)
Σ	110 (35.8%)	120 (39.1%)	77 (25.1%)	307 (100%)

χ^2=44.818; *df*=9; *p*=.000

Dobijeni rezultati ukazuju da su učenici prvog i drugog razreda svesni njihovih preteških torbi. Od ukupnog broja učenika 64.2% smatra da je njegova torba teška ili preteška. Torba je malo teža u 53.8% slučajeva - izjavljuju učenici trećeg grazreda. Učenici četvrtog razreda u većini slučajeva smatraju da su njihove torbe normalne težine. Različiti stavovi o težini đačke torbe, kod različitih uzrasta uslovili su statistički znalajnu razliku sa nivoom od p=.000.

DISKUSIJA

Najmanji broj dece dolazi u školu autobusom, dok je procenat seoske dece koja dolaza autobusom znatno veći. Mali je i broj dece koja pešači više od tri kilometra. Učenici seoskih škola svoju tešku torbu nose od jednog do osam kilometara u oba pravca. Najučestalija udaljenost je od dva do 6 kilometara (Marković i sar., 2013).

Preko 95.0% učenika nosi đačku torbu na oba ramena. U prvom razredu svi učenici nose torbu na oba ramena, što je u skladu sa rezultatima sličnih istraživanja kod kojih su se vrednosti kretale od 68-94% (Casey, i Dockrell, 1996; Pascoe i sar., 1997). Kod učenica situacija je drugačija i oko 30.0% njih nosi torbu na jedno rame (Marković i sar., 2013). Masa đačke torbe i njeno nepravilno nošenje na jednom ramenu su bitni faktori u nastanku lumbalnog bolnog sindroma u mlađe dece (Skoffer, 2007). Paušić i sar. (2009) su utvrdili da 93,1% učenika torbu nosi na oba ramena. Mali procenat učenika torbu nosi dijagonalno (0,8%), u jednoj ruci 2,3%, a kod 3,8% učenika torba je nošena od strane roditelja.

Odgovori na pomoć pri pakovanju torbi su obeshrabrujući. Od 307 učenika njih 276 samo pakuje torbu (89.9%), u 8.8% slučajeva pomažu roditelji i svega 1.3% stariji brat ili sestra. Kod seoske dece pomoć roditelja je neznatno veća, što se tumači prisustvom i ispraćanju dece u školu od strane roditelja. Jedno od rešenja koje bi dovelo do toga da torbe budu lakše su neophodni pregledi od strane roditelja.

Dobijeni rezultati upućuju da svi prvaci nose svoje radne listove, a slična je situacija i u starijim razredima. Najmanji broj dece ostavlja radne listove u školu. Roditelji bi trebalo da redovno proveravaju torbe svoje dece, kako ne bi bile ispunjene nepotrebnim stvarima, da podstiču svoju decu da pažljivo razmisle o tome šta im je zaista potrebno toga dana za školu. Često se dešava da deca prepune svoje torbe iz loših navika (University of Michigan Health System, 2003). Učitelji i nastavnici bi mogli razmotriti mogućnost najavljivanja koji su udžbenici neophodni za naredni dan i tako olakšati torbu učenika. Postoji manji broj učenika koji svakoga dana nose sve knjige i sveske u strahu da nešto ne zaborave.

Preopterećenja sa teškom đačkom torbom dovode do različite vrste bolova u vratu, ramenima i kičmenom stubu. Neprijatnosti usled teške torbe u vidu bola u ramenima u ovom istraživanju oseća 57.3%, a u leđima 40.7% učenika mlađeg školskog uzrasta. Bilo koji vid bola nije konstatovan samo u 2.0% slučajeva. U Engleskoj oko 45% učenika ima periodične bolove u vratu i leđima (Troussier et al. 1994; Fošnarič & Delčnjak, 2007). Deca koja su izložena teškoj torbi i trpe bol u leđima su pod povećanim rizikom od oboljevanja kičmenog stuba u kasnijem periodu, kao odrasli (Mackenzie et al. 2003).

Školske torbe su sve teže uprkos upozorenjima Svetske zdravstvene organizacije i stručnjaka. Svega 35.8% učenika smatra da je njihova torba normalne težine, 39.1% da je teška i 25.1% da je preteška. U pomoć su uključeni roditelji, dede i babe koji prate i sačekuju svoje đake. Često se torbe vuku na točkićima što takođe može narušiti posturalni status učenika.

ZAKLJUČAK

Đačka torba ne predstavlja problem samo učenika, već porodice, škole, grada i države. Preko potrebni đački ormarići su najzastupljeniji u beogradskim školama, dok će se u manjim seoskim školama sa kombinovanim odeljenjima na njih dugo čekati. Učenicima trebaju pomoći učitelji, roditelji, školske uprave i Ministrstvo prosvete, nauke i tehnološkog razvoja. Sve dok svi ovi faktori ne budu u funkciji deteta, ono će grcati pod teretom preteških torbi.

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THE ATTITUDES OF YOUNGER SCHOOL AGE STUDENTS TOWARDS A SCHOOLBAG

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INTRODUCTION

A schoolbag always associates people on school days and represents the beginning of one very important period in life. A heavy schoolbag is a constant problem, especially for younger school pupils. The weight of a schoolbag which is carried by younger age pupils in Serbia is over 10% of pupil's body weight and it is over allowed recommendations of the World Health Organisation, Numerous studies show that most children carry the load greater that 10% of their body weight (Feingold and Jacobs 2002; Van Gent, 2003; Korovessis et al., 2004). There are often 2 kilos of mathematics and Serbian language in a schoolbag, 800 grams of the World Around Us, 600 grams of drawing paper and colours, 500 grams of pencil case, 700 grams of snacks and bottle with water, over one kilo of physical education equipment, too heavy workbooks, and during the week the weight of a schoolbag varies from several kilos to even 8.5 kilos. The experts warn that a schoolbag should be lighter, when it is empty it should weigh up to one kilogram.

The problem of a heavy schoolbag is connected with different types of inaccurate posture, like kyphotic, lordotic, scoliotic postures and the presence of pain in certain parts of spine and harmful effect on the growth and development of a child. The percentage of children with inaccurate posture grows in the period from the age of six to the age of nine and that percent is between 51% to 62% (Grimmer et al., 2002; Hong and Cheung, 2003; Pausic et al., 2009).

Many studies done around the world indicate that the weight of schoolbags on average exceeds allowed value, and it is between 10% to 14% (Whittfiel, 2001; Fosnaric and Delcnjak, 2007). Recent studies on younger school age pupils in Croatia have shown that the average weight of a schoolbag in relation to the weight of a pupil is 12.5% to 13.8% (Pausic and Kujundzic, 2008). In the first grade the maximal ratio of the body and schoolbag weight is 29.17% from the allowed (Pausic et al., 2013), while it should not be bigger than 5% (Miloradovic et al., 2014). The results acquired in the research which had a goal to study the influence of the weight of a schoolbag on inaccurate postures, indicate that worsening is the most significant between the point without load (0%) and the first point with the load (5%) where children immediately during the first load change body posture (Prvan and Versic, 2011). The head moves forward and the pain in the neck starts (Hundekari et al., 2013). In adults forward compensatory movements start when the schoolbag weight exceeds 27% of the body weight (Rahman et al., 2011). Beside the pain in the neck, the pain in the back is also present (Reneman et al.,2006). Heavy schoolbags can contribute to lumbal pain at children (Troussier et al., 1994).

When the schoolbag weight is more then 15% to 20% of a pupil's weight a pain in the back starts and long term use can bring changes of posture and walk (Mackenzie et al., 2003).

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In Italy, at least once a week 34.8% of school children carry schoolbags whose weight is more than 30% of their body weight, which provokes pain in back (Negrini et al., 1999). Similar situation exists in America where an average pupil carries a schoolbag which is a quarter of his/her body weight, and every third pupil carries a schoolbag which represents the third of his or her body weight. (Pascoe and Pascoe, 1999). In Germany the ratio of a schoolbag weight and body weight in the first level of schooling is 11,10%, on the second level it is 12,5% and on the third level it is 12,50% and 14,30% (Voll and Klimt, 1977). Pascoe et al., (1997) show results that in America the ratio of a schoolbag weight and body weight is between 17% to 22%. Mackenzie had similar results in America (Mackenzie et al.,20013), where the ratio was 15% to 20%. A schoolbag weight in studies (Fosnaric and Delcnjak. 2007; Pausic and Kujundzic, 2008; Markovic et al., 2011) is about 15% of the pupil's body weight,

Actual problem of each student, family, school, school managements and Ministries in all countries with many studies of eminent experts provoked thinking that by this research it would be good to determine the attitudes of younger school age pupils towards problems connected with a schoolbag. These researches indicate that the problem is the most evident for younger school pupils.

METHOD

The research has transversal character and it was realized in 33 village and town primary schools on the territory of Belgrade, Šumadija, Braničevo and Pomoravlje region in the second term of 2014/2015 school year. The sample consisted of 307 students divided into four characteristic sub samples in relation to their age, and these were: 18 first grade pupils, 92 second grade pupils, 52 third grade pupils and 145 fourth grade pupils. A seven question survey was used for the collecting of the data. The survey was filled during regular physical education classes in the presence of a teacher. In the first grade the teacher read questions and wrote down the answers of the pupils. In the second, third and fourth grade, the pupils filled the forms themselves. The nature and the distribution of the results determined adequate statistical procedures. In the realm of quantitative analysis of the data the following was applied: percentage expressing of frequencies and hi-square test (χ^2) for the testing of hypothesis about the significance of differences.

RESULTS

Numerical and percentage values in Table 1.indicate that 55,6% of students in the first grade walk to school, a small number of them are driven by their parents, while none of the pupils comes to school by bus.

Table 1. The way of going to school

	You come to school:			
Grade	a) On foot	b) By car	v) By bus	Σ
First	10 (55.6%)	8 (44.4%)	0 (0%)	18 (100%)
Second	48 (52.2%)	35 (38.0%)	9 (9.8%)	92 (100%)
Third	37 (71.2%)	15 (28.8%)	0 (0%)	52 (100%)
Fourth	113 (77.9%)	22 (15.2%)	10 (6.9%)	145(100%)
Σ	208 (67.8%)	80 (26.1%)	19 (6.2%)	307 (100%)

χ^2=26.522; *df*=2; p= .000

Similar situation is in the second grade where 52,2% of pupils walk to school. In older school age the situation is even more convincing and in the third grade 71,2%, and in the fourth grade 77,9% of pupils walk to school. A small number of pupils go to school by car and smaller number by bus. The data indicate that there is a small number of pupils who travel to school. The values of χ2 test indicate that there are statistically significant differences in the way of coming to school between the pupils of the first, second, third and fourth grade.

Table 2. A distance from pupils' school to home

Grade	School is far from house				
	a) Up to 500 m	b) From 500 m to 1 km	v) From 1 km to 3 km	g) Over 3 km	Σ
First	1 (5.6%)	13 (17.2%)	3 (16.7%)	1 (5.6%)	18 (100%)
Second	29 (31.5%)	24 (26.1%)	18 (19.6%)	21 (22.8%)	92 (100%)
Third	26 (50.0%)	13 (25.0%)	8 (15.4%)	5 (9.6%)	52 (100%)
|Fourth	65 (44.8%)	41 (28.3%)	29 (20.0%)	10 (6.9%)	145(100%)
Σ	121 (39.4%)	91 (29.6%)	58 (18.9%)	37 (12.1%)	307 (100%)

$\chi 2=34.565$; df=9; p=.000

The first grade pupils walk to school from 500 meters to 3 kilometers. In the second grade the length of the road is various. Most pupils walk up to 500 meters, but there are also those who walk up to 3 kilometers. In the third grade 50% of pupils walk 500 meters. A small number of these walk to 3 kilometers and over 3 kilometers. The fourth grade pupils, depending of the place where they live walk from 500 meters to 3 kilometers. The smallest percentage is for those who travel over 3 kilometers. The values of $\chi 2$ test indicate that there are statistically significant differences in distance from home between pupils of the first, second, third and fourth grade of primary school.

Table 3. The way of carrying a schoolbag

Grade	You carry a schoolbag:		Σ
	a) Over one shoulder	b) On both shoulders	
First	0 (0%)	18 (100.0%)	18 (100%)
Second	6 (6.5%)	86 (93.5%)	92 (100%)
Third	2 (3.8%)	50 (96.2%)	52 (100%)
Fourth	7 (4.8%)	138 (95.2%)	145(100%)
Σ	15 (4.9%)	292 (95.1%)	307 (100%)

$\chi 2=9.761$; df=6; p=.135;

The results show that all first grade students carry a schoolbag on both shoulders. Similar situation is with 93,5% of second grade students, and 96,2% of third grade students and 95,2% of fourth grade students. In the whole sample only 4,9% of students of younger school age carry the schoolbag over one shoulder or in hand. The results influenced the value $\chi 2$ test which indicate that there is no statistically significant difference in carrying of a schoolbag between the pupils in the first, second, third and fourth grade of primary school.

Table 4. Packing of a schoolbag

Grade	For school you pack:			
	a) Alone	b) With the help of your parents	v) Brother or sister	Σ
First	11 (60.2%)	6 (33.3%)	1 (5.6%)	18 (100%)
Second	75 (81.5%)	15 (16.3%)	2 (2.2%)	92 (100%)
Third	50 (96.2%)	1 (1.9%)	1 (1.9%)	52 (100%)
Fourth	140 (96.6%)	5 (3.4%)	0 (0%)	145(100%)
Σ	276 (89.9)	27 (8.8%)	4 (1.3%)	307 (100%)

$\chi 2=67.782$; df=9; p=.000

It is really disappointing that in the first grade 60,2% of students pack their schoolbags alone, while every third parent helps their child to prepare for school. In the second grade the situation is the same with 81,5% of pupils who pack their bags alone. In the third and fourth grade over 96% of pupils pack their schoolbags alone. The help of parents, older brother or a sister almost does not exist. The value χ2 indicates that there is statistically significant difference in packing of a schoolbag between the pupils in the first, second, third and fourth grade of primary school.

Table 5. Pupils'workbooks

Grade	**Workbooks from certain subjects**			Σ
	a) Carry with you, for each lessonwhen you have these subjects	b) Leave them at homeand sometimes carry to school	v) Stay at shool at teachers' lockers	
First	18 (100.0%)	0 (0%)	0 (0%)	18 (100%)
Second	66 (71.7%)	11 (12.0%)	15 (16.9%)	92 (100%)
Third	40 (76.9%)	11 (21.2%)	1 (1.9%)	52 (100%)
Fourth	120 (82.2%)	6 (4.1%)	19 (13.1%)	145(100%)
Σ	244 (79.5%)	28 (9.1%)	35 (11.4%)	307 (100%)

χ2=25.000; df=5; p=.000

Considering workbooks the first grade pupils always carry them. Mostly carrying of workbooks is connected with packing of a schoolbag, in which parents do not participate, and teachers do not warn a day earlier what is necessary for tomorrow's lessons, so that some pupils carry all textbooks and workbooks every day. The pupils of second, third and fourth grade carry their workbooks. A small number of pupils who can leave their workbooks at school. Leaving of workbooks in school lockers is mostly enabled in Belgrade schools. The value of χ2 test indicates that there is statistically significant difference in carrying of workbooks between the pupils of the first, second, third and fourth grade of primary school.

Table 6. Inconveniences during carrying of a schoolbag

Grade	**Does a schoolbag induces pain**			Σ
	a) My shoulders hurt	b) My back hurts	v) I don't feel any pain	
First	12 (66.7%)	6 (33.3%)	0 (0%)	18 (100%)
Second	45 (48.9%)	44 (47.8%)	3 (3.3%)	92 (100%)
Third	31 (59.65)	21 (40.4%)	0 (0%)	52 (100%)
Fourth	88 (60.7%)	54 (37.2%)	3 (2.1%)	145(100%)
Σ	176 (57.3%)	125 (40.7%)	6 (2.0%)	307 (100%)

χ2=5.739; df=6; p=.453

The problem of pain during carrying of a schoolbag on weak back is manifested with the pain in neck and loin part of the spinal cord. Out of 307 pupils 57,3% feel the pain on shoulders, 40,7% on backs, and only 2% of pupils in the third and the fourth grade does not feel the pain at all. If we consider coming to school we can notice that these are the students that come to school by car or bus and they are not loaded by a heavy schoolbag. The value of χ2 test indicate that there is no statistically significant difference in the feeling of pain by carrying a heavy schoolbag. The pain is evenly present for all pupils on shoulders and spinal cord.

Table 7. Pupils'schoolbag

Grade	I think that my schoolbag is:			Σ
	a) Normal weight	b) Heavy	v) Too heavy	
First	6 (33.3%)	5 (27.8%)	7 (38.9%)	18 (100%)
Second	21 (22.8%)	33 (35.9%)	38 (41.3%)	92 (100%)
Third	19 (36.5%)	28 (53.8%)	5 (9.6%)	52 (100%)
Fourth	64 (44.1%)	54 (37.2%)	27 (18.6%)	145(100%)
Σ	110 (35.8%)	120 (39.1%)	77 (25.1%)	307 (100%)

$\chi 2=44.818$; df=9; p=.000

The results indicate that the first and the second grade pupils are aware of their too heavy schoolbags. From the total number of pupils 64.2% think that their schoolbag is heavy or too heavy. A schoolbag is a little heavier in 53,8% of cases – say the third grade pupils. The fourth grade pupils in most of the cases think that their schoolbags have normal weight. Different attitudes about the weight of a schoolbag, fro different age groups conditioned statistically significant difference with the level of p=.000.

DISCUSSION

The smallest number of children comes to school by bus, while the percentage of village children who come to school by bus is significantly bigger. There is also a small number of children who walk to school more than three kilometers. Pupils in village schools carry their heavy bags from one to eight kilometers in both directions. The most frequent distance is from two to six kilometers (Markovic et al., 2013).

Over 95.0% of pupils carry their schoolbags on both shoulders. In the first grade all pupils carry their schoolbags on both shoulders, which is in accordance with the results of similar researches in which the value were from 68%-94% (Casey and Dockrell, 1996; Pascoe et al., 1997). The situation is different for girls and about 30% of them carry their schoolbags over one shoulder (Markovic et al., 2013). The schoolbag weight and its inaccurate carrying over one shoulder are important factors in the continuation of lumbal pain syndrome at younger school children (Skoffer, 2007). Pausic et al., (2009) determined that 93,1% of pupils carry their schoolbags on both shoulders. A small percentage of pupils carry their schoolbags diagonally (0,8%), in one hand 2,3%, and at 3,8% of pupils a schoolbag was carried by parents.

The answers considering help during packing of a schoolbag are discouraging. Out of 307 pupils 276 pack their schoolbags alone (89,9%), and in 8,8% parents help their children and in only 1,3% older brother or sister. For village pupils the parents' help is slightly higher, which means that parents are present while children go to school and come back from school. One of the solution which would bring to the fact that a schoolbag is lighter is a necessary examining by the parents.

The results indicate that all first grade pupils carry their workbooks, and similar situation is in older grades. Very few children leave their workbooks at schools. Parents should regularly check their children's schoolbags, so that they are not filled with unnecessary things, to help their children to think carefully about what they really need fro that day at school. The habit is that children usually overload their schoolbags (University of Michingan Health System, 2003). Teachers should consider the possibility of announcing which textbooks are needed for the next day and in this way they could ease pupil's schoolbags. There is a smaller number of pupils who carry all books every day in fear not to forget something.

Overload with a heavy schoolbag cause different types of pain in te neck, shoulders and spinal cord. Inconveniences provoked by heavy schoolbag like pain in shoulders in this research feels 57,3%, and in backs 40,7% of younger age pupils. Any kind of pain was not noticed in only 2,0% of cases. In England around 45% of pupils have periodical pains in neck and back (Troussier et al., 1994; Fosnaric

and Delcnjak, 2007) The children who are exposed to heavy schoolbag and suffer pain in spinal cord have increasing risk of spinal cord diseases in later age, like adults (Mackenzie et al., 2003).

Schoolbags are heavier despite all the warnings of the World Health Organisation and other experts. Only 35,8% of pupils think that their schoolbag has normal weight, 39,1% that it is heavy and 25,1% that it is too heavy. Parents, grandfathers, grandmothers are engaged to help pupils; They escort and wait for their pupils. It is often the case that schoolbags are pulled on trolleys which can also damage pupils' posture.

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SPORTSKO-REKREATIVNI OBJEKTI I MENADŽMENT KAO ČINILAC USPEHA U SPORTSKO-REKREATIVNIM AKTIVNOSTIMA

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UVOD

Svakako najznačajniji materijalni resurs sistema sporta predstavljaju sportski objekti. Oni svojom strukturom, planiranom namenom i funkcionalnim statusom određuju, u velikoj meri, plansko-programsku orijentaciju kod izrade sportskih programa na svim nivoima organizovanja. Među sportskim objektima posebno mesto zauzimaju sportski centri kao polivalentni građevinski kompleksi koji, pružanjem usluga na tržištu, omogućavaju da se obezbede uslovi za bavljenje različitim modalitetima sportskih aktivnosti (sportsko obrazovanje, takmičarski sport, rekreativni sport, školski sport) i za različite kategorije korisnika (deca, omladina, odrasli, osobe sa posebnim potrebama).

Zakon o sportu Republike Srbije (Slụtbeni glasnik RS br. 52/96) u članu 53. definiše: „Sportski objekat je građevina, odnosno prostor (građevinski objekat, odnosno njegov deo ili uređena površina), namenjen za sportske aktivnosti, koji mora da ima prateći prostor (sanitarni, garderobni, spremišni, gledališni i drugi) i ugrađenu opremu (građevinsku i sportsku)." Sportsko-rekreativni objekti su manja ili veća skupina objekata i površina na suvom i vodi, namenjenih deci, omladini, građanima svih starosnih grupa, bez obzira na nivo motoričkih sposobnosti, sportistima, rekreativcima...tj prostori za realizovanje sportsko-rekreativnih aktivnosti u cilju zadovoljenja čovekovih potreba za bavljenjem organizovanim telesnim aktivnostima.

Sportski objekti mogu sadržati jedno ili više igrališta – vežbališta, glavne i pomoćne terene; prateće sadrṭaje poput svlačionica, ekonomata, magacina, ambulante, prostorije za službena lica, administraciju, teretane, saune, solarijume, sale za masažu; zatim prostor za publiku – gledalište sa pratećim prostorima; prostore za odmor i rekreaciju, učenje; kao i odgovarajuće komunikacije: hodnici, prilazi, prolazi, liftovi, parkinzi i dr. U okviru savremenih sportskih objekata, kao što su fudbalski stadioni, multifunkcionalne arene i slično, sve češće se pojavljuju komercijalni ili poslovni prostori koji se najčešće rentiraju drugim licima i predstavljaju značajan izvor prihoda u funkciji racionalnog upravljanja i poslovanja (pokrivanje troškova održavanja, osiguranja i eksploatacije sportskog objekta).

Javni sportski tereni, u smislu pomenutog zakona, jesu posebno uređene površine namenjene za određene sportske aktivnosti (trim staze, planinarske staze, skijaški tereni, biciklističke staze, plaže i sl.), dostupne građanima pod jednakim uslovima.

METOD

U radu je, da bi se što detaljnije prikazali sportsko-rekreativni objekti i prostori za vežbanje, kao i njihova bitna uloga upražnjavanju sportsko-rekreativnih aktivnosti, koristla metoda teorijske analize i metoda deskripcije.

Klasifikacija sportsko-rekreativnih objekata izvršena je prema različitim kriterijumima: prema potrebama korisnika, prema urbanističkoj stalnosti, prema sportskim aktivnostima, prema građevinskom obliku, prema lokaciji.

REZULTATI SA DISKUSIJOM

Klasifikacija sportsko-rekreativnih objekata

Sportske objekte možemo klasifikovati prema različitim kriterijumima.

Prema potrebama korisnika sportski objekti se mogu klasifikovati na:

Objekte za takmičarski sport

Objekte za masovni sport i rekreaciju

Objekte za školski i univerzitetski sport

Objekte za sport u vojsci

Objekte za sport invalida i osoba sa hendikepom

Prema urbanističkoj stalnosti:

Objekti stalnog karaktera

Objekti privremenog karaktera (sportski tereni se postavljaju na lokaciji predviđenoj za drugu namenu do početka izgradnje ili korišćenja lokacije)

Prema sportskim aktivnostima:

Objekte za sportske igre (sportske hale, fudbalski, ragbi, bejzbol stadioni...)

Objekte za atletiku (atletski stadioni i dvorane)

Oblekte za gimnastiku (gimnastičke dvorane i vežbališta)

Objekte za sportove na vodi (bazeni, jezera, reke, more...)

Objekte za zimske i ledene sportove (ledene dvorane, ski staze...)

Objekte za borilačke sportove (manje sportske hale, spcijalizovani objekti...)

Objekte za streljaštvo i streličarstvo (streljane, otvoreni streličarski objekti...)

Objekte za biciklizam (velodromi, biciklističke staze...)

Objekte za konjički sport (hipodromi)

Multifunkcionalne sportske objekte itd.

Prema građevinskom obliku:

Zatvoreni sportski objekti (hale)

Otvoreni sportski objekti (stadioni, javni sportski tereni)

Poluotvoreni sportski objekti

Objekti od lakih konstrukcija (balon hale, montaţni objekti...)

Kompleksni sportski objekti (mogu biti i otvorenog i zatvorenog tipa)

Prema lokaciji:

Objekti u gradsko-građevinskim zonama predviđenim sa sport i rekreaciju

Objekti u stambenim zonama (tereni za rekreaciju, otvoreni tereni...)

Objekti u školama (sale za fizičko vaspitanje, otvoreni tereni, bazeni...)

Objekti u vojnim ustanovama (vojni sportski objekti, streljane, poligoni...)

Objekti u specifičnim zonama (vodene površine, šume, posebni tereni...)

Objekti u poslovnim zonama (objekti i tereni u okviru kompanija i firmi)

Objekti na selu i u prirodi (sportski tereni, trim staze, stene i prostori za slobodno penjanje...)

Tipologija sportskih objekata može da posmatra sportske objekte kroz nekoliko osnovnih tipova:

Osnovni ili elementarni sportski objekti

Normirani objekti manjih dimenzija

Normirani objekti većih dimenzija

Sportske staze

Sportski objekti u prirodnim uslovima

Ove osnovne tipove je dalje moguće razvrstavati prema uslovima gde se sportske aktivnosti odvijaju: na zemlji, na vodi, na snegu, na ledu, u vazduhu...

Školski tereni (karakteristike, položaj, sadržaji):

Poželjno umrežavanje škola sa gradskim zelenilom i sportskim kompleksima

Lociranje oko parkova i gradskog zelenila – povoljna mikroklima i maksimalno iskorišćavanje gradskih slobodnih prostora

Udaljenost od saobraćajnih arterija, industrijskih kompleksa, železnica, skladišta, pijaca /sastav vazduha i izolacija od buke/

Kompleksi dvorišta sa sportskim terenima 1-2 ha

Broj, sadržaj i veličina sportskih terena zavise od broja učenika u školi i mogućnosti korišćenja postojećih terna u blizini škole

Sportski tereni:

Teren za košarku 14/26m

Teren za odbojku 9/18m

Prostor za skok iz zaleta i skok u vis

Kružna staza za trčanje dužine 333.3 m

Linija za bacanje kugle/diska

Poželjno je što više zelenih površina

Dečija igrališta – dečija obdanšta (funkcije, sadržaji, normativi)

- Igralište za decu treba da odgovara psihičkim i fizičkim potrebama dece
- Funkcije: igra, sportske i elementarne, zabava
- Kontakt sa prirodom
- Iniciranje kreativnosti i umetničkih sposobnosti dece
- Sadržaj vrta vrtića:

• Opšti prostor za igru, sportske i elementarne igre

• Manji botanički i zoo vrt, akvarijum

• Zelenilo – poljana za igru, drveće, zaštitno zelenilo, šiblje, cveće

- Grupni prostori – uokvireni šibljem – površina oko 80-100m2
- Opšti prostor za igru, sportske i elementarne igre – centralni položaj. Površina 10-20 m2 / detetu. Sadržaj: ljuljaške, kalckalice, tobogani, penjalice, sprave, prostor za grupne igre.
- Staza za trčanje, vožnju bicikli, obruč oko opšteg prostora za igru

Funkcije zelenila

- SOCIJALNO – ZDRAVSTVENA
- SNIŽAVA TEMPERATURU OKOLNOG VAZDUHA ZA 3-5
- PREČIŠĆAVA VAZDUH
- POVEĆAVA VLAŽNOST VAZDUHA /U ŠUMAMA JE 20% VEĆA VLAŽNOST U ODNOSU NA GRAD/
- APSORBUJE DEO ZVUČNE ENERGIJE
- ŠTITI I OD UDARA VETRA I DIMA
- ZAŠTITA OD PRETERANOG OSUNČANJA
- REGENERACIJA VIDA
- PSIHOFIZIČKA REGENERACIJA ČOVEKA
- ŠTITI TROTOAR I ASFALTNE POVRŠINE OD ZAGREVANJA – PRIJATNIJI MIKROKLIMAT
- OSLOBAĐANJE OD STRESA
- REKREACIJA
- PSIHOFIZIČKI RAZVOJ DECE
- ESTETSKO - DEKORATIVNA FUNKCIJA
- OŽIVLJAVANJE GRADSKOG PROSTORA
- ORGANSKO POVEZIVANJE GRADSKE POVRŠINE I GRADSKIH ČETVRTI
- UKRAŠAVANJE ULICA – ALEJE, DRVOREDI, TRAVNJACI

Sportski objekti po svojoj funkcionalnosti moraju udovoljavati:

– ***Zadacima treninga*** - moraju obezbediti da se trenažni proces sprovodi u dobro opremljenim zatvorenim prostorijama (halama, salama), na otvorenim terenima (igrališta, poljana, šuma), i u specifičnim uslovima (fitnes centrima, teretanama...), sa mogućnošću njihove svestrane upotrebe i za takmičenja.

– ***Specifičnim potrebama***, kako u odnosu na broj sportista, tako i na strukturu i karatker određenog sporta ili sportske dicipline.

– ***Ekološkoj lokaciji***, što podrazumeva da su odvojeni od objekata koji zagađuju vazduh, uz uslov da nisu suviše udaljeni od mesta stanovanja ili gde su sportisti smešteni

– ***Klimatskim uslovima***, naročito za vrijeme situacionih zajedničkih priprema u sportskim centrima pred velika sportska takmičenja.

Vrste objekata–prema namjeni i veličini područja čiji stanovnici gravitiraju objektu:

♦ Objekti manjeg područja gravitacije – zadovoljavaju potrebe do oko 10.000 stanovnika, udaljenosti 25-30 min hoda:

Dvorane, mala igrališta za sportske igre vazdušne streljane, kuglane, nogometno igralište, boćalište, tenis, ostali otvoreni objekti (trim staze, stolovi za stolni tenis,, mini golf, košarkaški stupovi i sl.

♦ Objekti većeg područja gravitacije - zadovoljavaju potrebe preko 10.000 stanovnika, udaljenosti 15 min biciklom ili 10 min javnim prevozom:

Plivališta otvorena i zatvorena,

Klizališta otvorena i zatvorena,

Atletska borilišta ,

Strelišta

Menadžment sportskih objekata je izučavanje proverenih i sređenih znanja o tome kako sportska organizacija postiže svoje ciljeve, pribavljajući, raspoređujući i koristeći ograničene ljudske, materijalne, informacione i novčane izvore svog uspeha. Nauka menadžmenta je identifikovala pet funkcija menadžmenta, kao neizostavnog opšteg uslova uspešnog upravljanja svakom organizacijom, pogotovo onom koja deluje u poslovnom/ tržišnom okruženju. Pripadnici sportske organizacije, koji obavljaju ove funkcije, pripadaju menadžmentu te organizacije. Te funkcije su:

Planiranje - postavljanje organizacijskih ciljeva i razrada strategija njihovog ostvarivanja, prognoziranje/ predviđanje budućnosti u kojoj će se odvijati ostvarivanje tih ciljeva, razrada ciljeva u planovima i rasporedima aktivnosti kojima se usklađuju napori svih članova organizacije ka postavljenim ciljevima.

Organizovanje - raspodela rada na uzajamno zavisne učesnike aktivnosti, grupisanje članova organizacije na specijalizovane poslove/ grupe i odeljenja koja podležu manjoj ili većoj centralizaciji upravljanja.

Upravljanje ljudskim resursima- dodeljivanje pravih ljudi na predviđene aktivnosti/ poslove putem određivanja, kvalifikacija/ obučenosti neophodnih za pojedine aktivnosti.

Rukovođenje - motivisaje svih članova organizacije na postizanje visoke produktivnosti putem saradnje i izvršavanja dobijenih uputstava i naređenja.

Kontrolisanje - praćenje ostvarivanja ciljeva predviđenih planovima sa utvrđenim karakteristikama učinka, ispravljanje odstupanja koja izlaze izvan utvrđenih standarda.

Ove funkcije su prisutne u delokrugu rada svakog menadžera iako u različitom obimu na različitim nivoima menadžmenta. Realizacija funkcija i društvenih uloga zahteva da menadžeri neprekidno stiču i usavršavaju ekspertske sposobnosti.

Delokrug sportskog menadžmenta

Menadžment je proces cikličnog kretanja kroz pet funkcija koje menadžeri realizuju pripremajući, izvodeći i kontrolišući kretanje organizacije ka ostvarivanju njenih ciljeva. U užem smislu, sportski menadžment kao akademska disciplina obuhvata područja znanja o menadžmentu koja su se iskristalisala u praksi upravljanja sportskim organizacijama.

Udruženja za fizičko obrazovanje i za sportski menadžment Severne Amerike za atestiranje (ocenu) programa obrazovanja sportskih menadžera na univerzitetima Severne Amerike, utvrdila

je sledeće standardne sadržaje izučavanja sportskog menadžmenta: izučavanje sociokulturnih dimenzija sporta, menadžment i liderstvo u sportu, etika u sportskom menadžmentu, marketing u sportu, komunikacije u sportu, budžet i finansije u sportu, pravni aspekti sporta, ekonomika sporta, menadžment sportskih objekata i priredbi, upravni organi i strukture u sportu, praktično iskustvo u sportskom menadžmentu.

U praksi fizičkih aktivnosti, u koje spada sport sa svim njegovim organizacionim područjima, sportski menadžment i administracija javljaju se kao posebne karijere u sledećim profesionalnim delokruzima:

Fizičke aktivnosti hendikepiranih lica - administrativni položaji u školama i univerzitetima, sportskim organizacijama i klubovima.

Akvatičke aktivnosti (na vodi) - menadžment i administracija u školama i koledžima, klubovima, opštinskim agencijama, banjama, preduzećima i klubovima zdravlja.

Obrazovanje u domenu plesa - administrativni položaji u školama i na univerzitetima, plesnim studijama i klubovima.

Fitnes - direktor fitnesa u banji, na brodu, vođenje sopstvene firme, klubovi zdravlja, klinike, bolnice.

Parkovi i rekreacija - menadžerski položaji u letnjim kampovima, nacionalnim parkovima, banjama, na brodovima, rekreacionim objektima.

Sportska administracija i menadžment - administrativni položaji sportskog direktora u srednjim školama, koledžima i na univerzitetima, referenti pri upravnim telima sportskih saveza i sl., referenti za pribavljanje fondova, za publicitet i sl., položaji menadžera u profesionalnom sportu, sportskim klubovima, banjama, sportskim udruženjima, upravnim telima.

Biznis - preduzeća sporta i fitnesa - komercijalni, marketinški, finansijski poslovi u robnim kućama i kompanijama sportskih dobara, fitnes opreme, rehabilitacije i sl.

Sportski mediji - položaji sportskog direktora i producenta na televiziji i sl.

Evropska opservatorija za zaposlenost u sportu Evropske mreže visokoškolskih institucija sportskih nauka utvrdila je pet profesionalnih kategorija u delokrugu sportskog menadžmenta i to su: Menadžer trenažne institucije u sportu, Menadžer sportskog objekta, Menadžer nacionalne sportske organizacije, Menadžer sportskog kluba, Menadžer (druge) servisne sportske organizacije (fitnes, sportski turizam, agencija za sportiste, škola skijanja, agencija za promociju događaja i sl)

ZAKLJUČAK

Osnovni uslov za sprovođenje aktivnosti iz oblasti sporta, fizičkog vaspitanja i rekreacije je postojanje dovoljnog broja sportskih objekata. Rad sportske organizacije nemoguće je organizovati i sprovesti bez adekvatnog sportskog objekta kao neizostavnog resursa. LJudski faktor i odgovarajući objekat (ili prostor) omogućava realizaciju sportskog potencijala, odnosno omogućava stvaranje sportskog rezultata, kao primarnog cilja u sportu. Nije, međutim, važan samo njihov dovoljan broj, već i da ti objekti zadovoljavaju propisane uslove (u pogledu dimenzija i bezbednosti, sanitarno-higijenske, protivpožarne, instalaciono-tehničke i dr.) kako bi se u njima mogle obavljati sportske aktivnosti.

Bez objekata je nemoguće raditi bilo šta u sportu. Nepostojanje adekvatnih sportskih objekata umanjuje mogućnost bavljenja sportom dece i omladine, kao i mogućnost za razvoj vrhunskog sporta, a istovremeno destimuliše građane da se bave rekreativnim sportom. Bez odgovarajućih sportskih objekata nema mogućnosti razvoja sporta.

Obezbeđenje ovog uslova zahteva izdavanje velikih materijalnih sredstava koja, po pravilu, ne mogu da obezbede sami korisnici (sportski klubovi, organizacije, pojedinci). Uzme li se u obzir neophodnost sportskih objekata, jasno je da rešavanje ovog infrastrukturnog problema, pored stručnosti, traži i velika budžetska izdvajanja. Svi znamo koliko je velika uloga sporta i sportskog načina života. Zato je postojanje dobre sportske infrastrukture jako bitna stvar, jer definitivno utiče na masovnost sporta, a samim tim i na zdravlje nacije, što se nikako ne može i nesme zanemariti.

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SPORTS AND RECREATIONAL FACILITIES AND MANAGEMENT AS A FACTOR OF SUCCESS IN SPORTS AND RECREATIONAL ACTIVITIES

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INTRODUCTION

Certainly the most important material resource of the system of sport are sports facilities. Their structure, their intended use and functional status is determined, to a large extent, by planning and programming orientation in making sports programs at all levels. Among the sports facilities a special place belongs to multi-purpose sports facilities construction complexes, providing services in the market. It make possible to provide the conditions for practicing different modalities of sports activities (sports education, competitive sports, recreational sports, school sports), and for different categories of users (children, teenagers, adults, people with special needs).

The Law on Sports of the Republic of Serbia (RS Official Gazette no. 52/96), Article 53 reads „sports facility is a building or space (building structure or part thereof or an area), designed for sports activities, which must have trailing space (toilet, wardrobe, storage, auditorium and others) and installed equipment (construction and sports)." Sports and recreational facilities are smaller or larger groups of objects and surfaces in dry and water, for children, youth, citizens of all ages, regardless of the level of motor skills, sportsmen ... i.e. spaces for the realization of sports and recreational activities in order to satisfy human needs for organized physical activities.

Sports facilities can contain one or more courses - practice grounds, main and auxiliary fields; accompanying contents such as locker rooms, yards, warehouses, clinics, rooms for officials, administration, gym, sauna, solarium, massage rooms; then the space for the audience - the audience with supporting areas; spaces for recreation, learning; as well as appropriate communication: corridors, driveways, elevators, parking lots and others. In the framework of modern sports facilities, such as football stadiums, multifunctional arenas and the like, are increasingly appearing commercial or business premises which are usually rented out to other parties and constitute a significant source of income in the function of rational management and operations (covering maintenance costs, insurance and exploitation sports facility).

Public sports facilities in terms of the aforementioned law, are specially designed areas intended for specific sports activities (fitness trails, hiking trails, ski resorts, bike paths, beaches, etc.), accessible to citizens under equal conditions.

METHOD

The paper is to show as much detail as sports and recreation facilities and spaces for exercise, as well as their important role in the exercise of sports and recreational activities. We have used the methods of theoretical analysis and description method.

Classification of sports and recreational facilities was carried out according to various criteria according to the needs of users, according to the urban continuity, according to sports activities, according to the construction form according to location.

RESULTS WITH DISCUSSION

Classification of sports and recreational facilities Sports facilities can be classified according to various criteria.

According to user needs sports facilities can be classified as:

- Facilities for competitive sport
- The facilities for mass sport and recreation
- Facilities for school and university sport
- structures for sport in the army
- Facilities for sports for disabled persons and persons with disabilities

According urban permanence:

- Construction of permanent character
- temporary facilities (sports facilities are installed at the location designated for other purposes until the beginning of construction or use of the site)

According to sports activities:

- Facilities for sports games (sports hall, football, rugby, baseball stadiums ...)
- The facilities for athletics (athletic stadiums and gyms)
- Facilities for gymnastics (gyms and practice sites)
- Facilities for water sports (swimming pools, lakes, rivers, sea ...)
- Facilities for the winter and ice sports (ice hockey, ski slopes ...)
- Facilities for martial arts (less gymnasiums, special facilities ...)
- Facilities for shooting and archery (shooting range, outdoor archery facilities ...)
- Facilities for cycling (Velodrome, cycling trails ...)
- Facilities for equestrian sport (racetracks)
- Multifunction sports facilities etc.

According to the construction form:

- Indoor sports facilities (halls)
- Outdoor sports facilities (stadiums, public sports grounds)
- Semi sports facilities
- Construction of lightweight construction (balloon halls, Prefabricated buildings ...)
- Complex sports facilities (can be open or closed)

According to the site:

- Facilities in the city-building zones provided with sports and recreation
- Construction in residential areas (fields of recreation, outdoor facilities ...)
- Facilities in the schools (gymnasium education, outdoor courts, swimming pools ...)
- Facilities in the military institutions (military sports facilities, shooting ranges, polygons ...)
- Facilities in specific areas (lakes, forests, special courts ...)
- Facilities in business zones (buildings and grounds within companies and firms)
- Objects in the countryside and nature (sports fields, running tracks, walls and places for rock climbing ...)

Typology of sports facilities can observe sports facilities through several basic types:

- Basic or elementary sports facilities
- Standardized objects of smaller dimensions
- Standardized objects larger
- Sports tracks
- Sports facilities under natural conditions

These basic types is still possible to classify under conditions where sports activities take place: on land, on water, on snow, on ice, in the air...

School facilities (characteristics, location, facilities). Preferably, the networking of schools with urban greenery and sports complexes. Locating around the parks and urban greenery - favorable microclimate and maximum utilization of the city's free spaces.

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Sports facilities for its functionality must meet:

- Tasks training - must ensure that the training process is carried out in well-equipped indoor facilities (halls, salami), on outdoor courts (courts, fields, forests), and specific conditions (fitness centers, gyms ...) with the possibility of their versatile use and for competitions.

- The specific needs, both in terms of the number of athletes, as well as the structure and character of a particular sport or sports discipline.

- Ecological location, which means that they are separate from facilities that pollute the air, provided that they are not too far from the place of residence or where the athletes are housed

- Climatic conditions, especially during the situational joint preparation in sports centers before major sporting events.

The types of objects - by purpose and size of the area whose residents gravitate facility:

- Objects with smaller area of gravity - to meet the needs of about 10,000 inhabitants, within 25-30 min walk: Halls, a small playground for sports games air shooting range, bowling alley, soccer field, bowling, tennis, other outdoor facilities (fitness trails, table tennis, mini golf, basketball poles and the like.

- Objects with larger catchment area - meet the needs of over 10,000 inhabitants, within 15 minutes by bike or 10 minutes by public transport: The pool opened and closed, Skating rinks opened and closed, Athletic fields, Shooting ranges.

Management of sports facilities is the study of disordered and proven knowledge of how sports organization achieves its objectives by obtaining, distributing and using limited human, material, information and financial resources of their success. Science management has identified five functions of management as a vital general conditions for successful management of any organization,

especially one that operates in the business / market environment. Members of sports organizations that perform this function, belong to the management of the organization. These functions are:

Planning - setting organizational goals and strategy of their achievement, forecasting / predicting the future, where will take place the achievement of these goals, development goals in the plans and schedules activities to coordinate the efforts of all members of the organization to set objectives.

Organization - division of labor in the interdependent activities of participants, grouping members of the organization on specialized tasks / groups and classes that are subject to a lesser or greater centralization of management. Human resources - assigning the right people to planned activities / tasks through identification, qualification / training needed for certain activities.

Leadership - motivating all members of the organization to achieve high productivity through collaboration and executing the obtained instructions and orders.

Controlling - monitoring the goals envisaged plans with defined characteristics, performance, correcting deviations that go beyond the established standards.

These functions are present in the scope of any manager, although to varying degrees at different levels of management. Realization of functions and social role requires that managers continuously acquire and improve expert skills.

The scope of sports management

Management is the process of cyclical movement through the five functions that managers realize preparing, performing and controlling the movement of the organization towards achieving its objectives. In a narrow sense, the sports management as an academic discipline covers areas of knowledge management, which had resulted in the practice of sports organizations.

Association for physical education and sports management in North America for certification (assessment) of the program of education of sports managers at universities in North America, established the following standard facilities to study sports management: a study of the socio-cultural dimensions of sport, management and leadership in sport, ethics in sports management, marketing in sport, the sport of communication, budget and finance in sports, legal aspects of sport, sports economics, management of sports facilities and events, administrative organs and structures of the sport, practical experience in sports management.

In the practice of physical activities, which include sport, with all its organizational areas, sports management and administration appear as a special career in the following professional areas:

Physical activity of disabled persons - administrative positions in schools and universities, sports organizations and clubs.

Aquatic activities (water) - management and administration in schools, colleges, clubs, municipal agencies, spas, health clubs and companies.

Education in the field of dance - administrative positions in Schools and Universities, dance studios and clubs.

Fitness - the director of fitness at the spa, on the board, managing their own companies, health centers, clinics, hospitals.

Parks and Recreation - management positions in summer camps, national parks, spas, ships and recreational facilities.

Sports administration and management - administrative positions as sports director in secondary schools, colleges and universities, clerks at the governing bodies of sports federations, etc., officers for obtaining funds for publicity, etc., the positions of managers in professional sports, sports clubs, spas, sports associations, governing bodies.

Business - companies in sport and fitness - commercial, marketing, financial operations in department stores and sporting goods companies, fitness equipment, rehabilitation, etc.

Sports Media – Positions on sport director and producer on television and the like European observatory for employment in sport

European network of higher education institutions of sports science has established five professional categories within the scope of sports management and to the manager the training institutions in the sport, Manager of the sports facility, Manager of the national sports organizations,

sports club Manager, Manager (other) service sports organizations (fitness, sports tourism, the associations for athletes, ski school, associations for the promotion of the event, etc.)

CONCLUSION

The basic condition for the implementation of activities in the field of sport, physical education and recreation is the existence of a sufficient number of sports facilities. The work of sports organizations is impossible to organize and implement without adequate sports facility as a vital resource.

Human factor and the corresponding object (or space) allows the realization of the potential of sport and enables the creation of sports results, as the primary goal in the sport. But it is not only important for their insufficient number, but also that these establishments meet the requirements (in terms of size and safety, sanitary and hygienic, fire protection, installation-technical, etc.) In order to be able to perform their sports activities no buildings is impossible to do anything in sports. Lack of adequate sports facilities reduces the possibility of practicing sport and children and youth, as well as the possibility for the development of professional sport, and simultaneously discourages citizens to engage in recreational sports.

Without adequate sports facilities there is no possibility of development of sport. Assuring of this demand by the issuance of large material means that, as a rule, cannot provide the users themselves (sports clubs, organizations, individuales). Taking into account the necessity of sports facilities, it is clear that solving the infrastructure problems in addition to expertise, search and large budgets. We all know how big the role of sport and sports lifestyle. Therefore, the existence of good sporting infrastructure is very important, because it definitely affects the mass of sport, and therefore the health of the nation, which cannot and must not be ignored.

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QUANTITATIVE-QUALITATIVE EVALUATION OF SHOT PUT THROWERS SPORT AND TECHNICAL ABILITIES

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INTRODUCTION

Shot put discipline is characterized by the highlighted speed-strength abilities of the throwers. The huge strength potential needed for realizing high sport result with the 7,260 kg heavy shot will not give expected results if it is not combined with extraordinary speed-strength abilities (Артарски, 1988; Верхошанский, 1980; Единна програма, 1985, Кръстев, 1976). The shot put throwers, along with their huge strength potential possess exceptional speed, incredible ability to jump and agility, all combined by exceptional movement coordination (Миленски, and Николов, 1992, Стойков, and Славчев, 1999). On the other hand, the disproportion of these physical qualities will not lead the athlete to high-level sport results (Бутенко et al.,1971;Стойков, and Фильов, 2005; Stoykov, 2007; Панайотов, 2011). The following questions arise from that: to what extend must each of those physical qualities be developed at different levels of sports qualification, how to develop and control them. That is why we focused our study on the degree of development of speed-strength abilities of elite shot put throwers with high-level results on national and international levels.

METHOD

The aim of this study is to improve shot put throwers training process by quantitative-qualitative assessment of speed-strength abilities.

The subject of the study are shot put throwers'physical abilities using indexes presenting the level of physical development of Bulgarian best shot put throwers.

The sample of the study included 10 Bulgarian shot put throwers with personal results between 18,52 and 21,09 meters, including six national record holders. (see Table 1)

Table 1 Shot put throwers included in the study.

№	name	result
1	Georgi Ivanov	21,09
2	Georgi Todorov	21,01
3	Ventzislav Hristov	20,83
4	Vulcho Stoev	20,72
5	Nikola Hristov	20,44
6	Nikolay Gemijev	20,2
7	Radoslav Despotov	20,13
8	Galin Kostadinov	20,1
9	Mihail Kyoshev	19,9
10	Rosen Karamfilov	18,52

For better insight into the nature of the physical potential of respondents, we traced changes in 12 indexes (see Table 2).

Table 2 Research indexes.

indexes	index	measured in:	accuracy
Y	Sport result	m	0,01
X1	Squat barbell on shoulders	kg	1
X2	Barbell bench press	kg	1
X3	Overhead barbell push from a rack	kg	1
X4	Barbell snatch	kg	1
X5	Barbell push from a rack	kg	1
X6	30 m crouch start with signal	sec.	0,01
X7	Standing long jump	m	0,01
X8	Standing triple jump	m	0,01
X9	Standing five stride jump	m	0,01
X10	Forward two-hand 7,260 kg shot throwing	m	0,01
X11	Backward two-hand 7,260 kg shot throwing	m	0,01

All indexes presenting in Table 2 reveal sports technical and physical abilities of respondents. They are part of the training process and are used for control and development of the relevant physical ability. In addition, they are easy to apply and measure and popular among all shot put throwers around the world.

RESULTS WITH DISCUSSION

The study includes data revealing physical abilities of shot put throwers in multi annual plan – during the period of their sport and technical development, but we analyze only data from the years in which they achieved their personal best result. For example, we analyze Georgi Todorov physical abilities when he achieved the following personal bests – 17,69 m, 18,34 m, 19,74 m, 20,09 m, 20,48m and 21,01 m. Physical abilities during the intermediate years where we do not observe increase in the sport results are excluded from the study. This way we investigate 45 cases. This presents the quality aspect of sport training process – the stack between technical and physical development.

Table 3 presents the results of the research of data variance analysis.

We observed high sport level sample based on sport result (Y) – the average value of the sport result was 19,44 m. Also we witnessed a wide range of sports result – 4,81 m (from 16,28 m to 21,09 m). In practice, this concerns the period from entering high level of sport mastery to world elite level. This is a good prerequisite for useful findings for both sport theory and practice.

Table 3. Research data – variance analysis

	Y	**X1**	**X2**	**X3**	**X4**	**X5**	**X6**	**X7**	**X8**	**X9**	**X10**	**X11**
X avg	19,4	250	203	128	155	170	4,13	3,08	8,8	15,1	17,9	19,2
Mx	0,23	5,97	5,82	3,04	3,23	2,83	0,02	0,02	0,1	0,1	0,24	0,28
Me	20	245	200	133	158	170	4,1	3,07	8,56	15,1	18,1	19,2
Mo	20,3	260	200	135	165	170	4,1	3,2	8,45	15,4	19,5	20,5
Sx	1,34	34,8	34	17,7	18,9	16,5	0,13	0,14	0,57	0,59	1,42	1,6
Sx2	1,79	1213	1153	313	355	273	0,02	0,02	0,32	0,35	2,03	2,57
Ex	-0	-0,7	-0,2	-0,9	-0,1	-0,1	1,14	-0	-1,2	-0,5	-0,3	-1
As	-1	0,23	0,53	0,01	0,15	-0,1	0,72	0,1	0,16	-0,5	0,05	0,06
R	4,81	130	130	65	80	65	0,6	0,55	1,9	2,2	6,32	6,3
Xmin	16,3	200	150	100	125	135	3,9	2,8	7,8	13,8	15,1	16,2
Xmax	21,1	330	280	165	205	200	4,5	3,35	9,7	16	21,4	22,5
Vx%	6,89	12	11,8	11,8	12,2	9,71	3,13	4,53	6,45	3,94	7,97	8,38

On the whole, the data sample is highly homogeneous, with normal Gaussian distribution of all studied indexes. This is confirmed by all coefficients presented in Table 3.

Table 4 presents research data correlation analysis. From there we can define all indexes as such of great importance to the sport result (r ranges from 0,64 to 0,93). It also allows us to use regression analysis to model the shot put throwers strength preparation. We can explain the high interrelation between research indexes with the fact that all of them are integral part of shot put throwers physical training and are proven as reliable over the years. Figure 1 clearly display these relations.

Table 4 Correlation matrix.

	Y	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11
X1	0,73	XXX										
X2	0,7	0,81	XXX									
X3	0,83	0,85	0,73	XXX								
X4	0,85	0,87	0,8	0,95	XXX							
X5	0,79	0,52	0,71	0,59	0,66	XXX						
X6	-0,68	-0,41	-0,44	-0,52	-0,53	-0,59	XXX					
X7	0,64	0,42	0,48	0,54	0,51	0,63	-0,72	XXX				
X8	0,79	0,57	0,68	0,68	0,66	0,75	-0,66	0,84	XXX			
X9	0,93	0,66	0,67	0,8	0,79	0,8	-0,71	0,8	0,91	XXX		
X10	0,83	0,54	0,48	0,71	0,73	0,73	-0,7	0,66	0,67	0,83	XXX	
X11	0,82	0,51	0,46	0,69	0,72	0,7	-0,68	0,66	0,64	0,8	0,97	XXX

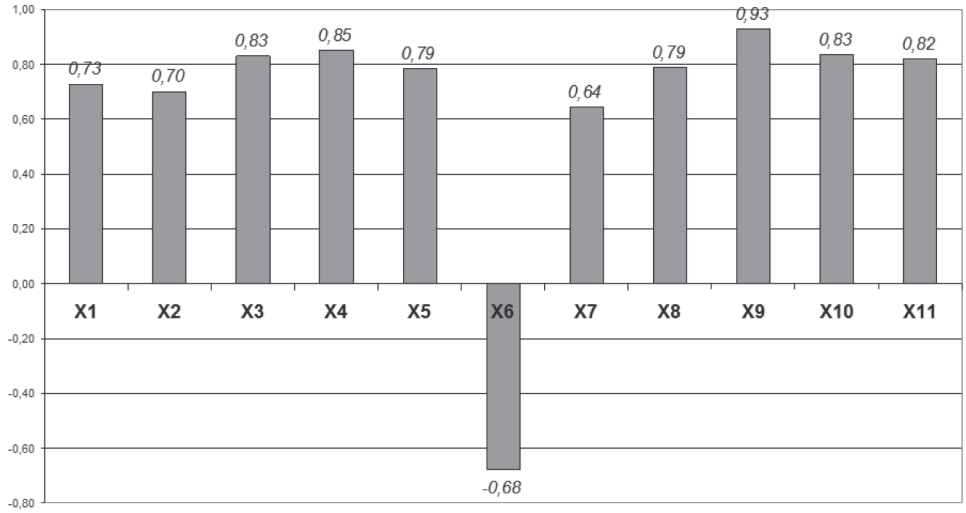

Figure 1. Sport result correlation model.

Additionally, the interrelations between research indexes are logical (it varies between -0,41 and 0,97) – all indexes are similar in form, content or rhythmic structure. Using the way of positive transmission, the development of each one gives a positive impact on the development of the other. In index X6 (30 m crouch start with signal) the correlation sign is negative because when speed increases, time decreases.

In Table 5 we present qualitative-quantitative assessment of shot put throwers physical development based on the Sigmal method. Evaluations are as follows – excellent, very good, good, fair and poor physical abilities development

Comparing throwers physical abilities with those presented in Table 5, each one can correct the direction in which to focus its efforts – mastering the technical or physical preparation. Full math between sport result and research indexes supports symmetric development of both technical and physical components.

Table 5 Evaluation table based on Sigmal method.

mark		Y	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11
excellent		over 22,12	over 319,2	over 270,6	over 163,6	over 192,8	over 203	under 3,87	over 3,36	over 9,93	over 16,23	over 20,72	over 22,36
very good	from	20,78	284,4	236,6	145,9	174	186,5	3,87	3,22	9,36	15,64	19,29	20,76
	to	22,12	319,2	270,6	163,6	192,8	203	4	3,36	9,93	16,23	20,72	22,36
good	from	18,1	214,7	168,7	110,5	136,3	153,5	4	2,94	8,23	14,45	16,44	17,55
	to	20,78	284,4	236,6	145,9	174	186,5	4,26	3,22	9,36	15,64	19,29	20,76
fair	from	16,76	179,9	134,7	92,83	117,5	137	4,26	2,8	7,66	13,86	15,02	15,95
	to	18,1	214,7	168,7	110,5	136,3	153,5	4,39	2,94	8,23	14,45	16,44	17,55
poor		under 16,76	under 179,9	under 134,7	under 92,83	under 117,5	under 137	over 4,39	under 2,8	under 7,66	under 13,86	under 15,02	under 15,95

Overtaking by the sport result (Y) related to other indexes (X) suggests a high level of technical ability and reserves in the physical training – very rare in this discipline.

Most often we are witnessing highly developed physical abilities (X) compared to sport-technical abilities (Y). After this finding a serious correction must be made in the training process in terms of specialized work for developing shot put technique. In this case we are focusing on technique development and maintaining the level of physical development or even lowering it until the desired symmetry is achieved. Premature strength development is often a cause of limitations in sport and technical realization in this throwing event (Миленски, М., 1981, Стойков, Ст., 2007)

CONCLUSION

The following study provides valuable information for both sport pedagogues and shot put throwers:

- Reveals the importance of studied indexes for sport results improvement;
- Gives a way to control of speed-strength abilities of shot put throwers.

Setting the conditions of each thrower with Bulgarian best shot put throwers, provided to every specialist a way to correct speed-strength abilities development when it is needed. This way the training process will be individualized and become more concrete and effective.

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RUNNING SPEED DYNAMICS IN THE DISCIPLINE 110 M HURDLES – MEN

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INTRODUCTION

Among the hurdle running disciplines, one of the most interesting and spectacular is the 110 m distance for men. Sport specialists in the field of both theory and practice are interested in speed dynamics in this discipline (Отрубянников, and Разумовский, 1988; Садовский, 1970; Letzelter, 1977, Карапетрова, 2011; Лазаров, 2011).There are many researches in this field, but many of them are based mostly on mathematics or statistical processing and for this reason sometimes they appear to be less informative. Also this approach of revealing speed dynamics will provide great help for training process optimization and control (Deutcher Leichathletik- Verband, 2009; JAAF, 2007; Kunz, 1980; McFarlene, 1994).

METHOD

The aim of the following study is to research in details running speed dynamics (using running time splits) in the discipline 110 m hurdles for men. In total 49 cases were analyzed using a video analysis and statistical methods (variance and correlation analysis). For conducting the following study, we recorded official competitions using video camera (Nikon D5100) and analyzed intermediate times for clearing each hurdle videos using Kinovea 0.8.24. The camera was set next to 8th hurdle and was recording all hurdlers during the 110 m distance. We used touchdowns after the hurdler to control the time splits (Гутев et al., 2015)

RESULTS WITH DISCUSSION

We divided respondents in two groups based on their results (using expert evaluation). The first more qualified groups consisted of athletes with results faster than 14,50 seconds (total number of analyzed cases for this group is 10). The second less qualified groups presented hurdlers with results slower than 14,50 seconds (the total number of analyzed cases for this group is 39). All the data from the variance and correlation analysis is presented inTable 1.

The average result for the more qualified group is 14,04 sec., and for the second group is 15,72 sec. Both groups are relatively homogeneous based on variance coefficient (V%) – its values for the first and the second group are V%=2,24 and V%=5,46 respectively.

Specific characteristic for the more qualified sample are high results (lap times) at the first part of the race distance (between 1st and 4th hurdle) where the times vary between 1,07-1,08 sec. (see Table 1).

For the second less qualified group the maximum values of lap times (presenting speed dynamics) are lower compared the first group. The highest average lap times are ranging between 1,20

and 1,22 sec. for the first half of the distances and between 1,22 and 1,31 for the second half. Here we find higher variance coefficient (V%) levels compared to the first groups where lap times are much more homogeneous. For the first group all lap times variance coefficient is lower than 5%, as for the second group these values are higher. Also the standard deviation with the results from the second groups are higher, especially with the second half of the race distance.

Table 1 Research data statistical analysis – hurdlers slower and faster than 14,50 sec.

result groups	age group	n	number of respondets	sport result (SR) - in sec.	respondents age (years)	time start - 1st hurdle	time 1st - 2nd hurdle	time 2nd - 3rd hurdle	time 3rd - 4th hurdle	time 4th - 5th hurdle	time 5th - 6th hurdle	time 6th - 7th hurdle	time 7th - 8th hurdle	time 8th - 9th hurdle	time 9th - 10th hurdle	time 10th hurdle - finish
below 14,50 sec.	men	10	10	**correlations with SR**		0,822	0,597	0,884	0,872	0,794	0,863	0,746	0,819	0,631	0,284	0,129
		variance	**X min**	13,64	21	2,60	1,02	1,04	1,00	1,06	1,02	1,03	1,04	1,06	1,10	1,47
			X max	14,47	30	2,80	1,16	1,12	1,12	1,12	1,14	1,14	1,16	1,16	1,16	1,57
			R	0,83	9	0,20	0,14	0,08	0,12	0,06	0,12	0,11	0,12	0,10	0,06	0,10
			X cp.	14,04	24,8	2,69	1,09	1,08	1,07	1,08	1,08	1,09	1,09	1,11	1,14	1,52
			S	0,040	2,348	0,084	0,044	0,028	0,054	0,021	0,048	0,037	0,038	0,030	0,022	0,040
			V	2,24	9,47	3,13	3,98	2,56	5,09	1,92	4,42	3,42	3,48	2,72	1,96	2,62
over 14,50 sec.		39	21	**correlations with SR**		0,689	0,809	0,835	0,869	0,932	0,945	0,954	0,919	0,957	0,860	0,611
		variance	**X min**	14,58	18	2,64	1,12	1,10	1,10	1,12	1,11	1,10	1,14	1,15	1,15	1,54
			X max	17,9	30	3,20	1,40	1,38	1,44	1,42	1,42	1,46	1,48	1,49	1,87	2,16
			R	3,32	12	0,56	0,28	0,28	0,34	0,30	0,31	0,36	0,34	0,34	0,72	0,62
			X cp.	15,72	23	2,82	1,20	1,21	1,21	1,22	1,23	1,25	1,26	1,28	1,31	1,74
			S	0,858	3,801	0,112	0,064	0,070	0,073	0,072	0,084	0,091	0,089	0,095	0,127	0,150
			V	5,46	16,51	3,99	5,36	5,77	6,01	5,93	6,87	7,27	7,02	7,42	9,74	8,62

Note: With green colour are mark all correlations with statisticsl significance 99%, and with orange are all correlations with statistical significance 95%.

The average values for clearing the all hurdles (average lap times) and the standard deviation for those values are presented graphically on Figure 1. They appear as a role model for the less qualified hurdlers.

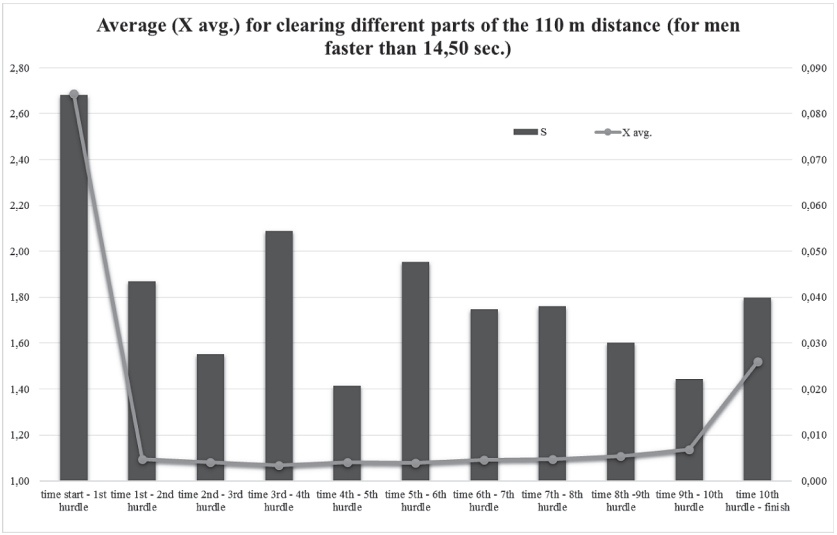

Figure 1

The correlation analysis of lap time for the first, more qualified group, is presented graphically on Figure 2 (also presented in Table 1). Notable for the first more qualified group of respondents are the high correlation levels between the start and the 1st hurdle, and the intermediates between 2nd and 8th hurdle (r>0,750). Also we find interesting lower levels of correlation between the sport result and the distance between 1st and 2nd hurdle where r=0,597. We well know that this intermediate is very important regarding the running rhythm between the hurdles. This fact can be explained by the number of running strides towards the first hurdle and afterwards the transition to three running strides between the hurdlers. Interestingly, lowering of correlation between intermediates at the end of the 110 m distance and the sport result means that hurdlers with similar results run this part of the distance in a different way.

As a characteristics of the less qualified hurdlers we can highlight high correlation levels of intermediates presenting the specific hurdler endurance (the second half of the distance between 4th and 9th hurdle). Significantly lower are the correlations values representing the start acceleration and the maximum running speed on the distance as a complex factors of the sport result.

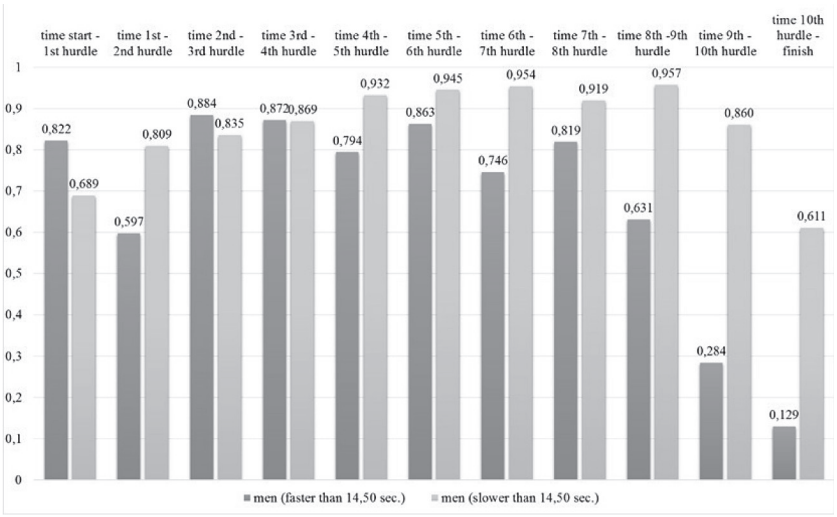

Figure 2.

Figure 3 displays the average split times of the men from both groups with results under and over 14,50 seconds. Based on these results we divided the groups two groups – more and less qualified.

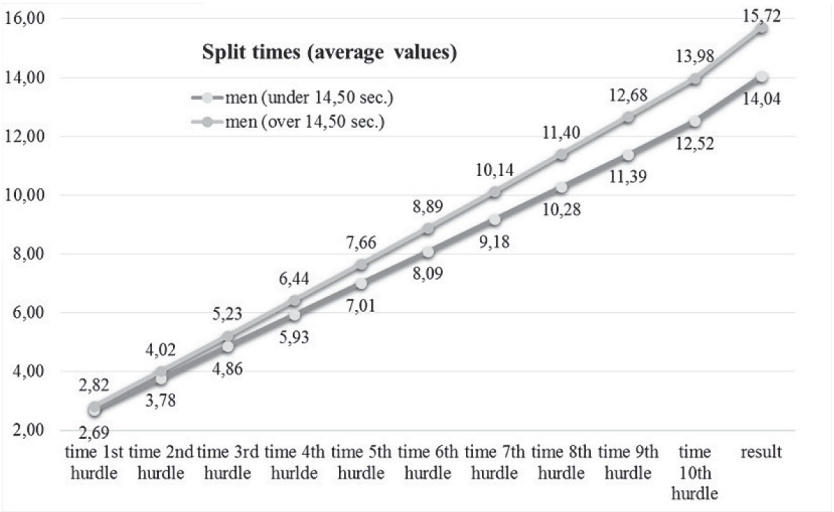

Figure 3.

Based on the results from the variance and correlation analysis, based on Sigmal method, we developed a model for speed dynamics control based on lap times for both qualification levels. The evaluation is based on 7 level scale presented in Table 2. The presented models for control present respondents' specificitiess and certain level of qualification specialties. Therefore they must be applied to hurdlers from similar levels of qualification.

Table 2

		time		evaluation						
				very high	high	above average	average	belove average	low	very low
men	high qualification level - results faster than 14,50 sec.	start - 1st hurdle	seconds	< 2,52	2,52-2,60	2,61-2,64	2,65-2,73	2,74-2,77	2,78-2,86	> 2,86
		1st - 2nd hudle		< 1,00	1,00-1,04	1,05-1,06	1,07-1,11	1,12-1,13	1,14-1,18	> 1,18
		2nd - 3rd hurdle		< 1,02	1,02-1,04	1,05-1,06	1,07-1,09	1,10-1,11	1,12-1,14	> 1,14
		3rd - 4th hurdle		< 0,96	0,96-1,01	1,02-1,03	1,04-1,10	1,11-1,12	1,13-1,18	> 1,18
		4th - 5th hurdle		< 1,04	1,04-1,05	1,06	1,07-1,09	1,10	1,11-1,12	> 1,12
		5th - 6th hurdle		< 0,98	0,98-1,02	1,03-1,05	1,06-1,10	1,11-1,13	1,14-1,18	> 1,18
		6th - 7th hurdle		< 1,02	1,02-1,04	1,05-1,06	1,07-1,11	1,12-1,13	1,14-1,16	> 1,16
		7th - 8th hurdle		< 1,01	1,01-1,04	1,05-1,06	1,07-1,11	1,12-1,13	1,14-1,17	> 1,17
		8th - 9th hurdle		< 1,05	1,05-1,07	1,08-1,09	1,10-1,13	1,14	1,15-1,17	> 1,17
		9th - 10th hurdle		< 1,10	1,10-1,11	1,12	1,13-1,15	1,16	1,17-1,18	> 1,18
		10th hurdle - finish		< 1,44	1,44-1,47	1,48-1,49	1,50-1,54	1,55-1,56	1,57-1,60	> 1,60
	low qualification level - results slower than 14,50 sec.	start - 1st hurdle		< 2,60	2,60-2,70	2,71-2,75	2,76-2,88	2,89-2,93	2,94-3,04	> 3,04
		1st - 2nd hudle		< 1,07	1,07-1,13	1,14-1,16	1,17-1,23	1,24-1,26	1,27-1,33	> 1,33
		2nd - 3rd hurdle		< 1,07	1,07-1,13	1,14-1,17	1,18-1,25	1,26-1,28	1,29-1,35	> 1,35
		3rd - 4th hurdle		< 1,06	1,06-1,13	1,14-1,16	1,17-1,25	1,26-1,28	1,29-1,36	> 1,36
		4th - 5th hurdle		< 1,08	1,08-1,14	1,15-1,17	1,18-1,26	1,27-1,29	1,30-1,36	> 1,36
		5th - 6th hurdle		< 1,06	1,06-1,14	1,15-1,18	1,19-1,27	1,28-1,31	1,32-1,40	> 1,40
		6th - 7th hurdle		< 1,07	1,07-1,15	1,16-1,19	1,20-1,30	1,31-1,34	1,35-1,43	> 1,43
		7th - 8th hurdle		< 1,08	1,08-1,16	1,17-1,21	1,22-1,30	1,31-1,35	1,39-1,44	> 1,44
		8th - 9th hurdle		< 1,09	1,09-1,18	1,19-1,22	1,23-1,33	1,34-1,38	1,39-1,47	> 1,47
		9th - 10th hurdle		< 1,06	1,06-1,17	1,18-1,24	1,25-1,37	1,38-1,44	1,45-1,56	> 1,56
		10th hurdle - finish		< 1,44	1,44-1,58	1,59-1,66	1,67-1,82	1,83-1,89	1,90-2,04	> 2,04

CONCLUSION

The following study reveals in details 110 m hurdle running speed dynamics using intermediate times for the age group men for two levels of sport qualification. Presented data are useful for sport practice for on field athletes' control using presented models for running speed evaluation.

Regarding the running speed dynamics during the start acceleration, we find individualities irrespective of the different sport qualification. Regarding the special hurdle endurance, we found that it appears to be one of the reserves for sport result improvement for the hurdlers with lower qualification. Maximum running speed is tightly connected to the level if qualification and sport result.

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STUDY THE EFFECT OF COORDINATION EXERCISES ON SPEED DEVELOPMENT OF FOOTBALL PLAYER U17

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INTRODUCTION

Work with adolescent football players (U17) in the stage of specialized sports preparation has a particular meaning for their future passing in the elite sport. This I so because the one side of pursuits with growing in their form and contents have to be tempting, on the other side the aim of the work is developing a complex of abilities and discovering their future possibilities for expression. (Бъчваров, 1999)

Our analysis of the current state of preparation of adolescent players in Bulgaria revealed the existence of several problems.

From the analysed methodological literature, we found little information regarding coordination speed for adolescent football players (Бъчваров, 1999; Гъдев, 2013). From sport-pedagogical point of view this component of the training process is with great importance for all football players.

On one hand, they are connected with the lack of trained specialists in conditional training and on the other hand, with the work of the coaches that does not meet the goals and objectives for this stage of the multiannual training process in football. (Алиев et al., 2010)

Regarding this, we set the goal to seek opportunities to optimize the training sessions with adolescent players by improving the effect of the training work in them. (Гутев, 2015)

METHOD

The aim of the following study is to optimize training session with adolescents' football players (U17) by improving the effect of training sessions using a set of various coordination exercises. A pedagogical experiment was carried for establish the effect of this training model including 20 football players (U17) from PFC Levski Sofia and 20 players U17 from PFC Lokomotiv. In the beginning of the season both groups (one training using commonly used methodology and the other one using experimental methodology) were tested using special set of tests, revealing coordination abilities. PFC Levski football players added to their training plan three sessions per week with priority use of coordination exercises (using hurdles, speed ladder and different exercises with change of direction – all performed with maximum speed). After the end of the first training cycle were applied 5 more test to both groups.

At the beginning of the educational and training work all the players were subjected to sport-pedagogical tests, revealing the level of speed:

1. Test for start quickness – running 5 meters, standing start (X1) in sec.;

2. Test for maximum speed - running 10 m, flying start (X2) in sec.;

3. Test for start acceleration - running 20 meters, standing start (X3) in sec.;

4. Test for linear speed - running 30 meters, standing start (X4) in sec.;

After the first training macrocycle, a second testing was conducted including the test from the first testing and adding 5 more specific football tests (all measured in seconds). Before the completion of the test all respondents warm up for 10 minutes.

5. Zig-zag test (X5);

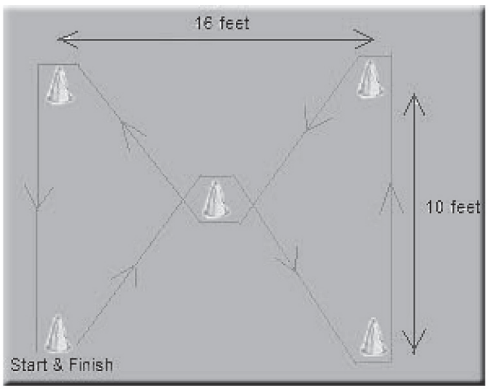

Figure 1. Zig-zag test (X5).

6. T-test (X6) - This test requires the athlete to touch a series of cones set out in "T" shape whilst side stepping and running as fast as possible;

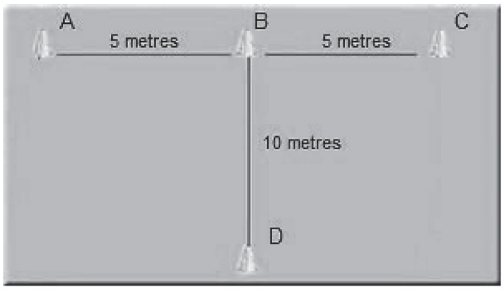

Figure 2. T-test (X6).

7. Test "Arrowhead" left (X7) - Purpose: this is a test of speed, explosion, body control and the ability to change direction over a range of angles and directions;

8. Test "Arrowhead" right (X8);

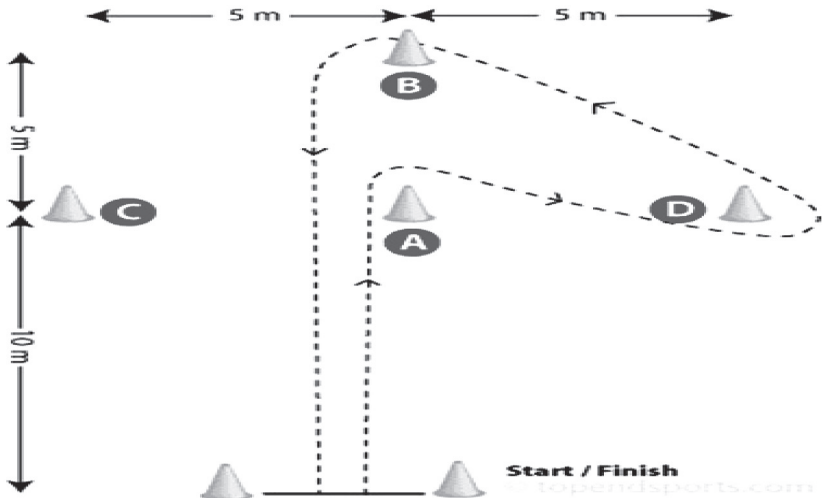

Figure 3. Test "Arrowhead" left (X7) and right (X8).

9. Test "Illinois" (X9).

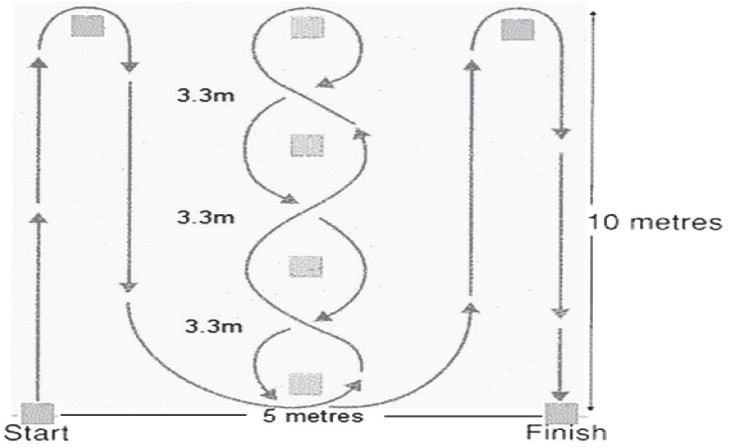

Figure 4. Test "Illinois" (X9).

RESULTS WITH DISCUSSION

Comparison of data at the beginning of the experiment revealed no significant differences in baseline adolescent football players involved in both groups. Table 1 presents variance and reliability analysis of control and experimental groups comparing the levels of both groups at the beginning of the experiment.

Table 1

Variance and reliability of differences in absolute (d) and relative (%) values for control and experimental groups at the beginning of the experiment.

Test	Statistical index	Control group	Experimental group	Difference		t – emp	t – tabl
		beginning	beginning	d	%		α=0,05
X1	X avg.	1,07	1,07	0	0	0,08	2,01
	Sx	0,076	0,076				
	V%	7,08	7,08				
X2	X avg.	1,8	1,83	-0,03	0,11	0,4	2,01
	Sx	0,069	0,08				
	V%	3,84	4,4				
X3	X avg.	3,21	3,02	-0,19	6	0,03	2,01
	Sx	0,117	0,066				
	V%	3,65	2,2				
X4	X avg.	4,3	4,21	-0,09	2	0,28	2,01
	Sx	0,115	0,088				
	V%	2,68	2,09				

According to the calculated empirical values of the Students T-test for dependent samples, all values show improvement at the end of the experiment and all differences are statistically reliable for both the control and experimental groups. This reveals, that both used in practice system for speed development and the proposed optimized model for adolescents football players significantly improve respondents speed abilities.

Table 2 and 3 presents data for the control and experimental groups regarding indexes from X1 to X4 at the beginning and the end of the experiment.

Table 2 Variance and reliability of differences in absolute (d) and relative (%) values for the control group at the beginning and the end of the experiment.

Test	Statistical indexes	Control group		Difference		t – emp	t – tabl α=0,05
		beginning	end	d	%		
X1	X avg.	1,07	1,01	-0,1	3,7	12,36	2,01
	Sx	0,076	0,045				
	V%	7,08	4,41				
X2	X avg.	1,8	1,77	-0	1,5	5,8	2,01
	Sx	0,069	0,059				
	V%	3,84	3,31				
X3	X avg.	3,21	3	-0,2	7	35,11	2,01
	Sx	0,117	0,098				
	V%	3,65	3,28				
X4	X avg.	4,3	4,19	-0,1	2,5	6,87	2,01
	Sx	0,115	0,124				
	V%	2,68	2,96				

Table 3Variance and reliability of differences in absolute (d) and relative (%) values for the experimental group at the beginning and the end of the experiment.

Test	Statistical index	Experimental group		Difference		t – emp	t – tabl α=0,05
		beginning	end	d	%		
X1	X avg.	1,07	1,01	-0,06	3,7	18,4	2,06
	Sx	0,076	0,045				
	V%	7,08	4,41				
X2	X avg.	1,83	1,69	-0,14	2,9	6,13	2,06
	Sx	0,08	0,053				
	V%	4,4	3,5				
X3	X avg.	3,02	2,98	-0,04	1	4,7	2,06
	Sx	0,066	0,159				
	V%	2,2	5,33				
X4	X avg.	4,21	4,1	-0,11	2,5	7,34	2,06
	Sx	0,088	0,2				
	V%	2,09	4,87				

More interesting for our study are the results from the comparison between results for both control and experimental groups at the second testing applying all 9 tests. According to all empiric values of Students T-test for independent samples shows essential difference in the second testing for the first four tests in favor of the experimental group.

Table 4 Variance and reliability of differences in absolute (d) and relative (%) values for the control and experimental group at the end of the experiment.

Test	Statistical index	Control group	Experimental group	Difference		t – emp	t – tabl
							α=0,05
		end	end	d	%		
X1	X avg.	1,01	1,01	0	0	0,23	2,01
	Sx	0,045	0,045				
	V%	4,41	4,41				
X2	X avg.	1,77	1,69	-0,04	1,09	0,06	2,01
	Sx	0,059	0,053				
	V%	3,31	3,5				
X3	X avg.	3	2,98	-0,02	1	0,31	2,01
	Sx	0,098	0,159				
	V%	3,28	5,33				
X4	X avg.	4,19	4,1	-0,09	1,08	2,42	2,01
	Sx	0,124	0,2				
	V%	2,96	4,87				
X5	X avg.	6,66	6,54	-0,12	1,27	0,32	2,01
	Sx	0,416	0,376				
	V%	6,25	5,75				
X6	X avg.	10,09	9,9	-0,19	2	2,63	2,01
	Sx	0,682	0,498				
	V%	6,76	5,03				
X7	X avg.	8,6	8,59	-0,01	0	4,34	2,01
	Sx	0,445	0,435				
	V%	5,17	5,07				
X8	X avg.	8,63	8,57	-0,06	0,54	6,24	2,01
	Sx	0,4	0,435				
	V%	4,63	5,08				
X9	X avg.	17,53	17,2	-0,24	2,34	3,78	2,01
	Sx	0,641	0,687				
	V%	3,66	3,99				

Regarding the comparative analysis of the results from the other five test revealing specific information with coordination character, we find greater improovment with the respondents from the experimental group. The statistically significant Student T-test value for independent samples supports the levels of improovment in favor of the experimental groupusing the new proposed optimized model for speed develepemnt through priority use of coordination exercises with adolescent football players (regarding indexes X5, X6, X7, X8 and X9).

The football players from the experimental group are ahead compared to their peers from the control groups mostly in maximum running speed (X2). This fact can be explained by the deliberate effect of coordination exercises for improvement of muscle coordination and frequency of movements. Also highlighted is the lead of the experimental group compared to the control regarding the test for linear speed/velocity (X4). This advantage of the first group can be explained by the positive effect of coordination exercises on start reaction, running acceleration and already mentioned maximum running speed.

Adolescent players from the experimental group who applied the training program with priority use of coordination exercises for speed development have better indicators characterizing the level of various forms of speed manifested in the sprint running.

Also clearly visible is the advantage of the experimental group compared to the control when analyzing specific coordination tests (X5, X6, X7, X8 and X9).

CONCLUSION

Based on the results from the control and experimental groups at the beginning and the end of the experiment we can conclude that:

1. The proposed experimental model including priority use of specific set of coordination exercises has a positive effect of speed development.

2. The priority use of coordination exercises in adolescents football players training process leads to reliably expressed development of specific abilities related to start, start acceleration, linear and maximum running speed.

3. From the results of all tests we found that through coordination exercises use were improved all components of speed and quickness.

In conclusion, we believe that the proposed new optimized model for preparation of adolescents' players with success can be used in different stages of sports training, in order to achieve greater impact in developing speed, respecting the basic principles of work for the age.

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UDK 796:316.624-057.874

ISTRAŽIVANJE STAVOVA VASPITAČA I RODITELJA O ZNAČAJU FIZIČKE AKTIVNOSTI U PREVENCIJI VRŠNJAČKOG NASILJA

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UVOD

Agresivnost i različiti oblici nasilja sve više su prisutni u međusobnoj komunikaciji među decom, ali i između odraslih i dece. Nasilje među decom obuhvata širok spektar agresivnih ponašanja, od rešavanja sukoba nasilnim putem, neprihvatljivog izražavanja ljutnje ili frustracije, do ozbiljnih incidenata koji mogu ugroziti i živote dece (Nedimović, 2014; Plut i Popadić, 2007; Popadić, 2009). Agresija se često izjednačava sa terminom nasilje i njegovim značenjem, iako je nasilje najizoštrenija i najgrublja agresija (Božović, 2007). Ono u velikoj meri zavisi od konteksta u kojem se dešava i u kome značajan udeo imaju društvene norme i običaji (Bodin, 2011; Olweus, 1994; Craig i Pepler, 1997). Bodin smatra (2011) da ono što se u modernom društvu smatra nasiljem, svakako ne bi imalo isto značenje na drugim područjima i kulturama. Nasilno ponašanje među vršnjacima odlikuje se elementima fizičkog i psihološkog povređivanja koji se namerno ponavljaju od strane jednog ili grupe učenika (Smederevac i sar., 2010, Nedimović i Biro, 2011; Nedimović, 2012). Nasilje (uključujući i vršnjačko) je svaki oblik jednom učinjenog ili ponovljenog verbalnog ili neverbalnog ponašanja koje ima za posledicu stvarno ili potencijalno ugrožavanje zdravlja, razvoja i dostojanstva deteta (Olweus, 1993). Pod nasiljem u sportu podrazumeva se ponašanje izvan pravila sporta koje je namerno usmereno na povređivanje i oštećenje drugih učesnika (Bačanac, 2010, prema, Popadić i sar., 2011). Posledice agresije i nasilja ne trpe samo žrtve, već i sami izazivači nasilja. Deca koja se nasilno ponašaju u detinjstvu su pod visokim rizikom da u odraslom dobu razviju delinkventne oblike ponašanja, uđu u kriminal i postanu zavisna od alkohola i psihoaktivnih supstanci (Kaltiala-Heino i sar., 2000). Posledice po nasilnike mogu biti u pravcu razvoja psihosomatskih simptoma (česte glavobolje, problemi sa kožom, atletsko stopalo, pojačano znojenje, drhtanje, palpitacija, panični napadi i sl.) i slabijeg akademskog postignuća (Ratner i sar., 2006). Nasilje među vršnjacima, posebno u predškolskim ustanovama i školama nije nova pojava, mada se o nasilju nedovoljno govori u našoj pedagoškoj, psihološkoj i sociološkoj literaturi, a stiče se utisak da se posebno malo izučava u okviru nastavničkih studija (posebno, vaspitača i učitelja) i stručnog usavršavanja prosvetnih radnika (Nedimović i sar., 2014). Tendencija opšteg neprihvatanja i šikaniranja među decom javlja se sve ranije, pa je taj problem potrebno rešavati već na predškolskom uzrastu uz neophodno uključivanje odraslih (roditelja, vaspitača, trenera i drugih). S druge strane, roditelji i društvo sve više očekuju od vaspitno-obrazovnih institucija (počev od predškolskih) da zadovoljavaju razvojno-obrazovne potrebe dece, da izlaze u susret njihovim mogućnostima i razvijaju potencijale koji nose, da stvaraju ambijent u kome sva deca mogu da uče i napreduju u skladu sa svojim sposobnostima, emocionalnim i motivacionim osobinama, interesovanjima, iskustvima i znanjima, kao i da rešavaju različite probleme. Otkrivanju uzroka problema i neprihvatljivog ponašanja kod dece, uklanjanju i preusmeravanju problematičnog ponašanja dece potrebno je posvetiti posebnu pažnju, u što ranijem uzrastu. Pojedini autori ističu činjenicu da ono što vršnjačko nasilje čini žilavim i održivim je nedovoljno ozbiljan tretman ovog fenomena, odbijanje da se pojava imenuje i da se o njoj javno govori. Predškolska ustanova, a ni porodica, često ne prepoznaju nasilje na pravi način (vide nasilje kao igru, zabavu, deo kulturnog nasleđa i sl.), pa mu se i ne suprotstavljaju ili to čine neadekvatno (Smederevac i sar., 2010).

Istraživači ističu (Conduct Problems Prevention Research Group, 1999; Drake, 2003; Gašić-Pavišić, 2004; Jovanović-Mađar, 2014; Nedimović i Biro, 2011; Popadić, 2009; Popadić i sar., 2011)

da je vršnjačko nasilje moguće suzbiti sprovođenjem odgovarajućih postupaka, dok je blagovremena identifikacija i evidencija problema osnovni uslov planiranja mera intervencije i njihovog usmeravanja na rizične grupe. Kada se radi o prevenciji nasilja i nasilnih obrazaca ponašanja, vaspitno-obrazovne institucije, kao i porodicu, treba senzibilisati i uspostaviti mehanizme otvorene i sadržajne komunikacije o ovom fenomenu savremenog društva koji sve više uzima maha u svakodnevnom životu. U tom kontekstu, neophodno je osmišljavanje različitih mehanizama i programa prevencije za suzbijanje vršnjačkog nasilja koji bi podstakli relevantne odrasle (roditelje, vaspitače, trenere i druge), ali i samu decu da postanu svesni ovog problema, kao i ponuditi strategije koje će doprineti smanjenju nasilja među decom. S obzirom na to da se uticaji socijalne sredine značajno odražavaju na dečije stavove i razvijanje društveno-prihvatljivih normi ponašanja, uključivanje porodice u vaspitni rad predškolske ustanove veoma je značajan.

Fizička aktivnost (FA) doprinosi povećanju kvaliteta života dece i odraslih (zdravlja, samopoštovanja, socijalnih odnosa) i utiče na razvoj različitih aspekata razvoja. Naučne studije pokazuju da je FA značajno sredstvo u prevenciji vršnjačkog nasilja (Božović, 2007; Nedimović, 2013; Popadić i sar., 2011). Fizička aktivnost ima pozitivan uticaj na mentalno zdravlje ljudi, budući da sprečava depresiju i anksioznost, neutrališe efekte stresa, uz istovremeno podizanje i razvijanje samopoštovanja i pozitivne slike o sebi (Jürimäe i Jürimäe, 2001, Matejak i Planinšec, 2014). Naravno, kada govorimo o pozitivnom uticaju fizičke aktivnosti na čovekov organizam, mora se imati u vidu da ona treba biti personalizovana, odgovarajuće učestalosti i trajanja (Pate i sar., 1995; Sallis i Owen, 2002). Fizički aktivan životni stil može voditi do poboljšanja fiziološkog i psihološkog zdravlja mladih ljudi (Sturza Milić i Nedimović, 2014). Fizička aktivnost predstavlja ključni faktor u poboljšanju i održavanju sposobnosti ljudskog organizma, kao i u umanjenju posledica funkcionalnih i degenerativnih oboljenja, koja se često nazivaju „bolesti načina života", dok sama promena načina života, uključujući i povećanje fizičke aktivnosti, može da dovede do smanjenja broja bolesti ili prerane smrti (Bratić, 2014). Nažalost, kao iskonska vrednost, fizička aktivnost sve više nazaduje. Njen nedostatak i pad ne dovodi samo do problema u biološkom smislu, već i do (samo)otuđenja čoveka i neprijateljskog odnosa prema drugim ljudima (Škof, 2010). Potrebno je stvoriti uslove za redovno upražnjavanje fizičke aktivnosti i njenih različitih oblika, sa napomenom da postoje populacione grupe koje zahtevaju posebnu pažnju. Ovde se prevashodno misli na decu i mlade, kao i na studente, koji će veoma brzo postati radno aktivna populacija (Andrijašević i sar., 2014; Cerar i Kondrić, 2014; Pedišić, 2014; Sturza-Milić, 2013, Sturza Milić i Nedimović, 2014). Na taj način bi, pored dece, i odrasli postali korisnici različitih programa (vaspitači i roditelji), aktivno učestvujući u planiranju i realizaciji vaspitno-obrazovnih sadržaja u predškolskoj ustanovi, te u određenim dečijim projektima ili u projektima lične edukacije. U skladu sa već pominjanom činjenicom da je problem vršnjačkog nasilja sve prisutniji i u vaspitno-obrazovnim ustanovama, sve je veća potreba za istraživanjima koja se bave ovom aktuelnom problematikom, a sa ciljem da se dobiju relevantni podaci i informacije koje bi pomogle prevenciji ovakvog ponašanja. Iz predhodno navedenih razloga, cilj ovog istraživanja bio je ispitivanje stavova vaspitača i roditelja o značaju fizičke aktivnosti u funkciji prevencije vršnjačkog nasilja na pripremnom predškolskom uzrastu.

METOD

Istraživanje je izvršeno na uzorku od ukupno 279 ispitanika. Od toga je 142 vaspitača dece pripremnih predškolskih grupa i 137 roditelja. U uzorku je bilo 11,8% ispitanika muškog pola i 88,2% ženskog pola. 97,2 % ispitanika živi u gradu (na teritoriji AP Vojvodine), a 2,7 u selu (na teritoriji AP Vojvodine).

Istraživanje se baziralo na deskriptivnom i kauzalnom neeksperimentalnom metodu. Da bi se ispitali stavovi vaspitača i roditelja o značaju fizičke aktivnosti u prevenciji vršnjačkog nasilja konstruisani su upitnici (za vaspitače i za roditelje) koji su sadržali 12 stavki i direktno uvodno obraćanje. Upitnici su bili Likertovog tipa (stepeni kontinuuma vrednosne skale organizovani su od 1 do 5, u logičnom sledu od minimalnog prihvatanja do maksimalnog prihvatanja datog stava). Svaka stavka upitnika sadržala je samo jednu misao koja nije bila dvosmislena i sugestivna. Izračunate merne karakteristike korišćenog instrumenta bile su zadovoljavajuće. Pouzdanost je potvrđena Cronbach-ovim koeficijentom alfa koji je iznosio 0,862. Objektivnost je obezbeđena procesom indirektnog prikupljanja podataka.

Za statističku obradu podataka korišćeni su parametri deskriptivne (M – prosek i SD – standardna devijacija) i komparativne statistike (T-test za utvrđivanje razlika između malih, nezavisnih grupa).

REZULTATI

U tabelama 1 i 2 prikazane su varijable koje su bile usmerene na ispitivanje značaja fizičke aktivnosti (FA) u prevenciji vršnjačkog nasilja, broj ispitanika (N), proseci (M) i standardne devijacije (SD) stavova vaspitača i roditelja:

Tabela 1. *Stavovi vaspitača o značaju FA u prevenciji vršnjačkog nasilja*

R.B.	**Varijabla**	**N**	**M**	**SD**
1.	Upražnjavanje FA je važno za fizički razvoj i zdravlje dece	142	4.95	.222
2.	Važno je da se deca bave FA svakog dana	142	4.88	.331
3.	Važno je da deca imaju redovnu FA u predškolskoj ustanovi	142	4.62	.567
4.	Važno je da podstičem decu da budu fizički aktivna	142	4.80	.399
5.	Deca u mojoj v.o. grupi uživaju u FA	142	4.67	.515
6.	Ja lično uživam u FA	142	4.45	.711
7.	Materijalni faktor je važan za upražnjavanje FA dece	142	2.71	1.391
8.	Upražnjavanje FA unapređuje kvalitet života	142	4.70	.524
9.	FA je važna za razvoj ličnosti dece	142	4.69	.507
10.	FA je važna za razvoj socijalne interakcije među decom	142	4.57	.595
11.	FA umanjuje pojavu nasilja kod dece	142	4.54	.646
12.	Deca su manje nasilna prema drugoj deci posle FA	142	4.33	.910

N- broj ispitanika; M- srednja vrednost; SD- standardna devijacija

Tabela 2. *Stavovi roditelja o značaju (FA) u prevenciji vršnjačkog nasilja*

R.B.	**Varijabla**	**N**	**M**	**SD**
1.	Upražnjavanje FA je važno za fizički razvoj i zdravlje dece	137	4.76	.458
2.	Važno je da se deca bave FA svakog dana	137	4.54	.630
3.	Važno je da deca imaju redovnu FA u predškolskoj ustanovi	137	4.46	.569
4.	Važno je da podstičem moje dete da bude fizički aktivno	137	4.63	.597
5.	Moje dete uživa u FA	137	4.69	.537
6.	Ja lično uživam u FA	137	4.13	.979
7.	Materijalni faktor je važan za upražnjavanje FA dece	137	2.65	1.427
8.	Upražnjavanje FA unapređuje kvalitet života	137	4.64	.573
9.	FA je važna za razvoj ličnosti dece	137	4.54	.719
10.	FA je važna za razvoj socijalne interakcije među decom	137	4.33	.855
11.	FA umanjuje pojavu nasilja kod dece	137	4.27	.910
12.	Moje dete je manje nasilno prema drugoj deci posle FA	137	3.72	1.277

N- broj ispitanika; M- srednja vrednost; SD- standardna devijacija

Nakon pojedinačne analize stavova vaspitača i roditelja, primenom T-testa za ispitivanje razlika između stavova vaspitača i roditelja o značaju fizičke aktivnosti u prevenciji vršnjačkog nasilja, uočava se da u sledećim varijablama postoji statistički značajna razlika, i to, u korist vaspitača (Tabela 3).

Tabela 3. *Razlika između stavova vaspitača i roditelja o značaju FA u prevenciji vršnjačkog nasilja*

Red. broj	**Varijabla**	**t - vrednost p – nivo značajnosti**
1.	Upražnjavanje FA je važno za fizički razvoj i zdravlje dece	t = 3.612; p=.000
10.	FA je važna za razvoj socijalne interakcije među decom	t = 2.531; p=.017
11.	FA umanjuje pojavu nasilja kod dece	t = 2.257; p=.025
12.	Deca su manje nasilna prema drugoj deci posle FA	t = 3.734; p=.000

DISKUSIJA

Na uzorku od 142 vaspitača pripremnih predškolskih grupa, ispitano je 12 varijabli koje su bile usmerene na ispitivanje stavova vaspitača o značaju fizičke aktivnosti (FA) u prevenciji vršnjačkog nasilja. Većina dobijenih skorova kreće se u rasponu od 4.33 do 4.95 na osnovu čega se može zaključiti da ispitani vaspitači dodeljuju izuzetno visoke ocene svim ispitanim varijablama. To se ne može zaključiti za varijablu: *Materijalni faktor je važan za upražnjavanje FA dece* (M=2,71), tako da će se ona zasebno analizirati. Najviše ocene vaspitači dodeljuju sledećim varijablama: *Upražnjavanje FA je važno za fizički razvoj i zdravlje dece* (4.95), *Važno je da se deca bave FA svakog dana* (4.88), *Važno je da podstičem decu da budu fizički aktivna* (4.80). Ovako pozitivno izraženi stavovi vaspitača dece pripremnih predškolskih grupa sugerišu na to da su ispitani vaspitači svesni značaja FA u savremenim uslovima života, potrebi za svakodnevnim upražnjavanjem FA, kao i lične uloge koju imaju kada je u pitanju podsticanje dece na svakodnevnu FA. Ovakva usmerenost u skladu je sa rezultatima i preporukama mnogih istraživanja o značaju FA za zdravlje i razvoj predškolske dece, kao i o značaju upražnjavanja i podsticanja dece na svakodnevnu FA (Đorđić, 2006; Starc i Strel, 2012; Sturza Milić, 2014; WHO, 2010; Zajec i Cemič, 2010). Zatim, relativno visoke ocene vaspitači dodeljuju svim varijablama u kojima se prepoznaje uticaj FA na različite segmente razvoja predškolskog deteta i na povećanje kvaliteta života, što je uočeno i u drugim istraživanjima (Matejak i Planinšec, 2008, 2014; Perić i Tišma, 2014; Sturza Milić i Nedimović, 2015): *Upražnjavanje FA unapređuje kvalitet života* (4.70), *FA je važna za razvoj ličnosti dece* (4.69) i *FA je važna za razvoj socijalne interakcije među decom* (4.57). Na osnovu visokih vrednosti ocena prilikom izražavanja stavova *Ja lično uživam u FA* (4.45) i *Deca u mojoj v.o. grupi uživaju u FA* (4.67), možemo zaključiti da vaspitači FA prepoznaju kao moćno sredstvo svakodnevnice u kojoj mogu uživati i odrasli i deca. Ipak, na osnovu dobijenih vrednosti zaključujemo da se permanentnom edukacijom i senzibilizacijom vaspitača u ovom segmentu FA može učiniti još zanimljivijom i pristupačnijom. Ovo je naročito važno u radu sa decom, s obzirom na to da u svakodnevnom životu predškolske dece fizička aktivnost, nažalost, sve češće „gubi bitku" sa kompjuterskim igricama, nekvalitetnim TV programom i drugim oblicima neadekvatne zabave dece (Biddle, 2010; Goldberg, 2003; Kisin i sar., 2007; Makavić i sar., 2007, Matić i sar., 2010; Sturza Milić i Nedimović, 2014). Analizom vrednosti stavova vaspitača FA je prepoznata kao sredstvo u borbi protiv vršnjačkog nasilja. To se može zaključiti na osnovu visokih vrednosti ocena koje vaspitači dodeljuju varijablama: *FA umanjuje pojavu nasilja kod dece* (4.54) i *Deca su manje nasilna pr. drugoj deci posle upražnjavanja FA* (4.33). Dobijene vrednosti, naročito, kada je u pitanju poslednja navedena varijabla ukazuju na mogućnost dodatne senzibilizacije i edukacije vaspitača kada je u pitanju primena svakodnevne FA u prevenciji vršnjačkog nasilja.

Na uzorku od 137 roditelja dece pripremnog predškolskog uzrasta, ispitano je 12 varijabli koje su bile usmerene na ispitivanje stavova roditelja o značaju fizičke aktivnosti u prevenciji vršnjačkog nasilja. Većina dobijenih skorova kreće se u rasponu od 3.72 do 4.76, na osnovu čega se može zaključiti da ispitani roditelji dodeljuju relativno visoke ocene svim ispitanim varijablama. To se ne može zaključiti za varijablu: *Materijalni faktor je važan za upražnjavanje FA dece* (M=2.65), slično kao i kod uzorka ispitivanih vaspitača. Na osnovu preciznije analize dobijenih rezultata može se zaključiti da roditelji dodeljuju visoke ocene za sve ispitane varijable koje povezuju fizičku aktivnost i njen pozitivan uticaj na pravilan razvoj i zdravlje dece, kao i na povećanje kvaliteta života: Upražnjavanje FA je važno za fizički razvoj i zdravlje dece (4.76), Upražnjavanje FA unapređuje kvalitet života (4.64) i FA je važna za razvoj ličnosti dece (4.54). Roditelji smatraju da je važno da deca imaju redovnu FA u predškolskoj ustanovi (Važno je da deca imaju redovnu FA u predš. ustanovi 4.46), kao i da ih treba podsticati na FA (Važno je da podstičem moje dete da bude fizički aktivno 4.63). Iz vrednosti ocena prethodne dve stavke možemo zaključiti da roditelji smatraju da u podsticanju dece na FA i porodica ima značajnu ulogu, a ne samo predškolska ustanova. Sličnu usmerenost možemo uočiti u brojnim studijama (Džejms i Praut, 2004; Hardman, 1997; Čižmanski i sar., 2008). Roditelji izražavaju stav da njihova deca više uživaju u FA (Moje dete uživa u FA 4.69), nego oni sami (Ja lično uživam u FA 4.13). Istraživanja pokazuju da se odnos roditelja prema FA itekako može preneti i na decu, kao i to da roditelji imaju važnu ulogu u stvaranju „kretnog" kapitala kod dece (Davison i sar., 2003; Đorđić, 2006; Maksimović i sar., 2008; Pišot, S., 2012; Sturza Milić, 2008). Nešto niže ocene roditelji dodeljuju varijablama: FA je važna za razvoj socijalne interakcije među decom (4.33), FA umanjuje pojavu nasilja kod dece (4.27) i Moje dete je manje nasilno pr. drugoj deci posle FA (3.72). Kao i vaspitači, najnižu ocenu prilikom izražavanja svog stava roditelji dodeljuju varijabli: Materijalni faktor je važan za upražnjavanje FA dece (2.65). Naime, roditelji smatraju da materijalni faktor nije presudan kada je u pitanju kvalitetna organizacija FA u radu sa predškolskom decom. S obzirom na činjenicu da je materijalni faktor kao sredstvo predškolskog fizičkog vaspitanja u mnogim istraživanjima prepoznat

kao vrlo značajan, pomalo začuđuju ovako dobijeni rezultati, ali, s druge strane obećavaju, s obzirom na to da vaspitači i roditelji smatraju da matrijalni faktor (dobar, ali, nažalost, u našoj sredini, češće - loš) ne mora biti presudan, pa samim tim ni ograničavajući za kvalitetno upražnjavanje FA od strane dece. Svakako bi se ovo pitanje trebalo preciznije ispitati u budućim istraživanjima.

Nakon pojedinačne analize stavova vaspitača i roditelja, primenom T testa za ispitivanje razlika između stavova vaspitača i roditelja o značaju fizičke aktivnosti, uočava se da u sledećim varijablama postoji statistički značajna razlika, i to, u korist vaspitača: Upražnjavanje FA je važno za fizički razvoj i zdravlje dece (t = 3.612, p=.000); FA je važna za razvoj socijalne interakcije među decom (t = 2.531, p=.017); FA umanjuje pojavu nasilja kod dece (t = 2.257, p=.025); Deca su manje nasilna prema drugoj deci posle upražnjavanja FA (t = 3.734, p=.000).

Ovako dobijeni rezultati upućuju na to, da kada je u pitanju senzibilizacija vaspitača i roditelja u vezi sa značajem fizičke aktivnosti na različite segmente razvoja dece, više prostora treba posvetiti senzibilizaciji roditelja, odnosno, osmišljavanja različitih strategija i programa edukacije odraslih (roditelja) u cilju promocije značaja FA. Roditelje treba upoznati sa činjenicom da nove tendencije vaspitno-obrazovnog rada u predškolskim ustanovama holistički posmatraju dete, uvažavajući saznanje da su različiti aspekti razvoja deteta u međusobnoj interakciji i da se ne mogu grubo razdvojiti, i da raznovrsnim fizičkim aktivnostima treba podsticati i delovati na sve segmente dečijeg razvoja (motorni, intelektualni, moralni, socijalni, radni), budući da se oni međusobno prepliću i uslovljavaju. Takođe uočavamo da vaspitači u odnosu na roditelje veći značaj pridaju redovnoj, svakodnevnoj fizičkoj aktivnosti dece, što se može pripisati njihovoj edukaciji u okviru školovanja za profesiju kojom se bave. Ovako dobijeni rezultati u skladu su sa aktuelnim istraživanjima o značaju edukacije budućih prosvetnih radnika (pre svega, vaspitača i učitelja) o širokom značaju FA (Biddle i sar., 2004, 2010; Deforche i sar., 2006; Đorđić, 2006; Pišot, R., 2012, 2014; Sturza Milić, 2013; Sturza Milić i Nedimović, 2014), a sa druge strane, nameću potrebu boljeg informisanja roditelja o značaju FA. Ispitivani vaspitači u većoj meri (u odnosu na roditelje) prepoznaju FA kao sredstvo suzbijanja vršnjačkog nasilja. Zato zaključujemo da bi roditelje u većoj meri trebalo senzibilisati primenom različitih programa i strategija koje FA preporučuju kao sredstvo suzbijanja nasilja kod dece.

ZAKLJUČAK

Jačanje kompetencija vaspitača, ali i roditeljskih kompetencija jedino je moguće na osnovu pažljivo i stručno osmišljenih programa koji su usmereni na razvijanje svesti o značaju uloge vaspitača i roditelja u vaspitanju dece predškolskog uzrasta, boljeg informisanja i stručne pomoći vaspitačima i roditeljima u vaspitanju dece. Društvo je odgovorno za stvaranje uslova koji bi omogućili kvalitetan i aktivan život dece (Bratić, 2014; Brodersen i sar., 2007; Matejak i Planinšec, 2008; Pišot, S., 2012). Rezultati ovog istraživanja pokazuju da fizičku aktivnost treba što više uključiti u svakodnevni život dece, kao i to da roditelji i vaspitači smatraju da je FA moćno sredstvo koje se može koristiti u prevenciji vršnjačkog nasilja. Fizičku aktivnost i njene raznovrsne oblike trebalo bi staviti u širi kontekst. U našem društvu svi znaju da nasilje treba zaustaviti, ali, realna sredstva u ostvarenju ove težnje, nažalost, često izostaju. Konkretni programi trebalo bi da budu usmereni ka podizanju nivoa svakodnevne FA kod dece, ali i na njenu usmerenost ka razvijanju samopoštovanja i poštovanja drugih, smisla za saradnju, tolerancije, fer ponašanja. Budući da je u ovom istraživanju uočena razlika između mišljenja vaspitača i roditelja o značaju FA na različite segmente života predškolske dece i za prevenciju vršnjačkog nasilja, različitim strategijama bi u većoj meri trebalo uticati na pedagoško obrazovanje roditelja i njihovo značajnije uključivanje u različite oblike zajedničkog vežbanja i aktivnosti sa decom. Iako je ovim istraživanjem obuhvaćen relativno mali uzorak ispitanika roditelja i vaspitača, dobijeni rezultati mogu da poslužе kao putokaz za sprovođenje potencijalnih programa prevencije vršnjačkog nasilja u kojima će dominirati kvalitetna fizička aktivnost.

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RESEARCH OF THE PRESCHOOL TEACHERS' AND PARENTS' OPINION ON THE IMPORTANCE OF PHYSICAL ACTIVITY FOR THE PREVENTION OF PEER VIOLENCE

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INTRODUCTION

Aggression and various types of violence are becoming increasingly present in communication and interaction among children, but also among children and adults. When we explore peer violence from the psychological perspective, we can view it as a subgroup of aggressive behaviour, since aggression is a broader concept which includes violence, and therefore also includes peer violence. Violence (including peer violence) is any form of once committed or repeated verbal or nonverbal behaviour which as a consequence has real or potential threat to the child's health, development or dignity (Olweus, 1994; Nedimovic, 2014). Violence among children covers a wide array of behaviour, from resolving a conflict in a violent manner, to unacceptable ways of expressing anger and frustration, to serious incidents which can even threaten the child's life (Nedimovic, 2014; Plut & Popadic, 2007; Popadic, 2009). Violence to a large degree depends on the context in which it occurs and on the social norms and customs of the community (Bodin, 2011; Craig & Pepler, 1997; Olweus, 1994). Bodin (2011) suggests that what the modern (western) culture considers violence would definitely not be understood in the same way in different regions. Violent behaviour among peers is characterized by elements of physical and psychological injury which is intentionally repeated by one or a group of peers (Nedimovic & Biro, 2011; Nedimovic, 2012; Smederevac et al., 2010). A large number of gathered information and numerous studies suggest that various forms of violence have serious long term consequences on victims' mental and physical health. Nasel et al. (2001) states results of a research which demonstrates that learners/children who were victims of peer violence show a higher level of insecurity, anxiousness, depression, loneliness, as well as lower levels of self-esteem in comparison to non-victims. Furthermore, research results (Bacanac, 2010, according to, Popadic et al., 2011) show that victims of violence in school are less popular than other learners who are not participants in peer violence. Repeated peer violence can have long term negative consequences on the victim for many years after the completion of schooling (Olweus, 1993). The feeling of isolation and the loss of self-esteem in the victims lasts until adulthood. This is supported by studies which indicate that vistims of peer violence in schools, when they grow up, have difficulties fitting into society. Consequences of peer violence are not only felt by the victims but also the children who express violent behavior. Children who express violent behaviour at an early age are under higher risk of developing delinquent forms of behaviour, do criminal activities, and become addicted to alcohol and psychoactive substances in adulthood (Kaltiala-Heino et al., 2000). Children who behave violently can also face the consequences of developing psychosomatic symptoms (frequent headaches, skin problems, athletes foot, increased sweating, trembling, palpitation, panic attacks atc.) and having lower academic achievement (Ratner et al., 2006). Violence among peers, especially in preschool institutions and schools is not a new occurrence. The tendency of shunning and mocking among children is becoming visible in children's behaviour earlier and earlier. Hence, this problem needs to be solved as early as in the preschool age with the compulsory involvement of the parents (Nedimovic et al., 2014). Certain authors consider that the reason why peer violence is so durable and sustainable is the insufficiently serious treatment of the problem, refusal to name the phenomenon, and to speak about it; all of which decreases the possibility of confronting the problem. Preschool institutions, but also parents, often do not identify violence in the right way (they

see violence as a game, fun, part of cultural heritage etc.), and therefore do not confront it, or do so inadequately (Smederevac et al., 2010) Researchers (Conduct Problems Prevention Research Group, 1999; Drake, 2003; Gasic-Pavisic, 2004; Jovanovic-Madjar, 2014; Nedimovic & Biro, 2011; Popadic, 2009; Popadić et al., 2011) stress that peer violence can be prevented through the implementation of adequate actions, and timely identification of the problem is a basic condition for the planning of intervention measures and their implementation with the risk groups. When it comes to the prevention of violence and violent forms of behaviour, educational institutions, as well as the family, need to become sensiblised to violence as a phenomenon, form mechanisms of open and meaningful communication about this phenomenon which is becoming ever more present in the modern society and everyday life. In this context it is necessary to construct various mechanisms and programs for lowering peer violence which would encourage the relevant adults (parents, preschool teachers, trainers and others), but also the children to become aware of the problem, and also offer strategies which will contribute to the lowering of violence among children. Possible strategies for lowering the frequency of peer violence could be directed towards the implementation of physical activities and their various forms, since many scientific studies show that PA is an important tool in the prevention of peer violence (Bozovic, 2007; Nedimovic, 2013; Popadic et al., 2011).

Physical activity (PA) contributes to the increase of the quality of life of children and adults (health, self-esteem, social relations, belief on one's own ability for activity, self-motivation) and influences the growth of various aspects of development. The positive connection between social influences and the increased physical activity in children was confirmed by (Sturza Milic & Nedimovic, 2014). We have based the assumption that peer violence can be prevented through physical activity on the fact that physical activity has a positive effect on the mental state of individuals, it prevents depression and anxiety, neutralizes the effects of stress while simultaneously developing self-respect and a positive view of oneself (Jürimäe & Jürimäe, 2001, Matejak & Planinsec, 2014). Of course, when we talk about the positive influence of physical activity on the human organism, one should keep in mind that it needs to be personalized, adequately sequenced and of the adequate duration (Sallis & Owen, 2002). The benefits of a physically active lifestyle are well documented and can lead to improvements of physiological and psychological health (Bratic, 2014). Exercise and physical activity have been losing out as primeval values. a lack of exercise does not merely result in a lack in biological terms, as humankind has also started lacking humanity, exhibiting alienation and a hostile attitude towards themselves and others around them (Skof, 2010).We need to create conditions for regular physical activity, in any form, with a note that certain population groups need special attention. Here we primarily refer to children and the young as well as the elderly. Of course, we should not neglect students, who will soon become a part of the working active population (Abazovic et al., 2014, Andrijasevic et al., 2014; Cerar & Kondric, 2014; Pedisic, 2014; Sturza Milic, 2013, Sturza Milic & Nedimovic, 2014). In accordance with the already mentioned fact that the problem of peer violence is becoming ever more present in educational institutions, the need for studies which deal with this problem and whose goal is to gain relevant data and information which would help the prevention of violent behaviour, is also increasing. Because of the aforementioned reasons, the goal of this paper was the exploration of teacher and parent opinions on the importance of physical activity in the prevention of peer violence at the preschool age.

METHOD

The research was conducted on a sample of 279 subjects. From that number, 142 subjects were preschool teachers and 137 were parents of children in the preschool age. In the sample 11,8% were men and 88,2% were women. 97.2% of the subjects live in the city (on the territory of the Autonomous Province of Vojvodina), and 2.7% live in villages (on the territory of the Autonomous Province of Vojvodina). The research was based on the descriptive and causal non-experimental method. In order to research the opinions of preschool teachers and parents on the importance of physical activity influence in the prevention of peer violence questionnaires were constructed (for parents and teachers) which contained 12 items and a direct introductory address. Each item contained only one statement which was neither ambiguous nor suggestive. The questionnaire was of the Likert type (the levels of the value scale continuum were from 1 to 5, in a logical order from the least agreement with the statement to the maximum agreement). The measurement characteristics of the used instrument were measured. The reliability was measured with the Cronbach coefficient alpha which was 0.862. Data processing referred to the calculation of main descriptive and comparative indicators.

RESULTS

In table 1 and 2 results reached after the questionnaire analysis, which was aimed at the research of the preschool teacher and parent's opinions on the importance of physical activity in the prevention of peer violence, were tested:

Table 1. The preschool teachers' opinions on the importance of physical activity (PA) in the prevention of peer violence among children

R.B.	**Variable**	**N**	**M**	**SD**
1.	Implementation of PA is important for the children's physical development	142	4.95	.222
2.	It is important that children do PA every day	142	4.88	.331
3.	It is important that children do PA regularly in preschool inst.	142	4.62	.567
4.	It is important that I encourage children to do physical activities	142	4.80	.399
5.	Children in my educational group enjoy PA	142	4.67	.515
6.	I enjoy PA	142	4.45	.711
7.	The material factor is important in PA implementation	142	2.71	1.391
8.	Doing PA improves the quality of life	142	4.70	.524
9.	PA is important for the children's character development	142	4.69	.507
10.	PA is important for the development of children's social intelligence	142	4.57	.595
11.	PA decreases the appearance of violence among children	142	4.54	.646
12.	Children are less violent towards other children after implementing PA	142	4.33	.910

N- number of subjects; M- middle value; SD- standard deviation;

Table 2. The parents' opinions on the importance of physical activity in the prevention of peer violence among children

R.B.	**Varijable**	**N**	**M**	**SD**
1.	Implementation of PA is important for the children's physical development	137	4.76	.458
2.	It is important that children do PA every day	137	4.54	.630
3.	It is important that children do PA regularly in preschool inst.	137	4.46	.569
4.	It is important for me to encourage my child to be physical activities	137	4.63	.597
5.	My child enjoys PA	137	4.69	.537
6.	I enjoy PA	137	4.13	.979
7.	The material factor is important in PA implementation	137	2.65	1.427
8.	Doing PA improves the quality of life	137	4.64	.573
9.	PA is important for the children's character development	137	4.54	.719
10.	PA is important for the development of children's social intelligence	137	4.33	.855
11.	PA decreases the appearance of violence among children	137	4.27	.910
12.	My child is less violent towards other children after PA	137	3.72	1.277

N- number of subjects; M- middle value; SD- standard deviation;

After the analysis of the preschool teachers and parent's opinions, through the implementation of the T-tests for the examination of differences among the preschool teachers' and the parents' opinions on the importance of physical activity in the prevention of peer violence, it was determined that a statistically significant difference exists in the following items, in favor of the preschool teachers.

Table 3. The difference in preschool teachers' and parent's opinions on the importance of physical activity (PA) for the prevention of peer violence in children

Variable	t- test p – level of significance
1.Implementation of PA is important for the physical development of children	t = 3.612, p=.000
10. PA is important for the development of children's social intelligence	t = 2.531, p=.017
11. PA decreases the appearance of violence among children	t = 2.257, p=.025
12. Children are less violent towards other children after implementing PA	t = 3.734, p=.000

DISCUSSION

From a sample of 142 preschool teachers of preparatory groups for school, 12 variables, which were directed towards the testing of preschool teachers' opinions on the importance of physical activity (PA) in the prevention of peer violence, were tested. Most of the gathered scores range from 4.33 to 4.65, on the basis of which we can conclude that the tested preschool teachers gave high grades to all of the tested variables. However, this cannot be concluded for the variable: *The material factor is important in PA implementation* (M=2.71). Preschool teachers gave the highest grades to the following variables: *Implementation of PA is important for the children's physical development* (4.95), *It is important that children do PA every day* (4.88), *It is important that I encourage children to do physical activities* (4.80). Such positively expressed opinions of the preschool teachers of preparatory groups suggest that the tested preschool teachers are aware of the importance of PA in the conditions of modern life, the need for daily participation in PA, as well as their role in the encouragement of daily PA in children. Such orientation is in line with the results and recommendations of many researchers on the importance of PA for health and the development of preschool children, as well as the importance of implementing and encouraging children to do PA daily (Djordjic, 2006; Starc & Strel, 2012; Sturza Milic, 2014; WHO, 2010; Zajec & Cemic, 2010). Furthermore, preschool teachers gave relatively high grades to all variables in which the influence of FA on different segments of a preschool child's development is recognized: *Doing PA improves the quality of life* (4.70), *PA is important for the children's character development* (4.69) and *PA is important for the development of children's socail intelligence* (4.57). On the basis of high values of grades while expressing the opinions on the following statements *I enjoy PA* (4.45) and *Children in my educational group enjoy PA* (4.67), we can conclude that preschool teachers consider PA as a powerful tool of everyday life which can be enjoyed by children and adults. However, on the basis of the gathered results we can conclude that PA can be made more interesting and available through permanent education and sensibilisation. This is especially important in work with children, since in the daily life of the preschool child PA is unfortunately "losing the battle" against video games, low-quality TV programs and other inadequate forms of fun for children (Biddle, 2010; Goldberg, 2003; Kisin et al, 2007; Makavić et al., 2007, Matić et al., 2010; Sturza Milic & Nedimovic, 2014). Through the analysis of the preschool teachers' opinions PA was recognized as a tool in the battle against peer violence. This can be concluded on the basis of high values of grades which the preschool teachers appointed to the following variables: *PA decreases the appearance of violence among children* (4.54) and Children are less violent towards other children after implementing PA (4.33). The gathered results, especially when the aforementioned variable is in question, indicate the possibility for additional sensibilisation and education of preschool teachers regarding the implementation of daily PA in the battle against peer violence.

From a sample of 137 parents of children in the preschool age, 12 variables were tested which had as an aim to test the parents' opinions on the importance of PA in the prevention of peer violence. Most of the gathered scores move in the span from 3.72 to 4.76, on the basis of which we can conclude that the tested parents give relatively high grades to the tested variables. However, this cannot be said for the variable: *The material factor is important in PA implementation* (M=2.65), which was also lower when preschool teachers were tested. On the basis of the analysis presentation of the gathered results it can be concluded that parents give high grades to all tested variables which

connect physical activity and its positive influence on development and health, as well as the quality of life: *Implementation of PA is important for the children's physical development* (4.76), *Doing PA improves the quality of life* (4.64) and *PA is important for the children's character development* (4.54). Parents consider it important that children have PA regularly in preschool institutions (It is important that children have PA regularly in preschool institutions 4.46), and also that the children need to be encouraged to do PA (It is important for me to encourage my child to be physical activities 4.63). From the grade values of the aforementioned two items it can be concluded that parents consider that the family and encouraging children to do PA play an important role, not just the preschool institution. A similar view can also be noticed in numerous studies (Cizmanski et al., 2008; Dzejms & Praut, 2004; Hardman, 1997). Parents express the opinion that their children enjoy PA (*My child enjoys PA* 4.69) more than they do (*I enjoy PA* 4.13). Studies show that the parents opinion of PA can easily be transferred to children, and that parents have an important role to play in the formation of the children's "movement" capital (Davison et al., 2003; Djordjic, 2006; Maksimović et al., 2008; Pisot, S., 2012; Sturza Milic, 2008). Slightly lower grades refer to the variables: *PA is important for the development of children's socail intelligence* (4.33), *PA decreases the appearance of violence among children* (4.27) and *My child is less violent towards other children after PA* (3.72). Like the preschool teachers, parents give the lowest grades to the variable: *The material factor is important in PA implementation* (2.65). Namely, parents do not consider the material factor as crucial for quality PA in the work with children. Taking into consideration the fact that the material factor, as a means for preschool physical education, was recognized as very important in many studies, the results gathered here are surprising, but also encouraging, since preschool teachers and parents do not consider the material factor (good, or, unfortunately, in our environment more often - bad) crucial, and therefore do not consider it limiting, for high quality PA of children. This question should be explored in more detail in future studies. After the analysis of the preschool teachers and parent's opinions, through the implementation of the T-tests for the examination of differences among the preschool teachers' and the parents' opinions on the importance of physical activity in the prevention of peer violence, it was determined that a statistically significant difference exists in the following items, in favor of the preschool teachers: *Implementation of PA is important for the physical development of children* ($t = 3.612$, $p=.000$); *PA is important for the development of children's social intelligence* ($t = 2.531$, $p=.017$); *PA decreases the appearance of violence among children* ($t = 2.257$, $p=.025$); *Children are less violent towards other children after implementing PA/ My child is less violent towards other children after PA* ($t = 3.734$, $p=.000$). Results gathered in this way, indicate that, when it comes to sensibilisation of parents and preschool teachers on the importance of physical activity for various segments of child development, more attention should be given to parent sensibilisation, i.e. forming various strategies and programs for the education of adults (parents) with the goal to promote the importance of FA. Parents should be aware that the new educational tendencies, which are being implemented in preschool institutions, approach the child holistically. It is accepted that different aspects of child development are in mutual interaction and cannot be sharply separated, and that physical activity can encourage and positively influence all segments of child development (motor, intellectual, moral, social, work), since they are mutually intertwined and connected. It can also be noticed that preschool teachers view daily physical activity of children as more important than parents, this can be explained by the education acquired by the preschool teachers. These results are in accordance with other modern research on the importance of education of future educators (mainly preschool and elementary school teachers) on the significance of PA (Biddle et al., 2004, 2010; Deforche et al., 2006; Djordjic, 2006; Pisot, R., 2012, 2014; Sturza Milic, 2013; Sturza Milic & Nedimovic, 2014), and on the other hand, indicate the need to better inform the parents on the importance of PA. The tested preschool teachers recognize the importance of PA to a higher degree (in comparison to parents) as a means of suppressing peer violence. For this reason it can be concluded that parents should be sensibilized through the implementation of programs and strategies which promote PA as a means of suppressing peer violence.

CONCLUSION

The strengthening of preschool teachers and parents' competencies is equally possible on the basis of carefully and professionally constructed programs, which are directed towards the development of awareness about the importance of the parents and preschool teachers role in the upbringing of preschool aged children, and keeping preschool teachers and parents informed

and providing them with professional help in the upbringing of children. Society is responsible for creating conditions which would enable children to have an active and full life (Bratic, 2014; Brodersen et al., 2007; Matejak & Planinšec, 2008; Pišot, S., 2012). The results of this research show that physical activity should be included in the children's daily life as much as possible, but also that parents and preschool teachers consider physical activity as a powerful tool which can be used in the prevention of peer violence. Physical activity and its various forms should be placed in the wider context. In our society everyone knows that we need to "say - stop" to violence, but we often lack the means to achieve this goal. Specific programs should be focused towards increasing children's level of daily physical activity, but also on its usage for developing self-respect and the respect of others, a feeling for collaboration, tolerance and fairness. Since, in this research, a difference was noticed between the parents' and preschool teachers' opinions on the importance of PA in different segments of preschool children's lives, the education of parents and their participation in various forms of exercises and activities with children should be implemented to a higher degree, through various strategies.

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THE SPORTS COACH AND HIS ROLE AS AN EDUCATOR OF CHILDREN AND YOUNG ADULTS

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INTRODUCTION

The role of sports in ancient Greek educational institutions was of an extreme importance. Among many sports education advocates were also famous Greek philosophers, Socrates and Aristotle. They hung great significance on athletic performance and physical development and also promoted the idea of sports activities as constituent part of educational process. The importance and role of sport activities has changed through time, however its educational significance has never been in question. Both empiric and theoretical researches accentuate the importance of sports educational aspects, support program and their influence on scientifically professional and organizationally communication activities while working with children and young adults. (Bratanić, 1989). Kinesiology is a scientific study of processes and methods of human growth and development end the optimization of human psychophysical abilities during development, and achieving top performance in sports. (Breslauer, Hublin, Zegnal Koretić, 2014).

The aim of sport pedagogy is directly linked to children and young adults and the way they acquire new information. (Lukić, 2003) Thus, a play represents a spontaneous human activity, crucial for children's cognitive and psychological development. The game playing is an important phenomenon in every child's life. It represents the fundamental part of human evolution, existence, creation, and individual accomplishments.

Education can be defined as a process of transferring the knowledge and experiences to young generation. That does not necessarily refer to only specific knowledge, skills, and experiences of a certain sport, like for example handball, volleyball or football, but more important are coach's life skills, his/her point of view, his/her attitude toward other people, conduct , problem solving and decision making.

By researching the sports and recreation educational aspect one can come to a conclusion that the game as a basic educational and developmental activity, has unfortunately become deformed.

Some studies has showed that taking part in sports activities leads to the adoption of desirable social and moral values. This is specifically notable within team sports activities. (Evans and Roberts, 1987; Fox, 1988). According to the same authors, the cooperation between the members of a team while striving towards the mutual goal, promote the importance of fair play and helps social skills development, like collaboration, tolerance, and mutual respect. Furthermore, some other researchers have concluded that sports activities enables the acquisition of number of positive personal attributes, like generosity, charity, courage, and patience. The acquired attributes are then applied not only on sports field but also in everyday life (Arnold, 1994).

Coaches should not only be competent for specific sports activity, they should also posses a wide range of teaching skills. The educational function is of an extreme importance, for it leads to child's personality and behavioral development that is manifested in real, everyday situations, and enable children's and young adult's integration into society. Therefore, the responsibility of a kinesiology professional begins with the possibility to influence many human components crucial for realization of positive goals. Physical and mental wellbeing has been important throughout human

history, and connected to education and professional accountability. The educational function should be the constituent part of every kinesiology process.

The empirical study (Liukkonen, Laakso, & Telama, 1996) in which the focus was on the coach's demeanor and the atmosphere during the training process, in order to analyze the atmosphere in which children train. The observation produced different information about the coach as a teacher. Furthermore, the study concluded that the younger coaches were more children oriented, and were demonstrating the activities important for initiative and collaboration development.

This study gave the insight to forming the conclusions about the coach's role as an educator, which should in fact be his/her major goal. By acquiring all necessary skills a child or young adult is able to enter the society while accepting all assigned roles. During this process the coach's educational role is of extreme importance.

METHOD

The bibliographical method was essential for data collection, while authors' extensive professional experience enabled them to use the empirical method to analytically and structurally describe sports coach's roles and tasks.

RESULTS

The empirical method based on the authors' extensive professional experience has given the analytic and structural characterization of a coach, his/her functions through hypothesis based on a sports club. In order to achieve both sports and educational results the coach first has to establish guidelines which would enable him/her to achieve complete autonomy during the educational process.

The authors of the study have determined the roles crucial for each educational process. The roles are: **children**, **parents**, **coaches**, **media and sponsors**.

Children. Rather than to discuss children and their character features, one should reexamine the adults' view on sports and the methods of its research and propagation. The studies has shown that today's children suffer from exercise deficiency, which resulted in the increasing number of obese children, while some authors even say that many children are in fact motor illiterate. Physical activity has got a preventive role in a number of disorders (Bouchard & Després, 1995), especially in obesity prevention and reduction. (Flynn & Assoc, 2006). ''There is no more time for spontaneous courtyard games, street and public area plays, especially in cities where children are no longer safe. The free time is mostly spent passively sitting, watching television and playing video games. These are all activities that do not incite children to move and exercise".

Parents need to be advised on how to properly take part in their child's sports education process. First of all, the emphasis should primarily be on the importance of exercise and sports, and not only on the achievement.

What is the role of a parent and where do we draw a line in his/her cooperation with a coach? By trying to answer this important question, the researchers have created the guidelines for parents.

Each parent should:

-Get familiar with the coach and his/her expectations,

-Inform the coach about his/her child's possible health issues,

-Compare sports and educational program with his/her child's needs,

-Discretely taking part or observing the child's sports activity,

-Taking part both practically and economically,

-Refrain himself/herself from influencing and trying to change coach's technical and tactical decisions,

-Regularly inform the coach about current issues (school, lack of obedience…)

Parents' over protectiveness often prevents their children to freely perform spontaneous motor exercises. Parents do not often recognize the child's sports as educational activity, and many times use sports activity as a prize for school achievements. These are just some of the examples that depict the real issues all coaches encounter on everyday basis.

The coach should decide whether he/she will concentrate solely on winning or he will strive to shape each child into both an athlete and decent human being. Next guidelines promote the latter option. The authors of this study believe that the coach/educator should:

-Customize the activity based on the child's age,

-Educate through tactic and strategic capacities,

-Determine optimal educational programs/techniques,

-Find time for ensuring the technical requirements,

-Work on reciprocal role switch,

-Allow everyone to participate in matches,

-Choose models customized for children's age,

-Promote athletic values (loyalty, fair play),

-Insist on maximal attendance but respecting child's school and other duties,

-Use inductive methods that are based on children's participation,

-Distinguish the collective and individual performance results.

What is the role of a coach and where do we draw a line in his/her cooperation with a parent? By trying to answer this important question, the researchers have created the guidelines for coaches. Thus, each coach should:

- Introduce himself/herself and meet the parents and get the insight to their expectations,

-Inquire about children's possible health issues,

-Notify parents about accomplishment goals,

- Notify parents about achieved results,

- Notify parents about their children's personal growth and progress,

-Notify parents directly about emerging problems.

The coach possesses the crucial role in a child's development. It is of the outmost importance that children, while getting the enough amounts of positive experiences, will ensure positive educational impacts and will drastically decrease quitting the sport. The coach does not only have an impact on a young athlete's sports development but also on other aspects of child's life (Smoll and Smith, 1989). One of his/her important roles is to help shape young athlete's psychosocial experience within a sport (Brustad, Babkes & Smith, 2001), while coach's way of conduct is considered as one of the crucial factors that influence the emotional atmosphere during practices (Salminen & Liukonnen, 1996).

The quality of training and its appeal to young athlete depend upon the way in which the coach will structure sports context, which goals will he/she determine as the most important, and what values and attitudes will he/she promote. If all those aspects appear to have positive impact on a young athlete's experience and motivation, the child will most certainly choose sport to be the environment in which he/she will develop and confirm his/her potentials.

Most coaches undoubtedly possess positive and desirable motives for working with young athletes. However, many of them are not aware of the impact of their demeanor and their impression on children and young adults. It is presumed that young athletes do not shape the opinion of coach's conduct directly on observing coach's behavior, but rather their individual interpretations of coach's demeanor is based on their personal perceptions and experiences (Smoll & Smith, 1984). Both cognitive and affective processes shape the attitude towards coach's behavior, therefore young athlete does not react only to information content and technical instructions, but also to the message, the way it is transmitted, and the moment in which it is sent.

Through training the coach increases the performance, improves motor skills and abilities, and brings positive changes into behavior and its educational processes. The relationship between the coach and his/her athletes is always an interactive process; both parties influence one another, their behavior and experiences. Coach's demeanor can have an impact on formation of some aspects of athlete's personality, such as his/her motivation, belief system, social competence development, habits and code of conducts (Lubich, 2001).

A society as a whole and some coaches are result oriented and consider a victory to be the most important feature of sports. Since success attracts most sponsors and media the educational aspect of the coaching process is often put in a position of secondary importance.

Media and sponsorship. Considering the mass media impact and its wide range accessibility, media professionals should be aware of their social responsibility not to cover only highly competitive and exclusive sports. Journalists and their editors should more often choose to report about socially important projects, young aspiring athletes and less popular sports. Sponsors' chief interest is to invest in the team that will secure a higher degree of public awareness of their brand or company. The sponsorships of young athletes' categories and coaching education are sparse.

DISCUSSION

Some questions arise both for coaches as well as parents. Does coach represent only the person who transfers his/her knowledge and skills to children and young adults, or has he also got a task to act as an educator? By analyzing the answers to that question we can conclude that the coach is primarily an educator, a person who overlooks and takes care of children entrusted in his/her care. He/she is a kind and helpful person who has to know how to draw a line between private and official. He/she has to be a professional, an animator with motivation skills who is able to create a positive work and life atmosphere and to influence young athletes' responsible behavior.

Sport has become a highly regarded activity in today's society. Its complex educational aspect makes it crucial for young athlete's development. It is agreed that one of the most important feature of sport is its educational component. Sport represents our society's important component; it is applicable to every segment of human life (Graf, 2002). All kinesiology activities should always be managed by qualified professionals. Coaches (professionals) that work with children have to be familiar with the entire anthropological status, all human growth and development laws, and have to strive towards their improvement. Coach should act as a role model, while the parent must be supportive of their children and should not have exceeding expectations. (Woolgar & Power, 1993).

As it has already been stated, both coaches and parents have got an important educational influence on young athletes. One must not forget the important impact of school, peers and family. Games children play on their free time and physical education classes are more accessible and relaxed forms of training, since there are no leagues and official scores as in sports clubs. The primary goals of club training are to achieve positive results ant to win, therefore, the coach's job is much more complex. Sports education can begin with the determination of goals; however it is very important not to overburden young athletes.

The coach's aim is not only to transfer knowledge and experience, but also to influence young athlete's development, to teach him/het to use the experiences from the sports field in everyday life, and to become new, role models for next generation. Coaches must be experts in kinesiology movement structure activities, and must be able to adapt exercises for specific age. A good coach has to always be competent and adaptable to athlete's individual, psychophysical, social, mental and emotional characteristics (Horga, 1993). That is the reason why the educational role is of an extreme importance**.** It leads to healthy personality development that represents the prerequisite for young adult's complete social integration.

The coach must devote specific attention to imposing boundaries, to obstacles, misses, accidents, disappointments, failures, as well as many other sports education elements. High quality plan and program will enhance the experiences of accomplishments and increase the level of motivation for future participation. The experiences of success and personal efficiency are basic factors for creating a good self image and preventing unwanted forms of behavior (Wigfield & Eccles, 1992).

It is often heard that good young athlete's coach has to be even better educator since his focus is both on children's ports and human development. All activities should be led in laidback atmosphere; children must at all times feel safe and self-assured. However, it is often considered that only the winning coach is a good one, while his/her educational values are almost unnoticed and highly unappreciated.

Practices and matches are important activities not only for technical and tactical drills, but also for the development of young athlete's intellectual and strategic aspects, like attention, observation, memory, and problem solving, all of which are essential and highly usable during football match, volleyball or basketball. The coach has to be a multi-skilled, highly educated professional.

Sport's educational aspects are the most prominent in situations when activities are introduced at the moment when a child is physically and mentally ready to successfully apply them. It is not hard to notice a downhearted child when teacher/coach forces the activity that is too advanced. The exactly right time can only be determined by highly professional person/coach that successfully communicates with children and young adults.

No matter what kind of knowledge is transmitted, teaching should always be a conscious, purposeful and planned activity. The unconscious actions (both appropriate and inappropriate) of a less experienced coach influence young adults, especially younger ones since they tend to use observational learning techniques. Interaction and communication are the important aspects of the process of education (Bratanić, 1991), it is the process mostly determined by the quality of interpersonal relations between a coach (educator) and an athlete (learner).

Children need to be taught how to respect rules of the games, coaches should encourage friendships between team mates, and nourish social emotions. The gradualism is very important for every educational process, which includes sports education. It is important to concentrate on present moment, without ignoring the educational stages and final goal. It is of an extreme importance to nourish a child's and young adult's sports talent and to cautiously and at a right time, stir a child towards desirable activities, without ruining his/her talent, but to help him/her to mature, not only as an athlete, but as well as a young person,.

The means that are necessary and should be used for new sports culture expansion among adults/coaches that are responsible for both motor and educational formation of children and young adults, by searching for mutual and not conflicting developmental process.

CONCLUSION

A coach's role as an integral part of educational process is unquestionable, but often overlooked while dealing with issues emerging during practices and process of coming of age. First and foremost, the staff working with children and young adults should be educated and continuously additionally trained through seminars and other educational means. Every society is responsible for organizing sports activities for all children no matter on which level is their psychophysical development. Each child should be able to excel and proudly show what they know and can do. All kinesiology activities should be adapted to the child's developmental stage and not to coach's or parents' wishes. Furthermore, every child should find joy in playing sports, must sense his/her progress in every segment (all anthropological aspects), above all, gain a sense of belonging and pleasure.

The competent coach is always a teacher that understands children's and young adults' mental processes and their behavior, and knows how to recognize children developmental level indicators for certain sports activity. She/he should be able to recognize special affinities for sports, and to show children and young adults the enthusiasm for their efforts and achievements. It is of extreme importance that each teaching professional is aware of her/his accountability while working with children and young individuals.

The coach controls contests and confirmations- presentation of acquired sports skills as well as encourage good manners outside sports court. Only then will children react to all educational components. Because if the coaches are too demanding or, on the other hand, insufficiently demanding the children are often giving up on sports activities, and sport can no longer act as educational medium and coach is no longer an educator. At the same time, if a child is unable to publicly present his/her skills and progress the level of interest for sport is dropping and with it the

possibility to influence child's education process. Sport as kinesiology activity is much more than just a game and entertainment; it is the activity in which each individual has got the privilege to get to know oneself and others.

Coaches should present the preoperational part of the practice through different games. The authors of this study suggest the introduction of the third part of the practice that will occur after the official match. That way all team members will be given the opportunity to take part in the game, especially children who played briefly or did not play at all.

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RELIJABILNOST ANALIZE KRETANJA ELITNIH FUDBALERA TOKOM UTAKMICE MERENOG PRIMENOM SOFTVERSKOG SISTEMA ZA PRAĆENJE KRETANJA

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UVOD

Tracking motion praćenje i analiza podataka o kretanju igrača tokom fudbalskog meča postali su važno dijagnostičko-analitičko sredstvo za praćenje funkcionalnosti i situacione efikasnosti igrača u modernom fudbalu.

Informacije, koje nam omogućavaju, postaju sve popularnije, kako u dijagnostici i analitici, kao nezaobolaznim segmentima sportske nauke, tako i u svakodnevnom treningu i takmičenju sportista.

Posebnu pažnju obraća se na značaj primene ovih istraživanja u trenažnoj i analitičkoj praksi, odnosno preduzet je niz naučno-istraživačkih postupaka da se pokrene novi pravac uticaja, sa ciljem unapređenja efektivnosti i egzaktnosti trenažnih alata i metoda (postulata).

Softversko praćenje i analiza kretanja su takođe od velikog značaja u cilju određivanja metaboličkih profila trenažnih stimulusa, u mikro i makro periodizaciji trenažnog procesa. Za tu svrhu napravljen je poseban softver, za praćenje i analizu kretanja.

Široki dijapazon informacija dobijenih na osnovu ovakvih analitičkih sistema ukazuje i na kvalitet i kvantitet takmičenja, odnosno pojedinačnih utakmica na egzaktan način, što često nije u korelaciji sa spekulativnim i hipotetskim predstavama o navedenim parametrima.

Niz istraživanja sprovedenih u ovoj oblasti ukazuje na činjenicu da vrhunski igrači fudbala tokom utakmice prosečno prelaze od 11.1 do 13.5 kilometara u zavisnosti od pozicija u timu. Prema intenzitetima kretanja opšti obim podeljen je na kretanje niskim intenzitetom, umerenim intenzitetom, visokointenzivno trčanje i submaksimalno i maksimalno trčanje (sprint) (Railly 2000; Bangsbo 2003).

Dobijeni rezultati praćenja kretanja softverskim sistemom BIOIRC su u velikoj meri u skladu sa rezultatima praćenja kretanja igrača iz najboljih evropskih liga i Lige Šampiona (Radaković i sar., 2012).

Cilj ove studije je određivanje interne reliabilnosti merenja obima kretanja vrhunskih igrača tokom utakmice merenog korišćenjem Software System Tracking Motion BIOIRC.

Dobijeni podaci ukazuju na metodološki pristup pri merenju strukture kretanja vrhunskih igrača softverskom metodom praćenja kretanja.

METOD

Ispitanici

Istraživanje je realizovano na uzorku od 23 igrača, koji su snimani tokom 6 zvaničnih utakmica iz sledećih klubova ili reprezentacija: FK Crvena Zvezda, Beograd; FK Radnički 1923, Kragujevac; FK

Partizan, Beograd; FC Bordoaux, Bordoaux; FC Omonia, Nicozia; Seniorske reprezentacije Srbije i Nacionalnog tima Belgije.

Utakmice su igrane kao kvalifikacioni mečevi UEFA Lige: Crvena Zvezda – Omonia i Crvena Zvezda - Bordoaux u sezoni 2012/13; polufinalni mečevi kupa Srbije u sezoni 2011/12; Crvena Zvezda-Partizan i Partizan-Crvena Zvezda; kvalifikacioni meč za World Cup Brazil 2014: Srbija-Belgija; i mečeva Premier Lige Srbije u sezoni 2014 / 15. Struktura igrača je bila: 7 igrača iz odbrambene linije, 10 igrača iz vezne linije i 6 igrača iz napada. Igrači su selektirani za analizu slučajnim izborom, uz uslov da su u potpunosti tj. svih 90 minuta bili u igri.

Varijable

U varijablama su date procene varijabilnosti kretanja vrhunskih igrača tokom utakmice, praćene softverskim sistemom Tracking Motion software system (BioIRC, Kragujevac, Serbia):

Varijable analizirane u prvom poluvremenu utakmice:

1. Ekipno I poluvreme, kretanje svih igrača ekipe tokom prvog poluvremena;
2. Odbrana I poluvreme, kretanje svih igrača odbrane tokom prvog poluvremena;
3. Sredina I poluvreme, kretanje svih igrača sredine tokom prvog poluvremena;
4. Napad I poluvreme, kretanje svih igrača napada tokom prvog poluvremena.

Varijable analizirane u drugom poluvremenu utakmice:

5. Ekipno II poluvreme, kretanje svih igrača ekipe tokom drugog poluvremena;
6. Odbrana II poluvreme, kretanje svih igrača odbrane tokom drugog poluvremena;
7. Sredina II poluvreme, kretanje svih igrača sredine tokom drugog poluvremena;
8. Napad II poluvreme, kretanje svih igrača napada tokom drugog poluvremena.

Napomena: Sve varijable iskazane su u metrima.

Performanse softverske analize

Za snimanje utakmica sistemom BioIRC Tracking Motion, korišćene su dve identične video kamere Sony NEX-VG10, u full-HD rezoluciji, i jedna kontrolna kamera sa high speed performansama.. Algoritamski deo softvera za obradu video snimaka, tj. za praćenje kretanja igrača, zasnivao se na utvrđivanju mere sličnosti statističke distribucije boje objekata. Obrada video snimka utakmice, sastoji se iz više faza.

Radi analize video fajlova, video snimci su komprimovani XVID kodekom u MOV format, sa frekvencijom osvežavanja od 30 slika u sekundi. Algoritamski deo softvera za obradu video snimaka, tj. za praćenje kretanja igrača, zasniva se na utvrđivanju mere sličnosti statističke distribucije boje objekata (Comaniciu, 2000; Comaniciu, 2000; Baviskar, 2012).

Softver za analizu, prati kretanje igrača na celoj površini terena, naizmenično analizirajući snimke jedne i druge polovine terena, a sve u zavisnosti od trenutne aktivnosti igrača (Kailath, 1967). Brzina analize na računaru Intel(R) Core2Duo E6750@2.66GHz, 2GB RAM, Win7 32bit, iznosi ~4 frejma u sekundi.

Analiza praćenja kretanja podrazumeva neku vrstu merenja, a ne samo komentare ili isticanje posebnih postupka. koji moraju biti preduzeti kako bi se postigao taj cilj. Korišćene metode mogu se grubo klasifikovati kao visoke tehnologije bazirane na hardverskom sistemu i na osnovu algoritma.

To može biti veoma korisno u sportskoj analitici i dijagnostici, kao i planiranju,programiranju treninga i izboru i kreiranju novih trenažnih metoda u elitnom sportu.

Softver omogućava individualno, linijsko, ili timsko praćenje igrača u bilo kom momentu meča, što omogućava da treneri u svakom trenutku utakmice imaju informacije u realnom vremenu, o poziciji i načinu kretanja sopstvenih, ili protivničkih igrača.

Na taj način omogućeno je sagledavanje pozitivnih i negativnih odgovora na zateve igre, taktičkih zamisli, ili individualnih akcija igrača na terenu, što je pre bilo nemoguće.

Takođe je valiki značaj vizuelnih efekata u prikazima samim akterima na terenu, u smislu analize i korekcija konkretnih detalja vezanih za određene kretnje.

Napredak u uvođenju softvera i hardvera omogućava korišćenje video snimanja, u realnom vremenu, transformacije, kao i softvera za filtriranje koji, istovremeno prikazuju snimak i 2 D prikaze i sheme analize utakmice. Ovi rezultati su dinamički sinhronizovani u realnom vremenu, tako da ih istraživač, trener, sportista mogu efikasno koristiti, kao bazu i proceniti motoričke i funkcionalne performanse svojih igrača i njihovu refleksiju na efikasnost u situacionim uslovima.

Metod softverskog praćenja kretanja igrača tokom fudbalske utakmice pruža mogućnost egzaktnog uvida u strukturu kretanja igrača, i sagledavanje situacija na terenu, nudeći sportskim ekspertima i trenerima velike mogućnosti za korekcije i analizu.

Istovremeno se mogu napraviti brojne opservacije, perspektive i predikcije pod različitim situacionim uslovima a zatim izvršiti neophodna prilagođavanja trenažnih stimulusa za razvoj datih sposobnosti prema metaboličkim profilima kretanja.

Nakon sticanja eksperimentalnih rezultata, korišćena je obrada slika i video softvera za analizu i pripremu numeričkih proračuna. Rezultati merenja su dati za opšte parametre, što je samo deo mogućnosti softvera

Osnovni cilj ovog eksperimenta je posedovanje apsolutnog uvida u strukturu, obim i intenzitet kretanja igrača na individualnom i integralnom nivou.

Softver poseduje mogućnost prikaza podataka u formi grafikona i numeričkih prikaza iskazanih u metrima, ili procentima od ukupnog kretanja u funkciji vremena (slika 1). Podešen je takođe da vrši i 2 D prikaz kretnji u bilo kom trenutku utakmice, paralelno sa praćenjem snimka meča, a ono što je najvažnije program omogućava nebrojeni niz operacija i analiza u bilo kom vremenskom intervalu, na individualnom, grupnom, ili integralnom nivou, za jednu, ili obe ekipe istovremeno.

Drugim rečima treneri i sportski eksperti mogu ovim softverom pratiti kretanje svojih, ili protivničkih igrača u svakom trenutku i na bilo kom delu terena.

Ovakav nivo sofisticiranosti BIOIRC tracking motion softverskog programa nudi ogromne mogućnosti u smislu analize i pokaza kretanja, pozicija igrača u datom trenutku, te kao takva može biti i sdredstvo taktičke, a ne samo analize funkcionalnog efektivizma igrača tokom utakmice.

Statistička analiza

Parametri strukture kretanja su analizirani deskriptivnom statističkom metodom, gde su izračunate: prosečne vrednosti (Mean), standardna devijacija (SD), koeficijent varijacije (cV%), standardna greška merenja izražena u apsolutnim (Std. Error. Aps.) i relativnim (Std. Error. Rel.) vrednostima, minimalna (Min) i maksimalna (Max) vrednost izmerenih varijabli.

Validnost praćenih varijabli je ispitivana primenom linearne regresione analize, primenom metode za definisanje interklasne korelacija podataka (ICC and Cronbach's Alpha), dok je razlika između parova varijabli utvrđena primenom univarijatne analize vraijanse (ANOVA). Sve analize su realizovane pomoću softverkog paketa SPPSS 19.0, a kriterijum verovatnoće razlika ili korelacija je bio na nivou $p = 0.05$.

REZULTATI

Tabela 1 prikazuje bazične deskriptivne pokazatelje varijabli kretanja igrača u prvom i drugom poluvremenu, na nivou celog tima i po linijama tima.

Tabela 1.Bazična deskriptivna statistika izmerenih varijabli

	Mean (m)	SD (m)	cV%	Std. Error. Aps. (m)	Std. Error. Rel. (%)	Min (m)	Max (m)
Overall sample of players (N = 23)							
I half	5748.2	731.0	12.72	152.4	2.65	4041.5	6875.3
II half	5885.4	698.2	11.86	145.6	2.47	3938.6	6808.2
Whole game	11633.6	1392.2	11.97	290.3	2.50	8038.0	13549.5
Defence (N = 10)							
I half	5153.8	614.8	11.93	194.4	3.77	4041.5	5671.6
II half	5530.4	874.4	15.81	276.5	5.00	3938.6	6612.7
Whole game	10684.1	1475.2	13.81	466.5	4.37	8038.0	12242.0
Midfielders (N = 7)							
I half	6536.7	233.8	3.58	88.4	1.35	6145.8	6875.3
II half	6435.4	244.4	3.80	92.4	1.44	6096.8	6808.2
Whole game	12972.1	433.9	3.34	164.0	1.26	12242.6	13549.5
Attackers/Strikers (N = 6)							
I half	5819.0	148.3	2.55	60.6	1.04	5586.0	6017.5
II half	5835.5	136.0	2.33	55.5	0.95	5596.5	6009.7
Whole game	11654.5	271.1	2.32	110.7	0.94	11182.6	11930.9

U odnosu na rezultate celokupnog uzorka igrača, može se tvrditi da su sve izmerene varijable veoma pouzdane jer koeficijent varijacije ne prelazi vrednost od 15.81 % (Table 1, Odbrana II poluvreme) pa sve do samo 2.33 % varijacije (Napadači II poluvreme). U odnosu na relativnu vrednost standardne greške merenja, kao mere greške merenja metode, može se tvrditi da se ona nalazi u rasponu od 0.94 % za napadače II poluvreme do 5.00 % za Odbranu II poluvreme. Drugim rečima, u odnosu na prosek svih greški merenja praćenih varijabli po pozicijama, ona se nalazi na nivou od 2.24 % (Tabela 1).

Tabela 2. Rezultati relijabilnosti

				Intraclass Correlation Coefficient				
	Cronbach's Alpha	ANOVA F relation	P value	Single Measures	Average Measures	95% Confidence Interval Lower Bound	Upper Bound	P value
				Overall sample of players				
	0.946	4.104	0.055	0.897	0.946	0.773	0.955	0.000
				Defenders				
I vs II half	0.950	13.01	0.006	0.905	0.950	0.798	0.988	0.000
				Midfielders				
I vs II half	0.785	1.774	0.231	0.646	0.785	-0.253	0.963	0.042
				Attackers/Strikers				
I vs II half	0.898	0.219	0.660	0.815	0.898	0.273	0.986	0.013

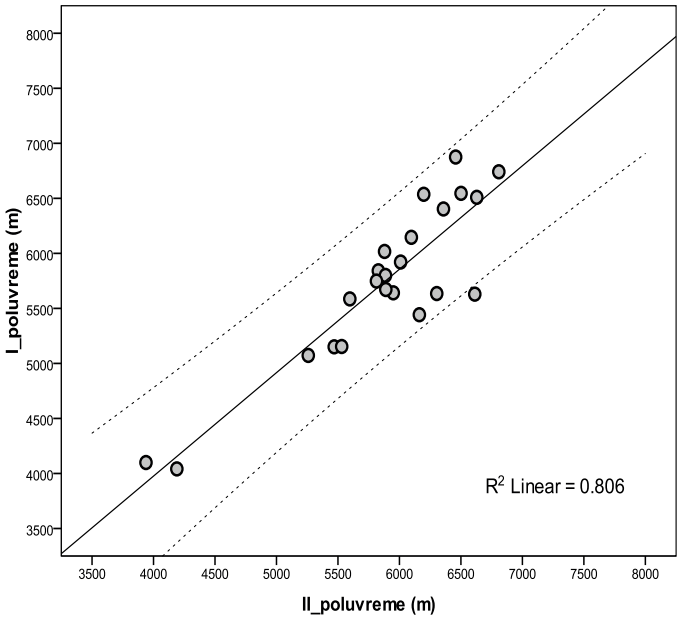
U tabeli 2 su prikazani rezultati izračunatih koeficijanata reliabilnosti za ispitivane varijable.

Na osnovu dobijenih rezultata se može tvrditi da se nivo generalne reliabilnosti, tj. reliabilnosti za celokupan uzorak igraèa nalazi na nivou od 0.946 (Table 2, Cronbach's Alpha) i da je statistički visoko značajan (p = 0.000). koeficijenti reliabilnosti kreću se od veoma visokih vrednosti, koje su utvrđene za igrače Odbrambene linije – 0.950, p = 0.000; i za Napadače – 0.898, p = 0.013, do visokih za Vezne – 0.785, p = 0.042 (Table 2).

Na grafikonima 1 do 4 su prikazani rezultati linearne regresione analize, radi definisanja linearnog stepena slaganja rezultata distance kretanja u prvom i drugom poluvremenu kao mere sličnosti ispitivanih varijabli primenom Tracking Motion software systema. Na grafikonu 1 su prikazani

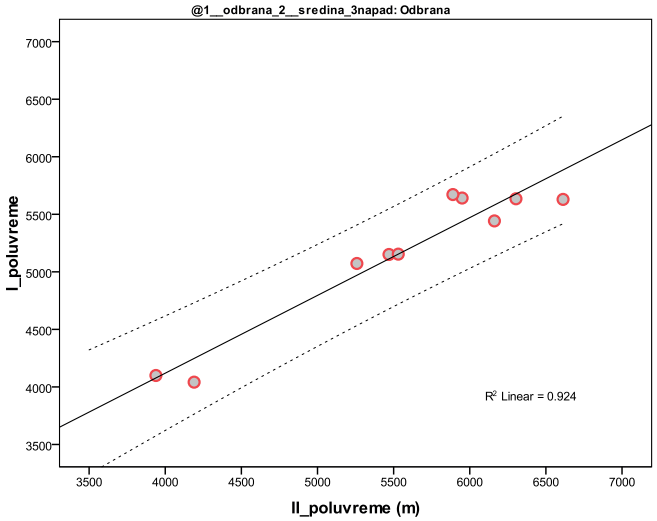
parametri distribucije zavisnosti kretanja igrača celog tima tokom prvog i drugog poluvremena na osnovu linearne regresije. Na generalnom nivou (Grafikon 1) se može tvrditi da je stepen slaganja rezultata prvog i drugog poluvremena u odnosu na ostvarene distance kretanja tokom utakmice na nivou koeficijenta determinacije od $R^2 = 0.806$, odnosno na nivou 80.6% objašnjenog varijabiliteta.

Grafikon 1. Linearna regresija u zavisnosti od pređene distance u prvom i drugom poluvremenu za sve igrače celog tima

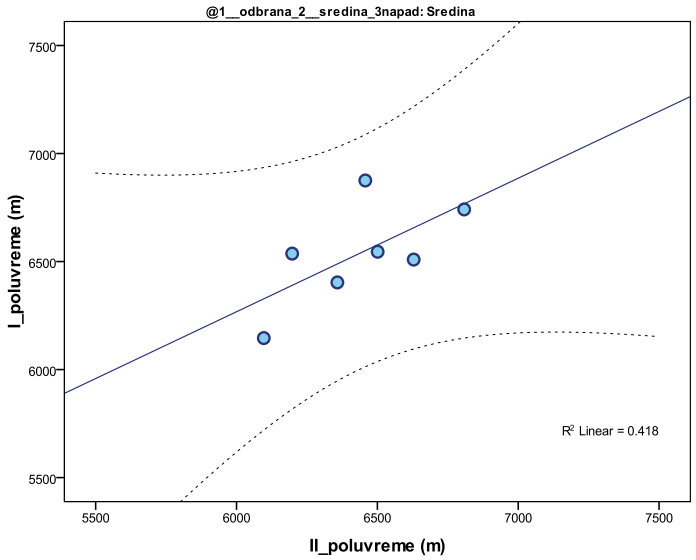


Na Grafikonu 2, 3 i 4 prikazani su parametri distribucije zavisnosti kretanja igrača odbrambene linije, srednje linije i igrača iz napada tokom prvog i drugog poluvremena. Na osnovu dobijenih rezultata (Grafikon 2, 3 i 4) se može tvrditi da je stepen slaganja rezultata prvog i drugog poluvremena u odnosu na ostvarene distance kretanja tokom utakmice za odbranbenu liniju na nivou koeficijenta determinacije od $R^2 = 0.924$, odnosno na nivou 92.4% objašnjenog varijabiliteta, za srednju liniju na nivou koeficijenta determinacije od $R^2 = 0.418$, odnosno na nivou 41.8% objašnjenog varijabiliteta i za liniju napada na nivou koeficijenta determinacije od $R^2 = 0.670$, odnosno na nivou 67.0% objašnjenog varijabiliteta kretanja.

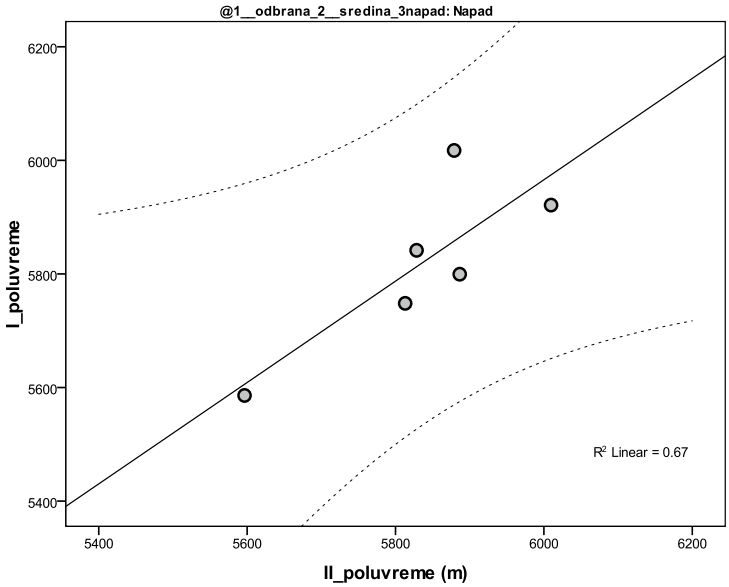
Grafikon 2. Linearna regresija u zavisnosti od pređene distance u prvom i drugom poluvremenu za odbrambene igrače



Grafikon 3. Linearna regresija u zavisnosti od pređene distance u prvom i drugom poluvremenu za vezne igrače



Grafikon 4. Linearna regresija u zavisnosti od pređene distance u prvom i drugom poluvremenu za napadače



DISKUSIJA

U odnosu na dobijene rezultate ovog istraživanja, sa aspekta relijabilnosti strukture kretanja igrača tokom utakmice, odnosno ispoljavanja takmičarske performanse, ogledane u obimu i intenzitetu kretanja, utvrđeno je da postoji visok stepen relijabilnosti kretanja igrača po linijama tima za analizirane utakmice. Ova konstatacija naročito se iskazuje u slučaju relijabilnosti kretanja celog tima i igrača odbrambene i napadačke linije ispoljavaju kretanje na isti način, dok je kod igrača vezne/srednje linije stepen relijabilnosti nešto niži.

Korelacije među primenjenim varijablama su praktično sve pozitivne i kreću se u domenu visokih pa do veoma visokih korelacija.

Za varijablu korelacija kretanja igrača odbrambene linije tokom prvog i drugog poluvremena koeficijenti varijabilnosti (Cronbach $\alpha = 0{,}950$) su sa vrlo visokim i zadovoljavajućim vrednostima,

kao i individuallna korelacija koja iznosi 0,897. Za varijablu korelacija kretanja igrača srednje (vezne) linije tokom prvog i drugog poluvremena koeficijenti varijabilnosti (Cronbach α = 0,785) su sa visokim i zadovoljavajućim vrednostima. Za varijablu korelacija kretanja igrača napadačke linije tokom prvog i drugog poluvremena koeficijenti varijabilnosti (Cronbach α = 0,898) su sa vrlo visokim i zadovoljavajućim vrednostima. Na nivou kretanja igrača celih timova tokom prvog i drugog poluvremena koeficijenti varijabilnosti (Cronbach α = 0,946) su sa vrlo visokim i zadovoljavajućim vrednostima .

Poređenjem Rezultata obima kretanja vrhunskih igrača analiziranih softverskim sistemom Tracking Motion, tokom ove studije, sa rezultatima obima kretanja 20 utakmica španske Primera lige i 10 utakmica Lige šampiona, praćenih System Amisco Pro Version 1.0.2., Nice, France, tokom takmičarske sezone 2003./04. uočava se visok stepen korelacije. Približne vrednosti rezultata obima kretanja mogu se uočiti i poređenjem sa studijama Bangsbo & Michalscik 2002; Kirkendal et al.; Williams et al. And Mochra et al., što ukazuje na visok nivo eksterne relijabilnosti softverskog sistema

Dobijeni rezultati parametara distribucije zavisnosti kretanja igrača odbrambene linije, srednje linije i igrača iz napada tokom prvog i drugog poluvremena ukazuju da je stepen slaganja rezultata prvog i drugog poluvremena u odnosu na ostvarene distance kretanja tokom utakmice za odbrambenu liniju na nivou koeficijenta determinacije od R^2 = 0.924, odnosno na nivou 92.4% objašnjenog varijabiliteta, za srednju liniju na nivou koeficijenta determinacije od R^2 = 0.418, odnosno na nivou 41.8% objašnjenog varijabiliteta i za liniju napada na nivou koeficijenta determinacije od R^2 = 0.670, odnosno na nivou 67.0% objašnjenog varijabiliteta kretanja.

Prostor neobjašnjene varijanse koeficijenta determinacije R^2 do 100%, je prostor koji objašnjava varijansu taktike i individualnih verovatnoća same utakmice.

ZAKLJUČAK

Na osnovu dobijenih rezultata kretanja igrača tokom analiziranih utakmica, može se zaključiti da postoji visok nivo izmerenih rezultata kretanja kao mere sličnosti ispitivanih varijabli primenom Tracking Motion software systema, odnosno da je interna mera relijabilnosti obima kretanja igrača tokom prvog i drugog poluvremena utakmice, kako na nivou celog tima, tako i po linijama tima veoma visoka - stepen relijabilnosti kreće od vrlo visoke kod igrača celog tima (Cronbach α = 0,946), odbrambene (Cronbach α = 0,950) i napadačke linije tima (Cronbach α = 0,898), do visoke kod igrača srednje linije tima (Cronbach α = 0,785).

Iz navedenog proizilazi da se softverska analiza odlikuje visokim stepenom osetljivosti i zadovoljavajućim koeficijentima interne reliabilnosti. Takođe, system softverske analize je veoma precizan analitički instrument, sa egzaktnim parametrima i lak za objašnjenje i korišćenje u metodologiji rada trenera i sportskih eksperata, te je kao takav preporučljiv u analitičko-dijagnostičkoj praksi u fudbalu.

Za potrebe budućih studija slične tematike, nameće se neophodnost postojanja većeg broja analiziranih utakmica (ispitanika), različitih tehničko-taktičkih zahteva i kvalitativnih nivoa takmičenja, kako bi se korelacije i međusobne zavisnosti datih parametara potvrdile na velikom uzorku i nametnule kao standardizovano analitičko-dijagnostičko sredstvo u metodologiji rada u fudbalu.

Zahvalnost

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THE RELIABILITY OF MOTION ANALYSIS OF ELITE SOCCER PLAYERS DURING MATCH MEASURED BY THE TRACKING MOTION SOFTWARE SYSTEM

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INTRODUCTION

Tracking motion analysis became a very important analytical-diagnostic means for tracking player's functionality and situation efficiency in modern soccer. Information obtained in that way are becoming more popular, both in analytics and diagnostics taken as the segments of sport science, as well as in daily trainings and competitions (Bangsbo 2003; Rampini, 2007; Carling 2008). A special attention was given to the usage of these results in training and analytical practice. Therefore, we performed several science and research procedures to enhance old and promote new training tools and methods (postulates) (Casajus, 2001; Bradley, 2003). We also emphasized that our software indirectly helps in determining metabolic profiles of training stimulus, in micro and macro periodization of training processes (Baviskar, 2012). Vast diapason of information obtained in this way gives us an indication of the quality and quantity of competition. Now, every single match can be analyzed in exact way, which is rarely in accordance with hypothetical opinions about mentioned parameters. The obtained results were, to a great extent, in accordance with motion tracking reports from various European Leagues and UEFA Champions League (Radakovic et a l., 2012). The aim of this study was to determine the internal reliability volume movements in the matches of top players measured using a software system Tracking Motion. The obtained data point to the methodological approach to measuring the volume of movement of top soccer players with the software method of tracking motion.

METHOD

The study was conducted on a sample of 23 players whose playing was recorded during 6 official matches of the following clubs or representations: FC Red Star, Belgrade; FC Radnički 1923, Kragujevac; FC Partizan, Belgrade; FC Bordoaux; Serbian national football team and National team of Belgium. The games were played as the qualifying matches for the Europa League red Star - Bordaux in season 2012/13; The Serbia Cup semi-final match in the 2011/12 season; Red Star-Partizan and Partizan-Red Star; qualifying match for the World Cup in Brazil in 2014: Serbia-Belgium; and match Premier League Serbia 2014/15th Radnicki 1923 Partizan. The structure of the players was the following: 6 Attackers, 7 Defenders, 10 Midfielders. The players were randomly selected provided that they are playing all 90 minutes (Radakovic, 2013). All subjects were informed about the case, the aim and task of the study and they gave voluntary consent, in cooperation with the trainers, to participate in it.

The variables were administered to assess the internal variability of movement of top players during the match measured by Tracking Motion software system (BioIRC, Kragujevac, Serbia): Variables analyzed in the first halves of the matches:

1. Overall_I half, the movement of players during the first half of the match, expressed in m;

2. Defense_I half, the movement of players in the defensive line during the first half, expressed in m;

3. Midfields_I half, the movement of midfield players during the first half, expressed in m;

4. Attackers_I half, the movement of attacker players during the first half, expressed in m.

Variables analyzed in the second halves of matches:

5. Overall_II half, the movement of players during the second half of the match, expressed in m;

6. Defense_II half, the movement of players in the defensive line during the second half, expressed in m;

7. Midfields_II half, the movement of midfield players during the second half, expressed in m;

8. Attackers_II half, the movement of attacker players during the second half, expressed in m.

Before object tracking process starts, we need to manually define it, i.e. we mark the silhouette of a player with an ellipse region as tight as possible in order to reduce the influence of the background pixels as much as possible. Next, based on that region, we define a mathematical model in the form of probability density function of the underlying color (i.e. histogram). Next, we apply the mean-shift procedure by determining the „region of interest" on the subsequent video frame within which we define a candidate model. Initial position of the candidate model corresponds to the last object's position on the previous frame. Since Bhattacharyya coefficient (Kailath, 1967) represents a normalized distance between the histograms of the reference and the candidate models, it is expected that its maximum corresponds to the vector that is directed towards the accurate object's position on the current frame. A detailed description of the mean-shift algorithm is described in (Comaniciu, 2000; Comaniciu, 2000; Baviskar, 2012). Therefore, only the most important parts of the above mentioned algorithm will be outlined in this paper.

The processing of video recording of football matches consists of several phases. Each of these phases requires a careful analysis and planning. For properly setting up the video equipment, it is necessary to take into account several parameters: technical characteristics of the recording equipment, number of cameras, their location, synchronization and so on. The basic requirement is that the selected cameras cover the entire surface of a football field; their fields of view should always overlap to a small degree. A larger number of cameras allows simplification of applied algorithms for computer tracking of player motion and also reduces the time needed to process the video data. On the other hand, it increases the cost of the required hardware, complicates the calibration of the system and also complicates the software needed to integrate data from multiple sources.

In our independently developed system, named BioIRC Motion Tracking, we used two identical Sony NEX-VG10video cameras with full-HD resolution video recording. In order to analyze video files, they were compressed with XVID codec into MOV format, with a refresh rate of 30 frames per second. Algorithmic part of the software for motion tracking of football players is heavily based on the previously described mean-shift algorithm. The basic version of the algorithm was improved several times, which has greatly improved its accuracy and efficiency. In the most demanding situations, the software allows full manual tracking of players up to obtaining favorable conditions scene again.

Analysis software tracks the movement of players around the football field, alternately analyzing recordings of both its halves in accordance with the current activities of the players. Performance analysis on the computer Intel (R) Core2Duo E6750@2.66GHz, 2GB RAM, Win7 32bit, was ~4 frames per second. Besides demanding algorithm for automatic player tracking, this low rate is also a result of the full-HD video editing (e.g. scaling to a size that can be fully accommodated in the application window) prior to applying the tracking algorithm.

For football match video recording and analyzing, we used BioIRC Motion Tracking system, composed of two identical Sony NEX-VG10 video cameras with full-HD resolution video recording.

Recorded video files were compressed with XVID codec into MOV format with the refresh rate of 30 frames per second. Analysis software tracks the movement of players around the entire football

field, alternately analyzing recordings of both its halves in accordance with the current activities of the players. Performance analysis on the computer Intel (R) Core2Duo E6750@2.66GHz, 2GB RAM, Win7 32bit, was ~4 frames per second.

Statistical analysis

Motion structure parameters were analyzed using a descriptive statistics method, where the following values were determined: mean values (Mean), standard deviation (SD), coefficient of variation (cV%), standard error of measurement expresses in both absolute (Std. Error. Aps.) and relative (Std. Error. Rel.) values, minimum (Min) and Maximum (Max.) values of the measured variables.

Reliability of the monitored variables was examined using linear regression analysis (Copic et al., 2012), with the application of a method for defining an intraclass correlation of data (ICC and Cronbach's Alpha), while the difference between the pairs of variables was determined using the univariate analysis of variance (ANOVA). All analyses were performed by using the software package SPPSS 19.0, and the criterion of probability of differences of correlations was on the level $p = 0.05$.

RESULTS

Table 1 shows basic descriptive indicators of the variables of the players' motion in the first and second half, at the level of the whole team.

Table 1.Basic descriptive statistics monitored variables

	Mean (m)	SD (m)	cV%	Std. Error. Aps. (m)	Std. Error. Rel. (%)	Min (m)	Max (m)
Overall sample of players (N = 23)							
I half	5748.2	731.0	12.72	152.4	2.65	4041.5	6875.3
II half	5885.4	698.2	11.86	145.6	2.47	3938.6	6808.2
Whole game	11633.6	1392.2	11.97	290.3	2.50	8038.0	13549.5
Defence (N = 10)							
I half	5153.8	614.8	11.93	194.4	3.77	4041.5	5671.6
II half	5530.4	874.4	15.81	276.5	5.00	3938.6	6612.7
Whole game	10684.1	1475.2	13.81	466.5	4.37	8038.0	12242.0
Midfielders (N = 7)							
I half	6536.7	233.8	3.58	88.4	1.35	6145.8	6875.3
II half	6435.4	244.4	3.80	92.4	1.44	6096.8	6808.2
Whole game	12972.1	433.9	3.34	164.0	1.26	12242.6	13549.5
Attackers/Strikers (N = 6)							
I half	5819.0	148.3	2.55	60.6	1.04	5586.0	6017.5
II half	5835.5	136.0	2.33	55.5	0.95	5596.5	6009.7
Whole game	11654.5	271.1	2.32	110.7	0.94	11182.6	11930.9

Compared to the results for the overall sample of the players, it can be concluded that all measured variables are highly reliable since the coefficient of variation does not exceed the value of 15.81 % (Table 1, Defence II half), and up to only 2.33 % variation (Attackers/Strikers II half). With regard to the relative value of the standard error of measurement, it can be stated that it falls within the range of 0.94 % of Attackers/Strikers II half to 5.00 % for Defence II half. In other words, compared to the average value of all errors of measuring variables that were monitored by their positions, it is at the level of 2.24 % (Table 1).

Table 2. Reliability results

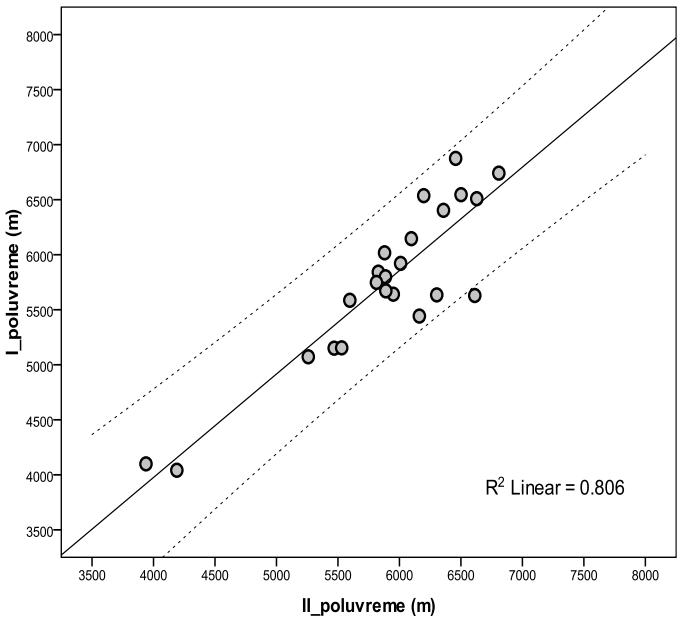
	Cronbach's Alpha	ANOVA F relation	P value	Intraclass Correlation Coefficient				
				Single Measures	Average Measures	95% Confidence Interval		P value
						Lower Bound	Upper Bound	
				Overall sample of players				
	0.946	4.104	0.055	0.897	0.946	0.773	0.955	0.000
				Defenders				
I vs II half	0.950	13.01	0.006	0.905	0.950	0.798	0.988	0.000
				Midfielders				
I vs II half	0.785	1.774	0.231	0.646	0.785	-0.253	0.963	0.042
				Attackers/Strikers				
I vs II half	0.898	0.219	0.660	0.815	0.898	0.273	0.986	0.013

Table 2 shows the results of the calculated reliability coefficient for the analzyed variables.

On the basis of the obtained results, it can be determined that the level of general reliability, that is, the reliability for the overall sample of players, is at the level of 0.946 (Table 2, Cronbach's Alpha) and is statistically highly significant (p = 0.000). Very high reliability coefficients were calculated for players by their positions as well, and those are the following: for Defenders – 0.950, p = 0.000; for Midfielders – 0.785, p = 0.042, and for Attackers/Strikers – 0.898, p = 0.013 (Table 2).

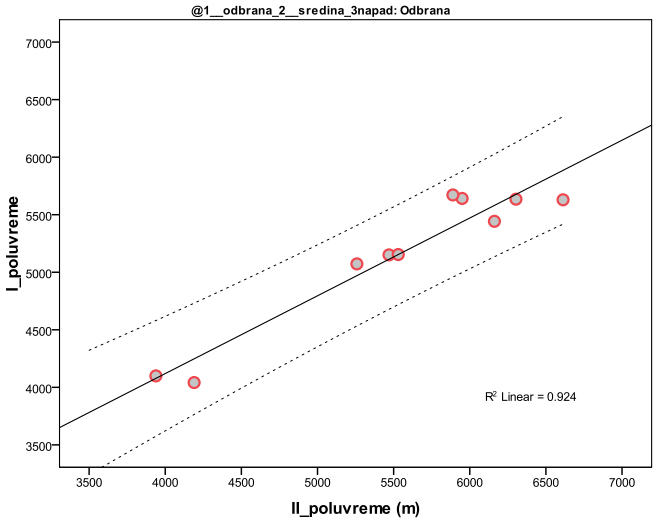
Graphs 1 to 4 present the results of linear regression analysis in order to define the degree of linear matching of results of the distance of movement in the first and the second half, as a measurement of the similarity of examined variables, by using the Tracking Motion software system. Graph 1 shows the parameters of the distribution of the dependence of all players' motion during the first and the second half on the basis of linear regression. At the general level (Graph 1), it can be determined that the degree of matching of the results from the first and the second half, compared to the realized distances of motion during the game, is at the level of determination coefficient R^2 = 0.806, that is, at the level of 80.6% of the explained movement variability.

Graph 1. Linear regression dependence of distance run of the first and second half of the overall pattern of players

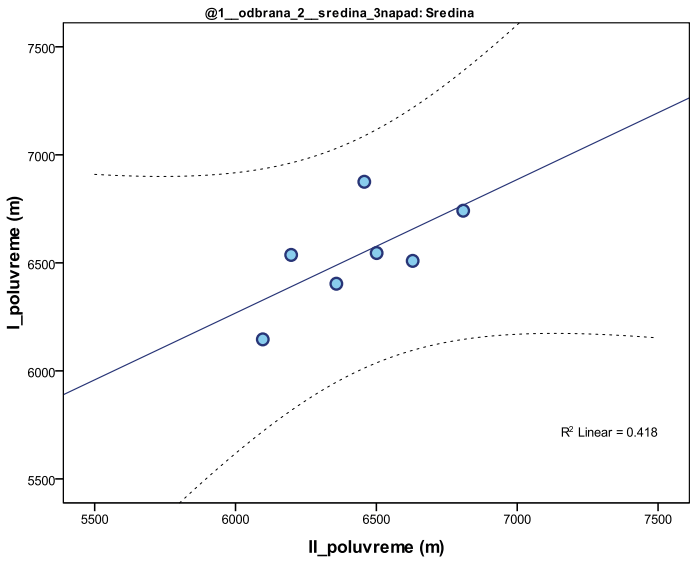


Graphs 2, 3 and 4 show the parameters of the distribution of the dependence of the motion of Defenders, Midfielders and Attackers/Strikers during the first and the second half of the game. On the basis of the obtained results (Graphs 2, 3 and 4), it can be determined that the degree of matching of the results from the first and the second half, compared to the realized motion distances during the game for the defensive players, is at the level of determination coefficient $R^2 = 0.924$, that is, at the level of 92.4% of the movement variability explained, for the midfielders at the level of determination coefficient $R^2 = 0.418$, that is, at the level of 41.8% of the movement variability explained, and for the attackers at the level of determination coefficient $R^2 = 0.670$, that is, at the level of 67.0% of the movement variability explained.

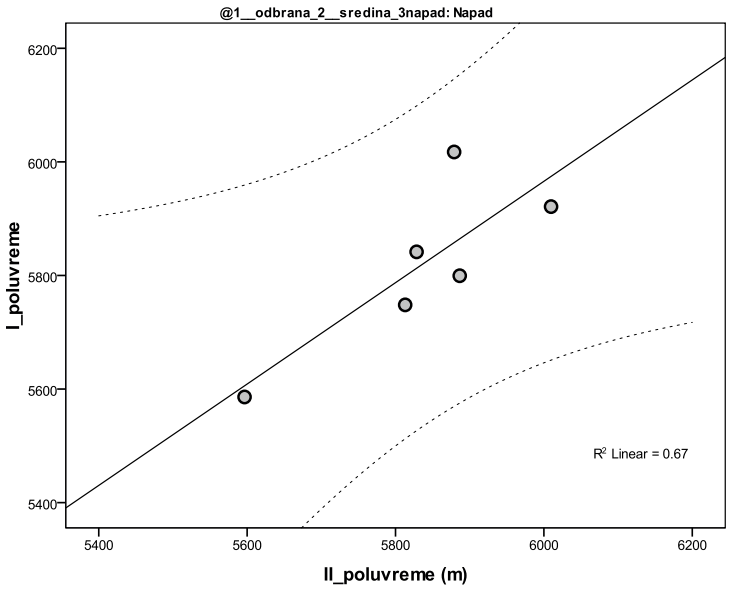
Graph 2. Linear regression dependence of distance run for the first and second half of the defender players



Graph 3. Linear regression dependence of distance run for the first and second half of the midfielder players



Graph 4. Linear regression dependence of distance run with the first and second half of the striker (attack) players



DISCUSSION

In relation to the obtained results, and from the aspect of reliability of movement structure of players during the match, i.e. by their competitors' performance concerning volume and intensity of movement, it is established that there is a high degree of reliability of line players' movement for the analyzed matches. This is especially noted in the movement reliability of the entire team and defense and attack players, whereas the degree of reliability for midfield players is a bit lower.

The correlations among the applied variables are practically all positive and fluctuate from high to very high.

The coefficients of variability for variable of correlation of defense players movement during the first and the second halves (Cronbach α = 0.950)are of very high and satisfactory values, as well as the individual correlation of 0.879.The coefficients of variability for variable of correlation of midfield players movement during the first and the second halves (Cronbach α = 0.785)are of high and satisfactory values. The coefficients of variability for variable of correlation of midfield players movement during the first and the second halves (Cronbach α = 0.898) are of very high and satisfactory values. The coefficients of variability on a level of movement of players of the entire team during the first and the second halves (Cronbach α = 0.946) are of very high and satisfactory values.

By comparing the results of movement volume of the top players analyzed with software system Tracking Motion during this study, with results of movement volume in20 matches of Spanish Premier League and 10 matches in the Champions League, tracked by System Amisco Pro Version 1.0.2., Nice, France during the 2003/2004 season, we can establish a high degree of correlation. Similar values of results of movement volume could be noticed in comparison to studies of Bangsbo and (Michalscik 2002; Kirkendal et al.; Williams et al. and Mochra et al.), which indicates that the external reliability of the software system is at a very high level.

The given results for distribution parameters of movement dependency of defense, midfield and attack players during the first and the second halves indicate that the degree of correlation of results for the first and for the second half in relation to movement distance during the match for defense line on a level of determinacy coefficient is R^2=0.924, i.e. 92.4% of explained variability, for mid line on a level of determinacy coefficient is R^2=0.418, i.e. 41.8% of explained variability and for attack line on a level of determinacy coefficient is R^2=0.670, i.e. 67.0% of explained movement variability.

The area of inexplicable variance of determinacy coefficient R^2 to 100% is an area which explains the variance of tactics and individual probabilities of the match itself.

CONCLUSIONS

On the basis of the results of players' movement during the analyzed matches, it can be concluded that there is a high level of reliability in application of Tracking Motion software system, i.e. that the internal measure of reliability of players' movement volume during the first and the second half of the match, both on the level of the entire team, as well as along the lines of the team, is very high - the degree of reliability ranges from very high with players of the entire team (Cronbach $\alpha = 0.946$), defense (Cronbach $\alpha = 0.950$) and the offensive line team (Cronbach $\alpha = 0.898$), to high with middle line players (Cronbach $\alpha = 0.785$).

It follows that the software analysis is characterized by a high degree of sensitivity and satisfactory coefficients of internal reliability. Also, the system of software analysis is very precise analytical instrument, with exact parameters and easy to explain and use in work methodology of couches and sport experts (Kailath, 1999), so that it could be recommended in analytical and diagnostic practice in soccer.

For purposes of future studies with a similar topic, there is a necessity of having a larger number of analyzed matches (players), with different technical and tactical demands and qualitative level of competition, so that the correlations and interdependencies of the given parameters could be confirmed on a large sample and emerge as a standardized analytical and diagnostic tool in the work methodology in soccer.

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STAVOVI NASTAVNIKA FIZIČKOG VASPITANJA PREMA INKLUZIJI DECE SA RAZVOJNIM SMETNJAMA

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UVOD

Poslednjih desetak godina koncept integracije dece sa razvojnim smetnjama, zamenjen je konceptom inkluzije. Pojam inkluzije vuče poreklo iz latinskog jezika i znači uključivanje, uključenost, obuhvatanje, podrazumevanje. Inkluzija podrazumeva opštu kulturnu rekonstrukciju stava prema osobama sa razvojnim smetnjama, jer problem takvih osoba nije samo njihov problem i problem njihove porodice, već problem čitavog društva (Hrnjica, 2004). Inkluzivno obrazovanje podrazumeva restruktuisanje sistema redovnog školstva na takav način da svaka škola bude u stanju da se prilagodi svakom detetu bez obzira na smetnje koje dete ima, kao i da obezbedi da svi učenici pripadaju zajednici. Učenici sa razvojnim smetnjama će u ovakvom okruženju bolje napredovati u socijalnom i akademskom pogledu, ono će ih bolje pripremiti za život u zajednici i istovremeno će se izbeći negativni efekti (Brojčin, 2013).

Imajući u vidu da su nastavnici ključne osobe u primeni inkluzivnog obrazovanja, autori se slažu da pozitivan stav prema uključivanju dece sa razvojnim smetnjama u redovnu nastavu predstavlja jedan od najvažnijih faktora za uspešno realizovanje inkluzivnih programa (Brojčin, 2013). Stavovi, kao direktivne i dinamičke dispozicije, mogu uticati kako na komunikacione procese u razredu, tako i na realizovanje sadržaja propisanih kurikulumom (Logan & Wimer, 2013). Istraživanja u oblasti inkluzivnog fizičkog vaspitanja su pokazala da nastavnici koji imaju pozitivnije stavove ulažu više truda u nastavni proces, kao i da učenici sa razvojnim smetnjama pokazuju veći napredak (Elliott, 2008).

Pregledna studija koju je sproveo Hutzler (2003) je pokazala da stavovi nastavnika prema inkluziji dece sa razvojnom smetnjama u nastavu fizičkog vaspitanja (FV) mogu biti moderirani različitim faktorima među kojima su najznačajniji pol nastavnika, iskustvo u radu sa decom sa razvojnim smetnjama i opažena kompetentnost nastavnika. Tako, u većini istraživanja obuhvaćenih ovom studijom pokazano je da nastavnice imaju pozitivnije stavove prema inkluziji dece sa razvojnom smetnjama u nastavu FV od nastavnika. Kada je u pitanju prethodno iskustvo u radu sa decom sa razvojnim smetnjama, rezultati studija daju kontradiktorne rezultate. U nekim studijama je pokazano da nastavnici koji imaju veće iskustvo u radu sa ovom decom imaju pozitivnije stavove prema inkluziji, dok su neke studije pokazale da ovakva povezanost ne postoji. Takođe, rezultati ove pregledne studije pokazuju da će stavovi biti pozitivniji ukoliko nastavnik sebe opaža kao kompetentnog za rad sa decom sa razvojnim smetnjama (Hutzler, 2003). U skladu sa ovim su i rezultati istraživanja koje pokazuje da nastavnici koji su bili stručno osposobljeni za inkluzivne programe pokazuju pozitivnije stavove prema inkluziji dece sa razvojnim smetnjama u nastavu (Avramidis, Bayliss, & Burden, 2000a,b).

Rezultati istraživanja u našoj sredini koja su se bavila stavovima nastavnika prema inkluzivnom obrazovanju nisu dala jednoznačne rezultate. Istraživanje koje su sproveli Kalyva, Gojkovic, & Tsakiris (2007) je pokazalo da nastavnici imaju blago negativne stavove prema inkluzivnom obrazovanju, kao i da nastavnici koji imaju više iskustva u radu sa decom sa razvojnim smetnjama imaju pozitivnije stavove od onih koji imaju manje iskustva. Sa druge strane, istraživanje koje je sprovela Đević (2009) je pokazalo da nastavnici imaju pozitivne stavove prema inkluzivnom obrazovanju, kao i da

pozitivnije stavove imaju oni nastavnici čije su škole uključene u inkluzivne programe. Istraživanje stavova učitelja seoskih i gradskih škola prema inkluziji dece sa razvojnim smetnjama u nastavu fizičkog vaspitanja je pokazalo da učitelji imaju umereno pozitivne stavove, kao i da stavovi učitelja nisu povezani sa mestom u kome rade (Đorđić, Tubić i Protić, 2014).

Imajući u vidu da su istraživanja koja se bave problemima inkluzije u nastavu FV u našoj sredini malobrojna, cilj ovog istraživanja bio je da se ispitaju stavovi nastavnika fizičkog vaspitanja prema inkluziji dece sa razvojnim smetnjama. Pored toga, cilj istraživanja je bio i da se ispita povezanost stavova prema inkluziji dece sa razvojnim smetnjama u nastavu FV sa polom nastavnika, mestom u kome rade, dužinom radnog staža i stručnim usavršavanjem u oblasti inkluzivnog obrazovanja.

METOD

Uzorak

Uzorak je činilo 58 nastavnika fizičkog vaspitanja (40 muškaraca i 18 žena) iz Beograda (N = 30) i Leskovca (N = 28).

Instrumenti

Za merenje stavova nastavnika prema inkluziji dece sa razvojnim smetnjama u nastavu fizičkog vaspitanja upotrebljen je instrument Atitude Toward Inclusive Physical Education (Hutzler, Zach, & Gafni, 2005), a koji su za potrebe ispitivanja u našim uslovima adaptirali Đorđić i saradnici (2014). Ovaj instrument se sastoji od 15 četvorostepenih tvrdnji Likertovog tipa od kojih je 11 formulisano u negativnom obliku. Veći skor na skali ATIPE ukazuje na pozitivnije stavove prema inkluziji dece sa razvojnim smetnjama u nastavu FV.

Pored instrumenta ATIPE, konstruisan je i dodatni upitnik kojim su prikupljeni podaci o polu nastavnika, iskustvu u radu sa decom sa razvojnim smetnjama (da li su imali iskustva u radu sa ovom decom i, ukoliko jesu, približan broj dece sa kojima su radili), godinama radnog staža i pohađanju seminara za stručno usavršavanje posvećenih inkluziji (pohađali seminar – nisu pohađali seminar).

Postupak

straživanje je sprovedeno u osnovnim školama u Beogradu i Leskovcu. Učešće u istraživanju je bilo dobrovoljno i anonimno. Popunjavanje upitnika trajalo je oko 15 minuta.

REZULTATI

U tabeli 1. prikazani su rezultati deskriptivne statistike (minimum, maksimum, aritmetička sredina i standardna devijacija) za pojedinačne stavke skale ATIPE.

Tabela 1. Deskriptivna statistika za pojedinačne stavke skale ATIPE

Stavka	*Min*	*Max*	*M*	*SD*
Nastavnik fizičkog vaspitanja nema znanja i veština da podučava učenike sa senzomotornim smetnjama.	1	4	2.57	0.99
Ne bi trebalo uključivati učenike sa invaliditetom u redovna odeljenja, zbog njihovog izgleda.	1	4	1.97	0.97
Pošto je kvalitet i efikasnost nastave fizičkog vaspitanja prioritet, važno je izbegavati moguća ometanja, uključujući i inkluziju dece sa smetnjama/invaliditetom.	1	4	2.41	0.90
Deca sa smetnjama/invaliditetom mogu mnogo dobiti učestvovanjem u fizičkom vaspitanju sa drugom decom.	1	4	3.26	0.83
Deca sa smetnjama/invaliditetom često izazivaju disciplinske probleme na času fizičkog vaspitanja.	1	4	2.14	0.98
Nastavnik koji uključuje dete sa smetnjom/invaliditetom u redovni čas fizičkog vaspitanja, smanjuje vreme koje može da posveti drugim učenicima.	1	4	2.84	1.02
Dete sa smetnjama/invaliditetom može usporiti učenje druge dece na času fizičkog vaspitanja.	1	4	2.60	1.06
Dete sa smetnjama/invaliditetom ometa nastavnika fizičkog vaspitanja.	1	4	2.28	0.89
Deca sa smetnjama/invaliditetom treba da pohađaju specijalna odeljenja.	1	4	2.79	0.95
Uključivanje dece sa smetnjama/invaliditetom predstavlja lični izazov za nastavnika.	1	4	2.98	0.83
Nastavnik koji uključi dete sa smetnjama/invaliditetom je izložen riziku većeg stresa.	1	4	2.96	0.93
Uključivanje deteta sa smetnjama/invaliditetom može doprineti razvijanju pozitivnih vrednosti.	2	4	3.31	0.68
Uključivanje deteta sa smetnjom/invaliditetom u odeljenju stvara frustraciju i neprijatnost.	1	4	2.14	0.74
Redovno odeljenje može imati koristi od inkluzije deteta sa smetnjama/invaliditetom.	1	4	2.57	0.88
Nije u redu tražiti od nastavnika koji treba da radi sa celim odeljenjem, da posveti posebnu pažnju deci sa smetnjama/invaliditetom i njihovim roditeljima.	1	4	2.72	1.06

Legenda: *Min* – Minimalna vrednost, *Max* – maksimalna vrednost, *M* – aritmetička sredina, *SD* – standardna devijacija

Nakon rekodiranja stavki koje su u formulisane u negativnom obliku u pozitivan izračunat je prosečan skor. Rezultati pokazuju da nastavnici fizičkog vaspitanja imaju umereno pozitivne stavove prema inkluziji dece sa smetnjama u razvoju u nastavu FV, $M = 2.65$, $SD = 0.55$.

Povezanost stavova prema inkluziji dece sa razvojnim smetnjama i pola nastavnika, mesta u kome rade, iskustva u radu sa decom sa razvojnim smetnjama i pohađanju seminara za stručno usavršavanje posvećenih inkluziji proverena je t-testom za nezavisne uzorke. Rezultati su pokazli da se muški ($N = 40$) i ženski ($N = 18$) nastavnici ne razlikuju statistički značajno u pogledu intenziteta stava prema inkluziji dece sa razvojnim smetnjama u nastavu FV. Takođe, nema značajnih razlika između nastavnika koji rade u Beogradu ($N = 30$) i u Leskovcu ($N = 28$), kao ni između nastavnika koji su pohađali seminar za stručno usavršavanje posvećenih inkluziji ($N = 30$) i onih koji nisu ($N = 28$).

Jedina značajna razlika javila se između nastavika koji su imali iskustva u radu sa decom sa razvojnim smetnjama (N = 52) i onih koji nisu imali takvo iskustvo (N = 6), $t(56) = -2.39$, $p < .05$. Ovi rezultati pokazuju da nastavnici koji nisu imali iskustva u radu sa decom sa razvojnim smetnjama (M = 3.13) imaju pozitivnije stavove prema inkluziji u odnosu na nastavnike koji su takvo iskustvo imali (M = 2.59). Ipak, imajući u vidu da je samo 6 nastavnika navelo da nije imalo iskustva u radu sa decom sa razvojnim smetnjama, ovakve rezultate treba uzeti sa rezervom.

Povezanost između stavova nastavnika prema inkluziji dece sa razvojnim smetnjama u nastavu FV i dužine radnog staža, kao i broja dece sa razvojnim smetnjama sa kojima su imali priliku da rade proverena je korelacionom analizom (Pirsonov koeficijent). Rezultati su pokazali da nema značajnih povezanosti između ovih varijabli.

DISKUSIJA

Osnovni cilj ovog istraživanja je bio da se ispitaju stavovi nastavnika fizičkog vaspitanja prema inkluziji dece sa razvojnim smetnjama u nastavu fizičkog vaspitanja u osnovnoj školi. Rezultati su pokazali da, u celini gledano, nastavnici imaju umereno pozitivan stav, što je u skladu sa rezultatitima prethodnog istraživanja u našoj sredini koje je sprovedeno na uzorku učitelja seoskih i gradskih škola (Đorđić i sar., 2014).

Analiza odgovora na pojedinačna pitanja skale ATIPE je dala finiji uvid u strukturu stavova nastavnika prema inkluziji dece sa razvojnim smetnjama u nastavu FV. Rezultati su pokazali da se nastavnici slažu sa tvrdnjama koje ističu pozitivne vrednosti inkluzivnog obrazovanja, a koje se prvenstveno odnose na isticanje dobrobiti koje deca sa razvojnim smetnjama mogu imati od uključivanja u redovnu nastavu. Međutim, nastavnici FV smatraju da nemaju dovoljno vremena, resursa i stručnih kompetencija za kvalitetan rad sa decom sa razvojnim smetnjama koja su uključena u redovna odeljenja. Ovakvi rezultati su u skladu sa rezultatitima pregledne studije koja je obuhvatila 28 istraživanja od 1958. do 1995. godine u kojoj je pronađeno je da, i pored toga što nastavnici uglavnom podržavaju generalni koncept pružanja podrške učenicima sa razvojnim smetnjama, samo trećina smatra da je dovoljno obučena da bi uspešno izvodila nastavu namenjenu ovoj deci (Scruggs & Mastropieri, 1996). Dobijeni rezultati su u skladu i sa nalazima novije studije koja je obuhvatila 38 istraživanja u periodu od 1995. do 2005. godine koja je pokazala da se nastavnici fizičkog vaspitanja uključeni u inkluzivne programe najčešće žale na nedostatak stručnih kompetenci i resursa potrebnih za uspešno izvođenje nastave (Block & Obrusnikova, 2007). Studija sprovedena u našoj sredini je takođe pokazala da nastavnici podržavaju koncept inkluzije, ali smatraju da u postojećem sistemu obrazovanja ne postoje adekvatni uslovi za uključivanje dece sa razvojnim smetnjama (Đević, 2009). Iako nastavnici fizičkog vaspitanja generalno imaju pozitivne stavove prema inkluziji, treba naglasiti da veliki broj nastavnika ipak smatra da decu sa razvojnim smetnjama treba smestiti u posebna odeljenja. Razlozi za ovakvo mišljenje nastavnika mogu biti višestruki: nedostatak stručnih kompetencija i resursa potrebnih za uspešno izvođenje nastave, eventualna negativna iskustva koja su nastavnici imali u radu sa ovom decom ili uverenje da bi deca sa razvojnim smetnjama bolje napredavala u nastavnoj sredini koja je prilagođena vrsti smetnje koju dete ima. Imajući ovo u vidu, neophodno je realizovati dodatna istraživanja koja bi pokušala da daju odgovore na pitanje zašto veliki broj nastavnika i pored pozitivnih stavova prema inkluziji smatra da decu sa razvojnim smetnjama treba smestiti u posebna odeljenja.

Rezultati ovog istraživanja su pokazali da stavovi prema inkluziji dece sa razvojnim smetnjama nisu povezani sa polom nastavnika, što nije u skladu sa rezultatima pregledne studije koju je sproveo Hutzler (2003), a koja je pokazala da u većini slučajeva nastavnice imaju pozitivnije stavove prema inkluziji dece sa razvojnom smetnjama u nastavu FV od nastavnika. Takođe, stavovi nastavnika nisu povezani sa mestom u kome rade, što je u skladu sa prethodnom studijom sprovedenoj u našoj sredini (Đorđić i sar., 2014). Istraživanja koja su se bavila povezanošću stavova nastavnika prema inkluziji i iskustva u radu sa decom sa razvojnim smetanjama nisu dala jednoznačne rezultate – neka su pokazala da nastavnici koji imaju veće iskustvo u radu sa ovom decom imaju pozitivnije stavove, dok su neke studije pokazale da ovakva povezanost ne postoji (Hutzler, 2003). Rezultati ovog istraživanja pokazuju nastavnici koji su imali prethodno iskustvo u radu sa decom sa razvojnim smetnjama imaju negativnije stavove od onih koji su imali takvo iskustvo, što je u suprotnosti sa nalazima prethodne studije. Iako ovaj nalaz treba uzeti s oprezom, s obzirom na to da je samo 6 nastavnika navelo da nije imalo iskustva u radu sa decom sa razvojnim smetnjama, u budućim istraživanjima trebalo bi ispitati

da li je inkluzivno obrazovanje donelo neka negativna iskustva koja su uticala da stavovi nastavnika koji su uključeni u ovaj proces postanu negativniji. Na kraju, rezultati ovog istraživanja su pokazali da stavovi nastavnika fizičkog vaspitanja prema inkluziji dece sa razvojnim smetnjama nisu povezani sa pohađanjem seminara za stručno usavršavanje posvećenih inkluzivnom obrazovanju. Ovakav nalaz nije u skladu sa prethodnim studijama koje su pokazale da nastavnici koji su stručno osposobljeni za inkluzivne programe pokazuju pozitivnije stavove prema inkluziji dece sa razvojnim smetnjama u nastavu (Avramidis et al., 2000b). Takođe, nalazi nisu u skladu sa rezultatima istraživanja sprovedenim u našoj sredini koje pokazalo da nastavnici čije su škole uključene u inkluzivne programe imaju pozitivnije stavove prema uključivanju dece sa razvojnim smetnjama u redovnu nastavu (Đević, 2009). Ovakvi rezultati otvaraju pitanje da li dosadašnji seminari za stručno usavršavanje nastavnika posvećeni inkluzivnom obrazovanju doista nude sadržaje koji mogu da usavrše kompetencije nastavnika fizičkog vaspitanja za rad sa ovom decom. U okviru odobrenih seminara za oblast fizičko vaspitanje u Katalogu programa stalnog stručnog usavršavanja nastavnika, vaspitača i stručnih saradnika za školsku 2014/15 i 2015/2016, nalazi se samo jedan seminar posvećen radu sa učenicima sa smetnjama u razvoju[1]. Ovaj podatak ukazuje da nastavnici fizičkog vaspitanja do sada i nisu imali veliki izbor seminara kroz koje bi mogli da se stručno usavršavaju za rad sa decom sa razvojnim smetnjama u nastavi fizičkog vaspitanja, dok sa druge strane, sadržaji seminara opšteg karaktera na ovu temu, verovatno, ne pomažu nastavnicima da usavrše njihove kompetence u radu sa ovom decom u nastavi fizičkog vaspitanja. Ukoliko sve navedeno uzmemo u obzir, onda i dobijeni rezultati u ovom istraživanju, da stavovi nastavnika prema inkluziji nisu povezani sa pohađanjem seminara za stručno usavršavanje posvećenih inkluzivnom procesu imaju svoje logično objašnjenje.

ZAKLJUČAK

Rezultati ovog istraživanja su pokazali da nastavnici fizičkog vaspitanja imaju umereno pozitivne stavove prema inkluziji dece sa razvojnim smetnjama u nastavu FV. Međutim, kako su pozitivni stavovi nastavnika jedan od najvažnijih faktora uspešne realizacije inkluzivnih programa, potrebno je dalje raditi na njihovom poboljšanju. Jedan od razloga što su stavovi samo umereno pozitivni je što nastavnici smatraju da nemaju dovoljno stručnih kompetenci i resursa za rad sa decom sa razvojnim smetnjama. Imajući ovo u vidu, neophodno je organizovati više usko stručnih seminara koji bi obuhvatili edukaciju nastavnika o različitim oblicima smetnji u razvoju dece. Seminari bi trebalo da pruže nastavnicima mnogo više konkretnih primera i metodičkih postupaka u radu sa učenicima sa smetnjama u razvoju, uzimajući u obzir specifičnosti nastave fizičkog vaspitanja. Takođe, trebalo bi da nastavnicima pruže znanja i poboljšaju njihove kompetencije u pravljenju Individualnih obrazovnih planova. Planovi bi trebalo da se prave na osnovu indivudalnih karakteristika učenika, uključujući obavezno oblik zaostajnja u odnosu na vršnjake, kao i ciljeve koji se žele ostvariti u određenom vremenskom roku (npr. podsticanje rasta i razvoja, korigovanje telesnih i motoričkih nedostataka) i načine njihovog praćenja i vrednovanja.

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ATTITUDES OF PHYSICAL EDUCATION TEACHERS TOWARDS INCLUSION OF CHILDREN WITH DEVELOPMENTAL DISABILITIES

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INTRODUCTION

The concept of integration of children with developmental disabilities was replaced by the concept of inclusion in the last ten years. The notion of inclusion originates from Latin language and means introduction, insertion, encompassing, involvement. Inclusion implies general cultural reconstruction of the attitude towards the persons with developmental disabilities, because the problem of these persons is not only theirs and their families' but also the problem of the entire society (Hrnjica, 2004). Inclusive education entails restructuring of the system of regular instruction so that every school would be able to adjust to every child regardless of the disabilities he/she might have, as well as to enable each student to be part of the community. In such environment, students with developmental disabilities will advance better in both social and academic sense, they will be more prepared for life in the community and at the same time will avoid negative effects (Brojčin, 2013).

Having in mind that teachers are key persons for application of inclusive education, the authors agreed that positive attitude towards inclusion of the children with developmental disabilities in regular classes is one of the most important factors for successful realization of inclusive programs (Brojčin, 2013). Attitudes, as directive and dynamic dispositions, can affect communication processes in class but also realization of the contents prescribed by the curriculum (Logan & Wimer, 2013). Research in the field of inclusive PE showed that teachers with positive attitudes put more effort in the teaching process and that students with developmental disabilities manifest greater improvement (Elliott, 2008).

The survey study made by Hutzler (2003) showed that teachers' attitudes towards inclusion of children with developmental disabilities in physical education classes (PE) can be moderated by different factors, the most important being teacher's gender, experience in work with children with developmental disabilities and observed teacher's competence. Thus, majority of investigations, included in this study showed that female teachers have more positive attitudes towards inclusion of children with developmental disabilities in PE classes. When it comes to previous experience in work with children with developmental disabilities, the results of studies provided contradictory results. Some of them proved that the teachers with more experience in work with these children have more positive attitudes towards inclusion, while some studies showed that no such correlation existed. Additionally, the results of this survey showed that attitudes will be more positive if a teacher perceives him/herself as competent for work with children with developmental disabilities (Hutzler, 2003). These are in accordance with the results of the research showing that teachers who were professionally trained for inclusive programs show more positive attitudes towards inclusion of children with developmental disabilities (Avramidis, Bayliss, & Burden, 2000a,b).

The outcome of the research performed in Serbia regarding the attitudes of teachers towards inclusive education did not provide uniform results. The research conducted by Kalyva, Gojkovic, & Tsakiris (2007) showed that teachers have slightly negative attitudes towards inclusive education and that teachers with more experience in work with children with developmental disabilities have more positive attitudes than the less experienced ones. On the other hand, the research conducted

by Đević (2009) showed that teachers have more positive attitudes towards inclusive education, as well as that more positive attitudes are manifested by those teachers whose schools are involved in inclusive programs. Research of attitudes of teachers from urban and rural schools towards inclusion of children with developmental disabilities in PE classes showed that male teachers have moderately positive attitudes, and also that teachers' attitudes are not related to the place where they work (Đorđić, Tubić i Protić, 2014).

Having in mind that research dealing with problems of inclusion in PE classes in our country are not numerous, the aim of this research was to examine attitudes of PE teachers towards inclusion of children with developmental disabilities. Additionally, the research was aimed at determining correlation of attitudes towards inclusion of children with developmental disabilities in PE classes with teacher's gender, place in which they work, length of service and professional training in the field of inclusive education.

METHOD

Sample

The sample consisted of 58 PE teachers (40 males and 18 females) from Belgrade (N = 30) and Leskovac (N = 28).

Instruments

For measuring the attitudes towards inclusion of children with developmental disabilities in PE classes we have used the instrument Attitude Toward Inclusive Physical Education (Hutzler, Zach, & Gafni, 2005), adapted for this research in our conditions by Đorđić et al. (2014). This instrument consists of 15 of four-degree Likert type statements, 11 of which were formulated in negative form. Better score on the ATIPE scale indicates more positive attitudes towards inclusion of children with developmental disabilities in PE classes.

Beside the ATIPE instrument, an additional questionnaire was designed to collect data on teachers' gender, experience in work with children with developmental disabilities (whether they had experience in work with these children and if yes, the approximate number of children they worked with), length of service and participation in seminars for professional improvement dedicated to inclusion (attended seminar –did not attend seminar).

Procedure

The research was conducted in elementary schools in Belgrade and Leskovac. Participation in research was voluntary and anonymous. It took about 15 minutes to fill in the questionnaire.

RESULTS

Table 1 shows the results of the descriptive statistics (minimum, maximum, mean and standard deviation) for individual items of the ATIPE scale.

Table 1. Descriptive statistics for individual items of the ATIPE scale

Item	*Min*	*Max*	*M*	*SD*
The PE teacher doesn't have knowledge and skill to teach a child with sensorimotor disability.	1	4	2.57	0.99
One shouldn't include a child with disability in the class because his/her image is disgusting.	1	4	1.97	0.97
Since excellence is a major requirement, it is important to avoid any disturbance to the PE class, such as inclusion of children with disability.	1	4	2.41	0.90
Children with disability can profit a lot from PE classes.	1	4	3.26	0.83
Children with disability often cause discipline problems during PE classes.	1	4	2.14	0.98
A teacher who includes a child with disability in the class will reduce the amount of time devoted to all the other children.	1	4	2.84	1.02
A child with disability could slow the learning of his/her peers.	1	4	2.60	1.06
A child with a disability is a threat to the PE teacher.	1	4	2.28	0.89
Children with disabilities should be taught in special classes.	1	4	2.79	0.95
Including a child with a disability is a personal challenge for the PE teacher.	1	4	2.98	0.83
A teacher who includes a child with disability is at risk of more stress.	1	4	2.96	0.93
Including a child with disability could enhance democratic and pluralistic values.	2	4	3.31	0.68
Including a child with disability in the class creates frustration and embarrassment.	1	4	2.14	0.74
The regular class can profit from the inclusion of a child with disability.	1	4	2.57	0.88
It is not appropriate to ask a teacher who is supposed to take a whole class to pay attention to the special needs of a disabled child and his/her family.	1	4	2.72	1.06

Note: Min – minimum, Max – maximum, M – Mean, SD – standard deviation

After re-coding of the items formulated in negative form into a positive one, a positive score was calculated. The results show that PE teachers have moderately positive attitudes towards inclusion of children with developmental disabilities in PE classes, $M = 2.65$, $SD = 0.55$.

Correlation of attitudes towards inclusion of children with developmental disabilities and teacher's gender, place where they work, experience in work with children with developmental disabilities and participation in seminars for professional advanced training dedicated to inclusion was verified by the t-test for individual variables. The results indicated that male ($N = 40$) and female ($N = 18$) teachers do not differ statistically significantly regarding the intensity of attitude towards inclusion of children with developmental disabilities in PE classes. Also, no statistically significant differences were found between the teachers who work in Belgrade ($N = 30$) and in Leskovac ($N = 28$), and between the teachers who attended seminar for professional advanced training dedicated

to inclusion (N = 30) and those who did not (N = 28). The only significant difference appeared between the teachers who were experienced in work with children with developmental disabilities (N = 52) and those with no such experience (N = 6), $t(56) = -2.39$, $p < .05$. These results showed that teachers with no experience in work with children with developmental disabilities (M = 3.13) had more positive attitudes towards inclusion compared to the teachers who had such experience (M = 2.59). Still, having in mind that only 6 teachers stated that they did not have experience in work with children with developmental disabilities, these results should be used with caution.

Correlation between the attitudes of teachers towards inclusion of children with developmental disabilities in PE classes and length of service, as well as the number of children with developmental disabilities they worked with was verified by correlation analysis (Pearsons's coefficient). The results indicated no significant correlation between these variables.

DISCUSSION

The basic aim of this research was to examine attitudes of physical education teachers towards inclusion of children with developmental disabilities in elementary school. The overall results indicated that teachers have moderately positive attitude which is in accordance with the results of the previous research in our country carried out in the sample of teachers from urban and rural schools (Đorđić et al., 2014).

Analysis of the responses to individual items of the ATIPE provided a more subtle view of the structure of the teachers' attitudes towards inclusion of children with developmental disabilities in PE classes. The results showed that teachers agree with the statements that underline positive values of inclusive education, which primarily refer to stressing the benefits that children with developmental disabilities can experience from inclusion in regular classes. However, PE teachers think that they do not have enough time, resources and professional competences for quality work with children with developmental disabilities included in regular classes. Such results are in compliance with the results of the survey encompassing 28 studies from 1958. to 1995. which proved that regardless of teachers' support the general concept of aiding the children with developmental disabilities, only one third thinks that they are trained enough to successfully implement instruction intended for these children (Scruggs & Mastropieri, 1996), as well as with the results of the more recent survey encompassing 38 studies from 1995 to 2005. Showing that PE teachers engaged in inclusive programs most often complain on lack of professional competences and resources necessary for successful education (Block & Obrusnikova, 2007). Additionally, the results correspond to the study carried out in our country that showed that teachers support the inclusion concept but they think that the existing educational system does not provide adequate reasons for inclusion of the children with developmental disabilities (Đević, 2009). Although the PE teachers generally have positive attitudes towards inclusion, it should be stressed that large number of teachers still thinks that children with developmental disabilities should be placed in separate classes. The reasons of such opinion of teachers can be multifold: lack of professional competences and resources required for successful performance in class, possible negative experiences the teachers might have had in work with these children or the belief** that children with developmental disabilities would better advance * in the learning environment adjusted to the type of disability of a particular child. Having this in mind, it is necessary to realize additional research that would try to offer responses to the question of why great number of teachers, regardless of positive attitudes towards inclusion think that children with developmental disabilities should be placed in separate classes.

The results of this research showed that attitudes towards inclusion of the children with developmental disabilities are not correlated with the teacher's gender, which is not in accordance with the results of the study conducted by Hutzler (2003), which showed that in majority cases female teachers have more positive attitudes towards inclusion of children with developmental disabilities in PE instruction then male teachers. Also, attitudes of male teachers are not related to the place where they work, which is in accordance with the previous study carried out in Serbia (Đorđić et al., 2014). The research dealing with connection of teachers' attitudes towards inclusion and experience in work with children with developmental disabilities did not give unambiguous results – some showed that teachers who had more experience in work with these children manifested more positive attitudes, while some studies showed no such connection (Hutzler, 2003). The results of this research showed that teachers who had previous experience in work with children with developmental disabilities

have more negative attitudes than those who did not have such experience, contrary to the outcome of the previous study. Although this outcome should be considered with care, since only 6 teachers stated that they did not have experience in work with children with developmental disabilities, future research should examine whether inclusive education resulted in negative experience due to which the attitudes of the teachers who participated in this process became more negative. Finally, the results of this research showed that attitudes of PE teachers towards inclusion of the children with developmental disabilities are not connected with participation in seminars for professional training dedicated to inclusive education. This result is not in accordance with the previous studies that showed that teachers, professionally trained for inclusive programs manifested more positive attitudes towards inclusion of the children with developmental disabilities in the instruction process (Avramidis et al., 2000b). Also, the results are not in accordance with the results of the research conducted in Serbia that showed that teachers whose schools are involved in inclusive programs have more positive attitudes towards inclusion of the children with developmental disabilities in general classes (Đević, 2009). Such results raise the questions of whether the present seminars for professional advanced training of teachers involved in inclusive education really offer contents that can improve PE teachers' competencies for work with these children. Within the approved seminars for the field of Physical education in the Catalogue of programs of continuous professional training of teachers, educators and professional associates for school years 2014/15 and 2015/2016, there is only one seminar dedicated to work with students with developmental disabilities[1]. This information indicates that PE teachers so far did not have a big choice of seminars at which they could be trained for work with children with developmental disabilities while on the other side the contents of general seminars pertaining to this topic probably, do not help teachers to improve their competences in work with these children in PE classes. Should we consider all of that, then the results obtained in this research, that teachers' attitudes towards inclusion are not correlated with participation in seminars for professional advanced training dedicated to inclusive process are logically explained.

CONCLUSION

Results of this research showed that PE teachers have moderately positive attitudes towards inclusion of children with developmental disabilities in PE classes. However, as positive attitudes of teachers are one of the most important factors for successful realization of inclusive programs, it is necessary to further improve them. One of the reasons for only moderately positive attitudes is that teachers think that they do not have sufficient competencies and resources for work with children with developmental disabilities. Having this in mind, it is necessary to organize more professional seminars to encompass education of teachers on different forms of disabilities in children development. Seminars should provide more real-life examples to teachers together with teaching methods for work with children with developmental disabilities, taking into account specificities of PE instruction. Additionally, teachers should be offered knowledge and improve their competences in creation of Individual educational plans. Such plans should be elaborated based on student's individual features, with an obligation to encompass the form of disability compared to peers, as well as aims to be realized in certain timeframe (e.g. stimulating of development and growth, correction of body and motor disabilities) and ways of their monitoring and assessment.

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RAZLIKE U MOTORIČKIM SPOBNOSTIMA UČENIKA SREDNJIH ŠKOLA IZ GRADSKIH I SEOSKIH PODRUČJA OPŠTINE LEBANE

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UVOD

Moderni civilizacijski tokovi i urbanizacija nametnuli su kroz celodnevne obaveze dominaciju veoma pasivnih oblika aktivnosti kao što su: sedenje u školama, sedenje u kolima, sedenje na radnom mestu, sedenje u kući ispred televizora ili računara, konstantnu upotrebu prevoznih sredstava kao što su automobili, autobusi, liftovi... (Dopsaj i sar., 2010). Istraživanja mnogih autora (Currie et al. 2004; Brettschneider & Naul, 2007; Smith & Biddle, 2008) pokazala su da je prisutan trend porasta broja mladih, posebno srednjoškolaca i studenata, koji imaju usvojene određene životne navike koje se mogu okarakterisati kao nezdrave. Prema tim istraživanjima navike mladih koje se mogu smatrati kao rizične po zdravlje naročito su: nepravilna i neredovna ishrana, nedostatak fizičke aktivnosti, sedentarni način života sa mnogo vremena provedenog uz kompjuter, mobilni telefon i televiziju, pušenje, konzumiranje alkohola, upotreba narkotičkih sredstava, itd. Kao neki od najvećih razloga zbog kojih je veliki broj mladih danas nedovoljno fizički aktivan, navode se kontinuirano opadanje fizičke aktivnosti i vežbanja u porodici, zatim u široj društvenoj zajednici, kao i smanjene mogućnosti za svakodnevno fizičko vežbanje dece u školama (Hardman, 2003).

Nivo motoričkih sposobnosti učenika srednjih škola, u direktnoj je vezi sa efektima fizičkih aktivnosti. Uvid u nivo motoričkih sposobnosti učenika olakšava nastavniku proces planiranja nastave fizičkog vaspitanja, izbor odgovarajućih metoda i organizacionih oblika rada i kao najvažnije, odabir adekvatnih fizičkih vežbi na osnovu kojih se određuju ciljevi i realizuju zadaci fizičkog vaspitanja (Mitrović & Đurašković, 2013). Nivo fizičke aktivnosti počinje se smanjivati u periodu adolescencije (Koppes, Twisk, & Kemper, 2004) pa je iz tog razloga ovaj period vrlo bitan za istraživanje motoričkih sposobnosti. Jedan od bitnih faktora koji može da ima snažan uticaj u rešavanju problema smanjene fizičke aktivnosti je fizičko vaspitanje. Fizičko vaspitanje sa dva časa nedeljno u srednjem obrazovanju za neke učenike predstavlja jedino aktivno vreme. Sve zemlje članice Evropske unije prepoznaju značaj fizičkog vaspitanja u školi, a takođe i ističu značaj fizičke aktivnosti i sporta, kao korisnog načina korišćenja slobodnog vremena (European Commission/EACEA/Eurydice, 2013). Međutim, fizičko vaspitanje često ne pruža učenicima iskustva koja bi za njih imala lično značenje i bila socijalno relevantna. Iz tog razloga ovo istraživanje predstavlja pokušaj da se ostvari uvid u nivo motoričkih sposobnosti učenika srednjoškolskog uzrasta sa aspekta urbano-ruralnog odnosa. Problem istraživanja su motoričke sposobnosti učenika srednjoškolskog uzrasta gradskih i seoskih područja opštine Lebane.

Cilj ovog istraživanja bio je da se utvrdi postojanje razlika u motoričkim sposobnostima učenika srednjih škola iz gradskih i seoskih sredina.

Na osnovu definisanog problema, kao i definisanog cilja istraživanja postavljene su sledeće hipoteze:

H_1 - Postoje statistički značajne razlike u motoričkim sposobnostima između učenika gradskih i učenika seoskih područja,

H_2 - Učenici seoskih područja imaju statistički značajno bolje rezultate svih testova za procenu motoričkih sposobnosti od učenika gradskih područja.

METOD

Istraživanje je sprovedeno u zimskom periodu na uzorku od 65 učenika prvog i drugog razreda srednjih škola sa područja opštine Lebane, prosečne starosti 15.54±0.56 godine, podeljenih na dva subuzorka, učenike iz gradske sredine (N=45) i učenike iz seoskih sredina (N=20). Učenici su bili prosečno visoki 178,03±6.84 cm i prosečne teški 67,84±11.76 kg. Za bolji uvid u karakteristike subuzoraka, u Tabeli 1, pored godina starosti, utvrđeni su antropometrijski parametri telesna masa (AMAST) i telesna visina (AVIST), a na osnovu njihovih vrednosti, izračunat je i parametar za procenu stepena uhranjenosti - indeks mase tela (BMI). Vrednost indeksa mase tela (BMI), izračunavana je formulom (Heyward & Stolarczyk, 1996; American College of Sports Medicine, 2006):

$$BMI\ (kg \bullet m^{-2}) = AMAST\ (kg) / AVIST^2\ (m^2).$$

Tabela 1. Karakteristike subuzoraka, učenika gradskih i seoskih područja

N = 65; N-URB. = 45 (69,23%); N-RUR. = 20 (30,77%)

KARAKTERISTIKE	Mean		Min.		Max.		Range		SD	
SUBUZORAKA	URB.	RUR.	URB.	RUR.	URB.	RUR.	URB.	RUR.	URB.	RUR.
godine starosti	15,65	15,30	15,01	14,10	16,10	16,09	1,09	1,99	0,49	0,62
AMAST (kg)	67,94	67,61	41,00	53,60	97,00	92,60	56,00	39,00	12,65	9,74
AVIST (cm)	178,56	176,85	158,20	168,70	192,00	186,50	33,80	17,80	7,42	5,30
BMI ($kg \bullet m^{-2}$)	21,19	21,64	16,10	18,09	28,98	29,480	12,88	11,39	3,08	3,16

Legenda: *N* - broj ispitanika; *AMAST* - telesna masa; *AVIST*- telesna visina; *BMI* - indeks mase tela; *Mean* aritmetička sredina; *Min.* - minimalna vrednost; *Max.* - maksimalna vrednost; *Range* - raspon rezultata; *SD* - standardna devijacija; *URB.* - učenici urbane sredine; *RUR.* - učenici ruralne sredine.

Za utvrđivanje razlika između subuzoraka, posmatrani su rezultati EUROFIT baterije testova za procenu motoričkih sposobnosti (Council of Europe, Committee for the Development of Sport, 1988):

1. "flamingo" - stajanje na jednoj nozi (meri se sposobnost održavanja ravnoteže) - RAVN,
2. тапинг руком (мери се сегментарна брзина и координација рука) - TAPR,
3. претклон у седу (мери се покретљивост кичменог стуба и у зглобовима кука) - PRET,
4. скок у даљ из места (мери се експлозивна снага ногу) - DALJ,
5. подизање трупа за 30 сек. (мери се репетитивна и експлозивна снага трбушне мускулатуре) - LS30,
6. издржај у згибу (мери се статичка снага руку и раменог појаса) - ZGIB,
7. повратно трчање 10x5 метара (мери се брзина - агилност) - 10x5m,

Dobijeni podaci obrađeni su primenom statističkog programa SPSS Statistics for Windows, Version 20.0 (IBM Corp. Released, 2011), a procedure su obuhvatile deskriptivne statističke parametre, dok je za utvrđivanje značajnih i kvantitativnih razlika i hijerarhije varijabli motoričkih sposobnosti koje doprinose razlikovanju (diskriminaciji) između subuzoraka korišćena Kanonička diskriminativna analiza (Petković, 2000).

REZULTATI

U Tabeli 2. prikazani su uporedni rezultati osnovnih statističkih parametara motoričkih sposobnosti učenika gradskih i seoskih područja.

Iz prikazanih rezultata osnovnih statističkih parametara motoričkih sposobnosti učenika (Tabela 2.) može se konstatovati da učenici iz gradskih područja imaju bolje prosečne rezultate (*Mean*) u četiri (*TAPR, DALJ, LS30, 10x5m*) od ukupno sedam testiranih varijabli motoričkog prostora u odnosu na učenike iz seoskih područja (*RAVN, PRET, ZGIB*). Oba subuzorka učenika su u priličnoj meri homogena (vrednosti *CV%*), osim kod varijabli *RAVN* (*URB.* 68,34 *vs. RUR.* 107,20) i *ZGIB* (*URB.* 62,51 *vs. RUR.* 46,87) gde imamo veliku heterogenost rezultata. Ta heterogenost rezultata posebno je izražena kod učenika iz seoskih područja u testu "flamingo" stajanje na jednoj nozi (*RAVN*) gde imamo ekstreman rezultat od 107,20%.

Tabela 2. Rezultati deskriptivne statistike motoričkih sposobnosti učenika gradskih i učenika seoskih područja

VARIJABLA		Mean	SD	Min.	Max.	CV %
RAVN (s)	**URB.**	5,37	3,67	1,96	24,30	68,34
	RUR.	5,83	6,25	2,00	30,75	107,20
TAPR (s)	**URB.**	11,22	1,36	14,47	8,78	12,12
	RUR.	11,32	1,33	15,00	9,16	11,75
PRET (cm)	**URB.**	32,66	8,06	9	44	24,68
	RUR.	36,50	5,34	21	46	14,63
DALJ (cm)	**URB.**	201,33	25,08	155	260	12,46
	RUR.	200,95	19,59	160	230	9,75
LS30 (pon)	**URB.**	25,78	5,41	16	39	20,98
	RUR.	24,70	4,40	18	32	17,81
ZGIB (s)	**URB.**	41,69	26,06	7,13	110,00	62,51
	RUR.	50,12	23,49	18,20	120,00	46,87
10x5m (s)	**URB.**	19,71	1,32	22,20	17,08	6,70
	RUR.	19,94	1,60	23,64	18,01	8,02

Legenda: *Mean* - aritmetička sredina; *Min.* - minimalna vrednost; *Max.* - maksimalna vrednost; *SD* - standardna devijacija; *CV %* - koeficijent varijacije;
URB. - učenici gradskih područja; *RUR.* - učenici seoskih područja.

Tabela 3. Značajnost izolovane diskriminativne funkcije motoričkih sposobnosti učenika iz gradskih i seoskih područja

Eigen-value	CR	Wilks' Lambda	Chi-Sqr.	df	p-level
0,176	0,387	0,850	9,658	7	0,209

Legenda: *Eigen- value* - kvadrat koeficijenta diskriminacije; *CR* - koeficijent kanoničke korelacije; *Wilks'Lambda* - diskriminativna jačina sistema varijabli;
Chi-Sqr.- hi-kvadrat test; *df* - broj stepeni slobode; *p-level* - nivo značajnosti.

Na osnovu vrednosti koeficijenta kanoničke korelacije (CR=38,70%) u Tabeli 3. može se konstatovati da je diskriminativna funkcija motoričkih sposobnosti, učenika iz gradskih i seoskih područja, približno srednjeg intenziteta. Rezultati ukazuju da je diskriminativna jačina varijabli motoričkih sposobnosti, prikazana testom *Wilks'-Lambda*, izrazito visoka (0,850), dok objašnjeni koeficijent korelacije na sve varijable ima nisku vrednost (*Chi-sqr*=9,658). Dobijeni rezultati govore u prilog činjenici da motoričke sposobnosti učenika iz gradskih i seoskih područja ne doprinose statistički značajno diskriminaciji između učenika gradskih i seoskih područja (*r-level*=0,209).

Tabela 4. Analiza diskriminativne funkcije motoričkih sposobnosti učenika iz gradskih i seoskih područja - pregled

Varijable	*Wilks'Lambda*	*F-remove (1,57)*	*p-level*
RAVN	0,853	0,504	0,480
TAPR	0,846	0,011	0,918
PRET	0,935	6,016	0,017*
DALJ	0,846	0,003	0,954
LS30	0,869	1,577	0,214
ZGIB	0,883	2,539	0,117
10x5m	0,867	1,464	0,231

Analizom diskriminativne funkcije motoričkih sposobnosti učenika iz gradskih i seoskih područja (Tabela 4), pojedinačno po varijablama, jedino kod testa pretklon u sedu je ustanovljeno da postoji statistički značajna diskriminacija u korist učenika seoskih sredina (*Wilks'-Lambda*=0.935; *r-level*=0.017).

Tabela 5. Faktorska struktura izolovane diskriminativne funkcije motoričkih sposobnosti učenika iz gradskih i seoskih područja

Varijable	Root 1
RAVN	0,285
TAPR	-0,081
PRET	-0,584
DALJ	0,018
LS30	0,235
ZGIB	-0,372
10x5m	-0,186

U Tabeli 5. data je struktura diskriminativne funkcije učešća varijabli motoričkih sposobnosti učenika iz gradskih i seoskih područja u formiranju značajnih diskriminativnih funkcija. Najveći doprinos diskriminativnoj funkciji daju varijable pretklon u sedu (*PRET* = -0,584) i izdržaj u zgibu (*ZGIB* = -0,372), nešto manje varijable „flamingo", stajanje na jednoj nozi (*RAVN* = 0,285), podizanje trupa za 30 sekundi (*LS30* = 0,235), povratno trčanje - 10h5m (*10x5m* = -0,186) i taping rukom (*TAPR* = -0,081) a najmanji doprinos diskriminativnoj funkciji daje varijabla skok u dalj iz mesta (*DALJ* = 0,018).

Tabela 6. Učenici iz gradskih i seoskih područja - centroidi grupa

Grupe	Root 1
G_1:1	0,275
G_2:2	-0,620

Iz Tabele 6. mogu se uočiti centroidi grupa, koji za učenike iz gradskih područja (*G_1:1*) imaju pozitivni predznak i iznose 0,275 dok za učenike iz seoskih područja (*G_2:2*) imaju negativni predznak i iznose -0,620. Položaji centroida ukazuju nam na to da učenici iz gradskih područja (pozitivni predznak) imaju bolje rezultate u motoričkim sposobnostima od učenika iz seoskih područja (negativni predznak). Udaljenost dva subuzorka učenika na diskriminativnoj dimenziji od sredine nije jednaka, i dijametralno je različita s obzirom na predznak, što znači da se rezultati nalaze u različitim diskriminativnim prostorima.

Tabela 7. Učenici iz gradskih i seoskih područja - klasifikaciona matrica

Grupe	*Percent*	*G_1:1 (69,23%)*	*G_2:2 (30,77%)*
G_1:1	95,56	43	2
G_2:2	40,00	12	8
Total	78,46	55	10

Klasifikaciona matrica iz Tabele 7. daje nam informaciju koliko u svakom od subuzoraka ima diskriminišućih rezultata u odnosu na rezultate svog subuzorka. Kod učenika iz gradskih sredina rezultati 2 učenika su diskriminišući, dok rezultati 43 učenika imaju karakteristike svoje grupe. Kod učenika iz seoskih područja rezultati 12 učenika su diskriminišući a rezultati 8 učenika imaju karakteristike svoje grupe. Homogenost rezultata učenika iz gradske sredine je izrazito visoka i iznosi 95,56%, dok je kod učenika iz seoske sredine srednje vrednosti i iznosi 40,00%.

DISKUSIJA

Iako su imali neznatno bolje rezultate kod testova za procenu motoričkih sposobnosti, kanoničkom diskriminacionom analizom nije utvrđeno da su motoričke sposobnosti dale statistički značajan doprinos razlici između učenika gradske sredine u odnosu na učenike seoskih sredina. Učenici gradske sredine postigli su bolje rezultate kod četiri varijable za procenu motoričkih sposobnosti (taping rukom, skok u dalj iz mesta, podizanje trupa za 30 sekundi, povratno trčanje - 10h5m), a učenici seoske sredine kod tri varijable („Flamingo“ - stajanje na jednoj nozi, pretklon u sedu i izdržaj u zgibu).

Male razlike koje se javljaju u korist učenika gradskih sredina, pretpostavka je prvenstveno su posledica faktora okoline (okruženja), kao obilja sadržaja i mogućnost urbane zajednice da obezbedi stimulativno okruženje za motorički razvoj učenika, na šta ukazuju druga istraživanja (Tadić, Bilak, & Dobraš, 2013). Mogući razlozi zbog čega su motoričke sposobnosti učenika koji žive u gradskom području na nešto višem nivou nego kod učenika koji žive u ruralnom području, mogu biti sledeći: češće svoje slobodno vreme provode baveći se sportom, nekim drugim oblicima vannastavnih aktivnosti ili igrom, uslovljenost i ograničenost bavljenja sportskim aktivnostima cenom koštanja tih aktivnosti, niska platežna moć građana seoskih i manjih gradskih sredina, gledanje televizije i provođenje dosta vremena uz kompjuter, što je u skladu sa istraživanjima nekih autora (Mehlbye & Jensen, 2003; Te Velde et al., 2007; Badrić, Prskalo i Šilić, 2011). Međutim, i pored takve navike, učenici gradskih sredina imali su bolje rezultate motoričkog sposobnosti, jer je, verovatno u seoskim sredinama jedan od najvećih problema nepostojanje uslova za bavljenje fizičkim aktivnostima, materijalni uslovi, odnosno rekviziti. Moguće je da su kod učenika seoske sredine postojali negativni stavovi prema fizičkom vežbanju u okviru nastave fizičkog vaspitanja, a koji su se možda odrazili nižim nivoom bavljenja vannastavnim sportskim aktivnostima, na šta ukazuju druga istraživanja (Fox, 1988; Trew et al., 1999).

Uloga fizičkog vaspitanja između ostalog bila je da omogući učenicima da steknu značajan deo preporučene dnevne doze fizičke aktivnosti, ali i saznanja o važnosti iste za ceo život (Scruggs et al., 2003). Ključni faktor motivacije učenika i promocije fizičkog vežbanja i zdravijeg načina života je profesor fizičkog vaspitanja, pa se može konstatovati da su učenici koji su zadovoljniji na časovima fizičkog vaspitanja mnogo više uključeni u vannastavne sportske aktivnosti odnosno fizičko vežbanje u slobodno vreme (Vilhjamsson & Thorlindsson, 1998). Prema istraživanju Kermeci i Mitić (2012) učenici koji žive u seoskim sredinama Vojvodine i imaju viši nivo motoričkih sposobnosti više koriste otvorene terene i prirodu za bavljenje vannastavnim sportskim aktivnostima. Ali su zato u zimskim mesecima bili hendikepiraniji nepostojanjem uslova za bavljenje vannastavnim aktivnostima u odnosu na učenike gradske sredine. Sve to utiče na podizanje nivoa motoričkih sposobnosti jer prema nekim autorima (Rowland, 1990; Beedie, Terry, & Lane, 2000) ne postoji ni jedna antropološka funkcija na koju kretanje i neki oblik fizičke aktivnosti ne ostvaruje značajan pozitivan uticaj. Razlozi postojanja razlika u nivou motoričkih sposobnosti mogu biti povezani sa različitim socio-ekonomskim uslovima, ali i treba uzeti u obzir da do tih razlika može doći zbog razlika u ponudi, odnosno izboru ponuđenih aktivnosti (Pfister & Reeg, 2006).

ZAKLJUČAK

Fizičko vaspitanje u školama neadekvatno je zastupljeno brojem časova u nastavnom planu, što predstavlja veliki problem u realizaciji programskih sadržaja. Pored toga, učenici su nedovoljno fizički aktivni u slobodno vreme i sve je manje mogućnosti za njihovo svakodnevno fizičko vežbanje u školama (Hardman, 2003). Može se zaključiti da su utvrđene razlike verovatno posledica različitih nivoa vežbanja tokom nastave fizičkog vaspitanja u prethodnom periodu (Mišigoj-Duraković, 2008).

Na osnovu rezultata istraživanja može se zaključiti da generalno ne postoje statistički značajne razlike između dva tretirana subuzorka, koji su činili učenici srednjih škola iz gradskih i seoskih sredina opštine Lebane.

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DIFFERENCES IN MOTOR SKILLS OF THE HIGH SCHOOL STUDENTS FROM URBAN AND RURAL AREAS OF THE COMMUNITY OF LEBANE

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INTRODUCTION

Modern civilization and urbanization trends, through daylong obligations, imposed the domination of a very passive form of activities such as: sitting in schools, sitting in the car, sitting at work, sitting at home in front of the television or computer, continuous use of means of transportation such as cars, buses, elevators ... (Dopsaj et al., 2010). Researches of many authors (Currie et al., 2004; Brettschneider & Naul, 2007; Smith & Biddle, 2008) have shown the presence of trend increase in the number of young people, especially among the high school students and university students, who have adopted certain lifestyle habits that can be characterized as unhealthy. According to these studies, the habits of young people which may be considered as a risk to human health in particular are: improper and irregular nutrition, deficiency of physical activity, sedentary lifestyle with lots of time spent using the computer, mobile phone and television, smoking, alcohol consumption, use of narcotics, etc. Continuous decline in physical activity and exercise in the family and wider community, as well as reduced possibilities for daily physical exercise of the children in schools are cited as some of the biggest reasons for large number of young people not being sufficiently physically active nowadays (Hardman, 2003).

The level of motor skills of a high school students, is directly related to the effects of their physical activities. Insight into the level of motor skills of pupils facilitates the planning of physical education classes to a teacher, the selection of appropriate methods and organizational forms of work and most importantly, the selection of adequate physical exercises on the basis of which the objectives are determined and the tasks of physical education are executed (Mitrovic & Djuraskovic, 2013). The level of physical activity begins to decline during adolescence period (Koppes, Twisk, & Kemper, 2004) and therefore this period is very important for exploring the motor skills. One of the important factors that can have a powerful impact in addressing the problem of reduced physical activity is physical education. For some students, the physical education with two hours per week in high school is the only active time. All EU Member States recognize the importance of physical education in school, and also emphasize the importance of physical activity and sport as a useful way of using free time (European Commission /EACEA/Eurydice, 2013). However, physical education often does not provide students the experiences that might personally be important to them and being socially relevant. For this reason, this research is an attempt to gain an insight into the level of motor skills of high school students age in terms of urban-rural relations. The topic of this research is motor skills of high school students of urban and rural areas of the community of Lebane.

The aim of this study was to identify the differences in motor skills of high school students from urban and rural areas.

Based on the defined problems as well as the defined goal of the research, the following hypotheses have been set:

H_1 - There are statistically significant differences in motor skills between students from urban and rural areas,

H_2 - Students from rural areas have significantly better results of all the tests for assessing the motor skills then the students of urban areas.

METHOD

The survey was conducted during the winter on a sample of 65 students of 1st and 2nd grade high school from the area of the Municipality of Lebane, average age 15.54 ± 0.56 years, divided into two subsamples - students from urban areas (N=45) and students from rural areas (N=20). Students were with average height of 178.03 ± 6.84 cm and the average weight 67.84 ± 11.76 kg. For a better insight into the characteristics of subsamples, in addition to age in Table 1 the anthropometric parameters were determined: Body Mass (BM) and Body Height (BH), and on the basis of their values, the parameter for assessing nutritional status was calculated - Body Mass Index (BMI). The value of Body Mass Index (BMI), was calculated by the formula (Heyward & Stolarczyk, 1996, American College of Sports Medicine, 2006):

$$BMI\ (kg \cdot m^{-2}) = BM\ (kg) / BH^2\ (m^2).$$

Table 1. Characteristics of subsamples, students from urban and rural areas
N=65; N-URB.=45 (69,23%); N-RUR.=20 (30,77%)

Characteristics of subsamples	Mean		SD		Min.		Max.	
	URB.	RUR.	URB.	RUR.	URB.	RUR.	URB.	RUR.
age	15,65	15,30	0,49	0,62	15,01	14,10	16,10	16,09
BM (kg)	67,94	67,61	12,65	9,74	41,00	53,60	97,00	92,60
BH (cm)	178,56	176,85	7,42	5,30	158,20	168,70	192,00	186,50
BMI ($kg \cdot m^{-2}$)	21,19	21,64	3,08	3,16	16,10	18,09	28,98	29,480

Legend: *N* - number; *BM* - body mass; *BH* - body height; *BMI* - body mass index; *Mean* - arithmetic mean; *Min.* - minimum value; *Max.* - maximum value; *SD* - standard deviation; *URB.* - students from urban areas;
RUR. - students from rural areas.

In order to determine the differences between the subsamples, the results of EUROFIT testing battery for evaluation of motor skills (Council of Europe, Committee for the Development of Sport, 1988) were observed. This testing battery is applied since 1993. in teaching the physical education in the Republic of Serbia, in the process of evaluation of the school population, and by Visnjic, Jovanovic & Miletic (2004) it takes into consideration the following tests:

1. „Flamingo" - balance test (the ability to keep the balance is measured) - BAL,

2. Plate tapping (segmentary speed and coordination of hands is measured) - TAP,

3. Sit and reach (the mobility of the spine and the hip joints is measured) - SITR,

4. Standing broad jump (the explosive power of the legs is measured) - JUMP,

5. Sit-ups in 30 sec. (the repetitive and explosive strength of the abdominal muscles is measured) - SU30,

6. Bent arm hang (the static strength of the arms and shoulders is measured) - BAM,

7. 10x5 meters shuttle run (running speed - agility is measured) - 10x5m,

Obtained data were processed using the statistical program SPSS Statistics for Windows, Version 20.0 (IBM Corp. Released, 2011), and the procedures included descriptive statistical parameters, while the Canonical discriminant analysis (Petkovic, 2000) was used for the identification of significant and quantitative differences and hierarchy of motor skills variables that contribute to distinction (discrimination) between the subsamples.

RESULTS

Table 2. shows the comparative results of basic statistical parameters of motor skills of students from urban and rural areas.

Based on the results shown regarding basic statistical parameters of motor skills of students (Table 2.) it can be concluded that students from urban areas have better average results (*Mean*) in four (TAP, JUMP, SU30, 10x5m) out of seven tested variables of motor space in comparison to the students from rural areas (BAL, SITR, BAH). Both subsamples of students are pretty much homogeneous (CV% values), except for the variables BAL (URB. 68.34 *vs.* RUR. 107,20) and BAH (URB. 62.51. *vs.* RUR. 46.87) where we have great heterogeneity of results. This heterogeneity of results is particularly evident among students from rural areas in the test „flamingo" balance test (BAL) where we have extreme score of 107.20%.

On the basis of values of canonical correlation coefficient (CR=38.70%) in Table 3. it can be concluded that the discriminant function of motor skills of students from urban and rural areas, is approximately of a medium intensity. The results indicate that the discriminative power of motor skills variables of, shown in the test *Wilks'-Lambda*, is extremely high (0.850), while the explained correlation coefficient to all the variables has a low value (*Chi-sqr*=9.658). The obtained results indicate the fact that the motor skills of students from urban and rural areas do not statistically contribute significantly to discrimination between students of urban and rural areas (*p-level*=0.209).

Table 2. Results of basic statistical parameters of of motor skills of students from urban and rural areas

VARIABLES		Mean	SD	Min.	Max.	CV %
BAL (s)	**URB.**	5,37	3,67	1,96	24,30	68,34
	RUR.	5,83	6,25	2,00	30,75	107,20
TAP (s)	**URB.**	11,22	1,36	14,47	8,78	12,12
	RUR.	11,32	1,33	15,00	9,16	11,75
SITR (cm)	**URB.**	32,66	8,06	9	44	24,68
	RUR.	36,50	5,34	21	46	14,63
JUMP (cm)	**URB.**	201,33	25,08	155	260	12,46
	RUR.	200,95	19,59	160	230	9,75
SU30 (pon)	**URB.**	25,78	5,41	16	39	20,98
	RUR.	24,70	4,40	18	32	17,81
BAH (s)	**URB.**	41,69	26,06	7,13	110,00	62,51
	RUR.	50,12	23,49	18,20	120,00	46,87
10x5m (s)	**URB.**	19,71	1,32	22,20	17,08	6,70
	RUR.	19,94	1,60	23,64	18,01	8,02

Legend: *Mean* - arithmetic mean; *SD* - standard deviation; *Min.* - minimum value; *Max.* - maximum value; *CV %* - coefficient of variation; *URB.* - students from urban areas; *RUR.* - students from rural areas.

Table 3. Significant the discriminant function of motor skills of students from urban and rural areas

Eigen-value	CR	Wilks' Lambda	Chi-Sqr.	df	p-level
0,176	0,387	0,850	9,658	7	0,209

Legend: *Eigen- value* - coefficient of discrimination; *CR* - canonical correlation coefficient; *Wilks'Lambda* - the discriminative power of motor skills variables; *Chi-Sqr.*- the explained correlation coefficient; *df* - degree of freedom; *p-level* – level of significance.

With the discriminant function analysis of motor skills of students from urban and rural areas (Table 4.), individually by variables, it was only established with the sit and reach test (SITR) that there is a statistically significant discrimination existing in favor of students from rural areas (*Wilks'-Lambda*=0.935; *p-level*=0.017).

Table 4. The discriminant function analysis of motor skills of students from urban and rural areas - overview

Variables	*Wilks'Lambda*	*F-remove (1,57)*	*p-level*
BAL	0,853	0,504	0,480
TAP	0,846	0,011	0,918
SITR	**0,935**	**6,016**	**0,017***
JUMP	0,846	0,003	0,954
SU30	0,869	1,577	0,214
BAH	0,883	2,539	0,117
10x5m	0,867	1,464	0,231

Table 5. presents the structure of discriminative function of motor skills variables participation of students from urban and rural areas in forming the significant discriminant functions. The largest contribution to the discriminant function is given by variable sit and reach test (SITR=-0,584) and bent arm hang (BAH=-0.372), a bit less the variables of „flamingo" balance test (BAL=0.285), sit-ups in 30 seconds (SU30=0.235), 10x5 meters shuttle run (10x5m=-0.186) and plate tapping (TAP=-0.081) and the lowest contribution to the discriminant function is given through the variable standing broad jump (JUMP=0.018).

Table 5. The structure of discriminative function of motor skills of students from urban and rural areas

Variables	**Root 1**
BAL	0,285
TAP	-0,081
SITR	-0,584
JUMP	0,018
SU30	0,235
BAH	-0,372
10x5m	-0,186

In Table 6. the group centroids could be noticed, having a positive sign for students from urban areas (G_*1: 1*) amounting to 0,275 while for students from rural areas (G_2 :2) they have a negative sign and amount to -0.620. Centroid positions indicate to us that students from urban areas (positive sign) have better results in motor skills than the students from rural areas (negative sign). The distance of two subsamples of students on discriminative dimension from the area is not the same, and is diametrically different having in mind the sign, which means that the results are in various discriminative areas.

Table 6. The group centroids

Groups	**Root 1**
G_1:1	0,275
G_2:2	-0,620

Classification matrix in Table 7. gives us the information on how many discriminatory results there are in each of the subsamples compared to the results of their subsamples. With the students from urban areas, the results of 2 students are discriminatory, while the results of 43 students have the characteristics of their group. With the students from rural areas, the results of 12 students are discriminatory, while the results of 8 students have the characteristics of their group. The homogeneity of the results of students from urban areas is extremely high and amounts to 95.56%, while with students from rural areas is of average value and amounts to 40.00%.

Table 7. Classification matrix

Groups	*Percent*	*G_1:1 (69,23%)*	*G_2:2 (30,77%)*
G_1:1	95,56	43	2
G_2:2	40,00	12	8
Total	78,46	55	10

DISCUSSION

Although they had slightly better results in tests for assessment of motor skills, the canonical discriminant analysis did not found that motor skills gave a statistically significant contribution to the difference between students in urban areas compared to students in rural areas. Students in urban areas have achieved better results in four variables for assessment of skills (plate tapping, standing broad jump, sit-ups in 30 seconds, 10x5 meters shuttle run), and students in rural areas in three variables („Flamingo" balance test, sit and reach, bent arm hang).

The assumption for slight differences that occur in favor of students from urban areas, is primarily a consequence of environmental factors (environment), as well as the abundance of contents and urban community possibility to provide a stimulating environment for motor development of students, as indicated by other researches (Tadic, Bilak, & Dobras, 2013). Possible reasons why the motor skills of students living in urban areas are at somewhat higher level than of the students who live in rural areas, could be the following: more often they spend their free time playing sports, other forms of extra-curricular activities or play, conditionality and limitations of sports activities by costing of these activities, low purchasing power of citizens in rural and smaller urban areas, watching television and spending a lot of time with the computer, which is in line with researches of some of the authors (Mehlbye & Jensen, 2003; Te Velde et al., 2007; Badric, Prskalo and Silic, 2011). However, despite these habits, students from urban areas had better results of motor skills, because most probably the one of the biggest problems in rural areas is the deficiency of conditions for practicing the physical activities, material conditions and props. It is possible that with students in rural areas there were negative attitudes towards physical exercise as part of physical education classes, which may have been reflected in lower level of practicing extra-curricular sports activities, as indicated by other researches (Fox, 1988; Trew et al., 1999) .

The role of physical education among other things was to enable students to acquire a significant portion of the recommended daily dose of physical activities, but also the knowledge about its importance for the entire life (Scruggs et al., 2003). A key factor in motivation of students and promotion of the physical exercises and a healthier lifestyle is a professor of physical education, so we can conclude that the students who are satisfied in physical education classes are much more involved in extra-curricular sports activities and physical exercise in their free time (Vilhjamsson & Thorlindsson, 1998). According to a survey Kermeci and Mitic (2012) students who live in rural areas of Vojvodina and have a higher level of motor skills more frequently use the open grounds and nature to deal with extra-curricular sports activities. But, during the winter months they were more handicapped with the absence of conditions for engaging in extra-curricular activities compared with the students from urban areas. All this affects the raising of the level of motor skills because, according to some authors (Rowland, 1990; Beedie, Terry, & Lane, 2000) there is no anthropological function to which the movement and some form of physical activity does not exercise the significant influence. The reasons for the existence of differences on the level of motor skills may be associated with different socio-economic conditions, but it should also be considered that such differences may occur due to differences in the offer, or the choice of the activities offered (Pfister & Reeg, 2006).

CONCLUSION

Physical education in schools is inadequately represented by the number of classes in the curriculum, which is a major problem in the implementation of program contents. In addition, students are not sufficiently physically active in their free time, and there are fewer opportunities for their daily physical exercise in schools (Hardman, 2003). Estimated differences in favor of students from urban areas are possibly a consequence of a different level of exercise during physical education training in the previous period (Misigoj-Durakovic, 2008).

Considering a results of the research, it can be concluded that, in general, there are no statistically significant differences between two treated subsamples consisted of high school students from urban and rural areas of the Municipality of Lebane.

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PSIHOLOŠKI KORELATI UKLJUČENOSTI STUDENTKINJA U SPORT I VEŽBANJE

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UVOD

Savremena istraživanja o važnosti bavljenja sportom i vežbanjem za opštu dobrobit ljudi skrenula su pažnju na polnu neujednačenost u pogledu uključenosti u sport i vežbanje. Evidentna je manja uključenost pripadnica ženskog pola u različite oblike fizičke aktivnosti (Gomes, Gonçalves, & Costa, 2015; Radisavljević Janić, Milanović, & Lazarević, 2012; Trost, Pate, Sallis, Freedson, Taylor, Dowda, et al., 2002). Rezultati istraživanja u oblasti psihologije sporta i vežbanja ukazuju na povezanost pojedinih psiholoških karakteristika i uključenosti u sport i vežbanje i njihov značaj za učestalost i kvalitet te uključenosti. Takođe, ukazuje se i na potrebu daljih istraživanja prirode i uslova ove povezanosti, kako u opštoj populaciji, tako i s obzirom na polnu pripadnost (Cox, 2005; Fox, 2002; Lindwall & Lindgren, 2005; McAuley & Blissmer, 2000; Weinberg & Gold, 2007).

Među psihološkim karakteristikama koje se smatraju značajnim za kvalitet i učestalost uključivanja u sport i vežbanje značajno mesto zauzima self-koncept sa svojim dimenzijama, od onih koje su specifičnije vezane za doživljaj sopstvene fizičke aktivnosti, kao što je fizička samoefikasnost, do opštijih, kao što je samopoštovanje (Bandura, 1997; McAuley & Gill, 1983; Sonstroem & Morgan,1989; Weinberg & Gold, 2007). Istraživanja, takođe, ukazuju i na povezanost učestovanja u vežbanju i sportu i emocija vezanih za doživljaj sopstvenog tela. Najveći broj istraživanja u ovoj oblasti odnosi se na socijalnu anksioznost zbog izgleda (Cox, 2005; Eklund & Crawford, 1994; Gomes, et al., 2015; Leary, 1992; Mülazimoğlu-Balli, Koca & Aşçi, 2010).

Samopoštovanje, fizička samoefikasnost i socijalna anksioznost zbog izgleda u sportu i vežbanju

Samopoštovanje, kao dimenzija self-koncepta koja se odnosi na opštu procenu sopstvene vrednosti osobe (Rosenberg, 1965), pozitivno je povezano sa uspehom u različitim aktivnostima. Rezultati istraživanja upućuju na veliki značaj samopoštovanja za sportsko postignuće, ali i na povratno delovanje uspeha u sportu na razvoj ove psihološke karakteristike (Fox, 2002; Marsh, 1997; Mikhnov, 2015; Weinberg & Gold, 2007). Takođe, utvrđeni su i efekti uključenosti mladih u različite programe vežbanja na razvoj njihovog samopoštovanja (Gomes et al., 2015).

Dimenzija self-koncepta, direktnije povezana sa kvalitetnim uključivanjem u sport i vežbanje je fizička samoefikasnost, koja je je izvedena iz šire teorije samoefikasnosti Alberta Bandure (Bandura, 1997), a odnosi se na uverenje osobe u svoje sposobnosti da uspe u nekoj fizičkoj aktivnosti (Ryckman, Robbins, Thornton, & Centrell, 1982). U većem broju istraživanja potvrđena je povezanost fizičke samoefikasnosti sa postignućem u sportu, kao i sa uključenošću u vežbanje (Cox, 2005; Ryckman et al., 1982; Vipene & Jona, 2012). Posebno su značajni rezultati onih istraživanja koji ukazuju na mogućnost da se uključivanjem mladih u redovno vežbanje i bavljenje sportom može delovati na povećane njihove fizičke samoefikasnosti (Martin, 2006; McAuley & Blissmer, 2000; Weinberg & Gold, 2007). Istraživanja takođe ukazuju da su u psihološkom profilu mladih koji se bave sportom i vežbanjem pozitivno povezani samopoštovanje i fizička samoefikasnost, a da su ove dve krakteristike negativno povezane sa socijalnom anksioznošću zbog izgleda (Lazarević, Orlić, & Lazarević, 2014; Martin, 2006; Vipene & Jona, 2012).

Socijalna anksioznost zbog izgleda se javlja u situacijama kada je osoba izložena posmatranju od strane drugih osoba. To je karakteristično i za situacije vezane za bavljenje sportom i vežbanjem. Rezultati pojedinih istraživanja pokazuju da redovno vežbanje i bavljenje sportom ima pozitivan uticaj na smanjenje socijalne anksioznosti zbog izgleda, ali i da smanjenje socijalne anksioznosti zbog izgleda pozitivno utiče na uključivanje u fizičko vežbanje (Craford & Eklund, 1994; Focht & Hausenblas, 2006 ; Fox, 2002; Leary, 1992; Gomes et al, 2015; Lindwall & Lindgren, 2005, Martin, 2006; Mülazimoğlu-Balli et al., 2010). Socijalna anksioznost zbog izgleda, izraženija je u ženskoj populaciji (Motl & Conroy, 200; Mülazimoğlu-Balli et al., 2010), što ukazuje na potrebu daljih istraživanja mogućih efekata ove karakteristike na manje angažovanje žena u fizičkom vežbanju i sportu.

Cilj istraživanja

Polazeći od značaja fizičkog vežbanja i bavljenja sportom za opštu dobrobit pojedinca, kao i od činjenice da su pripadnice ženskog pola manje uključene u fizičku aktivnost, cilj ovog istraživanja bio je da se ispita povezanost samopoštovanja, fizičke samoefikasnosti i socijalne anksioznosti zbog izgleda, kao psiholoških karakteristiaka, sa uključenošću studentkinja u sport i vežbanje.

METOD

Uzorak

U istraživanju je učestvovalo 155 studentkinja četiri fakulteta Univerziteta u Beogradu, prosečnog uzrasta 21 godina, *SD* = 1.8. Posmatrano prema uključenosti u sport, 13.5% studentkinja takmičarski se bavi sportom, 50.3% rekreativno, a 36.1% studentkinja ne bave se sportom. Posmatrano prema učestalosti vežbanja, 29.7% studentkinja ne bavi se vežbanjem, 38.1% vežba 1 do 2 puta nedeljno, 16.8% vežba 3 do 4 puta nedeljno, a 15.5% studentkinja vežba više od 4 puta nedeljno.

Varijable i instrumenti

1. Psihološke karakteristike:

- *Samopoštovanje*, za čije merenje je upotrebljena Rozenbergova skala samopoštovanja (Rosenberg's Self-Esteem scale – SES, Rosenberg, 1965). Skala se sastoji od 10 tvrdnji praćenih 4-stepenom skalom Likertovog tipa. Kao primer tvrdnji može se navesti: "Gledano u celini, ja sam zadovoljan/na sobom"; "Voleo/la bih da imam više samopoštovanja". Viši skor ukazuje na veće samopoštovanje. Pouzdanost skale proveravana je Kronbah alfa koeficijentom, čija vrednost .87 ukazuje na zadovoljavajuću unutrašnju konzistetnost skale.

- *Fizička samoefikasnost***,** koja je merena Skalom fizičke samoefikasnosti (Physical Self-Efficacy Scale – PSES, Ryckman, et al., 1982). Skala se sastoji od 22 tvrdnje praćene 6-stepenom skalom Likertovog tipa. Kao primer tvrdnji mogu se navesti "Imam odlične reflekse", "Nisam spretan/na i skladan/na". Viši skor ukazuje na veću fizičku samoefikasnost. Dobijena vrednost Kronbah alfa koeficijenta iznosila je .79 i ukazuje na zadovoljavajuću unutrašnju konzistentnost skale.

- *Socijalna anksioznost zbog igleda*, za čije merenje je upotrebljena Skala socijalne anksioznosti zbog izgleda (Social Physique Anxiety Scale – SPAS, Hart, Leary, & Rejeski, 1989). Primenjena je revidirana forma ove skale (Motl & Conroy, 2001), koja se sastoji od 7 tvrdnji praćenih 5-stepenom skalom Likertovog tipa 7. Kao primeri tvrdnji mogu se navesti: "Prija mi kako moje telo izgleda drugima"; „U prisustvu drugih, zabrinut/ta sam zbog građe svog tela". Viši skor ukazuje na više izraženu socijalnu anksioznost zbog izgleda. Kronbah alfa koeficijent od .83 ukazuje na zadovoljavajuću unutrašnju konzistentnost skale.

2. Varijable koje se odnose na uključenost u sport i vežbanje:

- *Bavljenje sportom* određeno na tri nivoa: 1. Takmičarski 2. Rekreativno 3. Ne bavi se sportom.

- *Uključenost u vežbanje* određeno na 4 nivoa učestalosti vežbanja: 1. Ne bavi se vežbanjem 2. Vežba 1-2 puta nedeljno 3. Vežba 3-4 puta nedeljno 4. Vežba više od 4 puta nedeljno.

Podaci o uključenosti u sport i vežbanje, kao i podaci o uzrastu i fakultetu na kome studiraju prikupljeni su posebnim upitnikom.

Postupak i analiza podataka

Istraživanje je realizovano dobrovoljnim učešćem studentkinja koje su anonimno popunjavale primenjene instrumente. Za analizu podataka primenjena je korelaciona, klaster i diskriminativna analiza i MANOVA.

REZULTATI

Rezultati deskriptivne analize su pokazali (Tabela 1) da su dobijeni prosečni skorovi na instrumentima SES i PSES iznad pretpostavljenih prosečnih vrednosti na ovim skalama, dok je na instrumentu SPA prosečni skor ispod pretpostavljene prosečne vrednosti skale. Između dve dimenzije self-koncepta, odnosno, samopoštovanja i fizičke samoefikasnosti, dobijene su pozitivne i statistički značajne korelacije, dok su korelacije između socijalne anksioznosti zbog izgleda i dimenzija self-koncepta takođe značajane, ali negative (Tabela 2).

Tabela 1

Deskriptivna statistika za instrumente za merenje psiholoških karakteristika

Instrumenti	*Min*	*Max*	*M*	*SD*
SES-Rozenbergova Skala samopoštovanja	1.00	4.00	3.14	0.48
PSES-Skala fizičke samoefikasnosti	2.45	5.64	4.22	0.61
SPA-Skala socijalne anksioznosti zbog izgleda	1.00	5.00	2.07	0.76

Tabela 2

Interkorelacije između Samopoštovanja, Fizičke samoefikasnosti i Socijalne anksioznosti zbog izgleda

Pirsonov koeficijent korelacije	**SES**	**PSES**	**SPA**
SES-Rozenbergova Skala samopoštovanja	1	.63**	-.55**
PSES-Skala fizičke samoefikasnosti	.63**	1	-.63**
SPA-Skala socijalne anksioznosti zbog izgleda	-.53**	-.63**	1

Klaster i diskriminativna analiza su pokazale da su se izdvojila tri procentualno ujednačena klastera u koje su se grupisale ispitanice. Najveća važnost u definisanju izdvojenih klastera pripada varijabli *učestalost vežbanja*, a zatim slede *uključenost u sport*, *fizička samoefikasnost*, *opšte samopoštovanje* i sa najmanjom prediktivnom vrednošću, *socijalna anksioznost zbog izgleda.*

Prvi klaster čine studentkinje koje se bave sportom takmičarski i rekreativno, vežbaju 3-4 puta nedeljno, uz najpovoljniji psihološki profil (najviši skorovi na PSES i SES, a niži skorovi na SPA). Drugi klaster čine studentkinje koje se rekreativno bave sportom, vežbaju 1-2 puta nedeljno, i koje odlikuje nešto povoljniji psihološki profil (viši skorovi na PSES i SES, a niži na SPA) i treći klaster, koji čine studentkinje koje se ne bave sportom i nisu uključene u vežbanje, koje odlikuje najnepovoljniji profil psiholoških varijabli (niži skorovi na PSES i SES, i nešto viši skorovi na SPA).

MANOVA, u kojoj je nezavisna varijabla *nivo uključenosti u sport* (bavi se sportom takmičarski, rekreativno, ne bavi se sportom), a zavisne varijable skorovi sa instrumenata SES, PSES i SPA, je pokazala da se studentkinje razlikuju u fizičkoj samoefikasnosti, $F(2, 151) = 20.81$, $p < .01$, i samopoštovanju, $F(2,151) = 4.62$, $p < .05$. Post-hoc (Bonferoni) testovi su pokazali da se studentkinje koje se na bave sportom razlikuju od ostalih grupa ispitanica u pogledu fizičke samoefikasnosti i samopoštovanja. Nisu se ispoljile statistički značajne razlike u pogledu socijalne anksioznosti zbog izgleda. S obzirom na *učestalost bavljenja fizičkim vežbanjem* ispoljile su se razlike u fizičkoj

samoefikasnosti, $F(3, 150) = 19.62$, $p < .01$, i samopoštovanju, $F(3, 150) = 6.10$, $p < .01$. Post-hoc analize pokazuju da kada je reč i o fizičkoj samoefikasnosti i o samopoštovanju najveće razlike postoje između studentkinja koje se ne bave vežbanjem i ostalih grupa ispitanica. Takođe, rezultati post-hoc analize pokazuju da se gubi značajnost razlika u pogledu posmatranih dimenzija self-koncepta posle učestalosti vežbanja veće od 1-2 puta nedeljno, što ukazuje na to da uticaj porasta učestalosti fizičkog vežbanja na percepciju samoefikasnosti i samopoštovanja dostiže plato. Nisu se ispoljile značajne razlike u pogledu socijalne anksioznosti zbog izgleda između studentkinja koje su sa različitom učestalošću angažovane u vežbanju.

DISKUSIJA

U ovom istraživanju pažnja je bila usmerena na samopoštovanje i fizičku samoefikasnost, kao dimenzije self-koncepta i na socijalnu anksioznost zbog izgleda, kao emociju vezanu za procenu sopstvenih fizičkih karakteristika u socijalnoj situaciji. Rezultati su potvrdili da između samopoštovanja i fizičke samoefikasnosti postoji pozitivna povezanost, dok je njihova povezanost sa socijalnom anksioznošću zbog izgleda negativna, što je u saglasnosti sa ranijim istraživanjima (Lazarević et al., 2014; Martin, 2006; McAuley & Blissmer, 2002; McAuley & Gill, 1983; Thornton et al., 1987; Rothberger, 2014).

Kada je u pitanju povezanost ispitivanih psiholoških karakteristika i uključenost studentkinja u sport i vežbanje rezultati pokazuju da se pozitivna povezanost ispoljila sa samopoštovanjem i fizičkom samoefikasnošću. Ovo je takođe u saglasnosti sa nalazima prethodnih istraživanja (Fox, 2002; McAuley & Blissmer, 2000; Weinberg & Gold, 2007). Dakle, pozitivan psihološki profil, određen izraženim samopoštovanjem i doživljavanjem sebe kao fizički efikasne osobe, može se očekivati kod studentkinja koje se bave sportom i koje redovno vežbaju. Socijalna anksioznost zbog izgleda, u uzorku studentkinja Beogradskog univerziteta, nije se pokazala kao psihološka karakteristika značajano povezana sa uključenošću u sport i učestalošću fizičkog vežbanja.

Rezultati ovog istraživanja takođe su pokazali, da je bavljenje sportom, bez obzira na to da li se radi o takmičarskom ili rekreativnom bavljenju, povezano sa identifikovanim poželjnim psihološkim profilom. Interesantan nalaz ovog istraživanja je da uticaj porasta učestalosti vežbanja na opažanje fizičke samoefikasnosti i samopoštovanja dostiže plato, tj. da se gubi značajnost razlika u pogledu posmatranih dimenzija self-koncepta kod učestalosti vežbanja veće od 1-2 puta nedeljno. Kao moguće objašnjenje može se navesti pretpostavka da povećanje učestalosti vežbanja nije značajno za dalji razvoj pozitivnog self-koncepta ili pak, pretpostavka da ajtemi primenjenih skala za merenje dimenzija self-koncepta ne dozvoljavaju da se napravi bolja diskriminacija između onih studentkinja koje su veoma posvećene sportu i vežbanju i učestvuju na takmičenjima višeg ranga i onih koje su u tome umerenije.

Mada su ranija istraživanja ukazala na postojanje značajne povezanosti između uključenosti u sport i vežbanje i socijalne anksioznosti zbog izgleda, koja se ispoljava u tome da osobe koje su uključene u sport i vežbanje imaju manje izraženu socijalnu anksioznost zbog izgleda (Fox, 2002; Gomes et al., 2015; Leary, 1992; Lindwall & Lindgren, 2005; Martin, 2006; Mülazimoğlu-Balli et al., 2010; Rothberger, 2014), u ovom istraživanju, ta povezanost nije potvrđena. Moguće objašnjenje nalaza da se na uzorku studentkinja Beogradskog univerziteta, socijalna anksioznost zbog izgleda nije se pokazala kao psihološka karakteristika značajano povezana sa uključenošću u sport i učestalošću fizičkog vežbanja, može se vezati za podatak da se na uzorku u celini ispoljila relativno niska anksioznost zbog izgleda. Ipak, uočena je tendencija smanjivanja socijalne anksioznosti zbog izgleda sa uključenošću studentkinja u sport i vežbanje. Kako bi se bolje pojasnio odnos socijale anksioznosti zbog izgleda i uključenosti pripadnica ženske populacije u sport i vežbanje, trebalo bi dalje istraživati ovaj problem na široj populaciji žena. U narednim istraživanjima bi takođe trebalo prikupiti podatke o uslovima u kojima se odvija vežbanje (u grupi ili individualno) i fizičkim karakteristikama studentkinja (na primer, BMI), neke psihološke karakterstike (na primer, anksioznost kao crta ličnosti, doživljavanje uspeha i neuspeha) kako bi se detaljnije objasnila relacija socijalne anksioznosti zbog izgleda kao psihološke karakteristike i bavljenja sportom i vežbanjem.

ZAKLJUČAK

Uključenost studentkinja u bavljenje sportom, takmičarski ili rekreativno, kao i u redovno fizičko vežbanje, pozitivno je povezana sa psihološkim karakteristikama samopoštovanje i fizička samoefikasnost.

U narednim istraživanjima bi trebalo dalje ispitati povezanost socijalne anksioznosti zbog izgleda i uključenosti studentkinja u sport i vežbanje, proširivanjem uzorka na druge grupe u okviru ženske populacije, uz kontrolu relevantnih fizičkih karakteristika, uslova vežbanja i uvođenjem i drugih psiholoških varijabli iz domena afektivnih odgovora na uključenost u sport i vežbanje i određenih crta ličnosti.

Takođe, bilo bi značajno uraditi IRT (Item Response Theory) analizu ajtema instrumenta PSES kako bi se proverila njihova diskriminativnost u specifičnim grupama ispitanica uključenih u sport i vežbanje.

Rezultati dobijeni ovim istraživanjem, s obzirom na to da su potvrdili pozitivnu povezanost pojedinih psiholoških karakteristika i angažovanja studentkinja u sportu i vežbanju, idu u prilog pokretanju šire društvene akcije za podsticanje većeg i redovnog uključivanja ženske populacije u sport i vežbanje.

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PSYCHOLOGICAL CORRELATES OF FEMALE STUDENT'S ENGAGEMENT IN SPORT AND EXERCISE

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INTRODUCTION

Recent studies investigating the impact of sport and physical exercise in general well-being draw the attention to inequality of engagement of males and females in sport and exercise. Studies document lower involvement of females in different forms of physical activity (Gomes, Gonçalves, & Costa, 2015; Radisavljević Janić, Milanović, & Lazarević, 2012; Trost, Pate, Sallis, Freedson, Taylor, Dowda, et al., 2002). Results of the studies in the field of psychology of sport and exercise indicate relationship between certain psychological characteristics and involvement in sport and exercise. Moreover, studies show that certain psychological characteristics influence frequency and quality of the engagement in sport and exercise. In addition, studies indicate necessity of investigation of nature and conditions underlying this relationship, both in general population, and with respect to gender (Cox, 2005; Fox, 2002; Lindwall & Lindgren, 2005; McAuley & Blissmer, 2000; Weinberg & Gold, 2007).

Among psychological characteristics that are considered to be important for the quality and frequency of engagement in sport and exercise, important place is occupied by self-concept with its dimensions including both those specifically related to self-perception of physical activity like physical self-efficacy, and more general such as self-esteem (Bandura, 1997; McAuley & Gill, 1983; Sonstroem & Morgan,1989; Weinberg & Gold, 2007). Researches also indicate the relationship between engagement in sport and exercise, and emotions related to self-perception of one's own body. Studies in this field are mostly dealing with social anxiety related to physique (Cox, 2005; Eklund & Crawford, 1994; Gomes, et al., 2015; Leary, 1992; Mülazimoğlu-Balli, Koca & Aşçi, 2010).

Self-esteem, physical self-efficacy, and social anxiety related to physique in sport and exercise

Self-esteem, as a dimension of self-concept that refers to the overall assessment of the self (Rosenberg, 1965), is positively related to success in different activities. The results of the studies indicate high importance of self-esteem for sport achievement, and imply reverse effects of success in sport on development of self-concept (Fox, 2002; Marsh, 1997; Mikhnov, 2015; Weinberg & Gold, 2007). Further, it has been documented that involvement of young people in different programs of exercise has effects on development of self-esteem (Gomes et al., 2015).

Dimension of self-concept, more directly related to high-quality involvement in sport and exercise is physical self-efficacy; the term derived from wider theory of self-efficacy by Albert Bandura (Bandura, 1997). Self-efficacy refers to the belief of a person in ability to succeed in some physical activity (Ryckman, Robbins, Thornton, & Centrell, 1982). Significant number of studies confirms relation between physical self-efficacy and both achievement and engagement in sport (Cox, 2005; Ryckman et al., 1982; Vipene & Jona, 2012). Especially important are results of the studies indicating that regular exercise and involvement in sport can increase physical self-efficacy in young people (Martin, 2006; McAuley & Blissmer, 2000; Weinberg & Gold, 2007). Furthermore, researches indicate that self-esteem and physical self-efficacy are characteristics that are positively

related in young people practising sport and exercise, while mentioned characteristics are both negatively related to social anxiety related to physique (Lazarević, Orlić, & Lazarević, 2014; Martin, 2006; Vipene & Jona, 2012).

Social anxiety related to physique occurs when physique of a person is exposed to observation and evaluation of others. Observation and evaluation of someone's physique is typical for situations related to practising sport and exercise. Results of the studies show that regular exercise and sport activities can have positive influence on reduction of social anxiety related to physique, and that reduction of physical anxiety related to physique has positive influence on involvement in physical exercise (Craford & Eklund, 1994; Focht & Hausenblas, 2006; Fox, 2002; Leary, 1992; Gomes et al., 2015; Lindwall & Lindgren, 2005, Martin, 2006; Mülazimoğlu-Balli et al., 2010). Social anxiety related to physique is more pronounced in female population (Motl & Conroy, 200; Mülazimoğlu-Balli et al., 2010). These results indicate the need for further investigation of possible effects of social anxiety related to physique on lower involvement of females in physical exercise and sport.

Aim of the study

Given the importance of physical exercise and sport for the general well-being of the individual, and the fact that females are less involved in physical activity, the aim of the study was to investigate the relationship between self-esteem, physical self-efficacy, and social anxiety related to physique on one side, and involvement in sport and exercise of female students on the other.

METHOD

Sample

Sample consisted of 155 female students of four faculties at the University of Belgrade, average age 21 years, *SD=1.8*. In the sample, 13.5% of the students were competitors, 50.3% was involved recreationally, and 36.1% were not involved in sport. When frequency of exercise is observed, 29.7% students did not exercise, 38.1% exercised once or twice per week, 16.8% exercised 3-4 times per week, while 15.5% exercised more than 4 times per week.

Variables and instruments:

1. Psychological characteristics:

- Self-esteem was assessed with Rosenberg's scale of self-esteem (Rosenberg's Self-Esteem scale – SES, Rosenberg, 1965). The scale consists of 10 items, with joint 4-point Likert type scale. Sample items: „On the whole, I am satisfied with myself"; „I wish I could have more respect for myself". Higher scores indicate higher self-esteem. Cronbach alpha reliability of the scale is satisfactory, $\alpha = .87$.

- Physical self-efficacy was assessed with Physical Self-Efficacy Scale – PSES (Ryckman, et al., 1982). The scale consists of 22 items, with joint 6-point Likert type scale. Sample items: „I have excellent reflexes", „I am not agile and graceful". Higher scores indicate higher physical self-efficacy. Cronbach alpha reliability of the scale is satisfactory, $\alpha = .79$.

- For assessment of social anxiety related to physique, Social Physique Anxiety Scale – SPAS was used (Hart, Leary, & Rejeski, 1989). In this study, revised form consisting of 7 items with joint 5-poin Likert type scale was used (Motl, & Conroy, 2001). Sample items: „I am comfortable with how my body appears to others", „In the presence of others, I feel apprehensive about my physique or figure". Higher scores indicate higher social anxiety related to physique. Cronbach alpha reliability of the scale is satisfactory, $\alpha = .83$.

2. Variables related to involvement in sport and exercise:

- *Level of involvement in* sport: 1. Competitively, 2. Recreationally, 3. Does not exercise sport

- *Frequency of involvement in sport:* 1. Does not exercise, 2. Exercises 1-2 times per week, 3. Exercises 3-4 times per week, 4. Exercises more than 4 times per week.

Data on involvement in sport and exercise, age, and faculty were collected with questionnaire designed for this study.

Data analysis

Research was conducted on volunteer respondents who anonymously participated in the study. For data analysis, correlational, cluster, discriminative analysis, and MANOVA were used.

RESULTS

Results of descriptive analysis showed that on average our respondents have higher scores on SES and PSES, while on SPA they have on average lower scores (Table 1). Two dimensions of self-concept, i.e., self-esteem and physical self-efficacy, intercorrelated positively, while correlations between social anxiety related to physique, and two dimensions of self-concept were negative (Table 2).

Table 1

Descriptive statistics for psychological characteristics

Instruments	*Min*	*Max*	*M*	*SD*
SES-Rosenberg self-esteem scale	1.00	4.00	3.14	0.48
PSES-Physical self-efficacy scale	2.45	5.64	4.22	0.61
SPA-Social anxiety related to physique scale	1.00	5.00	2.07	0.76

Table 2

Correlations between self-esteem, physical self-efficacy, and social anxiety related to physique

Pearson coefficient of correlation	**SES**	**PSES**	**SPA**
SES- Rosenberg self-esteem scale	1	.63**	-.55**
PSES-Physical self-efficacy scale	.63**	1	-.63**
SPA-Social anxiety related to physique scale	-.53**	-.63**	1

Cluster and discriminative analysis demonstrated that respondents group into three relatively equal clusters. The highest importance in prediction of cluster membership had the *frequency of exercise*, and it was followed by *involvement in sport*, *physical self-efficacy*, *and general self-esteem*. *Social anxiety related to physique* had lowest importance in prediction of cluster membership.

The first cluster includes participants involved in sport competitively and recreationally, exercise 3-4 times per week, with the most favourable psychological profile (highest scores on PSES and SES, and lowest on SPA). The second cluster includes participants involved recreationally in sport 1-2 times per week, with favourable psychological profile (higher scores on PSES, and SES, and lower on SPA). The third cluster included female students who are not involved in sport and exercise, with the least favourable psychological profiles (lower scores on PSES and SES, and somewhat higher on SPA).

MANOVA, where independent variable was *involvement in sport* (competitively, recreationally, and not involved in sport), and scores on SES, PSES, and SPA were dependent, showed that female students differ in physical self-efficacy, $F(2, 151) = 20.81$, $p < .01$, and in self-esteem, $F(2,151) = 4.62$, $p < .05$. Post-hoc (Bonferroni) tests showed that females not engaged in sport differ from other groups of participants with respect to physical self-efficacy and self-esteem. There were no statistical differences in social anxiety related to physique between the groups. Given the *frequency of involvement* in physical exercise, there were significant differences in physical self-efficacy, $F(3, 150) = 19.62$, $p < .01$, and in self-esteem, $F(3, 150) = 6.10$, $p < .01$. Post-hoc analyses show that highest differences exist between the females who are not exercising and other groups, in both self-efficacy and self-esteem. In addition, post-hoc tests showed that influence of frequency of exercising on self-efficacy and self-esteem is not incremental when frequency is higher than 1-2 times per week, i.e., increase of influence of frequency of exercise on self-efficacy and self-esteem reaches plateau. Differences in social anxiety related to physique between groups of students involved in physical exercise at different level were not significant.

DISCUSSION

This paper was focused on dimensions of self-concept, i.e., self-esteem and physical self-efficacy, and on emotion related to self-assessment of the physical characteristics in social situations, i.e., social anxiety related to physique. Results confirmed that self-esteem and physical self-efficacy are positively related, while these characteristics are both negatively related to social anxiety related to physique. This finding is in line with previous studies (Lazarević et al., 2014; Martin, 2006; McAuley & Blissmer, 2002; McAuley & Gill, 1983; Thornton et al., 1987; Rothberger, 2014).

When discussing relations between examined psychological characteristics and involvement of students in sport and exercise, the results show positive relations between engagement in sport on one side, and self-esteem and physical self-efficacy, on the other. This is also in line with the previous results (Fox, 2002; McAuley & Blissmer, 2000; Weinberg & Gold, 2007). Therefore, positive psychological profile, characterized by high self-esteem and self-perception of physical efficiency, can be expected in females exercising sport on a regular basis. Social anxiety related to physique, in the sample of female students was not significantly related to involvement in sport and frequency of physical exercise.

Results of this study demonstrated that exercising sport, regardless of the level of involvement (i.e., competitively or recreationally) is positively related to desirable psychological profile. Interestingly, increase in frequency of exercise has positive influence on perception of self-efficacy and self-esteem, but only to a certain extent, after which it reaches plateau. In other words, when frequency of exercise is higher than two times per week, there are no differences in assessed dimensions of self-concept. It is possible that increase in frequency of exercise is not important for further development of positive self-concept. Another possibility is that items of used scales are not discriminating females who are extremely dedicated to sport and exercise and participate in competitions of higher ranking, and those moderately involved in sport and exercise.

Although previous studies indicated the existence of significant relations between involvement in sport and exercise, and social anxiety related to physique, i.e., specifically, that persons involved in sport and exercise have less pronounced social anxiety related to physique (Fox, 2002; Gomes et al., 2015; Leary, 1992; Lindwall & Lindgren, 2005; Martin, 2006; Mülazimoğlu-Balli et al., 2010; Rothberger, 2014), this study did not confirmed those findings. It is possible that this finding result from low social anxiety related to physique in our sample. However, we have registered that social anxiety related to physique tends to reduce when females are engaged in sport and exercise. In order to disentangle the relationship between social anxiety related to physique and involvement of females in sport and exercise, wider sample of female population should be included. Future studies should focus on conditions for exercising (e.g., group or individual), and physical characteristics of the respondents (e.g., BMI), specific psychological characteristics (e.g., trait anxiety, perception of failure and success) so that relations between social anxiety related to physique and sport and exercise can be explained in more detail.

CONCLUSION

Engagement of female students in sport, competitively or recreationally, and regular exercise, is positively related to self-esteem and physical self-efficacy. Future studies should investigate social anxiety related to physique and involvement in sport and exercise by expanding the sample to other groups of females, controlling for relevant physical characteristics, conditions for exercising, and by introducing other psychological variables, like personality traits, and those mapping affective responses to engagement in sport and exercise.

Another recommendation would be to perform the IRT (Item Response Theory) analysis of the items of PSES instrument in order to test their discriminativity in specific groups of females involved in sport and exercise.

Since the results of this study confirmed positive relationship between specific psychological characteristics and engagement in sport and exercise, they support the idea of launching wider social action aimed to encourage higher and more regular engagement of females in sport and exercise.

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A TOTAL WEEKLY DIFFERENCE IN PHYSICAL EDUCATION CLASS ACTIVITIES BETWEEN 3RD AND 4TH GRADE PUPILS OF ELEMENTARY SCHOOL

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INTRODUCTION

The current state and results of Physical Education (PE) are unsatisfactory. The most frequently mentioned negative circumstances are: inadequate curriculum, poor material conditions, insufficient involvement of teachers and insufficient number of lessons per week. The material conditions, facilities and work methods are often inadequate and therefore incapable of inducing the required physiological load in pupils. The effectiveness of PE lessons in the lower grades is an essential prerequisite for successful teaching of PE in the subsequent educational periods.The lack of final positive effects means that the physical education has lost its meaning (Džibrić, J., et al., 2011).

The children are nowadays less physically active, which is confirmed by the results of many scientific papers. The results of one such research (Jureša, V., 2006, according to Neljak, B., 2008) indicate that 33% of the first grade primary school children watch television for at least one hour a day, 44% for two hours, and 15% for three hours a day. The same sample of first graders indicates that 38% of children on average spend one hour on the computer daily, 8% use the computer for two hours a day, while 50% of children do not use computers. High values of both systolic (over 130 mmHg – 2.2%) and diastolic (above 85 mmHg – 3.6%) blood pressure in children have been observed as early as the first grade. The same sample of subjects also reported low levels of health self-assessment: 13.2% of male and 13.3% of female pupils described their health level as good and less than good. This trend continues despite the evidence of positive effects of regular physical activity, which were disclosed in the declaration of the World Health Organization (WHO, 2004, according to Neljak, B., 2008).

It is important to note that PE is the only school subject in the Republic of Croatia which contains a practical health component. Therefore, it can be concluded that a well-organized and well-conducted lessons can and should induce positive effects on the health of pupils. Similarly, inadequate physical education can induce negative effects (Džibrić, J., et al., 2011). The issue is how much effect does one lesson of PE have on physical activity of pupils and how is that activity realized in practice. Considering that in the Republic of Croatia 3rd grade pupils attend PE lessons three times a week, and 4th grade pupils two times a week, the aim of this study is to determine the partial difference and the difference in the overal weekly physical activity of pupils during PE.

METHOD

Sample

The sample consisted of 127 pupils of Primary School Braće Radić in Pakrac, Croatia. Out of a total of 127 pupils, 65 attended the third grade (33 boys and 32 girls), and 62 attended the 4th grade (27 boys and 35 girls).

Sample of variables

The variables represented in the survey were: Number of steps (Steps) and Class duration (Time).

The total physical activity of pupils was estimated as a number of steps performed during PE lesson. The steps were measured by Uniqa type pedometer. The device itself consists of three buttons: Set, Reset, and Mode. Pressing the Set button displays the number of steps, pressing the Reset button resets the pedometer, while pressing Mode provides the option of converting the steps to kilometers, miles and calories burned.

Proceedings of collecting the data

The study lasted for four weeks and was conducted in six grade departments, three of both 3rd and 4th grade. Three classes of 3rd grade pupils were observed during a total of 12 PE lessons, and three classes of 4th grade pupils were observed during 8 lessons.

The pedometers were given to the pupils at the beginning of the PE lessons. The pupils wore the pedometer throughout the lesson, and measured the total number of steps taken at the end of the class. The duration of the class was measured in addition to the number of steps, since some classes lasted less than scheduled 45 minutes because of various organizational and spatial work conditions. For the purpose of determining the difference in the overall weekly physical activity and the total physical activity in one lesson the measure was taken to be one measuring on a physical education class. Given that some of the pupils did not attend all teaching hours (due to illness), the total number of measured results was 1247.

Methods of data processing

The arithmetic mean (M), standard deviation (SD), minimal (MIN) and maximal (MAX) result and the range between the minimal and maximal results (Range) are shown for each group of entities in particular. Shapiro-Wilk W test was used to determine the normality of distribution. The correlation analysis (Spearman rank of correlation) examined the connection between the total number of steps with lesson duration. The differences between the groups in the total number of steps taken in one lesson and in one week's lessons was analysed using the Mann-Whitney U test. Data were analysed by a computer program Statistica for Windows 12.0.

RESULTS WITH DISCUSSION

Table 1. Results of descriptive parameters - 3rd and 4th grade pupils

		STEPS (n)					TIME (min)			
Group	**N**	**M**	**SD**	**MIN**	**MAX**	**RANGE**	**AS**	**SD**	**MIN**	**MAX**
3rd g (week)	65	3564.73	819.60	1827.25	5702	3874.75				
4th g (week)	62	1900.92	490.49	1026	3205.25	2179.25				
3rd g	760	1188.73	448.95	306	2547	2241	39.14	2.05	32	43
4th g	487	948.08	323.24	315	1937	1622	38	3.70	30	42
M	598	1227.99	459.20	306	2547	2241	38.69	2.85	30	43
F	649	971.98	339.45	311	2201	1890	38.69	2.88		
3rd g M	388	1307.63	502.37	306	2547	2241	39,15	2.04	32	43
3rd g F	372	1064.71	344.78	311	2201	1890	39.12	2.07		
4th g M	210	1080.83	318.53	506	1937	1431	37.84	3.79	30	42
4th g F	277	847.44	289.10	315	1649	1334	38.12	3.63		

LEGEND: M = mean, SD = standard deviation, MIN = minimal result, MAX = maximal result, RANGE = difference between maximal result and minimal result, g = grade, M = male, F = female, week = result by weeks

Table 1. shows the descriptive parameters in the total number of steps performed during one PE lesson and during one week'lessons and for all groups of pupils. According to the arithmetic mean the best total weekly scores were achieved by 3rd grade pupils (3564.73). The best result in one lesson was achieved by 3rd grade boys (1307.63), while the worst result in one lesson was achieved by 4th grade girls (847.44).

3rd grade pupils show higher weekly range (difference between maximal and minimal results) of the total number of steps (3874.75) than the pupils in the 4th grade (2179.25) while the biggest range in one lesson was recorded in the group of 3rd grade boys (2241) and lowest in the group of 4th grade girls (1649).

According to the arithmetic mean, the longest lesson of PE was conducted in 3rd grade (39.14 minutes), whilst the arithmetic mean of the lesson duration in 4th grade was 38 minutes. The highest range between the minimal (30 minutes) and maximal (42 minutes) duration was observed in the 4th grade. Upon closer inspection it can be noticed that some PE lessons were too short, considering that the each lesson should have lasted 45 minutes.

Table 2. Shapiro-Wilk W test results

Group	STEPS		TIME	
	W	P	W	p
3rd g	0.973	0.00	0.889	0.00
4th g	0.975	0.00	0.852	0.00
3rd M	0.984	0.00	0.891	0.00
3rd F	0.982	0.00	0.887	0.00
4th M	0.971	0.00	0.856	0.00
4th F	0.967	0.00	0.849	0.00

LEGEND: g = grade, M = male, F = female, W = value, p = error

Shapiro-Wilk W test was used to test the normality of distribution. Table 2. shows that the variables are not normally distributed in all observed groups.

Table 3. Results of correlation analysis (Spearman rank correlation)

	Steps	Time
Steps	1	0.369*
Time	0.369*	1

* $p < 0.05$

Due to the duration of lessons from 30 to 43 minutes and range of 13 minutes, as seen in the Table 1, a correlation analysis was carried our between the variables of steps and time, as evident in Table 3. Based on the results it can be concluded that the correlation coefficient between the variables is statistically significant ($p < 0.05$) and totals to 0.369. Based on these results it can be concluded that the relationship between the number of steps performed and the time spent in one class session is low, and that the total number of steps depends not only on time, but also on other factors. Some of the factors most likely associated with a larger number of performed steps in physical education class may be class content, as well as methodical and organizational forms of work and the interest and motivation of pupils. According to Prskalo, I and Babin, J. (2009) time is an important factor in the success of the transformation process as well as in the process of motor learning. The limiting factor of time can be partly mitigated by using more complex and demanding methodic and organizational forms of work which are appropriate to the age of pupils. The teacher should use their knowledge and creativity to achieve the best possible results and optimize the exercise process.

Table 4. Results of Mann - Whitney U test it - test for independent samples

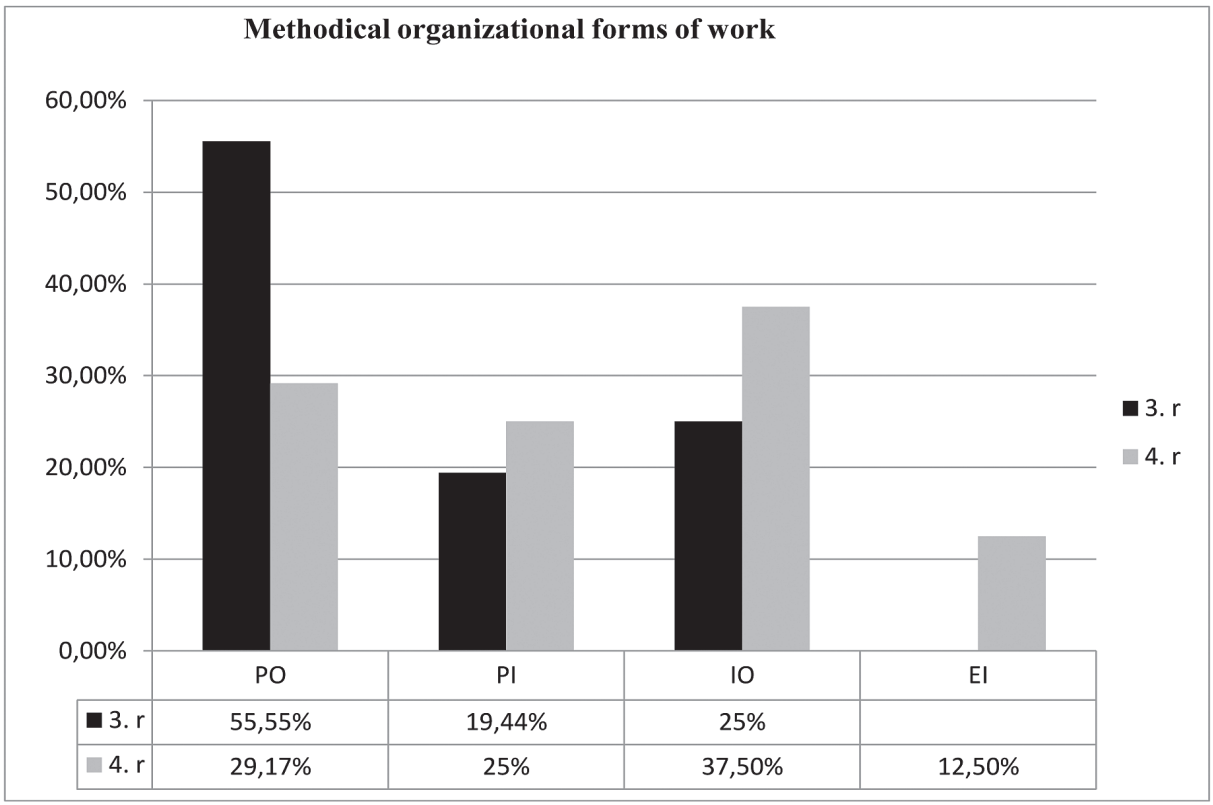
Group differences	Rank Sum	Rank Sum	U	Z	p-value	Valid N	Valid N
3rd – 4th (week)	6060	2068	115	9.16	0.00	65	62
M (3rd, 4th) - F (3rd, 4th) (weeks)	4574	3554	1276	3.54	0.00	60	67
3rd M – 3rd F (weeks)	1352	793	265	3.44	0.00	33	32
4th M – 4th F (weeks)	1119	834	204	3.80	0.00	27	35
3rd – 4th	534533	243595	124767	9.72	0.00	760	487
M (3rd 4th) - F (3rd, 4th)	438527	339601	128676	10.29	0.00	598	649
3rd M – 3rd F	169544	119636	50258	7.24	0.00	388	372
4th M – 4th F	63276	55552	17049	7.83	0.00	210	277
3rd M - 4th M	127825	51276	29121	5.76	0.00	388	210
3rd F – 4th F	140215	70710	32207	8.18	0.00	372	277

LEGEND: M = male, F = female, week = weekly result

Table 4. shows that the differences in the total number of steps are statistically significant (p=0.00) in all compared pairs. The statistically significant differences in the total weekly number of steps during the PE lesson between the 3rd and 4th grade pupils have been determined according to the basic aim of the study. It is evident that the 3rd grade pupils achieved a higher total weekly physical activity in during PE as compared to the 4th grade pupils (3564.73 : 1900.92). The differences were also observed in the overall weekly physical activity between 3rd and 4th grade boys and 3rd and 4th grade girls. The results indicate that boys usually achieve significantly higher activity during PE lessons than girls. These results are consistent with previous research (Vidranski, T., Pejanić, N., 2015) according to which the boys of 2nd and 4th grade perform more steps than 2nd and 4th grade girls. As mentioned above, the results show that the level of physical activity of 3rd grade pupils is higher than the level of activity of 4th grade pupils. This confirms the expected assumption of significant statistical difference in the total weekly number of steps, since according to the curriculum 3rd grade pupils have three PE lessons a week, whilst 4th grade pupils have two lessons a week. For this reason we explored the difference between 3rd and 4th grade pupils in the total number of steps performed during one single PE lesson. A statistically significant difference was also observed in that department, as 3rd grade pupils have performed a higher total number of steps in one lesson than 4th grade pupils (1188.73 : 948.08). These differences can most likely be attributed to the differences in children's chronological age. Similar research results have been observed by Nader et al. (2008), who have determined that physical activity in children decreases as they approach puberty, and that this decline in physical activity is different in girls and boys.

After the pupils were sorted by gender, the results of the analysis show statistically significant differences between girls (3rd and 4th grade) and boys (3rd and 4th grade), and also separately by grade. The results show that the boys, both of 3rd and 4th grade, achieve a higher total physical activity level than girls of the same grades (1227.99 : 971.98). These results are consistent with previous studies. Jurak et al. (2012) dealt with the assessment of physical activity and energy consumption of 11 years old children in Zagreb, Ljubljana and Ann Arbor. Their activity was followed by a sensory physical monitors, and the results of the study have shown that the boys were physically more active than girls in every type of physical activity.

Graph 1 Representation of methodic organizational forms of work during the implementation of the survey



	PO	PI	IO	EI
3. r	55,55%	19,44%	25%	
4. r	29,17%	25%	37,50%	12,50%

LEGEND: r = grade, PO = parallel section methodic organizational forms of the work, PI = parallel alternating methodic organizational forms of work, IO = alternating section methodic organizational form of work, EI = elementary games

Note: EI is not a methodical organizational form of work

Graph 1. shows that the implementation of content in the main part of the class session for the 3rd grade was mostly done through parallel section methodic organizational forms of work (55.55% - a total of 20 lessons). By its complexity this is the least demanding form of work. In the 4th grade the implementation of content in the main part of the session was mostly done through the alternating section methodic organizational form of work (37.5% - a total of 9 lessons). The reason behind this may be that the pupils of the 3rd grades of primary school are just only being introduced into more complex forms of work, for which the simpler forms of work are a prerequisite. The transition between these forms is the function of intensification, rationalization, humanization and optimization of both the teaching process and the controlled process of physical exercise. By respecting the principle of gradualism, the introduction of more complex methodic organizational forms of work requires a certain level of preparation and maturity of the pupils (Prskalo, I, Babin, J., 2009).

Parallel alternating methodic organizational form of work has been represented in both the 3rd and 4th grades. In the 3rd grade this methodic organizational form of the work was used in 19.44% PE classes (7 lessons), and in the 4th grade in 25% PE classes (6 class hours). The reason behind this could be found in the curriculum content for whose implementation this form of work is most appropriate, i.e. Passing and catching the ball in spot (Handball) and Passing the ball in movement (Football). These results suggest very modest material conditions in schools which participated in this research. The parallel alternating methodic organizational form of work contributes to better implementation of programs and leads to greater independence of pupils. Furthermore, no less important is the fact that this methodic organizational form of work is one of the foundations for the implementation of more demanding alternating section methodic organizational form of work. (Baić, M. et al. 2009).

CONCLUSION

On the basis of this study statistically significant differences between the pupils of 3rd and 4th grades were determined in physical activity during one PE lesson and in overall weekly physical activity during PE, and also by gender. The underlying reason may be that one additional PE lesson a week can contribute to the overall level of physical activity in PE. The effectiveness of a single PE lesson cannot only be estimated based on the number of hours doing physical exercises, but time is also an important factor. It would be beneficial to include one additional lesson of PE in 4h grades of elementary school in order to make it to three lessons of PE a week. In that case the total weekly difference in activity between pupils of 3rd and 4th grades would be lower.

The use of appropriate methodic organizational forms of work is one of the critical factors for successful conduction of PE lessons which can increase the physical activity of pupils. In order to make the most benefit from such methods, the attention should be given to the gradual introduction of pupils to the application of more complex methodic organizational forms of work in higher grades.

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SURVEY THE EFFECTIVENESS OF A METHODOLOGY FOR OPTIMIZING THE LEVEL OF MOTOR QUALITY SPEED AT 10-12 YEARS OLD, DEALING WITH RHYTHMIC GYMNASTICS

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INTRODUCTION

In modern rhythmic gymnastics possession of quality speed from dealing is an important factor for optimum developed physical preparation and achieving high sport achievements, related flawless set of compositions. During the last years the rules include mandatory difficulties with body, exercises with rotating movements under thrown gymnastics apparatus, masteries with it and dance steps (Code of Points, FIG- Technical Commitee / Rhythmic gymnastics, 2013-2016). The using of all these exercises with maximum accuracy and precision for a certain time to reach the maximum high evaluation impose an exceptional importance of the speed as motor quality, needed for successful realization in rhythmic gymnastics.

With the amendment to age the speed capabilities vary unevenly (Vankov, 1982). According to G. Braizgalov (2012) the best is manifestation of the speed at systematic training of children between 9-12 years. If at this age do not develop speed in the coming years it will be difficult to compensate the lag behind in terms of this motor quality (Kotz, 1998) and probably the reason for this is that compared to other motor qualities the speed slightly amenable to improvement and is defined as the genetically determined capability (Nikitushkin, 2009). That determine the age of the gymnasts in this survey.

The training process, although it can improve the speed capabilities, but only with the help of correct selected methodology, corresponding to the age of the gymnasts and the modern requirements of the sport. In literature not found enough information on science-based methods and programs for a development of speed in rhythmic gymnastics.

This necessitated the main aim of the study - development of a complexes exercise (combined into a single method) for optimizing the speed capabilities in different parts of the body and proving their effectiveness through their application in practice on 10-12 year gymnasts.

METHOD

The experimental protocol was done in the period 15th February – 15th March, 2014.

*Participants - this study was conducted on a sample of 43 rhythmic gymnasts, aged 10-12 years, divided into two groups:

- Control group - 16 gymnasts

- Experimental group - 27 gymnasts

*Measurements - 2 measurements were made in all tests: before and after the experiment. When we examine the speed by measuring the time is taken, that the best result is the smallest numerical value.

*Procedures – 6 tests were used for measuring and evaluating of the speed.

*Experimental program - were applied 5 complex of exercises for development of speed on

the experimental group, while the control was working with traditional means of development of the motor quality.

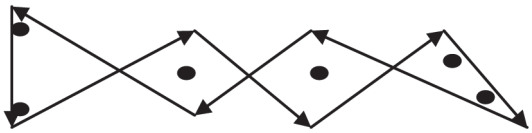
*Statistical analyses- the statistical processing of the results was done with SPSS Statistics 20: Analysis of the variance; -Hypotheses check - T- criteria of Student for independent samples

*Observation – the gymnasts should be well warmed up before the testing and the precision and accurateness of the execution of the motor tests should be observed.

*Comparative analysis of the obtained results from the control group and the experimental one.

Tests:

Name	Necessary equipment:	Execution:
1."Temping" test (T1) 	a stick, a stop watch	The researched individual sits down; there is a stick in front of her lying on a table, which is positioned opposite her breast-bone. The researched individual should touch the table on both sides of the stick with her left and right hand as fast as possible, alternating the sides. The elbow joint is in the air, right above the stick, the movement is done only from the forearm. The number of the touches of the hand on the two sides is counted within 30 sec. Each touch of the stick is penalized by taking away one touch. The aim is to make as many touches as possible with the left and right hand separately.
2. Backbend (T2) 	a stop watch	The researched individual is in initial straddling position, arms up. She executes 10 backbends, placing her palms on the floor. After each backbend the individual rises to initial position, her body should be in a vertical position. The aim is to do the exercise as fast as possible and the time is measured with accuracy of up to 0.1 sec.
3. Bends (T3) 	a wall, a stop watch	The researched individual is in straddling position in front of a wall. She executes a bend; her hands should touch the floor; she rises to the vertical and bends, touching the wall with both her hands. The exercise is done 10 times, alternating left and right bend. The aim is to do the exercise as fast as possible and the time is measured with accuracy of up to 0.1 sec.
4. Running 30 m/sec (T4) 	stop watch	From initial standing position the gymnasts run a distance 30 m long (2 in a series). The start is given by a sound signal. The time of each gymnast is measured with accuracy of up to 0.1 sec.

5. Test "Zigzag" (T5)	6 balls, non slippery flooring (rhythmic gymnastics carpet), a stop watch	The test is executed in the following manner: The balls are placed as shown in fig. 1, arranged throughout the 30 m perimeter. The researched individual follows the arrows, starting and finishing from the marker start/finish. The time for running the course is registered with accuracy of up to 0.1 sec. Start/Finish
		
6. Skipping (T6) 	a skipping rope, a stop watch	Two assistants hold the ends of the skipping rope and raise it 20 cm off the floor. The researched individual performs 20 skips, over the rope, and the aim is to do the exercise for a minimum time with accuracy of up to 0.1 sec.

RESULTS WITH DISCUSSION

Speed of upper limbs:

Figure 1 shows the results from the test for speed of the upper limbs before and after the application of the experimental treatment.

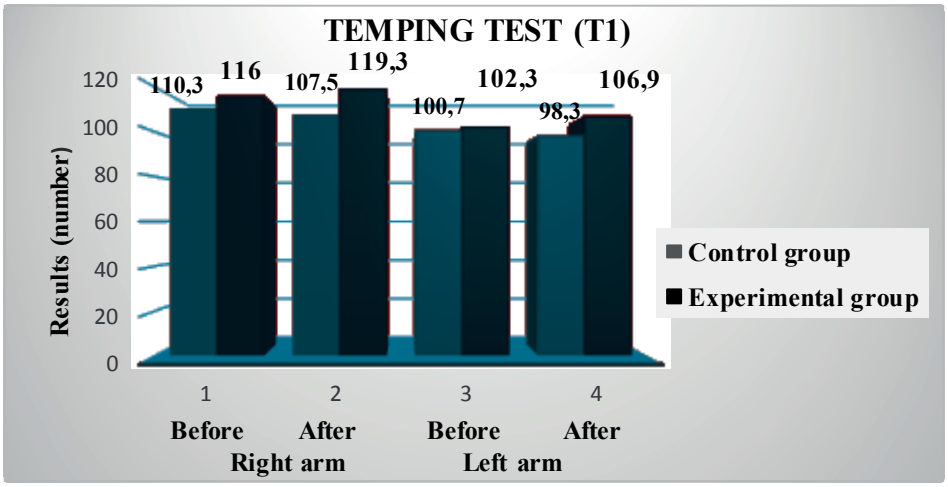


Figure 1

From the figure it is clear, that the experimental group was submitted better than the control, showing a larger average values for the both hands and the both tested. The difference in the mean scores between the two groups before the experiment for left arm is 1.6, And for the right hand-5.7.

In the second testing these differences are significantly increased as a left-hand it was 8.6, for right- 11.8, which gives reason to believe, that the control group seriously lagging behind from the experimental one in the development of the speed of upper limbs and methodology, used on this group is not effective for this motor quality, as watching the numerical values of the control group in both legs clearly visible, that at the second testing, it shows a decline compared with its personal results from the first testing. From the differences between the results of the both hands and the both tested (Figure 1) it is seen that in the both groups the left hand lags in terms of speed as compared to the right, as the more pronounced is this in the experimental group. These differences can to be explained by the fact, that the most of the children in both groups work mainly with „comfortable" (right) hand, in most cases, movements in the left hand are difficult and less coordinated by the tiredness it occurs -faster.

The coefficients of variation in the both groups and the two tests for both right (11.9%; 13.4%; 10.2%; 11.8) and left arm (14.9%; 15.5%; 13%; 14,3%) show, that the variance is average and the samples are approximately homogeneous. T-criterion of Student for independent samples proved, that there was no statistically significant difference between the control and experimental group of right arm only at the beginning of the study (P1 = 84.9%) and left arm in the two testings (P1 = 27.8%; P2 = 91.8%). The difference is random, and it may be assumed, that the two groups have approximately the same level of development of speed in these parts of the body. This, however, does not refer to the results shown in the right hand at the end of the study, where T criterion proved, that the difference in the development of this motor quality in this limb is statistically significant and actually control group lags behind than experimental, after application of the treatment, which proves its effectiveness.

Speed of the torso:

On figure 2 are shown the mean values of the two groups and the two tests (Backbend and Bands) at the beginning and end of the experiment.

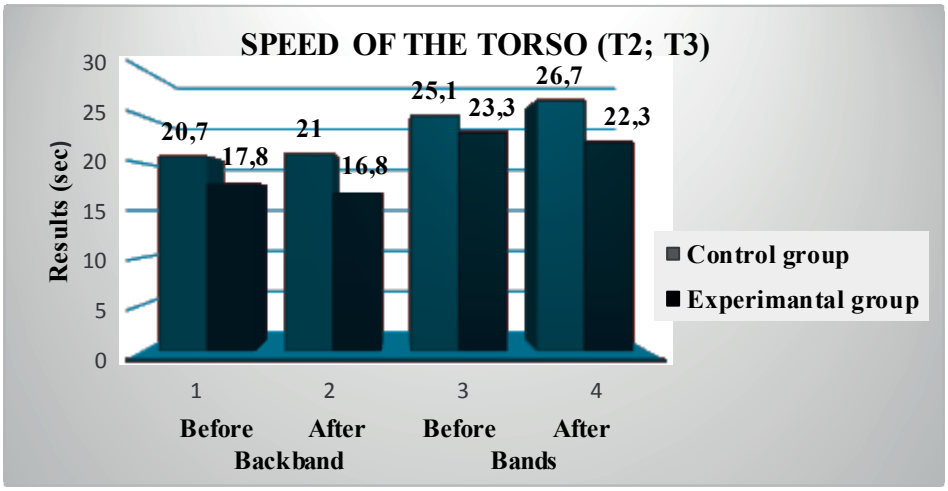


Figure 2

In the both tests the difference was in favor of experimental group, while T2 of the first testing it is 2.9 sec., while the second was increased to 4.2 sec. In T3 at first testing, the difference is 1.8 seconds, at second it is increased to 4.4 seconds. From figure 2 it is clear, that increased differences at the end of the study are due to the growth of the speed of the torso at the experimental group and improving its personal results from the beginning of the study and a decline in the development of this motor quality in the children from the control group, worked one year with the traditional forms of physical preparation. The experimental group has performed better, with better average of the two tests- first (17.8 sec., 23.3 sec.), second testing (16.8 seconds, 22.3 sec.). It makes impression a uniform difference with which the group improves its achievements in both test (1 sec.), which should show, that the actual experimental methodology is effective for speed of torso, regardless from the direction of movement. On the other side, the control group marked weaker results of the study from experimental group and the its personal achievements at the beginning of the study. This could be explained with the fact that the children from the control group train at the same club and

work with the same coach along the same methods. It is possible that one and the same omissions are made, which prevents the group from exceeding the results of the kids from the experimental group, working along different methods. The combination of different methods in a unified working system for developing the quality speed could fill the gaps and thus the experimental group could show better mean values.

The coefficients of variation for both groups at T2 of the testing (23.7%; 17.5%; 13.6%; 17.9%) indicate, that the variance is medium and the samples are approximately homogeneous. At T3 the coefficients of variation (9.6%; 10%; 6.9%; 9.9%) show that the variance is low, the samples are highly homogeneous, which determines the opinion that the two groups alone are homogeneous and the coaches independent from various methodologies, that probably apply, uniform working. With both tests for determining the level of speed of the torso at the beginning and the and the T-criteria of Student for independent samples (T2-P1=98,7%; P2=99,9%; T3-P1=99,6%; P2=100%) proves that there is statistically significant difference between the control group and the experimental one. The difference is reliable and the two groups are not homogeneous as regards the development of this motor quality, which proves the thesis that the experimental group, consisting of kids from different clubs, performed better than the control group where the children work along the same methods. This gives us reason to believe, that the methodology for the development of speed, used in the control group, there are gaps or inaccuracies, while the experimental methodology is effective for developing of this motor quality and can be successfully applied in this age group.

Speed of the lower limbs:

Figure 3 presents the mean values of the two groups for the three tests (Running 30 m/sec, test Zig-zag, Skipping) before and after the experiment. The best achievements are the smallest numeric values.

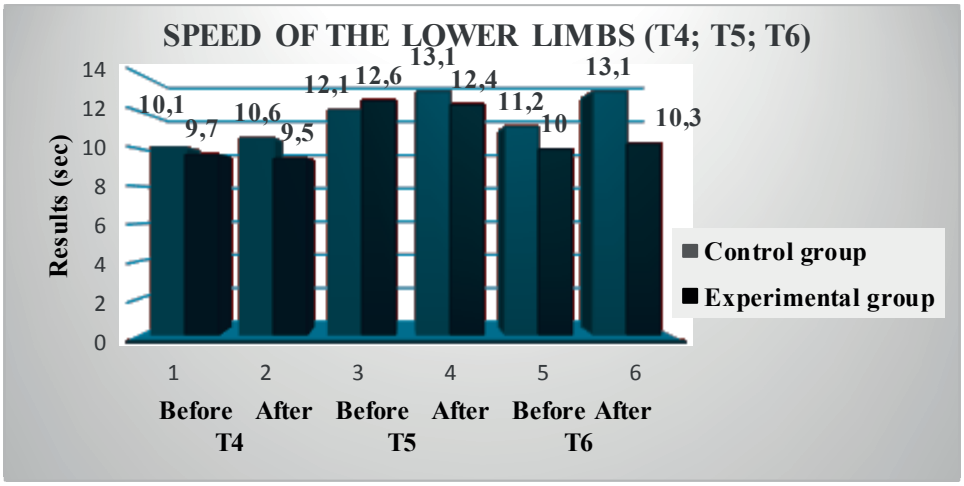


Figure 3

At T4 experimental group shows better results than the control group in both testing, but unlike the first, where the difference between the two groups is 0.4 sec., in the second testing it has increased to 1.1 seconds, such as the control group, working with traditional forms of development of speed, which decreased in achievement with 0.5 sec. Experimental group shows growth of this quality as has improved its result with 0.2 sec. At T5 in the beginning of the study the experimental group was represented by a poor average of 12.6 sec., compared with the control group (12.1 sec.). At the end of the study, however, the experimental group improved its score with 0.2 sec, while the control showed an increase in time with 1 sec. and lowered his achievement from first testing. This time the experimental performs better with the difference in values of 0.7 sec. The results of T4 and T5 give reason to believe that the developed methodology is effective and successful for the development of speed in 10-12 year rhythmic gymnasts.

-At T6 experimental group gives a better average in the two testing than the control group and confirmed the results from T4 (fig.3). There is, however, a drop in the performance of the both groups at the second testing. At the experimental it is 0.3 seconds, but in the control was significantly bigger- 1.9 sec. Probably this is due to the different nature of T6, where the main aim is the quick

movement of the legs at the time of a vertical jump, unlike the other two tests (T4 and T5), where gaining horizontal speed is the essential thing.

The coefficients of variation for the both groups at T4 (16,8% 16,8% 13,7% 15,6%) and T5 (15.9%; 15%; 18.1%; 19%) showed that the variance is medium and the samples are approximately homogeneous. At T6 the results of the first testing (8.9%; 8%) indicate that the variance in the both groups was low, meaning that the samples are highly homogeneous,which proves that the way of work for speed of the lower limbs is similar or sustaining the level of the quality without its increasing with the individuals in this age group. At the second testing, however, the coefficients of variation show an average scattering (17.8%; 13.7%). This is probably a result from applied methods, differences in them and their influence on the development of motor quality speed.

At T4 (first testing) and T5 T-criterion of Student for independent samples proved that there was no statistically significant difference between the control and the experimental group (T4-P1 = 64.5%; T5-P1 = 54.1%; P2 = 68,9%). The difference is random and the two groups have approximately the same level of development of this motor quality. At T4 (second testing- P2 = 95.9%) and T6 (P1 = 99.9%; P2 = 100%) T-criterion of Student for independent samples proved, that there is a statistically significant difference, it is not accidental and the experimental group has significantly superior development of speed of the lower limbs. This gives us reason to believe that the proposed methodology is effective in the developing of this motor quality and can be used in this age group and to adapt to other age groups.

CONCLUSION

1. The experimental methodology increases the level of development of speed and can be successfully applied in this age group.

2. The achievements in the control group clearly show that the traditional methods for developing of speed are not effective, but rather degradation and needs to be replaced with new more advanced. The experimental methodology is a decision based on the current requirements of rhythmic gymnastics and trends in its development. The results of its application show that it supports the development of speed in 10-12 years gymnasts.

3. The results of tests for speed of upper limbs showed a significant asymmetry in the development of motor quality at left and right. It would inhibit the use of more complicated exercises of the apparatus, the ease and fluidity of movement and protection of health, due to irregular development of qualities in various muscle groups.

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UDK 796.012.11:796.012.13

RELACIJA SILA-BRZINA U RUTINSKIM TESTIRANJIMA MIŠIĆA NOGU: EVALUACIJA PARAMETARA MAKSIMALNE SILE

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UVOD

Mišićna sila se može proceniti direktnim ili indirektnim putem. Testovi bazirani na indirektnoj proceni ili tzv. funkcionalni testovi su približniji prirodnim načinima kretanja, jednostavniji i ekonomičniji za izvođenje, pa je i njihova primena od velikog značaja. Međutim, u praksi se često kod primene funkcionalnih testova za određenu mišićnu grupu koristi samo jedan nivo opterećenja. Ovakvim testiranjem dobija se rezultat iz koga se ne može steći potpuna slika o mehaničkim osobinama mišića. Primenom više različitih spoljašnjih opterećenja može se dobiti opseg sile i brzine, koji dalje omogućava primenu linearnog regresionog modela

$$F(V) = F_0 - aV,$$

gde je F_0 parametar maksimalne sile, a nagib koji predstavlja količnik F_0/V_0, dok je V_0 parametar maksimalne brzine. Na osnovu relacije sila-brzina (F-V), može se odrediti i maksimalna snaga (P_{max}). Uz pomoć ovog linearnog modela dobijaju se četiri zavisna parametra F_0, V_0, a i P_{max}. Na ovaj način indireknim putem dolazi se do potpunijeg saznanja o mehaničkim osobinama mišića.

Na samom početku izučavanja mehaničkih osobina mišića pokazano je da relacija sila-brzina kod jednozglobnih pokreta ima hiperboličan oblik (Hill, 1938). Međutim, svakodnevno čovekovo kretanje zasniva se na višezgobnim pokretima kod kojih je dobijena drugačija, linearna F-V relacija. Jaka linearna veza između sile i brzine pokazana je kod gornjih (Nikolaidis, 2012; Sreckovic et al., 2015) i donjih ekstremiteta. Funkcionalni testovi kod kojih su procenjivana mehanička svojstva mišića donjih ekstremiteta i kod kojih je pokazana linearna F-V relacija su sledeći: testovi na bicikl ergometru (Driss et al. 2002; Driss and Vandewalle 2013), različite vrste vertikalnih skokova (Sheppard, 2008; Cuk et al., 2014), trčanje (Jaskolska et al., 1999) potisak nogama u izometrijskim i izokinetičkim uslovima (Yamauchi et al., 2009; Samozino et al., 2012; Samozino et al., 2014). Pokazana linearnost kod navedenih testova pruža mogućnost da se parametri dobijeni iz F-V relacije primene u rutinskom testiranju. Međutim, ovi parametri se moraju prvo evaluirati, a jedan od načina je i određivanje njihove konkurentne validnosti. Na ovaj način bi se funkcionalni testovi bazirani na F-V relaciji mogli validno koristiti u proceni mehaničkih osobina mišića. Dosadašnja istraživanja koja su ispitivala konkurentnu validnost parametra dobijenih iz F-V relacije pokazala su nekonzistentne nalaze (Jaric, 2015). Povezanost parametra maksimalne sile (F_0) sa direktno merenom silom kretala se od umerene do visoke (Cuk et al., 2014; Driss et al., 2002; Vandewalle et al., 1987), dok je u nekim istraživanjima bila niska ili je čak nije ni bilo (Rahmani et al., 2001; Yamauchi and Ishii 2007). Konkurentna validnost parametara V_0 bila je niska, dok je kod parametara P_{max} povezanost bila visoka (Cuk et al., 2014). Za razliku od ove studije autori Ravier i saradnici su (2004) pokazali da parametri V_0 i P_{max} imaju veću konkurentnu validnost nego F_0.

Zbog neusaglašenosti dosadašnjih istraživanja, cilj ove studije bio je da ispita povezanost parametara maksimalne sile dobijene iz F-V relacije sa direktno merenom maksimalnom silom kod testova za donje ekstremitete. Pretpostavlja se da će korelacija između parametara maksimalene sile i direktno merene maskimalne sile biti visoka, kao i da će između samih parametara maksimalne sile kod dva različita testa (kratki Vingejt test i vertikalni skok sa počučnjem) povezanost biti visoka.

METOD

Uzorak ispitanika činilo je 12 muškaraca (uzrasta 22.1 ± 3.4; telesne visine 184.1 cm ± 7.1; telesne mase 80.8 ± 8.2 kg). Indeks telesne mase ispitanika bio je 24.5± 1.5 cm/kg^2, a procenat masti 11.2 ± 2.8 %. Fizička aktivnost ispitanika procenjena je na osnovu IPAQ upitnika (Taylor –Piliae et al., 2006). Prema ovom upitniku 4 ispitanika su imala visok nivo aktivnosti, 5 srednji nivo, a preostala 3 ispitanika nizak nivo fizičke aktivnosti. Ispitanici nisu imali nikakvih zdravstvenih problema i svi su pre početka realizacije istraživanja bili upoznati sa predmetom i ciljem istraživanja, a potom svojim potpisom dali saglasnost za učestvovanje. Etička komisija Fakulteta sporta i fizičkog vaspitanja Univerziteta u Beogradu je odobrila realizaciju ovog istraživanja.

Za određivanje telesne visine korišćen je standardizovan antropometar po Martinu, a za procenu telesne mase i kompozicije tela bioelektrična impedanca (In Body 720; USA).

Maksimalna sila opružača nogu u izometrijskim uslovima merena je direktnim putem na izokinetičkom dinamometru (Kin Com, Chatex Corp., Chattanooga,TN). Testirana je vršeno na dominantnoj nozi koja je određena na osnovu saznanja kojom nogom u fudbalu izvode šut. Testiranju je prethodilo zagrevanje u trajanju od 5 min na stacionarnom biciklu, a nakon toga vežbe pasivnog rastezanja donjih ekstremiteta. Izvođena su dva pokušaja, a tokom svakog pokušaja ispitaniku je pružana snažna verbalna podrška. Ispitanici su dobili instrukcije da maksimalno jako i maksimalno brzo razviju silu u trajanju od 3 do 4s. Pauza između pokušaja trajala je 1 min (Knezevic et al., 2012).

Test maksimalni vertikalni skok sa počučnjem bez zamaha ruku (VS) izvođen je sa pojasom i prslukom u kojem je dodavano opterećenje (MiR Vest Inc; USA). Početno opterećenje je bila telesna masa ispitanika, a zatim je dodavano opterećenje od 8, 16, 24 i 32 kg. Ispitanici su ukupno izveli 10 skokova (5 opterećenja x 2 pokušaja). Skokovi su izvođeni na platformami sile, koja je bila kalibrisana prema specifikaciji proizvođača (AMTI, BP600400; USA). Ispitanici su dobili instrukciju da izvedu maksimalni vertikalni skok bez učešća ruku (ruke su bile na boku), a nisu date instrukcije o dubini izvođenja skoka. Odmor između dva skoka sa istim opterećenjem bio je 1 min, dok je odmor između različitih opterećenja bio od 2 do 3 min (Markovic et al., 2013).

Kratak anaerobni Vingejt test (BT) zahtevao je maksimalan sprint u trajanju od 6 sek (Mendez-Villanueva et al. 2007; Pazin et al., 2011) i izvođen je na bicikl ergometru (Monark 834E, Varberg, Sweden). Bilo je ukupno 5 maksimalnih sprinteva (5 opterećenja x 1 pokušaj). Kod svakog maksimalnog sprinta opterećenje je povećavano za po 2 kg, do dostignutih maksimalnih 10 kg. Period odmora nakon svakog opterećenja bio je 4min (Pazin et al., 2011). Ispitanici su dobili instrukciju da okreću pedale što je brže moguće, dok ne čuju komandu stop, kao i da ne smeju da ustaju sa sedišta tokom trajanja maksimalnog sprinta. Optimalna visina sedišta podešavana je za svakog ispitanika posebno.

Na slici 1 dat je prikaz oba primenjena testa, veritkalnog skoka sa počučnjem i kratkog anaerobnog Vingejt testa.

Slika.1. Prikaz izvedenih testova VS i BT.

Istraživanje je realizovano u 4 sesije, sa odmorom od 5 do 7 dana između svake (Cuk et al., 2014). Prva sesija obuhvatala je antropometrijsko merenje i familijarizaciju sa testovima. Preostale tri sesije služile su za prikupljanje podataka. Testovi su randomizovano izvođeni za svakog ispitanika. Svaka sesija trajala je sat vremena. Pre svakog testa izvođeno je standarno zagrevanje za donje ekstremitete u trajanju od 10 min.

Za akviziciju i procesiranje podataka sa izokinetičkog dinamometra, kao i za vizuelnu povratnu informaciju korišćen je program koji je napisan u LabView (National Instruments 2013; USA). Za dalju analizu korišćen je bolji pokušaj, odnosno onaj kod koga je realizovana veća sila pri maksimalnoj voljnoj kontrakciji (MVC).

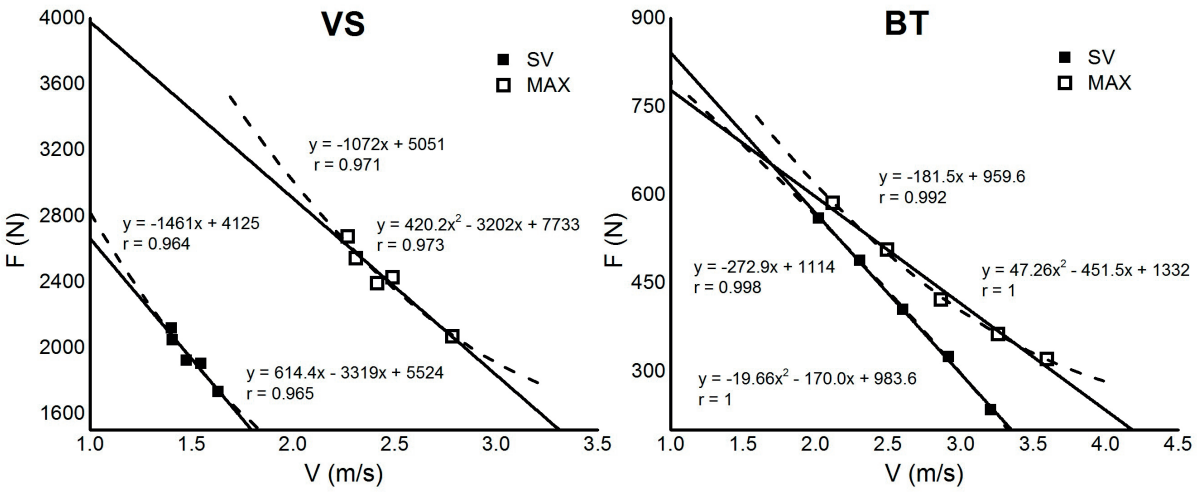
Za analizu podataka dobijenih iz testaVS, korišćen je softver napisan u LabVIEW programu (videti Cuk i sar., 2014 za više informacija). Frekvencija snimanja zapisa sile iznosila je 1000 Hz, dok je signal bio filtriran niskopropusnim Batervortovim filterom (frekvencija odsecanja signala iznosila 10 Hz). Za analizu testa VS posmatrana je samo koncentrična faza (Linthorne, 2001). Uz pomoć datog programa dobijene su varijable srednje i maksimalne vrednosti sile i brzine. Linearnom regresijom je dalje određen parametar maksimalne sile (F_0) koji predstavlja presek regresione prave i y-ose.

Za dobijanje podataka kod testa BT korišćen je već postojeći softver (Monark anaerobic test software) koji je automatski računao snagu koju ispitanik ostvaruje okretanjem pedala tokom svake sekunde. Dobijena maksimalna sila je linearno transformisana da bi podaci bili uporedivi sa testom VS. Parametri maksimalne sile kod BT su takođe dobijeni linearnom regresijom.

Pre primene statističkih procedura testirana je normalnost distribucije Kolmogorov-Smirnov testom, čime je ona i potvrđena. U okviru deskriptivne statistike za sve varijable izračunata je srednja vrednost, standardna devijacija, kojeficijent varijacije i minimalne i maksimalne vrednosti. Za ispitivanje obe hipoteze, povezanosti pomenutih varijabli, primenjena je Pirsonova korelacija. Kao nivo statističke značajnosti bilo je određeno $p < 0.05$. Svi statistički testovi bili su izvršeni korišćenjem programa SPSS 19.0 (SPSS Inc, Chicago, Il, USA).

REZULTATI

Na Slici 2, dat je prikaz relacije sila-brzina za testove vertikalni skok sa počučnjem i kratki anaerobni Vingejt test na reprezentativnom ispitaniku. Regresiona prava je dobijena na osnovu pet različitih nivoa opterećenja i posebno prikazana za srednje (SV) i maksimalne vrednosti (MAX) dobijenih varijabli sile i brzine. Koeficijent korelacije dobijen iz linearne regresije kod oba testa na slici 2 na reprezentativnom ispitaniku bio je izrazito visok ($r > 0.964$). Pored linearnog modela, na slici je dat prikaz i polinomijalnog modela. Srednja vrednost koeficijent korelacije za sve ispitanike kod testa BT bila je izuzetno visoka, iznosila je 0.992 (i za srednje i maksimalne vrednosti). Kod VS koeficijent korelacije je bio takođe visok, ali nešto manji nego kod BT (SV $r = 0.943$, MAX $r = 0.932$).



Slika 2. F-V relacija kod testa vertikalni skok sa počučnjem (levi panel) i kratkog Vingejt testa na bicikli ergometru (desni panel) na reprezentativnom ispitaniku. Dat je zajednički prikaz linearnog (puna linija) i polinomijalnog modela (isprekidana linija) sa koeficijentom korelacije (r). Srednje vrednosti (SV) prikazane su punim kvadratićem, dok su maksimalne (MAX) prikazane praznim kvadratićem.

U tabeli 1. prikazane su srednje vrednosti, standardne devijacije, koeficijenti varijacije kao i opseg parametara maksimalne sile i MVC kod testova za donje ekstremitete. Iz prikazane tabele može se uočiti da je parametar maksimalne sile kod VS veći od parametara dobijenog kod BT, kako kod srednjih, tako i kod maksimalnih vrednosti. Koeficijent varijacije je takođe veći kod VS (SV = 22.1%; MAX = 26.3%) u odnosu na BT (SV = 19.1%; MAX = 16.5%) i MVC (19.1%).

Tabela 1. Deskriptivna statistika za parametare maksimalne sile i maksimalnu silu dobijenu direktnim merenjem

Varijable	MVC (N)	F_0 VS $_{SV}$ (N)	F_0 VS $_{MAX}$ (N)	F_0 BT $_{SV}$ (N)	F_0 BT $_{MAX}$ (N)
SV±SD	927±177	2963±655	3906±1027	1033±222	928±153
CV%	19.1	22.1	26.3	21.5	16.5
Min-Max	648 -1369	2171 - 4114	2812 - 5768	724 -1506	679 - 1238

Legenda: MVC - maksimalna sila dobijena maksimalnom voljnom kontrakcijom, F_0 VS –parametar maksimalne sile kod vertikalnih skokova sa počučnjem, F_0 BT- parametar maksimalne sile kod kratkog Vingejt testa, SD - standardna devijacija, CV - koeficijent varijacije, SV - srednje vrednosti, MAX - maksimalne vrednosti.

U Tabeli 2 prikazane su korelacije između parametara maksimalne sile dobijenim iz F-V relacije i maksimalne sile dobijene direktnim merenjem. Iz date tabele se može videti da su korelacije umerene do visoke i značajne (Cohen, 1988). Koeficijent korelacije između F_0 kod VS i MVC za srednje vrednosti iznosio je 0.611, dok je za maksimalne vrednosti povezanost bila veća, r = 0.685. Najveći koeficijent korelacije zabeležen je između F_0 BT i MVC (SV r = 0.851; MAX r = 0.861). Koeficijent korelacije između F_0 kod VS i BT za srednje vrednosti iznosio je 0.593, dok je za maksimalne vrednosti povezanost bila veća, r = 0.742

Tabela 2. Korelacije parametara maksimalne sile i maksimalne sile dobijene direktnim merenjem

Varijable	MVC	F_0 BT $_{SV}$	F_0 BT $_{MAX}$	F_0 VS $_{SV}$	F_0 VS $_{MAX}$
MVC	1				
F_0 BT $_S$V	0.851**	1			
F_0 BT $_{MAX}$	0.861**	0.987**	1		
F_0 VS $_{SV}$	0.611*	0.593*	0.621*	1	
F_0 VS $_{MAX}$	0.685*	0.727**	0.742**	0.936**	1

Legenda: MVC –maksimalna sila dobijena maksimalnom voljnom kontrakcijom, F_0 VS - parametar maksimalne sile kod vertikalnih skokova sa počučnjem, F_0 BT – parametar maksimalne sile kod kratkog Vingejt testa, SV- srednje vrednosti, MAX - maksimalne vrednosti, * $p < 0.05$; **$p < 0.01$.

Povezanost F_0 između srednjih i maksimalnih vrednosti kod testa VS bila je visoka i iznosila je r = 0.936, dok je kod BT bila nešto veća r = 0.987.

DISKUSIJA

Dobijeni nalazi ovog istraživanja delimično su potvrdili obe hipoteze. Poveznost parametra maksimalne sile dobijenih iz F-V relacije i maksimalne sile procenjene direktnim merenjem bila je umerena do visoka i značajna. Takođe, umereno do visoka korelacija je zabeležena i između parametara maksimalne sile različitih testova (VS i BT) za donje ekstremitete.

Rezultati ovog istraživanja ukazuju na jaku i visoku linearnost kod testova VS i BT. Ovakvi nalazi su u skladu sa prethodnim istraživanjima koja su takođe pokazala linearnu vezu između sile

i brzine kod kratkog Vingejt testa (Jaskolska et al., 1999; Driss et al. 2002) i vertikalnog skoka sa počučnjem (Cuk et al,. 2014). Dobijeni rezultati su kod BT pokazali veći koeficijent korelacije koji opisuje linearnost veze, kao i manji koeficijent varijacije u odnosu na VS. Ovakvi nalazi ukazuju da je test vertikalni skok sa počučnjem varijabilniji u odnosu na kratki anaerobni Vingejt test, a jedan od mogućih razloga je veći broj stepeni slobode koji karakteriše izvođenje datog skoka.

Glavni nalazi ove studije odnose se na konkurentnu validnost parametara maksimalne sile dobijene iz F-V relacije i maksimalne sile dobijene direktnim merenjem. Rezultati koji se tiču povezanosti F_0 i MVC su u skladu sa prethodnim studijama kod BT (Driss et al., 2002) i VS (Cuk et al., 2014). U studiji Cuka i saradnika (2014) dobijena je veća povezanost parametra maksimalne sile kod testa vertikalni skok iz počučnja sa MVC, ali je pokazano i da VS daje jaču linearnu F-V relaciju, a ujedno je prirodniji i lakši za izvođenje. Međutim, nalazi dobijeni u ovoj studiji pokazuju da parametri maksimalne sile kod BT više koreliraju sa MVC ($r > 0.851$) nego F_0 sa VS. Mogući uzrok niže povezanosti kod VS može se objasniti time što je MVC zabeležena samo kod kvadricepsa jedne noge, a kod izvođenja vertikalnog skoka uključuje se veći broj mišića (nogu i trupa) i zglobova. Takođe, jedan od razloga može biti i dubina spuštanja tokom izvođenja skoka, koja utiče na silu reakcije podloge kod skokova sa opterećenjem (Samozino et al. 2012; Markovic et al. 2013). Rezultati ove studije su pokazali umereno do visoku povezanost između parametara maksimalne sile kod testova VS i BT. Parametar maksimalne sile dobijen iz F-V relacije moguće je validno proceniti upotrebom jednog od ova dva funkcionalna testa.

U ovoj studiji posebno su posmatrane srednje i maksimalne vrednosti parametra maksimalne sile. Pokazane visoke i značajne korelacije sugerišu da se u daljim istraživanjima mogu primenjivati bilo koje od ovih vrednosti (SV ili MAX).

ZAKLJUČAK

Nalazi ovog istraživanja su pokazali da kod vertikalnih skokova sa počučnjem i kratkog Vingejt testa postoji jaka linearna veza između sile i brzine. Na osnovu visoke linearnosti određeni su parametri maksimalne sile za oba testa, čija je povezanost dalje posmatrana sa direktno merenom maksimalnom silom. Dobijeni rezultati su pokazali umereno do visoku, značajnu korelaciju između parametara maksimalne sile kod oba testa i MVC merene direktnim putem. Na osnovu ovih nalaza može se konstatovati da F_0 dobijena iz relacije sila-brzina kod funkcionalnih testova VS i BT može u određenoj meri zameniti maksimalnu silu izmerenu direktnim putem kod jednozglobnih pokreta. Ovi nalazi su od značaja jer su navedeni testovi jednostavniji za izvođenje, ekonomičniji i približniji svakodnevnim kretanjima i sportskim aktivnostima za razliku od jednozglobnih testova.

Takođe, umereno do visoka korelacija zabeležena je i između samih parametara maksimalne sile kod dva različita testa za donje ekstremitete. Na osnovu ovih rezultata može se konstatovati da se parametri maksimalne sile kod donjih ekstremiteta mogu procenjivati validno uz pomoć oba testa VS i BT. Zbog jače linearne veze između sile i brzine, manje varijabilnosti parametara maksimalne sile i većih korelacija F_0 sa MVC, za dalja rutinska testiranja može se preporučiti kratki anaerobni Vingejt test.

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THE FORCE-VELOCITY RELATIONSHIP IN ROUTINE TESTING OF LEG MUSCLES: EVALUATION OF MAXIMUM FORCE PARAMETERS

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INTRODUCTION

The muscular force can be estimated directly or indirectly. Tests based on an indirect estimation or so called functional tests are closer to natural movements, simpler and more economical to perform, wherefore their use is of a great importance. However, in practice, during the testing of specific muscle group often is only one load of magnitude used. Such testing cannot provide a complete picture of mechanical properties of muscles. By applying different external loads range of force and velocity can be obtained, which allows the use of linear regression model

$$F(V) = F_0 - aV,$$

where F_0 is a parameter of maximum force, a slope that represents the quotient of F_0/V_0, while V_0 is the parameter of maximum velocity. With force-velocity relationship (F-V) we can also determine the parameter of maximum power (P_{max}). This linear model gives four dependent parameters F_0, V_0, a, and P_{max}. Thus indirectly more complete knowledge of the mechanical properties of the muscle could be acquired.

In the very beginning of studying the mechanical properties of muscle it has been shown that the force-velocity relationship for a single-joint movement had a hyperbolic shape (Hill, 1938). Nevertheless, everyday human movements are mostly based on the multijoint movements, where different shape is obtained, linear relation between force and velocity. Strong linear relationship between the force and velocity was shown in the upper (Nikolaidis, 2012; Sreckovic et al., 2015) and lower extremities. The linear F-V relationship is shown for the following functional tests: tests on a bicycle ergometer (Driss et al. 2002; Driss and Vandewalle 2013), different types of vertical jumps (Sheppard, 2008; Cuk et al., 2014), running (Jaskólski et al., 1999) leg press in isometric and isokinetic conditions (Yamauchi et al., 2009; Samozino et al., 2012; Samozino et al., 2014). This linearity shown in the texts above allows parameters obtained from F-V relationship to be applied in routine testing. However, these parameters must first be evaluated, and one of the ways is to determine their concurrent validity. In this way, functional tests based on F-V relation could be validly used in assessment of the mechanical properties of muscles. Studies that examined the concurrent validity of parameters obtained from F-V relationship have shown inconsistent findings (Jaric, 2015). The correlation of parameters of maximum force (F_0) with directly measured force in researches ranged from moderate to high (Cuk et al., 2014; Driss et al., 2002; Vandewalle et al., 1987), while in some researches was low or even did not exist (Rahmani et al., 2001; Yamauchi and Ishii, 2007). Concurrent validity for parameters V_0 was low, while for parameters P_{max} was high (Cuk et al., 2014). In contrast to these studies authors Ravier et al. (2004) have shown that the parameters V_0 and P_{max} have greater concurrent validity than the F_0.

Because of inconsistencies of previous research, the aim of this study was to examine the correlation of parameters of maximum force obtained from F-V relationship with directly measured maximum force during maximum voluntary contraction in tests for the lower extremities. It is assumed that the correlation between parameters of maximum force and directly measured maximum force will be high, as well as between the parameters of maximum force within two different tests (short Wingate test and countermovement jump).

METHOD

The sample consisted of 12 healthy male participants (age 22.1 ± 3.4; body height 184.1 cm ± 7.1; body mass 80.8 ± 8.2; data shown as mean ± SD). Their body mass index was 24.5 ± 1.5 cm/kg2, and percentage of body fat 11.2 ± 2.8 %. Their physical activity level was assessed via IPAQ questionnaire (Taylor –Piliae et al., 2006) whereas 4 participants reported high level of physical activity, 5 of them moderate level and remaining 3 low level of physical activity. None of the participants reported any medical problems or recent injuries. They were informed regarding the potential risks associated with the applied testing protocol. All participants gave written informed consent to the experiments, which was in accordance with the Declaration of Helsinki and approved by Institutional Review Board.

Body height was assessed by a standard anthropometer by Martin, and for assessment of body mass and body composition bioelectric impedance method was used (In Body 720; USA).

The maximum force in the knee extensor under isometric conditions was directly measured on the isokinetic dynamometer (Kin Com, Chatex Corp., Chattanooga, TN). The testing was performed on the dominant leg, which is determined based on the knowledge of which foot participants used in football for kicking a ball.

The warm up lasted 5 min and it was realized on stationary bicycle, after which participants did the passive stretching exercises of the lower limbs. Participants performed two attempts, and were strongly verbally supported during each attempt. They were instructed to develop maximum force for the shortest possible time and to maintain it 3 to 4s. Pause between attempts lasted 1 min (Knezevic et al., 2012).

Participants were performing countermovement jumps (CMJ) wearing a weighted west and belt (MiR Vest Inc; USA). The applied external loading for CMJ started with body weight jumps, followed by 8, 16, 24 and 32 kg jumps. In total participants performed 10 jumps (5 loads x 2 trials). Jumps were performed on a force plate (AMTI, BP600400; USA), mounted and calibrated according to the manufacturer's specifications. Participants were instructed to perform an unconstrained maximum vertical jump from a standing upright position without arm swing (arms on the hips). No specific instructions were given regarding the depth of the counter movement. Rest period between consecutive jumps was 1 minute and between 2-3 minutes among different loading magnitudes (Markovic et al., 2013).

The short anaerobic Wingate test (CYCLING) consisted entirely of testing the maximum power output through the 6-s maximum cycling sprint (Mendez-Villanueva et al. 2007; Pazin et al., 2011) performed on a Monark 834E leg cycle ergometer (Monark, Varberg, Sweden). Participants performed 5 sprints with external loading starting form 2 kg up to 10 kg (5 loads x 1 trial). The rest period among consecutive sprints was 4 min (Pazin et al., 2011). Participants were instructed to perform an "all out" effort from the very beginning of the test until instructed to stop and to remain seated during the entire sprint. The height of the seated position was optimal for every participant. The Figure 1 presents the applied tests, countermovement jump and short Wingate anaerobic test.

Figure 1.The loaded countermovement jump and short anaerobic Wingate test.

In total, each participant completed 4 sessions, separated by a rest period of 5-7 days (Cuk et al., 2014). The first testing session consisted of anthropometric measurements, followed by familiarization of the tests. The remaining three sessions were used for collecting of the data. Note that order of the tests was randomized for each participant. Each training session lasted about an hour. Prior to every test, standard warm up procedures were conducted and they lasted 10 min.

For data acquisition and processing from an isokinetic dynamometer as well as for visual feedback we used a program that is written in LabView program (National Instruments 2013; USA). For further analysis we used a better attempt, the one with greater force realized during maximum voluntary contraction (MVC).

For the analysis of data obtained from the CMJ test we used software written in LabView program (see Cuk et al., for more information). The signal was sampled at 1000 Hz and low-pass filtered (a second-order recursive Butter-worth at a cut-off frequency of 10 Hz). For the analysis of CMJ it was observed only concentric phase (Linthorne, 2001). With the custome-made softwer average and maximum force and velocity variables were obtained. The parameter of maximum force (F_0) for every participant is further obtained from linear regression analysis and represents the cross-section of regression line and the y-axis.

To obtain data from CYCLING test we used already existing software (Monark Anaerobic Test Software), which automatically calculated power of the pedals during every second separately for each participant. The resulting maximum force from CYCLING is transformed linearly to make the data comparable with CMJ test. The parameters of maximum force from CYCLING test were also obtained from linear regression.

Before applying statistical procedures the normality of distribution was tested with Kolmogorov-Smirnov test, which was confirmed. Within the descriptive statistics for all variables mean value, standard deviation, the coefficient of variation and the minimum and maximum range were calculated. For testing the both hypotheses, Pearson correlation was applied. The level of statistical significance was $p < 0.05$, and all statistical tests were performed using SPSS 19.0 (SPSS Inc, Chicago, IL, USA).

RESULTS

Figure 2 depicts the force-velocity relationship for applied tests: CMJ and CYCLING on a representative participant. Regression line is obtained on the basis of five different load magnitudes and separately shown for the average (AVG) and maximum value (MAX) of force and velocity. Correlation coefficient of linear regression in both tests was very high ($r > 0.964$). On figure 2 beside linear model, polynomial model for representative participant was also presented. Average value of correlation coefficient was very high for CYCLING test r = 0.992 (for bout AVG i MAX values). Test CMJ also had high correlation coefficient, but it was lower than CYCLING coefficient (AVG r = 0.943, MAX r = 932).

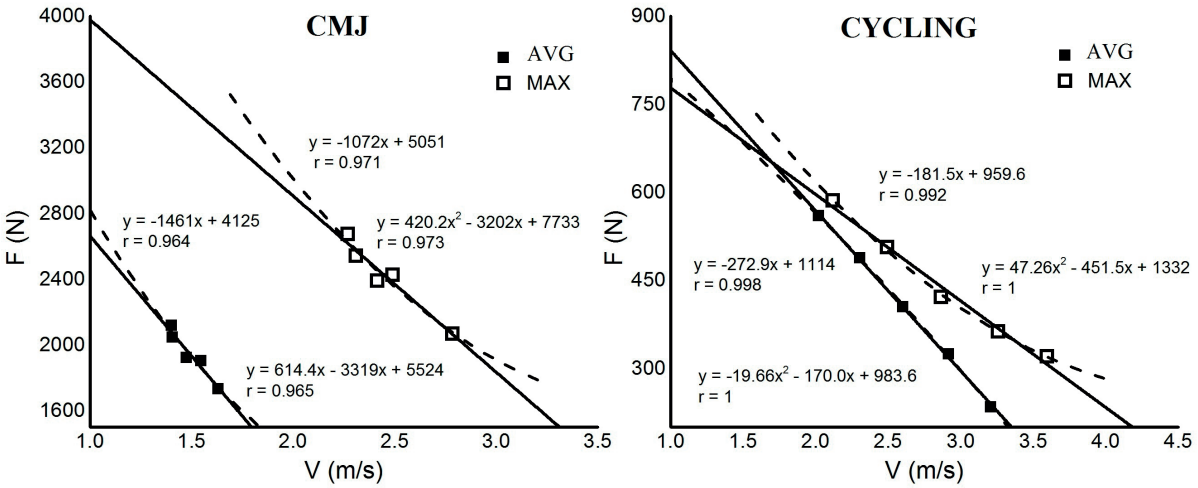

Figure 2.F-V relationship for a loaded countermovement jump (left panel) and a short Wingate test (right panel) for the representative participant. This figure depicts the linear regression model (solid line) and the polynomial model (dashed line) with a correlation coefficient (r). Average values (AVG) are presented with filled squares, while the maximum (MAX) are showed as an empty square.

Table 1 shows the mean value, standard deviation, coefficient of variation and the range of parameters maximum force and MVC in tests for the lower extremities. From the table it can be seen that the parameters of maximum force in CMJ are greater than parameters obtained in CYCLING, both as average and maximum values. The coefficient of variation is also greater in CMJ (AVG = 22.1%; MAX = 26.3%) compared to CYCLING (AVG = 19.1%; MAX = 16.5%) and MVC (19.1%).

Table 1.Descriptive statistics for the parameter of maximum force and maximum force obtained by direct measurement

Variable	MVC (N)	F_0 CMJ $_{AVG}$ (N)	F_0 CMJ $_{MAX}$ (N)	F_0 CYCLING $_{AVG}$ (N)	F_0 CYCLING $_{MAX}$ (N)
Mean±SD	927±177	2963±655	3906±1027	1033±222	928±153
CV%	19.1	22.1	26.3	21.5	16.5
Min-Max	648 -1369	2171 - 4114	2812 - 5768	724 -1506	679 – 1238

Legend: MVC – maximum voluntary contraction, F_0 CMJ –parameter of maximum force for CMJ, F_0 CYCLING- parameter of maximum force for CYCLING, SD – standard deviation, CV – coefficient of variation, AVG –average values, MAX – maximum values.

Table 2 shows the correlation between parameters of maximum force obtained from F-V relations and maximum force obtained by direct measurement. From this table we can see that all correlation are high and significant (Cohen, 1988The correlation coefficient between parameters of maximum force in CMJ and MVC for the average values was 0.611, while for the maximum values was also higher, r = 0.685. The highest correlation was noted between F_0 CYCLING and MVC (AVG r = 0.851; MAX r = 0.861).). The correlation coefficient between parameters of maximum force CMJ and CYCLING for the average values was 0.593, while for the maximum values was higher, r = 0.742.

Table 2.Correlations of parameters of maximum force and maximum force obtained by direct measurement

Variable	MVC	F_0 CYCLING $_{AVG}$	F_0 CYCLING $_{MAX}$	F_0 CMJ $_{AVG}$	F_0 CMJ $_{MAX}$
MVC	1				
F_0 CYCLING $_{AV}$G	0.851**	1			
F_0 CYCLING $_{MAX}$	0.861**	0.987**	1		
F_0 CMJ $_{AVG}$	0.611*	0.593*	0.621*	1	
F_0 CMJ $_{MAX}$	0.685*	0.727**	0.742**	0.936**	1

Legend: MVC – maximum voluntary contraction, F_0 CMJ –parameter of maximum force for CMJ, F_0 CYCLING - parameter of maximum force for CYCLING, AVG –average values, MAX – maximum values, * $p < 0.05$; **$p < 0.01$.

The correlation coefficient for F_0 in test CMJ between maximum and average values was high, and it was r = 0.936, while for the CYCLING test was slightly higher r = 0.987.

DISCUSSION

The findings of this research have partially confirmed both hypotheses. The correlation between parameters of maximum force obtained from F-V relationship and maximum force estimated by direct measurement was moderate to high and significant. Also, moderate to high correlation was observed between the parameters of maximum force among different tests (CMJ and CYCLING) for the lower extremities.

Results of this research indicate a relatively strong linear F-V relationship within CMJ and CYCLING tests. These findings are in accordance with previous studies which also showed a linear relationship between the force and velocity at short Wingate test (Jaskólski et al., 1999; Driss et al. 2002) and loaded countermovement jumps (Cuk et al,. 2014). The results showed higher correlation coefficient in CYCLING test (which describes stronger linear F-V relationship) and lower coefficient of variation than CMJ. These findings indicate that the CMJ test is more variable then short Wingate anaerobic test, and one of the possible reasons for that is higher number of degrees of freedom that characterizes countermovement jump.

The main findings of this study are related to concurrent validity of parameters of maximum force obtained from F-V relationship and maximum force measured directly. Correlation between F_0 and MVC was moderate to high at CYCLING and CMJ test, which is in accordance with previous studies (Driss et al., 2002; Cuk et al., 2014).

Results of the study Cuka et al (2014) showed greater correlation of parameters of maximum force in squat jump test with MVC, but it has been shown that test countermovement jump provides a stronger linear F-V relationship, and it is more natural and easier to perform. Nevertheless, the results in our study show that the parameters of maximum force at test CYCLING more correlated with MVC ($p > 0.851$) than F_0 of test CMJ.

The possible causes of lower correlation within test CMJ can be explained with MVC. This directly measured force was recorded only in the quadriceps of one leg, and countermovement jump involves a greater number of muscles (legs and trunk) and joints. Also, one of the reasons may be the depth of countermovement jumps during the execution of jumps with load, which affects the ground reaction force (Samozino et al. 2012; Markovic et al. 2013).

The results of this study showed moderate to high and significant correlation between the parameters of maximum force with two different tests of lower extremities (CMJ and CYCLING). This indicates that parameters of maximum force obtained from F-V relations can be validly assessed using one of these two functional tests.

In this study, average and maximum values of parameters of maximum force were observed separately. Namely, the results showed high and significant correlation for both variables so in further research any of these two could be used (AVG or MAX).

CONCLUSION

The findings of this study showed strong linear relationship between force and velocity for the CMJ and CYCLING tests. Based on this strong linearity, parameters of maximum force for both tests were obtained which are than correlated with directly measured maximum force. The results showed moderate to high correlation between the parameters of maximum force and MVC measured directly. On such outcome, it can be concluded that F_0 obtained from the force-velocity relation in functional tests (CMJ and CYCLING) can to some extent replace the maximum force measured directly in single-joint movement. These findings are important because mentioned functional tests are easier to perform, more economical and closer to everyday and sports activities, as opposed to single-joints tests.

The moderate to high correlations were also observed between parameters of maximum force within two different tests for the lower extremities. Based on these results it can be concluded that the parameters of maximum force in the lower extremities can by validly assessed with these tests. For future routine testing we recommend short Wingate anaerobic test because of the stronger linear relationship between force and velocity, less variable parameters of maximum force and higher correlation of F_0 with the MVC.

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ZASTUPLJENOST DEFORMITETA RAVNOG STOPALA KOD DECE OD 6 DO 14 GODINA U SRBIJI: SISTEMSKO PREGLEDNO ISTRAŽIVANJE

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UVOD

Rastom životnog standarda i tehničkih dostignuća dolazi do smanjenja fizičkih aktivnosti savremenog čoveka od rođenja pa do pozne starosti. Fizička neaktivnost dovodi do hipotrofije muskulature, smanjenog tonusa mišića što sve pogoduje, uz nepravilno držanje tela pri hodu, razvoju posturalnih telesnih deformiteta.

Najbitniju ulogu u formiranju i održavanju pravilnog držanja tela ima mišići sistem, kao deo sistema aktivnog aparata za kretanje. Slabost pojedinih mišićnih grupa, njihovo preveliko i jednostrano opterećenje, može da izazove pojavu različitih poremećaja. U slučaju nesrazmere između aktivne snage stopala i sile opterećenja dolazi do poremećaja normalnog izgleda stopala kao i njegove statike (D'Amico 2001; Mickle , Steele, Munro, 2008; Rose, Welton, Marshall, 1985). Prvo popušta snaga mišića, zatim se istežu ligamenti i na kraju dolazi do promena oblika kostura stopala. Ovakvi poremećaju manifestuju se spuštanjem svodova stopala i pojavom ravnih stopala (pedes plani) (Pfeiffer et al. 2006).

Prvu fazu spuštanja uzdužnog svoda (pes valgus) predstavlja kalkaneus koji zauzima valgus položaj. Ako se ova faza ne zaustavi dolazi do spuštanja čunaste kosti (os naviculare) i kockaste kosti (os cuboideum) i dolazi do spuštanja uzdužnog i poprečnog svoda i nastaje druga faza spuštanja (pes plano-valgus). Uporedo sa promenama na uzdužnom i poprešnom svodu dolazi do udaljavanja glavica metatarzalnih kostiju i njihovog spuštanja što predstavlja treću fazu spuštenosti stopala (pes transverso-planus) (Otman, Kose & Yakut, 2005).

Zbog plastičnosti i senzitivnosti dečijeg organizma, formiranje pravilnog posturalnog statusa je od posebnog značaja u predškolskom i školskom periodu. Prvi korak na putu ka ostvarivanju takvog cilja predstavlja pregled i procena razvoja deformiteta.

Cilj ovog naučnog rada je utvrditi zastupljenost deformiteta ravnog stopala kod dece od 6 do 14 godina u Srbiji.

METOD

Za prikupljanje dosadašnjih naučnih radova o zastupljenosti deformiteta ravnog stopala kod dece uzrasta od 6 do 14 godina bile su pretražene sledeće elektronske baze podataka: PubMed, PEDro, SCIndeks, DOAJ. Pretraživani su bili naučni radovi u vremenskom periodu od 2005. do 2015. godine. Prilikom pretraživanja baza podataka smo koristili sledeće ključne reči: sex, children, deformity, flat feet. Pronađeni naslovi naučnih radova, abstrakti i celi tekstovi su zatim bili čitani i analizirani. Da bi naučni rad bio prihvaćen za konačnu analizu morali smo da zadovoljimo dva kriterijuma: da u naučnom radu postoje ispitanici kojima je vršena procena deformiteta ravnog stopala na teritoriji Republike Srbije i da su ispitanici starosti od 6 do 14 godina. Naučni radovi koji su zadovoljili postavljene kriterijume su zatim analizirani i predstavljeni na osnovu sledećih parametara (Tabela 1): referenca (prvo slovo autora i godina objavljivanja naučnog rada), uzorak ispitanika (starost, ukupan broj i podgrupe ispitanika), metoda merenja i rezultati naučnog rada.

REZULTATI

Postupak prikupljanja naučnih radova

Postupak prikupljanja, analize i eliminacije nađenih naučnih radova je prikazan u Prikazu 1. Na osnovu ključnih reči je indetifikovano 375 radova. Broj istraživanja koja su odmah isključena na osnovu naslova, dupliranih naučnih radova, kao i naučnih radova koji su isključeni na osnovu perioda kada su izdati (stariji od 2005. godine) je 357, dok je 18 radova uključeno u dalju analizu. Daljom analizom 18 radova, isključeno je 8 radova na osnovu više kriterijuma: abstrakta, jer se radilo o sistematskim preglednim istraživanjima, kao i neadekvatan uzrast osoba koje su učestvovale u istraživanjima (mlađi od 6 i starije od 14 godina).

Preostalih 10 naučnih radova zadovoljilo je postavljene kriterijume. a to su: naučni radovi izdavani u vremenskom periodu od 2005. do 2015. godine, da u istraživanju učestvuju osobe, kojima je vršena procena deformiteta ravnog stopala uzrasta od 6 do 14 godina.

Prikaz 1. Postupak prikupljanja, analize i eliminacije nađenih naučnih radova.

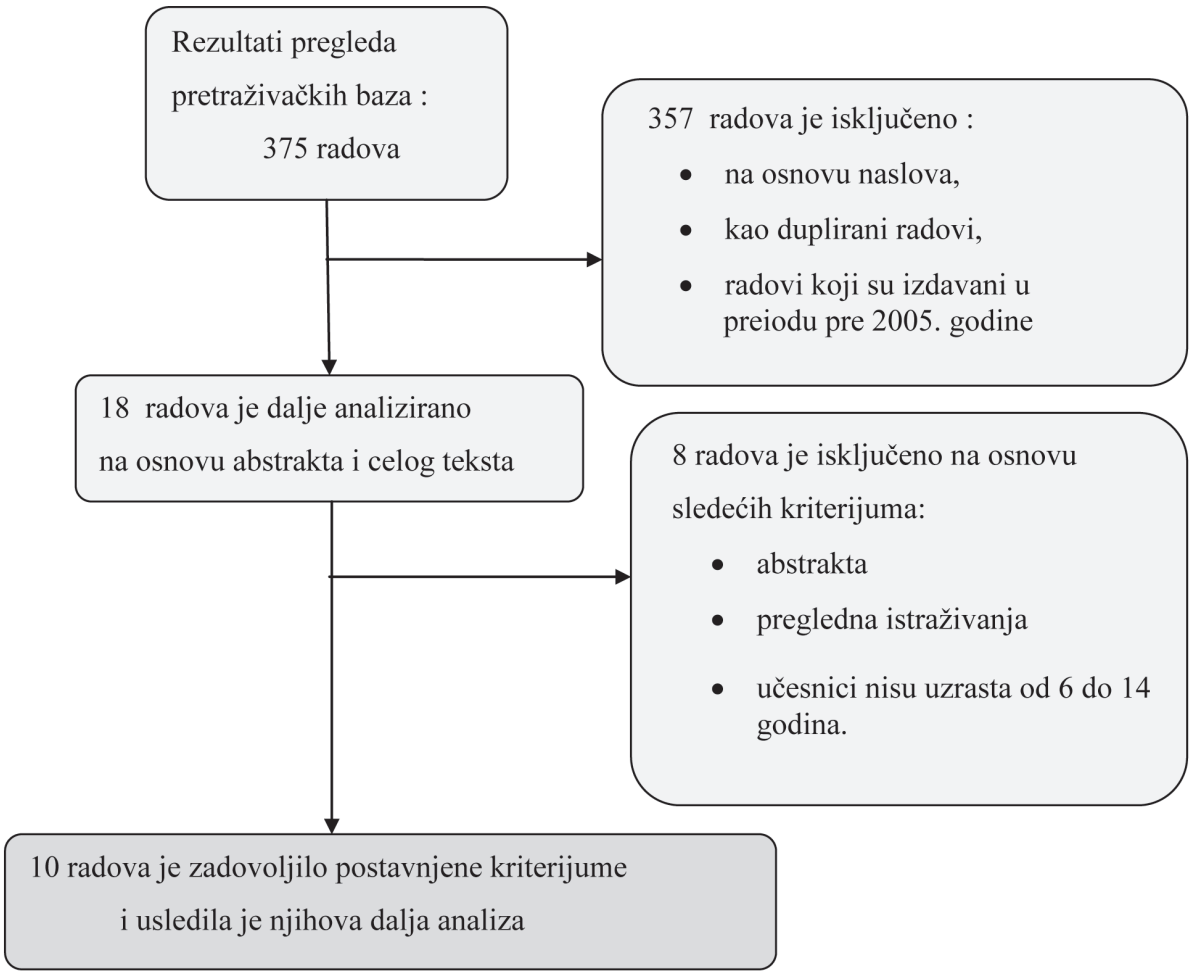

Tabela 1. Prikaz radova koji ukazuju na nivo zastupljenosti deformiteta rasvnog stopala kod dece uzrasta od 6 do 14 godina.

Reference	Uzrast	Broj ispitanika	Metoda merenja	Rezultati istraživanja
Milošević Zoran i sar. (2008).	7god.	377 ispitanika (193 devojčica i 184 dečaka)	Napoleon Volanski	I-stepen 58,31% II-stepen 10,03% Razlika između polova p=0.000
Đokić Zoran, Stojanović Marija (2010).	9-12 god.	1523 ispitanika (775 dečaka i 748 devojčica)	Čižinov metod uz pomoć plantografije	Deformitet stopala bio je 26,6% kod dece oba pola. Razlika između plolova p=0.000
Bogdanović, Z., Marković , Ž.(2010).	6-15 god.	651 ispitanik (310 devojčica i 341 dečak)	Thomsenovom metodom uz pomoć plantografije	I-stepen 51,77%, II-stepen 17,36%, III-stepen 0,15% Razlika između polova p=0.000
Đokić Z., i sar. (2011).	9-12 god.	810 ispitanika (404 dečaka i 406 devojčica)	Čižinov metod uz pomoć plantografije	Dečaci Devojčice Dečaci Devojčice 3 razred 3 razred 6 razred 6 razred 35.70% 24.40% 43.40% 29.90%
Puzović, V., i sar. (2010).	7-11 god.	232 (126 dečaka i 106 devojčica)	Metodom insprekcije	Bez deformiteta ravnog stopala 49 dece (21,2%) i 183 deteta sa deformitetom ravnog stopala (78,9%)
Stefan B. Simov, i sar. (2011).	6-7 god.	968 ispitanika	Pedoskop (četiri nivoa razvijenosti deformiteta)	Ispitanici sa deformitetom stopala su zastupljni u procentu 30,78.(I-17.66; II-8.37; III-3.92; IV-0.83)
Slobodan Pavlović (2012).	6 god.	638 ispitanika	Thomsenovom metodom uz pomoć plantografije	Deformitet stopala bio je 26,01% kod dece oba pola. Razlika između plolova p=0.000 (104-dečaka i 62-devojčice)
Branka Protić-Gava i sar. (2013).	8,52 god.	63 ispitanika	Napoleon Volanski	0-21.3%; I-stepen 59%; II-stepen 19,7%.
Stanišić, I., i sar. (2014).	6 god.	60 ispitanika (39 devojčica i 21 dečak)	Thomsenovom metodom uz pomoć plantografije	19,1% dečaka i 15,4% devojčica ima odstupanja koja se tretiraju kao funkcionalni stadijum deformiteta ravno stopalo.
Romanov, R., i sar. (2014).	6-7 god.	423 ispitanika (213 dečaka i 210 devojčica)	Metodom ruskih autora uz pomoć podografa	Spušteno stopalo I stepena zastupljeno je sa 43,23%, spuštenost stopala II stepena zastupljeno je sa 16,66%,

DISKUSIJA

Tabela 1. sadrži prikaz naučnih radova koji se bave utvrđivanjem zastupljenosti stanja deformiteta ravnog stopala kod osoba uzrasta od 6 do 14 godina starosti na prostoru Republike Srbije. Analizom tabele uočava se da su radovi predstavljeni i analizirani kroz pet grupa parametara: referenca, uzrast ispitanika, broja ispitanika i grupe ispitanika, metode i instrumenti merenja i rezultati merenja. Učesnici su bili starosti od 6 godine (Simov i sar., 2011; Pavlović, 2012; Stanišić i sar., 2014; Romanov i sar., 2014) do 14 godina (Bogdanović & Marković, 2010). Ukupan broj ispitnika oba pola obuhvaćen u radovima koji su predtavljeni je 5015, najmanje ispitanika, 60 ispitaniaka, bilo je u radu (Stanišić i sar., 2014) dok je najveći broj 1523 ispitanika bio u istraživanju sprovedenom od strane (Đokić & Stojanović, 2010). Dijagnostikovanje deformiteta ravno stopalo vršilo se uz pomoć

plantogrma (Đokić & Stojanović, 2010; Bogdanović & Marković, 2010; Đokić i sar., 2011; Pavlović, 2012; Stanišić i sar., 2014), pedoskopa (Simov i sar., 2011) i insprekcije (Puzović i sar., 2010) koji su tumačeni Tomsonovom metodom (Bogdanović & Marković, 2010; Pavlović, 2012; Stanišić i sar., 2014), metodom Napoleona Volanskog (Milošević i sar., 2008; Protić i sar., 2013), Čižinovom metodom (Đokić & Stojanović, 2010; Đokić i sar., 2011) i metodom Ruskih autora (Romanov i sar., 2014). Ukupan broj izmerenih ispitanika je 5015, od ovog broja ispitanika kod 2355 ispitanika je utvrđen deformitet ravno stopalo što predstavlja 46,95%. Što ukazuje da skoro svako drugo dete u Republici Srbiji u starosnoj dobi od 6 do 14 godina ima zastupljen deformitet ravno stopalo. Najveći broj dece u svakom od obuhvaćenih naučnih radova koje je imalo dijagnostikovan deformitet ravn stopalo imalo zastupljen prvi nivo deformiteta (taj ptocenenat je u zavisnosti od rada u rasponu od 17.66% do 59%) dok je drugi nivo ovog deformiteta bio jako malo zastupljen (taj ptocenenat je u zavisnosti od rada u rasponu od 8.37% do 19.7%). Na osnovu rezultata, može se predložiti plantograf i pedoskop kao sredstvo za procenu deformiteta ravno stopalo, kao i Tomsonov, Čižinov i metod Napoleona Volanskog za obradu dobijenih rezultata.

ZAKLJUČAK

Obim pregledanih naučnih radova ukazuje alarmantanost informacija proisteklih iz naučnih radova koja su se bavila procenom telesnog deformiteta ravno stopalo na teritoriji Republike Srbije kod dece uzrasta 6 do 14 godina.

Broj populacije sa deformisanim stopalima, a naročito osnovno školski uzrast je veliki. Zbog toga je sve veća potreba za pravovremenom preventivom i sanacijom takvih pojava. Posebnu ulogu u prevenciji imaju nastavnici i profesori sporta i fizičkog vaspitanja i zdravstvene kulture koji su profesionalno u kontaktu sa decom, kao i roditelji koji trebaju brinuti o zdravlju svoje dece. Prepoznavanje deformiteta u što ranijoj fazi nastanka, pravilan izbor vežbi za korekciju istih, fizička aktivnost, pravilna obuća, smanjenje pretilosti kod dece samo su neki od rešenja koja se mofu sprovoditi u cilju smanjenja deformiteta prikazanog i opisanog u ovom naučnom radu.

Zdravo i jako stopalo u detinjstvu neminovno vodi zdravom i sretnijem životu u kasnijoj dobi i zato posvetimo više pažnje ovom, često zanemarenom delu našeg tela.

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THE INCIDENCE OF PES PLANUS IN CHILDREN AGED 6-14 YEARS IN SERBIA: A SYSTEMATIC REVIEW STUDY

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INTRODUCTION

In parallel with the improvements in the standard of living and technological achievement, there has been a decrease in the physical activities in which modern humans engage in the course of life. Physical inactivity leads to muscular hypotrophy and reduced muscle tone, which, alongside improper body posture while walking, contribute to the development of postural deformities.

The muscular system, as part of the active movement apparatus, plays a crucial role in the formation and maintenance of correct body posture. The weakness of specific muscle groups, as well as too great or unilateral weight bearing on them, can lead to various disorders. In the case of imbalance between the active strength of the foot and tension force, an impairment of the normal appearance of the foot can occur, as well as its statics (D'Amico, 2001; Mickle, Steele, & Munro, 2008; Rose, Welton, & Marshall, 1985). Muscle strength is the first to give in, followed by an overextension of the ligaments, and changes in the shape of the foot's skeletal structure. Such impairments are characterized by a collapsing of the foot arch and the emergence of flat feet (pedes plani) (Pfeiffer, Kotz, & Ledl, 2006).

The first stage of the collapse of the medial longitudinal arch of the foot (pes valgus) is the calcaneus in the vagus position. Unless this phase is halted, what follows is the collapse of the accessory navicular (os naviculare) and cuboid bones (os cuboideum), the descending of the lengthwise and crosswise arches, resulting in the second phase of the collapse (pes plano-valgus). Simultaneously with the changes in the longitudinal and medial arches, the heads of the metatarsal bones grow further apart and descend, resulting in the third phase of the collapse (pes transverso-planus) (Otman, Kose, & Yakut, 2000).

Due to the plasticity and sensitivity of children's bodies, the formation of a correct postural status is of considerable importance in the pre-school and school stages. The first step on the path to achieving this goal is the review and assessment of the development of the deformity.

The objective of this paper is to investigate the incidence of pes planus in children aged 6 to 14 years in Serbia.

METHOD

The following electronic databases were searched in order to collect the studies conducted to date on the incidence of flatfoot deformity in children aged 6 to 14 years: PubMed, PEDro, SCIndeks, DOAJ. Only academic papers published between 2005 and 2015 were the object of the search. The following keywords were used while searching the databases: sex, children, deformity, flat feet. The retrieved study titles, abstracts and full texts were then read and analyzed. In order for a paper to be included in the final analysis, it had to meet the following two criteria: first, in assessing pes planus, the paper had to include subjects within the Republic of Serbia, and second, the participants had to

be between 6 and 14 years old. Those studies which met the criteria set were then analyzed, and are presented in Table 1 according to the following parameters: reference (last name and initial of the principal author, and year the study was published), the participant sample (age, total number, and subsamples), methodology, and results.

RESULTS

The procedure for academic study collection and selection

The process of collecting, analyzing and eliminating the retrieved academic papers is presented in Figure 1. Based on the keywords, a total of 375 papers were retrieved. Based on the title, study repetition, as well as the year when the study was published (e.g., prior to 2005), 357 papers were eliminated and the remaining 18 included in further analysis. By means of further analysis, 8 out of the 18 papers were excluded based on multiple criteria, such as: abstract, given that some of these were systematic review studies themselves, or participant age, where the participants in the study were either younger than 6 or older than 14.

The remaining 10 studies satisfied the criteria set, namely: these were studies published between 2005 and 2015, and the study participants being assessed for flatfoot deformity were aged between 6 and 14.

Figure 1. A representation of the study collection, analysis and elimination process

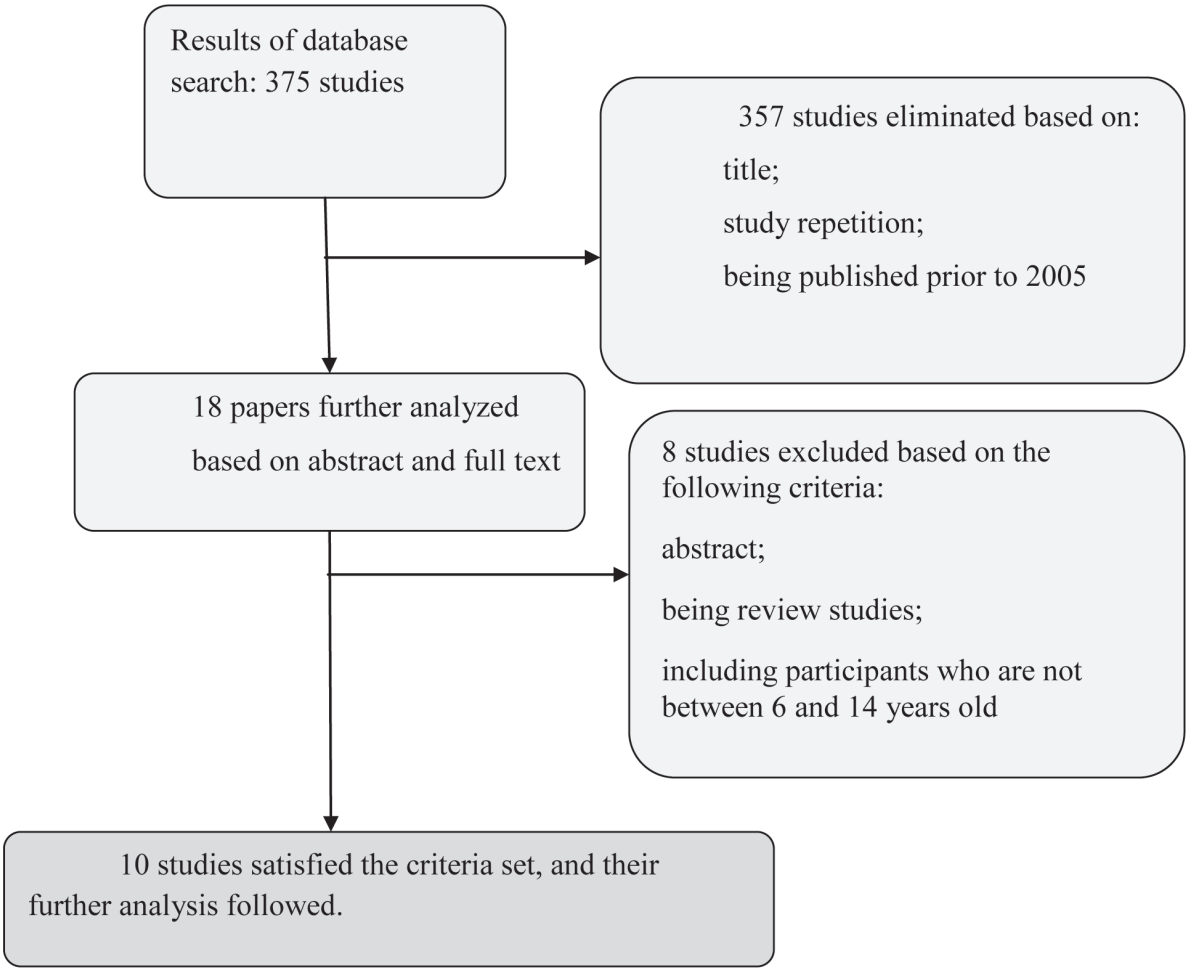

Table 1. A representation of studies of the incidence of pes planus in children aged between 6 and 14 years.

Reference	Age	Sample size	Measurement method	Study results
Milošević Z., et al. (2008)	7y	377 subjects (193 girls and 84 boys)	Napoleon Wolanski	I-degree 58.31% II-degree 10.03% Difference between the sexes p=0.000
Đokić, Z. & Stojanović, M. (2010)	9-12y	1523 subjects (775 boys and 748 girls)	Chizhin method using plantography	Foot deformity was 26.6% in children of either sex. Difference between sexes p=0.000
Bogdanović, Z., Marković, Ž. (2010)	6-15y	651 subjects (310 girls and 341 boys)	Thomsen method using plantography	I-degree 51.77%, II-degree 17.36%, III-degree 0.15% Difference between sexes p=0.000
Simov, S., et al. (2011)	6-7y	968 subjects	Pedoscope (four deformity stages)	30.78% of subjects with foot deformity (I-17.66; II-8.37; III-3.92; IV-0.83)
Pavlović, S. (2012)	6y	638 subjects	Thomsen method using plantography	Foot deformity in 26.01% in children of either sex. Difference between sexes p=0.000 (104 boys and 62 girls)
Protić-Gava, B., et al. (2013)	8,52y	63 participants	Napoleon Wolanski	0-21.3%; I-degree 59%; II-degree 19.7%.
Stanišić, I., et al. (2014)	6y	60 subjects (39 girls and 21 boys)	Thomsen method using plantography	19.1% boys and 15.4% girls had abnormalities treated as the functional stage of flatfoot.
Romanov, R., et al. (2014)	6-7y	423 subjects (213 boys and 210 girls)	Russian authors' method using a podograph	I-degree collapsed arch in 43.23%, II-degree collapsed arch in 16.66%,

DISCUSSION

Table 1 provides a representation of the studies addressing the incidence of pes planus deformity in persons aged between 6 and 14 years in the Republic of Serbia. The papers are presented in the table according to the following five parameter groups: reference, subject age, subject number and subgroups, measurement methods and instruments, and study results. The participants were aged between 6 (Simov et al., 2011; Pavlović, 2012; Stanišić et al., 2014; Romanov et al., 2014) and 14 years (Bogdanović & Marković, 2010). The total sample size in all the studies considered, including both sexes, is 5,015, with the fewest subjects (n=60) in Stanišić et al. (2014), and the most (n=1,523) in Đokić & Stojanović (2010). Diagnosing pes planus was done by means of the plantogram (Đokić & Stojanović, 2010; Bogdanović & Marković, 2010; Đokić et al., 2011; Pavlović, 2012; Stanišić et al., 2014), the pedoscope (Simov et al., 2011), and inspection (Puzović et al., 2010), and was next interpreted using the following methods: Thomsen method (Bogdanović & Marković, 2010; Pavlović, 2012; Stanišić et al., 2014), Napoleon Wolanski method (Milošević et al.., 2008; Protić et al., 2013), Chizhin method (Đokić & Stojanović, 2010; Đokić et al., 2011), and the method of the Russian authors (Romanov et al., 2014). The total number of participants tested was 5,015. Out of this total, 2,355 subjects, or 46.95%, were diagnosed with pes planus. This indicates that almost every other child aged 6-14 in the Republic of Serbia suffers from flatfoot deformity. The majority of children diagnosed with pes planus in all of the reviewed studies had the first stage of the deformity (the percentage varied from 17.66% to 59%, depending on the study), compared to the low percentages of the second stage of the deformity (ranging between 8.37% and 19.7%, depending on the paper).

Based on the results obtained, the plantograph and pedoscope can be recommended as instruments for flatfoot assessment, and the Thomsen, Chizhin and Napoleon Wolanski methods for the analysis of the results.

CONCLUSION

The review of the selected range of studies addressing the pes planus deformity in children in the Republic of Serbia aged 6 to 14 years indicates an alarming state.

The incidence of foot deformity in the population, and especially in school-age children, is very high. Consequently, there is a growing need for timely prevention and treatment of this phenomenon. Those who have contact with children in a professional capacity, such as teachers working in sport and physical education, as well as in health culture, play a special role in the prevention, as do the parents, who should prioritize their children's health and well-being. Identifying the deformity as early as possible, the adequate selection of corrective exercises to address this, physical activity, adequate footwear, and reducing child obesity, are just some of the solutions that can help reduce the occurrence and consequences of the deformity that is the focus of this paper.

A strong and healthy foot in childhood leads to a healthier and happier life later on. More attention should therefore be dedicated to this, frequently neglected part of our body.

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POUZDANOST I KONKURENTNA VALIDNOST PARAMETRA MAKSIMALNE SILE DOBIJENOG IZ LINEARNE RELACIJE SILA-BRZINA

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UVOD

Mehanička svojstva mišića su u fokusu istraživanja zbog značaja razumevanja funkcije koštano-mišićnog sistema čoveka, kao i efektivnosti uticaja različitih trenažnih i rehabilitacionih procesa usmerenih ka unapređenju fizičkih sposobnosti kod različite populacije (Cormie et al., 2011; Frost et al., 2010). Istraživanja su uglavnom usmerena na sposobnost mišićnog sistema da ispolji visok nivo spoljašnje sile prilikom pokreta velikom brzinom, a posledično, ispoljavajući visok mehanički „izlaz" snage.

Još od seminalnih studija sprovedenih u prvoj polovini dvadesetog veka, poznato je da se sila pojedinačnih mišića i mišićnih grupa smanjuje sa povećanjem brzine u nelinearnom (približno hiperboličnom) maniru (Hill, 1938; Wilkie, 1949; Fenn & March, 1935). Međutim, istraživanja novijeg datuma su pokazala da je relacija sila-brzina koja se dobija primenom određenog opsega opterećenja prilikom izvođenja maksimalnih višezglobnih pokreta približno linearna. Ovi nalazi potvrđeni su pri izvođenju različitih motoričkih zadataka kao što su vožnja bicikla (Driss & Vadewalle, 2013; Nikolaidis, 2012; Ravier et al., 2004), vertikalni skokovi (Cuk et al., 2014; Rahmani et al., 2001; Samozino et al. 2014; Sheppard et al 2008; Vadewalle et al., 1987) kao i pokreti gornjih ekstremiteta (Nikolaidis, 2012; Van Der Tillar, 2004; Hintzy et al., 2003; Sprague et al., 2007; Cronin et al., 2003; Sreckovic et al., 2015).

Zbog ovakvog oblika relacije, prilikom analize mehaničkih svojstava mišića, linearna regresija je veoma pogodna za primenu:

$$F(V) = F_0 - aV$$

gde F_0 predstavlja odsečak regresione prave na y-osi i predstavlja parametar maksimalne sile (koji odgovara teorijskom maksimumu sile u izometrijskim uslovima, jer je brzina jednaka nuli), dok a predstavlja nagib koji odgovara količniku F_0/V_0 (gde V_0 predstavlja odsečak regresione prave na x-osi i odgovara teorijskom maksimumu brzine, jer je sila jednaka nuli). Zbog jednostavnog načina izračunavanja, prilikom testiranja mehaničkih osobina mišića, kod višezglobnih pokreta često se primenjuje linearna relacija sila-brzina (Jaric, 2015).

Međutim, iako primenjeni linearni modeli uglavnom pokazuju visoku i jaku relaciju (Cuk et al., 2014; Hintzy et al., 2003; Ravier et al., 2004), samo su dve studije ispitivale pouzdanost njihovih parametara (Cuk et al., 2014; Sreckovic et al., 2015).

Sa druge strane, iako je nekoliko studija istraživalo konkurentnu validnost parametara linearne relacije sila-brzina, dobijeni rezultati su nekonzistentni. Tako je konkurentna validnost parametra maksimalne sile (F_0) prilikom direktnog merenja mišićne sile prema nekim istraživanjima, umerena do visoka (Driss et al., 2002; Cuk et al., 2014; Vandewalle et al., 1987, Sreckovic et al., 2015), dok prema drugim veoma niska, pa čak i beznačajna (Ravier et al., 2004; Yamauchi & Ishii, 2007; Rahmani et al., 2001). Iz tog razloga, pouzdanost i validnost parametara relacije sila-brzina, pogotovo parametra F_0 i dalje predstavljaju problem.

U odnosu na problem, postavljen je cilj istraživanja: Da se odredi pouzdanost i konkurentna validnost parametra maksimalne sile dobijene iz relacije sila-brzina prilikom izvođenja izbačaja tega sa grudi.

U odnosu na cilj i rezultate dosadašnjih istraživanja, postavljene su sledeće hipoteze:
Hipoteza 1: Pouzdanost parametra maksimalne sile biće visoka.
Hipoteza 2: Konkurentna validnost parametra maksimalne sile biće visoka.

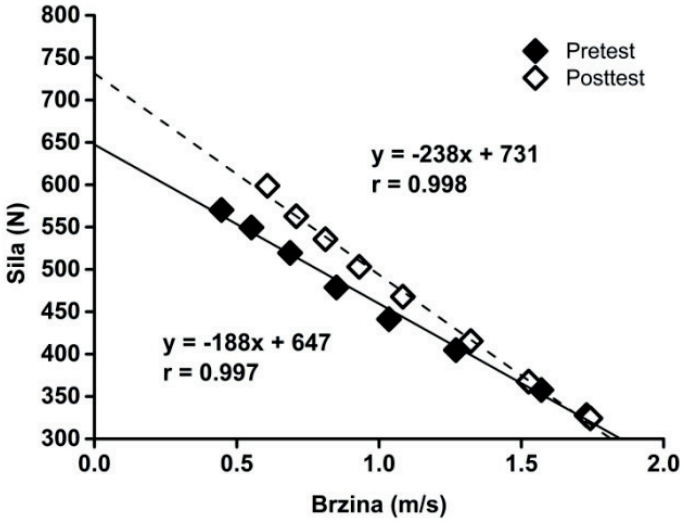
METOD

Uzorak je činilo 24 studenta muškog pola, Fakulteta sporta i fizičkog vaspitanja Univerziteta u Beogradu. Ispitanici su bili fizički aktivni u okviru svog akademskog kurikuluma koji je uključivao šest do osam časova sa fizičkim aktivnostima nedeljno. Fizičke aktivnosti nisu obuhvatale intenzivne i naporne vežbe za gornji deo tela. Svi ispitanici su bili upoznati sa potencijalnim rizicima primenjenih testiranja i potpisali su saglasnost za učešće u studiji. Eksperimentalni protokol i saglasnost bili su u skladu sa Helsinškom deklaracijom i odobreni od strane etičke komisije Fakulteta.

Ispitanici su bili nasumično raspoređeni u dve jednake grupe od po 12 ispitanika – eksperimentalnu (EKS; MT = 75,2 ± 9,1 kg; VT = 180,3 ± 7,8 cm; PMT = 11,2 ± 5 %; 1RM = 79,6 ± 11,4 kg) i kontrolnu (KON; MT = 77,9 ± 7,8 kg; VT = 181,9 ± 5,5 cm; PMT = 10,6 ± 3,6 %; 1RM = 82,1 ± 10,3kg). Nije bilo značajnih razlika u masi tela (MT), visini (VT), procentu masnog tkiva (PMT), kao i maksimalnom podignutom opterećenju (1RM) prilikom potiska tega sa grudi između ove dve grupe.

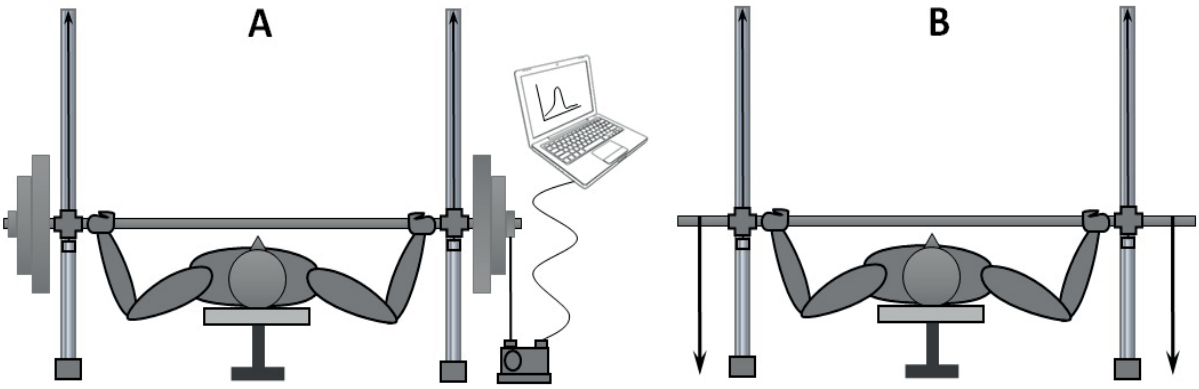
Studija je bila longitudinalnog karaktera. Eksperimentalni protokol se sastojao od pretesta, 8 nedelja treninga sprovedenog na EKS grupi i posttesta. Pretest i posttest su se sastojali od po 2 sesije testiranja i sprovedeni od 4 do 7 dana pre, odnosno posle eksperimentalnog tretmana, tj. treninga. Prva sesija pretesta podrazumevala je antropometrijska merenja (MT, VT, PMT), određivanje 1RM-a kod potiska tega sa grudi, kao i upoznavanje ispitanika sa vežbom izbačaj tega sa grudi. Merenje VT izvršeno je standardnim antropometrom, dok su MT i PMT određene uz pomoć bioelektrične impedance (IN BODY 720, SAD). U drugoj sesiji pretesta su vršena merenja prilikom izbačaja tega sa grudi. Prva i druga sesija posttesta bile su identične kao i u pretestu. Pre svake sesije testiranja ispitanici su izvodili standardnu proceduru zagrevanja koje se sastojalo od petominutnih dinamičkih vežbi u zglobovima ramenog pojasa i ruku, 2 serije po 6 ponavljanja izbačaja tega sa grudi intenzitetom 40% od 1RM-a, kao i petominutnih vežbi labavljenja i statičkog rastezanja mišića grudi i opružača ruku (Leontijevic, 2013; Sreckovic, 2015).

Izbačaj tega sa grudi koji je izvođen na modifikovanoj Smit mašini trebalo je da omogući opseg opterećenja kojim bi se dobile varijable sile (*F*) i brzine (*V*) za dalju analizu (Slika 1). Ispitanicima je data instrukcija da izbace teg najviše što mogu iz statičke startne pozicije. Šipka je bila pozicionirana 1cm od grudi ispitanika i bila je osigurana mehaničkim graničnicima. Ukupno, svi ispitanici su izvršili 24 izbačaja (8 opterećenja po 3 izbačaja). Opseg opterećenja (koje je uključivalo težinu ruku, šipke i tegova) koje je bilo primenjeno u pretestu i posttestu na Smit mašini (Slika 2) iznosilo je: 30, 37, 44, 51, 58, 65, 72 i 79% od individualnog 1RM-a ispitanika. Opterećenja su bila nasumično raspoređena za svakog ispitanika individualno.



Slika 1. Linearna relacija sila-brzina kod reprezentativnog ispitanika EKS grupe u pretestu (puni kvadratići) i posttestu (prazni kvadratići).

Trening je sproveden tokom vremenskog perioda od 8 nedelja, 3 puta nedeljno. Treningom je bila obuhvaćena samo EKS grupa i on se sastojao od izbačaja šipke sa grudi na koju su bile zakačene gume sa donje strane pružajući otpor koji je odgovarao opterećenju od 40kg, što je predstavljalo u proseku oko 50% od 1RM ispitanika (Slika 2). Svaki trening je trajao u proseku oko sat vremena kome je prethodila standardna procedura rastezanja i zagrevanja. Broj serija i ponavaljanja tokom treninga se povećavao, pa je tako u prvoj i drugoj nedelji izvođeno 6 serija sa 7 ponavljanja, u trećoj i četvrtoj 7 serija sa 7 ponavljanja, u petoj i šestoj 8 serija sa 7 ponavljanja i u sedmoj i osmoj nedelji 9 serija sa 7 ponavljanja. Pauza između serija iznosila je 5 minuta, dok je između ponavljanja ona iznosila oko 5 sekundi. KON grupa nije bila podvrgnuta trenažnom procesu, ali im je naglašeno da se pridržavaju standardnih fizičkih aktivnosti, tj. da nemaju dodatnih aktivnosti tokom trajanja studije.



Slika 2. Prikaz vrste opterećenja i prikupljanja podataka u pretestu i posttestu (panel A), kao i trenažnog opterećenja (panel B) pri izbačaju tega sa grudi na modifikovanoj Smit mašini.

Za analizu su korišćeni podaci dobijeni izbačajem tega sa grudi pri 8 različitih nivoa opterećenja tokom pretesta i posttesta. Treba skrenuti pažnju da su pretest i posttest sprovedeni na opterećenjima koje su karakterisali tegovi, dok je trening (samo kod EKS grupe) sproveden sa gumama koje su pružale otpor prilikom izbačaja. Pomeraj šipke je sniman optičkim linearnim enkoderom (Vivis Sport Med, Beograd, Srbija) čija je preciznost na nivou 0,01 cm i linearnost veća od 99 %. Podaci su uzorkovani na frekvenciji od 200 Hz i filtrirani niskopropusnim *Butterworth* filterom sa frekvencijom odsecanja od 5 Hz. Posebno napravljen softver (National Instruments LabVIEW 2010, Austin, TX, SAD) je korišćen kako bi se zabeležilo vertikalno kretanje šipke. Uz pomoć softvera izračunate su srednje vrednosti varijabli *F* i *V* samo u koncentričnoj fazi izbačaja, do trenutka napuštanja tega iz ruku (kada su vrednosti ubrzanja tega postale niže od -9,81). Kako bi se dobila relacija sila-brzina, individualne linearne regresije su računate za svakog ispitanika ponaosob. Nakon dobijene linearne regresije, za dalju analizu korišćen je parametar maksimalne sile (koji predstavlja presek regresione prave i ordinate). Ovaj parametar predstavlja teorijski maksimum sile koju bi ispitanik mogao da ispolji u datim izometrijskim uslovima (u tom trenutku je brzina jednaka nuli).

Primenom Kolmogorov-Smirnov testa, utvrđeno je da su podaci normalno distribuirani. Rezultati deskriptivne statistike prikazani su kao srednje vrednosti i standardne devijacije. Od statističkih procedura primenjena je Pirsonova korelacija kako bi se utvrdila pouzdanost individualnih parametara maksimalne sile dobijenih iz *F-V* relacija, dok je za utvrđivanje konkurentne validnosti dodatno upotrebljen i t-test za nezavisne uzorke. Treba napomenuti da su za pouzdanost korišćeni samo rezultati iz KON grupe, dok su za određivanje konkurentne validnosti upotrebljeni rezultati obe grupe pre i nakon treninga. Za utvrđivanje razlika u vrednostima F_0 i 1RM-a između pretesta i posttesta, korišćen je t-test za zavisne uzorke.

REZULTATI

Pre svega trebalo bi napomenuti da je linearnost relacije sila-brzina izuzetno visoka i jaka ($r > 0,95$). U tabeli 1. prikazana je deskriptivna statistika maksimalnog podignutog opterećenja i parametara maksimalne sile pri izbačaju tega sa grudi.

Tabela 1. Deskriptivna statistika vrednosti F_0 i 1RM-a u pretestu i posttestu po grupama

Grupa	F_0_pre (N)	F_0_post (N)	1RM_pre (N)	1RM_post (N)
EKS	726 ± 103	796 ± 97**	781 ± 112	834 ± 118**
KON	742 ± 94	740 ± 94	805 ± 97	805 ± 97

Može se primetiti da su vrednosti F_0 i 1RM bile veće kod EKS grupe u posttestu nego u pretestu, kao i da je ta razlika statistički značajna ($p < 0,01$). Ove vrednosti kod KON grupe ostale su praktično nepromenjene.

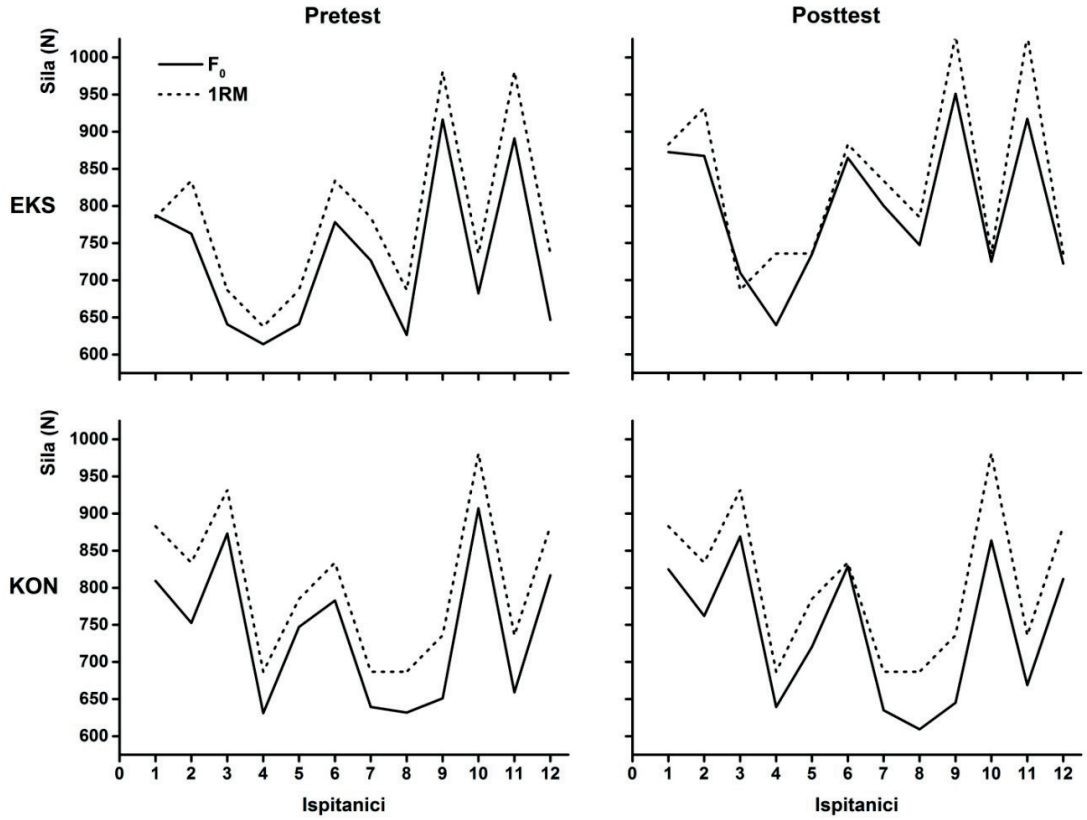
Za utvrđivanje pouzdanosti primenjena korelaciona analiza na rezultatima KON grupe pokazala je da je pouzdanost F_0 veoma visoka (ICC > 0,97).

U tabeli 2. prikazani su rezultati korelacione analize i t-testa primenjenih na rezultatima parametra maksimalne sile i maksimalnog podignutog opterećenja, a sve sa ciljem utvrđivanja konkurentne validnosti parametra maksimalne sile.

Tabela 2. Pirsonova korelacija i t-test primenjeni na rezultatima F_0 i 1RM-a u pretestu i posttestu po grupama

Grupa	r_pre	r_post	p_pre	p_post
EKS	0.97	0.94	0.23	0.40
KON	0.99	0.96	0.13	0.12

Kao što se može primetiti, dobijeni Pirsonovi koeficijenti korelacije u pretestu i posttestu u obe tretirane grupe su veoma visoki, što govori da je konkurentna validnost parametra maksimalne sile dobijenog iz linearne relacije sila-brzina izuzetno visoka. U prilog ovome, govori i nalaz da ne postoje statistički značajne razlike između ovih varijabli ni u pretestu ni u posttestu. Na slici 3. dat je detaljniji prikaz relacije između varijabli F_0 i 1RM individualno po ispitanicima.



Slika 3. Prikaz vrednosti F_0 i 1RM-a u pretestu i posttestu po grupama i pojedinačnim ispitanicima

U gornjem panelu prikazani su rezultati EKS, a u donjem rezultati KON grupe u pretestu (levi panel) i posttestu (desni panel) F_0 i 1RM-a. Primećuje se da su se vrednosti obe varijable u posttestu EKS grupe (gornji desni panel) povećale, dok su kod KON grupe (donji desni panel) ostale gotovo nepromenjene u odnosu na pretest. Međutim, ono što se može uočiti, to je relacija između ove dve varijable. Uočljivo je da pune linije (F_0) uglavnom prate isprekidane linije (1RM) sa manjim odstupanjima, bez obzira o kom se panelu radi. Iz ovoga se može zaključiti da je korelacija između ovih varijabli veoma visoka bez obzira o kojoj se grupi radi i da li je reč o pretestu ili posttestu.

DISKUSIJA

Kako bi pouzdanost i konkurentna validnost parametra maksimalne sile dobijene iz linearne relacije sila-brzina kod izbačaja tega sa grudi bile utvrđene, primenjene su korelaciona analiza i analiza razlika između pomenutog parametra i maksimalnog podignutog opterećenja kod izbačaja tega sa grudi.

Što se tiče pouzdanosti, primenjena korelaciona analiza na rezultatima KON grupe pokazala je veoma visoku pouzdanost F_0 (ICC > 0,97). Ovakvi nalazi su u skladu sa dosadašnjim istraživanjima (Sreckovic et al., 2015).

Vrednosti F_0 i 1RM-a iz tabele 1. govore u prilog tome da je sprovedeni trening efikasno uticao na razvoj sile. Rezultati iz tabele 2. pokazuju da su koeficijenti korelacije između F_0 i 1RM-a veoma visoki u obe grupe, kao i u pretestu i posttestu. Takođe, činjenica da ne postoje statistički značajne razlike između pomenutih varijabli, još jedna je potvrda visokoj konkurentnoj validnosti parametra F_0 i pre, ali i nakon trenažnog procesa od osam nedelja. U prilog ovakvom nalazu govore i podaci sa slike 3. Može se primetiti da su oblici punih linija koje predstavljaju vrednosti F_0 individualno za svakog ispitanika, uglavnom veoma slični i prate isprekidane linije koje predstavljaju individualne vrednosti 1RM-a. Ovo je još jedna kvalitativna potvrda o visokoj konkurentnoj validnosti parametra maksimalne sile dobijenog iz linearne relacije sila-brzina pri izbačaju tega sa grudi. Visoka konkurentna validnost zadržana je i nakon treninga od osam nedelja. Na grafiku se može primetiti da su vrednosti F_0 uglavnom manje od vrednosti 1RM-a. To se može objasniti činjenicom da su ovi parametri linearne regresije dobijeni iz srednjih vrednosti sile i brzine na svakom nivou opterećenja za svakog ispitanika. Ovakvi nalazi su u skladu sa prethodnim istraživanjima (Sreckovic, 2015).

Iz dobijenih rezultata sledi da su obe hipoteze potvrđene. Potvrđene hipoteze su u skladu sa dosadašnjim istraživanjima (Driss et al., 2002; Cuk et al., 2014; Vandewalle et al., 1987, Sreckovic et al., 2015).

ZAKLJUČAK

Rezultati sprovedenog istraživanja govore u prilog tome da se parametar maksimalne sile dobijen iz linearne relacije sila-brzina može pouzdano i validno koristiti u funkcionalnim testiranjima za procenu mehaničkih osobina mišića i pre i nakon sprovedenog trenažnog procesa. Prednosti korišćenja ovog parametra su višestruke. Može se koristiti u sportskoj dijagnostici, rekreaciji, rehabilitaciji i mnogim drugim oblastima fizičke aktivnosti. Takođe, primena relacije sila-brzina omogućava sveobuhvatniju sliku mišićne mehanike i na taj način bolje razumevanje mišićnog sistema čoveka.

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RELIABILITY AND CONCURRENT VALIDITY OF THE MAXIMUM FORCE PARAMETER OBTAINED FROM THE LINEAR FORCE-VELOCITY RELATIONSHIP

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INTRODUCTION

Mechanical properties of muscles are in the research focus due to importance of understanding muscle-skeletal system, as well as, understanding effectiveness of influence of different training and rehabilitation processes aimed at improving physical abilities in different populations (Cormie et al., 2011; Frost et al., 2010). Research has been mainly focused on the ability of the muscular system to exert a high level of external force during movement at high velocity and, consequently, exhibiting high mechanical power output.

Since the seminal studies in the first half of the twentieth century, it is known that the force of individual muscles and muscle groups decreases with increasing velocity in a nonlinear (approximately hyperbolic) manner (Hill, 1938; Wilkie, 1949; Fenn & March, 1935). However, recent studies have shown that the force-velocity relationship which is obtained by applying a certain load ranges and performing maximum multi-joint movement is approximately linear. These findings were confirmed when performing various motor tasks such as biking (Driss & Vadewalle, 2013; Nikolaidis, 2012; Ravier et al., 2004), vertical jumps (Cuk et al., 2014; Rahmani et al., 2001; Samozino et al. 2014; Sheppard et al 2008; Vadewalle et al., 1987) as well as the movements of the upper extremities (Nikolaidis, 2012; Van Der Tillar, 2004; Hintzy et al., 2003; Sprague et al., 2007; Cronin et al., 2003; Sreckovic et al., 2015).

Due to linear shape of the relationship, linear regression is highly suitable in the analysis of the mechanical properties of the muscles:

$$F(V) = F_0 - aV$$

where F_0 represents the y-axis intercept of the regression line representing maximum force parameter (corresponding to theoretically maximum of isometric force, because velocity value is equal to zero), while a represents slope corresponding to quotient of F_0/V_0 (where V_0 represents x-axis intercept corresponding to theoretically maximum of muscle shortening velocity, because force value is equal to zero). Because of the simple calculation methods, in testing of a mechanical properties of muscles in multi-joint movements, linear force-velocity relationship is often applied (Jaric, 2015).

However, although the applied linear models generally show a high and strong relationship (Cuk et al., 2014; Hintzy et al., 2003; Ravier et al., 2004), only two studies have assessed the reliability of their parameters (Cuk et al., 2014 ; Sreckovic et al., 2015).

On the other hand, although several studies have investigated the concurrent validity of the linear force-velocity relationship parameters, the results proved to be rather inconsistent. Thus, the concurrent validity of the maximum force parameter (F_0) regarding the directly measured muscle strength, according to some studies, could be moderate to high (Driss et al., 2002; Cuk et al., 2014; Vandewalle et al., 1987, Sreckovic et al., 2015), low, and even negligible (Ravier et al., 2004; Yamauchi & Ishii, 2007; Rahmani et al., 2001). For this reason, the reliability and validity of the linear force-velocity parameters, especially F_0 parameter, remain a problem.

Regarding the problem, the aim of this study was: To determine the reliability and concurrent validity of linear force-velocity maximal force parameter obtained from performing bench press throws exercise.

From the aim and results of previous studies, we set 2 hypotheses:
Hypothesis 1: Reliability of maximal force parameter will be high.
Hypothesis 2: Concurrent validity of maximum force parameter will be high.

METHOD

The sample consisted of 24 male students of the Faculty of Sport and Physical Education, University of Belgrade. The participants were physically active as part of their academic curriculum that included six to eight hours with physical activity per week. Physical activities did not include intense and strenuous exercise for the upper body. All participants were aware of the potential risks of the applied testing and they signed consent for participation in the study. The experimental protocol and consent were in accordance with the Declaration of Helsinki and approved by the Ethical Committee of the Faculty.

The participants were randomly assigned to two equal groups of 12 subjects – Experimental Group (EXP; BM = 75.2 ± 9.1 kg; BH = 180.3 ± 7.8 cm; PBF = 11.2 ± 5% 1RM = 79.6 ± 11.4 kg) and Control Group (CON; BM = 77.9 ± 7.8 kg; BH = 181.9 ± 5.5 cm; PBF = 10.6 ± 3.6%; 1RM = 82.1 ± 10,3kg). There were no significant differences in body mass (BM), body height (BH), percentage of body fat (PBF) or the maximum lifted load (1RM) in the bench press exercise between the two groups.

The conducted study was longitudinal. The experimental protocol consisted of pretest, 8 weeks of training conducted on the EXP group and posttest. Pretest and posttest consisted of 2 testing sessions each, and conducted from 4 to 7 days before or after the experimental treatment. The first pretest session included anthropometric measurements (BM, BH and PBF), determination of 1RM in the bench press exercise, as well as familiarization with bench press throws exercise. Measurement of BH was performed by standard anthropometer, while BM and PBF were determined using bioelectrical impedance (IN BODY 720, USA). In the second pretest session measurements were performed during the bench press throws. The first and second posttest sessions were identical as in the pretest. Before each testing session subjects performed a standard warm-up procedure, which consisted of five-minute dynamic shoulders and arms exercise, 2 sets of 6 reps of bench press throws with intensity of 40% of 1RM, as well as five-minute static stretching of triceps and pectorals (Leontijevic, 2013; Sreckovic, 2015).

Bench press throws were performed on a modified Smith machine that was supposed to enable the load range in order to obtain force (F) and velocity (V) variables for further analysis (Figure 1). Participants were instructed to throw the bar 'as high as possible' from the static starting position. Bar was positioned 1 cm from the participant's chest and assured by mechanical stops. In total, each participant performed 24 throws (8 loads x 3 throws). Load range (which included the weight of the hand, bar and weight plates), which was applied in the pretest and posttest on the Smith machine (Figure 2) was 30, 37, 44, 51, 58, 65, 72 and 79% of individual participant's 1RM. The loads were randomly distributed to each participant individually.

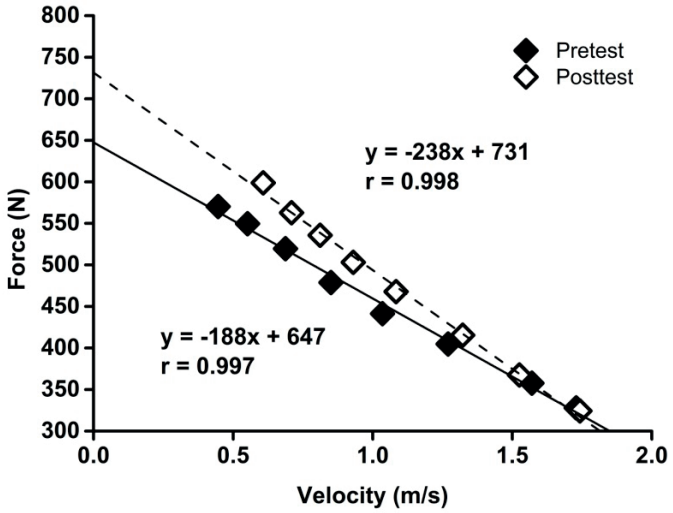

Figure 1.Linear force-velocity relationship at representative participant of EXS group at pretest (filled squares) and posttest (open squares).

The training was conducted over a period of 8 weeks, 3 times per week. Only EXP group trained. Training consisted of bench press throws with the attached elastic rubber bands that were pulling the bar downwards. Resistance matched load of 40kg, which was about 50% of participant's 1RM (Figure 2). Each training session lasted about an hour which was preceded by the standard procedure of stretching and warming up. The number of sets and repetitions during training increased, so in the first and second week participants performed 6 sets with 7 reps, in the third and fourth 7 sets with 7 reps, in the fifth and sixth 8 sets with 7 reps, in the seventh and eighth week 9 sets with 7 reps. Pause between sets was 5 minutes, while between repetitions was about 5 seconds. CON group was not involved to the training process, but they were instructed to have standard physical activities and not to have additional activities during the study period.

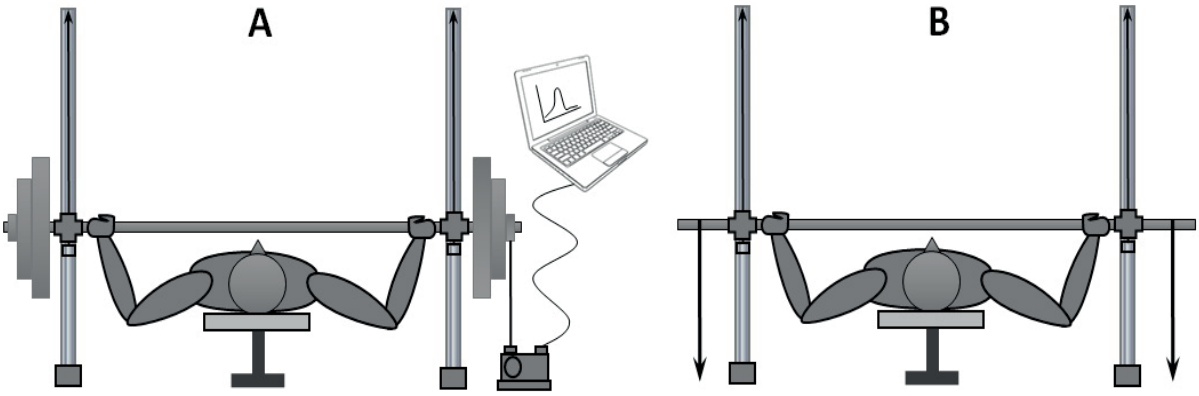

Figure 2.Illustration of the type of training load and data collection in the pretest and posttest (panel A) as well as the training load (panel B) at the bench press throws exercise on modified Smith machine.

Data obtained from the bench press throws at 8 different load magnitudes during the pretest and posttest were used for analysis. Note that the pretest and posttest were conducted on the weight plates attached, while the training (only for EXP group) was conducted with rubber bands attached to the bar. Displacement of the bar was recorded with linear transducer (Vivis Med, Belgrade, Serbia), with accuracy at the level of 0.01 cm and a linearity greater than 99%. The data was sampled at a frequency of 200 Hz and low-pass filtered using Butterworth filter with cutoff frequency of 5 Hz. Custom designed software (National Instruments LabVIEW 2010, Austin, TX, USA) was used in order to record vertical movement of the bar. Using this software, mean force and velocity variables were calculated only in the concentric phase of movement, by the time bar left participant's hands (moment when the acceleration value become lower than -9,81). In order to obtain a force-velocity relationship, individual linear regressions were calculated for each participant. After obtaining linear regression, for further analysis we used the maximum force parameter (which represents the intercept of regression line and the ordinate). This parameter represents the theoretical maximum isometric force (at this point the velocity value is equal to zero).

The normality of the distribution was tested applying Kolmogorov-Smirnov test. The data were normally distributed. Descriptive statistics are presented as means and standard deviations. For assessing the reliability of individual maximum force parameter obtained from linear force-velocity relationship, Pearson correlation was applied, while for establishing concurrent validity additionally, the t-test for independent samples was applied. Note that reliability was assessed on the results from only the CON group, while the results from both groups before and after the training were used for determining the concurrent validity. To determine the difference of values F_0 and 1RM between pretest and posttest, we applied the paired samples t-test.

RESULTS

First of all, note that the linear force-velocity relationship was very high and strong ($r > 0.95$). Descriptive statistics of maximal lifted load and maximum force parameter at bench press throws are shown at table 1.

Table 1.Descriptive statistics of F_0 and 1RM at pretest and posttest by groups

Group	F_0_pre (N)	F_0_post (N)	1RM_pre (N)	1RM_post (N)
EXP	726 ± 103	796 ± 97**	781 ± 112	834 ± 118**
CON	742 ± 94	740 ± 94	805 ± 97	805 ± 97

Note that values of F_0 and 1RM were higher in EXP group in posttest than in the pretest, and that this difference was statistically significant ($p < 0.01$). These values in CON group remained almost unchanged.

In order to determine the reliability, correlation analysis was applied on the results of CON group. Results showed that the F_0 reliability was very high (ICC > 0.97).

Table 2 shows the results of correlation analysis and t-test applied to the results of the maximum force parameter and the maximum load, all with the aim of determining the concurrent validity of maximum force parameter.

Table 2.Pearson's correlation and t-test applied on the F_0 and 1RM results at pretest and posttest by groups

Group	r_pre	r_post	p_pre	p_post
EXP	0.97	0.94	0.23	0.40
CON	0.99	0.96	0.13	0.12

Pearson's correlation coefficients in the pretest and posttest in both treatment groups were very high, which indicates that the concurrent validity of the maximum force parameter obtained from the linear force-velocity relationship was very high. The finding that there were no statistically significant differences between these variables either in pretest to posttest, are in support for this findings. Figure 3 depicts a more detailed shape of the relation between variables F_0 and 1RM individually by the participants.

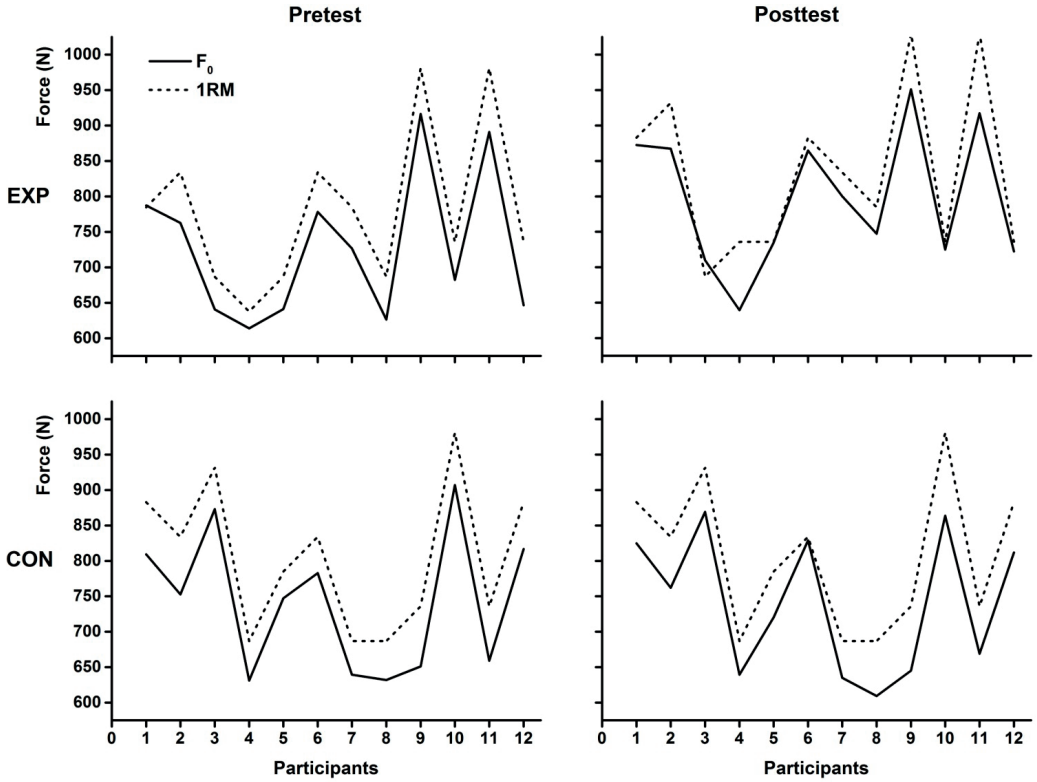

Figure 3.Illustration of F_0 and 1RM values at pretest and posttest by groups and individual participants

The upper panel shows the results of the EXP group, while lower panel shows results of the CON group at pretest (left panel) and posttest (right panel) of F_0 and 1RM. Note that the values of both variables at the posttest in EXP group (upper right panel) are increased, while the values in CON group (lower right panel) remained almost unchanged compared to the pretest. However, the relationship between these two variables is specific. It is noticeable that the full lines (F_0) generally follow dashed lines (1RM) with minor variations, regardless of the observed panel. From these results, we can conclude that the correlation between these variables was very high regardless the group and whether it is a pretest or posttest.

DISCUSSION

To assess reliability and concurrent validity of maximum force parameter obtained from the linear force-velocity relationship at bench press throws, we applied correlation analysis and analysis of the difference between the above mentioned parameters and maximal lifted loads at bench press exercise.

Regarding reliability, applied correlation analysis on the results of CON group showed very high reliability of F_0 parameter (ICC > 0.97). These findings are in accordance with previous research (Sreckovic et al., 2015).

The values of F_0 and 1RM in Table 1 support the fact that the conducted training effectively influenced the development of muscular force. Results in Table 2 showed that the correlation coefficients between F_0 and 1RM were very high in both groups, as well as at the pretest and posttest. Also, the fact that there were no statistically significant differences between the above mentioned variables is another confirmation of the high concurrent validity of F_0 parameter before, as well as after the training of eight weeks. The data in Figure 3 are in support of this finding. It can be noted that the shapes of solid lines which represent the values of F_0 individually for each participant, are generally very similar and follow the dashed lines representing the individual values of 1RM. This is another qualitative confirmation of the high concurrent validity of maximum force parameter obtained from the linear force-velocity relationship at bench press throws. High concurrent validity was maintained after eight weeks of training. Figure shows that the values of F_0 were generally less than the values of 1RM. This can be explained by the fact that these parameters were obtained by linear regression from the mean force and velocity variables at each load magnitude for each participant. These findings are consistent with previous research (Sreckovic, 2015).

From the obtained results, we can conclude that both hypotheses are confirmed. The confirmed hypotheses are in accordance with previous studies (Driss et al., 2002; Cuk et al., 2014; Vandewalle et al., 1987, Sreckovic et al., 2015).

CONCLUSION

Results of the conducted research support the fact that the maximum force parameter obtained from the linear force-velocity relationship could be reliably and validly used in functional testing to assess mechanical properties of muscles before, as well as, after conducted training process. The advantages of using this parameter are multiple. It can be used in the sports diagnostics, recreation, rehabilitation and many other areas of physical activity. Also, the application of force-velocity relationship provides a more comprehensive notion of muscular mechanics and thus, a better understanding of the human muscular system.

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UDK 796.1:37-055.2

THE EFFECTS OF THEORETICAL CLASSES ON HEALTH RELATED FITNESS OF FEMALE STUDENTS

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INTRODUCTION

Young people spend less and less time participating in activities that require muscle work meanwhile the activities associated with sitting and spending free time passively increases (Caspersen et al., 2000). Physical and health educational field because of its importance to the harmonious development of anthropological characteristics of students is unique for its features and specificities. Slater and Tiggemann (2010) emphasize the importance of the application of theoretical lectures in physical education for the promotion of learning motion structures with understanding and development of thinking skills during the performance of activities. While physical education is the type of school-based program that should promote lifelong PA, traditional sports-based physical education has failed to achieve this goal (Dale & Corbin, 2000; Pangrazi, 2010). Many high school programs around the nation have replaced traditional sports-based physical education in some grades with other curricular models with a health promotion focus, one of which is conceptual physical education (CPE). Differing from traditional physical education, these CPE courses generally follow a curriculum that includes classroom lessons that teach important health and fitness concepts coupled with activity sessions that teach fitness programming, self-monitoring, and fitness assessments (Dale & Corbin, 2000). CPE courses teach health-related fitness knowledge and exercise skills which are thought to help students understand and enjoy PA throughout their lifetime.

Health-related physical fitness components, consistent with modern definitions, include cardiovascular fitness, muscular endurance, strength, flexibility, and body composition (Pate, 1988). A more frequent of the conceptual topics often included in HRF courses are: Physical activity, Components of fitness, Overweight and obesity, Stress management, Nutrition, Tobacco use and Substance abuse. According to Hensley, "Fitness for Life" was the most common title used for courses that combined health concepts with physical activity (Hensley, 2000). The Fitness for Life textbook contains 18 chapters that cover the 5 components of fitness (muscular strength, muscular endurance, cardiovascular fitness, flexibility, and body composition), nutrition, self-management skills, goal setting, stress management skills, and personal program planning. Health-related assessments included in HRF courses are fitness testing, nutritional analysis, chronic disease risk factors, and stress assessment.

METHOD

The experiment was run during the 2012-2013 academic year, at the University of Osijek. The sample was consisteded of freshmen female students of the Department of Mathematics, Chemistry and Physic (N=84) who were randomized in two equal-sized groups, experimental (n=42) and control group(n=42). In order to realize the goals, two different programs of physical education were offered for a period of one academic year. Regarding the structure, experimental program was conducted on the same principles as in the control group. The only difference between the groups was that instead of the 90 minutes of practical training in the control group, the experimental group included every second class theoretical lecture for 30 minutes on a particular topic.

The experimental program consisted of 13 lectures from health related fitness field and kinesiology. Topics included kinesiology, anatomy of the human body, motor skills, energy systems, obesity and risks of sedentary lifestyles, regular physical activity programs, injury prevention, health nutrition, history of sport and exercise, substance abuse, fair-play, hygiene and exercise, psychological benefits of exercise.

The control group performed 90 minutes resistance training per week in circuit training, using an 8-12 repetition maximum (RM) and targeting major muscle groups of the upper and lower body.

Measurements were obtained in fitness centre before and after 8 month intervention by trained personnel in kinesiology. The following tests were used for assessment health related fitness: 6 minute run, seated straddle stretch, standing broad jump, trunk lift for 60 seconds, 3-site skinfold body fat.

Statistical analysis was made by Statistica, Version 10 for Windows package program. Arithmetic average, standard deviation, the lowest and highest values were determined. The two-measured ANOVA was performed on all health related fitness variables for comparison experimental and control group.

RESULTS

Physical fitness characteristics and anthropometric measurement of experimental and control groups at pretesting are presented in the Table 1.

Table 1. Health related fitness characteristics of experimental (E) and control (C) groups at pretesting

Variable	G	N	MEAN	MIN	MAX	SD	SKEW	KURT	MAXD
Triceps skin fold (mm)	C	42	18.87	8.73	30.50	5.75	0.10	-0.55	0.10
	E	42	18.74	9.26	46.73	6.70	1.95	6.23	0.14
Suprailiac skin fold (mm)	C	42	26.33	12.53	43.06	8.87	0.10	-1.15	0.11
	E	42	23.90	10.86	64.66	10.28	1.99	5.48	0.20
Thigh skin fold (mm)	C	42	31.74	13.00	50.00	9.32	0.00	-0.76	0.06
	E	42	30.30	15.80	60.93	9.61	1.03	1.25	0.15
Height	C	42	167.19	146.40	182.80	7.42	- 0.43	0.85	0.11
(cm)	E	42	167.40	155.20	180.90	6.00	0.08	-0.02	0.10
Weight	C	42	61.50	40.30	80.80	10.84	0.10	-0.99	0.12
(kg)	E	42	62.00	48.80	96.20	8.92	2.02	5.92	0.14
Seated straddle stretch (cm)	C	42	68.65	39.00	99.66	12.91	0.13	0.06	0.07
	E	42	64.64	41.33	90.66	12.86	0.21	-0.50	0.07
Standing broad jump (cm)	C	42	172.26	93.66	211.00	23.59	-0.82	1.82	0.09
	E	42	169.50	125.33	205.33	21.27	-0.19	-0.51	0.06
Trunk lift for 60 seconds (reps)	C	42	47.14	22	65	8.22	-0.49	1.37	0.12
	E	42	43.33	30	60	7.17	0.00	-0.54	0.08
6 minute run (m)	C	42	1030.7	782	1302	128.1	0.12	-0.78	0.11
	E	42	979.9	702	1276	130.2	0.14	-0.39	0.08

Legend: G-group, N-number of participants, E- experimental group, C - control group, MIN-minimum, MAX-maximum, SD-standard deviation, SKEW-skewness, KURT-kurtosis, MAXD-Kolmogorov-Smirnov test

In comparison with other studies (Mraković, 2011) students from University of Osijek scored lower in seated straddle stretch in relation with students from Medicine faculty University of Zagreb (72.74 cm), higher in standing broad jump relate to students of Faculty Teacher education University of Zagreb (7 cm). Compared with students of Faculty Teacher education in Čakovec, female students perform better results in test trunk lift for 60 seconds for 5 repetition (Nikolić, 2014).

Table 2. Health related fitness characteristics of experimental (E) and control (C) groups at pretesting (PRE) and posttesting (POST) using mean±standard deviation (SD)

Variable	G	MEAN±SD		p-value
		PRE	POST	
Height	E	167.40±6.00	167.38±6.14	0.46
(cm)	C	167.19±7.42	167.38±6.14	
Weight	E	62.00±8.94	62.41±8.59	0.29
(kg)	C	61.50±10.84	62.47±10.85	
Triceps skin fold (mm)	E	18.74±6.69	18.76±5.69	0.28
	C	18.87±5.75	19.90±6.68	
Suprailiac skin fold (mm)	E	23.90±10.28	20.99±8.82	0.71
	C	26.33±8.87	23.96±9.33	
Thigh skin fold (mm)	E	30.30±9.61	28.79±8.17	0.35
	C	31.74±9.32	31.69±9.44	
Fat percentage (%)	E	26.88±6.06	25.81±6.11	0.36
	C	28.14±6.54	27.86±6.49	
Seated straddle stretch (cm)	E	64.64±12.86	65.32±13.31	0.87
	C	68.65±12.91	69.36±13.17	
Standing broad jump (cm)	E	169.50±21.27	172.39±21.19	0.36
	C	172.26±23.59	172.98±23.64	
Trunk lift for 60 seconds (reps)	E	43.33±7.17	48.16±7.27	0.04*
	C	47.14±8.22	49.85±8.30	
6 minute run (m)	E	979.9±130.2	1047.1±122.5	0.00*
	C	1030.7±128.1	1022.7±149.1	

*p<0.05, **p<0.01

From the Table 2, it is clear that two-repeated measured ANOVA showed at posttesting, that the experimental in comparison with the control group performed better interaction results on the cardiovasculary endurance (p<0.01) and muscular endurance (p<0.05).

DISCUSSION

After enrolment to the faculty, inactivity of students grow rapidly, 41,53% of male students and 66,45% female students became sedentary (Fučkar Reichel et al., 2008). Physical education class in higher education once on week for 90 minutes is not enough to make any improvements in physical or health related fitness. Because of that, improvements were not expected to occur only with the effects from the class neither for both groups. Only chance to activate student outside the classroom is to promote regular physical activity with theoretical approach and give them some reasonable information, feedback to help interpret results, instruction that is useful in planning programs for improvement of fitness through regular physical activity, knowledge and "tools" how to exercise. The primary goal is promoting activity patterns that lead to reduced health risk and improved health-related physical fitness. Perry et al. (2002) found that biology curriculum integrated with exercise physiology theory and exercise activities may result in significance improvements in physical fitness, body size satisfaction, and physiology knowledge in high school adolescents.

The purpose of this study was to evaluate the effectiveness of a newly implemented health related theoretical lectures in traditional physical education class. Experimental group of two classes (n=42) went through the program designed to motivate student for better understanding of health related fitness concept, increase physical activity outside the classroom and enhance health related physical fitness components. The control group went through a standard traditional physical education curriculum.

Results showed that at baseline, both groups were fairly similar to their physical and anthropometrical characteristics. The control group showed better results at beginning in almost all physical variables (standing broad jump, seated straddle stretch, trunk lift for 60 seconds), and one cardiovascular variable 6 minute run as can be seen in Table 1. But after a 8 month period experimental group also showed significantly higher values and progress in two of these variables at posttesting (Table 2). It is possible that the cause of differences was also influence of the other physical exercising contents, performed by extracurricular activities, and activities in the free time.

CONCLUSION

Potential limitation of this study could originate from several reasons. Relatively small number of participants in samples could be one of them. Student evaluation of lectures and health related topics is also desirable at the end of experimental program.

Student period, as the final stage of the educational process, by which a targeted intervention to increase exercise and physical activity, provides a many options for intervention to change the undesirable health behavior. Therefore, different interventions are necessary in order to increase student physical activity, regular exercise and reduce sedentary behavior. Promoting participation in physical activity, exercise and sports can make an important contribution to the prevention of disease, promotion of health and community well being.

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ANALIZA FAZA MENADŽMENTA U REALIZACIJI SPORTSKO REKREATIVNOG KAMPA

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UVOD

Rad je nastao kao potreba da se primene dosadašnja znanja i iskustva tokom dugogodišnje realizacije različitih sportsko rekreativnih aktivnosti, kao i da se analiziraju faze menadžmenta u realizaciji sportsko rekreativnog kampa. Pojava i razvoj savremene tehnologije dovela je do velike uštede čovekove energije ali i do kompletne promene načina života. Čovek je izložen sve većim zahtevima savremenog društva pa samim tim i stresu. Zaboravlja se, da je jedna od osnovnih potreba koju deca žele da zadovolje potreba za igrom, kao i raznovrsno kretanje koje omogućava pravilan rast i razvoj naše dece. Pošto veliki deo dana deca provode u zatvorenom prostoru (u školi, učionici, stanu...), poželjno je van časovne slobodno izabrane aktivnosti izvoditi na otvorenom prostoru, čistom i svežem vazduhu. Deca u okviru ovog kampa prolaze kroz razne poligone koji su različitog karaktera. U njegovoj realizaciji veliku ulogu imaju i alati koji se upotrebljavaju. Od velike koristi su multimedijalna i digitalna oprema i rekviziti, muzika, video, zvučni efekti, razna pomoćna sredstva itd. Shodno tome jedna od definicije menadžmenta po Džejmsu i Stoneru (Stavrić, B., Stamatović M.,2003) koja je ostavila utisak glasi: "Menadžment se određuje kao proces planiranja, organizovanja, vođenja, odnosno liderstva i kontrole napora svih u organizaciji da bi se iskoristili svi organizacioni resursi i ostvarili postavljeni ciljevi organizacije" Menadžment proces se sastoji od četiri osnovne aktivnosti: planiranja, organizovanja, vođenja i kontrole, one se među sobom prepliću i jedna na drugu utiču. Planiranje je aktivnost u kojoj se donose odluke o ciljevima organizacije i u kojoj se osmišljavaju akcije neophodne kako bi se postavljeni ciljevi ostvarili. Organizovanje sledi nakon planiranja i obuhvata više aktivnosti istovremeno, pri čemu se sve aktivnosti usmeravaju na određivanje načina kako da se postavljeni ciljevi ostvare. Vođstvo je aktivnost koja se sastoji u obezbeđivanju vođstva u smislu korišćenja uticaja i motivacije na članove tima kako bi ispunili postavljene zadatke i tako ostvarili ciljeve organizacije. Kontrola je faza koja omogućava da se sve planirane aktivnosti ostvare, i ona u sebi uključuje više aktivnosti istovremeno.

Letnji kamp se realizovao u pet smena u periodu od 29. juna do 29. jula i trajanju od nedelju dana po smeni na Divčibarima u okviru kompleksa hotela i dečijih odmarališta UTD "Vujić Divčibare" u čijem sastavu se nalaze hotel „Maljen", odmaralište „Mladost", odmaralište „Crni vrh" i hotel „Divčibare". U realizaciji programa učestvovalo je trideset članova tima koji su obučeni sa svoje aktovnosti, kroz kamp je prošlo približno 2000 dece.

Predmet rada predstavlja ulogu i značaj четири faze menadžmenta u analizi sportsko rekreativnog kampa kroz program анимације рекреативних активности. Cilj rada je predstavljanje rekreativnih aktivnosti za decu, uzrasta od sedam do četrnaest godina, kroz planiranje, organizaciju, vođenje i kontrolu.

METOD

Metod rada:

- Korišćeni su empirijski postupci kao što su posmatranje, razgovor, anketa.
- Koristila se metoda teorijske analize i bibliografska metoda prikupljanja podataka.
- Od velikog značaja bila je iskustvena metoda analize podataka.

Kao istraživačka tehnika korišćena je tehnika anketiranja i skaliranja. Коришћена је петостепена Ликертова скала. Anketa je podrazumevala prikupljanje, analiziranje i prikazivanje podataka. Rezultati su prikazani u procentima. Urađena je osnovna statistička obrada podataka анкетираних 500 ispitanika.

REZULTATI

Planiranje kao prva faza menadžmenta je i najvažnija faza menadžmenta, ona određuje ciljeve organizacije i načine za njihovu realizaciju, predstavlja proces gde se na početku realizacije sportsko rekreativnog kampa postavljaju aktivnosti koje su bazirane kroz edukaciju, sport, rekreaciju i avanturu, prirodu i zdrav život, zabavu. Utvrđuje se tačan broj smena i termina izvođenja, lokacija i smeštajni kapacitet. Planirane aktivnosti se odvijaju u tri segmenta: prepodnevne, popodnevne i večernje.

- Edukaciju kao sastavni deo prve faze predstavljamo kroz aktivnosti kao što su: časovi engleskog jezika, mala škola saobraćaja, osnove šaha, umetničke radionice.
- Sport, rekreacija i avantura kao sastavni deo prve faze predstavljamo kroz aktivnosti kao što su: streličarstvo, mačevanje, vožnja bagija, „zorbing“, „buble fudbal“, „zip line“, poligoni, igre u bazenu, penjanje na veštačku stenu, jahanje konja, tenis, stoni tenis, slip, pikado.
- Priroda i zdrav život kao sastavni deo prve faze predstavljamo kroz aktivnosti kao što su: mladi izviđači, postavljanje šatora, orijentacija u prostoru, logorska vatra, ekološke radionice, zdrava ishrana i radne navike.
- Zabavu kao sastavni deo prve faze predstavljamo kroz aktivnosti kao što su: žurke, ples, karaoke, maskenbal, večernje animacije, kvizovi.

Tabela br. 1

	DAN 1.									DAN . 2						
	14^{30}-15^{30}	15^{45}-16^{45}	17-18	18^{15}-19^{15}	19^{15}-19^{45}	8-8^{30}	9-10	10^{15}-11^{15}	11^{30}-12^{30}	12^{45}-13^{45}	14-14^{30}		16-16^{45}	17-17^{45}	18-18^{45}	19^{15}-19^{45}
Zmajevi		Stena	P2	Bubl	V	D	P1	Bazen	Šah	Zorbin	R		Šatori	Strelič.	Zip	V
Tigrovi		P2	Bubl	P1	V	D	Bazen	Šah	Zorbin	Šatori	R		Strelič.	Zip	Air	V
Orlovi		Bubl	P1	Bazen	V	D	Šah	Zorbin	Šatori	Strelič.	R		Zip	Air	Engleski	V
Lavovi		P1	Bazen	Šah	V	D	Zorbin	Šatori	Strelič.	Zip	R		Air	Engleski	Orijenti	V
Štrumfovi		Bazen	Šah	Zorbin	V	D	Šatori	Strelič.	Zip	Air	R		Engleski	Orijenti	P3	V
Aligatori		Šah	Zorbin	Šatori	V	D	Strelič..	Zip	Air	Engleski	R		Orijenti	P3	Mač.	V
Ajkule	OTVARANjE	Zorbing	Šatori	Strelič.	V	D	Zip	Air	Engleski	Orijenti	R	PAUZA	P3	Mač.	Slip	V
Vukovi		Šatori	Strelič.	Zip	V	D	Air	Engleski	Orijenti	P3	R		Mač..	Slip	Umetnos	V
Lisice		Strelič..	Zip	Air	V	D	Engleski	Orijenti	P3	Mač..	R		Slip	Umetnost	Saobr	V
Kobre		Zip	Air	Engleski	V	D	Orijenti	P3	Mač.	Slip	R		Umetnost.	Saobr	Bagi	V
Generali		Air	Engleski	Orijenti	V	D	P3	Mač.	Slip	Umetnost.	R		Saobr	Bagi	Stena	V
Kauboji		Engleski	Orijenti	P3	V	D	Mač.	Slip	Umetnost	Saobr	R		Bagi	Stena	P2	V
Veverice		Orijenti.	P3	Mač.	V	D	Slip	Umetnos.	Saobr .	Bagi	R		Stena	P2	Bubl	V
Detlići		P3	Mač.	Slip	V	D	Umetnos	Saobr .	Bagi	Stena	R		P2	Bubl	P1	V
Delfini		Mač.	Slip	Umetnos.	V	D	Saobr	Bagi	Stena	P2	R		Bubl	P1	Bazen	V

Na tabeli br.1 prikazan je unapred planiran raspored aktivnosti na kampu za prvi i drugi dan. Aktivnosti su raspoređene tako da idu po sistemu dijagonale, gde će učesnici na kampu imati prilike da prođu kroz jednu aktivnost dva puta u toku svog boravka na kampu. U prvoj koloni vidimo nazive ekipa kojih imamo petnaest na kampu zatim sledeća kolona je vreme početka aktivnosti kao i nazivi aktivnosti kojih ima devetnaest na kampu. Plan aktivnosti je napravljen za svih sedam dana, gde se u tabeli može videti da se prvi dan razlikuje u satnici sa početkom od 14:30 časova, dok ostali dani kreću sa aktivnostima od 9 časova.

Organizacija kao druga faza menadžmenta je veoma važna da bi se planirani ciljevi ostvarili. Potrebno je odrediti uloge koje će pojedini delovi ili članovi organizacije obavljati. Jedna od tih uloga je izbor terena koji je podoban za postavljanje stanica

• aktivnosti kao i opremanje svake od aktivnosti. Zatim pronalaženje adekavatnog prostora za kvalitetnu realizaciju same aktivnosti i opremanje potrebnim rekvizitima i opremom, za nesmetanu realizaciju. Smeštaj dece po sobama, dogovaranje adekvatnog jelovnika kao i postavljanje lekarske službe su uloge koje imaju veliki značaj. Realizacija rasporeda aktivnosti kao i definisanje tačne satnice za prepodnevni, popodnevni i večernji blok su veoma važne stavke.

◊ Prepodnevni blok počinje od 9 časova i traje do 14 časova u tom periodu se realizuju četiri aktivnosti u trajanju od jednog sata.

◊ Popodnevni blok počinje od 16 časova i taje do 19 časova u tom periodu realizuju se tri aktivnosti u trajanju od 45 minuta.

◊ Večernji blok počinje u 20 časova i traje do 22 časa i taj deo aktivnosti je rezervisan za zabavu kroz večernju animaciju.

Blokovi se realizuju po sistemu stanica, gde je razmak između svake 15 minuta, dovoljan da vođe grupa dovedu decu na novu aktivnost, gde ih prepuštaju članovima tima koji su zaduženi za tu aktivnost. Nakon završetka aktivnosti grupa koju čini minimum dvadeset a maksimum trideset dece formira kolonu i na čelu sa svojim pratiocem grupe odlazi do sledeće stanice, gde ih dočekuje tim koji ih preuzima i priprema za sledeću aktivnost.

• **Vođenje** kao treća faza menadžmenta predstavlja stalnu funkciju i jednako važan aspekt menadžmenta. Na čelu organizacije je osoba koja donosi odluke, vodi ceo kamp i upošljava članove tima. Sistem je postavljen tako da svaki segment ima svoje lidere koji su zaduženi za pravilno funkcionisanje kampa. Lideri imaju zadatak da postave normative zadatke i da vode aktivnosti tj. komuniciraju sa članovima tima koji su na pojedinačnim aktivnostima. Osoba koja je dobila odgovornost vođenja aktivnosti dužna je da prilagodi teren za nesmetano obavljanje aktivnosti, da obezbedi neophodnu opremu kao i da brine o bezbednosti dece na samoj aktivnosti. Po završetku smene prolazi se detaljno kroz sve aktivnosti, vrši se osvrt na sve detalje, na koji način su se realizovale aktivnosti, i to da li je oprema bila zadovoljavajuća i bezbedna. Nakon utvrđivanja prednosti i nedostataka vrši se priprema za dolazak nove grupe, utvrđuje se raspored, satnica, broj grupa i dodeljuju se zadaci za sledeću smenu. Vođe sektora raspoređuju članove tima, svako dobija broj svog autobusa koji dočekuje i smešta u objekat, nakon smeštaja sledi svečano otvaranje, dodeljivanje rasporeda vođama grupa i početak realizacije aktivnosti. U timu vlada radna i vesela atmosfera zasnovana na fer i korektnom odnosu među članovima tima koji prate svog lidera.

• **Kontrola** kao četvrta faza menadžmenta ima za cilj kontrolu kvalitetnog rada i izvođenja planiranih aktivnosti. Vođe tima dužne su da podnesu izveštaj tim lideru i direktoru kampa kako bi se pravovremeno reagovalo, u slučaju da je potrebno preduzimati određene mere u cilju poboljšanja kvaliteta same aktivnosti.

Kod četvrte faze je sprovedeno istraživanje na uzorku od 500 ispitanika. Ankete nam ukazuju na ishod svega što smo planirali. Rezultati analize našeg kampa ukazuju na veoma visoke ocene, tj. procente, koji su dobijeni sprovođenjem ankete, a samim tim su potvrde pravilne realizacije.

Neophodnost odlaska na organizovane kampove videli smo iz sledećih rezultata gde je 58% ispitanika odgovorilo da su do sada više puta išli organizovano na letovanje. 18% ispitanika je je išlo jednom na letovanje dok 24% ispitanika nikada nije išlo organizovano na letovanje. Zabrinjavajuća je činjenica da 24% dece nije nikada bilo na organizovanom letovanju što nam govori da je organizacija ovakvih kampova preko potrebna kao i rekreativne aktivnosti za decu ovog uzrasta.

Tabela br.2

	Ocena 1	Ocena 2	Ocena 3	Ocena 4	Ocena 5
Smeštaj	3.6%	2.4%	14.4%	23.6%	56%
Ishrana	4%	5.8%	11.4%	25.8%	53%
Organizacija	0.4%	1.8%	2.8%	7.8%	87.2%
Tim animacije	0%	0.8%	1.8%	5%	92.4%
Dnevne aktivnosti	0%	0.6%	2.4%	5%	92%
Večernje aktivnosti	3.8%	1.8%	3.8%	13.4%	77.2%

Visoki procenti uspešne realizacije su potvrda dobro planiranih aktivnosti. U tabeli br.2 vidimo da su veoma visoke ocene dobile sve aktivnosti. Dnevne aktivnosti su u visokom procentu ocenjene ocenom 5. Odličnom organizacijom kampa ocenilo je čak 87,2% ispitanika, dok je tim koji je vodio kamp dobio odličnu ocenu sa preko 90 procenata. Kroz četvrtu fazu kontrole došli smo da zaključka da su aktivnosti na kampu veoma uspešno sprovedene dobijanjem visokih ocena od strane velikog broja ispitanika.

Tabela br. 3

	Ocena 1	Ocena 2	Ocena 3	Ocena 4	Ocena 5
Šah	2%	0.8%	5.4%	10%	81.8%
Saobraćaj	1.2%	2.4%	4.4%	13.2%	78.8%
Engleski	4.4%	3%	7.4%	14.4%	70.8%
Umetnost	1.2%	1.4%	3%	12.8%	81.6%

U tabeli br. 3 je prikazan segment edukacije gde su ispitanici ocenom 5 sa 81.8% ocenili šah, zatim umetnost 81.6%, saobraćaj 78.8% i radionicu engleskog jezika ocenilo je 70.8% ispitanika ocenom 5.

Tabela br. 4

	Ocena 1	Ocena 2	Ocena 3	Ocena 4	Ocena 5
Bagi	0.6%	1.4%	3.8%	9%	85.2%
Zip	0.4%	0.6%	0.8%	5.2%	93%
Stena	3%	3.2%	13.6%	19%	61.2%
Slip	0.2%	0.2%	2.6%	4.2%	92.8%
Poligoni	2.67%	2%	4.4%	8.6%	82.33%
Bazen	0.8%	0.4%	4%	6.2%	88.6%
Zorbing	0.8%	0.2%	0.6%	0.8%	97.6%
Buble	1.6%	1.4%	2.8%	6.6%	87.6%
Mačevanje	0.6%	0.4%	3.2%	9.6%	86.2%
Streličarstvo	0%	0.2%	1.2%	3.6%	95%
Air soft	1.4%	2.4%	5.2%	9.4%	81.6%
Jahanje konja	1.8%	0.4%	2.2%	7.4%	88.2%

Iz segmenta sporta, rekreacije i avanture možemo videti u tabeli br.4 da je najzanimljivija ak-

tivnost koja je dobila ocenu 5 od 97.6% ispitanika bila „zorbing“, zatim streličarstvo sa 95%, „zip line“ sa 93% ispitanika itd. Jedna od najinteresantnijih tabela gde možemo da uvidimo raznolikost rekreativnih aktivnosti koje su imale pozitivan utisak na učesnike kampa.

Tabela br. 5

	Ocena 1	Ocena 2	Ocena 3	Ocena 4	Ocena 5
Šatori	0.2%	1.8%	4%	14.6%	79.4%
Orijentiring	0.6%	1%	2%	9%	87.5%

Tabela br. 5 iz segmenta priroda i zdrav život je takođe dobro vrednovana od strane ispitanika gde je orijentiring sa 87.5% dobio ocenu 5, dok su šatori ocenjeni ocenom pet od strane 79.4% .

Tabela br. 6

	Ocena 1	Ocena 2	Ocena 3	Ocena 4	Ocena 5
Muzika	2%	1.4%	3.6%	10.8%	82.2%
Žurke	3.8%	2.2%	4.8%	8.8%	80.4%
Animacija	0%	0.8%	1.8%	5%	92.4%

U tabeli br.6 je prikazan segment zabave gde je animacija dobila ocenu 5 od strane 92.4% ispitanika, dok su muzika 82.4% i žurke 80.4% nešto manjim brojem ispitanika ocenjene 5. Sve ukazuje na neizostavni deo sportsko rekreativnog kampa a to je druženje i u večernjim satima tj. organizovan večernji program.

ZAKLJUČAK

Dobijeni rezultati nam govore da su četiri faze menadžmenta neophodne za uspešnu realizaciju rekreativnih aktivnosti ovog karaktera. Kroz analizu четврте faze kontrole uvideli smo da su mnoga deca prvi put na ovakvoj vrsti sportsko rekreativnog kampa čak 66.4% i njihove impresije su na zavidnom nivou. Iz istih rezultata smo uvideli visok procenat odličnih ocena kada su u pitanju raznolikost sportsko rekreativnih aktivnosti, tj. deci prija da budu angažovani sa velikim brojem aktivnosti. Резултати анализе показују да су све четири теоријски постављене фазе менаџмента веома интересантне за даља истраживања у области менаџмента спортско рекреативних активности. Ovakvom analizom smo pokazali da planski organizovane sporsko rekreativne aktivnosti mogu dati još bolje efekte primene. Rezultati pokazuju da je program kampa bio odličan, deca su se upoznala sa novim igrama i aktivnostima a posebno je socijalan efekat bio jako važan. Na ovakvim mestima mala deca se ponašaju kao veliki i zreli ljudi.

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ANALYSIS OF PHASE OF MANAGEMENT IN REALIZATION OF SPORTS RECREATIONAL CAMP

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INTRODUCTION

The work was established as well as the need to use current knowledge and experience over the years of implementation of the various sports and recreational activities, as well as to analyze the phase of management in the implementation of sport and recreational camp. The emergence and development of modern technology has led to significant savings of human energy, but also to a complete change of lifestyle. Man is exposed to the increasing demands of modern society and therefore stress. It is often forgotten that one of the basic necessities that children want to meet the needs of the game, as well as a diverse movement that allows proper growth and development of our children. Since a large part of the day children spend indoors (in the school, classroom, apartment ...), it is desirable to time out freely selected activities carried out in the open, clean and fresh air. The children in this camp pass various polygons which are different in character. In its implementation have a significant role and tools used. Of great benefit as multimedia and digital equipment and props, music, video, sound effects, various assets, etc... Consequently one of the definitions of management at James and Stoner (Stavrić, B. Stamatović M., 2003), which made an impression reads: „Management is defined as the process of planning, organization, leadership and control efforts of everyone in the organization to make use of all organizational resources and achieve the set goals of the organization „The management process consists of four main activities: planning, organization, leadership and control, they are among themselves overlap and affect one another. Planning is an activity in which decisions are made about the organization's goals and where devising actions necessary in order to set objectives. Organization follows the planning and includes several activities at the same time, where all activities are directed to determine how to achieve the set goals. Leadership is an activity consisting in providing leadership in terms of the use of influence and motivation to the team members in order to fulfill the tasks and thus achieve the objectives of the organization. Control is the phase that allows realizing all planned activities, and it in itself involves multiple activities simultaneously.

Summer camp is conducted in five shifts in the period from 29 June to 29 July and lasting one week per shift in Divcibare within the hotel complex and children's resorts UTD „Vujic Divcibare", which is composed of a hotel „Maljen" resort „Mladost „resort" Black top „and the hotel" Divčibare „. In implementing the program participated thirty team members who are trained for their activities mentioned, the camp passed about 2,000 children.

Subject and goal of the research

This research represents the role and importance of four stage management in the analysis of sports and recreational camp program, through animation and recreational activities. The aim is the presentation of recreational activities for children aged seven to fourteen years, through the planning, organization, management and control.

METHOD

Methods:

- We used empirical methods such as observation, interview, survey.
- It was used the method of theoretical analysis and bibliographic data collection methods.
- Of great importance was the empirical methods of data analysis.

As a research technique was used survey techniques and scaling. We used a five-point Likert scale. The survey involved the collection, analysis and presentation of data. The results are shown in percentages. We performed basic statistical data processing surveyed 500 respondents.

RESULTS

- **Planning** as the first phase of management is the most important phase of management, it defines the organization's goals and ways of their implementation, is a process where the beginning of the sport and recreational camp set of activities that are based through education, sports, recreation and adventure, nature and healthy life , entertainment. We identify the exact number of shifts and the term of performance, location and accommodation. Planned activities take place in three segments: the late morning, afternoon and evening.

Education as part of the first phase we present through activities such as: English language classes, small school traffic, the basics of chess, art workshops.

Sport, recreation and adventure as part of the first phase we present through activities such as archery, fencing, riding a buggy, „zorbing", „buble football", „zip line", polygons, games in the pool, climbing artificial rock, horseback riding, tennis, table tennis, slip, darts.

Nature and healthy life as part of the first phase we present through activities such as: young scouts, pitching tents, orientation in space, campfire, environmental workshops, and healthy diet and working habits.

Entertainment as part of the first phase we present through activities such as parties, dancing, karaoke, costume party, evening entertainment, and trivia.

Table.1

	DAY 1.									DAY . 2					
	14^{30}-15^{30}	15^{45}-16^{45}	17-18	18^{15}-19^{15}	19^{15}-19^{45}	8-8^{30}	9-10	10^{15}-11^{15}	11^{30}-12^{30}	12^{45}-13^{45}	14-14^{30}		16-16^{45}	17-17^{45}	18-18^{45}	19^{15}-19^{45}
Dragons		Rock	P2	Bublle	D	B	P1	Pool	chess	Zorbing	L		Tents	Archery.	Zip	D
Tigers		P2	Bublle	P1	D	B	Pool	Chess	zorbing	Tents	L		Archery	Zip	Air	D
Eagles		Bublle	P1	Pool	D	B	Chess	Zorbing	Tents	Archery.	L		Zip	Air	English	D
Lions		P1	Pool	Chess	D	B	Zorbing	Tents	Archery.	Zip	L		Air	English	orienteering	D
The Smurfs		Pool	Chess	Zorbin	D	B	Tents	Archery	Zip	Air	L		English	orienteerin	P3	D
Alligators		Chess	Zorbing	Tents	D	B	Archery..	Zip	Air	English	L		Orienteerin	P3	Fencing	D
Sharks		Zorbing	Tents	Archery	D	B	Zip	Air	rEnglish	orienteering	L		P3	Fencing	Slip	D
Wolves	OPEN	Tents	Archery	Zip	D	B	Air	English	orienteering	P3	L	PAUSE	fencing.	Slip	art	D
Handcuffs		Archery.	Zip	Air	D	B	English	orienteering	P3	Fencing .	L		Slip	Art	Traffic	D
Cobras		Zip	Air	English	D	B	orienteering	P3	Fencing .	Slip	L		.Art	traffic	Buggy	D
Generali		Air	English	orienteering	D	B	P3	Fencing .	Slip	Art .	L		Traffic	Buggy	Rock	D
Cowboys		English	orienteering	P3	D	B	Fencing	Slip	Art	Traffic	L		Buggy	Rock	P2	D
Squirrels		orienteering	P3	Fencing .	D	B	Slip	Art	Traffic .	Buggy	L		Rock	P2	Bublle	D
Woodpecker		P3	Fencing	Slip	D	B	Art	Traffic .	Buggy	Rock	L		P2	Bublle	P1	D
Dolphins		Fencing	Slip	Art	D	B	Traffic	Buggy	Rock	P2	L		Bublle	P1	Pool	D

In table No.1 ghost is predetermined schedule of activities at the camp for the first and second day. Activities are arranged so that they go through the system of diagonal, where the participants in the camp will have the opportunity to go through an activity twice during his stay at the camp. In the first column we see the names of the teams which have fifteen at the camp then next column is the start time of activities as well as the names of the activities which has nineteen at the camp. Activity plan is made for all seven days, where in the table can be seen that the first day is different in the hourly rate starting from 14:30, while other days with activities ranging from 9 o'clock.

• **Organization** as the second phase of management is very important to the planned objectives. It is necessary to determine the role that the individual parts or members of the organization to perform. One of those roles is a variety of terrain that is suitable for setting up cell activity and equipping each of the activities. Then finding space for a quality implementation of the activities and provide the necessary props and equipment for smooth implementation. Placement of a Child in the rooms, arranging adequate menu and the setting of medical services have roles that are of great importance. Implementation of the schedule of activities as well as defining the exact timetable for morning, afternoon and evening block are very important items.

Morning block starts at 9 am and lasts up to 14 hours during this period are realized four activities for a period of one hour.

Afternoon block starts at 16 pm and conceal up to 19 hours in that period were carried out three activities for 45 minutes.

Evening block starts at 20 am and lasts up to 22 hours and such activity is reserved for the entertainment through the evening entertainment.

The blocks are implemented by the system of cells, where the distance between every 15 minutes, enough to group leaders bring their children to a new activity, where they are left to team members who are responsible for that activity. After completing the activity group consisting of a minimum and a maximum of twenty and thirty children formed a column and led by their companion group goes to the next station, where they greeted those who picks them up and prepare for the next activity.

• **Leadership** as the third phase of management is a continuous function, and equally important aspect of management. The head of the organization is the person who makes decisions, takes the whole camp and employs team members. The system is set up so that each segment has its own leaders who are responsible for the proper functioning of the camp. Leaders have the task to set norms tasks and activities that lead. Communicate with team members who are on individual activities. The person who received the responsibility of keeping activities is required to adjust the ground for the smooth conduct of activities, to provide the necessary equipment and take care of the safety of children in the activities. Upon completion of the shift go through in detail all activities, carried out the review of all the details, how they realize the activities, and whether the equipment was satisfactory and safe. After identifying the strengths and weaknesses is done preparing for the arrival of a new group, determined schedule, schedule, number of groups and assign tasks for the next shift. The leaders of the sector distributed team members, each receives a number of its buses that welcomes and stored in the object, after having been placed following the opening ceremony, the allocation schedule group leaders and the start of implementation of activities. The government team working and cheerful atmosphere based on a fair and correct relationship among the team members are following their leader.

• **Control** as the fourth stage of management aims to control the quality of the city and carrying out the planned activities. Team leaders are obliged to report to the team leader and director of the camp in order to timely respond in the event that it is necessary to take adequate measures to improve the quality of the activity itself.

In the fourth stage of the research conducted on a sample of 500 respondents. Polls indicate a result of what we have planned. Results of the analysis of our camp indicate a very high marks, i.e. percentages obtained execution of the survey, and therefore are confirming proper realization.

The necessity of going to the organized camps, we saw the following results where 58% of respondents said they have so far organized several times went on vacation. 18% of respondents went one on vacation while 24% of respondents never gone organized the summer vacation. The disturbing fact is that 24% of the children had never been on an organized summer vacation, which tells us that the organization of such camps urgently needed, as well as recreational activities for children of this age.

Table. 2

	Score 1	Score 2	Score 3	Score 4	Score 5
Accommodation	3.6%	2.4%	14.4%	23.6%	56%
Nutrition	4%	5.8%	11.4%	25.8%	53%
Organization	0.4%	1.8%	2.8%	7.8%	87.2%
Tim animation	0%	0.8%	1.8%	5%	92.4%
Daily activities	0%	0.6%	2.4%	5%	92%
Evening activities	3.8%	1.8%	3.8%	13.4%	77.2%

High percentage of successful realization has been confirmation of well-planned activities. In table 2 we see that the very high ratings received all activities. Daily activities are a high percentage of the estimated assessment 5. Good organization of the camp is even rated by 87.2% of respondents, while those who led camp got excellent mark with more than 90 percent. Through the fourth phase of control we have come to the conclusion that the activities at the camp successfully carried out by obtaining high marks by a large number of respondents.

Table. 3

	Score 1	Score 2	Score 3	Score 4	Score 5
Chess	2%	0.8%	5.4%	10%	81.8%
Traffic	1.2%	2.4%	4.4%	13.2%	78.8%
English	4.4%	3%	7.4%	14.4%	70.8%
Art	1.2%	1.4%	3%	12.8%	81.6%

Table no. 3 shows the education segment where respondents gave 5 with 81.8% rated chess, then the art of 81.6%, transport 78.8% and English workshop assessed the 70.8% of respondents Score 5.

Table. 4

	Score 1	Score 2	Score 3	Score 4	Score 5
Bagi	0.6%	1.4%	3.8%	9%	85.2%
Zip	0.4%	0.6%	0.8%	5.2%	93%
Rock	3%	3.2%	13.6%	19%	61.2%
Slip	0.2%	0.2%	2.6%	4.2%	92.8%
Polygon	2.67%	2%	4.4%	8.6%	82.33%
Pool	0.8%	0.4%	4%	6.2%	88.6%
Zorbing	0.8%	0.2%	0.6%	0.8%	97.6%
Buble	1.6%	1.4%	2.8%	6.6%	87.6%
Fencing	0.6%	0.4%	3.2%	9.6%	86.2%
Archery	0%	0.2%	1.2%	3.6%	95%
Air soft	1.4%	2.4%	5.2%	9.4%	81.6%
Horseback riding	1.8%	0.4%	2.2%	7.4%	88.2%

From the segment of sports, recreation and adventures we can see in Table 4 that the most interesting activity that received a score of 5 out of 97.6% of respondents were „zorbing", then archery with 95%, „zip line" with 93% of respondents, etc. This is one of the most interesting tables where we can see variety of recreational activities that have had a positive impression on the participants of the camp.

Table. 5

	Score 1	Score 2	Score 3	Score 4	Score 5
Tents	0.2%	1.8%	4%	14.6%	79.4%
Orienteering	0.6%	1%	2%	9%	87.5%

Table no. 5 from the segment of nature and healthy life is also well valued by the respondents which is orienteering with 87.5% received a rating of 5, and are graded with five tents by 79.4%.

Table. 6

	Score 1	Score 2	Score 3	Score 4	Score 5
music	2%	1.4%	3.6%	10.8%	82.2%
Parties	3.8%	2.2%	4.8%	8.8%	80.4%
Animation	0%	0.8%	1.8%	5%	92.4%

Table No.6 shows the entertainment segment where the animation received 5 votes by 92.4% of the respondents, while 82.4% music and parties 80.4% somewhat smaller number of respondents rated 5. Everything points to an essential part of sports and recreational camp which is gathering and in the evening i.e. organized evening.

CONCLUSION

The results tell us that there are four stages of management necessary for successful realization of recreational activities of this character. Through the analysis of the fourth phase of control, we realized that many children for the first time in this kind of sport and recreation camp 66.4% and their impressions are very high. For the same results we have seen a high percentage of excellent score when it comes to the variety of sports and recreational activities, i.e. children feels good to be involved with a number of activities. The results show that all four theoretically set stage management is very interesting for further research in the field of management of sports and recreational activities. Such analyzes show that the planning organized recreational activities can provide even better effects application. Results show that the program was an excellent camp, the children were met with new games and activities, and especially the social impact was very important. In places like small children behave as large and mature people.

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RESEARCH OF ANTHROPOMETRIC MARKS WITH MARATHON RUNNERS

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INTRODUCTION

The development of modern sport with its increasing specialization required to deepen the knowledge about the structure of the human body. The modern world practice and research in the field of athletics provide convincing evidence that the role of anthropometric marks is extremely important, regardless of the sport level, age and gender (Fleck, 1983; Hollings, and Robson, G (1991); Housh, et al.,1984; Marfell-Jones, et al, 2006; Parizkova, J., 1977; Pastor, G. G., 2009). This requires more detailed disclosure of relationships between body composition and functional capabilities of humans to improve their methods of research, creation of model morphological characteristics in different sports disciplines. A lots of publications have recently been devoted to identification of the influence of the morphological characteristics of sports performance, describing the body structure of the athletes or providing results of measurements on body sizes (Fleck,1983; Housh, et al., 1984; Pastor, 2009; Stellingwerff, et al., 2007). Anthropometric studies would enable us to bring the real value of each mark for the competitors in the marathon running. The aim of this study was to increase the effectiveness of the training process by theoretical justification of optimal anthropometric parameters in athletes in of marathon running.

METHOD

The object of research are 35 athletes in marathon running, which were measured as following:

- height (in cm right);
- body weight (kg);
- % body fat (FM), by measuring the skin folds using regression equations by Parizkova J. (Parizkova,1977);
- % muscle mass (MM);
- free fat mass (FFM);

The anthropometric marks that were studied were part of the functional analysis of competitors. The measurement of line dimensions of the body was done in standing position. From the same starting position diameters were measured and body circumference of the upper limbs and lower limbs of the torso - by standing feet apart. Measuring of the body fat was performed only on the right body half with a vertical grip on the skin fold. Later in the results of the functional research, an individual maximum speed (S max), was used associated to maximum oxygen consumption (VO2max). The received data were systematized and subjected to statistical processing programs by IBM SPSS Statistics and Microsoft Excel.

RESULTS

Height is the basic and permanent mark of the physical development of man. Its values are mostly genetically determined and have the age and gender specificity. It is also affected by systemic and specific training activities. The growth of the tested athletes ranged from 164.0 cm to 182.5 cm and the average value of the index was 175.15 centimetres. Weight is characterized by the total mass of the human body (muscle, bones, internal organs, subcutaneous fat, etc.). Keeping it optimal is crucial for the realization of high sports result in marathon running. The weight of researches athletes ranged from 53.6 kg to 66.2 kg, and the average value is 60.25. Body fat. In anthropology it is known that body weight has two basic components - body fat and free fat mass. This separation is based on the most widely applied anthropology model - model Behnke (Fleck,1983). According to him, free fat mass consists of all no fat tissues, internal organs, fluids, etc. Body fat is defined metrically by two characteristics: an absolute amount of fat as a percentage (%) of body weight. More objective information for body composition is provided by body fat percentage, because it gives the impression of the proportion of active and bodyweight. Body fat in athletes ranged between 7.2% and 13.7%. Its arithmetic mean is 9.75.

Muscle mass is a basic anthropometric measurements with essential sports result. The endurance in marathon running is expressed by the relationship between muscle strength and time for its maintenance. (Stellingwerff, et al., 2007) From these results it is clear that the tested long-distance runners having high values of this mark - values vary between 44.7% and 51.2, the average is 48.86. Free fat mass (FFM). As mentioned above, the free fat mass represents no fat component by weight. FFM of athletes is between 49.4 kg and 61.4 kg, and its the average value is 57.64 kg. Smax. The maximum speed of running is a key indicator of sporting achievement in the laboratory. It ranges from 18.4 km / h to 20.8 km/h and average value is 19.8 km / h.

Table 1. shows the correlations between all tested parameters.

	High	Weight	FM	FFM	MM	Smax
High	1	0.79	0.39	0.78	0.79	0.32
Weight		1	-0.23	0.98	0.90	0.43
FM			1	-0.25	-0.71	-0.52
FFM				1	0.95	0.52
MM					1	0.59
Smax						1

The height is highly correlated with body weight (r = 0.79). On one hand, it is logical, on the other hand, and advantageously, because the higher competitors have longer levers, on the acting muscles. Therefor, the equally longer levers provide bigger amplitude of movements (and the length of the running step), but also require less frequent moves for economical running, which is important for long running distances in athletics. The body mass correlates most highly with basic strength of the body muscles (muscle mass) and free fat mass. The bigger strength allows the athletes to run with a bigger step, without reducing significantly the frequency. This leads to later onset of fatigue during competition when the stride length hardly reduced.

High correlations of FFM with other marks supports this theory that it is advisable weight is made of more muscle mass and less body fat. The lack of high correlation dependence of the maximum speed of running (Smax) with body mass can be explained by the fact that well-trained athletes reach and maintain high speed running, which is not very different for light and heavy athletes so the best ratio for realize the speed potential is with athletes which have low body mass. Optimal values of anthropometric marks for athletes running in a marathon are presented in Table 2.

Table 2

	Recommended values
High	169.5-179.2
Weight	56.7-61.2
FM	9.6-11.3
FFM	51.0-61.0
MM	49.0-50.9

CONCLUSION

1. There is high correlation of the standard anthropometric marks and the sport achievement in running of marathon;

2. Muscle mass appears to be primary anthropometric mark that affects maximal speed in running of men. Its levels vary between 49.9-50.9%;

3. The values of anthropometric features with athletes in marathon running should be in followed ranges: height: 169.5-179.2 cm; weight: 56.7-61.2; fat mass (%): 9.6-11.3; muscle mass (%): 49.0-50.9.

4. The presented optimal values for anthropometric features could help sports theory and practice in the following areas:

- recruitment and selection of promising athletes;

- evaluation of the effectiveness of the training process;

- adjusting the diet.

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ASSESSMENT OF FUNCTIONAL EFFICIENCY AND ADAPTABILITY AT THE INDIVIDUAL RUNNERS AT MIDDLE DISTANCES

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INTRODUCTION

One of the tasks of functional diagnostics in sport is a study of the changes that occur in cardiorespiratory system when carrying out training activities. In contemporary sports science and practice there are a lots of effective methodological approaches that are related to the precise dosage of training effects. In our research we set such a task in one of the most interesting and prestigious athletics disciplines - running at middle distances. Its solution implies a response to some of the issues of monitoring and evaluation of the current situation and the effectiveness of the specific running loads. Novelty in sports theory and practice is that these results are a function of studies conducted entirely in terms of coaching with unique equipment. Similar studies in complex exercise, in this case running with progressive increases in speed have been made so far only in the laboratory, and test loads are modeled on the special flight simulation devices (tretban or stationary bike). The research that we have made allows us to compare the results of laboratory and field studies and to improve the regulatory system for monitoring and evaluation of adaptation processes that characterize the effectiveness of the training process.The aim of the study is to increase the effectiveness of the training process in running at middle distances through creating of criteria for assessing the effects of adaptation running loads.

The aim assumes the following tasks:

1. Study of the functional capacity of athletes in running at 800m;
2. Analysis of changes in levels of functional parameters in standard running load with progressively increasing the intensity;
3. Evaluation of functional changes and individual adaptation to running loads.

METHOD

Object of the research are changes of functional marks with implementation of systematic training loads over a six-week pre-competition training mesocycle.Subject of the study are 20 men and 20 women athletes in running at middle distances. Competitors were tested in natural conditions of sports training twice - the first time in the beginning of experimental stage and after its completion. The test, which they performed is standard running load 6 x 1000 m in 3-minute passive pause with progressively increasing speed. The test is performed on a standard running track. The pace of the race was regulated with a special automatic pacemaker. During the testing by telemetry computer complectation "K4" were measured following indicators of activity of the cardiorespiratory system:

- Dynamics of the pulse frequency in the phases of load and rest;
- Dynamics of oxygen consumption (maximum and relative) in the operating and recovery phases
- Dynamics of the oxygen pulse in operating and recovery phases of the load;

The data obtained is related to the speed running through statistical analysis of the respective correlations and regressions.

RESULTS

The comparative analysis of results of the two testing created the opportunity for an individual assessment of the functional effect of the applied training. The following two tables show the obtained results. These data are the basis for assessing the general changes in the functional state.

Table 1. variation of the studied parameters before training mesocycle

N =40	*Smax*	$VO_{2\ max}$	$vVO_{2ан.}$	*vAnT*	*vAeT*	$HtrVo_{2max}$	*HtrAnT*	*HtrAeT*
X	5,57	62,46	4,83	3,83	3,58	196,11	185,33	165,22
S	0,71	4,73	0,53	0,59	0,44	9,14	10,39	10,20
Sample Variance	0,50	22,39	0,28	0,35	0,19	83,61	108,00	103,94
Kurtosis	1,79	-0,63	-0,31	4,32	3,29	-0,73	0,47	0,43
Skewness	-0,85	0,69	-0,25	1,94	1,34	0,31	-0,25	-0,34
Range	2,52	13,2	1,68	1,87	1,58	28	35	34
Minimum	4,1	57,8	3,9	3,36	3,33	183	167	147
Maximum	6,62	71	5,58	5,23	4,27	211	202	181
Coefficient of variance	12,7	9,0	10,88	15,38	12,25	4,66	5,51	6,17

Table 2. variation of the studied parameters after training mesocycle

N = 40	*Smax*	VO_{2max}	vVO_{2max}	*vAnT*	*vAeT*	$HtrVo_{2max}$	*HtrAnT*	*HtrAeT*
Mean	5,57	65,77	4,99	3,95	3,80	192,44	181,89	161,89
Standard Deviation	0,71	4,65	0,56	0,39	0,24	6,78	8,46	8,46
Sample Variance	0,50	21,64	0,31	0,15	0,06	46,03	71,61	71,61
Kurtosis	1,79	2,17	-1,32	-0,73	2,90	0,85	-0,90	-0,90
Skewness	-0,85	0,75	0,32	0,36	1,59	0,93	0,16	0,16
Range	2,52	17	1,58	1,17	0,75	22	25	25
Minimum	4,1	58,4	4,3	3,47	3,59	184	169	149
Maximum	6,62	75,4	5,88	4,64	4,34	206	194	174
Sum	50,12	501,9	44,93	35,56	34,24	1732	1637	1457
Coefficient of variance	12,7	8,3	11,14	9,9	6,23	3,53	4,65	5,23

Legend:
vVO2max-speed of running at VO2max (m / s)
vAnT – speed anaerobic threshold (m / s)
vAeT – speed aerobic threshold (m / s)
HtrVO2max - VO2max rate (beats / min)
HtrAnT - heart rate in threshold of anaerobic exchange (beats / min)
Smax - maximum running speed (m / s)

The comparing between the quantitative values of the researched marks confirms expectations for change in the basic functional status of the athletes. Quantitative expression of this change are:

- oxygen consumption increased from 62.46 mil. /kg to 65.77 mil / kg
- running speed associated with this value increased from 4.83 m / sec. to 4.99 m / sec;
- running speed at the anaerobic transition increased from 3.83 m / sec. To 3.95 m / sec;
- speed running at aerobic threshold increased from 3.58 m / s to 3.80 m / sec;
- Limits of pulse markers reduced as follows: a maximum of 196.11 to 192.44 beats / min., Anaerobic from 185.33 to 181.89 beats / min., Aerobic from 165.22 to 161.89.

The described changes show that in the functional status of the athletes significant positive changes occurred. Therefore, we have increased energetic potential of the organism, with improving the effectiveness of its consumption, i. e. at high values of mechanical muscle work decreased voltage in the operation of the cardiovascular system. The following two tables show correlations between the basic parameters that characterize the level of adaptation and change before and after the experiment.

Table 3. Correlation structure of functional status before the start of the six-week training mesocycle

	Smax	VO_{2max}	vVO_{2max}	vAnT	vAeT	$HtrVO_{2max}$	HtrAn	HtAeT
Smax	1,00							
VO_{2max}	0,33	1,00						
vVO_{2max}	0,55	0,45	1,00					
vAnT	**0,61**	-0,16	**0,70**	1,00				
vAeT	0,53	0,08	**0,80**	**0,94**	1,00			
$HtrVO_{2max}$	-0,36	-0,51	-0,37	-0,11	-0,26	1,00		
HtrAnT	-0,22	**-0,61**	-0,45	-0,05	-0,25	**0,93**	1,00	
HtAeT	-0,23	**-0,63**	-0,46	-0,05	-0,26	**0,93**	1,00	1,00

Analysis of correlations between basic marks before starting the trainings in the experimental cycle showed a relatively significant spillage correlation connections. Their total number is 8 (Pt> 0,6). So the maximum running speed directly depends on the speed of running, associated with the anaerobic transition. Speed associated to anaerobic transition has almost functional dependence with speed associated to the aerobic threshold.

Table 4. Correlation structure after a six-week training mesocycle

	Smax	VO_{2max}	vVO_{2max}	vAnT	vAeT	$HtrVO_{2max}$	HtrAnT	HtAeT
Smax	1,00							
VO_{2max}	0,12	1,00						
vVO_{2max}	**0,81**	0,48	1,00					
vAnT	**0,59**	0,03	0,56	1,00				
vAeT	**0,74**	-0,02	0,56	**0,92**	1,00			
$HtrVO_{2max}$	-0,06	**-0,75**	-0,49	-0,07	0,04	1,00		
HtrAnT	-0,20	**-0,58**	**-0,70**	-0,18	0,01	**0,71**	1,00	
HtAeT	-0,20	**-0,58**	**-0,70**	-0,18	0,01	**0,71**	1,00	1,00

DISCUSSION

After the experiment correlation structure expands considerably, with significant correlations increased to 11 and localized to specific marks. For example, such an important indicator of the practice, the maximum speed of running logically turns associated with different speeds associated functional adaptation to the respective markers. Expending the correlation influence of the maximum oxygen consumption and pulse markers. All this gives us reason to believe that the data from the experiment are correct enough to be the basis for developing assessments of the effectiveness of the functional effects of the implementation of running loads.

CONCLUSION

The analysis of the studies and experiments have pulled out important conclusions for sports practice. They are related to the assessment of the functional effects of specific running loads of elite runners in middle distance running.

1. The speed of recovery of the pulse frequency in the phases of the shortened rest is correct adaptation marker for determination of individual tolerance in running loads and level of training of the athlet.

2. The intensity (speed) of running and pulse rate in the phases of load and rest are functionally dependent.

3. Pulse ranges in the phase of recovery related to the speed and duration of the running loads determine the extent of current tolerance and the level of individual functional preparedness.

4.The parametres of individual working pulse rate that characterize the specificity of adaptation processes are grouped in the following three ranges: unlimited adaptation-pulse rate of 135 to 160 beats/min; limited adaptation-pulse rate of 161 to 175 beats/min.; impaired adaptation-over 175 beats/min.

5. This study allows to compare the results of laboratory and field studies and to improve the regulatory system for individual monitoring and evaluation of adaptation processes that characterize the effectiveness of the training process.

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POVEZANOST EKSPLOZIVNE SNAGE MIŠIĆA I TELESNOG SASTAVA RUKOMETAŠA UZRASTA 14 DO 16 GODINA U ODNOSU NA IGRAČKU POZICIJU

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UVOD

Eksplozivna snaga je jedna od determinanti uspešnosti u svim aktivnostima koje zahtevaju očitavanje maksimalne mišićne sile u što kraćoj jedinici vremena (Newton & Kreamer, 1994). Većina izbačajnih aktivnosti tj. udaraca i dodavanja rekvizita (lopte) u sportu, a posebno u rukometu, zavisi u najvećoj meri od eksplozivne snage mišićne regije kojom se vrši izbačaj.

Eksplozivna snaga predstavlja sposobnost koja omogućava jednom sportisti ubrzanje njegovog tela prema nekom objektu ili partneru. Ispoljena eksplozivna snaga zavisi od procenta i sastava motornih jedinica odgovarajuće mišićne grupe (Bubanj & Branković, 1997).

Sastav tela - ljudsko telo sačinjeno je od kože, masnog tkiva, mišićnog tkiva (sa preovlađujućim skeletnim mišićima), koštanog tkiva (i drugog vezivnog tkiva), nervnog sistema (mozak, itd.) i organa (srce, jetra, itd.).

Idealna količina masnog tkiva (izražena u procentima) razlikuje se i veća je za žene u odnosu na muškarce. Masno tkivo je ženama neophodno da bi održale menstrualni ciklus, tj. reproduktivnu sposobnost (American Councilon Exercise, n.d.).

U savremenoj rukometnoj igri svaka igračka pozicija ima razvijene specifične motoričke sposobnosti koje doprinose krajnjem timskom učinku (Oxyzoglou, Hatzimanouil, Kanioglou, & Papadopoulou, 2008.). Bolek (1982.) navodi da kružni napadači ostvaruju veću snagu gornjih u odnosu na donje ekstremitete, dok krilni igrači u odnosu na igrače na drugim pozicijama ostvaruju najveću izdržljivost mišića trbušne regije i stopala.

Osnovni cilj ovog istraživanja je kvantifikovnje varijabli ispoljene eksplozivne snage ruku i nogu i utvrđivanje korelacija između ekplozivne snage i telesnog sastava u zavisnosti od igračke pozicije.

METOD

Uzorak ispitanika sačinjava 30 dečaka rukometnog kluba „Sloga„ iz Kraljeva koji se takmiče u Drugoj ligi Zapad. Uzrast ovih dečaka je od 14 do 16 godina koji su podeljeni po igračkim pozicijama na subuzorke i to bekovi (n=9), krila (n=10), golmani (n=5) i pivoti (n=6). Osnovni kriterijum za učešće u istraživanju je dužina bavljenja rukometom u trajanju od najmanje tri godine, kao i odsustvo oboljenja i povreda koji bi mogli negativno da utiču na zdravstveni status ispitanika i rezultate istraživanja.

Uzorak varijabli:

Antropometrijske karakteristike biće procenjene sledećim varijablama:

- TelTež (telesna težina izražena u kg),

- TelVis (telesna visina izražena u cm) i
- BMI (indeks telesne mase, prema engl. Body mass index).

Upotrebom analizatora bioimpedanse „OmronBF511“, utvrdiće se vrednosti sledećih varijabli telesnog sastava:

- Body Fat (masno tkivo izraženo u procentima),
- MUSCLE (količina skeletnih mišića izražena u procentima) i
- RM kcal (dnevna potrošnja kalorija u kcal.).

Upotrebom bežičnog akcelerometra Myotest, utvrdiće se vrednosti sledećih varijabl ieksplozivne snage gornjih ekstremiteta:

- Power (snage izražene u W),
- Force (sile izražene u N) i
- Velocity (brzine izražene u cm/s).

Upotrebom bežičnog akcelerometra Myotest, utvrdiće se vrednosti sledećih varijabli eksplozivne snage donjih ekstremiteta:

- Height (visina izražena u cm),
- Power (snaga izražena u W/kg),
- Force (sila izražena u N/kg) i
- Velocity (brzina izražena u cm/s).

Organizacija, instrumentarijum i uslovi merenja

Istraživanje je bilo transverzalnog karaktera, a sproveo ga je autor i za tu priliku posebno obučeni saradnici za upotrebu analizatora bioimpedanse „OmronBF511“ i uređaja za procenu eksplozivne snage „Myotest”. Merenju telesnog sastava i eksplozivne snage prethodilo je merenje telesne visine upotrebom antropometra po Martinu. Istraživanje je sprovedeno u skladu sa Helsinškom Deklaracijom, u sali Sportskog Centra „Ibar“ u Kraljevu. Svi ispitanici su biti upoznati sa zadacima merenja, a svoje učešće, t.j. saglasnost o učešću u istraživanju potvrdili su pismenim putem. Merenju ekplozivne snage donjih ekstremiteta prethodilo je zagrevanje koje se sastojatojalo iz laganog trčanja 800m, skipa unapred 4x30m, bočnog kretanja 4x30m i skipa unatrag 4x30m. Merenju ekplozivne snage gornjih ekstremiteta prethodilo je zagrevanje koje se sastojalo iz protokola potiska sa klupe sa 2x5 ponavljanja niskog inteziteta i opterećenjem od 10kg, 2x5 ponavljanja umerenog inteziteta i opterećenjem od 10kg i 2x3 ponavljanja visokog inteziteta i opterećenjem od 20kg. Između navedenih serija potiska sa klupe, postojao je odmor u trajanju od 1 minuta, kao i nakon sprovedenih serija zagrevanja i to u trajanju od 3 minuta.

Postupak merenja

Ispitanici su najpre pristupiti merenju telesne visine, a zatim i telesnog sastava u koloni jedan iza drugog. U cilju utvrđivanja eksplozivne snage gornjih ekstremiteta potiskom sa klupe, autori su postavljali uređaj “Myotest” na šipku Smith mašine, čija je ukupna težina sa tegovima iznosila 20 kg. Iz početnog ležećeg položaja sa opruženim rukama u zglobovima laktova, ispitanici su izveodili po pet spuštanja i podizanja opterećenja, nakon kratkih zvučnih signala uređaja “Myotest”. U cilju utvrđivanja eksplozivne snage donjih ekstremiteta, neposredno pred skok oko struka im je postavljen poseban pojas na koji je bio pričvršćen uređaj “Myotest”. Ispitanici su izvodili pet skokova sa počučnjem na način opisan u potpoglavlju. Takođe, ispitanicima su davane instrukcije da ruke postave o bokove, kako njima ne bi saopštavali dodatni impuls telu prilikom odskoka, zatim da mesto odskoka treba da bude identično mestu doskoka, kao i da kontakt sa podlogom treba da bude što kraći. Telesni sastav utvrđivan je tako što su ispitanici, bosonogi, statajali najpre na elektronsku vagu koja predstavlja sastavni deo uređaja „Omron BF511“ i tom prilikom utvrđivana je njihova telesna težina. Zatim su uzimali pokretni deo bioimpendance, izvršavali određena podešavanja softvera u odnosu na pol,godine života i ruke postavljali u položaj predručenja sa fleksijom u zglobovima ramena od 90 deg. Jedinstvena tehnologija „8 senzora“ preko kojih su bile postavljene ruke i stopala obezbeđuje

najtačnije rezultate merenja telesnog sastava metodom bioimpedance. Vrednosti telesnog sastava, očitavale se sa displeja uređaja „OmronBF511". Vrednosti varijabli eksplozivne snage, očitavale su se sa displeja uređaja "Myotest", koji statistički obrađuje srednju vrednost istraživanih varijabli. U cilju statističke obrade dobijenih podataka korišćen je paket "SPSS version 13", a dobijeni rezultati su prikazani deskriptivnom statistikom (tabelarno i grafički). Za utvrđivanje povezanosti varijabli eksplozivne snage i telesnog sastava, korišćena je korelaciona analiza (Petković, 2000). Provera normalnosti raspodele podataka proveravana Kolmogorov Smirnovljevim testom.

REZULTATI

Deskriptivna statistika

Tabela 1. Telesna težina i telesna visina igrača po pozicijama

Pozicija		Weight (Kg)	Height (cm)
bek	Mean	73,78	185,56
n=9	Std. Dev.	9,16	5,70
	Minimum	62,00	175,00
	Maximum	91,00	193,00
krilo	Mean	62,70	184,60
n=10	Std. Dev.	7,17	9,07
	Minimum	54,00	174,00
	Maximum	77,00	198,00
pivot	Mean	86,33	181,00
n=6	Std. Dev.	5,75	5,69
	Minimum	79,00	171,00
	Maximum	92,00	187,00
golman	Mean	67,60	184,40
n=5	Std. Dev.	1,14	4,39
	Minimum	66,00	178,00
	Maximum	69,00	189,00
Total	Mean	71,57	184,13
n=30	Std. Dev.	11,02	6,75
	Minimum	54,00	171,00
	Maximum	92,00	198,00

Tabela 2. Eksplozivna snaga gornjih ekstremiteta igrača po pozicijama.

pozicija		Power (W)	Force (N)	Velocity (cm/s)
bek	Mean	135,22	260,89	68,11
n=9	Std. Dev.	14,91	24,52	6,90
	Min.	114,00	231,00	58,00
	Max.	159,00	293,00	79,00
krilo	Mean	135,70	242,70	65,10
n=10	Std. Dev.	12,70	52,86	7,26
	Min.	118,00	149,00	54,00
	Max.	161,00	293,00	77,00
pivot	Mean	109,33	233,83	56,17
n=6	Std. Dev.	9,61	10,03	6,74
	Min.	98,00	221,00	49,00
	Max.	123,00	251,00	68,00
golman	Mean	139,20	255,40	68,40
n=5	Std. Dev.	19,20	12,60	4,22
	Min.	112,00	241,00	62,00
	Max.	163,00	273,00	73,00
Total	Mean	130,87	248,50	64,77
n=30	Std. Dev.	17,32	34,41	7,80
	Min.	98,00	149,00	49,00
	Max.	163,00	293,00	79,00

Tabela 3. Eksplozivna snaga donjih ekstremiteta igrača po pozicijama.

		Height (cm)	Power (W)	Force (N)	Velocity (cm/s)
pozicija					
bek	Mean	37,56	38,33	24,47	222,11
n=9	Std. Dev.	4,77	10,63	2,61	*38,56*
	Min.	31,00	28,00	21,20	165,00
	Max.	46,00	54,00	28,70	276,00
krilo	Mean	35,60	41,00	24,47	246,30
n=10	Std. Dev.	3,75	7,21	4,43	20,19
	Min.	32,00	30,00	20,20	208,00
	Max.	43,00	52,00	33,40	278,00
pivot	Mean	33,50	39,67	24,83	227,17
n=6	Std. Dev.	3,15	6,68	2,25	30,05
	Min.	28,00	33,00	21,20	192,00
	Max.	37,00	51,00	28,00	279,00
golman	Mean	39,00	40,40	24,40	216,60
n=5	Std. Dev.	9,46	8,56	2,83	59,20
	Min.	29,00	30,00	21,60	117,00
	Max.	51,00	51,00	27,80	261,00
Total	Mean	36,33	39,83	24,53	230,27
n=30	Std. Dev.	5,31	8,15	3,10	36,32
	Min.	28,00	28,00	20,20	117,00
	Max.	51,00	54,00	33,40	279,00

Povezanost varijabli telesnog sastava sa eksplozivnom snagom

Tabela 4. Povezanost varijabli telesnog sastava sa eksplozivnom snagom gornjih ekstremiteta kod krilnih igrača.

		BMI	BodyFat (%)	Muscle (%)	RMkcal (kcal)
Power (W)	Pearson Correlation	**,741***	**,765****	-,019	,448
	Sig.(2tailed)	**,014**	**,010**	,957	,194
	N	**10**	**10**	10	10
Force (N)	Pearson Correlation	,483	,278	-,476	,416
	Sig.(2tailed)	,157	,437	,165	,231
	N	10	10	10	10
Velocity (cm/s)	Pearson Correlation	**,681***	,618	-,293	,543
	Sig.(2tailed)	**,030**	,057	,412	,105
	N	**10**	10	10	10

U subuzorku krila postoji značajna pozitivna korelacija između varijabli BMI i Power, BMI i Velocityy, BodyFat i Power

Tabela 5. Povezanost varijabli telesnog sastava sa eksplozivnom snagom gornjih ekstremiteta kod pivota

		BMI	BodyFat (%)	Muscle (%)	RMkcal (kcal)
Power (W)	Pearson Correlation	,593	,348	,005	,221
	Sig. (2-tailed)	,215	,499	,993	,674
	N	6	6	6	6
Force (N)	Pearson Correlation	,288	,050	-,203	-,130
	Sig. (2-tailed)	,580	,925	,700	,807
	N	6	**6**	6	**6**
Velocity (cm/s)	Pearson Correlation	,390	**,899***	,701	**,876***
	Sig. (2-tailed)	,445	**,015**	,120	**,022**
	N	6	**6**	6	**6**

U subuzorku krila postoji značajna pozitivna korelacija između varijabli BodyFat i Velocityy, Muscle i Velocity.

Tabela 6. Povezanost varijabli telesnog sastava sa eksplozivnom snagom donjih ekstremiteta kod bekova.

		BMI	BodyFat (%)	Muscle (%)	RMkcal (kcal)
Height (cm)	Pearson Correlation	-,298	-,200	-,318	-,100
	Sig. (2-tailed)	,436	,607	,404	,799
	N	9	9	9	9
Power (W/Kg)	Pearson Correlation	-,529	-,163	,535	-,036
	Sig. (2-tailed)	,143	,675	,137	,927
	N	9	9	9	9
Force (N/kg)	Pearson Correlation	-,555	,136	,259	,114
	Sig. (2-tailed)	,121	,728	,501	,770
	N	9	9	9	9
Velocity (cm/s)	Pearson Correlation	-,524	-,208	**,669***	-,014
	Sig. (2-tailed)	,148	,591	**,049**	,972
	N	9	9	**9**	9

Na subuzorku bekova postoji značajna pozitivna korelacija između Muscle i Velocity.

Tabela 7. Povezanost varijabli telesnog sastava sa eksplozivnom snagom donjih ekstremiteta kod krilnih napadača

		BMI	BodyFat (%)	Muscle (%)	RMkcal (kcal)
Height (cm)	Pearson Correlation	-,123	,090	-,406	,213
	Sig. (2-tailed)	,736	,805	,245	,554
	N	10	10	10	10
Power (W/Kg)	Pearson Correlation	,213	,353	-,294	,282
	Sig. (2-tailed)	,555	,317	,409	,430
	N	10	10	10	10
Force (N/kg)	Pearson Correlation	,471	,289	,092	,238
	Sig. (2-tailed)	,200	,450	,814	,538
	N	9	9	9	9
Velocity (cm/s)	Pearson Correlation	,492	**,649***	-,179	,271
	Sig. (2-tailed)	,149	**,042**	,620	,449
	N	10	**10**	10	10

Na subuzorku krila postoji značajna pozitivna korelacija između BodyFat i Velocity.

Tabela 8. Povezanost varijabli telesnog sastava sa eksplozivnom snagom donjih ekstremiteta kod golmana.

		BMI	BodyFat (%)	Muscle (%)	RMkcal (kcal)
Height (cm)	Pearson Correlation	,216	-,211	-,668	-,139
	Sig. (2-tailed)	,727	,733	,218	,823
	N	5	5	5	5
Power (W/Kg)	Pearson Correlation	-,877	,350	,019	-,387
	Sig. (2-tailed)	,051	,563	,976	,520
	N	5	5	5	5
Force (N/kg)	Pearson Correlation	-,543	-,150	-,058	-,573
	Sig. (2-tailed)	,344	,809	,926	,312
	N	5	5	5	5
Velocity (cm/s)	Pearson Correlation	**-,908***	,638	,526	-,385
	Sig. (2-tailed)	**,033**	,247	,362	,522
	N	**5**	5	5	5

U subuzorku golmana postoji značajna negativna korelacija između BMI i Velocity.

DISKUSIJA

U subuzorku golmana i bekova ne postoji značajna korelacija između telesnog sastava i eksplozivne snage gornjih ekstremiteta, dok u subuzorku pivota postoji značajna pozitivna korelacija između varijabli BodyFat i Velocity (p= ,015), Muscle i Velocity (p= ,022), a kod subuzorka krila postoji značajna pozitivna korelacija između varijabli BMI i Power (p= ,014), BMI i Velocity (p= ,030), BodyFat i Power (p= ,010) . Rezultati istraživanja nam ukazuju na sledeće činjenice: posmatrajući rezultate koji su postignuti kod ispitivanih golmana i bekova gde nismo uočili značajnu korelaciju, da se zaključiti da u dosdašnjem trenažnom procesu nije dovoljno rađeno na specifičnosti pozicija koje igrači zazuzimaju. Dok igrači na mestu pivota koju su obuhvaćeni ispitivanjem imaju veći procenat masnoće u organizmu , veću opštu telesnu masu, a samim tim poseduju manju mišićnu masu što sve ukupno (Noutsosetal 2004 ; Srhojetal 2002), prouzrokuje sporiju pokretljivost samog tela,slične rezultate su u svom istraživanju dobili i Sporiš i sar. (2010). Dok igrači na poziciji krila, prema rezultatima u tabelama su sa manjim procentom masnoće u organizmu, samim tim i većom mišićnom snagom, manjom opštom masom organizma, pa sve to ukupno dovodi do veće pokretnjivosti celog organizma, a samim tim i delova tela. Matthysetal (2013) u svom istraživanju navod da se za pozicije krila prilikom selekcije biraju uvek najniži igrači i igrači sa najmanjom telesnom masom, čime možemo objasniti gore navede rezultate. Zato ovde ne smemo zanemariti ni principe selekcije, njihove predispozicije i kratk vremenski periodo trenažnog postupka kao bitane faktore koje utiču na izmerene rezultate.

Na osnovu rezultata iz tabela možemo uočiti da na subuzorku bekova postoji značajna pozitivna korelacija između Muscle i Velocity (p= ,049), kao i da na subuzorku krila postoji značajna pozitivna korelacija između BodyFat i Velocitya (p=,042), a da na subuzorku golmana postoji značajna negativna korelacija između BMI i Velocity (p=,033). Sama uloga pivota i mesto koje igra u ekipi pod uticajem već napred pominjane selekcije i predispozicije pivotmena nam daje za pravo da potvrdimo rezultate iz tabela. U ovom uzrastu ne postoji značajna uočljiva podudarnost u zadatim parametrima. Dok kod bekova se vidi da analizirani parametri bitno utiču na eksplozivnu sangu donjih

ekstremiteta. To je uočljivo iz podataka u gore navedenim tabelama, da što je procenat mišićne mase veći to je veći i procenat pokretljivosti tela, a to nam ukazuje na potrebu da prilikom trenažnog postupka posebno obratimo pažnju na mišićnu masu odnosno snagu mišića. Foretić i sar.(2010) to objašnjavaju činjenicom da se prilikom odabira igrača za poziciju beka u mlađem uzrastu selektiraju igrači sa većom telesnom visinom i većim vrednostima longitudinalnih dimenzionalsnosti skeleta. Krilni igrači su obično izuzetno brzi, eksplozivni, kako u premeštanju svog tela u vremenu i prostoru, tako i u frekvenciji pokreta ruku i nogu, za njih je karekteristističan brz prelaz iz faze odbrane u fazu napada (Čaval, 2012) nada su i logični rezultati u tabelama koji nam govore da što je manji procenat masnoće u organizmu, veća je pokretnjivost celokpnog tela, a samim tim i donjih ekstremiteta. U ispitivanim uzorcima na pozicijama golmana, došlo se do saznanja da što je veći procenat masnoće u organizmu brzina pokretljivosti je manja. Logika ovog zaključka može proizaći iz činjenice, da su golmani dosta statični u igri, a samim tim i u trenažnom procesu, slične rezultate je u svom istraživanju dobio i Svrhoj (2006) gde objašnja da za golamane jeste potrebna eksplozivna snaga ali više u vidu odraza i da su kod njih dominantna bočna kretanja, stavovi i dubinski izlasci. Ako želimo da nam golman bude pokretljiv, sa brzim pokretima ruku i nogu, tokom treniga moramo voditi računa o njegovoj mišićnoj masi i što većem smanjenju procenta masnoće u organizmu.

ZAKLJUČAK

Posmatrajući ovo istraživanje koje je sprovedeno na gore navedenom uzorku kao izolovanu celinu, možemo doći do saznanja da je selekcija ispitivanih igrača zadovoljavajuće izvršena, prema njihovim psihofizičkim sposobnostima i telesnoj kompoziciji u odnosu na mesta na kojima igraju. Da je eksplozivna snaga povezana sa telesnom kompzicijomm i da je to najviše izraženo kod igrča na poziciji pivota i kod krilnih igrača. Da je u dosadašnjem njihovom trenažnom postupaku mnogo više pažnje posvećivano opštoj fizičkoj pripremi ispitanika, nego li njihovoj specifičnoj fizičkoj pripremi u zavisnosti od mesta koje igraju u timu. Ekipa je u sistem takmičenja verovatno prerano uključena pa treneri nisu imali dovoljno vremena da se posvete specifičnim potrebama pojedinaca. Trebalo bi zato da u narednom periodu obrate što je moguće više pažnje kako o načinu ishrane, sportskom načinu života i da se za svaku poziciju i za svakog pojedinca uradi program i plan sistema vežbi, a u cilju postizanja što boljih rezultata svakog pojedinca na svom mestu u timu, a ujedno i boljem uspehu ekipe uopšte. A da treneri ove informacije koristiti u procesu planiranja i progamiranja treniga u cilju postizanja većeg uspeha u rukometu.

Rezultati istraživanja ukazuju na potrebu posvećivanja veće pažnje specifičnim fizičkim pripremama pojedinaca ovog uzrasta u odnosu na igračku poziciju u timu i to na način da se kod:

1) krila – poboljšati sprintersku sposobnost i skočnost;

2) bekova – poboljšati sprintersku sposobnos i skočnost;

3) pivota – poboljšati skočnost i eksplozivnu snagu;

4) golmana – smanjenjiti procenat masnoće u organizmu i poboljšati eksplozivnu snagu bočnim kretanjima, stavovima (golmanskim) i dubinskim izlascima.

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CORRELATION OF EXPLOSIVE STRENGTH AND BODY COMPOSITION IN HANDBALL PLAYERS AGED 14-16 DEPENDING ON PLAYING POSITIONS

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INTRODUCTION

Explosive strength is one of determinants of success in all activity which require maximal muscle force developed in shortest amount of time (Newton & Kreamer, 1994). Most throw activities i.e. shot or passing the prop (ball) in sport, and especially in handball, depends mostly of explosive strength of a muscle region which is making the throw out.

Explosive strength represents ability which allows one sportsman body acceleration towards an object or partner. Expressed explosive strength depends of percentage and composition of motor units appropriate muscle built (Bubanj & Branković, 1997).

Body composition - Human body is made of skin, Sastav tela - Ljudsko telo sačinjeno je od kože, adipose tissue, muscle tissue (with the prevailing skeletal muscle), bone (and other connective tissue), nervous system (brain, etc.) and organs (heart, liver, etc.). Typical, anthropometric, two-component model of the human body is consisted of low fat and fat tissue with specific density.

The ideal amount of body fat (expressed in percentage) varies and is higher for women compared to men. Adipose tissue is necessary to women in order to maintain the menstrual cycle, i.e. reproductive capacity (American Councilon Exercise, n.d.).

In modern handball each playing position has developed specific motor skills that contribute to the ultimate team performance (Oxyzoglou, Hatzimanouil, Kanioglou, & Papadopoulou, 2008). Bolek (1982) states that the circular attackers have greater strength in upper nor in the lower extremities, while wing attackers compared to players at other positions achieve maximum muscle endurance in abdominal region and feet.

The main objective of this study is to quantify the variables of demonstrated explosive force of arms and legs and to establish correlations between the explosive strength and body composition depending on the playing positions.

METHOD

The sample consist 30 boys which are playing for handball team „Sloga„ from Kraljevo and competing in Second West League. Boys were 14 to 16 years of age which were divided based on playing positions on subgroups of backs (n=9), wings (n=10), goalkeepers (n=5) and pivots (n=6). Based criteria for participating in research was longiness in handball, which was mininum of three years, and absence of any illness or injuries which would have negative inffluence on healh status of participants and research results.

Variables sample

Anthropometric characteristics were evaluated with following variables:

- TelTež (body weight in kg),
- TelVis (body height in cm) and

- BMI (body mass index).

Using bioimpedance analyzer „Omron BF511," value of the following variables of body composition were determined:

- Body Fat (adipose tissue is expressed as a percentage),
- MUSCLE (the amount of skeletal muscle expressed as a percentage) and
- RM kcal (daily consumption of calories in kcal).

Using wireless accelerometers Myotest, values of the following variables of explosive strength of upper extremity ere determined:

- Power (expressed in W),
- Force (expressed in N) and
- Velocity (expressed in cm/s).

Using wireless accelerometers Myotest, values of the following variables of explosive strength of lower extremity ere determined:

- Height (expressed in cm),
- Power (expressed in W/kg),
- Force (expressed in N/kg) and
- Velocity (expressed in cm/s).

Organization, instrumentation and measurement conditions

The research had transversal character and was deducted by the author and for the occasion by specially trained staff to use the analyzer bioimpedanse „OmronBF511" and devices for the assessment of explosive strength „Myotest". Measurement of body composition and explosive strength preceded by measurement of body height using anthropometry according to Martin. The research was conducted in accordance with the Helsinki Declaration, in the hall of the Sports Center „Ibar" in Kraljevo. All participants were familiar with the tasks of measurement, and their participation, i.e., agreement on participation in the study was confirmed in writing. Measuring the explosive power of the lower extremities was preceded by warm-up which was comprised of easy running 800m, the forward skip 4x30m, the lateral movement of 4x30m and back skips 4x30m. Measurement of explosive strength of upper extremities was preceded by a warm-up which was composed of protocols bench-pressing with 2x5 repetitions of low intensity and load of 10 kg, 2x5 repetitions moderate intensity and load of 10 kg and 2x3 repetitions of high intensity and load of 20 kg. Among the above series of bench-pressing, there was a rest period of 1 min, and also after conducting a series of warm-up for a period of 3 minutes.

Measurement method

Participants were initially access the measurement of height, and then the body composition in the column one after the other. In order to determine the explosive power of the upper extremities with bench thrust, the author has set device „Myotest" the rod Smith machines, whose total weight, with weights was 20 kg. From the initial standing position with hands outstretched in elbows, subjects performed five lifting and lowering of the load, after a short sound signal device „Myotest". In order to determine the explosive power of the lower extremities, prior the jump, around the waist was set up a special belt with attached device „Myotest". Participants performed five jumps from a half squat in the manner described in presection. Also, participants were instructed to put hands on hips, as they would not report these additional impulse to the body during the jump. It was required that the place of rebound be identical to landing spot, and that contact with the ground be as short as possible. For body composition, participants, barefoot, were standing first on the electronic scale which is an integral part of the device „Omron BF511" and which determined their body weight. In the next step, movable part of bioimpendance was taken, certain adjustments were made based on gender and age, participants have placed their hands in outstretched position with flexion of the shoulder joints of 90 deg. Unique technology „8 sensors" through which they placed hands and feet has provided the

most accurate measurement results of body composition using bioimpendance method. Values of body composition, was read from the display device „OmronBF511". The values of the variables of explosive strength, was read to the display device „Myotest" which statistically processes the mean value of the studied variables. For statistical analysis of data, package "SPSS version 13" was used, and the results are presented by descriptive statistics (tables and graphs). To determine correlation of variables of explosive strength and body composition, correlation analysis was used (Petkovic, 2000). Normality check of data distribution was checked by Kolmogorov-Smirnov test.

RESULTS

Descriptive statistic

Table 1. Body weight and body height of players in positions

Position		Weight (Kg)	Height (cm)
Back	Mean	73,78	185,56
n=9	Std. Dev.	9,16	5,70
	Minimum	62,00	175,00
	Maximum	91,00	193,00
Wing	Mean	62,70	184,60
n=10	Std. Dev.	7,17	9,07
	Minimum	54,00	174,00
	Maximum	77,00	198,00
Pivot	Mean	86,33	181,00
n=6	Std. Dev.	5,75	5,69
	Minimum	79,00	171,00
	Maximum	92,00	187,00
Goalkeeper	Mean	67,60	184,40
n=5	Std. Dev.	1,14	4,39
	Minimum	66,00	178,00
	Maximum	69,00	189,00
Total	Mean	71,57	184,13
n=30	Std. Dev.	11,02	6,75
	Minimum	54,00	171,00
	Maximum	92,00	198,00

Table 3. Explosive strength of lower extremities of players in positions.

Position		Height (cm)	Power (W)	Force (N)	Velocity (cm/s)
Back	Mean	37,56	38,33	24,47	222,11
n=9	Std. Dev.	4,77	10,63	2,61	*38,56*
	Min.	31,00	28,00	21,20	165,00
	Max.	46,00	54,00	28,70	276,00
Wing	Mean	35,60	41,00	24,47	246,30
n=10	Std. Dev.	3,75	7,21	4,43	20,19
	Min.	32,00	30,00	20,20	208,00
	Max.	43,00	52,00	33,40	278,00
Pivot	Mean	33,50	39,67	24,83	227,17
n=6	Std. Dev.	3,15	6,68	2,25	30,05
	Min.	28,00	33,00	21,20	192,00
	Max.	37,00	51,00	28,00	279,00
Goalkeeper	Mean	39,00	40,40	24,40	216,60
n=5	Std. Dev.	9,46	8,56	2,83	59,20
	Min.	29,00	30,00	21,60	117,00
	Max.	51,00	51,00	27,80	261,00
Total	Mean	36,33	39,83	24,53	230,27
n=30	Std. Dev.	5,31	8,15	3,10	36,32
	Min.	28,00	28,00	20,20	117,00
	Max.	51,00	54,00	33,40	279,00

Table 2. Explosive strength of upper extremities of players in positions.

Position		Power (W)	Force (N)	Velocity (cm/s)
Back	Mean	135,22	260,89	68,11
n=9	Std. Dev.	14,91	24,52	6,90
	Min.	114,00	231,00	58,00
	Max.	159,00	293,00	79,00
Wing	Mean	135,70	242,70	65,10
n=10	Std. Dev.	12,70	52,86	7,26
	Min.	118,00	149,00	54,00
	Max.	161,00	293,00	77,00
Pivot	Mean	109,33	233,83	56,17
n=6	Std. Dev.	9,61	10,03	6,74
	Min.	98,00	221,00	49,00
	Max.	123,00	251,00	68,00
Goalkeeper	Mean	139,20	255,40	68,40
n=5	Std. Dev.	19,20	12,60	4,22
	Min.	112,00	241,00	62,00
	Max.	163,00	273,00	73,00
Total	Mean	130,87	248,50	64,77
n=30	Std. Dev.	17,32	34,41	7,80
	Min.	98,00	149,00	49,00
	Max.	163,00	293,00	79,00

Correlation of body composition with explosive strength

Table 4. Variable correlation of body composition with explosive strength in upper extremities among wing players.

		BMI	BodyFat (%)	Muscle (%)	RMkcal (kcal)
Power (W)	Pearson Correlation	**,741***	**,765****	-,019	,448
	Sig.(2tailed)	**,014**	**,010**	,957	,194
	N	**10**	**10**	10	10
Force (N)	Pearson Correlation	,483	,278	-,476	,416
	Sig.(2tailed)	,157	,437	,165	,231
	N	10	10	10	10
Velocity (cm/s)	Pearson Correlation	**,681***	,618	-,293	,543
	Sig.(2tailed)	**,030**	,057	,412	,105
	N	**10**	10	10	10

In subsample of wing players there is statisical significant correlation between variables BMI and Power, BMI and Velocityy, BodyFat and Power

Table 5. Variable correlation of body composition with explosive strength in upper extremities among pivot players.

		BMI	BodyFat (%)	Muscle (%)	RMkcal (kcal)
Power (W)	Pearson Correlation	,593	,348	,005	,221
	Sig. (2-tailed)	,215	,499	,993	,674
	N	6	6	6	6
Force (N)	Pearson Correlation	,288	,050	-,203	-,130
	Sig. (2-tailed)	,580	,925	,700	,807
	N	6	**6**	6	**6**
Velocity (cm/s)	Pearson Correlation	,390	**,899***	,701	**,876***
	Sig. (2-tailed)	,445	**,015**	,120	**,022**
	N	6	**6**	6	**6**

In subsample of pivot players there is statisical significant correlation between variables BodyFat and Velocityy, Muscle and Velocity.

Table 6. Variable correlation of body composition with explosive strength in lower extremities among back players.

		BMI	BodyFat (%)	Muscle (%)	RMkcal (kcal)
Height (cm)	Pearson Correlation	-,298	-,200	-,318	-,100
	Sig. (2-tailed)	,436	,607	,404	,799
	N	9	9	9	9
Power (W/Kg)	Pearson Correlation	-,529	-,163	,535	-,036
	Sig. (2-tailed)	,143	,675	,137	,927
	N	9	9	9	9
Force (N/kg)	Pearson Correlation	-,555	,136	,259	,114
	Sig. (2-tailed)	,121	,728	,501	,770
	N	9	9	9	9
Velocity (cm/s)	Pearson Correlation	-,524	-,208	**,669***	-,014
	Sig. (2-tailed)	,148	,591	**,049**	,972
	N	9	9	**9**	9

In subsample of back players there is statisical significant correlation between variables Muscle and Velocity.

Table 7. Variable correlation of body composition with explosive strength in lower extremities among wing players.

		BMI	BodyFat (%)	Muscle (%)	RMkcal (kcal)
Height (cm)	Pearson Correlation	-,123	,090	-,406	,213
	Sig. (2-tailed)	,736	,805	,245	,554
	N	10	10	10	10
Power (W/Kg)	Pearson Correlation	,213	,353	-,294	,282
	Sig. (2-tailed)	,555	,317	,409	,430
	N	10	10	10	10
Force (N/kg)	Pearson Correlation	,471	,289	,092	,238
	Sig. (2-tailed)	,200	,450	,814	,538
	N	9	9	9	9
Velocity (cm/s)	Pearson Correlation	,492	**,649***	-,179	,271
	Sig. (2-tailed)	,149	**,042**	,620	,449
	N	10	**10**	10	10

In subsample of wing players there is statisical significant correlation between variables BodyFat and Velocity.

Table 8. Variable correlation of body composition with explosive strength in lower extremities among goalkeepers.

		BMI	BodyFat (%)	Muscle (%)	RMkcal (kcal)
Height (cm)	Pearson Correlation	,216	-,211	-,668	-,139
	Sig. (2-tailed)	,727	,733	,218	,823
	N	5	5	5	5
Power (W/Kg)	Pearson Correlation	-,877	,350	,019	-,387
	Sig. (2-tailed)	,051	,563	,976	,520
	N	5	5	5	5
Force (N/kg)	Pearson Correlation	-,543	-,150	-,058	-,573
	Sig. (2-tailed)	,344	,809	,926	,312
	N	5	5	5	5
Velocity (cm/s)	Pearson Correlation	**-,908***	,638	,526	-,385
	Sig. (2-tailed)	**,033**	,247	,362	,522
	N	**5**	5	5	5

In subsample of goalkeepers there is statisical significant negative correlation between variables BMI and Velocity.

DISCUSSSION

In the subsample of goalkeepers and backs there is no significant correlation between body composition and explosive strength of upper extremities, whereas in the subsample of the pivot there is a significant positive correlation between variables BodyFat i Velocity (p =,015), Muscle and Velocity (p =, 022), and in subsamples wings there is a significant positive correlation between the variables BMI and Power (p =, 014), BMI and Velocity (p =,030), BodyFat and Power (p =,010). The research results point to the following facts: observing the results that were achieved in goalkeepers and backs we did not observe a significant correlation, it can be concluded that in the current training process is not enough done on the specifics of the position that players take. Pivot players have a higher percentage of body fat, increased overall body weight, and therefore have less muscle mass as a total (Noutsosetal, 2004; Srhojetal, 2002), all of which causes a slower mobility of the body extremities and the body itself, similar to research of Sporis et al. (2010). Wing players according to the results in the tables are with a smaller percentage of fat in the body, thereby have increased muscle strength, overall reduced weight of the body, which all leads to a greater mobility of the whole organism, and therefore the body parts. Matthysetal (2013) in his research indicate that in selection for the wing players experts will always choose the lowest players and players with the lowest body mass, which can be explained by the above-stated results. So therefore we must not neglect the principles of selection, their predispositions and the short period of training process as important factors which are affecting the measured results.

Based on the results from the tables we can see that the subsample of back players shows a significant positive correlation between Muscle and Velocity (p =,049), and that the subsample of the wing players shows a significant positive correlation between BodyFat and Velocity (p =,042), and that the subsample of the goalkeepers shows a significant negative correlation between BMI and Velocity (p =,033). The very role of pivot and the position he plays in the team is under the influence already mentioned forward selection and predispositions, gives us the right to verify the results from the table. At this age there is no significant noticeable correlation in the given parameters. While at the back players, analyzed parameters are showing significant impact on the explosive power of lower extremities. It is evident from the data in the tables above, that the higher percentage of muscle

mass leads to the greater percentage of motion, and this indicates a need that at training process we especially pay attention to muscle mass and muscle strength. Foretić et al. (2010) explained that the selection of players for the quarterback position in younger children requires preparation of players with greater body height and higher values of longitudinal dimension of skeleton. Wing players are usually very quick, explosive, as in the transfer of their body in space and time, as well as the frequency of movements of arms and legs, they have caracterisitc quick transition from defense to attack (Cavallo, 2012) although, logical results in tables are telling us that the smaller the percentage of fat in the body we have, the greater percentage of motion of the whole body is, and therefore in the lower extremities. The examined sample on the goalkeepers, showed that the higher the percentage of fat in the body leads to lower mobility speed. The logic of this conclusion may result from the fact that goalkeepers are a mostly static in the game, and in the training process. Similar results were found in Svrhoj (2006), where he describes that goalkeeper explosive strength is needed at take-off, but for them most important are side movements, postures and deep outs. If we want agile goalkeeper, with fast-moving arms and legs, during the trainings we have to take care of his muscle mass and work on major reduction in the percentage of fat in the body.

CONCLUSION

Observing this research which was conducted on the above sample as isolated entity, we come to realize that the selection of players was satisfactorily completed, according to their mental and physical abilities and body composition in relation to the positions they play. That the explosive strength is associated with body composition and that it is most prevalent in wing and pivot players. That in their previous training procedure much more attention was devoted to the general physical condition of the participants, rather than their specific physical preparation depending on the position that they play in a team. The team was probably premature included in the competition system and coaches did not have enough time to devote to the specific needs of individuals. Therefore, in the future they should focus as much as possible attention to the diet, sports and lifestyle for every position and for every individual, and make a program and plan of exercises, in order to achieve the best possible results of each individual player position in the team, and also the better success of the team in general. The coaches should use this information in planning and programming the trainings in order to achieve greater success in handball.

The research results are showing the need for heightened attention to specific physical preparation of individuals in this age group compared to the playing position in the team and specifically:

1) wing players - improving sprint ability and explosive strength;

2) back players - improving sprint ability and explosive strength;

3) pivots - improving jumping ability and explosive strength;

4) goalkeepers - reducing the percentage of fat in the body and improve explosive power with lateral movements, postures (goalkeepers) and deep outs.

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PRIMJENA MODIFIKOVANE EUROFIT BATERIJE TESTOVA U OSNOVNOJ ŠKOLI

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UVOD

Tjelesna i zdravstvena kultura obavezni je predmet u hrvatskom odgojno obrazovnom sustavu te se od prvog do trećeg razreda osnovne škole provodi tri sata tjedno, odnosno 105 sati godišnje, dok se u četvrtom razredu provodi dva sata tjedno, odnosno 70 sati godišnje. Nastava tjelesne i zdravstvene kulture treba biti primjerena razvojnim značajkama djece i mladeži, čime se osigurava usmjerenost nastave tjelesne i zdravstvene kulture prema optimalnom razvoju i usavršavanju onih znanja, sposobnosti i osobina koje su u pojedinom razvojnom razdoblju bitne za učenike (*Nastavni plan i program za osnovnu školu, 2006).* Svrha tjelesnoga i zdravstvenoga područja prema *Nacionalnom okvirnom kurikulumu za predškolski odgoj i obrazovanje te opće obvezno i srednjoškolsko obrazovanje (2011),* jest usvajanje znanja, stjecanje vještina i navika te razvijanje pozitivnoga stava prema tjelesnoj aktivnosti i zdravomu načinu življenja kako bi se omogućilo dostizanje najboljih tjelesnih i duševnih potencijala pojedinca. Pri tome kvaliteta rada u svim područjima primijenjene kineziologije izravno ovisi o kvaliteti procjene stanja sudionika kineziološkim programa (Malina i sur., 2004.). Prilikom praćenja i provjeravanja motoričkih sposobnosti stručnjaci se često susreću s nedovoljno kvalitetnim i neprimjerenim mjernim instrumentima. Šegregur i sur. (2010, prema Matković, 1995) navode kako se analiza procjene motoričkih sposobnosti čovjeka obavlja testovima koji se koriste u praksi za mjerenje motoričkih sposobnosti, brzine pokreta, snage statičkog, eksplozivnog i repetitivnog tipa, fleksibilnosti, koordinacije tijela, agilnosti, ravnoteže, preciznosti te funkcionalne sposobnosti kao aerobne izdržljivosti. U kineziološkoj edukaciji primjenjuje se primjeren kineziometrijski sustav praćenja antropoloških obilježja za mlađu školsku dob koji je opisan i normiran (Findak i sur. 1996.), a svrha praćenja jest kontrola rada te kvalitetno programiranje i provođenje planiranih sadržaja tjelesne i zdravstvene kulture. Kineziološkim se mjerenjima na temelju nekog standardiziranog postupka izaziva određena motorička reakcija ispitanika koje se veličina registrira, odnosno koje se efekt, izazvan nekim standardnim podražajem, mjeri (Dizdar, 2006). Metoda mjerenja veoma je važna za uspješno cjelokupno odvijanje nastave tjelesne i zdravstvene kulture te za precizno i objektivno utvrđivanje individualnih značajki, osobina i sposobnosti učenika, stanja i razine njihovih motoričkih postignuća te drugih potrebnih informacija o učenicima. Podaci i rezultati provjeravanja dobiveni mjerenjem omogućavaju nastavniku lakšu i uspješniju izradu programa, praćenje njegove realizacije te dobivanje objektivnih informacija o učincima provedenog programa (Findak, 2003). Kako bi se pogreška mjerenja svela na minimum, testiranje je potrebno provoditi u jednakim standardiziranim uvjetima, ispitanici trebaju biti adekvatno zagrijani i pripremljeni za mjerenje, potrebno je osigurati adekvatnu izmjenu opterećenja i odmora, testovi trebaju biti relevantni za područje primijenjene kineziologije, mjerni instrumenti moraju imati visoke metrijske karakteristike, a prikaz i interpretacija dobivenih rezultata moraju biti razumljivi, pouzdani i pragmatički valjani te jasno ukazivati na smjernice daljnjeg rada (Vučetić, 2010). U tjelesnoj i zdravstvenoj kulturi mjerenje se provodi pomoću standardiziranih mjernih instrumenata koji moraju imati primjerene metrijske karakteristike. Koristi se kod procjene kinantropoloških obilježja učenika i motoričkih postignuća, a podaci prikupljeni metodom mjerenja vrednuju se na različite načine (Neljak, 2013). Procjena motoričkih sposobnosti veoma je kompleksan zadatak zbog „prikrivenosti" motoričkih sposobnosti, i to najčešće morfološkom građom pojedinca i/ili eventualno znanjem o izvođenju nekog motoričkog zadatka koji se izvodi prilikom testiranje pojedine motoričke sposobnosti (Sekulić, Metikoš, 2007).

Jedna od najkorištenijih baterija testova jest Eurofit, koji predstavlja skup mjera i testova za procjenu kinantropoloških obilježja učenika osnovnoškolske i srednjoškolske dobi. Također, pri

tome pojam kinantropološka obilježja zajednički je naziv za morfološka obilježja, motoričke i funkcionalne sposobnosti učenika. Ovaj standardizirani skup testova preporučen je od strane Vijeća Europe te se provodi u mnogim europskim školama od 1988. godine. Eurofit niz testova odabran je zbog mogućnosti provođenja testova s malim brojem pomagala u vremenu od 35 do 40 minuta (Neljak i sur, 2011).

Mjere skupa Eurofit baterije testova:

Morfološka obilježja:

- Tjelesna visina
- Tjelesna težina
- Indeks tjelesne mase
- Postotak masti

Testovi motoričkih sposobnosti:

- Flamingo – test ravnoteže
- Taping rukom – test brzine frekvencije pokreta
- Sjed i dohvat – test fleksibilnosti
- Skok u dalj s mjesta – test eksplozivne snage
- Stisak šake – test mišićne jakosti
- Ležanje sjed – test repetitivne snage
- Izdržaj u zgibu – test statičke snage
- Trčanje tamo – ovamo 10x5 m – test brzine i agilnosti

Test funkcionalnih sposobnosti:

- Beep test – test kardiovaskularne izdržljivosti

Crofit

„Metodologija praćenja i vrjednovanja u tjelesnom i zdravstvenom odgojno-obrazovnom području" Mrakovića i sur. iz 1986. godine metodologija je praćenja i vrjednovanja morfoloških obilježja, motoričkih i funkcionalne sposobnosti, koja je 1994. godine osvježena novim vrijednostima objavljenima u knjizi Primijenjena kineziologija u školstvu *„Norme"* Findaka i sur. iz 1996. godine. Nedovoljno provjerena pouzdanost uvrštenih mjera i testova u spomenutoj metodologiji zahtijevala je izradu nove metodologije vrjednovanja kinantropoloških obilježja učenika koja je opisana u nadolazećem tekstu (Neljak i sur, 2011).

Predložene mjere i testovi prema Findaku i sur. iz 1996. :

- tjelesna visina
- tjelesna težina
- opseg podlaktice
- nabor nadlaktice
- poligon natraške
- taping rukom
- pretklon sjedeći
- skok u dalj s mjesta
- izdržaj u visu zgibom
- podizanje trupa iz ležaja
- trčanje na 3 i 6 minuta

Projekt *„Validacija mjera i testova za procjenu kinantropoloških obilježja učenika osnovnih i srednjih škola"* proveden je s ciljem prikupljanja novih informacija o kinantropološkim obilježjima djece i mladeži (Neljak i sur. 2011). Glavno istraživanje provedeno je školske godine 2008./2009., a

nakon provedenih mjerenja prikupljeni su podatci za 21 876 učenika i učenica osnovnih i srednjih škola. Tako velikim brojem učenika minimizirane su standardne pogrješke aritmetičkih sredina mjera i testova, a uzorak je reprezentativan jer zahvaća oko 3% populacije učenika Republike Hrvatske. Na temelju rezultata istraživanja, izrađene su orijentacijske vrijednosti. Ukupan broj mjera i testova definiran s obzirom na rezultate predistraživanja bio je 23, od čega su 4 mjere morfoloških obilježja, 15 testova motoričkih sposobnosti i 4 testa funkcionalnih sposobnosti. Svaka varijabla mjeri se tri puta, osim testova repetitivne snage i jednog testa funkcionalne sposobnosti koji se mjere jedanput.

Ciljevi istraživanja u ovom projektu (Neljak i sur. 2011) bili su:

1. objektivno određivanje orijentacijskih vrijednosti pojedinih kinantropoloških obilježja učenika osnovnih i srednjih škola u Republici Hrvatskoj
2. određivanje strukture prostora motoričkih sposobnosti učenika i učenica

Glavna svrha istraživanja bila je izrada nove metodologije s novim i smanjenim skupom mjera i testova kinantropoloških obilježja djece i mladeži. Novi skup mjera i testova moći će se provesti u dva nastavna sata, a sva mjerenja osobno će provoditi učitelj ili nastavnik tjelesne i zdravstvene kulture, što će doprinijeti većoj točnosti prikupljenih podataka i interpretaciji pojedinih razrednih rezultata. Svi testovi upotrebljeni u ovom istraživanju pouzdani su i preporučljivi za korištenje (Neljak i sur, 2011).

Crofit je nastao standardizacijom mjernih instrumenata za procjenu kinantropoloških obilježja učenika u predmetnoj nastavi osnovne škole i srednje škole. Pomoću nove metodologije, u tjelesnom i zdravstvenom području kinantropološka obilježja učenika osnovnih i srednjih škola prate se i provjeravaju pomoću 8 varijabla, a dolje navedene mjere i testovi koriste se u osnovnom školstvu.

Mjere morfoloških obilježja:

- visina
- težina
- indeks tjelesne mase
- postotak masnog tkiva

Testovi motoričkih sposobnosti:

- prenošenje pretrčavanjem
- pretklon u uskom raznoženju
- podizanje trupa iz ležaja

Test funkcionalne sposobnosti:

- trčanje na 600 metara za djevojčice
- trčanje na 800 metara za dječake

Cilj ovog rada je utvrditi primjerenost i pouzdanost Crofit testova za procjenu motoričkog statusa učenika u razrednoj nastavi S obzirom na pretpostavku kako Crofit mjerni instrumenti imaju zadovoljavajuću razinu pouzdanosti i faktorsku strukturu u predmetnoj nastavi za očekivati je kako je moguća i njihova primjena u razrednoj nastavi.

METOD

Uzorak ispitanika

Uzorak ispitanika činilo je 52 učenika i učenica prva četiri razreda Osnovne škole Donji Kraljevec. Od ukupnog broja učenika njih 32 bili su dječaci, a 20 djevojčice. Mjerenje je provedeno tijekom veljače i ožujka 2015. godine, a svaki je učenik pojedinačno mjeren u četrnaest varijabli. Svi učenici pohađali su redovni nastavni program tjelesne i zdravstvene kulture i nisu imali nikakvih zdravstvenih poteškoća.

Uzorak varijabli

U ovom istraživanju su korišteni standardizirani testovi iz projekta *„Metodologija vrjednovanja kinantropoloških obilježja učenika u tjelesnoj i zdravstvenoj kulturi, Crofit norme*" (Neljak i sur., 2011) te *„Primjenjena kineziologija u školstvu – Norme*" (Findak i sur., 1996).

1. Tjelesna visina (ATV)
2. Tjelesna težina (ATT)
3. Opseg podlaktice (AOP)
4. Poligon natraške (MPN)
5. Kotrljanje lopte nedominantnom rukom (MKOKLR)
6. Prenošenje pretrčavanjem (MAGPRP)
7. Pretklon raznožno (MPR)
8. Skok u dalj s mjesta (MSD)
9. Sprint iz visokog starta na 20 m (MESS20)
10. Podizanje trupa (MPT)
11. Čučnjevi (MRSCUC)
12. Taping rukom (MTR)
13. Izdržaj u visu zgibom (MIV)
14. Trčanje na 3 minute (F3)

Od četiri motorička testa koja se primjenjuju u višim razredima osnovne škole dva su bila standardizirana; čučnjevi, za procjenu repetitivne snage (MRSCUCU) i prenošenje pretrčavanjem, za procjenu agilnosti (MAGPRP). S obzirom na dob ispitanika druga dva testa su bila modificirana, te je tako test za procjenu eksplozivne snage *sprint 20 metara* koji u standardiziranoj verziji provodi na udaljenosti 20 metara skraćen i provodio se na udaljenosti od 10 metara. Test za procjenu koordinacije *kotrljanje lopte ne dominantnom rukom* u standardiziranoj verziji se provodi u izvođenju 4 dužine za redom, a u modificiranoj izvedbi samo 2 dužine.

Metode obrade podataka

U svim varijablama izračunati su osnovni deskriptivni parametri (aritmetička sredina i standardna devijacija, minimalni i maksimalni rezultat), za utvrđivanje spolnih razlika u promatranim varijablama koristio se t-test za nezavisne uzorke (p=0,05). Pouzdanost CROFIT mjernih utvrđivala se metodom interne konzistencije čestica Cronbachovom α, a homogenost prosječnom korelacijom među česticama (AVR). Za utvrđivanje povezanosti skupa varijabli koristio se Personov koeficijent korelacije, a za utvrđivanje strukture promatranog motoričkog prostora koristila se faktorska analiza metodom glavnih komponenata, uz Gutmann- Kaiserov kriterij za ekstrakciju glavnih komponenata. Za utvrđivanje normalnosti distribucije podataka koristio se Kolmogorov – Smirnov test. U kompozitnim mjernim instumentima izračunao se prosječan rezultat tri čestice (mjerenja) koji se koristio za daljnju obradu i interpretaciju rezultata.

REZULTATI

Kolmogorov smirnovim testom utvrdilo se da distribucije podataka niti u jednoj varijabli ne odstupa značajno od normalne.

Tabela 1. Deskriptivni parametri u standardizovanim testovima i Krosfit testovima

	N	Mean	SD	Min	Max
ATV	52,00	135,12	8,40	114,00	157,00
ATT	52,00	35,00	10,04	20,00	74,00
AOP	52,00	20,83	2,09	18,00	27,00
MTR	52,00	22,88	3,48	16,00	30,00
MSD	52,00	141,90	22,64	90,00	200,00
MPN	52,00	23,24	6,31	10,74	47,10
MPT	52,00	33,33	6,93	15,00	45,00
MPR	52,00	53,15	10,70	36,00	80,00
MIV	52,00	32,81	8,39	15,00	52,00
F3	52,00	526,19	60,13	410,00	690,00
MESS	52,00	3,76	0,56	2,40	5,09
MRSCUC	52,00	43,58	8,37	28,53	63,07
MKOKLR	52,00	14,77	3,07	7,02	19,25
MAGPRP	52,00	17,77	2,37	13,68	24,89

Usporedivši dobivene rezultate s normativima za 5. razred (Neljak i sur., 2011), koji su izračunati na način da se uzela prosječna vrijednost oba spola, možemo uočiti kako razlike svim testovima. Tako u testovima koji nisu modificirani učenici 5. razreda postižu bolje rezultate od učenika u razrednoj nastavi; u testu MRSCUC rezultat učenika 5. razreda iznosi 45,84 čučnja, a učenika u razrednoj nastavi 43,58 čučnjeva, a u testu MAGPRP učenici 5. razreda ostvaruju prosječan rezultat od 11,92 sekunde, dok učenici razredne nastave ostvaruju rezultat 17,77 sekundi. U dva testa koja su modificirana iz objektivnih razloga, očekivano su uočene razlike. U testu za procjenu eksplozivne snage MESS učenici petih razreda ostvaruju prosječan rezultat od 4,12 sekundi, a učenici razredne nastave od 3,76. Dakle, unatoč upola kraćoj udaljenosti razlika je neznatna. U testu MKOKLR učenici 5. razreda ostvaruju prosječan rezultat od 20,45 sekundi, a učenici razredne nastave 14,77, opet unatoč skraćenosti testa za dvije dužine razlika je gotovo zanemariva.

Tabela 2. Razlike u motoričkim sposobnostima između dečaka i devojčica

	Mean _M	Mean _ F	Mean _M	Mean _ F	t- value	SS	p
ATV	134,90	135,43	8,38	8,62	-0,22	50,00	0,83
ATT	34,84	35,24	8,86	11,79	-0,14	50,00	0,89
AOP	21,03	20,52	2,04	2,18	0,86	50,00	0,40
MTR	23,45	22,05	3,59	3,20	1,44	50,00	0,16
MSD	145,71	136,29	23,82	20,02	1,49	50,00	0,14
MPN	23,07	23,49	7,20	4,87	-0,23	50,00	0,82
MPT	34,55	31,52	6,90	6,74	1,57	50,00	0,12
MPR	50,84	56,57	10,64	10,08	-1,95	50,00	0,06
MIV	35,77	28,43	7,25	8,19	3,40	50,00	0,00*
F3	539,10	507,14	62,37	52,41	1,93	50,00	0,06
MESS	3,73	3,81	0,61	0,49	-0,53	50,00	0,60
MRSCUC	45,22	41,16	8,41	7,88	1,75	50,00	0,09
MKOKLR	13,82	16,16	3,38	1,83	-2,89	50,00	0,01*
MAGPRP	17,34	18,40	1,92	2,85	-1,60	50,00	0,12

*p=0,05

T –testom za analizu razlika utvrdilo se kako dječaci statistički značajno bolje rezultate postižu samo u standardiziranom testu za procjenu statičke jakosti (MIV) te u CROFIT testu za procjenu koordinacije (MKOKLR), dok u ostalim testovim dobivene razlike nisu statistički značajne.

Metrijske karakteristike, pouzdanost i homogenost CROFIT mjernih instrumenata se u svima pokazala na zadovoljavajućoj, pa čak i visokoj razini.

Tabela 3. Pouzdanost i homogenpst Krosfit testova

	Cronbach α	AVR
MESS	0,86	0,59
MRSCUC	0,91	0,85
MKOKLR	0,94	0,86
MAGPRP	0,87	0,74

Iz tablice 4. vidljivo je kako samo test eksplozivne jakosti (MESS – sprint 20m) ima niže koeficijente pouzdanosti i osobito homogenosti, iako su sve vrijednosti na zadovoljavajućoj razini.

Usporedbom dobivenih koeficijenata pouzdanosti i vrijednosti standardiziranih testova u predmetnoj nastavi osnovne škole, uočljivo je kako su razlike vrlo male, pri čemu se vrijednosti Cronbach α u testu MESS kreću u rasponu od 0,90 – 0,95, u testu MKOKLR 0,88 – 0,92 i u testu MAGPRP 0,88 – 0,94.

Tabela 4. Korelaciona matrica

	ATV	ATT	AOP	MTR	MSD	MPN	MPT	MPR	MIV	F3	MESS	MRSCUC	MKOKLR	MAGPRP
ATV	1,00	**0,81**	**0,68**	**0,41**	0,23	0,01	0,01	**0,56**	0,02	**0,44**	-0,16	0,25	**-0,61**	0,24
ATT	**0,81***	1,00	**0,90**	**0,37**	-0,10	0,12	-0,16	**0,46**	**-0,28**	0,18	0,00	0,10	**-0,40**	**0,52**
AOP	**0,68**	**0,90**	1,00	**0,33**	-0,12	0,18	-0,05	**0,39**	-0,22	0,16	0,05	0,12	**-0,39**	**0,47**
MTR	**0,41**	**0,37**	**0,33**	1,00	**0,43**	-0,26	0,02	**0,45**	0,24	**0,61**	**-0,39**	**0,48**	**-0,67**	-0,01
MSD3	0,23	-0,10	-0,12	**0,43**	1,00	**-0,60**	**0,38**	**0,28**	**0,69**	**0,70**	**-0,44**	**0,42**	**-0,54**	**-0,48**
MPN	0,01	0,12	0,18	-0,26	**-0,60**	1,00	-0,25	-0,13	**-0,51**	**-0,57**	**0,29**	**-0,35**	**0,30**	0,18
MPT	0,01	-0,16	-0,05	0,02	**0,38**	-0,25	1,00	-0,09	**0,55**	**0,31**	-0,22	0,25	-0,18	**-0,41**
MPR	**0,56**	**0,46**	**0,39**	**0,45**	**0,28**	-0,13	-0,09	1,00	0,01	**0,42**	-0,19	**0,32**	**-0,36**	0,00
MIV	0,02	**-0,28**	-0,22	0,24	**0,69**	**-0,51**	**0,55**	0,01	1,00	**0,70**	**-0,34**	**0,57**	**-0,49**	**-0,59**
F3	**0,44**	0,18	0,16	**0,61**	**0,70**	**-0,57**	**0,31**	**0,42**	**0,70**	1,00	**-0,43**	**0,69**	**-0,74**	**-0,31**
MESS	-0,16	0,00	0,05	**-0,39**	**-0,44**	**0,29**	-0,22	-0,19	**-0,34**	**-0,43**	1,00	**-0,32**	**0,41**	0,20
MRSCUC	0,25	0,10	0,12	**0,48**	**0,42**	**-0,35**	0,25	**0,32**	**0,57**	**0,69**	**-0,32**	1,00	**-0,54**	**-0,28**
MKOKLR	**-0,61**	**-0,40**	**-0,39**	**-0,67**	**-0,54**	**0,30**	-0,18	**-0,36**	**-0,49**	**-0,74**	**0,41**	**-0,54**	1,00	0,18
MAGPRP	0,24	**0,52**	**0,47**	-0,01	**-0,48**	0,18	**-0,41**	0,00	**-0,59**	**-0,31**	0,20	**-0,28**	0,18	1,00

* p=0,05

Iz matrice korelacije vidljivo je kako postoje statistički značajne korelacije CROFIT mjernih instrumenata sa standardiziranim motoričkim testovima.

Test sprint iz visokog starta na 10 m (MESS10) ima pozitivne korelacije s testovima: poligon natraške (MPN); kotrljanje lopte nedominantom rukom (MKOKLR); prenošenje pretrčavanjem (MAGPRP); i negativne korelacije s testovima taping rukom (MTR); skok u dalj s mjesta (MSD); podizanje trupa (MPT); pretklon raznožno (MPR); izdržaj u visu zgibom (MIV); trčanje na 3 minute (F3); čučnjevi (MRSCUC). Ovaj test je namijenjen procjeni i eksplozivne jakosti, međutim, nisu potvrđene statistički značajne korelacije sa standardiziranim testovima koji su konstruirani za procjenu tih motoričkih sposobnosti..

Test čučnjevi (MRSCUC) ima pozitivne korelacije s testovima: taping rukom (MTR); skok u dalj s mjesta (MSD); podizanje trupa (MPT); pretklon raznožno (MPR); izdržaj u visu zgibom (MIV); trčanje na 3 minute (F3); i negativne korelacije s testovima: poligon natraške (MPN); sprint iz visokog starta na 20 m (MESS20); kotrljanje lopte nedominantom rukom (MKOKLR); prenošenje

pretrčavanjem (MAGPRP). Vidljivo je kako je ovaj test koji služi za procjenu jakosti značajno koreliran s standardiziranim testovima za procjenu različitih pojavnih oblika snage i jakosti.

Test kotrljanje lopte nedominantom rukom (MKOKLR) ima pozitivne korelacije s testovima: poligon natraške (MPN); sprint iz visokog starta na 20 m (MESS20); prenošenje pretrčavanjem (MAGPRP); i negativne korelacije s testovima: taping rukom (MTR); skok u dalj s mjesta (MSD); podizanje trupa (MPT); pretklon raznožno (MPR); izdržaj u visu zgibom (MIV); trčanje na 3 minute (F3): čučnjevi (MRSCUC). Ovaj test služi za procjenu koordinacije i značajno je pozitivno povezan s standardiziranim testovima za procjenu te sposobnosti.

Test prenošenje pretrčavanjem (MAGPRP) ima pozitivne korelacije s testovima: poligon natraške (MPN); sprint iz visokog starta na 20 m (MESS20); kotrljanje lopte nedominantom rukom (MKOKLR); i negativne korelacije s testovima: taping rukom (MTR); skok u dalj s mjesta (MSD); podizanje trupa (MPT); izdržaj u visu zgibom (MIV); trčanje na 3 minute (F3); čučnjevi (MRSCUC). I kod ovog testa je značajna povezanost sa standardiziranim testovima testovima koji procjenjuju istu sposobnost, odnosno agilnost.

Struktura promatranog antropometrijskog i motoričkog prostora utvrđivala se faktorskom analizom. Dobivene su dva statitstički značajna faktora koja zajedno objašnjavaju približno 63% varijance.

Tabela 5. Eigenvalue of factors

ekstrakcije	Eigenvalue	% Total	Cumulative Eigenvalue	Cumulative %
1	5,22	37,26	5,22	37,26
2	3,59	25,65	8,81	62,91
Prp.Totl	0,34	0,29		

Faktorskom analizom dobila su se dva interpretabilna faktora. Prvi faktor može se nazvati *faktor motoričkih sposobnosti* i saturiran je najviše svim varijablama motoričkih sposobnosti, izuzev testa za procjenu fleksibilnosti. Drugi faktor se može nazvati *morfološki faktor,* i saturiran je svim antropometrijskim varijablama i testom fleksibilnosti.

Tabela 6. Obrazac matrice

	Factor 1	Factor 2
ATV	0,54	-0,70
ATT	0,28	-0,91
AOP	0,25	-0,85
MTR	0,71	-0,28
MSD3	0,77	0,35
MPN	-0,55	-0,35
MPT	0,38	0,41
MPR1	0,50	-0,44
MIV	0,70	0,56
F3	0,92	0,07
MESS	-0,55	-0,15
MRSCUC	0,73	0,08
MKOKLR	-0,84	0,21
MAGPRP	-0,33	-0,69
Expl.Var	5,22	3,59
Prp.Totl	0,37	0,26

Tabela 7. Struktura matrice

	Factor	Factor
ATV	0,10	0,87
ATT	-0,23	0,92
AOP	-0,22	0,86
MTR	0,47	0,60
MSD	0,84	0,10
MPN	-0,65	0,02
MPT	0,54	-0,16
MPR1	0,21	0,64
MIV	0,88	-0,12
F3	0,83	0,41
MESS	-0,54	-0,15
MRSCUC	0,67	0,30
MKOKLR	-0,62	-0,61
MAGPRP	-0,64	0,43
Expl.Var	4,79	4,02

DISKUSIJA

Rezultati ovog istraživanja pokazali su kako učenici petih razreda postižu bolje rezultate u dva standardizirana CROFIT testa od učenika u razrednoj nastavi, dok razlike u rezultatima modificiranih testova nisu velike u odnosu na veličinu modifikacije, u kojima je količina gibanja skraćena za 50%. Takvi rezultati nisu iznenađujući s obzirom kako su razlike po dobi kod djece uočene već i u ranijim istraživanjima. Tako Pejčić, Malacko (2005), navode kako antropometrijske karakteristike, kao i motoričke sposobnosti učenika od 1. do 4. razreda osnovne škole, ravnomjerno i stabilno napreduju, a statistički značajne razlike dobivene su u svim motoričkim testovima između učenika od 1. do 4. razreda, kod oba spola pri čemu svaka starija generacija postiže bolje rezultate. Slične rezultate na uzorku iste dobi dobili su i Katić, Pejčić i Viskić – Štalec (2004), analizirajući morfološko-motoričku strukturu u odnosu na starosnu dob. Rezultati jasno pokazuju progresivno napredovanje u motoričkim sposobnostima tijekom odrastanja, kao i promjenu u morfološko-motoričkom funkcioniranju ovisno o starosnoj dobi. S obzirom na navedeno, dobivene razlike između učenika različite starosne dobi ne trebaju utjecati na odabir mjernih instrumenata.

Metrijske karakteristike standardiziranih i modificiranih mjernih instrumenata korištenih u ovom istraživanju pokazale su zadovoljavajuću razinu potrebnu za primjenjivost testova u razrednoj nastavi. Samo test eksplozivne snage (MESS – sprint 10m) ima niže koeficijente pouzdanosti i osobito homogenosti, iako su sve vrijednosti na zadovoljavajućoj razini. Usporedbom dobivenih koeficijenata pouzdanosti i vrijednosti standardiziranih testova u predmetnoj nastavi osnovne škole, uočljivo je kako su razlike vrlo male, pri čemu se vrijednosti Cronbach α u testu MESS kreću u rasponu od 0,90 – 0,95, u testu MKOKLR 0,88 – 0,92, a u testu MAGPRP 0,88 – 0,94 (Neljak i sur., 2011). Visoke razine pouzdanosti motoričkih testova dobivene su i u drugim istraživanjima, tako su Caput Jogunica, De Privittelo i Lončarić (2009) u pet različitih testova za procjenu eksplozivne snage dobili vrijednosti Cronbach α između 0,90 i 0,95.

S obzirom kako su vrijednosti dobivene ovim istraživanjem visoke i ne odstupaju od vrijednosti Cronbach α u predmetnoj nastavi može se zaključiti kako su testovi primjereni za procjenu motoričkih sposobnosti učenika u razrednoj nastavi.

Također iz matrice korelacija vidljivo je kako svi testovi, osim testa MESS10 imaju statistički značajne korelacije s standardiziranim testovima čija je faktorska struktura već i ranije potvrđena za procjenu pojedine sposobnosti. Tako čučnjevi (MRSCUC) ima pozitivne korelacije s testom izdržljivosti (F3), testom snage (MIV), testom snage (MSD), testom brzine (MTR) i testom fleksibilnosti (MPR). Test kotrljanje lopte nedominantnom rukom (MKOKLR) ima pozitivne korelacije s testovima: poligon natraške (MPN); sprint iz visokog starta na 10 m (MESS10). Test prenošenje

pretrčavanjem (MAGPRP) ima značajne pozitivne korelacije s dvije antropometrijske varijable (ATV i AOP), te pozitivne ali ne i statistički značajne korelacije s testovima koordinacije (MPN, MKOKLR) i eksplozivne snage (MESS10).

Jedini test koji nema značajnu povezanost s ostalima slobodnostima je MESS10 koji je konstruiran za procjenu eksplozivne snage. Iz dobivenih korelacija je vidljivo kako je statistički značajno povezan s testovima za procjenu koordinacije (MPN, MKOKLR). Očito ovaj test u svojoj strukturi sadrži elemente koji u ovoj dobi djece zahtijevaju više koordinacije tjelesnih pokreta.

Faktorskom analizom dobila su se dva značajna faktora, 1. faktor motoričkih sposobnosti i 2. morfološki faktor. Faktor motoričkih sposobnosti saturiran je s testovima MIV, MSD, F3, MRSCUC, MKOKLR,MAGPRP,MPN, MPT, MTR i MESS10. Drugi faktor je saturiran varijablama ATV, ATT, AOP i MPR. Iako je 1. faktor relativno čist, 2. faktor, morfološki je saturiran i sa fleksibilnosti. Neljak i sur. (2011) su u svom istraživanju 5. razredu dobili tri značajna faktora: 1. koordinacije agilnosti i eksplozivne snage, 2. faktor repetitivne snage i 3. samostalni faktor fleksibilnosti. Očigledno fleksibilnost u ovoj dobi nije u vezi s ostalim motoričkim sposobnostima. Povezanost fleksibilnosti i antropometrijskih karakteristika utvrdili su Bala, Jakšić i Katić (2009), pri čemu je kod djece u dobi od 6. godina utvrđena kanonička korelacije tjelesne mase, tri kožna nabora i fleksibilnosti.

ZAKLJUČAK

Na osnovu provedenog istraživanja na uzorku od 52 ispitanika može se zaključiti kako Crofit testovi svojim metrijskim karakteristikama zadovoljavaju kriterije koji bi opravdali njihovo korištenje u nastavi tjelesne i zdravstvene kulture od 1. do 4. razreda osnovne škole.

U ovom istraživanju se pokazalo kako modificirani mjerni instrumenti za procjenu motoričkih sposobnosti imaju zadovoljavajuću razinu pouzdanosti te zadovoljavajuću faktorsku strukturu za procjenu pojedinih motoričkih sposobnosti. U svrhu povećanja pouzdanosti dobivenih rezultata u ovom radu, preporučljivo je proširiti istraživanje na veći broj ispitanika te u isto uključiti svih 8 varijabla preporučenih CROFIT testova u osnovnoj školi.

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HRONIČNE BOLESTI KAO DETERMINANTA U PLANIRANJU FIZIČKIH AKTIVNOSTI KOD OSOBA SA DAUNOVIM SINDROMOM

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UVOD

Čovek je društveno i biološko biće. Bez obzira na pol i starost, kretanje je biološka potreba svakog čoveka bez koje fizički i mentalno degeneriše (Eminović i sar., 2011). Sprovođenje fizičkih aktivnosti (fizičko vaspitanje, spotrske aktivnosti i rekreacija) ima za cilj unapređenje opšteg zdravstvenoh stanja, otklanjanje ili ublažavanje stanja nastalih usled prisustva telesnih deformiteta kao i unapređenje psihičkog stanja samog pojedinca, razvoj sprtskog duha i osećaja za funkcionisanje u grupi.

Daun sindrom ili Syndroma Langdon Down je najčešći hromozomski poremećaj, a nastaje usled prisutnosti treće kopije celog ili dela hromozoma 21 u naslednom materijalu čoveka. Detaljne karakteristike ovog sindroma prvi je opisao engleski lekar John Langdon Down 1866. godine i zato ovaj sindrom po njemu nosi ime. Dr J. L. Down je svoju porodičnu kuću pretvorio u sanatorijum za osobe sa invaliditetom, gde je uočio da postoji bar deset procenata dece koja su jako ličila jedna na druge. Primetio je njihovu psihofizičku posebnost koja ih je izdvajala u odnosu na ostalu decu sa intelektualnim teškoćama. Od 1975. godine, kada je u Denveru američki Nacionalni institut za zdravstvo održao Konferenciju o standardizovanju naziva urođenih malformacija, preporučeno je da se sindromi ne nazivaju po autorima. Ipak naziv Daun sindrom se i dalji koristi. Naziv Daun (Down) prihvaćen je u Americi, Kanadi i velikom broju zemalja Evrope i sveta, dok se naziv Daunov (Downov) sindrom koristi u Engleskoj i nekim zemljama anglosaksonskog jezičkog područja (Dimitrijević i sar., 2013). Incidenca Daunovog sindroma iznosi jedan na 650–1.000 živorođene dece. U Srbiji je učestalost Daunovog sindroma 13 na 10.000 živorođenih godišnje. Daunov sindrom je najčešći uzrok mentalne retardacije u dečijoj patologiji i uz karakterističnu kraniofacijalnu dismorfiju često se javljaju teške abnormalnosti različitih organa i organskih sistema, posebno kad su u pitanju srčane mane, što neretko zahteva hirurišku intervenciju u prvih nekoliko godina života.

Cilj našeg rada da revijalnim pregledom literature izdvojimo najčešće hronične bolesti koje se javljaju kod dece/odraslih sa daunovim sindromom kao i smernice za planiranje fizičkih aktivnosti kod ove populacije u odnosu na prisustvo istih. Za identifikovanje najznačajnijih hroničnih bolesti kod osoba sa daunovim sindromom korišćen je metod teorijske analize, deskriptivni metod.

Hronične bolesti kod osoba sa Daunovim sidromom

Postoje brojna određenja hroničnih boleti pa tako Rapaić i Nedović (2003) smatraju da se pod pojmom hronična bolest podrazumeva patološka promena u organizmu koja ima dugotrajan tok, kod koje postoji sklonost njenog ponavljanja u određenim vremenskim razmacima, pri čemu je sposobnost funkcionisanja smanjena. Bolovi, povišena temperatura, emocionalni stres i poremećena motorika su najčešći pratioci hroničnih bolesti. Hronične bolesti ne podrazumevaju istovremeno i invalidnost, ali se ona može dogoditi, a u ranom uzrasnom dobu, značajno može usporiti motorički razvoj, kao i ugroziti obavljanje aktivnosti zasnovanih, prevenstveno, na gruboj motorici. U grupu hroničnih nezaraznih bolesti spadaju sledeća oboljenja: oboljenja kardiovaskularnog, respiratornog, endokrinog sistema, oboljenja ureopoeznog aparata i maligna oboljenja.

Kada govorimo o vrsti hroničnog oboljenja, kod osoba sa intelektualnom ometenošću se često javljaju zdravstveni poremećaji poput oboljenja tiroidne žlezde, epileptičnih napada, mentalnih oboljenja, gojaznosti i različitih oralnih bolesti. Višestruki poremećaji su veoma česta pojava kod starijih osoba sa intelektualnom ometenošću (Fortin et al., 2005; Van den Akker et al., 1998). Oni se mogu definisati kao skup više različitih zdravstvenih poremećaja istovremeno prisutnih kod neke osobe (Van den Akker et al., 1996;). Jedna kanadska studija (Fortin et al., 2005) je pokazala da kod osoba od 45 do 64 i od 65 godina starosti i naviše, čak 95% i 99% žena i 89% i 97% muškaraca ima 2 ili više hroničnih zdravstvenih poremećaja. Time su autori ove studije došli do zaključka da je stopa višestrukih poremećaja prilično visoka kod oba pola i da raste sa godinama. Pacijenti koji se leče od višestrukih poremećaja kod porodičnog lekara predstavljaju pravilo pre, nego izuzetak (Fortin et al., 2005; Van den Akker et al., 1998).

Fisher & Kettl (2005), istražujući koliko se tokom godina povećao prosečni životni vek kod osoba sa intelektualnom ometenošću, otkrivaju da izvestan broj faktora ima značajan uticaj na prosečni životni vek kod ovih osoba, kao što su kvalitetna zdravstvena i društvena nega, smeštaj u odgovarajuće centre za zbrinjavanje kao i napredak u tehnologiji i programima rada sa takvim osobama. Dokazano je, takođe, da povećana stopa smrtnosti kod osoba sa intelektualnom ometenošću, može biti uslovljena različitim naslednim bolestima, (Janicki et al. 1999; Hollins et al. 1998; Patja et al. 2000), rasnim (Yang et al., 2002) ili urođenim (naslednim) faktorima (Bittles et al., 2002).

Kardiovaskularna oboljenja kod Daunovog sindroma

U prilog, da je kod osoba sa sniženom intelektualnom ometenošću veći rizik od pojave srčanog oboljenja nego u opštoj populaciji, govore brojne studije. McDermott, Plann i Krishnaswami (1997) ispitivali su da li osobe sa intelektualnom ometenošću podležu većem riziku od hroničnih bolesti. Analizirajući 366 osoba sa primarnom dijagnozom intelektualna ometenost, dve grupe ljudi bez ove dijagnoze (427 ispitanika bilo je u prvoj i 746 ispitanika u drugoj grupi), došli su do rezultata da su, osobe sa intelektualnom ometenošću, imale veći broj neurofizioloških poremećaja, EPI napada, senzornih poremećaja i poremećaja CNS-a, u poređenju sa ostale dve grupe. Međutim, kod njih je primećen manji broj nekih hroničnih poremećaja (npr. hipertenzije, migrenoznih napada ili hroničnog dijabetesa, anskioznosti, gojaznosti) u poređenju sa ljudima iz ostale dve grupe.

Finska studija (Patja et al., 2001) zasnovana je na tridesetpetogodišnjem posmatranju sveobuhvatne populacije od 2319 osoba sa intelektualnom ometenošću, starosti između 2 i 97 godina. Od tog broja njih 1095 umrlo je tokom perioda posmatranja. Kod 36% ustanovljeno je da su vaskularne bolesti bile primarni uzrok smrti. Ovaj procenat je daleko niži od procenta opšte populacije poređene po polu i starosti. Prosečni rizik od smrtnosti usled vaskularnih bolesti je niži kod svih muškaraca sa intelektualnom ometenošću i kod većine žena, osim onih starosti između 20 i 39 godina sa lakšom ili težom intelektualnom ometenošću. U mlađoj starosnoj grupi, srčana insuficijencija, aneurizma srčane aorte i kardiomiopatija, bili su najčešći uzroci smrti, i to kod osoba sa Daunovim ili drugim sindromima, uopšteno povezanim sa valvularnim i drugim strukturalnim poremećajima. Među svim ovim srčanim oboljenjima, u 38% slučajeva glavni uzrok smrti bio je akutni srčani miokard (infarkt), kod 33% osoba moždani udar ili izliv krvi na mozak, kongenitalno srčano oboljenje kod 18%, i plućni infarkt kod 6%. Prosečna starosna granica u trenutku smrti od kardiovaskularnih bolesti je 63.2 godine. Od ukupnog broja umrlih koji, su bili stariji od ovog proseka, vaskularne bolesti bile su ređe prisutne nego kod opšte Finske populacije.

Iako nisu bile zasnovane na posmatranju opšte populacije, i druge studije su takođe zabeležile primetan porast broja slučajeva smrti usled kongenitalnih srčanih poremećaja kod osoba sa Fragilnim X sindromom, Daunovim i Rubenstajn-Tajbi sindromom (Barnard et al., 2002), kao i visoku smrtnost prouzrokovanu visokim pritiskom kao propratnim stanjem kod osoba sa Williams i Turner sindromom (O'Brien, 2008), ali ovi poremećaji, prema rezultatima istraživanja,više pogađaju mladu i populaciju srednjih godina nego starije. Rezultati finske studije (Patja et al., 2001) vezani za uzročnike smrti veoma su slični rezultatima istraživanja u SAD (Strauss et al., 1998; Janicki et al., 1999; Esbensen et al. 2007). Najčešći uzročnici smrti prema tim istraživanjima su kardiovaskularne bolesti, respiratorna oboljenja i rak. Kao i u opštoj populaciji, životni stil i ponašanje prema zdravlju povezan sa načinom ishrane, količinom fizičke aktivnosti doprinosi u velikom procentu rizika ka kardiovaskularnim bolestima.

Van den Akker et al. (2006) je istraživao slučajeve kardiovaskularnih bolesti kod osoba sa intelektualnom ometenošću u stambenim naseljima, na uzorku od 436 ispitanika. Njegovo istraživanje

je pokazalo da je stopa kardiovaskularnih oboljenja viša kod osoba sa intelektualnom ometenošću starije dobi. U poređenju sa ljudima opšte populacije od 30-49 godina starosti, ljudi stari 50-59, 60-69 i preko 70 imali su znatno uvećan rizik od kardiovaskularnih bolesti. Stariji su takođe češće patili od hipertenzije i cerebrovaskularnih bolesti.

Janicki i saradnici (2002) su prikupili informacije o zdravstvenom stanju i različite modele poremećaja i oboljenja kod velikog broja odraslih sa intelektualnom ometenošću, starosti 40 ili više godina, koji su smešteni u ustanovama za male grupe ljudi, na teritoriji države Njujork. Kod većine ispitanika ustanovljeno je dobro zdravstveno stanje, uz neke poremećaje koji su se pogoršavali sa godinama (npr. kardiovaskularna oboljenja) i neke poremećaje koji su postajali blaži sa godinama (npr. mentalna oboljenja). Iako se većina poremećaja pogoršavala sa godinama, njihova učestalost se razlikovala u zavisnosti od pola i težine poremećaja. Uočeno je da se kod odraslih osoba sa intelektualnom ometenošću uglavnom ređe ispoljavaju znaci kardiovaskularnih bolesti, uključujući hipertenziju, hiperlipidemiju, kao i pozni dijabetes. Ovi podaci se ne poklapaju sa podacima o stopi smrtnosti kod odraslih sa intelektualnom ometenošću.

Skorije istraživanje (Henderson et al, 2008) sprovedeno u sličnoj sredini u SAD, pokazalo je nižu stopu povećane telesne težine, ali veću stopu goajznosti kod institucionalizovanih odraslih osoba sa intelektualnom ometenošću (<5% preko 65 godina starosti) i približno istu stopu hipertenzije u odnosu na opštu populaciju (Haveman et al., 2010).

Draheim i saradnici (2002), govore nam, takođe, o postojanju veće stope pojave kardiovaskularnih oboljenja kod osoba sa intelektualnom ometenošću, nego u opštoj populaciji, kao i da se prevalenca ovog oboljenja povećava sa godinama. Podaci o hipertenziji u okviru studije Havemana i sar. (2011) pokazuju da se ovo oboljenje javlja u procentu od 5,8% kod osoba sa intelektualnom ometenošću starosti od 19 do 34 godine, i u 30,4% kod ljudi starosti od 65 godina i više. U poređenju sa mlađom grupom, veći je procenat srčanih udara, zabeležen je kod starosti od 65 godina i više.

Garrod (1894) je prvi govorio o prevalenci srčanih oboljenja kod osoba sa dijagnozom Daunovog sndroma. Pueschel i Werner (1994) govore o postojanju kongenetalnih srčenih mana u oko 40% osoba sa Daunovim sinromom, koje se obično koriguju na rođenju, a ukoliko se to ne desi i oboljenje se nastavi tokom celog detinjstva, skraćuje se životni vek ovih osoba. Isti autor napominje da je prolaps srčenog zaliska najprisutnije kod osoba sa Daunovim sindromom (44,44-57%) u odnosu na ostale osobe sa intelektualnom ometenošću (5-10%).

Kardiovaskularne bolesti karakteristične su za mlađe pripadnike ove populacije, i predviđa se da će prosečni broj ovih oboljenja rasti sa dužim životnim vekom ovih osoba. Van der Akker et al. (2006), govore o tome da su hipertenzija i kardiovaskularne bolesti češće u starijoj polulaciji, i da zavise od nivoa intelektualne ometenosti, pola i etiologije. Istraživanje je vršeno uključujući osobe sa Daunovim sindromo, u odnosu na ostale etiologije.

Hahn i saradnici (1986, prema McGinis and Foege, 1993) govore o dva rizika faktora kada su u pitanju kardiovaskularna oboljenja kod osoba sa intelektualnom ometenošću, a to su: gojaznost i nedostatak fizičke aktivnosti. Studija koja je ispitivala odrasle osobe sa Daunovim sindromom, otkrila je da 31% muškaraca i 22% žena, iz te grupe, pati od gojaznosti, što se pokazalo kroz indeks (vrednost) telesne mase (BMI) 25–29, dok je kod 48% muškaraca i 47% žena ta vrednost bila dosta viša (BMI ^{3}30). Svi ovi podaci sadrže poređenja u skladu sa godištem, a izveštaji govore o porastu prevalence koardiovaskularnih oboljenja i postojanju povećanog rizika kod odraslih sa intelektualnom ometenošću.

Patološke promene na kardiovaskularnom sistemu, koje ometaju njegovu pravilnu hemodinamiku, zahtevaju zabranu fizičkog naprezanja usled nemogućnosti adaptacije srca na izmenjene hemodinamske uslove, kao i zbog nemogućnosti njegovog prilagođavanja na potrebe organizma pod uslovima pojačanog fizičkog rada ili naprezanja; stoga, oboljenja srca i cirkulatornog aparata vode ka sekundarnom oštećenju motorike. Srčana aktivnost je jedan od veoma bitnih faktora, kada je u pitanju sačinjavanje individualnog programa za sprovođenje sportskih aktivnosti. Ovom temom su se bavili mnogi autori (Varela & Pitetti, 1995; Fernhall et al, 1996; Eberhad et al, 1997). Varela i Pitetti (1995) su došli do zaključka da su, u okviru grupe osoba sa Daunovim sinromom, neke uspele da dostignu maksimalnu srčenu ferkvenciju, a neke ne. Fernhall et al. (1996) takođe govore o varijabilnosti kada je u pitanju maksimalna srčena ferkvencija. Pored srčane ferkvencije, kao bitni elementi pri koncipiranju individualnih sportskih aktivnosti navodi se i manjak motivacije, manjak maksimalnog postignuća, niska potrošnja kiseonika, niska maksimalna ventilacija i neadekvatna respiratorna razmena.

Ostala oboljenja o kojima je potrebno voditi računa kada je u pitanju kapacitet vežbanja i same fizičke aktivnosti su: poremećaj štitne žlezde, problem sa utroškom energije kao i poremećaj utroška substrata i neadekvatan odgovor na vežbe, kao i prisustvo anemije (Pitetti et al., 1992).

Bolesti endokrinog sistema kod Daunovog sindroma

Dokazano je da se tiroiditis (zapaljenje štitne žlezde), celijačna bolest, i dijabetes melitus (šećerna bolest) češće dešavaju kod osoba sa Daunovim sindromom nego kod opšte populacije (Kinik, ÖZÇAy, & Varan, 2006; Hanssonet al., 2005), kao i da kod tih osoba postoji izmenjena aktivnost T-ćelija (belih krvnih zrnaca) i nivo tumor markera (Prada et al., 2005; Oda et al., 1993; Ugazio et al., 1990). Anomalije tiroidne žlezde su češće kod osoba sa intelektualnom ometenošću. Povećani hormon tiroidne žlezde (TSH) nađen je kod 48% osoba sa Daunovim sindromom, koje su smeštene u nekoj instituciji. Druga studija je ukazala na to da kod 50% osoba sa Daunovim sindromom nikada nije ispitan rad tiroidne žlezde, uprkos tome što je opšte poznato da je kod ovih osoba povećan broj slučajeva sa poremećenim radom tiroidne žlezde (Jones & Kerr, 1997). Bolesti tiroidne žlezde je zajednički problem osoba sa intelektualnom ometenošću, dijagnoza je uglavnom hiper i hipotiroza.

Sama terapija i praćenje simptoma koje osobe manifestuje je jako bitan činilac u struktuiranju tretmana i fizičkih aktivnosti kod ovih osoba. Kada govorimo o primarnom hipertiroidizisu koji je i najčešći, trauma, ekstremni napor i infekcija ukazuju na poremećeno hipermetaboličko stanje. Takođe kod ovih osoba ishrana i terapija lekovima usko su povezane. Potrebno je izbaciti sve namirnice koje blokiraju asorpciju joda.

Respiratorna oboljenja kod Daunovog sindroma

Problem aspiracije osoba sa sniženim intelektualnim funkionisanjem može izazvati patologiju pluća (bronhitis, pneumoniju) i može dovesti i do smrti usled respiratornih infekcija (Chany & Eyman, 2000). Kada govorimo o respiratornim tegobama osobe sa intelektualnom ometenošću, posebno osobe sa Daunovimm sindromom, imaju opstruktivnu apneu tokom spavanja (Mitchell, Call & Kelly, 2003). Većina ovih pacijenata takođe ima problem sa gutanjem, disanjem, neuhranjenošću i dehidratacijom (Kennedy et al., 1997). „Testiranje dece sa Daunovim sindromom na potrošnju kiseonika (VO2) može se vršiti samo kod onih kod kojih nije prisutan nikakav oblik urođenih ili stečenih srčanih mana“ (Romanov, 2010, str. 68). Deca i adolescenti sa dijagnozom ovog sindroma imaju niže vrednosti za maksimalnu potrošnju kiseonika kako u odnosu na decu opšte populacije (18-25ml/kg/min), tako i za vršnjačku populaciju sa intelektualnom ometenošću koja nemaju ovu dijagnozu. Guerra et al. (2000) govore o tome da se kod dece sa intelektualnom ometenošću i nakon sprovedenog programa fizičkih aktivnosti (10 sati nedeljno u toku godina) ne mogu dostići prosečne vrednosti potrošnje kiseonika u okviru vršnjaka redovne populacije.

Autori su se u svojim radovima bavili kardiorespiratornim kapacitetom osoba sa hroničnim bolestima i osoba sa intelektualnom ometenošću. “Kardiorespiratorni kapacitet kod osoba sa Daunovim sinromom je niži nego kod drugih osoba u okviru populacije sa intelektualnom ometenošću“ (Fernhall et al, 1996, str. 366). Isti autori govore da je ova stopa 10% niža nego kod njihovih vršnjaka kod koji nije konstatovana ova dijagnoza (Fernhall et al, 1997). Pomenuto istraživanje se sprovelo na 111 ispitanika (od toga 31 osoba muškog i 16 osoba ženskog pola sa dijagnozom Daunovog sindroma, dok je sa intelektualnom ometenošću, ali bez ove dijagnoze, bilo 35 muškaraca i 29 žena). Centri koji su učestvovali u ovom istraživanju koristili su testove u vidu pokretnih traka. Rezultati su pokazali da osobe sa intelektualnom ometenošću imaju nizak nivo maksimalnog unosa kiseonika (VO2), i u skladu sa tim nizak nivo kardiorespiratornih sposobnosti. Maksimalan unos kiseonika i maksimalna ventilacija po minutu kao viša zabeležena je kod osoba muškog pola (r=0,006) i kod osoba koje nemaju Daunov sindrom. Maksimalna srčana ferkvencija i maksimalna respiratorna razmena je takođe veća kod osoba bez dijagnoze Daunovog sindroma (r=0,006). Isti autori (Fernhall et al, 1997) su istražili i validnost i pouzdanost kardiovaskularnih tzv,“terenskih“ testova kod dece sa intelektualnom ometenošću. U okviru pomenutog istraživanja došli su do zaključka da su pomenuti testovi validni i pouzdani i da se mogu koristiti kao pokazatenji kapaciteta maksimalnog unosa kiseonika (VO2), kod dece sa umerenom i teškom intelektualnom ometenošću. Pitetti et al. (1992) takođe u okviru populacije sa intelektualnom ometenošću, govore o niskom unosu kiseonika, ventilaciji u minuti i srčanoj frkfenciji.

Oboljenja bubrega i urinarnog sistema kod Daunovog sindroma

Kada govorimo o provalenci bubrežnih oboljenja kao i anomalijama urinarnog trakta kod dece sa intelektualnom ometenošću u svom istraživanju Kupferman, Druschel i Kupchik (2009), ističu da su ova oboljenja u najvećem stepenu zastupljena kod Daunovog sindroma u odnosu na druge dijagnoze a o kojima govorimo kada je u pitanju populacija dece sa intelektualnom ometenošću. S toga, deca koja imaju Daunov sindrom su pod velikim rizikom kada su u pitanju ova oboljenja. Pomenuto istraživanje obuhvatalo je grupe dece sa intelektualnom ometenošću, sa i bez dijagnoze daunov sindrom, koja su rođena u oblasti Njujorka, u periodu od 1992. do 2004. godine. Studija potvrđuje hipotezu da su deca koja imaju Daunov sindrom pod značajnim rizikom, tako da je potrebno da pregled i ultrazvuk bubrega i urinarnog trakta, bude obavezan sastavni deo u okviru pregleda novorođenih beba sa ovim sindromo. Studije na ovu temu dovele bi do otkrivanja što većeg broja anomalija, a takođe bi dovele do dijagnostikovanja istih što ranije, čime bi se smanjila stopa smrtnosto kod ovih osoba.

Kad govorimo o urođenim anomalijama bubrega i urinarnog trakta, prevalenca kod Daunovog sindroma iznosi 4-5% u odnosu na provalencu istih oboljenja u opštoj populaciji (Mason et al., 2005. Veliki broj studija, takođe, beleži postojanje anomalija i urođenih defekata kod odojčadi sa daunovim sindromom (Cleves et al, 2007; Torfs & Christianson, 1998).

Kao najčešća oboljenja kada su u pitanju bubrezi i problemi urinarnog trakta, možemo izdvojiti sledeća oboljenja: prednja opstrukcija uretra, cistčna dispeneja bubrega, hidronefroza. Kada govorimo o oboljenjima bubrega, autori se slažu da one nalažu motorička ograničenja i ograničenja fizičkih aktivnosti (Manojlović i sar., 2003; Stošljević i sar, 1997).

Maligna oboljenja kod Daunovog sindroma

Još jedna od posledica povećanog životnog veka kod osoba sa intelektualnom ometenošću je učestala pojava oboljenja od kancera (Hollins et al., 1998; Janicki et al., 1999, 2002; Maaskant et al., 2002; Patja et al., 2000; Strauss et al., 1998; Sullivan et al., 2004; Yang et al., 2002). U studiji Janicki et al. (2002) i Merrick et al. (2004) zabeležen je značajan porast broja starijih osoba obolelih od kancera, ali stopa i učestalost ove bolesti nije bila ništa veća nego kod opšte populacije. Istraživanja su pokazala da u današnje vreme svaka deseta osoba sa intelektualnom ometenošću umre od kancera (Cooke, 1997; Hollins et al., 1998).

Standardna stopa osoba sa Daunovim sindromom obolelih od leukemije daleko je viša nego kod opšte populacije (Sullivan et al., 2007) Kod osoba sa Daunovim sindromom leukemija je vrlo prisutna, a skorije studije pokazuju da imaju samo 50% rizika od dobijanja neke druge vrste kancera (Henderson et al., 2000).

ZAKLJUČAK

Shodno svim osobenostima populacije sa intelektualnom ometenošću, generalne smernice tokom koncipiranja programa fizičkih aktivnosti su:

- individualni sadržaj preporučenih fizičkih aktivnosti (u saradnji sa kardiologom, lekarom sportske medicine i lekarom specijalistom),
- uzeti u obzir medikaciju i njen uticaj na organizam, kao i njen uticaj tokom samog vežbanja,
- pružanje konstantnog i povećanog nadzora,
- inkorporirati bihejvoralnu terapiju i motivacione tehnike.

Program može uključivati sledeće grupe vežbi:

- program kardiovaskularnih vežbi (šetnja, džoging, stacionarni bicikl, aerobni ples),
- vežbe snage – povećanje mišićne snage u velikim mišićnim grupama,
- vežbe oblikovanja
- „vežbe fleksibilnosti/istezanja SE NE PREPORUČUJU, usled hipermobilnosti i laksaliteta, koje nalazimo udružene u okviru dijagnoze Daunovog sinroma".

Kada je u pitanju trening snage potrebno je povećati mišićnu snagu u velikim mišićnim grupama. Za opštu populaciju trening treba da bude intenziteta 70-80% 1 RM, međutim s obzirom na specifičnosti populacije osoba sa sniženim intelektualnim funkcionisanjem intenzitet treninga je niži i treba da iznosi 50-70 % (iz tri seta od 8-12 ponavljanja). Program treba da smenjuje 2-3 minuta treninga, 30-60 sekundi odmora između svakog seta vežbi.

Bitno je, takođe, kada pristupamo struktuiranju tretmana, istaći da li je hronično oboljenje progresivnog ili neprogresivnog karaktera, prisustvo medikamentozne terapije i njenog delovanja na izvođenje motoričkih aktivnosti (usporenost, zamorljivost).

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CHRONIC DISEASES AS A DETERMINANT IN THE PLANNING OF PHYSICAL ACTIVITY IN PEOPLE WITH DOWN'S SYNDROME

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INTRODUCTION

The man is a social and biological creature. Regardless of one's gender or age, movement is a biological necessity of every human being without which they degenerate, both physically and mentally (Eminović et al., 2011). Conducting physical activities (physical education, sports activities and recreation) has the aim to improve one's overall health condition, remove or alleviate conditions caused by presence of physical deformities as well as to improve mental state of an individual themselves, develop sport spirit and sense of functioning in a group.

Down's syndrome or Syndroma Langdon Down is the most frequent chromosome abnormality, and is caused by the presence of the third copy of the whole or partial chromosome 21 in the human's genetic material. The characteristics of this syndrome were first described in detail by an English physician John Langdon Down in 1866, therefore this syndrome was named after him. Dr J. L. Down turned his family home into a sanatorium for people with disabilities, where he came to notice that there were at least ten per cent of children who bore a striking resemblance to each other. He observed their psychophysical distinctiveness which distinguished them from other children with mental disabilities. Since 1975, when the Conference on standardizing the names for inborn malformations was held in Denver by the American National Health Istitute, it has been recommended that syndromes should not be named after the authors. Nevertheless, the term Down'ssyndrome is still used. The term Down is accepted in America, Canada and a number of countries in Europe and the world, whereas the term Down's syndome is used in England and some countries of Anglo-Saxon speaking area (Dimitrijević et al., 2013). The incidence rate of Down's syndrome is one in every 650-1000 liveborn children. In Serbia that rate is 13 in 10000 liveborn children per year. Down's syndome is the most common cause of intelectual disability in pediactric pathology and along with typical craniofacial dysmorphia there are frequently severe abnormalities of different organs and systems of organs, especially when it comes to heart anomalies, which quite often requires undergoing surgery in the first few years after birth.

The goal of our work is to use literature review so as to extract the most frequent chronic diseases which occur in children/adults with Down's syndrome as well as to offer some guidelines for planning physical activities in this population considering the presence of the aforementioned. We have used the method of theoretical analysis, descriptive method to identify the most significant chronic diseases in pepole with Down's syndrome.

Chronic diseases in people with Down's syndrome

There are numerous definitions of chronic diseases and so Rapaić and Nedović (2003) consider that the notion of chronic disease entails some long-lasting pathological change in one's organism,with the tendency to re-appear in certain time intervals, which largely decreases the ability to function. Feeling pain, increased body temperature, emotional stress and disturbed motor skills most commonly go hand in hand with chronic diseases. Chronic diseases do not necessarily

imply disability, but there is a possibility of its occurrence, and if that happens at an early age, it can significantly slow down the development of motor skills, as well as endanger performing activities based primarily on gross motor skills. The following conditions belong to the group of chronic non-communicable diseases: diseases of cardiovascular, respiratory, endocrine system, diseases of urinary sistem and malignant diseases.

When it comes to the type of chronic disease, in people with intellectual disabilities often occur health disorders such as thyroid disease, epileptic attacks, mental disorders, obesity and various oral diseases. Multiple disorders are a very frequent phenomenon in elderly people with intellectual disabilities (Fortin et al., 2005; Van den Akker et al., 1998). They can be defined as a set of a few different health disorders simultaneously present in a person (Van den Akker et al., 1996;). One Canadian study (Fortin et al., 2005) has shown that in the range of people between 45 and 64 years of age and in those older than 65, as many as 95% and 99% of women and 89% and 97% of men have two or more chronic health disorders. Thus the authors of this study came to the conclusion that the rate of multiple disorders is pretty high in both genders and that it increases with age. Patients who are treated for multiple disorders by their family physicians represent a rule rather than an exception (Fortin etal., 2005; Van den Akker et al., 1998).

Fisher & Kettl (2005), while doing a research on how much the average life expectancy of people with learning disabilities has increased over the years, discovered that a certain number of factors has a significant affect on the average life expectancy of such people, such as good health and social care, being accommodated in proper care centers as well as technological advancement and advancement in working programme. It has also been proven that the increase in the mortality rate in people with intellectual disabilities can be caused by various hereditary diseases (Janicki et al. 1999; Hollins et al. 1998; Patja et al. 2000), racial (Yang et al., 2002) or inborn (genetic) factors (Bittles et al., 2002).

Cardiovascular diseases in Down syndrome

A number of studies speak in favour of the fact that there is a higher level of risk of getting a cardiovascular disease in people with intellectual disabilities than in general population. McDermott, Plann, & Krishnaswami (1997) performed a study on whether people with intellectual disabilities undergo a higher level of risk of chronic diseases. Analyzing 366 people with the primary dyagnosis of intellectual disability, two groups of people without this dyagnosis (there were 427 examinees in the first group and 746 examinees in the second one), reached the conclusion that the people with intellectual disabilities had a higher number of neurophysiological disorders, epileptic attacks, sensory disorders and disorders of CNS, comparing to the other two groups. However, they detected a lower number of some chronic diseases (e.g. hypertension, migraine headaches or chronic diabetes, anxiety, obesity), in comparison to the people from the other two groups.

A Finnish study (Patja et al., 2001) is based upon a 35-year observation of general population of 2319 people with intellectual disabilities, age between 2 and 97. Of that number 1095 people died during the period of observation. In 36% of them it was established that vascular diseases had been the main cause of death. This percentage is far lower than the percentage of general population sorted by gender and age. Average risk of mortality due to vascular diseases is lower in all men with intellectual disabilities and most women as well, except for those between 20 and 39 years of age who have lighter or more severe form of learning disabilities. In the younger age group, heart failure, aortic aneurysm and cardiomyopathy, were the most frequent causes of fatal outcome, and that in people with Down's syndrome or other syndromes, generally related to valvular and other structural disorders. Among all these heart diseases, in 38% of all cases the main cause of death was acute myocardial heart attack (infarction), in 33% of people the cause was a stroke (cerebrovascular accident- CVA) .

Congenital heart disease was the cause in 18% of people and pulmonary infarction in 6%. The average age limit at the time of death in people who had died of cardiovascular diseases was 63.2 years. In all the people who died and were above this age limit, vascular diseases were less present than in general Finnish population.

Although they were not based on observing general population, other studies also recorded a notable increase in number of cases in which death was caused by congenital heart anomalies in people with Fragile X syndrome, Down's and Rubinstein-Taybi syndrome (Barnard et al., 2002), as well as high mortality rate caused by high blood pressure as a side effect in people with Williams

and Turner syndrome (O'Brien, 2008), but these anomalies, according to the research results, affect young and middle-aged people rather than the elderly. The results of the Finnish study (Patja et al., 2001) in relation to the causes of death are quite similar to the results of studies conducted in the USA (Strauss et al., 1998; Janicki et al., 1999; Esbensen et al. 2007). The most frequent causes of death, according to those studies, are cardiovascular diseases, respiratory diseases and cancer. The same as in general population, lifestyle and one's attitude to their health directly connected with nutrition regimen and the amount of physical activity can contribute to the increase in risk of cardiovascular diseases.

Van den Akker et al. (2006) was conducting a study on cases of cardiovascular diseases in people with intellectual disabilities in housing estates, on a sample of 436 examinees. His research showed that the rate of cardiovascular diseases is higher in elderly people with intellectual disabilities. Compared with people of general population between the age of 30 and 49, people who were 50-59, 60-69 and 70 years old had a significantly increased risk of cardiovascular diseases. The elderly also showed propensity to suffering from hypertension and cerebrovascular diseases.

Janicki et al. (2002) gathered information on health condition as well as various behavioural patterns and diseases in a number of adults with intellectual disabilities, age 40 or older, who are placed in institutions for small groups of people, on New York state teritory. Most examinees were diagnosed with good health condition, with some anomalies which deteriorated over the years (e.g. cardiovascular diseases) and some anomalies which alleviated over the years (e.g. mental disorders). Although most disorders got worse over the years,their frequency differed depending on gender and the severity of the disorder. It was noticed that in adults with intellectual disabilities symptoms of cardiovascular diseases, including hypertension, hyperlipidemia and late-onset diabetes, were mostly not expressed very frequently. These data do not match the data on mortality rate in adults with intellectual disabilities.

A recent stady (Henderson et al., 2008) conducted a similar envinonment in the USA, has shpwn a lower rate of incrased body weight,but a higher rate of obesityin institucionalized adults suffering from intellectual disabilities (< 5% over 65 years of age and aproximately the same rate f hipertension compared to general population (Haveman et al., 2010)

Draheim at all. (2002), also talk about the existence of a higher rate of cardiovascular diseases appearing in people with learning disabilities than in a general population, as well as that the prevaence of this kind of condision increseases with age.

The date on hipertension within in stady Havemana et al. (2011), show that this condition afflicts around 5,8% of people with intellectual disabity age between of 19-34 years, and in 30,4% in people age of 65 years and older. Comparing the younger age group, there is a higher percentage of hurt attacks notet in a age or older.

Garrod (1894) was the first onewho talked about the prevalence of heart diseases in people dyagnosed with Down syndrome. Pueschel & Werner (1994) talks about the existence of congenetal heart anomalies in about 40% of people with Down syndrome wich usually treat upon birth and if does not happen and the heart anomaly continues existing trought the childhood life expectsncy of these people get affected. The same author emphasizes that mitral valve prolaps is most present in people with Downs syndrome (44,44-57%) compared to other people with intellectual disabilites (5-10%).

Cardiovascular diseases are typical of younger members of this population and it is praticed that theoverage number of these disease will increase with the increase in life expect ancy of these people. Van der Akker et al. (2006) talk abouy hipertension and cardiovascular diseases occur more frequently in the elderly and that they depend on the level of learning disability, gender and etiology. This research was conducted by including people with Downs syndrome in comparison to other etiologies.

Hahn at al. (1986, McGinis & Foege, 1993) talk about two risk factors when it comes to cardiovascular diseases in peopla with intellectual disabilities,which are obesity and lack of physical activity. A study which has done a research on people with Down syndrome has discovered that 31% of man and 22% of women from that group suffer from obesity which shown trought the BMI(body mass index)25-29,whereas in 48% of man and 47% of women that number was much higher (BMI30). All these data contain comparisons in accordance with the age and the reports witness the increase of the prevalance of cardiovacular diseases and the existence of increased risk in people with intellectual disabilities.

Pathological changes in cardiovascular system which impede its regular hemodynamics, require prohibition of physical strain due to inability of the heart to adapt to altered hemodynamic conditions, as well as because of its inability to adapt to the needs of an organism in conditions of higher physical strain; therefore, heart and circulatory system diseases lead to the secondary motor impairments. Heart activity is one of very significant factors when it comes to making up an individual programme for conducting sports activities. Many authors have tackled this issue (Varela & Pitetti, 1995; Fernhall et al., 1996; Eberhad et al., 1997). Varela & Pitetti (1995) reached the conclusion that some of the people with Down's syndrome had managed to reach maximum heart frequency, and some of them had not. Fernhall et al. (1996) also talk about variability when it comes to maximum heart frequency. Besides heart frequency, other elements significant for making up individual sports activities are stated, such as lack of motivation, lack of maximum achievements, poor oxygen uptake, low level of maximum voluntary ventilation and inadequate respiratory exchange.

Other diseases which we should take into consideration when it comes to practicing capacity and physical activity itself are: thyroid gland disorder, problems with energy consumption, the disorder of substrate consumption and inadequate response to execise, as well as the presence of anaemia (Pitetti et al., 1992).

Endocrine system diseases within Down syndrome

It is proven that thyroiditis (inflammation of the thyroid gland), celiac disease, and diabetes mellitus (diabetes) more often affect people with Down syndrome rather than the general population (Kinik, ÖZÇAy, & Varan, 2006; Hanssonet al., 2005), and those people have changed activity of T-cells (white blood cells) and a level of tumor marker (Prada et al., 2005; Oda et al., 1993; Ugazio et al., 1990). Thyroid gland anomalies are more often present within the people with intellectual disability. Increased hormone of thyroid gland (TSH) is found within 48% of people with Down syndrome, who are situated in an institution. Another study has shown that 50% of people with Down syndrome never got examined for the functioning of thyroid gland, in spite of the fact that cases of thyroid gland functioning disorder are more often noticed with these people (Jones & Kerr, 1997). Diseases of the thyroid gland are the common problem that affects people with intellectual disorder, the diagnosis is usually hyper or hypothyroidism.

The therapy itself and the monitoring of symptoms those people manifest are a very important factor in the structuring of treatments and physical activities for them. When it comes to primary hyperthyroidism, which is also the most common, the trauma, extreme effort and infection indicate a disordered hypermetabolic condition. Also diet and medical therapy are closely connected for those people. It is necessary to take out all types of food that block absorption of iodine.

Respiratory diseases within Down syndrome

Respiratory problems of people with lowered intellectual function can cause lung pathology (bronchitis, pneumonia) and can lead even to death in case of respiratory infections (Chany & Eyman, 2000). When we talk about respiratory problems of people with lowered intellectual function, especially people with Down syndrome have obstructive sleep apnea (Mitchell, Call, & Kelly, 2003), A large number of this patients also have problem with swallowing, breathing, malnutrition and dehydration (Kennedy et al., 1997). „Testing children with Down syndrome for oxygen consumption (VO2) can be done only with those who don't have any kind of congenital and acquired heart defects" (Romanov, 2010, pp. 68).

Children and adolescents diagnosed with this syndrome have lower values for the maximum oxygen consumption, in comparison with children of the general population (18-25ml/kg/min), as well as in comparison with the same age population with intellectual disorder who are not diagnosed with this syndrome. Guerra et al. (2000) say that children with intellectual disorder even after executing a program of physical activities (10 hours per week within a year) cannot reach the average values of oxygen consumption of the same age standard population children.

In their papers, the authors dealt with cardio respiratory capacity of the people with chronic diseases and people with intellectual disability. "Cardio respiratory capacity of the people with Down

syndrome is lower than of other people within the population with intellectual disability." (Fernhall et al,1996, pp. 366). The same authors say that this rate is 10% lower than the rate within the same age people who are not diagnosed with this disease (Fernhall et al, 1997). The mentioned research was conducted among 111 respondents (31 males and 16 females with Down syndrome, and there were 35 males and 29 females with intellectual disability, but without this diagnosis). The centers that participated in this research used the tests in the form of conveyor belts. The results showed that the people with intellectual disability have low level of maximal oxygen uptake (VO2), and in accordance with that, they have low level of cardio respiratory abilities. The maximal oxygen uptake and the maximal ventilation per minute are recorded to be higher within males (r=0,006) and people who don't have Down syndrome. The maximal heart rate and the maximal respiratory exchange are also higher within people without Down syndrome (r=0,006). The same authors (Fernhall et al, 1997) have also researched the validity and reliability of cardiovascular so called "terrain" tests within children with intellectual disability. Within the mentioned research they came to the conclusion that the mentioned tests are valid and reliable and that they can be used as indicators of the capacity of the maximal oxygen uptake (VO2), within children with moderate and serious intellectual disability. Pitetti et al. (1992) also talk about low oxygen uptake, ventilation per minute and cardiac frequency within the population with intellectual disability.

Kidneys and urinary system diseases within Down syndrome

When it comes to kidney diseases prevalence, as well as the anomalies of the urinary tract within children with intellectual disability, Kupferman, Druschel, & Kupchik (2009) point out in their research that these diseases are mostly present within Down syndrome in comparison with other types of diagnosis which are present when it comes to population of children with intellectual disability. Therefore, children with Down syndrome are at high risk when it comes to these diseases. The mentioned research included groups of children with intellectual disability, with or without Down syndrome, born in the New York region, in the period from 1992 to 2004. The research confirms the hypothesis that the children with Down syndrome are at high risk, so it is necessary that the examination and ultrasound of kidneys and urinary system are required during the examination of newborns with this syndrome. The studies with this topic would help discover many more anomalies, and it would lead to diagnosing these diseases as early as possible, which would lower the death rate of these people.

When it comes to congenital anomalies of kidneys and urinary system, the prevalence within Down syndrome is 4-5% in comparison with the prevalence of the same diseases within the general population (Mason et al., 2006). Numerous studies also record the existence of anomalies and congenital defects within newborns with Down syndrome (Cleves et al, 2007; Torfsand & Christianson, 1998).

As most common diseases, when it comes to kidneys and the urinary system problems, we can mark out the following diseases: front urethral obstruction, cystic kidney dyspnea, hydronephrosis. When it comes to kidney diseases, the authors agree that they bring along motor and physical activities limitations (Manojlović et al., 2003; Stošljević et al., 1997).

Malignant diseases within Down syndrome

Another consequence of the longer lifespan of people with intellectual disorder is the common appearance of cancer diseases (Hollins et al., 1998; Janicki et al., 1999, 2002; Maaskant et al., 2002; Patja et al., 2000; Strauss et al., 1998; Sullivan et al., 2004; Yang et al., 2002). The research Janicki et al. (2002) and Merrick et al. (2004) records the significant increase of elderly people suffering from cancer, but also the rate and the frequency of this disease was not higher than within the general population. The researches have shown that in today's world every tenth person with intellectual disorder dies from cancer. (Cooke, 1997; Hollins et al., 1998).

The standard rate of people with Down syndrome who suffer from leukemia is much higher than within the general population.(Sullivan et al., 2007). Leukemia is very often noticed within people with Down syndrome, and the recent studies show that those people have only 50% risk of suffering from another type of cancer (Henderson et al., 2000).

CONCLUSION

The general guidelines during the conceptualization of the physical activities program are:

- individual content of the recommended physical activities,
- take into account the medication and its effect on the organism, as well as its effect during the exercising itself,
- constant and increased supervision,
- incorporate behavioral therapy and motivation techniques.

The program can include the following groups of exercises:

- the program of cardiovascular exercises (walking, jogging, stationary bicycle, aerobic dance),
- strength exercises – increase of muscular strength in big muscular groups,
- shaping exercises,
- "flexibility/stretching exercises ARE NOT RECOMMENDED, due to hyper mobility and instability which are usually combined within the diagnosis of Down syndrome".

When it comes to strength training, it is necessary to increase muscle strength in big muscle groups. For the general population the training should have an intensity of 70-80% 1 RM, whereas having in mind the specific situation of the people with lowered intellectual functioning, the training intensity is lower and should be 50-70 % (in three sets with 8-12 repetitions). The program should balance 2-3 minutes of training and 30-60 seconds of rest between every set of exercises.

When the treatment structure is being created, it is also important to take into account whether the chronic disease has progressive or non-progressive character, whether there is any medical therapy and how it affects the execution of motor activities (slowness, fatigue).

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SPECIFIČNOSTI OBUKE SKIJANJA KOD DECE

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UVOD

Sport se smatra izuzetno korisnim za fizički i psihički razvoj deteta. Već u ranom uzrastu deca počinju da učestvuju i takmiče se u sportu. On pomaže detetu da unapredi koordinaciju, poveća svest o sopstvenom telu, ostvaruje socijalne kontakte, usvaja i poštuje pravila ponašanja, poveća koncentraciju i razvija samopouzdanje. Deca kroz sport uživaju u fizičkoj aktivnosti, razvijaju fizičke sposobnosti, takmiče se, uzimaju učešće, donose odluke, vrednuju bezbednost, poštuju druge, prihvataju odgovarajuće uloge i usvajaju aktivan stil života (Andrews, 1999). Skijanje je sport u kojem značajnu ulogu igra veština ili drugim rečima - motoričko znanje. Skijanje kao veština predstavlja neprirodan oblik kretanja odnosno motoričku veštinu koja nije biološki urođena i mora da se nauči (Ilić, 1988). Skijaško znanje se sastoji od određenih elemenata skijaške tehnike, na osnovu kojih se procenjuje postignuti nivo skijaškog znanja. Definisanje osnovnog nivoa ovladanosti skijaškom tehnikom zahteva izvršavanje neke zadate motoričke radnje na skijama, čiju strukturu i sklop predstavljaju skijaški elementi (Dopsaj, 2004). Obučavanje i usvajanje osnovnih elemenata tehnike alpskog skijanja kod dece je veoma složen i organizovan proces koji se kroz teoriju i praksu, temelji na potvrđenim principima (postupnosti, sistematičnosti, očiglednosti...), metodama (demonstracije, usmenog izlaganja, metod igre...) i postupcima (sintetički, analitički, situacioni). Osnovne karakteristike vežbanja u predškolskom periodu rasta i razvoja dece proističu iz potrebe za stvaranjem senzitivne osnove u funkciji stvaranja motivacije za telesnom aktivnošću i sportskim aktivnostima. Na osnovu doživljenih radosti u vežbanju i razdraganosti u igri omogućavaju se uslovna formiranja radosti življenja i smisla telesnog vežbanja u toku života (Balsevič i Zaporožanov, 1987).

Škola skijanja može da predstavlja značajan činilac i važan faktor koji učestvuje u formiranju i razvijanju svestrane ličnosti. Škola skijanja predstavlja organizovni, planski i sistematski proces sportskog usavršavanja, (obrazovanja) usmeren na usvajanje, racionalne i celishodne tehnike kretanja skijama na snegu (skijanja). U toku obuke, kroz proces usvajanja tehnike skijanja, deca se susreću sa vrednostima, zahtevima i normama, koje vladaju u društvu i na taj način škola skijanja daje svojevrstan doprinos povoljnim uslovima za razvoj ličnosti. Dobro organizovana i sistematska obuka, uz odgovarajući pedagoški pristup, pri obuci skijanja dece predškolskog uzrasta, predstavlja značajno vaspitno-obrazovno sredstvo (Lazarević, 1987): sredstvo vaspitanja (kroz formiranje određenih moralno-voljnih osobina, stavova, vrednosti, usmerenja, samokontrole i dr.), kao i sredstvo obrazovanja (kroz sticanje i razvijanje sposobnosti za učenje određenih znanja i veština).

Obrazovna koristi od skijanja prema Frejzeru (*Fraser*, 2004) se može podelititi u 4 kategorije: socijalnu edukaciju, fizičku, akademsku i eksperimentalnu. Od posebnog značaja su socijalna edukacija (učenje više o sebi i svojim vršnjacima, dostizanje više ili manje od očekivanog, reagovanje na nove situacije, ohrabrivanje međusobnog uticaja među vršnjacima, izazov za lične barijere…) i fizička edukacija (šansa da se proba nova aktivnost, šansa da se istakne u sportu koji ne uključuje timski rad, šansa da se bude aktivan bez obzira na telesnu građu, težinu ili fizičke sposobnosti, razvoj motričkih sposobnosti…). Mnogi đaci koji se ne ističu u timskim sportovima napreduju u skijanju; uče o sopstvenim sposobnostima i sposobnostima njihovih vršnjaka i često su iznenađeni svojim reagovanjem u različitim okruženjima.

U trogodišnjem istraživanju sprovedenom u Rusiji Lisovski (*Lisovskiy,* 2007) na eksperimentalnoj i kontrolnoj grupi od po 30 dece uzrasta od 4-6 godina (pri čemu je istraživanje obuhvatalo

testiranje fizičkih sposobnosti deteta, medicinske parametre zdravlja, upitnik za roditelje, psihološke metode, pedagošku opservaciju, pedagoški eksperiment i statističku obradu) potvrđeno je da raspoloženje dece tokom skijanja raste u odnosu na inicijalni nivo (pre početka skijanja). Analiza odgovora roditelja takođe pokazuje da je skijanje presudan pozitivni faktor za unapređenje međusobnog razumevanja između roditelja i dece i unapređenja psihičke klime u njihovoj porodici. Autori ovog istraživanja zaključuju da je: organizovano alpsko skijanje dece predškolskog uzrasta aktivan način za promociju njihovog zdravlja, unapređenje njihovog fizičkog razvoja i jačanje porodičnih odnosa.

METOD

Ovaj rad je empirijskog karaktera i bazira se na teorijskim saznanjima iz oblasti psihofizičkog razvoja dece i usvajanja osnovne tehnike skijanja kod dece, i logički je doveden u sklad sa empirijskim zapažanjima autora nakon višegodišnjeg rada sa decom polaznika škole skijanja.

REZULTATI SA DISKUSIJOM

Skijanje je specifičan sport po tome što su retki skijaši koji imaju prilike da skijaju tokom cele godine (pogotovo u detinjstvu). Upravo zbog toga, može se dogoditi da u razdoblju kada dete ne skija, usled ubrzanog rasta i razvoja, dođe do promena u morfološkom i funkcionalnom smislu. Ukoliko bi se to dogodilo u razdoblju kada dete skija, tada bi se i dete i treneri postepeno navikavali na promenu u longitudinalnim, transverzalnim dimenzijama i masi tela. Međutim, kada se to dogodi u periodu treninga van skijaških staza, tada ove promene mogu imati negativne posledice jer se javlja poremećaj motoričkog programa. Dete u narednoj skijaškoj sezoni upotrebljava motorički program skijanja iz prethodne sezone, kada je poslednji put skijalo i kada mu je masa tela bila manja. Taj motorički program tada treba modifikovati i nadopuniti novim informacijama koje će omogućiti jednako efikasno skijanje kao i u prošloj sezoni. Zbog toga treninzima treba pokušati unaprediti one motoričke programe koji bi mogli biti najviše „narušeni" porastom mase ili visine tela do čega tokom rasta i razvoja deteta neminovno dolazi. S obzirom na ovaj problem skijanje je vrlo specifično, jer su vrlo retki sportovi u kojima postoji tako velika pauza u specifičnom treningu kao što je slučaj u skijanju (Bompa, 2000).

Navedene činjenice treba imati u vidu prilikom obuke i usavršavanja tehnike skijanja, pogotovo kada su deca u pitanju. Deca imaju drugačije kapacitete i drugačije se adaptiraju na vežbanje, odnosno drugačije reaguju na trenažne podražaje i kineziološke operatore. Kod dece istog uzrasta mogu postojati velike razlike u morfološkim obeležjima, kao i motoričkim i funkcionalnim sposobnostima zbog različite brzine biološkog razvoja ali i različitih polnih obeležja što različito dolazi do izražaja u različitim razvojnim fazama (Petošić, 2009).

Prema teorijskom modelu motornog razvoja (Gallahue i Ozmun 1996) fundamentalne kretne veštine predškolskog uzrasta dele se na 3 stupnja: inicijalni (2-3 godine), elementarni (4-5 godina) i zreli stupanj (6-7 godina). Zreli stupanj karakterišu mehanički efikasna, koordinisana i kontrolisana kretanja. Dete može biti u zreloj fazi kada je reč o pojedinim kretnim zadacima, u drugim u elementarnoj fazi a u nekim u inicijalnoj fazi. Deca imaju razvojni potencijal da za većinu fundamentalnih kretanja dostignu zreli stupanj sa 6-7 godina.

Poznavanje integriteta razvoja deteta, strukture motoričkog prostora deteta, principa psihomotornog učenja, tehnike i metodike skijanja, pedagoško-didaktičke posebnosti učenja skijanja dece, su područja sa kojima se mora detaljno upoznati pre bilo kakvog rada sa decom. Učitelji skijanja i treneri moraju biti kvalitetni i dobro poznavati značaj uzrasnih kategorija sa kojima rade da bi mogli postići željene ciljeve, kako bi se ispoštovale zakonitosti dečjeg svestranog biološkog, psihološkog i socijalnog razvoja, a da pritom ne utiču negativno na zdravlje, rast i razvoj dece.

Organizovana obuka skijanja dece može početi već u uzrastu od treće godine. Početak obuke određen je time da dete mora da bude sposobno da kontroliše sopstvene pokrete. Uslov za takvu aktivnost je čvrsta fiziološka veza između opažaja (pomoću kojih dete zapaža kretanje drugih osoba) i motoričkih osećaja sa osećajima ravnoteže sopstvenog tela. Ova veza se postepeno usklađuje i učvršćuje već krajem druge, početkom treće godine i to je period kada se može početi sa obukom skijanja. Roditelji mogu svoju decu da uče kretanju na skijama 2-3 meseca nakon što dobro ovladaju

tehnikom hodanja. Najbolje je decu uključiti u skijanje onda kada su za tu aktivnost spremna, kada su motivisana da probaju nešto novo i da u tome uživaju, a prema pojedinim autorima neće se mnogo propustiti ako se sa obukom počne nekoliko godina kasnije (Bačanac, 2008).

Kretanje dvogodišnjeg deteta se razlikuje od kretanja sedmogodišnjeg i u razvoju motoričkih sposobnosti je neophodna postupnost u izboru motoričkih informacija i zahtevnosti izabranih sadržaja. Iz tog razloga, pri obuci tehnike skijanja kod dece treba uključivati bazična motorička kretanja, filogenetski uslovljena - hodanje, trčanje, puzanje, valjanje, koja su detetu razvojno najbliža i zatim ih postepeno modifikovati u složenije i zahtevnije kretne zadatke, tipa koordinacije i ravnoteže. Već sama skijaška oprema, za dete predstavlja novu situaciju. Prilagođavanje na opremu pre uključivanja deteta u školu skijanja i aktivnosti na snegu kao što su sankanje, grudvanje, klizanje, elementarne igre na snegu, omogućuju detetu manje opterećenje pre prvog „pravog" odlaska na sneg i olakšavaju susret s „pravim" učiteljem skijanja i njegovom obukom ove sportske discipline (Goršnik, 2002).

Navedene činjenice govore da učenje skijanja najmlađih predstavlja složen proces. Poznavanje osnovnih prirodnih tendencija razvoja deteta, osnovnih zakonitosti učenja skijanja, kao i adekvatno izabrani zadaci i vežbe, sprečavaju nepravilno usvajanje kretnih stereotipa pri obuci skijanja kod dece. Uvek treba poštovati osnovno pravilo usvajanja motoričkih zadataka, od jednostavnih prelazi se na sve složenije i specifičnije, u ovom slučaju kretne zadatke koje zahteva obuka tehnike alpskog skijanja.

Efikasnom motornom učenju dece predškolskog uzrasta, u velikoj meri doprinose metode koje se koriste tokom učenja. Njihovo pravilno korišćenje omogućuje da deca uz manji napor, lakše i uspešnije uče. Postavlja se pitanje, koje su optimalne metode za usvajanje osnovne tehnike skijanja kod dece.

Igra je bila i ostala sastavni deo dečije aktivnosti i predstavlja najpogodniji metod, za usvajanje skijaške tehnike, ali i važno sredstvo socijalizacije u razvitku mnogih osobina ličnosti. Igra predstavlja ljudsku delatnost motivisanu zadovoljstvom učestvovanja i samopotvrđivanja u njoj. Značaj igre proučavan je sa psihološkog, pedagoškog, sociološkog, istorijskog i antropološkog stanovišta i zajedničko za sva istraživanja je da se u igri vidi jedan od osnovnih oblika ponašanja koji služi individualnom razvoju (Lazarević, 1987).

Osnovna svojstva igre koja se sreću u obuci skijanja su:

- da je igra aktivnost na koju deca pozitivno reaguju (biološki aspekt),

- da je igra izvor i sredstvo pozitivnog emocionalnog i opšteg raspoloženja (psihološki zadovoljava izvesne dečje potrebe i utiče na psihički razvoj deteta),

- da se kroz igru vrši razmena (interakcija) emocija i raspoloženja (socijalni aspekt).

Kroz aktivnosti u igri u školi skijanja, kod dece predškolskog uzrasta, međusobno se prepliću, razvoj sposobnosti pojedinih funkcija i socijalnih odnosa utičući jedni na druge. Socijalni kontakti podstiču dete da usavršava svoje sposobnosti, a usavršene sposobnosti omogućuju bolje učešće u socijalnim odnosima.

Funkcionalnu radost, koja preovlađuje u početku dečije aktivnosti u školi skijanja, u igri, postepeno zamenjuje težnja deteta za povećanjem sopstvenih sposobnosti. Time se menja i motivacija, koja utiče na sadržaj i usmerenost dečije aktivnosti, pri obuci i usavršavanju osnovne tehnike skijanja. Kroz igru i skijanje dete oslobađa i razvija svoja osećanja, doživljava vrednost sadržaja aktivnosti na snegu i članova grupe u kojoj skija. Baš ti motivi, koji su nadahnuti osećanjima, imaju posebnu snagu i zato dobijaju posebnu ulogu u motivaciji dece i postaju podstrekači i usmeravači dečjih aktivnosti u procesu obuke skijanja.

Struktuiranost igre učesnicima pruža mogućnost da ponavljaju situacije koje im pružaju zadovoljstvo, na taj način usavršavaju elemente tehnike skijanja. Zbog toga osnovni pristup detetu mora biti kroz igru i to u najširem smislu te reči. Treba omogućiti detetu okvirna pravila igre, sredstva i slobodu stvaranja. Takvim je pristupom, dete kroz igru i takmičenje sa samim sobom, motivisano i spremno za susret sa različitim skijaškim zadacima.

Važnu ulogu i značajan uticaj na uspešnost usvajanja tehnike skijanja kod dece, pored igre, može da ima i grupa vršnjaka, sa kojima pojedinac ostvaruje socijalne kontakte u školi skijanja. Grupni vid nastave u školi skijanja, predstavlja pogodno mesto za razvijanje takmičarskog duha, da se nastava organizuje kroz igru, da deca uče gledajući jedna od drugih, i gde dete može da zadovolji svoje potrebe za socijalnim kontaktima, razvija svoje funkcije i različite osobine ličnosti. Grupa

vršnjaka na taj način može da pruži svojevrstan doprinos uspešnom usvajanju tehnike skijanja kod dece i omogući povoljnije uslove da se program obuke organizuje na način, koji je deci interesantan, zabavan i predstavlja im zadovoljstvo (Mladenović i Ropret, 2009).

Jedna od specifičnosti prilikom obuke tehnike skijanja kod dece predstavlja izbor kretnih zadataka. Izbor zadataka za usvajanje osnovne tehnike alpskog skijanja kod dece predstavlja značajan organizacijski i motivacijski problem, koji zahteva prilagođavanje metodskog postupka obuke, specifičnostima, potrebama i sposobnostima u skladu sa uzrastom deteta. Vreme koje stoji na raspolaganju za učenje određenog motornog zadatka, odnosno elementa tehnike skijanja može biti ispunjeno različitim zadacima. Sam postupak učenja elemenata tehnike skijanja kod dece zahteva da dete izvršava neku zadatu motoričku radnju na snegu čiju strukturu i sklop predstavljaju skijaški elementi. Pri izboru kretnih zadataka za usvajanje jednostavnijih ili složenijih elemenata tehnike alpskog skijanja kod dece potrebno je pre svega voditi računa o vrsti zadataka, težini izvođenja, broju zadataka i dužini njihovog trajanja, ali i o izboru adekvatnog terena, uslovima u kojima se obuka izvodi i korišćenju odgovarajuće terminologije.

Pri izboru vrste zadataka, mora se voditi računa da zadaci sadrže osnovne elemente tehnike skijanja: tipičnu poziciju - stav, kontrolu kretanja skija, mehanizam promene pravca kretanja i međusobnu koordinaciju pokreta.

Težina izvođenja zadataka, bilo da se radi o sintetičkom pristupu, gde se učenje tehnike skijanja sastoji u tome da se objašnjenja, demonstracija i izvođenje zadataka vrše u celosti ili analitičkom pristupu kada se složeni elementi tehnike raščlanjuju na jednostavnije delove, mora biti prilagođena mogućnostima dece, pre svega da zadatak mogu da shvate, a potom i da mogu da ga izvedu. Uspešno izvršen zadatak pored pohvala i nagrada je jedan od faktora koji jačaju dečje samopouzdanje i učvršćuju motive za dalje učešće u obuci skijanja.

Broj zadataka ili elemenata tehnike, predviđenih planom i programom obuke u okviru jednog časa kod dece, ne treba da bude veliki. Ukoliko bi se koristio veliki broj elemenata tehnike skijanja za usvajanje i veliki broj zadataka u okviru jednog časa, to bi dovelo do prevelikog opterećenja, što bi se negativno odrazilo na uspešnost usvajanja i motivaciju dece.

Dužina trajanja časa ne treba da bude preduga zbog nemogućnoti dugotrajnog održavanja pažnje i koncentracije dece. Opadanje pažnje i koncentracije kod dece su prvi pokazatelji umora i to je znak kada treba privoditi čas skijanja kraju kako se ne bi negativno odrazilo na njihovu motivaciju. Iz tog razloga je bolje početne časove za decu u toku dana, organizovati u dva termina u kraćem vremenskom trajanju. Optimalna dužina trajanja časa, kako iskustva u radu sa decom govore, je oko šezdeset minuta kada je u pitanju početna faza obuke na poligonu i 120 minuta na skijaškim stazama kada se koriste žičare.

Stoga pri izboru kretnih zadataka za obuku skijanja kod dece, trebalo bi voditi računa da su zadaci dovoljno interesantni i zabavni, da deluju motivišuće prilikom izvođenja, i ukoliko je moguće da budu organizovani na zanimljiv način kroz vid igre i formu takmičenja.

Izbor adekvatnog terena na kome se izvodi obuka skijanja dece predstavlja važan preduslov za pravilno i uspešno usvajanje elemenata tehnike skijanja i njihovih delova. Teren treba da bude adekvatan za pravilno izvođenje odabranih elemenata tehnike predviđenih planom i programom obuke (Ilić, 1988). Pre svega treba voditi računa o izboru terena sa odgovarajućim nagibom, o bezbednosti polaznika i uslovima u kojima se obuka izvodi (meteo uslovi, brzina podloge, drugi skijaši, motorna vozila na stazi) kako bi se polaznici zaštitili od negativnih uticaja spoljašnje sredine. Potrebno je izabrati adekvatan teren, koji zahteva postupnost pri izboru nagiba, počev od ravne podloge i terena bez nagiba, pogodnog za usvajanje početnih elemenata tehnike (navikavanje na opremu, hodanje, okretanje), zatim terena sa blagim nagibom i ravnim istekom padine, gde nakon spusta pravo može da se zaustavi bez dodatnih radnji i pokreta na skijama, pogodnog za usvajanje osnovnih elemenata tehnike (spust pravo, zaustavljanje, penjanje, zaokreti) do terena sa nagibom srednjeg stepena težine, pogodnog za usvajanje naprednijih elemenata tehnike (paralelni zaokret, paralelno vijuganje i dr.) u zavisnosti od uslova, elemenata tehnike koji se usvajaju, dostignutog nivoa usvojenog skijaškog znanja i cilja koji se želi postići,.

Pored izbora odgovarajućih kretnih zadataka i adekvatnog terena, specifičnost obuke skijanja kod dece je i u postavljanju markacija na terenu, koje su neophodne zbog nemogućnosti procene

prostora dece prilikom izvođenja zadataka i elemenata tehnike koji se usvajaju. Markacije su vizuelni orjentiri postavljeni na terenu gde se vrši obuka, koje polaznicima služe za izvršavanje određenih zadataka (zaustavljanje, zaokret, pregibanje, opružanje i dr). U kolikoj meri će orjentiri pomoći u izvršavanju zadatka u velikoj meri zavisi od načina postavljanja, njihove vidljivosti ali i uzrasta, psihofizičke zrelosti polaznika, postavljenih ciljeva i zadataka.

Jedna od karakteristika obuke skijanja kod dece odnosi se na specifičnosti u verbalnoj komunikaciji sa decom. Verbalna objašnjenja pri obuci skijanja kod dece treba da budu kratka, jasna i precizna, zbog nemogućnosti dugotrajnog održavanja pažnje i koncentracije. Prilikom verbalnih objašnjenja treba koristiti samo razumljive termine, dok nove termine treba najpre objasniti, uveriti se da ih svi razumeju i nakon toga početi sa njihovim korišćenjem. Umesto pojmova „levo" i „desno" za decu bi pogodnije bilo koristiti vizuelne orjentire, koji su dovoljno veliki i jasno uočljivi (npr. šuma-hotel, jelka, žičara i sl.).

ZAKLJUČAK

Specifičnosti obuke skijanja kod dece ogledaju se u sledećem:

- Postoji velika razlika u specifičnom treningu između dve skijaške sezone gde zbog porasta mase i visine tela dolazi do narušavanja motoričkog programa iz prethodne sezone. U narednoj skijaškoj sezoni teninzima treba pokušati unaprediti one motoričke programe koji su najviše narušeni porastom mase i visine tela.

- Kod dece istog uzrasta postoje velike razlike u morfološkim obeležjima, motoričkim i funkcionalnim sposobnostima zbog različite brzine biološkog razvoja, koje dolaze do izražaja u različitim razvojnim fazama. Za rad sa decom neophodno je dobro poznavati zakonitosti dečjeg svestranog biološkog, psihološkog i socijalnog razvoja, posedovati sposobnost za prepoznavanje svakog stepena dečjeg sazrevanja i visok stepen ličnog prilagođavanja realnim mogućnostima deteta.

- Sa obukom se može početi veoma rano, već krajem druge i početkom treće godine života. Zbog toga pri obuci skijanja kod dece treba uključiti bazična motorička kretanja, filogenetski uslovljena koja su detetu razvojno najbliža i postepeno ih modifikovati u složenije i zahtevnije kretne zadatke tipa koordinacije i ravnoteže.

- Igra predstavlja najpovoljniji metod za usvajanje skijaške tehnike kod dece. Igru u školi skijanja postepeno zamenjuje težnja za povećanjem sopstvenih sposobnosti čime se menja i motivacija koja utiče na sadržaj i usmerenost dečje aktivnosti i podstiče ih u procesu obuke skijanja

- Sprovođenje programa obuke kod dece je pogodnije kroz grupni vid nastave. Obuka skijanja u grupi istog uzrasta je pogodnija za razvijanje takmičarskog duha, za organizovanje nastave kroz igru i da deca uče gledajući jedna od drugih. Grupa u školi skijanja je mesto gde dete može da zadovolji svoje potrebe za socijalnim kontaktima, razvija svoje funkcije i različite osobine ličnosti.

- Jednu od specifičnosti predstavlja i izbor kretnih zadataka koji zahteva prilagođavanje specifičnostima, potrebama i sposobnostima u skladu sa uzrastom deteta. Pri izboru kretnih zadataka potrebno je voditi računa o vrsti zadataka, težini izvođenja zadatka, njihovom broju i dužini trajanja.

- Na uspešnost usvajanja može da utiče i izbor terena za obuku. Adekvatno izabran teren podrazumeva postupnost pri izboru terena kada je nagib u pitanju, počev od terena sa ravnom podlogom bez nagiba, zatim teren sa blagim nagibom i ravnim istekom padine, kao i teren sa nagibom srednjeg stepena težine u zavisnosti od elemenata koji se uče, dostignutog nivoa usvojenog skijaškog znanja i cilja koji se želi postići, teren koji je bezbedan i zaštićen od negativnih uticaja spoljašnje sredine.

- Zbog nemogućnosti dece da procene prostor neophodno je da prilikom izvođenja zadatka na terenu gde se vrši obuka, budu postavljene markacije koje bi služile kao vizuelni orjentiri za izvršavanje određenih zadataka.

- Pri radu sa decom neophodno je koristiti samo poznate i deci razumljive termine i voditi računa da objašnjenja budu kratka, jasna i precizna zbog nemogućnosti dece da dugo održe pažnju i koncentraciju.

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SPECIFICITY IN CHILDREN SKI TRAINING

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INTRODUCTION

Sport is considered extremely useful both for physical and mental development with children. From an early age children start participating and competing in sports. Sports help children in improving coordination, increase awareness on their body, maintain social contacts, adopt and abide by behavioural rules, enhance concentration and build confidence. Through sports, children enjoy physical activity, develop physical abilities, compete, take part, make decisions, value safety, respect others, accept appropriate roles and learn how to lead an active life (Andrews, 1999). Skiing is a sport in which an important role is played by skill, or in other words - motor abilities. Skiing as a skill represents an unnatural way of movement, that is a motor skill not biologically given- inherited and has to be learned (Ilic, 1988). Ski 'knowledge' consists of certain elements of ski technique, based on which assessed is the level of ski know-how. Defining basic level of acquiring ski technique requires performing some of the given motoric actions on skis, whose structure and form are presented in ski elements (Dopsaj, 2004). Training and adopting basic elements in alpine skiing with children is a highly complex and organized process, and through both theory and practise it is based on the confirmed principles (gradual, systematic, obvious...), methods (demonstrations, oral presentations, playing...) and approaches (synthetic, analytical, situational). Basic features with exercising in pre-school period of growth and development with children emerge from the need to create sensitive basis in the function of building motivation for body activities and sports activities (Balsevic and Zaporozanov, 1987).

Ski school can represent an important factor and significant contributor which takes part in creating and developing multi-potent (versatile) personality. Ski school could be an organized, planned and systematic process of mastering sports (education), directed towards adopting rational and expedient technique of moving on the snow - skiing. In the course of training, through process of acquiring ski technique children become familiar with requests and norms existing in society and hence, ski school provides some kind of its own contribution to favorable conditions for personality development. Well organized and systematic training, with adequate pedagogical approach with training skiing for pre-school children also implies an important educational and upbringing means (Lazarevic, 1987): means to teach children (by forming certain moral features and will properties, attitudes, values, direction, self-control etc.) and educate them (through acquiring and developing abilities to learn certain skills and facts)

Educational benefits from skiing, according to Fraser (Fraser, 2004) can be divided into 4 categories: social education, physical, academic and experimental. Social education (learning more about yourself and your peers, reaching less or more than expected, reactions to new situations, encouraging mutual influence among peers challenge for personal boundaries...) and physical education (opportunity to try out a new activity, chance to excel in sports which does not include team work, opportunity to be active regardless of body shape, weight or physical abilities, development of motor abilities...) Many students who do not excel at team sports improve in skiing; learn about their own abilities and capacities of their peers and are often surprised by their reactions in different environments.

In a three year study conducted in Russia, Lisovskiy (Lisovskiy, 2007) on his control and experimental group consisting of 30 children aged 4 to 6 (where the research included testing

physical abilities, medical health parameters, questionnaire for parents, psychological methods, pedagogical observation, experiment and statistical processing) it was confirmed that the spirit raised with children during skiing, compared to initial level (prior to skiing). The analysis of responses by parents also points out that skiing is a key positive factor in improving mutual understanding among parents and children and enhancing mental 'atmosphere' in their families. The authors of this study conclude that organized alpine skiing with pre-school children is an active way to promote their health, improving their physical development and strengthening family relations.

METHOD

The paper is of empirical nature and is based on theoretical findings in the field of physical and mental development of children and the adoption of basic skiing technique with children, and logically, it has been put in a context with the empirical observations of the author after a couple of years working with the children attending the ski school.

RESULTS WITH DISCUSSION

Skiing is a specific sport as few skiers are able to ski all year round (especially in childhood). Due to that fact really it could happen that during the time when a child does not ski, conditioned by fast growth and development changes occur both in morphological and functional sense. If those changes happened in the period of child skiing, then both child and ski instructors could gradually adjust to changes in longitudinal, transversal dimensions and body mass. However, when that happens in the period of training outside of ski tracks those changes could have negative consequences due to occurrence of motor program disorder.

In the next ski season, children use the skiing motor program from the previous season they skied and their body mass was lower. That motor program then requires to be modified and updated with new information which will enable skiing as efficient as it was in last season. Because of all that, during trainings we should try to improve those motor programs which could be mostly 'jeopardised' by mass increase or body height, which are unavoidable in the course of growth and development. Considering this the very issue of skiing is pretty specific, as rare are the sports in which such a long breaks are taken in specific trainings as in skiing (Bompa, 2000).

All the stated facts need to be taken into consideration when training and mastering ski techniques, especially in regard to children.

Children have different abilities and adapt to exercising in different manner, that is they respond differently to training stimuli and kinesiological operators. With children of the same age there could be large differences in morphological features and also motor and functional capacities due to different speed of biological development but also various gender characteristics, which is all differently expressed at different development stages (Petosic, 2009).

According to theoretical model of motori development (Gallahue and Ozmun, 1996) fundamental movement skills with pre-school age are divided into three stages: initial (2-3 years), elementary (4-5 years), and mature stage (6-7 years). Mature stage is characterized by mechanically efficient, coordinated and controlled movements. Children can be in mature stage in regard to certain movements tasks, elementary regarding others and with some in initial stage. Children have development potential for most fundamental movements to reach the mature stage aged 6-7.

Being familiar with integrity of children's development, structure of motor space with children, principles of mental and motor learning, skiing technique and methods, pedagogical and didactic specific features of skiing with children - those are all areas with which one should be thoroughly acquainted prior to any kind of work with children. Ski instructors and coaches need to be of good quality and full of knowledge about the importance of age categories with which they walk in order to achieve the goals wished for, in order to respect legitimacy of children's versatile biological, mental and social development and with all that leave no negative impact on health, development and growth of all children.

Organized ski trainings with children can start as early as at the age of three. The start of training is conditioned by the fact that a child has to be able to control his/her movements. The condition for such an activity is a physiological connection between perception (by which a child notices movements of other people) and motor senses with sense of balance of their own body. This connection is made stronger in the end of second or beginning of third year and that is the period in which ski training can start. Parents can teach their children to walk on skis 2-3 months after children master walking techniques. It is best to include children in skiing when they are ready for that activity, motivated to try out something new, enjoy that and according to some authors, not much would be missed if that training starts a few years later (Bacanac, 2008).

Movements of two-year olds are different from the ones with seven-year olds and in development of motor capacities required is gradualness in selecting motor information and level of challenging in chosen contents. For that reason with ski training for children included should be basic motoric movements, philogenetically conditioned - walking, running, crawling, rolling which are closest to children in regard to development and then gradually modify those into more demanding movement tasks, involving coordination and balance. The very wearing ski clothes represent a new situation for children. Adapting to that equipment prior to enrolling children to ski school and activities on snow, such as sledging, snowballing, skating, basic games on snow enable children to be less pressured before their first 'real' outing on snow and facilitate their meeting with 'real' ski instructor and their training of that sport (Gorsnik, 2002).

The facts stated so far point to us that learning skiing with our youngsters represents a complicated process. Being acquainted with basic natural trends in development of children, basic rules in learning to ski and adequately chosen tasks and exercises prevent the incorrect adoption of movement stereotypes with children. One basic principle with adopting motor tasks should always be abided by go from simple to more complex and more specific tasks, in this case, movement tasks required by training in alpine skiing.

Methods used in the course of training highly contribute to efficient motor learning with pre-school children. Using those methods correctly enables children to learn more efficiently, more easily and with less effort. The question arises what the optimum methods for adopting basic ski technique with children are.

Playing has always been, remains a vital part of children's activities and represents the most adequate methods for adopting ski technique and is also an important tool in socializing while developing many personality traits. Playing represents a human activity motivated by pleasure in taking part and self-affirmation. The importance of playing has been studied from psychological, historical and antropological point of view/ perspective and the common thing for all is that playing is considered to be one of basic manners of behaviour serving11 to individual development (Lazarevic, 1987).

Basic features of playing observed in ski training are:

- Playing is an activity to which children positively respond (biological aspect)

- Playing is a source and means of emotional and general mood (psychologically satisfies certain needs of children and affects children's mental development)

- Through playing exchange is conducted (interaction) of emotions and moods (social aspect)

- Through activities in playing at ski school with children of pre-school age mutually intertwined are development of certain functions and social relations affecting each other. Social contacts inspire children to master their abilities, and mastered/ acquired abilities enable for better participation in social relations.

Functional joy, which is dominant at the beginning of children's activities at ski school in playing is gradually replaced by children aspiring to increase their abilities. Hence, changed is motivation also, which affects the content and direction of children's activities while training and mastering basic ski techniques. Through playing and skiing children set free and develop their emotions, experience the value of content of all activities on snow and members of their ski groups. Those very motifs, inspired by feelings have special power, thus gain a special role in motivating children and become drivers of children's activities in the course of ski training.

The good structure of game provides participants ability to repeat the situations which give pleasure, and in that way master the elements of ski technique. Due to all that, approach to children need to be through playing in the widest sense of word. Children should be given opportunity to

learn the general rules of the game, means and freedom of creativity. With such an approach, through playing and competing with themselves really children are motivated and prepared to face various ski challenges.

An important role and significant impact on successful mastering of ski technique with children, in addition to playing can also be played by peer group with whom an individual maintains social contacts at ski school. Group type of training at ski school represents a good place to build competitiveness, organize training through playing, for children to learn by watching at each other and where children can satisfy their need for social contacts, develop their functions and different personality traits. Peer group in that way can provide a special contribution to successful adoption of ski technique with children and enable more favorable conditions for the ski training to be organized in a way interesting for children, fun and represents pleasure from them (Mladenovic and Ropret, 2009).

One of specific features with ski training of pre-school children is presented in selection of movement tasks. Selecting those tasks to be adopted for basic alpine ski technique with children represents an important organizational and motivational issue, which requires adapting to methodical approach of training, specific traits, needs and abilities in accord with children's age. Time available for learning certain motor tasks, in other words elements of ski technique with children can be filled with various tasks. The very process of learning the elements of ski technique with children requires from children to perform certain motor activity on snow, whose structure and unity are presented in ski elements. When selecting movement tasks for adopting simpler or more complex elements of alpine ski technique with children above all it is necessary to take care of types of tasks, difficulty of performing, number of tasks and length of those, but also of choosing adequate environment, conditions under which training course is taken and using adequate terms.

When selecting types of tasks, it must be taken into consideration for those to contain basic elements of ski technique: typical position - pose, control of ski movements, mechanism of changing direction, movements and coordination of movements- mutual.

The difficulty of performing tasks, whether applied is synthetic approach, where ski technique learning consists of the idea to conduct explanations, demonstration and performing tasks as a whole or analytical approach, in which complex elements of technique are separated into simpler parts – needs to be adapted to children's abilities, above all they have to be able to comprehend the tasks, and then to perform it. Successfully conducted tasks in addition to rewards and praises is one of the factors which increase children's self-confidence and strengthen motifs for children's further participation at ski school.

Number of tasks or technique elements, projected in ski course plan and training PLAN within one lesson with children should not be too high. If used is a large number of elements of ski technique for adoption and large number of tasks in just one class that would be a real burden to children and have negative impacts on success in adopting and children's motivation.

The class should not last too long due to lack of ability in children to concentrate long and focus their attention for long. Fall in attention and concentration in children are the first signs of tiredness and the signal to bring ski class to an end, in order to avoid negative effects on their motivation. For that reason it is better to organize initial classes for children two times in a day, lasting shorter. Optimum length of class duration is about 60 minutes, speaking of initial stage of training at the ground and around 120 minutes on ski tracks, using ski lifts.

Hence, when selecting movement tasks for ski training with children it should be taken into account that the tasks are interesting enough and fun, motivating while being performed and if possible to be organized in an interesting way, through some kind of playing and competition forms.

Selecting adequate ski grounds at which ski training for children is conducted represents an important precondition for correct1 and regular adoption of ski technique elements and their parts. The grounds need to be adequate for proper performing of ski technique elements as projected in training plan. (Ilic, 1988). Above all, it should be made sure the grounds have the adequate slopes, safety of course goers and conditions under which training is done (meteoeological conditions, speed of surface, other skiers, vehicles on ski tracks) in order to protect course goers from negative impacts of outside world. It is necessary to choose adequate grounds, which require graduality in choosing slopes, starting from flat surface, with no slopes, appropriate for adopting basic technique elements (getting accustomed to equipment, walking, turning) then grounds with mild slopes, and flat slope expiration, where after going down the slope a skier can just stop without additional activities and

movements on skis, adequate to adopting basic technique elements (straight dive, stopping, ascent, turning) to grounds of medium difficulty adequate for adopting more advanced technique elements (parallel turns, convolutions) depending on conditions, technique elements being adopted and reached level of ski skills and the goal aspired for.

In addition to selecting adequate movement tasks and adequate ground, specific feature of ski training with children is also in providing marks on the ground which is necessary due to children's lack to assess space while performing tasks and technique elements which are being adopted. Those markers are visual landmarks set up on the grounds where training is conducted and assist course goers in performing certain tasks (stopping, turning, flexion, stretching and other). How much those landmarks can help largely depends on the way they are arranged, their visibility but also on age, mental and physical maturity of course goers and goals and tasks stated.

One of the features of ski training with children refers to specific features in verbal communication with children. Verbal explanations within ski training with children should be brief, clear and precise due to inability to maintain focus and concentration for a long time. When using verbal explanations only understandable terms ought to be used and new ones should be explained first, make sure everybody understands them and only after that start applying those. Instead of terms 'left' and 'right' it would be more favorable for children to use visual landmarks, sufficiently big and clearly visible (for example, forest- hotel, pine tree, ski lift and other).

CONCLUSION

Specific features of ski training with children are reflected as follows:

- There is a great difference in specific training between two ski seasons where due to increase in body mass and height motoric program from the previous season is jeopardised. In the following ski season we should attempt to improve those motor programs mostly endangered by increase in body mass and height.

- With children of same age there are large differences in morphological features, motor and functional abilities due to different speed of biological development, specially visible in different stages of development. For working with children it is necessary to be acquainted with laws of children's versatile biological, mental and social development, have the ability to recognize each stage in their maturity proves and high level of personal adaptation to real children's capacities.

- With training it can be started quite early on, at the end of second and beginning of third year of their lives. Due to that, ski training with children should includ basic motoric movements, phylogenetically conditioned but in regard to development closest to children and gradually modify those into more complex and more demanding tasks, such as balance and coordination.

- Playing represents the most favorable method for adopting ski technique with children. At ski school playing is slowly replaced by striving to increase one's own abilities and thus motivation is also changed, which affects the content and direction of children's activities and stimulates them in ski training process.

- It is best to conduct ski training program with children using group approach. Ski training in single- aged group is most favorable for developing competitive spirit, for organizing training through playing and for children to learn while observing each other. Group at ski school is a place where children can satisfy their needs for social contacts, develop their functions and different personality traits.

- One of specific features is presented in selecting the movement tasks which requires adapting to specific traits, needs and abilities, in accord with children's age. When choosing the movement task it is necessary to take into account type of task, difficulty of performing, their number and duration length.

- Selection of grounds can also affect successfulness in adopting techniques. Adequately chosen grounds imply graduality in regard to slope, starting from grounds with flat surface, no sloped then grounds/ terrain with mild sloped and flat slopes down and also ones with medium level of difficulty depending on elements being taught, accomplished level of ski skills and goals wished for, grounds which would be safe and protected from negative impact of outside world - environment.

- Due to children not being able to assess the space it is necessary to set up landmarks - markers on the training grounds while performing tasks as those would be visual landmarks for performing certain tasks.

- When working with children, it is necessary to use only/ just terms familiar to children and well- known, make sure explanations are brief, clear and precise due to children's lack of ability to maintain focus and concentration long.

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AKTIVNOSTI U PRIRODI U FUNKCIJI ZAŠTITE ŽIVOTNE SREDINE NA PRIMERU MAPIRANJA DIVLJIH DEPONIJA NA IZLETNIČKOJ TURI

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UVOD

Fizičko vežbanje manifestovano kroz programske sadržaje sportskih aktivnosti u prirodi ima višestruku korist na zdravstveni status korisnika prirode uz povratnu spregu svih pozitivnih faktora spoljašnje sredine. Aktivnosti u prirodi nije preporučljivo sprovoditi u nezdravom okruženju, zbog negativnih uticaja na vežbače. Boravak u zdravom okruženju je elementarno pravo svakog čoveka. Danas je to pravo privilegija pojedinaca koji mogu sebi priuštiti "deo netaknute pirode", ako se ista može naći u takvom obliku. Izuzevši područja koji su kategorisana kao: nacionalni parkovi, parkovi prirode, zaštićena prirodna dobra i sl, da li nam se uskraćuje mogućnost sprovođenja fizičke aktivnosti u zdravim sredinama? Da li prihvatiti činjenicu i jednostavno zaobići ekološke probleme ili pomoći u realizaciji njihovog otklanjanja? Na žalost i ove tvrdnje moraju se uzeti sa rezervom. Nijedna od navedenih zaštićenih kategorija nije pošteđena od tragova "urbanog čoveka". Sve je više posetilaca prirode koji ukazuju na ekološke probleme i njihovu naglu ekspanziju. Da li tražiti uzroke nastanka ovom zagađenju ili jednostavno to prihvatiti kao trend, koji je možda prolaznog karaktera? Osnovna ideja ovoga rada je da se ukaže na nastale ekološke probleme i da se isti evidentiraju i prezentuju kako bi se mogla ustanoviti količina (stepen) zagađenja. Na osnovu ovog saznanja mogu se preduzeti dalje mere za uklanjanje svega što ne pripada prirodi. Rad je nastao iz potrebe da se pokaže značaj i upotrebna vrednost stečenih znanja iz oblasti Aktivnosti u prirodi i njihova logična veza sa ostalim društvenim delatnostima, konkretno sa zaštitom životne sredine.

Slika 1. (Ne)svakidašnji ambijent kao povod za pokretanje akcije mapiranja i rešavanja ekoloških problema. Fotografija jedne od mapiranih lokacija na teritoriji Miljakovca III sa preciznim geografskim koordinatama: 44° 43' 3" N 20° 28' 24" E, *na kojoj se može uočiti divlja deponija različitog otpada.*

Kako bi se studentima (učesnicima ovog istraživanja) približio predmet istraživanja, neophodno ih je bilo uputiti u osnovne definicije po pitanju otpadnog materijala. Po Zakonu o upravljanju otpadom, otpad jeste svaka materija ili predmet sadržan u listi kategorija otpada (Q), koji vlasnik odbacuje, namerava ili mora da odbaci, u skladu sa zakonom. Otpad se razvrstava prema Katalogu otpada koji je usklađen sa evropskim katalogom otpada, a u kome je sistematizovano više od 800 vrsta otpada, prema delatnostima iz kojih se generiše, tipu otpada, odnosno materijalima ili procesima. U radu je uzeta u obzir samo klasifikacija otpada, budući da je karakterizacija otpada veoma složen postupak ispitivanja fizičko-hemijskih, hemijskih i bioloških sastava otpada. Klasifikacija predstavlja relativno jednostavan postupak razvrstavanja otpada u skladu sa utvrđenom listom otpada. Po pravilu, sav generisan otpad bi trebalo odložiti na za to propisane deponije, a koje predstavljaju interna ili stalna mesta za odlaganje ili skladištenje otpada. Prema ovoj tvrdnji sve ostale deponije bile bi ilegalne, odnosno divlje, što znači da su protivzakonite. Na žalost, sve više postajemo svedoci stvaranja divljih deponija, odnosno odlaganja nesortiranog otpada u prirodni ambijent, a čime se vrši ne samo degradacija prostora i narušava vizuelni identitet pejzaža, već i stvara pogodno tle za razvoj invazivnih vrsti, potencijalnih prenosilaca zaraza. Ovo su uslovi koji od prirode kreiraju nezdravi ambijent, zahvaljujući čemu dobijamo sve manje prostora za boravak i kretanje u zdravom okruženju.

Cilj ovog istraživanja je bio da se izvrši pronalaženje i mapiranje divljih deponija na pešačkoj turi, kako bi nadležni po dobijanju izrađene mape i izveštaja mogli što jednostavnije pronaći i rešiti nastale eko-probleme.

METOD

U planiranoj izletničkoj turi, u kojoj je učestvovalo **22 učesnika** izleta, sprovedeno je **namensko orijentaciono kretanje** usmereno na **pronalaženje i evidentiranje divljih deponija** i pojedinačnog otpada. Korišćen je **metod opservacije terena** duž maršrute i **metod digitalnog mapiranja** upotrebom sistema za globalno pozicioniranje (GPS) uređaja - *Magellan Triton 500* i softvera *Navigon (Garmin)* instaliranom na telefonu iPhone. Nikako ne treba zanemariti **upotrebu topografske karte** kao metoda koji je paralelno pratio digitalno mapiranje, gde su u terenskim uslovima ucrtane lokacije divljih deponija.

Da bi studenti lakše prihvatili ovaj zadatak date su im instrukcije o načinu kretanja po terenu uz pomoć GPS uređaja. Osnovni princip rada GPSa je upotreba satelita kao referentnih tačaka za određivanje pozicije na zemljinoj površini metodom trilateracije (*Milojković,* 2009). GPS uređaj je od trenutka komercijalizacije postao dostupan svim njegovim korisnicima i sastavni je deo lične opreme za aktivnosti u prirodi, a koristi se i u obrazovnom procesu u okviru redovne nastave predmeta Aktivnosti u prirodi. Da bi istraživanje bilo kompletirano, dalji koraci posle terenskog rada bili su upotreba **Geografsko informacionih sistema** (GIS). GIS predstavlja sistem za upravljanje prostornim podacima i njima pridruženim osobinama. U užem smislu GIS je računarski sistem sposoban za integrisanje, skladištenje, uređivanje, analizu i prikaz geografskih informacija. U širem smislu GIS je oruđe „pametne karte" koje ostavlja mogućnost korisnicima da postavljaju interaktivne upite (istraživanja koja stvara korisnik), analiziraju prostorne informacije i uređuju podatke. Tehnologija GISa može se koristiti za naučna istraživanja upravljanja resursima, imovinsko upravljanje, planiranje razvoja, prostorno planiranje**,** kartografiju i planiranje infrastrukture. GIS se često koristi i za potrebe zaštite životne sredine, u geologiji, građevinarstvu, ali i u svim oblastima koje koriste podatke vezane za karte i geodeziju uopšte, kao i određenim sportskim sadržajima u prirodi (*Jovanović, Đurđev, Srdić, Stankov*, 2012). Kao takav, GIS je našao primenu i u sistemu fizičke kulture kako je već ranije u tekstu navedeno, a na ovom primeru istraživanja na još jedan način jasno je potvrdio svoj značaj. Da bi GIS funkcionisao takođe je značajno doprinela i globalna elektronska mreža - internet, koja zbog brzine ažuriranja podataka skraćuje vreme određenih radnji u ovom složenom procesu prikupljanja i ažuriranja podataka. Posebno za ovo istraživanje i publikovanje podataka veoma je bitna brzina delovanja, kako bi se u realnom vremenu moglo rešavati dosta zadataka iz oblasti zaštite životne sredine. *Cetl* smatra da se za Internet, kao novu platformu, mora naglasiti važnost spremanja i prenosa prostornih podataka, karata i planova. Razvojem web tehnologije promenjen je način isporuke i obrade prostornih podataka prema korisnicima GISa. Prikazivanje karata, distribucija prostornih podataka i GIS na Webu već duže vreme doživljavaju različite implementacije na Internetu. U GIS alatima aktuelna je primena različitih IMS (Internet Map Server) sistema koji mogu interaktivno vizuelizovati i izrađivati on-line prikaze i posluživati različite vrste prostornih podataka.

Bitnu ulogu u razvoju nacionalne Infrastrukture prostornih podataka (IPP) ima postavljanje prostornih podataka na Internet. Danas sve više postoji potreba za primenom GIS-a u Internet okruženju. Tehnologije IMS sistema omogućavaju da se dođe do povoljnih GIS klijentskih računara, a takođe je moguće i višestrano korićenje i pristup aktuelnim podacima. Posledica toga je da time po prvi put moguće učiniti GIS pristupačan velikom broju korisnika putem Interneta. Pored osnovnih informacija koje studenti dobiju na obrazovnom programu aktivnosti u prirodi vezanih za orijentaciono kretanje, za potrebe ovog istraživanja pored poznavanja tehnike orijentacije na terenu i mapiranja prezentovane su informacije o klasifikaciji otpada. U tabeli 1 je dato dvadeset grupa otpada, razvrstanih prema važećem nacionalnom Katalogu otpada ("Sl. glasnik RS", br. 29/2010). Ova lista služi kao vodič, odnosno informativnog je karaktera, kako bi se studentima približila problematika koju obrađuju. Iz tabele za istraživanje je preuzeto samo pet kategorija otpada.

Tabela 1. Mesto i poreklo nastanka otpada

Indeksni broj	**Mesto i poreklo nastanka otpada:**
01	Otpadi koji nastaju od istraživanja, iskopavanja iz rudnika ili kamenoloma, i fizičkog i hemijskog tretmana minerala
02	Otpadi iz poljoprivrede, hortikulture, akvakulture, šumarstva, lova i ribolova, pripreme i prerade hrane
03	Otpadi od prerade drveta i proizvodnje papira, kartona, pulpe, panela i nameštaja
04	Otpadi iz kožne, krznarske i tekstilne industrije
05	Otpadi od rafinisanja nafte, prečišćavanja prirodnog gasa i pirolitičkog tretmana uglja
06	Otpadi od neorganskih hemijskih procesa
07	Otpadi od organskih hemijskih procesa
08	Otpadi od proizvodnje, formulacije, snabdevanja i upotrebe premaza (boje, lakovi i staklene glazure), lepkovi, zaptivači i štamparska mastila
09	Otpadi iz fotografske industrije
10	Otpadi iz termičkih procesa
11	Otpadi od hemijskog tretmana površine i zaštite metala i drugih materijala; hidrometalurgija obojenih metala
12	Otpadi od oblikovanja i fizičke i mehaničke površinske obrade metala i plastike
13	Otpadna ulja i otpadi tečnih goriva (osim jestivih ulja i onih u grupama 05, 12 i 19)
14	Otpadi od organskih rastvarača, sredstava za hlađenje i potisnih gasova (osim 07 i 08)
15	Otpadi od ambalaže; apsorbenti, krpe za brisanje, materijali za filtriranje i zaštitne tkanine, ako nije drugačije specificirano
16	Otpadi koji nisu drugačije specificirani u katalogu
17	Građevinski otpad i otpad od rušenja (uključujući i iskopanu zemlju sa kontaminiranih lokacija)
18	Otpadi iz objekata u kojima se obavlja zdravstvena zaštita ljudi i životinja i/ili s tim povezanog istraživanja (isključujući otpad iz kuhinja i restorana koji ne dolazi od neposredne zdravstvene zaštite)
19	Otpadi iz postrojenja za obradu otpada, pogona za tretman otpadnih voda van lokacije nastajanja i pripremu vode za ljudsku potrošnju i korišćenje u industriji
20	Komunalni otpadi (kućni otpad i slični komercijalni i industrijski otpadi), uključujući odvojeno sakupljene frakcije

Takođe, za potrebe ovog istraživanja izrađen je anketni list - **Eko-izveštaj**, posebno konstruisana (prilagođena) anketa za potrebe konkretnog istraživanja, sa podacima o klasifikaciji, količini i koordinatama za lako pronalaženje i uklanjanje evidentiranih deponija na eksperimentalnoj ruti. Na drugoj strani izveštaja planirana je da se unese mapa lokacije na kojoj su evidentirane crne tačke. U Eko-izveštaj učesnici ture evidentirali su sve neophodne podatke od ekološkog značaja, a deo koji se odnosi na klasifikaciju otpada unesen je zahvaljujući podacima iz tabele 1. Eko-izveštaj je napravljen tako da bude jednostavan, precizan i informativan, kako bi bio od koristi službama čiji je zadatak pronalaženje i uklanjanje navedenih problema.

Tabela 2. Popunjeni Eko-izveštaj posete prirodi

EKO-IZVEŠTAJ POSETE PRIRODI

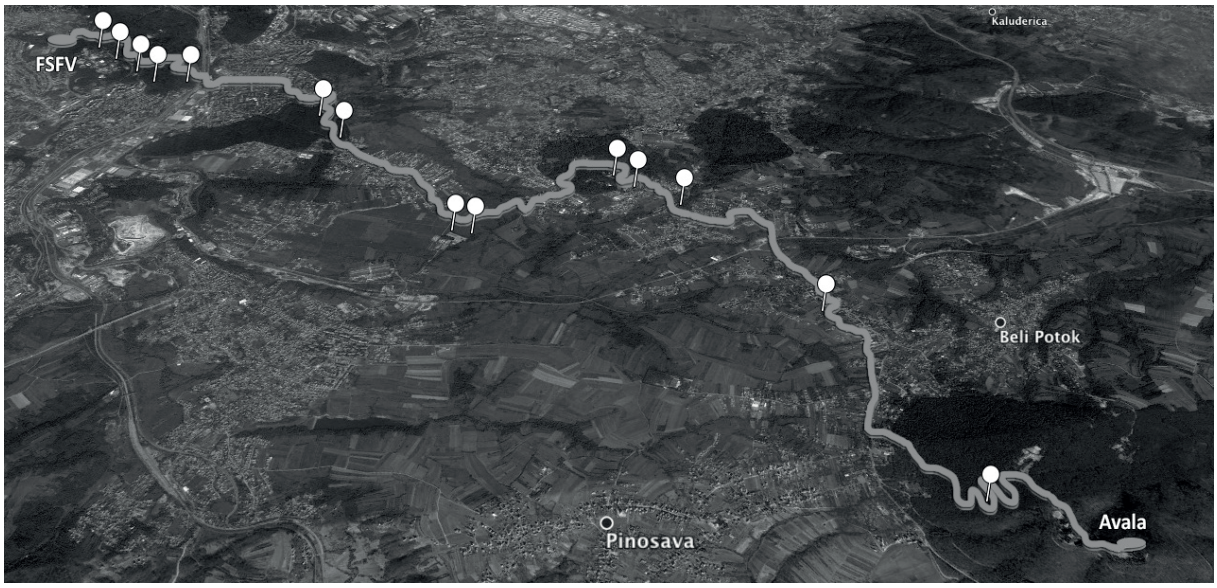
Lokacija otpada		**Klasifikacija otpada**	**Količina otpada**	**Individualno opažanje**
rb	Koordinate:	Plastika, šut, drvo, staklo, metal, hemijske supstance …	Zauzimanje zemljišta po m^2	Blizina objekata, industrijskih postrojenja, vodotokova …
1	44 45 25 N 20 26 19 E	Plastične flaše		
2	44 45 22 N 20 26 25 E	Građevinski materijal		
3	44 45 21 N 20 26 27 E	Građevinski materijal		
4	44 45 22 N 20 26 27 E	Plastične flaše		
5	44 45 24 N 20 26 33 E	Ambalaža motornog ulja		
6	44 44 59 N 20 27 21 E	Deponija raznog otpada		
7	44 44 27 N 20 27 48 E	Razna plastika		
8	44 44 25 N 20 27 47 E	Deponija raznog otpada		
9	44 43 34 N 20 28 21 E	Deponija raznog otpada		
10	44 43 31 N 20 28 24 E	Deponija raznog otpada		
11	44 43 30 N 20 28 41 E	Građevinski materijal		
12	44 43 43 N 20 29 33 E	Drveni otpad		
13	44 42 22 N 20 30 25 E	Zatvorene odložene kese		
14	44 41 39 N 20 30 36 E	Ostaci pojedinačnog otpada		

Napomena U izveštaju se pojavljuje više lokacija zbog karaktera posete prirodi, koja je organizovana kao pešačka tura. Na pešačkoj turi pređeno je 16 km, na kojoj je uočeno i evidentirano 14 divljih deponija. Cilj pešačke ture prvenstveno je bio pronalaženje i evidentiranje deponija.

Svrha posete prirodi	**Pešačka tura**
Datum podnošenja izvešaja	**08. IX 2015.**
Podnosilac izveštaja	**Vladimir Miletić**
Izveštaj preuzeo	

REZULTATI SA DISKUSIJOM

Na osnovu izvršene opservacije terena kroz koji se kretala pešačka maršruta dužine 16 km, evidentirano je ukupno 14 divljih deponija različitog otpada, čije su koordinate precizno unete u gore navedeni izveštaj, a iz izveštaja ucrtane u mapu. Ova mapa je precizno urađena metodom izrade preciznih karti za orijentaciona takmičenja prema standardnim uputstvima (*Гърков,Владимиров, Педев*, 2009).



Slika 2. Aero foto snimak - mapa maršrute sa 14 evidentiranih divljih deponija, izrađena zahvaljujući podacima unetim iz Eko-izveštaja

Tura se odvijala na teritoriji tri beogradske opštine i na njima se pronašlo: 4 deponije na Čukarici, 3 u Rakovici i 7 na Voždovcu. Kada bi se evidentirane deponije raspodelile pravilno na ovoj ruti dolazi se do zaključka da bi na svakih 1142m nalazila po jedna divlja deponija. Najinteresantniji podatak je da se sav otpad odlagao uglavnom na "najskrivenijim" mestima prirode: u Košutnjaku, Miljakovačkoj šumi, šumi spomen parka Jajinci i na Avali, što se može uočiti posmatranjem slike.

Budući da je evidentirani uzorak mali statistička obrada podataka ne bi dala validne rezultate, te je ovo istraživanje pilot istraživanje koje bi tebala vršiti svaka lokalna zajednica, a shodno tome da statistički obradi podatke i rešava probleme iz ovoga domena.

Cilj je da Eko-izveštaji postanu praksa svih korisnika prirode bez obzira na njihovu delatnost, a kako bi lokalna zajednica imala jasnu ekološku sliku u nadležnosti svoje teritorije. Kao rezultat istraživanja realizovanog u terenskim uslovima na turi dužine od 16 km evidentirano je ukupno 14 divljih deponija, sa različitim sadržajima otpada ubeleženih u Eko-izveštaj. Posle završene opservacije na terenu podaci iz izveštaja uneti su u topografsku kartu i uz pomoć tehnologije geografsko informacionog sistema (GISa) napravljena je digitalizovana baza podataka. Izrađena mapa je predata nadležnim institucijama, čiji je zadatak dalje rešavanje evidentiranog problema, nakon čega će slediti nastavak prakse mapiranja deponija na drugim aktivnostima koje se odvijaju u prirodi.

Ono što je primarni zadatak u okviru vaspitno-obrazovnog procesa, jeste da se nove generacije vaspitavaju i usmeravaju na jedini mogući put razvoja svesti pre svega, preko jačanja kolektivne ekološke inteligencije, a kako bi oni dalje svojim naslednicima ostavili čist i bezbedan životni prostor. Stoga, naš osnovni zadatak jeste pravilna edukacija kako bi mladi ljudi bili u mogućnosti da spoznaju sopstvene i tuđe uticaje na životnu sredinu, čime bi bili podstaknuti da promišljaju o mogućim poboljšanjima te na kraju bili i osposobljeni da stečeno znanje primene, podele i prenesu drugima. Fizička kultura posredstvom aktivnosti u prirodi kao integralnog dela svih njenih entiteta, raspolaže moćnim "akademskim oružjem" za ovu borbu iz koje mora izaći kao pobednik.

Svi oblici edukacije u prirodi, a posebno kretnih aktivnosti, zahtevaju čisto i zdravo okruženje neskrnavljeno otpadom, a na nama je da ovo okruženje sačuvamo u izvornom obliku. Ako nismo u stanju da sprečimo proces uništavanja prirode, onda je naša moralna dužnost da se isti uspori, kako bi imali dovoljno vremena da razmislimo na koji način se dalje kretati ka budućnosti. Na slici

3 prikazana je fotografija jedne od mapiranih lokacija na teritoriji Košutnjaka sa preciznim geografskim koordinatama: 44° 45’ 24” N 20° 26’ 33” E na kojoj se može uočiti plastična ambalaža za skladištenje motornog ulja (indeksni brojevi 13 i 15 iz tabele 1.). Po klasifikaciji ovaj otpad smatra se toksičnim otpadom.

Slika 3. Uobičajeni detalji na fotografijama pejzaža - na prvi pogled bezazlen

ZAKLJUČAK

Zaštita životne sredine nije samo “dodatak” koji je razvijen kao odgovor na aktuelne probleme, već suštinska i osnovna odgovornost koja se mora uzeti u obzir u svakom trenutku od strane svih.

Područja pod bilo kojim stepenom zaštite ukazuju na odnos prema prirodnom okruženju, odnosno kada bi stepen ekološke inteligencije bio viši svi ti zakoni bi bili nepotrebni. Duž izletničke ture, budući da su imali zadatak da izvrše opservaciju terena, studenti su obraćali pažnju na smeće i deponije, a koje u redovnoj turi ne bi toliko primećivali. Opažanjem eko problema i njegovo lokalizovanje probudilo je svest studenata, kao i želju da pomognu u rešavanju istih. To jeste samo prvi stepenik, ali prvi i najbitniji korak u rešavanju ekoloških problema.

Iz istraživanja može se zaključiti da se većina deponija nalazi upravo u samom srcu prirode, najverovatnije zbog “najsigurnijeg skrivanja” od zakona koji se tiče odlaganja otpada. Količinski najzastupljeniji je građevinski otpad za čije se odlaganje verovatno mora izdvojiti više finansijskih sredstava, pa je shodno tome najekonomičniji način odlaganja upravo na datim lokacijama.

Kako bi se podigao nivo ekološke osvešćenosti, neophodno je na svim obrazovnim nivoima i kroz sve predmete uključiti osnove nauke u životnoj sredini, naravno, prilagođene različitim uzrastima i nastavnom programu. Kako bismo uspešno implementirali željeni deo nauke o životnoj sredini u određeni nastavni program, neohodno je probuditi zainteresovanost, te motivaciju kako bi se studenti uključivali ili čak osmišljavali sopstvene akcije vezane za poboljšanje životne sredine.

Obrazovanje koje promoviše svest “sveta” i razumevanje da postoji veza između svih sastavnih delova životne sredine, stvoriće uslove za ujedinjenje čovečanstva u cilju stvaranja adekvatnih odgovora na sve ekološke i razvojne izazove. Ekologiju kao naučnu disciplinu koja proučava međusobne odnose živih bića i spoljašnje sredine trebalo bi posmatrati više kao životnu filozofiju i na taj način je prezentovati budućim generacijama koje treba obrazovati u duhu zaštite životne sredine, što će svakako uticati na podizanje nivoa svesti na viši nivo i aktuelne probleme ostaviti iza sebe negde daleko na “otpadu istorije”.

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OUTDOOR ACTIVITIES IN FUNCTION OF ENVIRONMENT PROTECTION ON EXAMPLE OF MAPPING ILLEGAL DUMPS ALONG THE HIKING TOUR

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INTRODUCTION

Physical exercise manifested through the program of sports activities in nature has multiple benefits on the health status of the beneficiaries of nature with all the positive feedback on the environmental factors. It is not advisable to carry out activities in nature in an unhealthy environment, due to the negative impact on practitioners. Staying in a healthy environment is a fundamental right of every man. Today it is a real privilege of individuals who can afford *"part of the pristine inner nature",* if it can be found in such a form. Except in areas that are categorized as: national parks, parks of nature, protected areas, etc., are we denied the possibility of implementation of physical activity in a healthy environment? Shall we just accept this and just bypass the eco-problems or assist in the realization of its elimination? Unfortunately, these claims should be taken with a pinch of salt. None of the above protected categories are free from traces of *"urban man".* More and more visitors of nature point to environmental problems and their rapid expansion. Shall we look for the causes of this pollution occurrence or simply accept it as a trend, which may be transient? The basic idea of this paper is to point to the emerging environmental problems and that the same recorded and presented in order to determine the volume (level) of pollution. Based on this knowledge further measures may be taken to remove everything that does not belong to nature. The work arose from the need to demonstrate the importance of using values of the acquired knowledge in the field of outdoor activities and their logical connections with other social sectors, in particular environmental protection.

Figure 1. (Un)usual environment as a pretext for taking action of mapping and solving environmental problems. Photo of one of the mapped locations in Miljakovac III with precise geographical coordinates: 44° 43' 3" N; 20° 28' 24" E, which can be seen wild dumps of various wastes.

In order to bring the subject of research closer to students (participants of this study), they need to be addressed in the basic definitions concerning waste materials. According to the Law on Waste Management, the waste is any substance or object in the list of categories of waste (Q), which the holder discards or intends or is required to discard, in accordance with the law. Wastes are classified according to the Waste Catalogue, which is compliant with the European waste catalogue, in which more than 800 types of waste are systematized, according to the industry which generates it, the type of waste or materials or processes. The work has taken into account only classification of waste, since the waste characterization means very complex procedure tests of physical-chemical, chemical and biological composition of the waste. Classification is a relatively simple procedure of classifying waste according to the accepted list of waste. As a rule, all generated waste should be disposed of in the appropriate waste disposal site, which are internal or permanent sites for the disposal or storage of waste. According to this statement, all other landfill sites would be illegal, or wild, which means they are unlawful.

Unfortunately, we witness more and more creation of illegal dumps or disposal of unsorted waste in the environment, and consequently not only the degradation of space but also of visual identity of the landscape, and this creates a favorable environment for the development of invasive species, potential carriers of infection. These are the conditions that created an unhealthy atmosphere from nature, thanks to which we get less and less space for living and moving in a healthy environment.

The aim of this study was to carry out and mapping illegal dumps within walking tour, in order for competent authorities upon receipt of folders to easier find and remove the ecological problems.

METHOD

Within the hiking tour attended by 22 participants, goals were finding and recording of illegal dumps and individual waste. We have used the method of observation field (route) and the method of digital mapping using GPS devices - *Magellan Triton 300* and *Navigon* software installed on iPhone.

The use of topographic maps should not be ignored as a method that is parallel followed digital mapping, where in the field conditions locations of illegal dumps are plotted.

In order to make students more easily accept this task instructions are given about how to get around on the field with the help of GPS devices. The basic principle of operation of GPS is to use satellites as reference points to determine the position on the Earth's surface by method of trilateration *(Milojkovic, 2009).* GPS unit, from the moment of its commercialization, became available to all its customers and is an integral part of the personal equipment for outdoor activities, and is also used in the educational process within the regular curriculum in the course of outdoor activities.To study was completed, further steps after the field work were the use of geographical information systems (GIS). GIS is a system for managing spatial data and their associated properties. In a narrow sense, GIS is a computer system capable of integrating, storing, editing, analysis and display of geographic information. In a broader sense, GIS is a tool of *"smart cards"* which leaves the possibility for users to ask interactive queries (user created surveys), analyse the spatial information and edit data. GIS technology can be used for scientific research of resource management, property management, development planning, urban planning, mapping and infrastructure planning. GIS is often used for environmental purposes, in geology, civil engineering, but also in all areas used by the data related to maps and surveying in general and certain sports activities in nature *(Jovanovic Djurdjev, Srdic Stankov, 2012).* As such, GIS has been applied in the system of physical culture as already indicated above, and in this case of research is on another way clearly confirmed its importance. To GIS function also significantly contributed the global electronic network - the Internet, that because of the speed data update shortens the time of certain operations in the complex process of collecting and updating data. Specifically for the study and publication of data speed of action is very important, in order to solve in real-time a lot of tasks in the field of environmental protection. *Cetl* considers that the Internet, as a new platform, must emphasize the importance of saving and transfer of spatial data, maps and plans. The rise of Web technologies have changed the way of delivery and processing of spatial data by GIS users. Displaying maps, distribution of spatial data and GIS on the Web for a long time perceived different implementations on the Internet. In the current GIS tools various IMS *(Internet Map Server)* system are used that can be interactively visualized, with created online accounts and they serve different types of spatial data. An important role in the development of national spatial data infrastructure (NSDI) has set up data to the Internet. Today more and more there is a need for the application of GIS in the Internet environment. IMS technology enables to reach a favorable GIS client computers, and it is

possible multilaterally easy manage and access to current information. Consequently, for the first time is possible to make GIS accessible to a large number of users over the Internet.

Besides the basic information that students receive within educational program of outdoor activities related to the tentatively movement, for the purpose of this research besides techniques of land navigation and mapping information about the classification of waste was presented. In the Table 1 is given twenty groups of waste, classified according to the National Waste Catalogue *("Off. Gazette of RS", no. 29/2010).* This list serves as a guide, and for information only, in order to approach the issues to students that they deal with. From the table for exploration only five categories of waste have been downloaded.

Table 1. Location and origin of waste generation

Index no.	Location and origin of waste generation
01	Wastes generating from exploration, mining, and quarrying, and physical and chemical treatment of minerals
02	Wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing, food preparation and processing
03	Wastes from wood processing and the production of paper, cardboard, pulp, panels and furniture
04	Wastes from the leather, fur and textile industries
05	Wastes from petroleum refining, natural gas purification and pyrolytic treatment of coal
06	Wastes from inorganic chemical processes
07	Wastes from organic chemical processes
08	Wastes from the manufacture, formulation, supply and use of coatings (paints, varnishes and vitreous enamels), adhesives, sealants and printing inks
09	Wastes from the photo industries
10	Wastes from thermal processes
11	Wastes from chemical surface treatment and coating of metals and other materials; non-ferrous hydrometallurgy
12	Wastes from shaping and physical and mechanical surface treatment of metals and plastics
13	Oil wastes and wastes of liquid fuels (except edible oils, and those in groups of 05, 12 and 19)
14	Wastes from organic solvents, coolants and propellant gases (except 07 and 08)
15	Waste from packaging; absorbents, wiping cloths, filter materials and protective clothing not otherwise specified
16	Wastes that not otherwise specified in the catalog
17	Construction waste and demolition wastes (including excavated soil from contaminated sites)
18	Effluent from facilities that provide health care for humans and animals and / or related research (excluding waste from the kitchen and restaurant that not arising from immediate health care)
19	Wastes from waste treatment plants, plants for treatment of waste water off site and the preparation of water for human consumption and industrial use
20	Municipal wastes (household waste and similar commercial, industrial and institutional wastes) including separately collected fractions

Also, for the purposes of this study has been prepared a questionnaire - *Eco-report*, specially constructed (adjusted) survey for the needs of specific studies, with data on the classification, quantity and coordinates for easy finding and removing the registered landfills in the experimental route. On the other side of the report is planned to enter map of location where they are registered black dots. The Eco-tour report participants recorded all the necessary information from the environmental aspect, and the part that refers to the classification of waste is entered, thanks to the data from table 1.

Eco-report is designed to be simple, accurate and informative, in order to be of use to agencies whose task is to find and remove these problems.

Table 2. A completed Eco-report of the visit to nature

ECO-REPORT OF THE VISIT TO NATURE

	Location of waste	**Waste classification**	**Quantity of waste**	**Individual observation**
no.	Coordinates:	Plastic, rubble, wood, glass, metal, chemical ...	Occupation of land per m^2	The proximity of facilities, industrial plants, waterways...
1	44 45 25 N 20 26 19 E	Plastic bottles Construction material		
2	44 45 22 N 20 26 25 E	Construction material		
3	44 45 21 N 20 26 27 E	Construction material		
4	44 45 22 N 20 26 27 E	Plastic bottles		
5	44 45 24 N 20 26 33 E	Packaging of engine oil		
6	44 44 59 N 20 27 21 E	Landfills		
7	44 44 27 N 20 27 48 E	Various plastics		
8	44 44 25 N 20 27 47 E	Landfills		
9	44 43 34 N 20 28 21 E	Landfills		
10	44 43 31 N 20 28 24 E	Landfills		
11	44 43 30 N 20 28 41 E	Construction material		
12	44 43 43 N 20 29 33 E	Wood waste		
13	44 42 22 N 20 30 25 E	Closed delayed bags		
14	44 41 39 N 20 30 36 E	The remains of a single waste		

Notes In the report multiple locations appear due to the nature of trips to nature, which is organized as a walking tour. Within walking tour we have travelled 16km, where is observed and recorded 14 illegal dumps. The goal of walking tours was primarily to find and record landfills.

The purpose of the visit to nature	**Walking tour**
Date of reporting	**08. IX 2015.**
Report submitted by	**Vladimir Miletic**
Report taken by	

RESULTS WITH DISCUSSION

Based on the observations of terrain through which ranged tracking route length of 16km, there were recorded a total of 14 illegal dumps of various wastes, whose coordinates are accurately entered in the above report, and from the report drawn in the map. This map is accurately done by the method of making precise maps for orientation competition according to standard guidelines *(Гърков,Владимиров, Педев, 2009).*

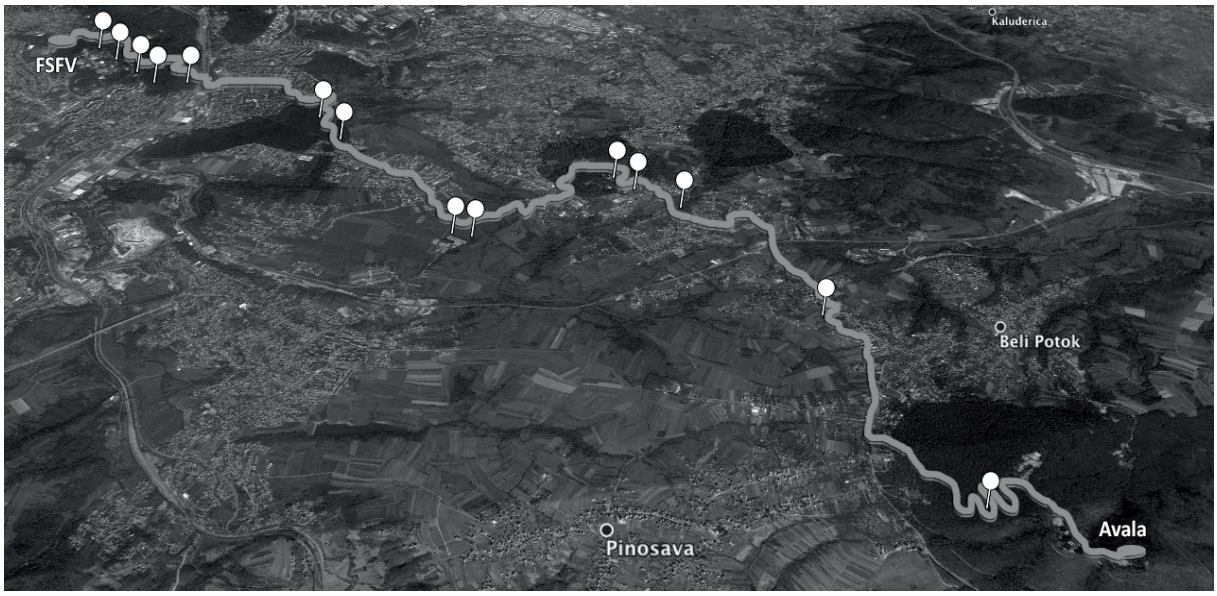

Figure 2. Aerial footage - map of route with 14 registered illegal dumpsites, made thanks to the data entered from the Eco-report

The tour took place on the territory of three Belgrade municipalities and in them is found: 4 landfill in *Cukarica*, *Rakovica* 3 and 7 in *Vozdovac*. If the registered landfill distributed properly on this route leads to the conclusion that every 1142m there was one single wild landfill. The most interesting fact is that all waste deposited mainly on the *"most hidden"* places in nature in *Kosutnjak*, forest of *Miljakovac*, rustles memorial park *Jajinci* and *Avala*, which can be seen by observing the images.

Since the recorded sample is small, statistical analysis of the data would not give valid results, so this research is a pilot study that should be performed by every local community and, consequently, to make the statistical processing of data and solve problems in this domain.

The aim is that Eco-statements enters into practice of all nature users regardless of the nature of their activities, and to provide the local community with a clear environmental picture in the competence of its territory. As a result of research conducted in field conditions on the tour length of 16km there were a total of 14 illegal dumps containing various waste recorded in *Eco-report*. After completion of field observation, data from the reports are entered in the topographic map and with the help of technology of geographic information system (GIS) is made digitized databases. Made folders are handed over to the competent institutions, whose task is to continue solving the problems recorded, after which will follow the continuation of the practice of mapping landfills in other activities that take place in nature.

The primary task within the educational process, is to educate the new generation and route them to the only possible way of development of consciousness, primarily through strengthening of collective ecological intelligence, in order to left to their successors a clean and safe living environment. Therefore, our main objective is the proper education so that young people could be able to recognize their own and other people's impact on the environment, which could encouraged them to reflect on possible improvements and at the end and were able to apply their knowledge, and share to others. Physical culture through outdoor activities as an integral part of all its entities, has a powerful *"academic weapon"* for this fight, which shall emerge victorious.

All forms of education in nature, and especially of movement activities, require a clean and healthy environment unpolluted by waste, and up to us to preserve this environment in its original

form. If we are not able to stop the process of destruction of nature, it is our moral duty to the same slow down, in order to have sufficient time to consider how to continue to move towards the future. Figure 3 shows a photograph of one of the mapped locations in *Kosutnjak* with precise geographical coordinates: 44° 45' 24" N; 20° 26' 33" E, where one can see plastic containers for the storage of motor oil (index numbers 13 and 15 in Table 1). By classification this waste is considered as toxic waste.

Figure 3. Typical details in the photographs of landscapes - on the first sight harmless

CONCLUSION

Environmental protection is not just an „add", which was developed in response to the current problems, but fundamental and basic responsibility that must be taken into consideration at all times by all.

Areas with any degree of protection indicates the relationship to the environment, or if the level of environmental intelligence was higher all these laws would be unnecessary. Along the tour, since it had the task to carry out observation of the field, students are paying attention to garbage dumps, what in a regular tour would not be noticed that much. By observing ecological problems and its localization has raised the awareness of students, as well as a desire to help in solving them. This is only the first step, but the first and most important step in solving environmental problems.

From the research it can be concluded that most of the landfill is located just in the heart of nature, probably because of the *"safest hiding"* of the laws concerning the disposal of waste. The most common, by volume, is the construction waste whose disposal is likely to allocate more financial resources, and is therefore the most economical way to dispose precisely at these sites.

In order to raise the level of environmental awareness, it is necessary at all educational levels and through all subjects to include fundamentals of the environmental science, of course, adapted to different age groups and teaching program. In order to successfully implement the desired part of the environmental science in a particular curriculum, it is necessary to raise awareness in order to motivate the students to involve or even devising its own shares related to the improvement of the environment.

Education that promotes awareness of the *"world"* and an understanding that there is a connection between all components of the environment, will create conditions for the unification of mankind in order to create adequate response to all the environmental and development challenges. Ecology as a scientific discipline that studies the interrelations of living beings and the external environment should be seen more as a philosophy of life and thus the present to future generations

that should be educated in the spirit of environmental protection, which will certainly have impact on raising awareness to a higher level and current problems left behind somewhere in the *"waste of history."*

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ANALIZA TAKMIČARSKE AKTIVNOSTI VRHUNSKIH KIK BOKSERA U OKVIRU MEĐUNARODNIH TAKMIČENJA

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UVOD

Veliki uticaj na razvoj kik boksa u svetu imali su "stariji" borilački sportovi na bazi udaraca i to - engleski boks, francuski boks-savate, kao i grupa srodnih „istočnjačkih" borilačkih sportova – karate i tajlandski boks. Upravo pioniri tj. prvi takmičari kik boksa potiču iz navedenih sportova. Jednostavnost pravila, atraktivnost i efikasnost tehnike u takmičarskoj borbi privukli su veliki broj majstora različitih udaračkih sportova da učestvuju u kik boks takmičenjima. Početak devedesetih godina 20. veka predstavlja snažan razvoj borbe sa K1 pravilima, discipline kik boksa koja je dala značajan doprinos popularizaciji kik boksa u svetu. Danas je ovaj sport rasprostranjen u svim segmentima fizičke kulture: kao takmičarski sport, kao rekreativni sport i kao sadržaj specijalnog fizičkog vaspitanja među pripadnicima vojske i policije (Blagojević, Vučković i Dopsaj, 2009).

Na osnovu takmičarskih rezultata na mađunarodnom nivou u Srbiji kik boks se ubraja u najtrofenije sportove. U ringovnim disciplinama kik boksa K1 pravila i lou kik reprezentativci Srbije su redovno visoko plasirani na svim međunarodnim takmičenjima. Takmičarska aktivnot kao najveća specifičnost trenažnog procesa je ogledalo ukupne efikasnosti realizovanog treninga kik boksera. S tim u vezi grupa autora je odredila zadatak analize takmičarske aktivnosti vrhunskih kik boksera.

Takmičarska aktivnost u različitim sportskim granama uslovljena je karakteristikama tih grana. U manje složenim, monostrukturnim cikličnim sportovima, istraživanja takmičarske aktivnosti su relativno jednostavnija. S druge strane, polistrukturne i kompleksne sportske grane, znatno su teže za ovakve vrste istraživanja. Među njima posebno mesto zauzimaju borilački sportovi. Ove sportove karakterišu variranje inteziteta, promene tempa i ritma borbe, promene nivoa nervno-mišićnog naprezanja, smene aktivnih i pasivnih faza, dinamičke promene u sportisti, njegovoj okolini i u njegovom protivniku...

METOD

Prikupljanje podataka je izvršeno primenom notacione metode tj. metode evidetiranja događaja, odnosno analizom snimaka finalnih borbi u navedenim kategorijama kik boksa sa Evropskog prvenstva (Bilbao-Španija 2014.) i Evropskog kupa (Beograd 2014. i 2015.). S obzirom da nema uticaja na ispitivanu pojavu, nego je samo ispitan uzorak rezultata dobijenih u realnim uslovima, ovo istraživanje ima karakteristike EX-POST-FACTO nacrta.

Istraživanje je sprovedeno na uzorku od 20 takmičara vrhunskog nivoa u dve ženske (60 i 65 kg) i tri muške težinske kategorije (63.5, 71 i 91 kg). Ukupno je analizirano deset borbi i to četiri ženske i šest muških parova. Za potrebe rada analizirani su sledeći elementi takmičarske aktivnosti:

- broj udaraca ručnim tehnikama
- broj udaraca nožnim tehnikama
- ukupan broj udaraca
- aktivni deo borbe
- pasivni deo borbe

Posebno su upoređeni rezultati istraživanja ostvareni na različitim takmičenjima. Dobijeni rezultati u okviru svakog analiziranog elementa, predstavljeni su preko brojčanih i procentualnih vrednosti u odnosu na ukupnu učestalost registrovanih elemenata. U ovoj tezi su korišćene statističke procedure iz oblasti deskriptivne statistike, distirbucija frekvencija koja je prikazana numerički, uz korišćene tabela. Od deskriptivnih statističkih procedura u ovom radu su primenjene metode za dobijanje vrednosti centralne tendencije koju čini aritmetička sredina kojom započinje statističko izračunavanje. Rezultati su prikazani u apsolutnim vrednostima.

REZULTATI SA DISKUSIJOM

U Tabeli 1 prikazani su numerički i procentualni pokazatelji broja ručnih i nožnih udaraca kod muških takmičara u borbama na Evropskom kupu u Beogradu 2014. Dobijeni rezultati pokazuju da je prosečan broj udaraca rukom u sve tri runde 7.44 što procentualno iznosi 40.09% u odnosu na ukupan broj udaraca zadatih u toku borbe. Prosečan broj udaraca nogom je 10.71 što procentualno iznosi 59.04 % u odnosu na ukupan broj zadatih udaraca u toku borbe. Broj udaraca nogom čini nepunih 60% od ukupnog broja udaraca što ukazuje na veću zastupljenost nožnih udaraca u odnosu na ručne.

Tabela 1. Prosečni numerički i procentualni pokazatelji ručnih i nožnih udaraca u odnosu na ukupan broj udaraca u toku rundi na Evropskom kupu u Beogradu (konkurencija muškaraca)

Udarci zadati ručnom i nožnom tehnikom	srednja vrednost	procenat u odnosu na ukupan broj udaraca
Broj udaraca rukom u prvoj rundi	7.83	43.10
Broj udaraca rukom u drugoj rundi	7.33	40.74
Broj udaraca rukom u trećoj rundi	7.16	39.02
Srednja vrednost ručnih udaraca u svim rundama	7.44	40.09
Broj udaraca nogom u prvoj rundi	10.33	56.90
Broj udaraca nogom u drugoj rundi	10.66	59.26
Broj udaraca nogom u trećoj rundi	11.16	60.98
Srednja vrednost nožnih udaraca u svim rundama	10.71	59.04

U Tabeli 2 prikazani su numerički i procentualni pokazatelji broja ručnih i nožnih udaraca kod muških takmičara u borbama na Evropskom prvenstvu u Bilbaou, Španija. Dobijeni rezultati pokazuju da je prosečan broj udaraca rukom u sve tri runde 9.83 što procentualno iznosi 38.16 % u odnosu na ukupan broj udaraca zadatih u toku borbe. Prosečan broj udaraca nogom je 15.94 što procentualno iznosi 61.83 % u odnosu na ukupan broj zadatih udaraca u toku borbe. Broj udaraca nogom čini više od 60% od ukupnog broja udaraca što ukazuje na veću zastupljenost nožnih udaraca u odnosu na ručne.

Tabela 2. Prosečni numerički i procentualni pokazatelji ručnih i nožnih udaraca u odnosu na ukupan broj udaraca u toku rundi na Evropskom prvenstvu u Bilbaou, Španija 2014. godine (konkurencija muškaraca)

Udarci zadati ručnom tehnikom	Srednja vrednost	procenat u odnosu na ukupan broj udaraca
Broj udaraca rukom u prvoj rundi	9.00	38.86
Broj udaraca rukom u drugoj rundi	11.00	38.82
Broj udaraca rukom u trećoj rundi	9.50	36.82
Srednja vrednost ručnih udaraca u svim rundama	9.83	38.16
Broj udaraca nogom u prvoj rundi	14.16	61.14
Broj udaraca nogom u drugoj rundi	17.33	61.18
Broj udaraca nogom u trećoj rundi	16.33	63.18
Srednja vrednost za sve runde	15.94	61.83

Upoređujući rezultate analize takmičarske aktivnosti vrhunskih kik boksera na Evropskom kupu u Beogradu 2014. i 2015. i Evropskom prvenstvu u Bilbaou, Španija 2014. uočava se razlika u proseku broja udaraca ručnom ali i nožnom tehnikom. Iako je procentalna zastupljenost ručnih u odnosu na nožne tehnike na oba takmičenja bila približna, učesnici Evropskog prvenstva u Bilbaou, Španija 2014. bili su aktivniji te su u napadima realizovali veći broj udaraca. Procentalna zastupljenost ručnih i nožnih tehnika na oba takmičenja je približna.

U Tabeli 3 prikazani su numerički i procentualni pokazatelji broja ručnih i nožnih udaraca kod ženskih takmičara u borbama na Evropskom kupu u Beogradu 2014. Dobijeni rezultati pokazuju da je prosečan broj udaraca rukom u sve tri runde 6.25 što procentualno iznosi 40.56% u odnosu na ukupan broj udaraca zadatih u toku borbe. Prosečan broj udaraca nogom je 9.25 što procentualno iznosi 59.42 % u odnosu na ukupan broj zadatih udaraca u toku borbe. Broj udaraca nogom čini nepunih 60% od ukupnog broja udaraca što ukazuje na veću zastupljenost nožnih udaraca u odnosu na ručne.

Tabela 3. Prosečni numerički i procentualni pokazatelji ručnih i nožnih udaraca u odnosu na ukupan broj udaraca u toku rundi na Evropskom kupu u Beogradu (konkurencija žena)

Udarci zadati ručnom i nožnom tehnikom	Srednja vrednost	procenat u odnosu na ukupan broj udaraca
Broj udaraca rukom u prvoj rundi	6.25	36.23
Broj udaraca rukom u drugoj rundi	6.00	42.85
Broj udaraca rukom u trećoj rundi	6.50	42.62
Srednja vrednost ručnih udaraca u svim rundama	6.25	40.56
Broj udaraca nogom u prvoj rundi	11.00	63.76
Broj udaraca nogom u drugoj rundi	8.00	57.14
Broj udaraca nogom u trećoj rundi	8.75	57.37
Srednja vrednost nožnih udaraca u svim rundama	9.25	59.42

U Tabeli 4 prikazani su numerički i procentualni pokazatelji broja ručnih i nožnih udaraca kod ženskih takmičara u borbama na Evropskom prvenstvu u Bilbaou, Španija. Dobijeni rezultati pokazuju da je prosečan broj udaraca rukom u sve tri runde 12 što procentualno iznosi 40.67 % u odnosu na ukupan broj udaraca zadatih u toku borbe. Prosečan broj udaraca nogom je 17.58 što procentualno iznosi 59.32 % u odnosu na ukupan broj zadatih udaraca u toku borbe. Rezultati pokazuju veću zastupljenost nožnih udaraca u odnosu na ručne.

Tabela 4. Prosečni numerički i procentualni pokazatelji ručnih i nožnih udaraca u odnosu na ukupan broj udaraca u toku rundi na Evropskom prvenstvu u Bilbaou, Španija 2014. godine (konkurencija žena)

Udarci zadati ručnom tehnikom	Srednja vrednost	procebat u odnosu na ukupan broj udaraca
Broj udaraca rukom u prvoj rundi	14.00	41.17
Broj udaraca rukom u drugoj rundi	11.25	42.45
Broj udaraca rukom u trećoj rundi	10.75	38.39
Srednja vrednost ručnih udaraca u svim rundama	12.00	40.67
Broj udaraca nogom u prvoj rundi	20.00	58.82
Broj udaraca nogom u drugoj rundi	15.25	57.54
Broj udaraca nogom u trećoj rundi	17.25	61.60
Srednja vrednost za sve runde	17.58	59.32

Upoređujući rezultate analize takmičarske aktivnosti vrhunskih kik boksera u konkurenciji žena na Evropskom kupu u Beogradu 2014. i 2015. i Evropskom prvenstvu u Bilbaou, Španija 2014. uočava

se razlika u proseku broja udaraca ručnom ali i nožnom tehnikom. Iako je procentalna zastupljenost ručnih u odnosu na nožne tehnike na oba takmičenja bila približna takmičari, učesnici Evropskog prvenstva u Bilbaou, Španija 2014 bili su aktivniji te su u napadima realizovali veći broj udaraca.

Tabela 5. Prosečni numerički i procentualni pokazatelji dužine pasivnog dela runde u toku Evropskog kupa u Beogradu i Evropskog prvenstva u Bilbaou, Španija 2014. godine (konkurencija žena)

Pasivni deo borbe na Evropskom kupu u Beogradu i Evropskom prvenstvu u Bilbaou	Srednja vrednost u sekundama	procenat u odnosu na ukupano trajanje runde
Pasivni deo borbe u 1. rundi na E. Kupu u BGD	78	65
Pasivni deo borbe u 2. rundi na E. Kupu u BGD	66.50	55.41
Pasivni deo borbe u 3. rundi na E. Kupu u BGD	62	51.66
Srednja vrednost pasivnog dela borbe na Evropskom kupu u Beogradu	68.83	57.36
Pasivni deo borbe u 1 rundi na E. P. u Bilbaou	20	16.66
Pasivni deo borbe u 2. rundi na E. P u Bilbaou	13	10.83
Pasivni deo borbe u 3. rundi na E.P u Bilbaou	16.50	13.75
Srednja vrednost pasivnog dela borbe na Evropskom prvenstvu u Bilbaou	16.50	13.74

Rezultati pokazuju da su prosečne vrednosti pasivnog dela borbe na Evropskom kupu u Beogradu i Evropskom prvenstvu u Bilbaou u konkurenciji žena različiti odnosno da su takmičarke na Evropskom prvenstvo bile znatno aktivnije te su bile pasivne (neaktivne) svega prosečno 16.5 sekundi u jednoj rundi čije je trajanje 120 sekundi (2 minuta). Procentualno 13.74 % one nisu bile u razmeni udaraca sa protivnicama. Takmičarke koje su učestvovale na Evropskom kupu u Beogradu bile su manje aktivne te su se prosečno pripremale ili izbegavale borbu 68.83 sekunde ili 57.36% od ukupnog trajanja runde.

Tabela 6. Prosečni numerički i procentualni pokazatelji dužine pasivnog dela runde u toku Evropskog kupa u Beogradu (2014 i 2015) i Evropskog prvenstva u Bilbaou (2014), Španija 2014. godine (konkurencija muškaraca)

Pasivni deo borbe na Evropskom kupu u Beogradu i Evropskom prvenstvu u Bilbaou	Srednja vrednost sekundama	procenat u odnosu na ukupano trajanje runde
Pasivni deo borbe u 1. rundi na E. Kupu u BGD	65	54.1
Pasivni deo borbe u 2. rundi na E. Kupu u BGD	65	54.1
Pasivni deo borbe u 3. rundi na E. Kupu u BGD	51	42.5
Srednja vrednost pasivnog dela borbe na Evropskom kupu u Beogradu	60.33	50.23
Pasivni deo borbe u 1. rundi na E. P. u Bilbaou	33.3	27.75
Pasivni deo borbe u 2. rundi na E. P. Bilbaou	31.6	26.33
Pasivni deo borbe u 3. rundi na E.P u Bilbaou	31	25.80
Srednja vrednost pasivnog dela borbe na Evropskom prvenstvu u Bilbaou	31.9	26.63

Rezultati pokazuju da su prosečne vrednosti pasivnog dela borbe na Evropskom kupu u Beogradu i Evropskom prvenstvu u Bilbaou u konkurenciji muškaraca različiti. Takmičari na Evropskom prvenstvu bili su znatno aktivniji, a bili su pasivni (neaktivni) prosečno 31.9 sekundi u jednoj rundi čije je trajanje 120 sekundi (2 minuta). Procentualno 26.63 % oni nisu bili u razmeni udaraca sa protivnicama. Takmičari koji su učestvovali na Evropskom kupu u Beogradu bili su manje aktivni te su se prosečno pripremali za napad ili izbegavali borbu pola runde, 60.33 sekunde ili 50.23 % od ukupnog trajanja runde.

Predpostavka je da značajna razlika u obe konkurencije (muška i ženska) u svim kategorijama (60 kg, 65 kg, 63.5 kg, 71 kg i 91 kg) koja je utvrđena kod ukupnog broja poentirajućih udaraca nogama i ukupnog broja poentirajućih svih udaraca u korist takmičara na Evropskom prvenstvu (Bilbao - Španija 2014.) u odnosu na takmičare sa Evropskog kupa (Beograd 2014. i 2015.) postoji iz sledećih razloga: 1) pre svega zbog većeg vrednovanja udaraca nožnom tehnikom u odnosu na udarce izvedene ručnom tehnkom, 2) zbog bolje fizičke pripremljenosti takmičara, 3) zbog boljeg nivoa tehničko-taktičkog majstorstva boraca, tako da oni mogu zadati veliki broj udaraca pogotovo nožnom tehnikom koja je tehnički i složenija.

Razlika u odnosu na veću aktivnost tokom borbe na Evropskom prvenstvu, kod muškaraca i kod žena, je najverovatnije posledica bolje fizičke pripremljenosti za aktivan rad u visokom intezitetu, tj. takmičari za Evropsko prvenstvo, se zbog kvalitetnijeg nivoa takmičenja, najverovatnije više i bolje pripremaju u trenažnom procesu. Takođe, mora se naglasiti da je kriterijum za učestvovanje na Evropskom prvenstvu strožiji, nego za sistem takmičenja evropskih kupova, tako da utvrđeni podaci mogu biti i posledica razlike apsolutnog kvaliteta takmičara, imajući u vidu činjenicu da su za potrebe ovog rada analizirane finalne borbe.

ZAKLJUČAK

U radu su izloženi rezultati analize takmičarske aktivnosti vrhunskih kik boksera na regionalnom međunarodnom takmičenju Eveopskog kupa u Beogradu 2014. i 2015. godine kao i na Evropskom prvenstvu u Bilbaou 2015. godine. Obrađeni su rezultati u istim kategorijama 63.5, 71, i 91 kg kod muških, kao i kategorije 60 i 65 kg kod žena na navedenim takmičenjima. Ukupno je obrađeno 10 borbi po pet na Evropskom kupu i pet na Evropskom prvenstvu u Bilbaou. Prikupljanje podataka je izvršeno tehnikom posmatranja koje je realizovano na osnovu video snimaka celih tokova održanih borbi (mečeva). Analizirani su sledeći elementi: broj udaraca ručnom tehnikom, broj udaraca nožnom tehnikom kao i pasivnost u toku borbe u vidu pripremanja ili izbegavanja napada. Rezultati u konkurenciji muškaraca su pokazali sličnu podelu ručnih i nožnih tehnika, te je broj udaraca rukom na Evropskom kupu bilo 40.09% dok je na broj udaraca rukom na Evropskom prvenstvu bilo 38.16 % od ukupnog broja udaraca. Preostali procenti zauzimaju udarci nogama, na Evropskom kupu 59.04% i na Evropskom prvenstvu 61.83%. Međutim broj udarca u istoj procentualnoj podeli je različit ako ga posmatramo numerički te je prosečno 7.44 udarca rukom urađeno na Evropskom kupu dok je na Evropskom prvenstvu urađeno prosečno 9.83. udaraca rukom. Slični rezultati su dobijeni kada pratimo udarce nogama, prosečno je izvedeno 10.71 udaraca na Evropskom kupu dok je na Evropskom prvenstvu prosečno urađeno 15.94. Posmatrani odnos između aktivnog i pasivnog vremena na Evropskom kupu je 50.23% pasivnog dok je ostali procenat 49.77% aktivno vreme runde. Na Evropskom prvenstvu u Bilbaou pasivno vreme čini 26.63 % dok je aktivni deo znatno duži nego što je slučaj na Evropskom kupu i traje 73.37%. Odnos aktivnog i pasivnog dela u konkurenciji muškaraca na posmatranim prvenstvima je posledica broja udaraca koji su izvršeni.

Rezultati u konkurenciji žena su pokazali sličnu podelu ručnih i nožnih tehnika, te je broj udaraca rukom na Evropskom kupu bilo 40.56 % dok je na broj udaraca rukom na Evropskom prvenstvu bilo 40.67 % od ukupnog broja udaraca. Udarci nogama na Evropskom kupu su činili 59.04% i na Evropskom prvenstvu 59.33% svih udaraca. Međutim broj udarca u istoj procentualnoj podeli je različit ako ga posmatramo numerički te je prosečno 6.25 udaraca rukom urađeno na Evropskom kupu dok je na Evropskom prvenstvu urađeno prosečno 12 udaraca rukom. Slični rezultati su dobijeni kada pratimo udarce nogama, prosečno je izvedeno 9.25 udaraca na Evropskom kupu dok je na Evropskom prvenstvu prosečno urađeno 17.58. Posmatrani odnos između aktivnog i pasivnog vremena na Evropskom kupu je 57.36% pasivnog dok je ostali procenat 42.64 % aktivno vreme runde. Na Evropskom prvenstvu u Bilbaou pasivno vreme čini 26.63 % dok je aktivni deo znatno duži nego što je slučaj na Evropskom kupu i traje 73.37%. Odnos aktivnog i pasivnog dela u konkurenciji žena na posmatranim prvenstvima je posledica broja udaraca koji su izvršeni.

Na oba posmatrana takmičenja takmičari su se više služili udarcima nogu, a veći broj udarca u obe konkurencije izveden je na mečevima Evropskog prvenstva, što se može pojasniti kvalitetnijim takmičenjem, boljom pripremljenosti takmičara i većom željom za uspehom i osvajanjem titule prvaka Evrope.

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ANALYSIS OF THE COMPETITIVE ACTIVITIES OF TOP KICK BOXERS AT INTERNATIONAL COMPETITIONS

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INTRODUCTION

„Older" martial arts based on punching, such as English boxing, French boxing (Savate), and a group of related „Oriental" martial arts, karate and Thai boxing, have had a great influence on the development of kickboxing in the world. In fact, the pioneers of the sport, the first kickboxers, originate from these oriental sports. The simplicity of rules, attractive and effective techniques in a competitive battle were more than enough to attract a large number of different masters to participate in kickboxing competitions. The beginning of the nineties of the 20th century reflects a strong development of the sport with K1 rules, a type of kick boxing, which has contributed significantly to the popularization of kickboxing in the world. Today the sport is prevalent in all aspects of physical culture – as a competitive sport as well as a recreational sport and as a part of special physical education among members of the army and police (Blagojevic, Vuckovic and Dopsaj, 2009).

Based on the competition results in internationally active level, kickboxing is one of Serbia's most medal-winning sports. In the categories K1 and Low Kick Serbian national team is regularly highly placed in all international competitions. Competitive activity is the greatest specificity of training process and reflects the overall efficiency of the realized training that a kick boxer does. In this regard, a group of authors has set the task of analyzing the competitive activities of top kick boxers.

Competitive activity in various sports is conditioned to the characteristics of these sports individually. In less complex, monostructural cyclic sports, competitive research activities are relatively simple. On the other hand, polistructural and complex sport branches, are much more difficult for this kind of research. Among them a special place belongs to martial arts. These sports are characterized by varying the intensity, changes of pace and rhythm of fighting, changing levels of nerve-muscle strains, shifts the active and passive phases, dynamic changes in athletes, his/her environment and opponent ...

METHOD

Data collection was performed using notation methods. Notation methods were used on events for analyzing images of the final battle in many categories of kickboxing from the European Championship (Bilbao, Spain 2014) and the European Cup (Belgrade 2014 and 2015). Given that there is no impact on the observed phenomenon – a sample of the results obtained in real conditions has only been examined – this research has the characteristics of EX-POST FACTO draft.

The survey was conducted on a sample of 20 competitors on the highest level, in two women (60 and 65 kg) and three male weight categories (63.5, 71 and 91 kg). A total of ten fights, four female and six male bouts. For the purpose of the research, analysis was done of the following elements of competitive activities:

- The number of hand punches
- The number of kicks
- The total number of punches
- The active part of the fight
- Passive part of the fight

Special comparison was made among research results achieved in different competitions. The data obtained within each of the analyzed element is provided by a numeric and percentage values relative to the total incidence of registered elements. In this thesis are used statistical procedures in the field of descriptive statistics, while distribution frequency is displayed numerically. As far as descriptive statistical procedures in this study are concerned, applied methods for obtaining values of central tendency that makes the arithmetic mean were used, being a point of departure for statistical calculation. The results are presented in absolute values.

RESULTS WITH DISCUSSION

Table 1 shows the numeric and percentage figures of the number of punches and kicks of male athletes in the fighting at the European Cup in Belgrade in 2014. The results show that the average number of punches in three rounds is 7:44 with the percentage of 40.09% compared to the total number of shots given during the combat. The average number of kicks is 10.71 % which makes 59.04% compared to the total number of shots given during the combat. Number of kicks makes less than 60% of the total number of punches indicating greater representation of kicks over hand punches.

Table 1. The average number and percentage indicators of punches and kicks to the total number of hits during the rounds at the European Cup in Belgrade (men)

Shots inflict hand and foot techniques mean value percentage compared to the total number of strokes	middle value	%total of rounds
Number of punches in the first round	7.83	43.10
Number of punches in the second round	7:33	40.74
Number of punches in the third round	7.16	39.02
The mean value of hand strokes in all rounds	7:44	40.09
Number of kicks in the first round	10:33	56.90
Number of kicks in the second round	10.66	59.26
Number of kicks in the third round	16.11	60.98
The mean value kicks in all rounds	10.71	59.04

Table 2 shows the numeric and percentage figures of the number of punches and kicks of male athletes in the fighting at the European Championships in Bilbao, Spain. The results show that the average number of punches in three rounds is 38.16% compared to the total number of hits given during combat. The average number of kicks is 15.94 % which was 61.83% out of the total number of shots given during the combat. Number of kicks constitutes more than 60% of the total number of hits indicating greater representation of kicks over punches.

Table 2. Average number and percentage indicators of punches and kicks to the total number of hits during the round at the European Championships in Bilbao, Spain in 2014 (men)

Shots specify a manual technique mean value percentage compared to the total number of strokes	middle value	%total of rounds
Number of punches in the first round	9:00	38.86
Number of punches in the second round	11.00	38.82
Number of punches in the third round	9:50	36.82
The mean value of hand strokes in all rounds	9.83	38.16
Number of kicks in the first round	14:16	61.14
Number of kicks in the second round	17:33	61.18
Number of kicks in the third round	16:33	63.18
The mean value for all rounds	15.94	61.83

Comparing the results of the analysis of the competitive activities of top kick boxers at the European Cup in Belgrade in 2014 and 2015 and the European Championship in Bilbao, Spain, in 2014 we can see the difference in the average number of hits by hand or foot technique. Although the use of hand in relation to foot techniques in both competitions was similar, the participants of the European Championship in Bilbao, Spain in 2014 were active in the attacks and implemented higher number of blows. The occurrence of the use of hand and foot techniques in both competitions is similar.

Table 3 shows the number and percentage figures of the number of punches and kicks of female athletes in the fighting at the European Cup in Belgrade in 2014. The results show that the average number of punches in three rounds is 6.25 % which makes 40.56% of the total number of shots given during combat. The average number of kicks is 9.25 % which is 59.42% compared to the total number of shots given during the combat. Number of kicks makes less than 60% of the total number of hits indicating greater representation of kicks over punches.

Table 3. Average number and percentage indicators of punches and kicks to the total number of hits during the rounds at the European Cup in Belgrade (women)

Shots inflict hand and foot techniques mean value percentage compared to the total number of hits	middle value	%total of rounds
Number of punches in the first round	06.25	36.23
Number of punches in the second round	6:00	42.85
Number of punches in the third round	6:50	42.62
The mean value of hand strokes in all rounds	25.06	40.56
Number of kicks in the first round	11:00	63.76
Number of kicks in the second round	8:00	57.14
Number of kicks in the third round	8.75	57.37
The mean value kicks in all rounds	09.25	59.42

Table 4 shows the numeric and percentage figures of the number of punches and kicks of female athletes in the fighting at the European Championships in Bilbao, Spain. The results show that the average number of punches in three rounds is %12 which makes 40.67% compared to the total number of strokes given during combat. The average number of kicks is 17:58 which makes 59.32% compared to the total number of shots given during the combat. Results show a greater occurrence of kicks over punches.

Table 4. Average number and percentage indicators of punches and kicks to the total number of strokes during the round of the European Championship in Bilbao, Spain in 2014 (women)

Shots specify a manual technique percentage of value in relation to the total number of strokes	middle value	%total of rounds
Number of punches in the first round	14:00	41.17
Number of punches in the second round	11.25	42.45
Number of punches in the third round	10.75	38.39
The mean value of hand strokes in all rounds	12:00	40.67
Number of kicks in the first round	20:00	58.82
Number of kicks in the second round	15:25	57.54
Number of kicks in the third round	17:25	61.60
The mean value for all rounds	17:58	59.32

Comparing the results of the analysis of the competitive activities of top kick boxer in the competition of women in the European Cup in Belgrade in 2014 and 2015 and the European

Championship in Bilbao, Spain, in 2014 we can see the difference in the average number of strokes of hand or foot technique. Although the occurrence of hand in relation to foot techniques in both competitions was similar, participants of the European Championship in Bilbao, Spain in 2014 were more active in attacks and they used more strokes.

Table 5. Average number and proportion of the length of passive indicators of the part of the round during the European Cup in Belgrade and the European Championship in Bilbao, Spain in 2014 (women)

The passive part of the fight at the European Cup in Belgrade and the European Championship in Bilbao	middle value	%total of rounds
The passive part of the fight in the first round of the Cup in E. BGD	78	65
The passive part of the fight in the second round of the E. Cup in Beograd	66.50	55.41
The passive part of the fight in the third round of the Cup in E. BGD	62 51	57.36
The mean value of the passive part of the fight at the European Cup in Belgrade	68.83	16.66
The passive part of the fight in rounds 1 Championship in Bilbao	20	10.83
The passive part of the fight in the second round of the E. P in Bilbao	13	13.75
The passive part of the fight in the third round of the European Championship in Bilbao	16:50	13.74
The mean value of the passive part of the fight at the European Championships in Bilbao	16:50	65

The results show that the average values of passive part of the fight at the European Cup in Belgrade and the European Championship in Bilbao in the women's competition are different or that the competitors at the European Championship were much more active, i.e. they were passive (inactive) approximately for 16.5 seconds in the round one with a duration of 120 seconds (2 minutes). In percentages - 13.74% for not being in exchange punches with rivals. Contestants who participated in the European Cup in Belgrade were less active and have an average of preparing or avoided the fight of 68.83 seconds and 57.36% of the total duration of the round.

Table 6. Average number and proportion of the length of passive indicators of the part of the round during the European Cup in Belgrade (2014 and 2015) and the European Championship in Bilbao (2014), Spain 2014 (men)

The passive part of the fight at the European Cup in Belgrade and the European Championship in Bilbao	middle value	%total of rounds
The passive part of the fight in the first round of the Cup in E. BGD	65	54.1
The passive part of the fight in the second round of the Cup in E. BGD	65	54.1
The passive part of the fight in the third round of the Cup in E. BGD	51	42.5
The mean value of the passive part of the fight at the European Cup in Belgrade	60.33	50.23
The passive part of the fight in the first round of the European Championship in Bilbao	33.3	27.75
The passive part of the fight in the second round of the European Championship Bilbao	31.6	26.33
The passive part of the fight in the third round of the European Championship in Bilbao	31	25.80
The mean value of the passive part of the fight at the European Championships in Bilbao	31.9	26.63

The results show that the average values of passive part of the fight at the European Cup in Belgrade and the European Championship in Bilbao in the men's competition are different. Competitors at the European Championships were much more active, i.e. they were passive (inactive)

averagely 31.9 seconds in round one with a duration of 120 seconds (2 minutes). Percentage of 26.63% indicates that they were not exchanging blows with rivals. The contestants who participated in the European Cup in Belgrade were less active and have an average of preparing for an attack or avoiding the fight of half round, 60.33 seconds, or 50.23% of the total duration of the round.

The assumption is that a significant difference in both categories (male and female) in all categories (60 kg, 65 kg, 63.5 kg, 71 kg and 91 kg), which was found in the total number of scoring kicks and total scoring of all hits is in favor of competitors at the European Championship (Bilbao - Spain 2014) compared to the competition from the European Cup (Belgrade 2014 and 2015) is for the following reasons: 1) primarily due to the higher valuation of the foot technique punches as compared to impacts performed using hand techniques, 2) due to better physical fitness of competitors, 3) due to a better level of technical and tactical mastery of fighters so that they can make a large number of hits especially using leg techniques (which, technically speaking, are more complex).

The difference compared to the higher activity during the fight at the European Championships in men and in women categories, is likely due to the result of better physical fitness for active work in high intensity. Competitors of the European Championships, due to a higher quality level of the competition, probably were more and better prepared in the training process. It must also be noted that the criterion for participation in the European Championship is stricter than the competition system of the European Cup, so that the collected data could a result of differences of absolute quality of the competitors (bearing in mind the fact that for this study only fights in finals were taken into consideration).

CONCLUSION

This study presents the results of the analysis of competitive activities of top kick boxers at the regional international competitions – the European Cup in Belgrade in 2014 and 2015, as well as at the European Championship in Bilbao in 2015. The results were analyzed in the same categories (63.5, 71, and 91 kg for males and 60 and 65 kg for women). 10 fights in total were analyzed, five in the European Cup and five in the European Championship in Bilbao. Data collection was performed by the technique of observation and was conducted on the basis of video recordings of entire fights (matches). We analyzed the following elements: the number of hits performed by hand techniques, the number of kicks and passivity during combat in the form of preparation or avoiding attacks. Results in the men's division showed a similarity in use of hand and foot techniques. The number of punches at the European Cup was 40.09%, while the number of punches at the European Championship was 38.16% of the total number of hits. The remaining percentages represent kicks at the European Cup 59.04% and 61.83% at the European Championship. However, the number of hitting in the same percentage share is different if we look at it numerically - an average of 7.44 of strikes was done at the European Cup and at the European Championship it was done on an average of 9.83. Similar results were obtained when we look at only foot technique – on average there was 10.71 strokes performed at the European Cup, while at the European Championship on average there was 15.94. The observed relationship between active and passive time in the European Cup was 50.23% of the passive time while the remaining percentage of 49.77% of the time was active. At the European Championships in Bilbao passive time made 26.63%, while the active part was considerably longer than in the case of the European Cup, and it took 73.37%. The ratio of active and passive part in the men's championships in observed matches is a consequence of the number of strokes which have been carried out.

Results in the competition of women showed a similar division of hand and foot techniques. The number of punches at the European Cup was 40.56%, while the number of punches at the European Championship was 40.67% of the total number of hits. Kicks in the European Cup consisted of 59.04%, while at the European Championship it was 59.33% of all strokes. However, the number of hitting in the same percentage category is different if we look at things numerically and an average of 25.6 shots done by hand in the European Cup and the European Championship it was done on an average of 12 punches. Similar results were obtained when we look at only foot technique, an average of 25.9 hits performed in the European Cup and 17:58 at the European Championship on average. The observed relationship between active and passive time in the European Cup was 57.36% in favour of the passive time, while the remaining percentage of 42.64% of the time was active in the round. At the European Championships in Bilbao passive time makes 26.63%, while the active part is

considerably longer than is the case at the European Cup, and makes 73.37%. The ratio of active and passive part in the competition of women in the observed championships is a consequence of the number of strokes which were carried out.

Within both of the competitions observed, there were more kicks made, while the total number of hits is performed at the European Championship, which can be explained by quality of the competition, better preparation of competitors and growing desire for success and winning the European Championship.

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STAVOVI RODITELJA O GLAVNIM BARIJERAMA ZA UKLJUČIVANJE FUDBALA KAO AKTIVNOST ZA DEVOJČICE MLAĐEG ŠKOLSKOG UZRASTA

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UVOD

Fizička aktivnost predstavlja osnovnu potrebu ljudskog organizma. Jedan od najvećih problema današnjice je nedostatak fizičke aktivnosti prouzrokovan ubrzanim tehnološkim razvitkom i njenim uticajem na slobodno vreme kod dece i odraslih. Fizička aktivnost igra važnu ulogu kao prevencija protiv gojaznosti i gojaznih u detinjstvu i adolescenciji, samim tim smanjuje dalji rizik od gojaznosti u odraslom dobu. U pubertetu i periodu adolescencije gojaznost se najčešće javlja zbog seksualnog sazrevanja i smanjenja fizičke aktivnosti.

Većina istraživanja (Fox & Hillsdon, 2007; Pierilainen K. et. al. 2008) usmerena na odnos između fizičke neaktivnosti i gojaznosti, ukazuje na povezanost sedentarnog načina života i mogih bolesti koje se javljaju usled neaktivnosti organizma. Starost, pol, socio-ekonomski status, zanimanje, sve to utiče, pozitivno ili negativno, na motivisanost za fizičku aktivnost. (Department of Health, 2010). Prekomerna nekontrolisana težina i gojaznost predstavljaju veliku opasnost po zdravlje stanovništva velikom broju zemalja. Kao dodatni problem, gojazne osobe pate od socijalne introvertnosti, predrasuda i diskriminacija ne samo javnosti, već i zdravstvenih profesionalaca, (WHO, 2000).

Fizička neaktivnost uz nepravilnu ishranu predstavlja važan faktor rizika za nastanak hroničnih nezaraznih bolesti, a kod školske dece može da utiče i na nepravilan razvoj tela i nastanak deformiteta. U svetu je približno 31% osoba starijih od 15. godina nedovoljno fizički aktivno (WHO 2002). U mnogim zapadnim zemljama, veliki procenat dece i adolescenata ne zadovoljavaju preporuke za količinu dnevne fizičke aktivnosti; osobe koje se bave nekom fizičkom aktivnošću imaju niži nivo telesne masti od onih koji su manje aktivni. (Hills, at. al. 2011).

Fizička aktivnost ima važnu ulogu u rastu, razvoju i zdravljenom stanju mladih; ima pozitivan uticaj na fizičko i psihičko zdravlje.Današnje okruženje nameće nam neaktivni način života koji u mnogome doprinosi gojaznosti. Nevezano za to da li je dete u pitanju ili adolescent, fizička aktivnost doprinosi zdravom načinu života i prevenciji bolesti. (Hills, 2007) Ukoliko se deca već u prvim godinama života navikavaju na fizičku aktivnost, to će imati veliki uticaj sticanje zdrave navike o potrebi za fizičkim aktivnostima što dalje dovodi do poboljšanja zdrvavlja i prevenciju od bolesti i gojaznosti. u današnje vreme se javlja potreba za omogućavanje aktivnog načina života za decu u pokušajima smanjivanja sve veće rasprostranjenosti gojazne dece (Hills, 2007). Fizička aktivnost takođe može značajno doprineti dobrom mentalnom stanju. Učestvovanje u fizičkim aktivnostima povećava mogućnost druženja i stvara osećaj pripadnosti zajednici. (Darren, 2006). Gojaznost i višak kilograma su sve rasprostranjeniji i u naglom porastu kod zemalja bolje ekonomske razvijenosti. Epidemija gojaznosti je postala globalni problemi i sve više je prisutna kod dece predškolskog i osnovnoškolskog uzrasta. . (WHO, 2000).

U različitim studijama koje istražuju fizički nivo aktivnosti između dečaka i devojčica, rezultati pokazuju da su dečaci stalno aktivniji od devojčica (Dumith et al 2010, Trost 2002;. Dencker i Andersen, 2008; Fuchs et al, 1988, Sallis, 2000). Različite studije su pokazale da je znatno veće učešće u fizičkim aktivnostima različitih nivoa intenziteta kod dečaka u odnosu na devojčice (GAO, 2012), značajno veće razlike kako se nivo fizičke aktivnosti povećava (Trost 2002; Fuks et al 1988) . Osnovno školska deca su znatno aktivnija od dece srednjoškolskog i visokoškolskog uzrasta dece (Sallis, 1998, 2000. Trost, 2002; Sherar, Esliger, Bakter-Jones & Tremblai, 2007). Međutim, važnost razlika u ocenama na

nivou razreda nisu u skladu sa najvećim razlikama koje se javljaju između razreda u istraživanju u SAD. (Fuchs et al., 1988). Posmatrane polne razlike u nivou fizičke aktivnosti na početku donošenja odluka, preporučuju ovaj period kao potencijalno važan za intervenciju promocije zdravlja.

Kao jedan od rešenja za ovo smanjenje fizičke aktivnosti kod devojčica može biti uvođenje novih igara i aktivnosti ili popularizaciji postojećih igara koje nisu toliko popularan kod devojaka. Fudbal igra je jedna od najpopularnijih među dečacima u mnogim zemljama (Višnjić, 2011, Ignjatović, 2006:, Gao, 2012).

Učešće u sportskim timskim igrama je najpopularnija aktivnost u aktivnom stanovništvu u svim uzrastima, polu i etničkim grupama (Rusel 2000). Oko 10% učenika učestvuje u samostalnim fizičkim aktivnostima, tako da se kao najbolji način za povećanje nivoa fizičke aktivnosti kod dece treba da budu timske igre i timske aktivnosti. Pregled izveštaja koji istražuju domaće i međunarodne dokaze o fizičkom vaspitanju i sportu u osnovnim i srednjim školama, pokazuje veliku popularnost fudbala u svim delovima sveta. Za decu uzrasta od 7-15 godina, fudbal je najčešća sportska aktivnost (Nilsen, 2011; Ignjatović, 2006). Školske veze sa klubovima su najuticajniji sa fudbalskih klubova (79%). Slično tome, fudbal je veoma popularna aktivnost u toku nastave fizičkog vaspitanja (Ignjatović, 2006), pošto je većina podataka preuzeto iz najnovijih časopsa, istraživački članci pokazuju jasnu razliku između upisa dečaka i devojčica u fudbal. Čak iako se razlika smanjuje, danas 12% mladih igrača su žene, razlika je i dalje značajna. UEFA i različiti stručnjaci najavljuju aktivnije i masovno uključivanje žena u fudbalu (FIFA Online ...). Jedan od misije FIFA i prioriteta za naredne četiri godine je temelj ženskom fudbalu i podsticanje njenog rasta i razvoja. Koncept je jednostavan – da je ženski fudbal postao timski sport i sve devojke i žene mogu da igraju. Ključni faktori za razvijanje su percepcija i dostupnost.

Istraživanje (Zametkin et al, 2004; Levin et al 2001) predlaže da roditeljski stavovi prema fizičkim aktivnostima utiču na stavove dece prema aktivnom učešću u različitim oblicima fizičke aktivnosti. Kako deca rastu mogu izabrati vrstu fizičke aktivnosti i sport koji vole, bez snažnih uticaja roditelja. Ali u ranom uzrastu, roditeljska uloga je važna jer oni deluju kao socijalna podrška svojoj deci i treba da ih ohrabri da učestvuju u nekoj sportskoj aktivnosti (Kastiljo, et al., 1997, Sallis, 1994). Osim toga, u cilju povećavanja nivoa fizičkih aktivnosti i zdravstvenog statusa dece, neophodna je adekvatna podrška roditelja da bi deca obavljala željenu fizičku aktivnost.

METOD

Podaci su prikupljeni putem anonimnog upitnika koji je dobrovoljno završen od strane oca i majke dece u njihovim školama pre roditeljskih sastanaka. Roditelji popunjavaju upitnik, za koji su objašnjeni ciljevi studije i traži se njihova saradnja. Upitnik Likertovog tipa sa skalom od 5 stupnjeva sa odgovorima u rasponu od 1 (Potpuno se slažem) do 5 (potpuno se ne slažem) je razvijen iz ranijih studija (Welton, 2013, Ignjatović 2013) kako bi se utvrdile prepreke koje onemogućavaju da devojčice od 7 - 10 godina učestvuju u fudbalskim utakmicama i šta se može uraditi da se prevaziđu ove prepreke.

Anketiranje je sprovedeno u prostorijama dve osnovne škole u Jagodini (OŠ „Boško Đurić“ i OŠ „17. oktobar“) gde su roditelji devojčica (100 ispitanika). Cilj anketiranja je prikazivanje ličnog mišljenja roditelja devojčica o mogućnostima primene fudbalske igre kod devojčica školskog uzrasta. Pitanja u anketi su organizovana u vidu izjava sa ponuđenim odgovorima.

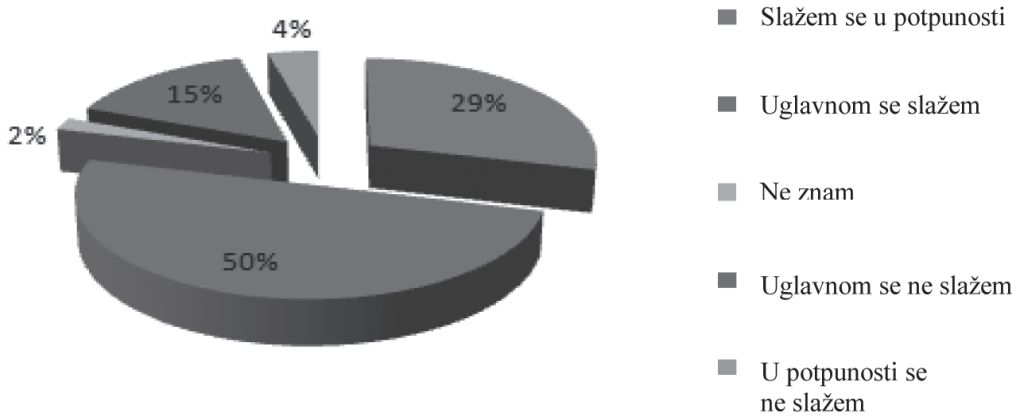
REZULTATI

Kod pitanja: „Da li postoje mnogo adekvatnije aktivnosti za devojčice posmatrano u odnosu na fudbal“ vidimo da se ispitanici slažu da postoje mnogo adekvatnije aktivnosti za devojčice od fudbala, pa se tako 42 njih u potpunosti slaže, a 29 se uglavnom slaže sa ovom pretpostavkom. Njih 18 ne zna odgovor na ovo pitanje, dok se samo 11 njih ne slaže. Onih koji se u potpunosti ne slažu, nema.

Slažem se u potpunosti	*Uglavnom se slažem*	*Ne znam*	*Uglavnom se ne slažem*	*U potpunosti se ne slažem*
42	***29***	***18***	***11***	***0***

Grafik. 1. Da li postoje mnogo adekvatnije aktivnosti za devojčice posmatrano u odnosu na fudbal?

Na pitanje: „Devojčice ne igraju fudbal zato što imaju mišljenje da je ta igra predviđena za dečake“ pokazuje da se 29 ispitanika slaže sa pitanjem da devojčice ne igraju fudbal zašto što one smatraju da je to igra za dečake, međutim 15 ispitanika se ne slažu sa time, dok četvoro ispitanika ne znaju ili su ipak suzdržani.

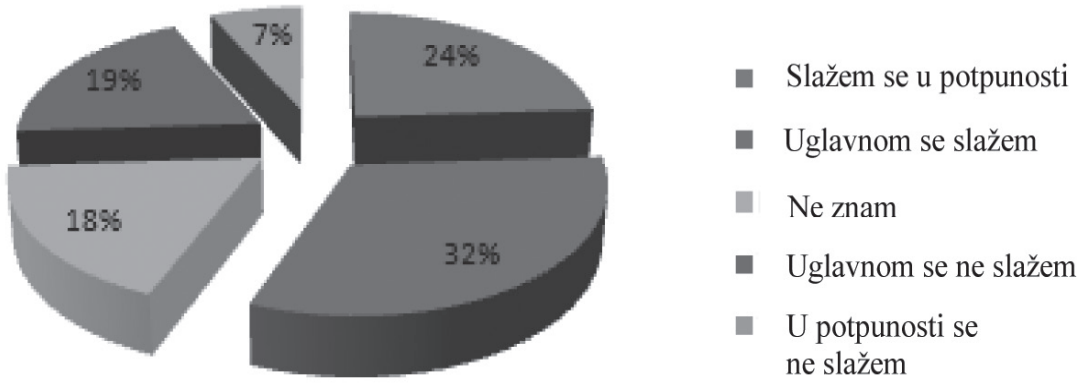


Slažem se u potpunosti	*Uglavnom se slažem*	*Ne znam*	*Uglavnom se ne slažem*	*U potpunosti se ne slažem*
29	*50*	*2*	*15*	*4*

Grafik 2. Devojčice ne igraju fudbal zato što imaju mišljenje da je ta igra predviđena za dečake

Na pitanje: „Igranje fudbala može da izmeni izgled devojčice i njeno ponašanje može biti približnije ponašanju dečaka“ pokazuje da se 56 ispitanika slaže da fudbal može da promeni ponašanje i izgled devojčica i koje će biti slično ponašanju dečaka., međutim 26 ispitanika je reklo da se sa ovim ne slažu, dok se 18 izjasnilo da ne zna. Dakle vidimo da je većina roditelja saglasna sa pitanjem da fudbal može da izmeni ponašanje i izgled devojčica.

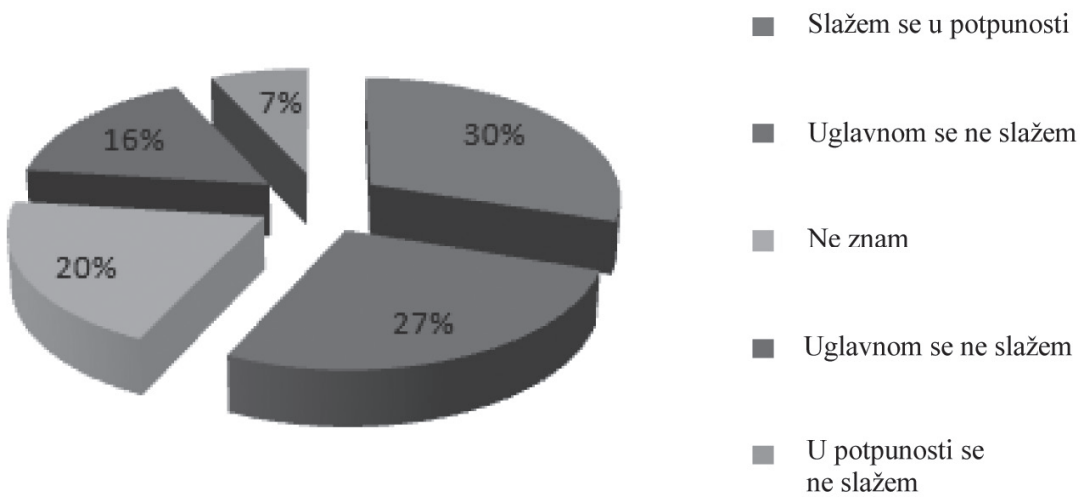
Slažem se u potpunosti	*Uglavnom se slažem*	*Ne znam*	*Uglavnom se ne slažem*	*U potpunosti se ne slažem*
24	*32*	*18*	*19*	*7*



Grafik 3. Igranje fudbala može da izmeni izgled devojčice i njeno ponašanje može biti približnije ponašanju dečaka

Na pitanje: „Devojčice su više spretnije i uspešnije u drugim sportovima nego u fudbalu“ možemo videti da se veći deo ispitanika slaže da su devojčice više spretnije ali i uspešnije u drugim sportovima, ali ima 20 onih koji to ne znaju, 16 njih koji se uglavnom ne slažu i sedmoro njih, koji se u potpunosti ne slažu sa ovim.

Slažem se u potpunosti	*Uglavnom se slažem*	*Ne znam*	*Uglavnom se ne slažem*	*U potpunosti se ne slažem*
30	*27*	*20*	*16*	*7*



Grafik 4. Devojčice su više spretnije i uspešnije u drugim sportovima nego u fudbalu

DISKUSIJA

Visok nivo sedetarnog života u školskom uzrastu kod djevojčica znači da je potrebno da utičemo na mere koje ih podstiču da povećaju svoje učešće u različitim fizičkim aktivnostima. Povećan nivo fizičke aktivnosti mogao bi dovesti do zdravog načina života i angažovanje na dodatne sportske aktivnosti u slobodno vreme.

Osnovni cilj ovog istraživanja je bio da se ispita da li su elementi fudbalske igre mogu biti način za povećanje sportskog učešća kod devojaka. Prethodne studije (Dumith et al 2010, Trost 2002;. Dencker i Andersen, 2008;. Fuchs et al 1988, Sallis, 2000) pokazuju da su muškarci bili znatno aktivniji od žena, a ovo udruženje je još više izraženije naspram umerene aktivnosti. Uprkos povećanoj popularnosti fudbala kod devojka širom sveta, roditeljski odnos prema fudbalu kao aktivnost za svoje ženske dece nije ohrabrujuće.

Nalazi studija, dodatno ukazuju na to da postoji puno prepreka za uključivanje devojčica u fudbalske aktivnosti. Rezultati ovog istraživanja ukazuju da su se više od polovine roditelja složili da fudbal nije najbolji izbor za devojčice. Rezultati takođe pokazuju da je fudbal timska igra koju izbegavaju devojke zbog takmičarskog karaktera koji donosi sa sobom. Većina roditelja (71%) smatra da postoje mnogo pogodnije fizičke aktivnosti za devojčice od fudbala. Među njima 42% u potpunosti se slaže sa konstatacijom da postoje druge mnogo bolje aktivnosti za devojčice. Nijedan roditelj u našem uzorku se ne slaže u potpunosti sa ovom izjavom, što ukazuje na to da roditelji ne smatraju fudbal dobrim izborom fizičke aktivnosti za devojčice.

Literatura pokazuje da stavovi roditelja prema fizičkim aktivnostima imaju uticaj na razvijanje stavova kod njihove dece. Pod ovim okolnostima, od ključnog je značaja uključivanje roditelja u cilju ohrabrivanja devojčica školskog uzrasta za razvijanje aktivnog načina života. Uključenost i bavljenje

roditelja spotskim aktivnostima ima direktan uticaj na nivo fizičke aktivnosti kod dece (Garcia et al 1995; Reverter, 2013). Osim toga, podrška roditelja je podjednako odlučujući faktor u fizičkim i sportskim navikama mladih (Dempsei et al, 1993; Brustad, 1996, Leff i Hoile, 1995) Stav roditelja prema fudbalu kao potencijalnoj aktivnosti za devojčice podstiče mogućnost za masovno učešće.

U zemljama u kojima fudbal ima jaku tradiciju kao što su Španija, fudbal je jedan od najpoželjnijih aktivnosti od strane roditelja (Romero i saradnici, 2009). Većina anketiranih roditelja, njihovo mišljenje o bavljenje fizičkom aktivnošću, složili su se da učestvovanje u sportu i fizičkim aktivnostima povoljno utiče na zdravlje. Iznenađujuće, više od polovine roditelja (52%) koji su učestvovali u našem istraživanju smatra da bi fudbal mogao imati negativne efekte na zdravlje devojčica i njihovo ponašanje. Prema našim saznanjima ne postoje naučne činjenice koje potvrđuju negativne efekte fudbala na fiziološki, psihološki i sociološki status devojaka. Ženski fudbal je jedan od najbrže razvijenih sportova, ali i dalje sa ograničenim naučnim podacima o tome kako igrači reaguju na fizički stres koji nameće fudbalska utakmica kod ženskih subjekata. Pored toga, stručne organizacije preporučuju aktivnosti koje uključuju početni nivo fudbala i bejzbola, plivanje, trčanje, klizanje i gimnastiku. Ostale aktivnosti uključuju ples, vožnju bicikla, borilačke veštine i reketne sportove, kao što je tenis koji odgovaraja za dečake i devojčice uzrasta od 6 do 10 (Purcel, 2005).

Fudbal ili Soccer kako se obično naziva u SAD, ima rast popularnosti u nekim delovima američke populacije. Trenutno preko 3,3 miliona dece uzrasta od 5-19 godina igra fudbal u organizovanim ligama (US Youth Soccer 2011). Ipak, fudbal nije široko popularan u svim oblastima i populacijama. Istraživanja pokazuju da su ljudi imaju više kontakta sa imigrantima imaju pozitivniji pogled na fudbal (Hoffman 2009). Istraživanja su takođe pokazala da stavovi roditelja prema vrstama aktivnosti imaju uticaj na razliku između nivoa aktivnosti kod devojčica i dečaka. Roditelji podstiču sinove da učestvuju u timskim sportovima snažnog i umerenog intenziteta (košarka i fudbal) kao i u individualnim aktivnostima uključujući trčanje, vožnju biciklom, plivanje i klizanje, više nego što ohrabruju svoje kćerke za ovakve aktivnosti. Prema stavovima roditelja, aktivnosti umerenog intenziteta kao što su bejzbol, softbol, odbojka, hodanje, vožnja bicikla oko komšiluka i golf su pogodnije za devojčice. I u Americi još uvek postoji polna pristrasnost za podsticanje dečaka da učestvuju u određenim sportovima i treninzima više od devojčica (Andresen et al., 2009).

Primarni ciljevi učešća za decu uzrasta od 6 do 10 godina je da treba da budu aktivni, zabave se, i da imaju pozitivan sportski doživljaj kroz učenje i praksu osnovnih veština (Gould, 1998). Percepcija roditelja i dece zašto deca vole da se bave sportom je sasvim drugačija. Većina istraživanja ispituje stav roditelja dece koji su ustanovili da je pobeda glavni razlog za ljubav prema nekom sportu (Hedstrom et al 2013; Markel, 2013), u suprotnosti istraživanju koje otkriva da je sportsko zadovoljstvo i zabava glavni razlog zbog kog većina dece želeli da učestvuju u različitim sportskim i fizičkim aktivnostima. Rezultati naših prethodnih studija (Ignjatović i saradnici, 2013, Ignjatović 2015), ispitivanje nastavnika o stavovima u vezi sa fudbalskim učešćem devojaka pokazuje manje negativnih stavova. Samo 20% ispitanih nastavnika veruje da devojke ne treba da učestvuju u fudbalu, dok 77% smatra da fudbal može biti korisna i zdrava aktivnost za devojke.

Kao potencijalni razlog da roditelji veruju da fudbal nije bezbedan za devojke su podaci koji pokazuju da dečaci imaju tendenciju da se izdrže mnogo više organizovanih sportskih povreda i više teških povreda od devojaka (Viliams i sar, 1998; DeHaven & Lintner, 1986), i momci uglavnom igraju fudbal. Najčešće povrede (prelomi i iščašenja, uganuća i istegnuća, otvorene rane i modrice) se dešavaju u biciklizmu, košarci i aktivnostima na igralištu. Procenti povreda nastali tokom fudbala nisu preporuka, i da je ovo jedan od najvažnijih i najrizičnijih aktivnosti za dečake i devojčice (Dishman et al. 2012). Postoji malo veća povreda kod žena sportista koji učestvuju u fudbalu i košarci u odnosu na muškarce. Stopa povreda kod žena izraženih kao procenat sportista razlikuju se od dečaka samo po povredama ligamenata kolena (Dishman i saradnici, 2012). Međutim, ovi podaci o stopama povreda još uvek su retki ili neuverljivi i ne mogu da se odnose na osnovnu školu ili na konkurentnu aktivnost.

ZAKLJUČAK

Roditelji devojčica osnovnoškolskog uzrasta su najveći protivnici fudbalu kod devojčica, u odnosu na nastavnike, studente sa fakulteta, kao i na samu decu. Većina ispitanika smatra da bi fudbal imao negativne efekte po zdravlje, negativne socijalne efekte i negativan razvoj karaktera. Brojne studije pružaju podršku za posebno pozitivnim efektima fudbala, što znači da su pozitivni aspekti ličnom razvoju među mladima, kao što su samopouzdanje, cilj postavljanja, i vođstva (Gould, 1998).

Prema našim saznanjima, još uvek ne postoje naučne činjenice koje potvrđuju negativne efekte fudbala na izgled i ponašanje devojaka. Ženski fudbal je jedan od najbrže razvijenih sportova, ali i dalje sa ograničenim naučnim podacima o tome kako ženski subjekti reaguju na fizički stres tokom fudbalske utakmice. Sa trenutnim trendom smanjivanja aktivnosti kod devojka kako bivaju starije, kao i širenje nejednakosti između fizičke aktivnosti kod dečaka i devojčica, neophodno je pronaći načine da se podrži i popularizuje fizička aktivnost kod devojčica.

Zahvalnost

Rad je deo Projekta „Efekti primenjene fizičke aktivnosti na lokomotorni, metabolički, psihosocijalni i vaspitni status populacije Republike Srbije" pod brojem III47015, kao deo potprojekta „Efekti primenjene fizičke aktivnosti na lokomotorni, metabolički, psihosocijalni i vaspitni status populacije žena Republike Srbije", koji finansira Ministarstvo prosvete i nauke Republike Srbije – Ciklus naučnih projekata 2011–2015.

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PARENTS ATTITUDE TOWARDS MAIN BARRIERS IN GIRL'S FOOTBALL PARTICIPATION ON P.E. CLASSES

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INTRODUCTION

Physical activity is a basic need of the human organism. One of the biggest problems today is the lack of physical activity caused by rapid technological development and its impact on free time for children and adults. Physical activity plays an important role as a prevention against obesity and overweight in childhood and adolescence, therefore further reducing the risk of obesity in adulthood. At puberty and during adolescence obesity is most common for sexual maturation and decreased physical activity.

Sedentary lifestyle as well as many of today's jobs lead to an increase in concerns about physical inactivity. Most studies (Fox & Hillsdon, 2007; Pierilainen et. al. 2008) focused on the relationship between physical inactivity and obesity, suggesting a connection between sedentary lifestyle and many diseases that occur due to the inactivity of the organism. Age, gender, socio-economic status, occupation, all influence, positively or negatively, the motivation for physical activity. (Department of Health, 2010). Excessive uncontrolled weight and obesity are a major threat to public health many countries. As an additional problem, obese people suffering from social introversion, prejudice and discrimination are not only the public but also health care professionals (WHO, 2000).

Physical inactivity with improper diet is an important risk factor for chronic diseases, and in school children can be affected by the abnormal development of body and deformities. In the world, approximately 31% of people over 15 years of insufficiently active (WHO 2002). In many Western countries, a large percentage of children and adolescents do not meet the recommendations for the amount of daily physical activity; persons engaged in any physical activity have lower levels of body fat than those who were less active. (Hills et al., 2011).

Physical activity plays an important role in the growth, development and be healing condition of youth; has a positive effect on physical and mental health. Nowdays environment puts us inactive lifestyle that contributes greatly to obesity. Irrespective of whether the child in question or adolescent, physical activity contributes to healthy lifestyles and disease prevention. (Hills, 2007). If the children in the first years of life are getting used to physical activity, it will have a major impact on the acquisition of healthy habits necessary for physical activities which further leads to improvement health and prevention of disease and obesity. Nowadays there is a need to facilitate an active lifestyle for children in attempts to reduce the growing prevalence of obese children (Hills, 2007). Physical activity can also contribute significantly to the good state of mind. Participation in physical activity increases the possibility of socializing and creates a sense of belonging to a community. (Darren, 2006). Obesity and overweight are increasingly widespread and rapid increase among countries better economic development. The epidemic of obesity has become a global issue and is increasingly present in children of preschool and school age. (WHO, 2000).

In various studies that investigate physical activity levels between boys and girls, the results show that boys are constantly active more than girls (Dumith et al 2010, 2002 ;. Dencker Trost and Andersen, 2008; Fuchs et al, 1988, Sallis, 2000). Various studies have shown that a significantly greater participation in physical activities of different levels of intensity in boys than girls with a significantly greater (GAO, 2012) as the level of physical activity increases (Mechelen Trost et al, 2002; Fuchs et al .. 1988). Primary school children are much more active than children in high school and higher age of children (Sallis, 1998, 2000, Trost, 2002 ,; Sherar, Esliger, Bakter-Jones & Tremblay,

2007). However, the size of the differences in the classroom are not in accordance with the largest differences which occur between lovers grades in research in the United States. (Fuchs et al., 1988). Observed gender differences in physical activity levels at the beginning of decision suggestion that this is potentially an important period for health promotion interventions.

One of the solutions for this decrease in physical activity among girls may be introducing new games and activities, and the popularization of the existing games that are not so popular with the girls. Football game is one of the most popular among boys in many countries (Visnjic, 2011, Ignjatovic, 2006; Gao, 2012).

Participation in sport team games is the most popular activity in the active population in all ages, gender and ethnic groups (Rusel, 2000;). Around 10% of pupils are participating in solo physical activity, so it seems that the best way to increase physical activity level among children are team games and team activity. Summary reports investigating domestic and international evidence on physical education (PE) and sport in primary and secondary schools all showing high popularity of football in all parts of the world. For the children aged 7-15 year, football is the most common sport activity (Nilsen, 2011; Ignjatovic, 2006). The school links with the clubs are most influential with football clubs (79%). Similarly, football is very popular activity during physical education classes (Ignjatovic, 2006).The majority of the data are taken from the most recent PE, Sport Survey and research articles shows clear difference between enrolment of boys and girls in football. Even thou the differences are lowering, today 12% of youth players are females, the difference is still significant. UEFA and different experts propagate the more active and mass inclusion of females in football (FIFA online). One of the FIFA mission and priority for the next four years is a foundation of women's football and encourage its growth and development. The concept is simple – that women's football has arrived as a team sport and all girls and women can play. The key factors to develop are perception and accessibility.

Research (Zametkin et al. 2004; Levine et al. 2001) suggested that parental attitudes toward physical activity affect children's attitudes towards active participation in various forms of physical activity. As children grow they can choose the type of physical activity and sport they like, without strong influence of their parents. But in the early age, parents role is important as they act as the socialising agents of their children and encourage them to take part in some sport activity (Castillo et al., 1997, Sallis, 1994). Furthermore, in order to increase children physical activity level and health its crucial to have the support for desired activities by their parents.

METHOD

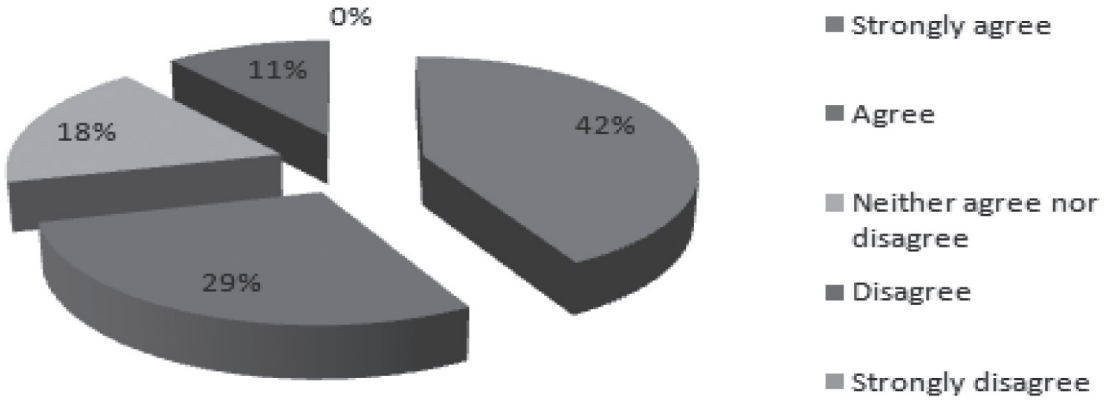
Data were collected through an anonymous questionnaire that was voluntarily conducted by the father and mother of children in their schools a parent-teacher meetings. Parents fill out a questionnaire in which there were explained the objectives of the study and requesting their cooperation. The questionnaire with Likert scale of 5 degrees with responses ranging from 1 (strongly agree) to 5 (strongly disagree) was developed from previous studies (Welton, 2013, Ignjatovic 2013) in order to identify the obstacles that prevent girls age 7 - 10 years to participate in any football matches and what can be done to overcome these obstacles.

The survey was conducted in the premises of two elementary schools in Jagodina (Primary School "Bosko Djuric" and PS "17. oktobar") where the parents of girls (100 respondents). The aim of the survey is to present personal opinions of parents of girls on the implementation of football among girls of school age. The questions in the survey are organized in the form of a statement to be answered.

RESULTS

In the question: "Do you believe that there are many more appropriate activities for girls compared to football" we can see that the respondents agree that there are much more appropriate activity for girls than football, so that 42 of them completely agrees, and 29 generally agrees with this assumption. 18 of them do not know the answer to this question, and only 11 of them disagree. There were no one to strongly disagree.

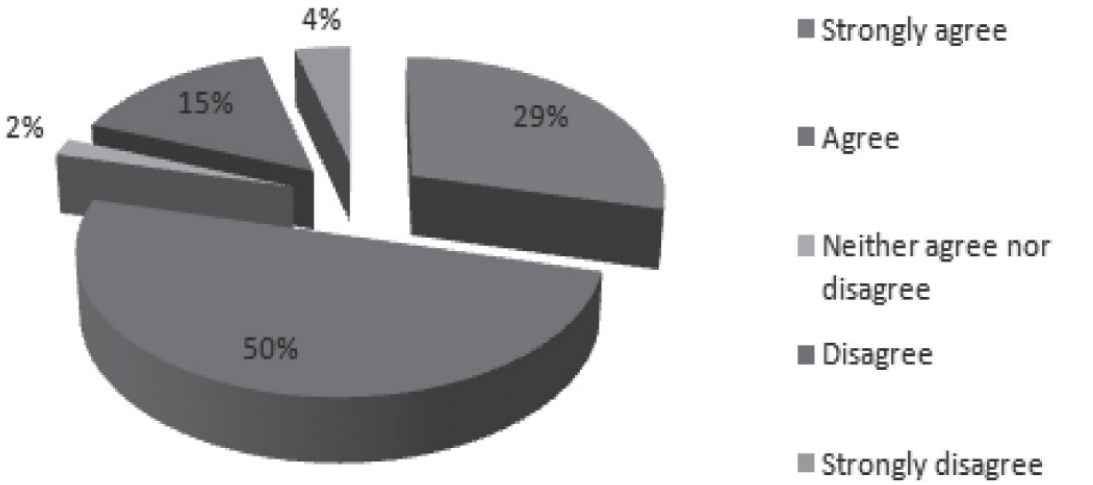
Strongly agree	*Agree*	*Neither agree nor disagree*	*Disagree*	*Strongly disagree*
42	*29*	*18*	*11*	*0*



Graph. 1. Are there many appropriate activities for girls in comparison to football?

The question: "Do you believe that football is game designed for boys" shows that 29 respondents agreed with the question that girls do not play football because they see it's a game for boys, however, 15 respondents disagree with that, while four respondents strongly disagree and two of them neither agree not disagree.

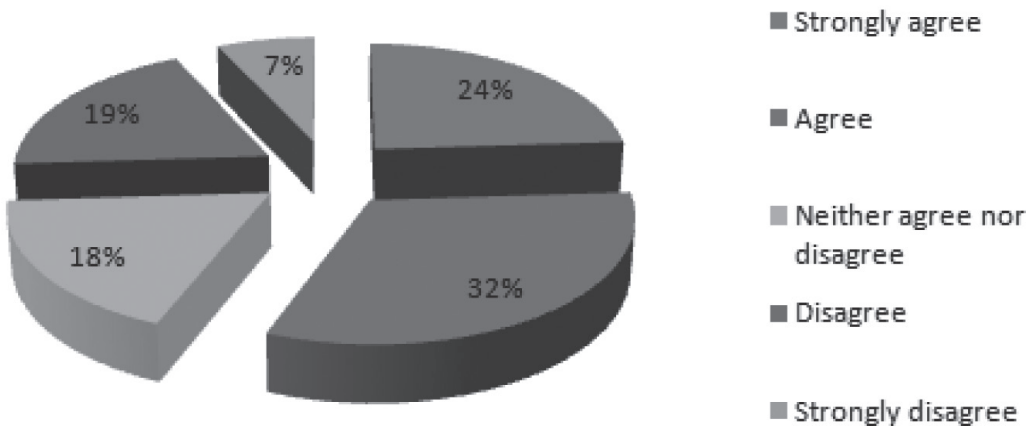
Strongly agree	*Agree*	*Neither agree nor disagree*	*Disagree*	*Strongly disagree*
29	*50*	*2*	*15*	*4*



Graph 2. The girls do not play football because I have an opinion that this game is intended for boys

The question: "Do you believe that playing football can effects on girl's attitudes and behavior" shows that 32 respondents agreed that football can change the behavior and appearance of girls and that will be similar to the behavior of boys. However 24 respondents disagree, while 18 said they neither agree nor disagree. So we see that most parents agree with the question that football can modify the behavior and appearance of girls.

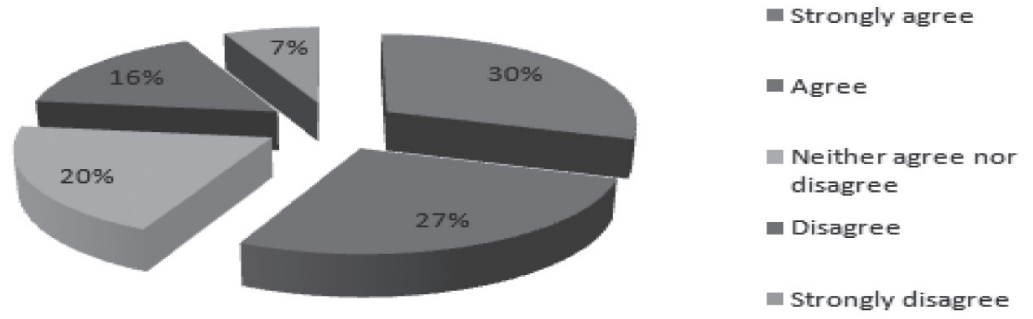
Strongly agree	*Agree*	*Neither agree nor disagree*	*Disagree*	*Strongly disagree*
24	*32*	*18*	*19*	*7*



Graph 3. Playing football can modify the appearance of the girl and her behavior could be closer to the behavior of boys

The question: "Do you believe that girls have more chance for success in other type of physical activities" we can see that the majority of respondents agree that girls are more skilful but also more successful in other sports, but there are 20 people who neither agree nor disagree, 16 of them to be disagree, and seven of them who strongly disagree with this.

Strongly agree	*Agree*	*Neither agree nor disagree*	*Disagree*	*Strongly disagree*
30	*27*	*20*	*16*	*7*



Graph 4. Girls are more resourceful and successful in other sports than football

DISCUSSION

The high level of sedentarism in school-age girls children means that we need to set up measures that encourage them to increase their participation in various physical activities. Increased PA level could lead to healthy lifestyle and incorporation of additional sport activity into their free time.

The main purpose of this study was to examine whether the elements of football game could be a way to increase girls' sport participation. Previous Studies (Dumith et al., 2010, Trost 2002; Dencker and Andersen, 2008; Fuchs et al., 1988, Sallis, 2000) demonstrate that males were significantly more active than females, and this association was even more pronounced in the high

versus moderate activity. Despite, increased popularity of girls football worldwide, parents attitude toward football as activity for their female children is not encouraging.

The findings of current study, further suggesting that a number of barriers are presented against girls participating in football games. The findings from the questionnaire compliment this theme as over half agreed that this football is not best choice for girls. The findings also suggest that football team games are avoided by girls because of the competitive nature they bring with them. Majority of parents (71%) believe that there are much more suitable physical activities for girls than football. Among them 42% strongly agree on the statement that there other much better activities for girls. No single parent completely disagree with this statement, indicating that there are no single parent in our sample that strongly believe that football is proper choice for girls physical activity.

Literature suggests that parental attitudes towards physical activity influence their children's attitude towards physical activity. Under these circumstances, it is crucial to involve parents in any initiative aimed at encouraging their school-age daughters to developed active lifestyles. Parents participations and enrolment in sport activity will directly influence children's level of physical activity (García et al., 1995: Reverter, 2013). Furthermore, direct support from parents are equally determining factors in young people's physical and sporting habits (Dempsey et al., 1993; Brustad, 1996, Leff and Hoyle (1995). The parents attitude towards football as a potential activity for girls undermine the possibility for massive participation.

In the countries where football has strong tradition like Spain, it is one of the most preferred activity by parents (Romero et al., 2009). In majority of parents surveyed, when asked their opinion about physical activity they agreed that participating sport and physical activity is good for your health. Surprisingly, more than half of parents (52%) participating in our research believe that football could have negative effects on girls health and behavior. As far as we know, there are no scientific facts that support negative effects of football on physiological, psychological, and sociological status of girls. Female soccer is one of the fastest growing sports but still with limited scientific data on how players respond to the physical stress imposed by a soccer game in female subjects. Furthermore, expert organizations are recommending activities include entry-level soccer and baseball, swimming, running, skating and gymnastics. Other activities include dancing, riding a bicycle, martial arts and racquet sports, such as tennis appropriate for boys and girls age 6 to 10 (Purcel, 2005).

Football or Soccer as it usually called in US is growing in popularity in some sectors of the American population. Currently over 3.3 million children ages 5–19, currently playing soccer in organized leagues alone (USYouth Soccer 2011). Still, soccer is not widely popular in all areas and populations. Research indicating that people with closer contact with immigrants have more positive view of soccer (Hoffman 2009). Researches also showed that parents' attitudes toward the types of activities have influence on the difference between activity levels between girls and boys. Parents encouraged sons to partake in vigorous- and moderate-intensity team sport (basketball and soccer) and individual activity included running, cycling, swimming and skating more than they encouraged these activities for their daughters. Moderate intensity activities such as baseball/softball, volleyball, walking, biking around the neighborhood and golf are by parents attitude more convenient for girls. There still is gender bias on encouraging boys to participate in certain sports and strenuous activities more than girls (Andresen et al., 2009).

Primal goals of participation for children age 6 to 10 are to be active, have fun, and to have a positive sport experience through learning and practice of fundamental skills (Gould, 1998). The parents and children perception of why their like to play sports is quite different. Majority of research examining parents attitude of their children found that wining is the main reason for liking some sport (Hedstrom et al., 2013; Markel, 2013), contrary to sport satisfaction surveys that are revealing that "having fun" is the main reason that most children like to participate in different sport and physical activities. The results of our previous studies (Ignjatovic et al., 2013, Ignjatovic 2015) examining teachers and girls attitudes regarding girls football participation showing less negative attitudes. Only 20% of examined teachers believe that girls should not participate in football, while, 77% believe that football could be beneficial and healthy activity for the girls.

As a potential reason for parents belief that football is not safe for girls are data suggesting that boys tend to sustain many more organized sports injuries and more severe injuries than girls (Wiliams et al., 1998; DeHaven &.Lintner, 1986), and boys are mainly playing football. Most common injuries (fractures and dislocations, sprains and strains, opened wounds and bruises) occurred during cycling, basketball and playground activity. Percentages of injuries occurred during football are not suggesting that this is one of the riskiest activities for boys and girls (Dishman et al., 2012). There is

slightly higher injury in female collage athletes participating in football and basketball compared to males. Rate of injury in females expressed as a percentage of athletes differ from boys only in knee ligament injuries (Dishman et al., 2012. However, this injury rate data are still sparse or inconclusive and cannot apply to elementary school non-competitive activities.

CONCLUSION

Parent of female elementary school students are the biggest opponent of girls football compared to teachers, students of teachers college, and children themselves. Majority of subjects believe that football could have negative health effects, negative social effects and negative character development. A number of studies provide some support for the positive effects of football in particular, indicating that positively aspects of personal development among youth, such as self-esteem, goal-setting, and leadership (Gould, D). Up to our knowledge there are no scientific facts that support negative effects of football on physiological, psychological, and sociological status of girls. Female soccer is one of the fastest growing sports but still with limited scientific data on how players respond to the physical stress imposed by a soccer game in female subjects. With the current trend of decreasing levels of activity as girls get older, and a widening disparity between girls' and boys' physical activity behavior it is necessary to find ways to promote and popularize physical activity in girls.

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ANKSIOZNOST I TAKMIČARSKO SAMOPOUZDANJE KOD SPORTISTA SA I BEZ INVALIDITETA

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UVOD

Glavna odlika takmičarske situacije je neizvesnost ishoda takmičenja. Činjenica da se takmičenje završava sa samo jednim pobednikom, predstavlja značajan izvor stresa za sve učesnike takmičenja čiji je cilj pobeda. Doživljaj stresa u takmičarskoj situaciji može u manjoj ili većoj meri da izazove anksiozne reakcije kod sportista i da ugrozi emocionalnu stabilnost i samopouzdanje. Anksioznost i samopouzdanje u takmičarskim situacijama bili su predmet mnogih istraživanja u sportskoj psihologiji (Martens, Vealey, & Burton, 1990; Weinberg & Gould, 1999).

Anksioznost se definiše kao strepnja, zabrinutost, napetost, neskladnost, teskoba. U sportu se anksioznost vezuje za situacije izvođenja veštine, a ispoljava se kao posledica konflikta između želje, težnje i potrebe da se postigne cilj, a sa druge strane brige, straha i nelagodnosti da se taj cilj ne može postići i posledice koje donosi nepostizanje tog cilja (Lazarević, 2003). **Spilberger je ukazao na postojanje anksioznosti kao crte li**čnosti **i kao psihičkog stanja (Spielberger, 1966). Stanje anksioznosti je povezano sa prolaznim uzbuđenjem i tenzijom, dok crta anksioznosti ukazuje na trajniju** karakteristiku osobe. Razvijanje anksioznosti kao crte ličnosti zavisi od personalnih dispozicija i sredinskih uticaja i nije prisutna kod svih sportista, dok stanje takmičarske anksioznosti može da postoji u izvesnoj meri kod svih sportista (Elgin, 2000).

Za sportski kontekst posebno su relevantne kognitivna i somatska anksioznost. Kognitivna anksioznost označava anksiozne misli, stalno iščekivanje nepovoljnih ishoda događaja, preveliku brigu o potencijalnim negativnim posledicama, kognitivnu preokupiranost sobom i događajima koji su van domašaja i kontrole osobe. Somatska anksioznost odnosi se na stanje fiziološke tenzije, koje može u različitoj meri da bude prisutno kod svih sportista i ne mora uvek da bude praćeno neprijatnim psihičkim doživljajem (Martens, et al, 1990). Međusobni odnos različitih komponenti anksioznosti i uticaj na sportsko izvođenje nije jednostavan, a istraživanja ne donose jednoznačne rezultate. Opšti zaključak bio bi da kognitivna anksioznost svakako umanjuje učinak sportiste, jer usmerava na iščekivanje poraza. Somatska anksioznost može da doprinese sportskom postignuću, ukoliko nije prisutna kognitivna anksioznost, jer može da pomogne sportisti da postigne i održi optimalan nivo aktivacije (Woodman & Hardy, 2003).

Samopouzdanje se odnosi na verovanje pojedinca da poseduje sposobnosti i veštine neophodne za postizanje uspeha (Vealey & Chase, 2008). Opšti je stav, kako među istraživačima u sportskoj psihologiji, tako i među sportistima i trenerima, da je samopouzdanje jedan od ključnih faktora uspeha i afirmacije u sportu. Za sport je značajno razlikovanje samopouzdanja kao crte ličnosti i samopouzdanja kao stanja. Sportisti koji imaju više samopouzdanja na nivou crte ličnosti, najčešće poseduju više samopouzdanja i u pojedinačnim takmičarskim situacijama (Lazarević, 2003). U sportskoj psihologiji se dugo smatralo da su samopouzdanje i anksioznost lice i naličje istog novčića, ali iako odnos ove dve psihološke varijable nije tako jednostavan, uopšteno govoreći, visoko samopouzdanje i niska anksioznost dovode se vezu sa uspehom u situaciji sportskog postignuća (Weinberg & Gould, 1999; Mladenovic & Trunic, 2014).

U literaturi se često ističe da je uticaj sporta na unapređenje celokupnog psihičkog funkcionisanja osoba sa invaliditetom pozitivan (Mladenović, 2015), kao i da usavršavanjem sportskih kom-

petencija sportisti sa invaliditetom uspešno ovladavaju stresnim situacijama u sportu i unapređuju psihološke veštine (Bačanac, Milićević-Marinković, Kasum, & Marinković, 2014). Istraživanja koja ispituju psihološko stanje sportista sa invaliditetom u situaciji takmičenja su u povoju poslednjih dvadeset godina, a nalazi su vrlo različiti i uglavnom ukazuju da značajnijih razlika u odnosu na sportiste bez invaliditeta nema ili da su razlike u domenu somatske anksioznosti i samopouzdanja (Campbell & Jones, 1997).

Cilj ovog istraživanja bio je da ispita da li u pogledu kognitivne anksioznosti, somatske anksioznosti i takmičarskog samopouzdanja, postoje značajne razlike između sportista sa indvaliditetom i bez invaliditeta. Postavljena je hipoteza da između sportista sa i bez invaliditeta nema značajnih razlika u pogledu ispitivanih varijabli.

METOD

Uzorak

Ispitano je ukupno 70 sportista, 18 sa telesnim invaliditetom i 52 bez invaliditeta. Sportisti sa invaliditetom se u najvećem broju bave atletikom, imaju telesni invaliditet (sa amputacijama i povredama kičme) i članovi su Sportskog saveza za osobe sa invaliditetom Beograda. Sportisti bez invaliditeta su košarkaši i rukometaši nacionalnih reprezentativnih selekcija Srbije. Uzorak je bio ujednačen u odnosu na pol ispitanika. Bilo je 47,1% muškaraca i 52,9% žena. Starost ispitanika je od 14 do 60 godina. Polovina ispitanih ima do 22 godine, dok 80% uzorka čine ispitanici do 30 godina starosti.

Instrument

Kognitivna i somatska anksioznost i takmičarsko samopouzdanje ispitani su primenom upitnika Competitive State Anxiety Inventory II (Martens, Vealey & Burton, 1990). Upitnik se sastoji od tri subskale. Prva subskala meri koliko su sportisti pred nastup na takmičenju zabrinuti za svoje izvođenje, da li sumnjaju u sebe, da li se plaše neuspeha, slabe igre, da neće razočarati važne osobe (kognitivna anksioznost). Druga subsakala meri koliko su kod sportista izraženi simptomi somatske anksioznosti: napetost u telu i stomaku, nervoza, uzrujanost, lupanje srca, znojenje ruku, sušenje grla, vlažne i hladne ruke itd. Treća subskala utvrđuje nivo samopouzdanja i sigurnosti da će nastup biti dobar, da će se postići ciljevi, osloboditi napetosti i prihvatiti izazov. Svaka subskala ima po 9 pitanja. Rezultat po subskalama može se teorijski kretati od minimalnih 9 do maksimalnih 36 poena. Na svako pitanje odgovara se zaokruživanjem jednog od 4 odgovora: 1=uopšte ne; 2=nešto malo; 3=srednje; 4=vrlo mnogo. Viši skorovi su indikator većeg prisustva kognitivne anksioznosti, somatske anksioznosti i samopouzdanja**.**

Statistički postupci

Podaci su obrađeni deskriptivnom statistikom i analizom varijanse (ANOVA) u statističkom programu SPSS, verzija 22.

REZULTATI

Rezultati deskriptivne statistike pokazuju više vrednosti aritmetičke sredine na merama kognitivne i somatske anksioznosti, a niže na takmičarskom samopouzdanju, kod sportista sa invaliditetom u odnosu na sportiste bez invaliditeta (Tabela 1). Vrednosti standardne devijacije ukazuju da među sportistima sa invaliditetom ima više individualnih razlika u pogledu merenih varijabli, nego kod sportista bez invaliditeta. Minimalna vrednost kognitivne i somatske anksioznosti kod oba poduzorka iznosi 9, dok obe grupe ispitanika imaju veće maksimalne vrednosti kognitivne (31) nego somatske (26) anksioznosti. U slučaju takmičarskog samopouzdanja, najniža pojedinačna vrednost je 18, a maksimalna pojedinačna vrednost iznosi 36 (Tabela 1).

Table 1. Rezultati deskriptivne statistike: M, SD, minimalne i maksimalne vrednosti kognitivne anksioznosti, somatske anksiozonosti i samopouzdanja kod sportista sa invaliditetom (N_1=18) i sportista bez invaliditeta (N_2=52)

		M	*SD*	*Min*	*Max*
Kognitivna anksioznost	N1	18,61	5,97	9,00	29,00
	N2	14,58	4,86	9,00	31,00
	Total	15,61	5,42	9,00	31,00
Somatska anksioznost	N1	16,78	4,72	9,00	24,00
	N2	14,58	4,64	9,00	26,00
	Total	15,14	4,73	9,00	26,00
Samopouzdanje	N1	27,33	5,32	19,00	36,00
	N2	30,16	4,30	18,00	36,00
	Total	29,42	4,72	18,00	36,00

Rezultati analize varijanse (ANOVA) prikazani su u Tabeli 2 i pokazuju da se sportisti sa invaliditetom i sportisti bez invaliditeta razlikuju u pogledu kognitivne anksioznosti, *F=8,180, df=1, p<0,01* i takmičarskog samopouzdanja, *F=5,05, df=1, p<0,05*, dok u odnosu na nivo somatske anksioznosti značajnih razlika nema, *F=2,984, df=1, p>0,05*.

Table 2. Rezultati analize varijanse (ANOVA) za kognitivnu anksioznost, somatsku anksioznost i samopouzdanje, kod sportista sa invaliditetom (N_1=18) i sportista bez invaliditeta (N_2=52)

		Sum of Squares	*df*	Mean Square	*F*	*p*
Kognitivna anksioznost	Između grupa	217,62	1	217,62	8,18	,006
	Unutar grupa	1808,97	68	26,60		
	Ukupno	2026,59	69			
Somatska anksioznost	Između grupa	64,77	1	64,77	2,98	,089
	Unutar grupa	1475,80	68	21,70		
	Ukupno	1540,57	69			
Samopouzdanje	Između grupa	106,07	1	106,07	5,05	,028
	Unutar grupa	1406,74	67	20,99		
	Ukupno	1512,81	68			

DISKUSIJA

Subjektivni doživljaj stresa u situaciji takmičenja zavisi od nivoa i vrste takmičarske situacije i u psihološkoj literaturi se navodi da će sportisti koji se takmiče na višem nivou takmičenja verovatnije doživeti anksiozna stanja. Kompetetivnost situacije može i najuspešnije i emocionalno najstabilnije sportiste da isprovocira da osete nervozu, strah od neuspeha, pad samopouzdanja i anksioznost (Moran, 2004). Psihološka istraživanja takođe pokazuju da doživljaj i vrsta anksioznosti u takmičarskoj situaciji zavisi i od percepcije sportista. Istu takmičarsku situaciju neki sportisti mogu da opaze kao facilitirajuću, dok kod drugih može da isprovocira anksiozne reakcije i defanzivne strategije (Ntoumanis & Biddle, 2000). Kako će sportista opažati konkretnu situaciju zavisi od strukture ličnosti i psihološke pripremljenosti za takmičarsku situaciju.

Poslednjih decenija sport osoba sa invaliditetom promenio se na organizacionom nivou (Kasum, 2015; Misener & Darcy, 2013), pa se i sportisti sa invaliditetom sve češće suočavaju sa stresnim

zahtevima takmičarskog sporta na različitim nivoima. Istraživanja uglavnom pokazuju da između sportista sa i bez invaliditeta značajnih razlika u psihološkom profilu pred takmičenje nema (Bačanac et al, 2014). U jednom istraživanju ispitivana je anksioznost i takmičarsko samopouzdanje kod vrhunskih sportista u invalidskim kolicima (Campbell & Jones, 1997). Pokazalo se da sportisti u invalidskim kolicima pokazuju slične simptome predtakmičarske anksioznosti, kao i sportisti iz kontrolnog uzorka, ali da izvesnih razlika ima u pogledu intenziteta subjektivnog doživljaja somatskih simptoma i izvesnog pada samopouzdanja neposredno pred početak takmičenja. Autori tog istraživanja doveli su u pitanje rezultate u pogledu somatske anksioznosti, jer su sportisti u invalidskim kolicima imali oštećenja kičmene moždine, što im je onemogućavalo da u potpunosti dožive reakcije autonomnog nervnog sistema koje su saopštavali da imaju. Campbell i Jones (1997) su zaključili da je doživljaj somatske anksioznosti u ovom slučaju više deo mentalne pripreme za realnu situaciju, koji uključuje imaginaciju predstojećih situacija i izazivanje senzacija koje treba osetiti, nego stvarni porast somatske komponente anksioznosti.

Jedno drugo istraživanje takmičarske anksioznosti i samopouzdanja sprovedeno na sportistima koji su učestvovali na olimpijskim i paraolimpijskim igrama, pokazalo je da značajnih razlika u pogledu predtakmičarske anksioznosti nema, ali da ima značajnih razlika u pogledu takmičarskog samopouzdanja, u korist učesnika olimpijskih igara (Ferreira, Chatzisarantis, Gaspar & Campos, 2007).

Takmičarska anksioznost, posebno kognitivna komponenta anksioznosti, pokazalo se da je povezana sa grupnom kohezijom, pa tako sportisti iz timskih sportova imaju manje šanse da osete simptome anksioznosti u takmičarskim situacijama. Istraživanja pokazuju da je visoka timska kohezija pozivitno povezana sa samopouzdanjem u takmičarskoj situaciji, samopoštovanjem, dobrim opštim raspoloženjem, efikasnošću i prihvatanjem odgovornosti u takmičarskoj situaciji (Borrego, Cid & Silva, 2012). Slične nalaze donosi i istraživanje sprovedeno na deci osnovno školskog uzrasta. Pokazalo se da su deca koja su uključena u individualne sportove sklonija da razvijanju socijalnu anksioznost nego deca koja se bave timskim sportovima (Schumacher-Dimech & Seiler, 2010).

U ovom istraživanju pokazalo se da sportisti sa invaliditetom statistički značajno više poseduju kognitivnu anksioznost i imaju manje takmičarskog samopouzdanja, nego sportisti iz kontrolnog uzorka. U pogledu somatske anksioznosti, naše istraživanje pokazalo je da razlika između sportista sa invaliditetom i bez invaliditeta, nema. Treba imati u vidu da se naši ispitanici, sportisti sa invaliditetom, u najvećem procentu bave atletikom, dok je kontrolni uzorak iz timskih sportova. Pa tako, vrsta sporta može biti važna varijabla, koja nije uzeta u obzir, a možda je uticala na razlike u pogledu kognitivne anksioznosti između sportista sa invaliditetom i bez invaliditeta.

Rezultati dobijeni u ovom istraživanju pridružuju se, s jedne strane, korpusu istraživanja koja ukazuju na značajne razlike u samopouzdanju u situaciji takmičenja, kod sportista sa invaliditetom i sportista bez invaliditeta. S druge strane, ovo istraživanje ukazuje na značaj koji simptomi kognitivne anksioznosti mogu da imaju kod sportista sa invaliditetom u takmičarskim situacijama. Moguće je da kognitivna komponenta anksioznosti postaje naglašenija kako se tokom poslednjih par decenija institucionalizuju takmičenja za sportiste sa invaliditetom, pa iščekivanje pobede i preokupiranost brigom da li će se ostvariti postavljeni cilj, izrastaju kao sve aktuelniji psihološki fenomen među sportistima sa invaliditetom. Faktore koji utiču na pojavu anksioznosti i pad samopouzdanja u takmičarskim situacijama, kod sportista sa invaliditetom, treba tražiti među personalnim varijablama, a ne samo u karakteristikama takmičarskih situacija i nivoa takmičenja. Istraživanja uglavnom potvrđuju i promovišu bavljenje sportom kao sredstvo za unapređenje celokupnog personalnog funkcionisanja osoba sa invaliditetom (Martin, 2011; Scarpa, 2011). Kada se porede osobe sa invaliditetom, koje se kontinuirano bave fizičkim aktivnostima i sportom, sa osobama sa invaliditetom koje ne praktikuju sportske aktivnosti, istraživanja potvrđuju da efikasnost u sportskim aktivnostima značajno uvećava samopoštovanje, pozitivno se odražava na celokupnu samopercepciju osoba sa invaliditetom, jača ego snage i emocionalnu stabilnost i konstruktivan pristup rešavanju problema (Martin, Eklund, & Adams-Mushett, 1997; Martin & Gill, 1991; Goodwin, Krohn & Kuhnle, 2004; Gaskina, Andersen & Morris, 2009; Kasum, Lazarević, Jakovljević & Bačanac, 2011). Međutim, treba imati u vidu da sportski teren tokom takmičenja može da bude ”klizav” za razvoj samopoštovanja, samopouzdanja i prevladavanja anksioznih reakcija, pa je važno jačanje svih personalnih potencijala, koji bi mogli da deluju ‘’preventivno” na eliminisanje kognitivne anksioznosti i jačanje samopouzdanja.

Prema nekim istraživanjima, važnu ulogu u predviđanju anksioznih reakcija u takmičarskim situacijama, pored samopoštovanja, ima i motivacija. Pokazalo se da su nisko samopoštovanje i nemotivisanost (Deci & Ryan, 2000; Mladenović, 2010) od prediktivnog značaja za pojavu stanja anksioznosti u takmičarskoj situaciji (Kolayis, 2012). Razvijanjem i jačanjem intrinzičkih motiva, podsticao

bi se unutrašnji lokus kontrole, što je jedan od preventivnih načina delovanja protiv kognitivne anksioznosti. Kada sportista nauči da detektuje šta je u situaciji takmičenja pod njegovom kontrolom, a šta nije, može da restrukturiše i odbaci kognitivne misli.

Pored toga, za optimalno psihološko funkcionisanja sportista sa invaliditetom, pa samim tim i konstruktivno razmišljanje o situaciji takmičenja, od velikog značaja je integracija invalidnosti u lični identitet. U kontekstu razmatranja odnosa sporta, invaliditeta i identiteta u literaturi se navode tri diskursa (Smith, 2015). U prvom, dominira sportski identitet. Sportista opisuje sebe isključivo kroz samoopise vezane za svoju ulogu u sportu. U samoopisu postoje samo reči koje opisuju osobu kao sportistu, ne kao muškarca ili ženu, osobu određene starosti, već samo kao sportistu, koji trenira naporno i čini sve što je potrebno da bi ostvario postignuće u sportu. To je samoopis šampiona. Drugi diskurs odnosi se na identitet koji u prvom planu sadrži činjenicu da je osoba prvo sportista, pa potom invalid. Treći diskurs, ukazuje na samopopis u kojem je u prvom planu invalidnost, pa tek potom druga obeležja (sportista, osoba). Istraživanja pokazuju da ukoliko sportista nije na psihološkom planu prihvatio invalidnost i ugradio je u realnu sliku o sebi, može u mnogim situacijama da ima netačnu percepciju svojih mogućnosti i okolnosti na koje tokom treninga i takmičenja ima ili nema uticaja (Martin, 2011). Istraživanja koja su se bavila pitanjem takmičarske anksioznosti i samopouzdanja kod sportista sa invaliditetom, ukazuju na mogući značaj motivacije, vrste sporta i nivoa takmičenja, odnosa sportiste prema invaliditetu i intergisanost invaliditeta u lični identitet sportiste.

Na praktičnom planu, neophodno je posvetiti pažnju psihološkoj pripremi sportista sa invaliditetom, kojoj se kod nas kao i u drugim zemljama, poklanja malo ili nimalo pažnje. Istraživanja ukazuju na značaj psihološke pripreme sportista sa invaliditetom i važnost razvoja pozitivnih psiholoških veština i koping mehanizama (Bačanac et al, 2014; Shin, Park & Kim, 2012).

ZAKLJUČAK

Istraživanja takmičarske anksioznosti i samopouzdanja, kod sportista sa invaliditetom, uglavnom jednoznačno ukazuju na značaj variranja samopouzdanja u takmičarskim situacijama. Postoje nalazi koji upućuju i na razlike u pogledu somatske anksioznosti, između sportista sa i bez invaliditeta.

Ovo istraživanje pokazalo je da sportisti sa invaliditetom poseduju statistički značajno viši nivo kognitivne anksioznosti i manje samopouzdanja, nego sportisti bez invaliditeta, dok razlika u pogledu somatske anksioznosti nema. S obzirom na relativno mali broj ispitanih sportista sa invaliditetom u ovom istraživanju, kao i da su iz individualnog sporta, ostaje nejasno da li se dobijene razlike mogu pripisati vrsti sporta kojim se bave ispitanici sa invaliditetom, ili je reč o drugim faktorima iz domena psihološkog profila. Pored vrste sporta i nivoa takmičenja, mogući psihološki faktori koje treba ispitati u budućim istraživanjima, su self-koncept koji (ne)integriše invalidnost, motivacija, samopoštovanje, koping strategije. Rezultati ovog istraživanja sugerišu da buduća istraživanja treba da ispitaju faktore koji mogu da se predvide i utiču na pojavu kognitivne anksioznosti kod sportista sa invaliditetom.

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ANXIETY AND COMPETITIVE SELF-CONFIDENCE WITHIN ATHLETES WITH AND WITHOUT DISABILITY

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INTRODUCTION

Main characteristic of the competitive condition is uncertainty of final outcome. The fact that competition ends with only one winner presents significant stress source for the competition participants who want to win. Stress experience in the competition condition may provoke reaction of anxiety within athletes and endanger their emotional stability and self-confidence. Anxiety and self-confidence under the competitive condition were subject of many studies in Sport Psychology (Martens, Vealey, & Burton, 1990; Weinberg & Gould, 1999).

Anxiety is defined as inner turmoil, worry, tense, clumsiness, uneasiness of mind. In the sport anxiety is related to performing skills situations and it is caused by confict of desire, ambition and need to achieve the aim on one side and on the other side by worry, fear and inner turmoil of failure and consequences of the failure (Lazarevic, 2003).

Spilberger implied concept of trait and state anxiety (Spielberg, 1966). State anxiety is related to temporary restlessness and tension, while trait anxiety is general propensity to be anxious. Development of anxiety as a trait depends on personal dispositions and person`s bringing up social environment and it does not exist within all athletes, while state of competitive anxiety can exist in certain measure within all athletes (Elgin, 2000).

In the context of sport the most relevant are somatic and cognitive anxiety. Cognitive anxiety presents anxious thoughts, constant expectation of unfavorable outcome, excessive worry of potential failure, cognitive preoccupation with oneself and events that are out of reach and control of a person. Somatic anxiety is related to the state of physical tension that can exist within all athletes and it is not necessary followed by unpleasant psychological experience (Martens, Vealey, & Burton, 1990). Mutual relation of the different anxiety components and impact on sport performace is not simple and studies don`t bring unambiguous results. General conclusion would be that cognitive anxiety for certain diminishes athlet`s results as it directs to failure expectation. Somatic anxiety can contribute competitive results, if there is no presence of cognitive anxiety, because it can help an athlete to achieve and maintain optimal activation level (Woodman & Hardy, 2003).

Self confidence is related to an indiviual`s belief that he has necessary abilities and skills to achieve success (Vealey & Chase, 2008). General opinion, among researchers in sport psychology and among athletes and couches is that self-confidence is one of the key factors of success and afirmation in the sport. For self-confidence is necessary to distinguish self-conficence as part of one`s personal characteristic and on the other side a state of self-confidence. Athlets that have more self-confidence as a part of their character most likely have more self-confidence and in the individual competitive situations (Lazarević, 2003).

In sport psychology it was long believed that self-confidence and axiety are front and back of the same coin, still even if the relation of these two psychological variables is so simple, generally speaking, high self-confidence and law anxiety are related to the success in the situation of sport achievment (Weinberg & Gould, 1999; Mladenovic & Trunic, 2014).

In the literature it is often highlighted that sport influence on total psychological functioning within the persons with disability is positive (Mladenović, 2015), as well as that with improvement of sport`s competences athletes with disability successfully overcome stressful situations in the sport and improve psychological skills (Bačanac, Milićević-Marinković, Kasum, & Marinković, 2014). Studies analysing psychological state of athletes with disabilities in situation of competition are still on its beginning, in late twenty years, and findings are different and mainly indicate that there are no significant difference when comparing athletes without disabilities or that there are differences related to somatic anxiety and self-confidence (Campbell & Jones, 1997).

The aim of this study was to examine whether in terms of cognitive anxiety, somatic anxiety and competitive self-confidence there are significant differences between athletes with and without disabilities with hypothesis that there are no significant differences between athletes with and without disabilities.

METHOD

Sample

A total of 70 athletes were examined, 18 with physical disabilities and 52 without a disability. Athletes with disabilities are mostly engaged in athletics, they have physical disability (amputees and spinal injuries) and are members of the Sports Federation for Persons with Disabilities Belgrade. Athletes without disabilities are basketball and handball national teams. The sample was balanced with respect to gender. There were 47.1% of men and 52.9% women. Age of participants were from 14 to 60. Half of the participants up to 22 years, while 80% of participants were under 30.

Instruments

Cognitive and somatic anxiety and competitive self-confidence are examined by using Competitive State Anxiety Inventory II questionnaire (Martens, Vealey & Burton, 1990). The questionnaire consists of three subscales. The first subscale measures how much the athletes concerned for their performance before participate at the event, whether they doubt themselves, are they afraid of failure, poor game and that they will not disappoint the important persons (cognitive anxiety). The second subsale measures how much are expressed somatic symptoms of anxiety among athletes: the tension in the body and stomach, nervousness, agitation, palpitations, hands sweating, dry throat, wet and cold hands, etc. The third subscale determines the level of self-confidence and assurance in good performance and that the goals will be achieved which relieved tension and the challenge. Each subscale has 9 questions per issue. Results per subscales can theoretically range from MIN 9 to MAX 36 points. Each question is answered by circling one of 4 replies 1 = not at all; 2 = slightly; 3 = average; 4 = very much. Higher scores are an indicator of the higher presence of cognitive anxiety, somatic anxiety and self-confidence.

Statistic methods

Data were processed by descriptive statistics and analysis of variance (ANOVA) in the statistical program SPSS, version 22.

RESULTS

Results of descriptive statistics show higher values of arithmetic mean on measures of cognitive and somatic anxiety, and low competitive self-confidence with athletes with disabilities in comparison with athletes without disabilities (see Table 1). Values of standard deviation indicates that among athletes with disabilities has more individual differences in terms of the measured variables, than among athletes without disabilities. The minimum value of cognitive and somatic anxiety in both subsamples is 9, while both groups have higher maximum value of cognitive (31) than the somatic (26) anxiety. In the case of competitive self-confidence, the lowest individual value is 18, and the highest individual value is 36 (Table 1).

Table 1. Results of descriptive statistics: M, SD, MIN and MAX values of cognitive anxiety, somatic anxiety and self- confidence within athletes with disabilities (N1 = 18) and athletes without disabilities (N2 = 52)

		M	*SD*	*Min*	*Max*
Cognitive anxiety	N1	18,61	5,97	9,00	29,00
	N2	14,58	4,86	9,00	31,00
	Total	15,61	5,42	9,00	31,00
Somatic anxiety	N1	16,78	4,72	9,00	24,00
	N2	14,58	4,64	9,00	26,00
	Total	15,14	4,73	9,00	26,00
Self-confidence	N1	27,33	5,32	19,00	36,00
	N2	30,16	4,30	18,00	36,00
	Total	29,42	4,72	18,00	36,00

Analysis of variance (ANOVA) presented in Table 2 show that athletes with disabilities and athletes without disabilities differ in terms of cognitive anxiety, *F=8,180, df=1, p<0,01,* and competitive self-confidence, *F=5,05, df=1, p<0,05*, while in comparison with the level of somatic anxiety there are no significant differences *F=2,984, df=1, p>0,05*.

Table 2. Results of analysis of variance (ANOVA) for cognitive anxiety, somatic anxiety and self-confidence in athletes with disabilities (N1 = 18) and athletes without disabilities (N2 = 52)

		Sum of Squares	*df*	Mean Square	*F*	*p*
Cognitive anxiety	Between Groups	217,62	1	217,62	8,18	,006
	Within Groups	1808,97	68	26,60		
	Total	2026,59	69			
Somatic anxiety	Between Groups	64,77	1	64,77	2,98	,089
	Within Groups	1475,80	68	21,70		
	Total	1540,57	69			
Self-confidence	Between Groups	106,07	1	106,07	5,05	,028
	Within Groups	1406,74	67	20,99		

DISCUSSION

The subjective stress experience in the competitive situation depends on the level and type of competitive situations and it is stated in the psychological literature that athletes who compete at the higher competition level will likely experience anxiety. Competitiveness of the situation can provoke the most successful and the most emotionally stable athletes to feel anxiety, fear of failure, the decline in self-confidence and anxiety (Moran, 2004). Psychological studies also show that experience and kind of anxiety in the competitive situation depend on the athlete`s perception. The same competitive situation may be perceive as in facilitating, while in others it may provoke anxious reactions and defensive strategies (Ntoumanis & Biddle, 2000). How will the athletes perceive concrete situation depends on one`s psychological structure and readiness for the competitive situation.

In recent decades, sport of the persons with disabilities changed at the organizational level (Kasum, 2015; Misener & Darcy, 2013), so the athletes with disabilities are more often faced with stressful demands of competitive sports at different levels.

Studies generally show that there are no significant differences between athletes with and without disabilities in psychological profile before the competition (Bačanac et al, 2014). In one study, the anxiety and competitive self-confidence within elite athletes in wheelchairs (Campbell & Jones, 1997). The study showed that athletes in wheelchairs show similar symptoms of pre-competitive anxiety, as well as athletes from the tested sample, still there are some differences in the subjective perception intensity of somatic symptoms and some low self-confidence right before the start of competition. The authors of this study have challenged the results in terms of somatic anxiety, because the athletes in the wheelchairs had a spinal cord injury, which made it impossible to fully experience of the autonomic nervous system reaction that have announced, they have. Campbell and Jones concluded that in this case the experience of somatic anxiety is more part of the mental preparation for the real situation, which includes the imagination of the upcoming situation and causing a sensation to feel, than the real increase of somatic anxiety component (Campbell & Jones, 1997).

Another study of competitive anxiety and self-confidence carried out on the athletes who took part in the Olympic and Paralympic Games, showed that there are no significant differences in terms of pre-competitive anxiety, still that there are significant differences in terms of competitive self-confidence, to the benefit of the participants of the Olympic Games (Ferreira, Chatzisarantis, Gaspar, & Campos, 2007).

It is showed that competitive anxiety, particularly the cognitive component of anxiety, is connected to the group cohesion, so the athletes from team sports have less chances to experience symptoms of anxiety in competitive situations. The study shows that high team cohesion have positively linked with self-confidence in the competitive situation, self-esteem, good general mood, efficiency and responsibility acceptance in the competitive situation (Borrego, Cid & Silva, 2012). Similar findings were reported in the study carried out on elementary school children. It showed that children who are engaged in individual sports are more likely to develop social anxiety than children who are engaged in team sports (Schumacher Dimech & Seiler, 2010).

This study showed that athletes with disabilities have significantly higher cognitive anxiety and lower competitive self-confidence than athletes of the tested sample. In terms of somatic anxiety, our study showed that there are no difference between athletes with disabilities and without disabilities. We should have in mind that our participants, athletes with disabilities are mostly engaged in athletics, while the control sample was from the team sports. Thereby, type of sport can be an important variable and it has not been considered here and perhaps it influenced the differences in terms of cognitive anxiety among athletes with disabilities and without disabilities.

The results obtained in this study, on one hand, associate with the corpus of studies that indicate significant differences in self-confidence in the competitive within athletes with disabilities and athletes without disabilities. On the other hand, this study indicates the importance of the cognitive symptoms of anxiety which an athlete with disabilities can have in the competitive situations. It is possible that the cognitive component of anxiety becomes more highlighted by institutionalization of competitions athletes with disabilities over the last few decades, thereby the expectation of victory and preoccupation with worry if the one will achieve the set goal, grow as more and more actual psychological phenomenon among athletes with disabilities. Factors that impact the anxiety occurrence and decrease self-confidence in the competitive situations within athletes with disabilities, should be sought among personality variables and not only in the characteristics of the competitive situation s and the level of the competition. Studies tend to support and promote the practice of sport as a mean of overall personal functioning improvement of persons with disabilities (Martin, 2011; Scarpa, 2011). When comparing people with disabilities, who are continuously engaged in physical activities and sports, with people with disabilities who do not practice sports activities, study confirms that efficiency in sports activities significantly increased self-confidence, positive effect on the overall self-perception of people with disabilities, powering up one`s ego, emotional stability and a constructive approach to problem solving (Martin, Eklund, & Adams-Mushett, 1997; Martin & Gill, 1991; Goodwin, Krohn, & Kuhn, 2004; Gaskin, Andersen & Morris, 2009; Kasum i Lazarevic, Jakovljevic, & Interconnection, 2011). However, it should kept in mind that the field during the competition can be a ''slippery" for the development of self-esteem, self-confidence and overcoming anxiety reaction, so it is important to strengthen all the personnel potential, which could act ''preventively" to eliminate cognitive anxiety and to build self-confidence.

According to some studies, an important role in predicting anxiety reactions in the competitive situations is not only one`s self-esteem, but also one`s motivation. It was shown that low self-esteem

and lack of motivation (Deci & Ryan, 2000; Mladenovic, 2010) is of the predictive value for the occurrence of the state of anxiety in the competitive situations (Kolayis, 2012). By developing and strengthening the intrinsic motives will abet internal control locus, which is one of the preventive way against cognitive anxiety. When athletes learn to detect what is and what is not in the competitive situation under his control, he can restructure and dismiss cognitive thoughts. In addition to that, for optimal psychological functioning of athletes with disabilities, and therefore constructive thinking about the competitive situation, the integration of disability in personal identity is of great importance. In the context of the sport, disability and identity literature states three discourses (Smith, 2015). In the first, sports identity dominates. Athlete describes solely through self-description related to his/her self role in the sport. In the self-description there are only words for the person as an athlete, not as a man or a woman, a person of certain age, but only as an athlete who trains hard and does everything necessary to fulfill achievement in sport. It's self-description of a champion. The second discourse refers to identity in the foreground contains the fact that the person is firstly an athlete and then an invalid. The third discourse, indicates self-description in which in the first place is his disability, and only after that other characteristics (athletes, people). Studies show that if an athlete didn't accept disability psychologically and build it in a realistic picture of oneself, an athlete can have an incorrect perception of one`s opportunities and circumstances in many situations during training and competition on which one can or cannot effect (Martin, 2011). Studies that have addressed the issue of competitive anxiety and self-confidence within athletes with disabilities, indicate the possible importance of motivation, types of sports and levels of competition, athletes relations towards disability and integrated disability in the personal identity of the athlete.

Practically, it is necessary to pay more attention to the psychological preparation of athletes with disabilities. So far in our country like in other countries, no attention is paid on this issue. Studies showed the importance of psychological preparation of athletes with disabilities and the importance of developing a positive psychological skills and coping mechanisms (Bačanac et al, 2014; Shin, Park & Kim, 2012).

CONCLUSION

Studies about competitive anxiety and self-confidence among athletes with disabilities, mostly clearly point to the importance of variations of self-confidence in the competitive situations. There are findings that indicate the differences in terms of somatic anxiety among athletes with and without disabilities.

This study showed that athletes with disabilities have significantly higher levels of cognitive anxiety and lower self-confidence than athletes without disabilities, while there are no the difference in terms of somatic anxiety. Due to the relatively small number of examined athletes with disabilities in this study, and the fact that they are engaged in individual sports, it remains unclear whether the resulting difference can be attributed to the type of sport they practice or in terms of other factors in the domain of psychological profiles. In addition to the types of sports and levels of competition, possible psychological factors to be examined in future studies, the self-concept (not) integrate disability, motivation, self-esteem, coping strategies. The results of this study suggest that future studies should examine the factors that can predict and influence the occurrence of cognitive anxiety among athletes with disabilities.

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PARAMETRI PLIVAČKIH SPOSOBNOSTI UČENIKA OSNOVNE ŠKOLE

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UVOD

Filogenetski i ontogenetski razvojni tokovi koji ujedno čine manifestni i latentni motorički prostor čoveka predstavljaju značajan faktor geneze ljudske jedinke. Razvoj filogenetskih motoričkih formi (hodanje, trčanje, puzanje, hvatanje, bacanje...) zapisan je u genotipu jedinke i odvija se unapred utvrđenim tokom karakterističnim za svakog pojedinca. Ontogenetske motoričke forme čine složeniji oblici kretanja stečeni motornim učenjem i specifičnost su svake jedinke. Plivanje kao esencijalna motorička veština, ciklična sportska grana u kojoj je dominantna izdržljivost (Bompa, 1999), telesna (fizička) vežba je ontogenetsko motoričko umenje i najčešće se definiše kao sposobnost da se cikličnim lokomotornim pokretima tela čovek održava i kreće po površini vode (Madić i sar., 2007).

Usled specifičnog horizontalnog položaja plivača i kretanja u tečnom fluidu plivanje ima izuzetno veliki pozitivan uticaj na sve organske sisteme, prevashodno na kardiorespiratorni, lokomotorni posturalni status i nervni (proprioceptivni, piramidalni i ekstrapiramidalni) sistem (Ilić, 2001; Grujić, 2003). U nenaučnim krugovima sama semantika reči plivanje asocira na pozitivan uticaj na zdravstveni status čoveka. Pravilan metodički pristup već u predškolskom uzrastu podstiče pozitivan razvoj fizioloških parametara deteta, međutim učenje, podučavanje i usavršavanje tehnike plivačkih stilova ima za posledicu i poboljšanje biomehaničkih aspekata plivačkih parametara (Maglischo, 2003; Dekerle, et al, 2005; Grosse, 2007). Stoga obučavanje efikasne tehnike sportskog plivanja čini niz adaptacija i reorganizacija kretnih stereotipa u skladu sa promenama dužina poluga, težišta pojedinih segmenata tela, odnosa napadnih tačaka sile potiska i sile pritiska, momente inercije propulzivnih segmenata (Blanksby et al, 1995; Rushal et al, 1998). Upravo na toj kinematičkoj osnovi zasnovano je ovo istraživanje čiji su predmet plivačke sposobnosti i parametari zaveslaja dečaka i devojčica (ne)obučenih plivača, odnosno plivača početnika uzrasta 11-14 godina (Pavic, et al, 2008; Potdevin, et al, 2011).

Cilj istraživanja odnosio se na identifikovanje i kvantifikovanje brzine plivanja kao i analizu uzajamnih odnosa primenjenih varijabli u istraživanju koje je sprovedeno u toku četiri kursa obuke plivanja od ukupno 16 časova u okviru redovnog programa nastave fizičkog vaspitanja od 5 do 8 razreda osnovne škole.

METOD

Uzorak ispitanika čini 80 učenika, 36 dečaka i 44 devojčice viših razreda osnove škole ”J.J. Zmaj” iz Sremske Mitrovice, uzrasta 11-14 godina koja su pohađala četiri kursa obuke plivanja u trajanju od 16 časova mesečno, odnosno 64 sata godišnje u okviru nastave fizičkog vaspitanja. Volumen trenažnog opterećenja su činila 60 do 65% opterećenja u aerobnim uslovima, 25 do 30% u mešovito aerobno-anaerobnim i 2 do 3% u anaerobnim glikolitičkim i alaktatnim energetskim izvorima. Grupe su formirane u toku aprila 2015. godine prema kalendarskom uzrastu, polu, uzrastu i plivačkim sposobnostima. Svi ispitanici su plivali 50 metara kraul startom iz vode u bazenu dužine 50 metara. Testiranje je izvedeno u toku juna 2015. godine tako što je:

- Brzina plivanja (K50) izražena u metrima u sekundi (m/s) i izračunata je deljenjem preplivane deonice od 50 metara sa vremenom plivanja ;
- Dužina zaveslaja (DZ) je izračunata deljenjem preplivane deonice sa brojem ciklusa (dva zaveslaja čini jedan ciklus) i izražena je m/ciklusu (m/cik.) ;
- Frekvencija zaveslaja (FZ) izračunata je deljenjem broja ciklusa zaveslaja sa vremenom preplivane deonice i izražena je u ciklusima/sek (cik/s) ;
- Indeks zaveslaja (IZ) kao mera uspeha u plivačkim disciplinama, izračunat je kao proizvod brzine i dužine zaveslaja i izražava se u m/s/cik.

Za sve navedene varijable primenjene su deskriptivne i komparativne diskriminativne (T-test) i kauzalne statističke procedure (korelaciona analiza).

REZULTATI

Brzina (K50) plivanja učenika, parametri zaveslaja mereni tokom plivačke discipline kraul na 50 metara i indeks zaveslaja prikazani su u tabelama 1 i 2.

Tabela 1. *Plivačke sposobnosti i parametri zaveslaja kod učenika*

Plivačke karakteristike	**Uzrasna kategorija**			
	11 godina	12 godina	13 godina	14 godina
Brzina plivanja (K50) m/s	0,80	0,83	0,94	0,97
Dužina zaveslaja (DZ) m/cik.	1,21	1,23	1,39	1,46
Frekvencija zaveslaja (FZ) cik/s	0,62	0,64	0,64	0,67
Indeks zaveslaja (IZ) m/cik/s	0,98	1,03	1,31	1,42

Prosečne vrednosti brzine plivanja bile su 0,885 m/s za dečake i 0,745 m/s za devojčice, što nam ukazuje da je prosečno vreme za koje deca preplivaju 50 metara kraul stilom iznosi 57 sekundi za dečake i 67 sekundi za devojčice. Vrednosti brzine su se povećavale u skladu sa uzrastom i znatno su bile veće kod dečaka (Tabela 1. i Tabela 2.).

Tabela 2. *Plivačke sposobnosti i parametri zaveslaja kod učenica*

Plivačke karakteristike	**Uzrasna kategorija**			
	11 godina	12 godina	13 godina	14 godina
Brzina plivanja (K50) m/sek	0,71	0,73	0,75	0,80
Dužina zaveslaja (DZ) m/cik	1,38	1,39	1,43	1,46
Frekvencija zaveslaja (FZ) cik/sek	0,51	0,53	0,54	0,54
Indeks zaveslaja (IZ) m/cik/sek	0,98	1,01	1,08	1,17

Vrednosti brzine plivanja (K50) statistički su značajne u odnosu na pol ispitanika na $p=0,05$ (Tabela 3.). Prosečne vrednosti dužine zaveslaja bile su za dečake 1,33 m/ciklusu i za devojčice 1,41 m/ciklusu i nisu se statistički značajno razlikovale u odnosu na polnu pripadnost, osim u uzrastu 11 i 12 godina. Utvrđeno je da uzrast statitistički značajno utiče na vrednosti dužine zaveslaja $p<0,05$ (Tabela 3). Frekvencija zaveslaja u proseku je za svaku uzrasnu grupu imala veće vrednosti, ali bez statističke značajnosti, tako da je aritmetička sredina kod dečaka iznosila 0,64 ciklusa/sekundi a kod devojčica 0,53 ciklusa/sekundi. Brzina zaveslaja u odnosu na pol dece pokazala je konstantnu razliku u svakom uzrasnom periodu ($p<0.01$; $F=0.24$). Linearna korelacija je postojana u odnosu na pol učenika i brzinu plivanja na nivou značajnosti od $p<0,01$ (Tabela 3.). Indeks zaveslaja (IZ) se nije razlikovao u jedanaestoj i dvanaestoj godini, ali je imao znatno veće vrednosti kod dečaka u odnosu na devojčice u 13 i 14 godini (Tabela 1. i Tabela 2.).

Tabela 3 *Povezanost rezultata plivačkih sposobnosti u odnosu na pol i uzrast učenika*

	uzrast	pol	brzina (K50)	dužina (DZ)	frekvencija(FZ)
uzrast	1	,000	,574	**,733***	,268
pol		1	**-,776***	,510	**-,956****
brzina (K50)			1	,136	**,890****
dužina (DZ)				1	-,294
frekvencija (FZ)					1

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed)

DISKUSIJA

Programski trenažni model primenjen u toku 16 časova istraživačkog postupka bio je usmeren na uvećanje efikasnosti i stabilnosti tehnike usavršavanjem mehaničkih karakteristika i veštine zaveslaja u nivou zona aerobnog i anaerobnog praga. Istraživanje je pokazalo da se vrednosti većine parametara plivačkih sposbnosti povećavaju sa uzrastom učenika oba pola i to:

- Povećanje brzine plivanja, kod dečaka 23,6%, a kod devojčica 12,6%;
- Povećanje dužine zaveslaja, kod dečaka 34,7 %, a kod devojčica 5,8%;
- Povećanje frekvencije zaveslaja, kod dečaka 8%, a kod devojčica 5,8%;
- Povećanje indeksa zaveslaja, kod dečaka 44%, a kod devojčica 19,4%.

Ova činjenica može se objasniti poboljšanjem motoričkih sposobnosti u odnosu na uzrast, ali i primenom programa obuke plivanja na kursevima tokom časova fizičkog vaspitanja (Coiwin,1996; Grosse, 2007; Matić i sar, 2007). Osim toga, da bi se postigao uspeh u plivačkoj kraul tehnici na 50 metara, plivač mora da poseduje određen nivo maksimalne anaerobne moći, specifične motoričke sposobnosti i antropometrijske karakteristike (Chollet, et al, 2000; Pereira, 2010). Više vrednosti brzine plivanja koje su uočene kod dečaka uzrasta 12-14 godina mogle bi se objasniti povećanjem anaerobne moći i mišićne snage kod dečaka nakon puberteta, a sveukupno poboljšljanje plivačkih parametara može se objasniti povećanjem laktatne komponente u toku rasta i razvoja (Pavic, et al, 2008).

Razlike uočene između polova u ovoj studiji bili su u skladu sa dosadašnjim istraživanjima. Tako su Inbar i Bar-Or (1977) pokazali da su anaerobni plivački testovi na 25 i 50 metara veoma pouzdani i validni kada se uporede sa Vingejtovim anaerobnim testovima kod neobučenih plivača uzrasta 8-12 godina. Isti autori su ustanovili da su apsolutne vrednosti anaerobne moći merene Vingejtovim testom znatno uvećane u odnosu na uzrast kod oba pola. Na vrednosti dužine zaveslaja, pol je na uzrastu dece 11-12 godina imao najveći uticaj i ta prednost se objašnjava ranijim pubertetom devojčica koji se karakteriše vrednostima mase i somatotipa. Nakon 11-12 godine razlike u dužini zaveslaja dečaka potiču od razlike u odnosu parametara telesna visina /raspon ruku (Grosse, 2007). Frekvencija zaveslaja nije se značajno promenila prema uzrastu kod oba pola, a vrednosti su bile znatno više kod dečaka, nego kod devojčica za istu uzrasnu grupu, što je u skladu sa zapažanjima koja je izneo Racev (1989) tokom longitudinalne studije na uzrastu 5-21 godine.

Poređenje 57 muškaraca i 65 žena vrhunskih plivača ocenjivanih na 50 metara slobodnim stilom, pokazala su da su vrednosti dužine zaveslaja i frkvencije zaveslaja niže kod (ne)obučenih plivača (Pelayo, 1997). U poređenju ove kategorije elitnih plivača isti autor ističe da se žene odlikuju identičnim frekvencijama zaveslaja i nižim vrednostima dužine zaveslaja u odnosu na muškarce (Maglischo, 2003;Dekerle, et al, 2005; Huot-Marchand, et al,2005) Podsetimo u ovom istraživanju kod neiskusnih plivača frekvencija zaveslaja je glavni faktor koji je uticao na to da dečaci plivaju brže od devojčica, dok se dužina zaveslaja nije bitno razlikovala kod ispitanika prema polu.

ZAKLJUČAK

Rezultat ciklusa zaveslaja definisanog dužinom i frekvencijom zaveslaja predstavlja jednu od osnovnih komponenti brzine plivanja. Različiti multidisciplinarni timovi proučavali su postojanje optimalne proporcije FZ/DZ u odnosu na brzinu plivanja i varijacije koje unose stilovi plivanja ili dužina staze. Na osnovu rezultata ovog istraživanja mogu se izvesti sledeći zaključci važni za trenere i nastavnike fizičkog vaspitanja:

1) Frekvencija zaveslaja je faktor koji ostaje nepromenjen od 11-14 godine;
2) Bolje vrednosti plivačkih parametara uočenih kod dečaka mogu se objasniti većom frekvencijom zaveslaja nego kod devojčica;
3) Vrednosti dužine zaveslaja (DZ) imaju veće vrednosti u svakoj narednoj godini života, ali se ne razlikuju između dečaka i devojčica u periodu od 12 godine, tako da se sa velikom verovatnoćom može tvrditi da su tehničke mogućnosti identične kod oba pola;
4) Indeks zaveslaja (SI) može da bude praktično merilo za trenere i nastavnike fizičkog vaspitanja kako bi procenili nivo plivačkih sposobnosti i sačinili parametre ocenjivanja učenika;
5) Primena antropometrijskih varijabli, plivačkog trenažnog staža, veći broj ispitanika i uključivanje drugih uzrasnih kategorija, doprineli bi reprezentativnijim podacima opserviranog problema istraživanja.

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PARAMETERS OF SWIMMING SKILLS OF PRIMARY SCHOOL PUPILS

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INTRODUCTION

The phylogenetic and ontogenetic development trends, which constitute manifest and latent motor area of humans, represent a significant factor in the genesis of a human being. The development of phylogenetic motor forms (walking, running, crawling, grasping, throwing...) is written in the genotype of the individual and it takes the predetermined path typical for every individual. Ontogenetic motor forms are complex movements, acquired by motor learning and they represent typical characteristics of each individual. Swimming as an essential motor skill, cyclic sports branch in which endurance is predominant (Bompa, 1999), body (physical) exercise is ontogenetic motor skill and it is usually defined as the ability to keep and move the body on the surface by cyclic locomotor movements of the human body (Madić et al., 2007).

Due to a specific horizontal position of the swimmer and the movement in the liquid fluid, swimming has a significant positive effect on all organic systems, primarily on the cardiorespiratory, locomotor posture status and nervous (proprioceptive, pyramidal and extrapyramidal) system (Ilic, 2001 Grujic, 2003). In non-scientific circles the semantics of the word 'swimming' is associated with a positive impact on the health status of an individual. Appropriate methodical approach in preschool age fosters positive development of physiological parameters of the child. However, learning, teaching and training techniques of swimming styles result in the improvement of biomechanical aspects of swimming parameters (Maglischo, 2003; Deckerle, et al, 2005; Gross, 2007). Therefore, effective training techniques of swimming consist of a series of adaptation and reorganization of motion stereotypes associated with the length of the humerus, the center of gravity of individual body segments, and the correlation of the points of tensile and compressive forces and moments of inertial propulsion segments (Blanksby et al, 1995; Rushal et al, 1998). This research is based on the kinematic basis. Its subject is swimming skills and stroke parameters of boys and girls (un)skilled swimmers or swimmer beginners aged 11-14 (Pavic, et al, 2008; Potdevin, et al, 2011).

The aim of the research was related to the identification and quantification of the speed of swimming and the analysis of interrelationships of variables in applied research conducted during four training sessions of swimming, which included 16 hours within the regular program of physical education classes from 5 to 8 grades of primary school.

METHOD

The sample included 80 students, 36 boys and 44 girls in higher grades of primary school „J.J. Zmaj" in Sremska Mitrovica, aged 11-14 who attended four training sessions of swimming for 16 hours, or 64 hours per year within physical education classes. The volume of training load consisted of 60 to 65% load under aerobic conditions, 25 to 30% in mixed aerobic-anaerobic and 2 to 3% in the anaerobic glycolytic and alactate energy sources. The groups were formed in April 2015 according to age, gender and swimming ability. All participants swam 50 meters crawl start out of the water in the pool 50 meters long. Testing was carried out in June 2015, by measuring:

- Swimming speed (K50) is expressed in meters per second (m/s) and is calculated by dividing of swum section of 50 meters with a swimming time;
- The length of the stroke (SL) is calculated by dividing swum section the with number of cycles (two stroke make one cycle) and it is expressed in m/cycle (m/cycle);
- The frequency of stroke (SF) is calculated by dividing the number of stroke cycles with the time needed to swim the section and it is expressed in cycles/sec (cycle/S);
- Stroke index (SI) as a measure of success in swimming disciplines, it is calculated as the product of speed and length of stroke and it is expressed in m/s/cycle.

Descriptive and comparative discriminant (t test) and causal statistical procedures (correlation analysis) were applied for all variables.

RESULTS

Speed (K50) of swimming of students, stroke parameters measured during the swimming discipline crawl 50 meters and stroke index are shown in Tables 1 and 2.

Table 1 *Swimming abilities and parameters of stroke among male students*

Swimming characteristics	Age group			
	11 years	12 years	13 years	14 years
Swimming speed (K50) m/sec	0,80	0,83	0,94	0,97
Length of stroke (SL) m/cycle	1,21	1,23	1,39	1,46
Stroke frequency (SF) cycle/sec	0,62	0,64	0,64	0,67
Stroke index (SI) m/cycle/sec	0,98	1,03	1,31	1,42

Average values of speed were 0.885 m/s for boys and 0.745 m/s for girls, which show that the average time for which children swim 50 meters crawl style is 57 seconds for boys and 67 seconds for girls. Speed values were increased in accordance with the age and were significantly higher in boys (Table. 1. and Table 2.).

Table 2 *Swimming abilities and parameters of stroke among female students*

Swimming characteristics	Age group			
	11 years	12 years	13 years	14 years
Swimming speed (K50) m/sec	0,71	0,73	0,75	0,80
Length of stroke (SL) m/cycle	1,38	1,39	1,43	1,46
Stroke frequency (SF) cycle/sec	0,51	0,53	0,54	0,54
Stroke index (SI) m/cycle/sec	0,98	1,01	1,08	1,17

The values of the speed of swimming (K50) were statistically significant in relation to gender at p = 0.05 (Table 3). Average values of the length of stroke were 1.33 m/cycle for boys and 1.41 m/cycle for girls. They did not differ significantly by gender, except at the age of 11 and 12. It was found that age statistically significantly affects the value of length of stroke p=0.05 (Table 3). Stroke frequency showed higher values for each age group, but without statistical significance, so that the arithmetic mean for boys was 0.64 cycles/second and 0.53 cycles/second for girls. Stroke speed in relation to the gender showed constant difference at any age ($p<0.01$; $F=0.24$). Linear correlation was stable compared to the gender of students and swimming speed at the level of significance of p = 0.01 (Table 3). Stroke index (SI) did not differ at the age of 11 and 12, but it had significantly higher values among boys compared with girls aged 13 and 14 (Table 1. and Table 2.).

Table 3. *Correlation between the results of swimming ability in relation to gender and age of students*

	age	gender	speed (K50)	length (SL)	frequency(SF)
Age	1	,000	,574	**,733***	,268
Gender		1	**-,776***	,510	**-,956****
Swimming speed (K50)			1	,136	**,890****
Length of stroke (SL)				1	-,294
Stroke frequency (SF)					1

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed)

DISCUSSION

Programming training model applied during the 16 hours of the research process was focused on enhancing the efficiency and stability of the technique by the improvement of skill and mechanics of the stroke in the level zone of aerobic and anaerobic field. The research has shown that the values of most parameters of swimming abilities increased with age of students of both genders, as follows:

- Increase of the value of the speed of swimming, 23.6% in boys and 12.6% in girls
- ncrease of the value of the length of the stroke, 34.7% in boys and 5.8% in girls
- Increase of the value of the frequency of stroke, 8% in boys and 5.8% in girls
- Increase of the value of the stroke index, 44% in boys and 19.4% in girls;

This fact can be explained by the improvement of motor skills in relation to growth, but also by training program of swimming courses during physical education (Coiwin, 1996; Grosse, 2007; Matić et al, 2007). In addition, in order to achieve success in the swimming crawl technique at 50 meters, the swimmer must possess a certain level of maximum anaerobic power, specific motor and anthropometric characteristics (Chollet et al, 2000; Pereira, 2010). Higher values of speed swimming which are observed among boys aged 12-14 could be explained by an increase in anaerobic power and muscular strength in boys after puberty and general improvement of swimming parameters can be explained by the increase of lactation components during the growth and development (Pavic, et al, 2008).

The differences observed between the genders in this study were consistent with previous researches. Thus, Inbar and Bar-Or (1977) showed that anaerobic swimming tests at 25 and 50 meters are very reliable and valid when compared with the Wingate anaerobic tests with untrained swimmers aged 8-12. The same authors found that the absolute values of anaerobic power measured by Wingate test increased significantly in comparison to age in both genders. The gender had the greatest influence on the values of the length of the stroke at the age of 11-12, which can be explained by earlier puberty with girls which is characterized by the values of the mass and somatotype. After the age of 11-12 the difference in the length of the stroke in boys results from differences in relation to body height/arm span parametres (Grosse, 2007). The frequency of stroke was not significantly changed by age in both genders and values were significantly higher in boys than in girls of the same age group. The same observation is made by Racev (1989) during longitudinal study which included examinees aged 5-21. Comparison of 57 male and 65 female elite swimmers evaluated at 50 meters freestyle, showed that the values of the length of the stroke and the stroke frequencies were lower in (un)skilled swimmers (Pelayo, 1997). Having considered this category of elite swimmers the same author points out that women are characterized by identical stroke freqeuncy and lower values of the length of stroke compared to men (Maglischo, 2003; Decker, et al, 2005; Huot-Marchand et al, 2005). Stroke frequency represents the main factor in this study with inexperienced swimmers which influenced the fact that boys swim faster than girls, while the length of stroke was not significantly different in these examinees.

CONCLUSION

The result of the stroke cycle defined by length and frequency of stroke is one of the basic components of swimming speed. Various multidisciplinary teams studied the existence of optimal proportions of stroke frequency/ length of stroke in relation to the speed of swimming and variations made by swimming styles or section length. The following conclusions, important for coaches and PE teachers can be made according to the results of this research:

1) Stroke frequency is a factor that remains unchanged in the period from 11 to 14;
2) Better values of swim parameters observed in boys may be explained by the higher stroke frequency than at girls;
3) The values of length of stroke (SL) increase by each subsequent year, but they do not differ between boys and girls at the age of 12; therefore, it can be stated that the technical abilities are identical at both genders;
4) Stroke index (SI) may be a practical measure for coaches and PE teachers to assess the level of swimming ability and make the list of parameters for students assessment;
5) Application of the anthropometric variables, swimming training experience, greater number of examinees and the involvement of other age groups, would contribute to a more representative data of observed trends.

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RAZLIKE MOTORIČKIH SPOSOBNOSTI KARATISTA JUNIORSKOG UZRASTA PREMA SPECIJALIZACIJI

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UVOD

Karate danas spada u najpopularnije i masovno najprihvaćenije sportove obuhvatajući dve takmičarske discipline - kate i borbe. Kata se sastoji od definisanih sekvenci ofanzivnih i defanzivnih tehnika koje se izvode po tačno utvrđenom redosledu, ponekad relativno sporo i u relativno niskim stavovima (Imamura i sar. 1998). Borbe u karateu sastoje se od slobodno izabranih ofanzivnih i defanzivnih akcija koje se realizuju u odnosu na protivnika (Imamura i sar. 2002), obuhvatajući niz tehnika i kretanja koje zahtevaju stalno pomeranje tela u prostoru (Iide i sar. 2008). Višegodišnje vežbanje karatea može uticati na poboljšanje osnovnih motoričkih sposobnosti i to najviše na razvoj eksplozivne snage, brzine i koordinacije (Simonović, 2010). Vežbe zastupljene u učenju tehnike karatea aktiviraju celokupnu muskulaturu podjednako utičući na razvoj obe hemisfere, izbegavajući jednostranost kao u nekim sportovima. Dominantno obeležje karatea predstavljaju brzi, eksplozivni pokreti sa naglašenom kontrolom realizacije sile u odnosu na protivnika. Na pravilno izvođenje tehnike u karateu neophodan je određeni nivo motoričkih sposobnosti. Razvoj motoričkih sposobnosti i tehnička priprema međusobno su povezani i zavisni. To znači da rad na razvoju karate tehnike utiče i na razvoj motoričkih sposobnosti, i obrnuto. Praćenje, vrednovanje i ocenjivanje morfološkog i motoričkog statusa sportista je veoma značajno za procese upravljanja transformacionim procesima koje nastaju kao posledica trenažne aktivosti karatista obe specijalizacije, kataša i boraca. Neophodno je da se morfološke karakteristike i motoričke sposobnosti postave u optimalnu vezu sa tehničkim izvođenjem i taktičkom pripremom, u direktnoj borbi sa protivnikom, pri čemu se koriste celokupni psihički i fizički energentski potencijal. Stoga je procena i evaluacija karatista i njihovih specifičnih sposobnosti od velikog značaja u karateu.

Morfološke karakteristike sportista mogu uticati na uspešnost u postizanju sportskih rezultata. Adekvatne morfološke karakteristike sportiste predstavljaju preduslov za ostvarivanje uspeha u disciplini kojom se bavi, naravno, uz uslov da su ispunjeni ostali bitni faktori koji određuju uspešnost. Bitna je pretpostavka da će od dvojice sportista, uz veoma slične uslove koji su potrebni za postizanje sportskog rezultata, uspešniji biti onaj čije su morfološke karakteristike povoljnije za konkretnu sportsku discipline. Za određenu vrstu sportskih aktivnosti potreban je adekvatan morfološki tip sportiste za postizanje iznad prosečnih i vrhunskih rezultata, što uz višegodišnje podvrgavanje trenažnom procesu u nekoj sportskoj aktivnosti i u skladu sa prethodnom selekcijom i genetskom osnovom formira odgovarajući tip sportista za bavljenje određenom fizičkom aktivnošću. Optimalne morfološke karakteristike sportista u velikoj meri zavise od izabranog sporta, međutim, generalno bolje rezultate postižu oni čija je morfologija prilagođena zahtevima određenog sporta, što je naročito izraženo na višem takmičarskom nivou (Jakšić, 2010).

Motoričke sposobnosti podrazumevaju čovekove kretne mogućnosti, u zavisnosti od fizičkih, psiholoških, sociooloških i drugih svojstava, koje se mogu izmeriti i upoređivati. Postoje razlike u ispoljavanju motoričkih sposobnosti u raznim motoričkim aktivnostima. Neko postiže bolje rezultate u eksplozivnoj snazi, neko u preciznosti, a neko u gipkosti. Sve to zavisi od genetskih predispozicija, rasta i razvoja, razvijanja i usavršavanja posredstvom fizičkog vaspitanja i sporta. Sa sebi svojstvenim osobinama i sposobnostima čovek raste, razvija se i usavršava vlastite sposobnosti čuvajući pri tome svoje specifičnosti (Rodić i Buišić, 2012).

Motoričke sposobnosti latentnog karaktera ne mogu se meriti direktno već indirektno, a to znači da se direktno mogu meriti samo motoričke reakcije, odnosno manifestacije različitim mernim

jedinicama (Malacko i Popović 2001). Registrovanje motoričkih reakcija vrši se raznim motoričkim testovima ili mernim instrumentima koji moraju biti standardizovani. Osnovne motoričke sposobnosti (Kurelić i sar., 1975) predstavljaju „conditio sine qua non" (uslov bez kojeg se ne može) u svakom učenju motoričkih zadataka na osnovu čega se može smatrati da predstavljaju bazičnu vrednost u ukupnom prostoru čovekove motorike (Badrić i sar., 2012) . Najčešće prihvaćena podela bazičnih motoričkih sposobnosti (Kurelić i sar., 1975) je na snagu, izdržljivost, brzinu, gipkost, preciznost i ravnotežu. Sa velikim brojem svojih manifestacija broj bazičnih motoričkih sposobnosti i njihovih dimenzija mnogo je veći od nabrojanih (Paspalj, 2008). Specifične motoričke sposobnosti stečene su kao rezultat specifičnih treninga u pojedinim sportovima.

Većina istraživanja u karateu urađena je na ispitanicima seniorskog uzrasta muškog pola, pa bi, ukoliko se žele objektivniji rezultati, trebalo povećati broj istraživanja sa uzorkom ispitanika iz populacije karatista mlađih uzrasnih kategorija, pionira, kadeta i juniora. Motoričke sposobnosti i morfološke karakteristike imaju značajnu ulogu u procesu selekcije i kontroli trenažnog procesa (MacDougall i sar. 1991), ali ne postoje podaci koji bi ukazali na relacije ovih dimenzija između takmičara u borbama i takmičara u katama.

Testovi za procenu sile i snage prilikom jednog ponavljajućeg maksimuma iz polučučnja i sa grudi, kao i skok iz polučučnja i izbačaj sa grudi sa opterećenjem 30% od maksimalnog, osetljivi su za procenu takmičarske uspešnosti karatista (Roschel i sar. 2009). Blažević i saradnici (2006) pokušali su da identifikuju „motornu strukturu" koja je relevantna za takmičarsku uspešnost u borbama i došli su do saznanja da su tri glavna faktora koordinacija, eksplozivna snaga i frekvencija pokreta. Pokreti u karateu dešavaju se u određenim amplitudama koje zahtevaju gipkost, naročito nogu. U skladu sa time, karate trening podrazumeva adaptaciju vežbača na određene, produžene stavove i kretanja kao specifični ambijent za realizaciju snažnih pokreta (Probst i sar. 2007).

Na ispoljavanje sile i snage utiču telesne dimenzije (Jarić, 2003; Jarić i sar. 2005; Nedeljković i sar. 2009), koje mogu imati značajnu ulogu u selekciji takmičara povezano sa različitim zahtevima sportskih disciplina u katama i borbama. Ovde treba uzeti u obzir postojanje težinskih kategorija u borbama, koje uvažavaju postojanje veze između antropometrijskih karakteristika takmičara i dinamičkih dimenzija udaraca koji se ispoljavaju u direktnom kontaktu sa protivnikom (Kajčevski, 1981). U zavisnosti od specijalizacije i podele na takmičare u borbama i katama moguće je uočiti razlike u morfološkim karakteristikama (Fritzschel and Raschka 2007).

Ispitivanjem karakteristika vrhunskih takmičara u katama i borbama, primenom testova opšte motorike, specifične motorike i testova za procenu neuromišićne funkcije u različitim režimima mišićnog naprezanja uočene su razlike između karatista pri čemu su takmičari u borbama u odnosu na takmičare u katama imali bolje rezultate u testovima trčanja na 10 metara iz mesta i troskoku iz mesta (Koropanovski i sar., 2011). Zbog neophodne brzine u izvođenju, takmičari u borbama mogu da pokažu veću brzinu pokreta i veću snagu, dok bi se sa druge strani mogla očekivati manja veličina tela i veća gipkost nogu kod kata takmičara.

METOD

U radu je primenjen neeksperimentalni istraživački metod transverzalne studije. Kvalitativnim pristupom izvršeni su posmatranje i deskripcija, a kvantitativnim testiranje i metod merenja.

Na osnovu podataka dobijenih na testiranju, odvojeno za kataše i borce, izračunati su deskriptivni parametri (srednja vrednost, standardna devijacija, koeficijent varijacije, minimalna i maksimalna vrednost) za sve posmatrane varijable po protokolima EUROFIT baterije testova za procenu motoričkih sposobnosti ispitanika. Istraživanjem je obuhvaćeno 44 ispitanika, učesnika sedmodnevnog kampa beogradskog karate saveza „Beograd 2014". Od svih ispitanika prethodno je dobijena saglasnost koju su potpisali roditelji.

Uzorak varijabli raspoređen je na morfološke varijable, koje bliže opisuju morfološki status ispitanika, i motoričke sposobnosti ispitanika koje su podeljene na testove za procenu jačine, snage, brzine, agilnosti, koordinacije, gipkosti, izdržljivosti. Statistička značajnost razlika morfološkog i motoričkog statusa kataša i boraca utvrđena je analizom varijansi (ANOVA).

Procena morfološkog statusa ispitanika vršena je na osnovu podataka dobijenih merenjem visine i mase tela. Merenje visine tela (VT) vršeno je korišćenjem antropometra po Martinu sa tačnošću merenja 0,1 cm. Za merenje mase tela (MT) ispitanika korišćena je medicinska decimalna vaga.

Rezultat je očitavan sa tačnošću 0,1 kg. Indeks mase tela (IMT), kao mera voluminoznosti ispitanika, je odnos mase tela izražene u kilogramima i kvadrata visine tela ispitanika izražene u metrima (Heyward,V., Stolarczyk, L. 1996).

Varijable za procenu motoričkih sposobnosti predstavljaju podaci dobijeni primenom EUROFIT baterije testova, čiji je redosled sprovođenja određen opštim upustvima, preporučenih za standardizovanu primenu u zemljama članicama Evropskog saveta. Na početku testiranja izvršavali su jednostavne zadatke, čija realizacija ne prouzrokuje samo zamor, a zatim su sledili zadaci sa većim energetskim zahtevom. Opis testova za procenu motoričkih sposobnosti.

Za procenu **jačine** primenjen je test izdržaj u zgibu (ZGIB), a za procenu **snage** testovi: skok u dalj iz mesta (DALj), vertikalni skok iz polučučnja (SJ), vertikalni skok sa polučučnjem (CMJ), serija vertikalnih skokova (7RJ). Za procenu **brzine** primenjeni su testovi: taping rukom (TAPR), sprint na 10 metara iz visokog starta (10 S), sprint na 10 metara iz letećeg starta (10 LS), sprint na 20 metara iz visokog starta (20 S), dok je **agilnost** procenjivana sa dva testa: povratno trčanje 10x5 m (10x5), t test. Za procenu **koordinacije** primenjen je test: brzina opružanja trupa (BOT), za procenu **ravnoteže** flamingo test (RAVN), a za procenu **gipkosti** test: pretklon u sedu (PUSE). Na kraju testiranja za procenu **izdržljivosti** primenjen je test povratnog trčanja 20 m sa postepenim povećanjem brzine (SRUN).

REZULTATI

Morfološke karakteristike ispitanika (N=44), od čega je 25 ispitanika koji se bave borbama (borci), prosečnog uzrasta 13.47±2.29 godina, i 19 ispitanika koji se bave katama (kataši), prosečnog uzrasta 14.87±2.35 godina, prikazane su u tabeli 1.

Tabela 1. Deskriptivni pokazatelji morfoloških karakteristika ispitanika u odnosu na disciplinu

test	pol	N	Mean	StDev	Min	Max	Cv%
Visina tela (cm)	B	25	164.76	15.72	140.00	197.00	9.54
	K	19	160.89	9.48	145.00	180.00	5.89
Masa tela (kg)	B	25	54.60	20.64	30.00	118.00	37.81
	K	19	51.74	9.85	37.00	71.00	19.05
IMT	B	25	19.42	3.78	14.06	30.41	19.48
	K	19	19.84	2.37	16.41	24.01	11.96

Na osnovu prikazanih rezultata uočljivo je da su borci viši i teži u odnosu na kataše, sa većim koeficijentom varijacije, naročituo u masi tela. Rezultati ANOVE ukazuju da ne postoje statistički značajne razlike morfoloških karakteristika boraca i kataša ni kod jedne posmatrane varijable (p=0.35-0.67).

U testu za procenu jačine (zgib) borci su ostvarili bolje rezultate (27.36s, prema 22.93s) pri čemu razlika nije statistički značejna (p=0.39). Deskriptivni pokazatelji za procenu snage (Tabela 2.) ukazuju na bolje rezultate kataša u većini testova (SJ, CMJ, CMJZ i 7RJ) pri čemu su razlike blizu statističke značajnosti u testovima SJ, CMJ i CMJZ (p=0.09-0.14).

Tabela 2. Deskriptivni pokazatelji testova za procenu - snage

test	pol	N	Mean	StDev	Min	Max	Cv%
DALJ (cm)	B	25	177.36	35.16	109.00	241.00	19.82
	K	19	177.84	39.38	100.00	260.00	22.14
SJ (cm)	B	25	22.60	5.79	14.90	39.10	25.63
	K	19	25.68	6.24	18.80	41.80	24.30
CMJ (cm)	B	25	26.35	6.85	15.20	44.90	25.98
	K	19	29.90	6.25	22.40	44.40	20.92
CMJZ (cm)	B	25	32.18	7.72	20.90	51.80	23.98
	K	19	35.69	7.77	28.20	54.40	21.76
7RJ (cm)	B	25	22.84	6.95	11.90	42.00	30.45
	K	19	24.14	6.22	13.3	32.7	25.78

Deskriptivni pokazatelji za procenu brzine (Tabela 3.) ukazuju na bolje rezultate kataša u odnosu na borce u svim testovima, pri čemu je u testu za procenu frekvencije pokreta rukom (TAPR) uočena statistička značajnost ($p<0.05$; $F=5.71$)

Tabela 3. Deskriptivni pokazatelji testova za procenu - brzine

test	pol	N	Mean	StDev	Min	Max	Cv%
TAPR (s)	B	25	5.87	0.92	4.31	7.49	15.72
	K	19	5.22	0.85	4.21	6.96	16.31
10S (s)	B	25	2.09	0.16	1.81	2.33	7.47
	K	19	2.07	0.14	1.84	2.35	6.73
10LS (s)	B	25	1.62	0.20	1.26	1.99	12.34
	K	19	1.57	0.14	1.26	1.85	9.00
20S (s)	B	25	3.68	0.32	3.09	4.26	8.67
	K	19	3.64	0.27	3.16	4.10	7.34

U testovima za procenu agilnosti, koji su ispitani testovima: povratno trčanje 10x5 m i T test, kao ni u testovima za procenu koordinacije i gipkosti, nisu uočene razlike između grupa u odnosu na specijalizaciju. U testu za procenu gipkosti (PUSE) kataši su pokazali bolje rezultate u odnosu na borce (25.8 cm nasuprot 23.8 cm). Prosečan broj grešaka u testu ravnoteže (RAVN) za borce je bio 14.52 (5.52) grešaka, dok su kataši imali 9.21 (6.05) grešaka, što ukazuje na statistički značajnu razliku ($p<0.01$; $F=9.20$). U testu za procenu aerobnih sposobnosti borci su bili neznatno bolji, ali ne statistički značajno.

DISKUSIJA

Rezultati istraživanja motoričkih testova karatista u odnosu na specijalizaciju uočeno je da su kataši postigli u proseku bolje rezultate u većini testova mada je statistički značajna razlika nađena samo u dva testa u korist kataša. Ovo delimično ukazuje na očigledan nedostatak podataka o razlikama kataša i boraca. Zbog takmičarski neophodne brzine u izvođenju kretnih zadataka, borci mogu da pokažu veću brzinu pokreta i veću snagu, ali imaju i hendikep većih dimenzija tela prilikom zauzimaja položaja koji iziskuju snagu (Lohman, 1998, Jaric et al 2005). Očekivani nalazi mogli bi biti značajni ne samo u ranim selekcijama i treninzima karatea, već i pri određivanju specijalizacije i evaluacije boraca i kataša.

Utvrđeno je da su borci viši i teži od kataša što verovatno potiče od razloga da u borbama postoje težinske kategorije od najmanjih do najvećih koji diferenciraju težinu, a posredno i visinu tela. Indeks mase tela je izjednačen.

Bolji rezultati boraca u testu za procenu jačine mogli bi se pripisati direktnom kontaktu boraca sa protivnikom udaracima i u klinču, dok kataši imaju borbu sa zamišljenim protivnikom. Veća uspešnostu kataša u testovima za procenu snage je očekivana jer kate zahtevaju izvođenje dubokih stavova kao i kretnji u njima pa ovakvi pokreti i tehnike razvijaju mišićnu silu a posredno i snagu mišića koja najviše utiče na izvođenje skokova, doskoka, promena pravca kretanja, itd. Testovi za procenu brzine pokazali su statistički značajne razlike u korist kataša jedino u testu za procenu frekvencije pokreta rukom. Ovo se može povezati sa brzim promenama pokreta rukom u pojedinim katama, što nije toliko prisutno u borbama.

S obzirom da kate zahtevaju održavanje tehnički zahtevnih položaja pa čak i na jednoj nozi (Gankaku kata) test za procenu ravnoteže je direktan pokazatelj uticaja tehničkih zahteva na dobijene rezultate. Kataši imaju striktnu šemu pokreta koja ne bi smela naknadno da se koriguje, dok je kod boraca dozvoljeno korigovanje pozicije za adekvatno izvođenje tehnike pri kojima se često narušava ravnoteža.

Analizirajući rezultate testa pretklon u sedu, iako nema statistiški značajne razlike, kataši su postigli bolje srednje vrednosti. Koropanovski i sar. (2011) uočili su da kataši ostvaruju bolje rezultate u testovima gipkosti. Što se gipkosti u zglobovima nogu tiče kataši su pokazali bolje rezultate što

se može objasniti razlikama u tehnici boraca i kataša, jer u borbama nije bitna striktno precizna šema pokreta, u katama su zastupljeni niski stavovi kojima je neophodna velika gipkost u svim zglobovima nogu.

Aerobni kapacitet se smatra značajnim faktorom u karateu (Caput P. Krstulović S. i Katić R. 2013). Odlaže nastanak zamora tokom treninga i omogućava procese oporavka tokom pauze između dva uzastopna segmenta tokom kate, kao i između dve uzastopne borbe.

ZAKLJUČAK

Iako je uočen očigledan nedostatak podataka o razlikama kataša i boraca mlađeg uzrasta, u budućnosti bi trebalo ponoviti sličnu studiju koja bi pomogla da se na osnovu većeg broja podataka i ispitanika koji su bili uključeni u ovu, a i u neku narednu studiju izvrši predikcija rezultata i postave ciljevi za neki duži period. Praćenje realizacije programa, procenjivanje ostvarenih rezultata i njihova komparacija u trenažnom procesu sa karatistima treba da bude osnova za podsticanje trenera i svih stručnih ljudi za odgovorniji i svestraniji odnos prema radu u ovoj oblasti. Bilo bi dobro da se u budućnosti kroz ovakva istraživanja, kako bi se još tačnije utvrdio odnos određenih grupa karatista, i na osnovu dobijenih rezultata još preciznije vršila selekcija na kataše i borce i to u najboljem periodu za njih.

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DIFFERENCES OF MOTOR ABILITIES OF JUNIOR KARATEKA ACCORDING THE SPECIALISATION

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INTRODUCTION

Karate nowadays belongs to the most popular and most widely accepted sports encompassing two competitive disciplines – kata and combat. Kata comprises defined sequences of offensive and defensive techniques, which are executed in a strictly determined order, sometimes relatively slow and in relatively low stances (Imamura et al. 1998). Combats in karate comprise freely chosen offensive and defensive actions realized in relation to the opponent (Imamura et al. 2002), encompassing a number of techniques and movements demanding continuous shifting of the body in space (Iide et al. 2008). Practicing karate for longer period of time (several year) can affect better basic motor abilities especially the development of explosive strength, speed and coordination (Simonovic, 2010). Practices presented in learning of karate techniques activate the whole musculature evenly influencing on the development on both hemispheres, avoiding laterality, as against some sports. The dominant marks of karate are the quick, explosive moves with the emphasized control of the realization of the force in relation to the opponent. For the proper execution of the karate technique a certain level of motor abilities is necessary. The development of motor abilities and technical preparation are interconnected and interdependent. This means that work on the development of karate technique influences on the development of motor abilities and vice versa. Observing, evaluating and assessing of morphological and motor status of sportsmen is very significant for the processes of managing transformational processes which occur as a consequence of training activity of karate players of both specialties, kata and combat competitors. It is necessary that the morphological characteristics and motor abilities be put in an optima link to the technical performance and tactical preparation, in the direct fight with the opponent, during which the whole psychological and physical energetic potential is being used. This is why estimating and evaluating of karate players and their specific capabilities is of great significance in karate.

Morphological characteristics of athlete can affect success in achieving sport results. Adequate morphological characteristics of the sportsman represent the precondition for achieving success in the discipline, which he does, of course, with the condition that all other important factors, which define success, are met. The important presupposition that from the two athletes, with very similar conditions necessary to achieve sport results, the more successful will be the one whose morphological characteristics are more favorable for the specific sport discipline. For a certain type of sport activities, an adequate morphological type of athlete is necessary to achieve above average and top results, which with several years of training process in some sport activity and in accordance to the previous selection and genetic basis to form an appropriate type of sportsman for doing the specific physical activity. The optimal morphological characteristics of athlete greatly depend on the chosen sport; however, generally better results are achieved by those whose morphology is adjusted to the demands of the specific sport, which is highly expressed in higher competitive level (Jaksic, 2010).

Motor abilities encompass man's movement possibilities, depending on the physical, psychological, sociological and other traits, which can be measured and compared. There are differences in expressing motor abilities in different motor activities. Someone achieves better results in explosive strength, some in accuracy, and some in flexibility. It all depends on the genetic predispositions, growth and development, growing and perfecting with physical education and

sport. With its own unique traits and capabilities a man grows, develops and perfects their own capabilities guarding their specificities (Rodic and Buisic, 2012).

Motor abilities of latent character cannot be measured directly but indirectly, which means that only motor reactions can be measured directly, that is the manifestations in different measurement units (Malacko and Popovic 2001). Registering of motor reactions is conducted by different motor tests or measurement instruments, which need to be standardized. The basic motor abilities (Kurelic et al., 1975) represent "condition sine qua non" (a condition without which there cannot be) in every learning of motor tasks, which can be considered to represent the basic value in whole space of man's motor skills (Badric et al., 2012). The most frequently accepted division of the basic motor abilities (Kurelic et al., 1975) is strength, endurance, speed, flexibility, accuracy and balance. With great number of its manifestations the number of motor abilities and their dimensions is much greater than the aforementioned (Paspalj, 2008). Specific motor abilities are acquired as a result of specific trainings in some sports.

Most of researches in karate have been conducted on the senior age males, so, to get more objective results, there should be an increase in number of research with a sample of subjects from karate athletes of younger categories – pioneers, cadets and juniors. Motor abilities and morphological characteristics play an important role in selection and control of the training process (MacDougall et al. 1991), but there are no data to show the relation of these dimensions between the combat and kata competitors.

The tests for evaluating the force and strength during a repetitive maximum from half-crouch and from the chest, as well as the jump from half-crouch and the thrust from the chest with 30% from maximum overload are sensitive for evaluating competitive success of the karate players (Roschel et al. 2009). Blazevic et al (2006) tried to identify the "motor structure" which is relevant to the competitive success in fights and they have come to understanding that three main factors are coordination, explosive strength and frequency of movement. The moves in karate occur in certain amplitudes, which require flexibility, especially of the feet. In accordance to that, karate training involves the adaptation of the player to the specific, elongated stances of movement as a specific ambient for the realization of the strong moves (Probst et al. 2007).

Body dimensions influence on exerting force and strength (Jaric, 2003; Jaricet al. 2005; Nedeljkovic et al. 2009), which can bear a significant role in the selection of the contestants connected to the different demands of the sport kata and combat competitors. Here, the existence of weight categories in fights should be taken into consideration, which approves the existence of the link between anthropometric characteristics of the contestants and the dynamic dimensions of the blows, which are inflicted in the direct contact with the opponent (Kajcevski, 1981). Depending on the specialization and division on contestants in combat and kata competitors, it is possible to notice the differences in morphological characteristics (Fritzschel and Raschka 2007).

By Investigating the characteristics of the top in kata and combat competitors, by applying the general motor tests, specific motor tests and neuromuscular function tests in different parts of muscular strain the differences between karate players could be noticed, the combat competitors having the better results in test on 10 meters from standing position and triple jump from standing position as against the kata competitors (Koropanovski et al., 2011). For the necessary speed in performance, the combat competitors had to display greater speed of movements and greater strength, while on the other hand, lesser body size and greater flexibility could be observed at kata competitors.

METHOD

In this study was applied non-experimental research method of transversal studies. With qualitative approach the observing and description have been conducted and with quantitative the method of measurement.

According to the data received from the testing, the kata players and fighters separately, the descriptive parameters (mean value, standard deviation, coefficient of variation, minimum and maximum) could be calculated for all observed variables by the protocols of EUROFIT battery tests for evaluating motor abilities of the subjects. The research included 44 participants, members of a karate union "Belgrade 2014" seven-day camp. All the subjects previously handed in their consents signed by their parents.

The sample for the variables was divided into morphological variables, which closely describe the morphological status of the subjects; their motor abilities were divided into test for evaluating strength, power, speed, agility, coordination, flexibility and endurance. Statistical significance of the differences between the morphological and motor status of the kata and the combat competitors was defined by the analysis of the variance (ANOVA).

Evaluating of the morphological status of the subjects was done based on their data acquired by measuring height and weight of the body. Body height (BH) was assessed with the standard anthropometer by Martin with the accuracy of measuring 0.1 cm, and body weight (BW) was assessed by digital scale with the accuracy of 0.1 kg. The index of the weight of the body (BMI), as well as the measure of the voluminosity of the subject is the relation of the body weight expressed in kilos and the square of the body height expressed in meters (Heyward,V., Stolarczyk, L. 1996).

The variables for evaluating the motor abilities represent the data acquired by applying the EUROFIT battery tests, which order of execution was defined by general instructions, recommended for the standardized usage in the country members of the European Council (Kukolj et al. 1993). At the beginning of the testing they executed simple tasks, for the realization of which strain was not the sole result, and then followed the tasks with greater energetic demand.

For evaluating the **strength** a test Bent arm hang (BAH) was applied, and for the evaluating the **power** the tests: Standing broad jump (JUMP), Squat jump (SJ), Countermovement jump without (CMJ) and with arm swing (CMJA), Seven repetition jumps (7RJ). For evaluating of **speed** next tests were applied: Plate tapping (PTAP), sprint fro 10 meters from standing position (10 S), sprint for 10 meters flying start (10 FS), sprint for 20 meters from standing position (20 S), whereas the **agility** was evaluated with two tests: Shuttle run 10x5 m (10x5), T test. For evaluating the **coordination** the test of speed of relaxing the trunk (BOT) was used, for evaluating the **balance** the flamingo test (BAL), and for evaluating of flexibility Seat and reach (SAR). At the end of the testing for evaluating the **endurance** the test 20 m shuttle run (SRUN) was used.

RESULTS

Morphological characteristics of the subjects (N=44), out of which 25 subjects do combat of mean age 13.47±2.29 years and 19 subjects doing katas, of mean age 14.87±2.35 years, are shown in table 1.

Table 1. Descriptive markers of the morphological characteristics of the subjects according to the discipline

test	pol	N	Mean	StDev	Min	Max	Cv%
Body Height (cm)	C	25	164.76	15.72	140.00	197.00	9.54
	K	19	160.89	9.48	145.00	180.00	5.89
Body Weight (kg)	C	25	54.60	20.64	30.00	118.00	37.81
	K	19	51.74	9.85	37.00	71.00	19.05
BMI	C	25	19.42	3.78	14.06	30.41	19.48
	K	19	19.84	2.37	16.41	24.01	11.96

According to the shown results it can be pointed out that the combat competitors are taller and weight more with regard to the kata competitors, with greater coefficient of variation, especially in the body weight. Results of ANOVA revealed that there are no statistically significant differences in morphological characteristics of the combat and kata competitors in any observed variable (p=0.35-0.67).

In the strength test (BAH) the combat competitors achieved better results (27.36s, as against 22.93s), but not statistically significant (p=0.39). The descriptive markers for evaluating power (Table 2.) point out the better results of the kata competitors in most of the tests (SJ, CMJ, CMJA i 7RJ), the differences being close to statistically significant for SJ, CMJ i CMJA (p=0.09-0.14).

Table 2. The descriptive parameters of the test for evaluating strength

test	spec	N	Mean	SD	Min	Max	Cv%
JUMP (cm)	B	25	177.36	35.16	109.00	241.00	19.82
	K	19	177.84	39.38	100.00	260.00	22.14
SJ (cm)	B	25	22.60	5.79	14.90	39.10	25.63
	K	19	25.68	6.24	18.80	41.80	24.30
CMJ (cm)	B	25	26.35	6.85	15.20	44.90	25.98
	K	19	29.90	6.25	22.40	44.40	20.92
CMJA (cm)	B	25	32.18	7.72	20.90	51.80	23.98
	K	19	35.69	7.77	28.20	54.40	21.76
7RJ (cm)	B	25	22.84	6.95	11.90	42.00	30.45
	K	19	24.14	6.22	13.3	32.7	25.78

The descriptive markers for speed tests (Table 3.) indicate the better results of the kata competitors compared to the combat competitors in all tests, except for the test of evaluating the hand movement frequency (PTAP) where was obtained statistic significance difference ($p<0.05$; $F=5.71$)

Table 3. Descriptive parameters of the tests for evaluating speed

test	spec	N	Mean	SD	Min	Max	Cv%
PTAP (s)	B	25	5.87	0.92	4.31	7.49	15.72
	K	19	5.22	0.85	4.21	6.96	16.31
10S (s)	B	25	2.09	0.16	1.81	2.33	7.47
	K	19	2.07	0.14	1.84	2.35	6.73
10FS (s)	B	25	1.62	0.20	1.26	1.99	12.34
	K	19	1.57	0.14	1.26	1.85	9.00
20S (s)	B	25	3.68	0.32	3.09	4.26	8.67
	K	19	3.64	0.27	3.16	4.10	7.34

In the agility tests which were administered by tests: 10x5 m and T test, as well as the tests for evaluating coordination and flexibility, there weren't noticed differences between groups according to the specialization. In the test for evaluating flexibility (SAR) the kata competitors revealed better results with regard to the combat competitors (25.8 cm vs. 23.8 cm). The average number of mistakes in the test of balance (BAL) was 14.52 (5.52) for combat competitors and 9.21 (6.05) for kata competitors, which indicates a statistically significant difference ($p<0.01$; $F=9.20$). In the test for evaluating aerobic capabilities the combat competitors were insignificantly better.

DISCUSSION

The results of the research of tests of karate competitors according to their specialization revealed better results of the kata competitors in most of the tests, though statistically significant difference was found only in two tests. This partially shows the obvious lack of data on the differences of kata and combat competitors. Due to the competitively necessary speed in executing the movement tasks, the combat competitors can display greater movement speed and greater strength, but they have a handicap of greater body dimensions during taking stance, which demands strength (Lohman, 1998, Jaric et al 2005). The expected results could be important not only in the early

selections and karate trainings, but during the choice of specialization and evaluation of the combat and kata competitors.

It is ascertained that combat competitors are taller and heavier than the kata competitors which perhaps is owing to the fact that combat competitors have weight categories from least to most which define body weight, and indirectly the body height. The body mass index is evened.

The better results of the combat competitors in test for evaluating force could be acclaimed to the direct contact to the fighter with blows and in clinch, whereas the kata competitors have a fight with an imaginary opponent. The greater success with kata competitors in power tests was to be expected for katas demand performing of deep stances as well as movement within them, hence these movements and techniques develop musculature strength and indirectly the power of the muscles which influences the most on performing jumps, landings and changing the direction of movement, etc. The tests for evaluating speed have shown statistically significant differences in favor of the kata competitors in the Plate tapping test. This can be related with the fast hand movements in some katas, which is not at all present in combats.

Bearing in mind that katas demand maintaining technically demanding stances even on one foot (Gankaku kata) the balance test is a direct marker of the influence of technical demands on the received results. The kata competitors have a strict movement pathern, which shouldn't be altered subsequently, whereas combat competitors are allowed to alter their position for adequate performance of the technique, which often disrupts the balance.

Analyzing the results of the Seat-and-reach, even though there are no statistically significant differences, the kata competitors achieved better average values. Koropanovski et al. (2011) have noticed that the kata competitors achieve better results in flexibility tests. When it comes flexibility of leg joints, the kata competitors have shown better results which can be ascribed to the differences in the techniques of combat and kata competitors, because combats do not require a strictly precise scheme of movement and in katas low stances are presented which demand abundant flexibility in all joints of the legs.

Aerobic capacity is considered a significant factor in karate (Caput P. Krstulović S. i Katić R. 2013). It prevents strain during training and enables the process of recovery during taking breaks between two segments in a row of katas or between two combats in a row.

CONCLUSION

Even though a clear insufficiency of data has been noticed on the differences of kata and combat competitors of younger age, a similar study should be repeated in the future to help with the greater amount of data and subjects who were included in this and in some next studies to make a prediction of the results and set the goals for a longer period of time. Observing the realization of the program, evaluating of achieved results and their comparison in the training process with the karate athletes should be the basis for encouraging the trainers and all professional people responsible for all-encompassing approach to the work in this area. It would be good that these types of research in the future, according to the received results, even more precisely conduct the selection of kata and combat competitors and in their best age, so as to even more accurately ascertain the relation between the certain groups of karate players.

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ANALIZA TAKMIČARSKE AKTIVNOSTI RVAČA SLOBODNIM STILOM NA PRVIM EVROPSKIM OLIMPIJSKIM IGRAMA 2015. GODINE

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UVOD

Istraživanja takmičarske aktivnosti danas dobijaju sve veću aktuelnost u savremenoj sportskoj teoriji i praksi i sve više se afirmišu kao posebna grupa istraživanja sa specifičnom metodologijom. Takmičarska aktivnost u različitim sportskim granama uslovljena je karakteristikama tih grana (Hughes and Franks, 2008). Rezultati koji opisuju takmičarsku aktivnost sportista spadaju u pokazatelje koji najdireknije odslikavaju vezu između procesa pripreme i takmičarskih rezultata u konkretnoj sportskoj grani (Tünnemann, 1996). Uočavanje i analiza najznačajnijih parametara takmičarske aktivnosti, kvantitativno određivanje uticaja i međusobne povezanosti tih parametara, kao i objašnjenje njihove zavisnosti i povezanosti sa određenim aspektima pripreme, predstavljaju veoma važan i delikatan istraživački zadatak (Dopsaj, 2009). Naravno, ovakva vrsta istraživanja pravi smisao ima tek kada se realizuju u uslovima izrazite usmerenosti ka maksimalnom rezultatu, odnosno na najznačajnijim takmičenjima (Jovanović, Koprivica, Ćirković i Koropanovski, 2010).

Takmičarska aktivnost u rvanju predstavlja ispoljavanje takmičara u skladu sa pravilima rvanja, a ona direktno zavisi od njegove pripremljenosti. Tehnička, taktička, psihološka, kondiciona i teorijska priprema rvača stavljene su u funkciju unapređenja takmičarske aktivnosti, ali i pokazatelji takmičarske aktivnosti direktno utiču na sve navedene segmente pripreme rvača. Analiza takmičarske aktivnosti nedvosmisleno pokazuje koji se elementi tehnike najviše primenjuju, koji detalji taktike imaju poseban značaj, te pravce u kojima bi trebalo usmeriti kondicionu i psihološku pripremu rvača. Uspeh u rvanju pokazatelj je dobre usklađenosti svih ovih faktora, čime se omogućavaju uspešno manifestovanje potrebnih znanja i veština, a pokazatelji takmičarske aktivnosti „otkrivaju“ način na koji se ti faktori pripreme manifestuju u rvačkoj borbi (Tuenneman, 2004). Na taj način dosadašnja istraživanja otkrivaju specifičnost takmičarske aktivnosti na Evropskim i Svetskim takmičenjima.

Analizom finalnih borbi Evropskog prvenstva 2013. godine (Marković i Kasum, 2013b) dobijeni su sledeći rezultati takmičarske aktivnosti: ostvareno je 157 bodova u 102 akcije, od čega je dolascima na leđa ostvareno više od 50% bodova, tj. preovladavaju akcije sa malim faktorom rizika, a posmatranjem realizovanih bodovnih akcija po delovima rundi uočena je veća uspešnost u drugim delovima rundi.

Analiza Svetskog prvenstva 2013. godine (Marković i Kasum, 2013a) pkazala je da se u rvanju slobodnim stilom, i nakon izmene pravila, nastavio trend sužavanja repertoara korištenih tehnika. Broj bodova ostvarenim u borbama za medalju nije se značajno promenio 166 boda dok je broj akcija opao za 20 procenata. Kao posledica povećanja vrednosti akcije dolaska na leđa na 2 boda.

Istraživanje koje je obuhvatilo isti uzorak (Svetsko prvenstvo 2013. godine) pokazalo je da je došlo poboljšanja indeksa performansi i efikasnosti napada, te ogroman napredak ka napadačkoj orijentaciji u borbi. Formalno uvaćavanje akcija za 2 boda dovodi do smanjenja akcija za 1 bod, ali ne i povećanja akcija za 3 i 5 bodova (Tünnemann, 2013a).

Komparativna analiza takmičarske aktivnosti rvača slobodnim stilom na Prvenstvu Evrope 2013. i 2014. godine (Kasum i Marković, 2014), otkriva da se broj bodova značajno promenio, tako da je na EP 2014. ostvareno znatno više nego 2013. godine. Međutim, broj realizovanih akcija je ostao nepromenjen, što ide u prilog tezi da se učinak takmičara nije značajno promenio ali je borba, zbog načina vrednovanja, postala dosta neizvesnija i interesantnija za gledaoca.

Predmet ovog rada je takmičarska aktivnost vrhunskih rvača slobodnim stilom, koja je analizirana na Prvim evropskim olimpijskim igrama 2015. godine. Predmet istraživanja moguće je definisati kao ispitivanje najreprezentativnijih pokazatelja koji karakterišu takmičare kroz rvačku borbu i određivanje njihove diferencijalno dijagnostičke vrednosti.

Glavni cilj ovog rada je sagledavanje specifičnosti tehničko-taktičkog delovanja vrhunskih rvača koji su ostvarili pobedu u borbi, ali i poraženih takmičara slobodnim stilom, a na osnovu pokazatelja njihove takmičarske aktivnosti.

METOD

Prikupljanje podataka, u ovom istraživanju transverzalnog karaktera, izvršeno je metodom opservacije, tj. analizom zvaničnih izveštaja (zapisnika-biltena) i video materijala borbi Prvih evropskih olimpijskih igara 2015. godine. U odnosu na osnovnu metodu, ovaj rad prema karakteru pripada kategoriji prirodnog neeksperimentalnog istraživanja. U odnosu na vrstu istraživanja ovaj rad ima karakteristike i fundamentalnog i primenjenog istraživanja, jer obezbeđuje inovaciju postojećeg opšteg znanja iz oblasti trenažne tehnologije kod vrhunskih rvača slobodnim stilom, koje se može praktično primeniti. Osnovni metod saznanja u ovom radu će biti induktivno zaključivanje jer će se na osnovu pojedinačnih indikatora takmičarske aktivnosti objašnjavati uspešnost rvača.

Kao uzorak istraživačkog rada analizirane su 146 borbi, tj. 6 olimpijskih od ukupno 8 težinskih kategorija realizovanih na takmičenju. Obrađene težinske kategorije su: 57kg, 65kg, 74kg, 86kg, 97kg, 125kg (izostavljene su kategorije 61kg i 70kg). Racionalna tipologizacija takmičara izvršena je na adekvatan način, na takmičare koji su ostvarili pobedu i one koji nisu uspeli da ostvare pobedu u borbi, čime je dobijena mogućnost primene komparativne analize. Na osnovu rezultata komparativne analize moguće je dobiti egzaktne pokazatelje o svim bitnim elementima kako jedne borbe, tako i pokazatelje po pojedinim težinskim kategorijama, ali i takmičenju u celini. Obradom velikog uzorka borbi definišu se glavni parametri, faktori uspešnosti, koji karakterišu pobednike na pomenutim takmičenjima, ali se i jasno profilišu pokazetelji takmičarske aktivnosti koje odlikuju pobeđene rvače.

Varijable ovog istraživanja predstavljaju neki od tipičnih pokazatelja takmičarske aktivnosti, a to su broj i vrednost akcija, dominantan vremenski period realizacije akcije, frekvencija poentirajućih tehnika, broj poena napravljenih u stojećem stavu kao i u parteru. Takmičarska aktivnost rvača u okviru praćenog takmičenja predstavljena je preko kvantifikovanih pokazatelja učestalosti pojavljivanja svakog elementa i njihovih podmodaliteta.

Sirovi rezultati svih varijabli korišćenih u ovom istraživanju su podvrgnuti izračunavanju osnovne deskriptivne statistike. Za potrebe utvrđivanja razlika između subuzoraka ispitanika, tj. između pojedinačnih varijabli ispitivanih subuzoraka je utvrđena t testom.

Dobijeni rezultati trebali bi da pomognu i usmere sportske stručnjake u rvačkom sportu da na odgovarajući način izvrše modelovanje trenažne aktivnosti, odnosno da trening rvača omogući maksimalnu efikasnost boraca na takmičenju i time ostvari što bolji uspeh.

REZULTATI

Grubo dobijeni rezultati pokazuju da je u prvoj rundi svih borbi ostvareno 762, dok u drugoj 594 boda. Od ukupnog broja ostvarenih bodova u svim borbama obuhvaćenih uzorkom, 1011 je realizovano u stojci, dok svega 262 boda u parteru, a 83 boda kroz neuspešne čelendže i pasivni način vođenja borbe.

Daljom analizom takmičenja kreirani su subuzorci radi dobijanja, praktično korisnijih i vrednijih rezultata. Na ovakav način, grupisanjem podataka i analizom takmičarske aktivnosti, utvrđuju se faktori koji karakterišu profil pobednika, ali i nedostatci poraženog takmičara. U Tabeli 1 i 2 prikazani su rezultati varijabli, bodovi po rundama, bodovi po minutima u rundama, dominantan način vođenja borbe, intezitet realizovanja svake akcije, ali i efikasnost tih akcija, kako za pobednika (W), tako i za poraženog takmičara (L) u borbi, čime se želi uvrditi odnos, tj. da li postoji statistički značajna razlika.

Tabela 1. Rezultati ispitivanih varijabli kao odnos pobednika i pobeđenog u prve tri kategorije.

Kategorija	Varijable		Mean		N		t		p	
			L	W	L	W	L	W	L	W
57 kg	Bod. rund.	I runda	0.74	3.89	19	19	-3.697		**0.000**	
		II runda	0.95	3.63			-3.908		**0.000**	
	Bodovi po minut. u rundama	1. minut	0.32	1.00			-1.606		0.059	
		2. minut	0.26	1.79			-3.101		**0.002**	
		3. minut	0.16	1.11			-2.470		**0.009**	
		1. minut	0.42	1.79			-2.460		**0.009**	
		2. minut	0.16	0.89			-2.326		**0.013**	
		3. minut	0.37	0.95			-1.665		0.052	
	Dom. tehnike	Stojka	1.11	5.00			-5.808		**0.000**	
		Parter	0.42	2.11			-3.240		**0.001**	
	Intez. akcija		300.58	86.53			4.356		**0.000**	
	Efik. akcija		0.70	2.11			-6.430		**0.000**	
65 kg	Bod. rund.	I runda	1.92	4.19	26	26	-2.886		**0.003**	
		II runda	1.38	3.77			-3.654		**0.000**	
	Bodovi po minut. u rundama	1. minut	0.38	1.27			-2.158		**0.018**	
		2. minut	0.81	1.38			-1.401		0.084	
		3. minut	0.73	1.54			-1.651		0.053	
		1. minut	0.38	1.54			-2.772		**0.004**	
		2. minut	0.42	1.15			-1.829		**0.037**	
		3. minut	0.58	1.08			-1.500		0.070	
	Dom. tehnike	Stojka	2.46	6.23			-4.400		**0.000**	
		Parter	0.62	1.31			-1.627		0.055	
	Intez. akcija		173.63	79.08			3.508		**0.000**	
	Efik. akcija		1.41	1.99			-2.339		**0.012**	
74 kg	Bod. rund.	I runda	0.76	5.00	25	25	-5.913		**0.000**	
		II runda	0.84	2.84			-2.797		**0.004**	
	Bodovi po minut. u rundama	1. minut	0.08	1.84			-3.949		**0.000**	
		2. minut	0.52	1.72			-2.585		**0.006**	
		3. minut	0.16	1.44			-4.064		**0.000**	
		1. minut	0.40	1.28			-2.211		**0.016**	
		2. minut	0.36	0.92			-1.537		0.065	
		3. minut	0.08	0.64			-1.948		0.029	
	Dom. tehnike	Stojka	1.28	5.68			-6.390		**0.000**	
		Parter	0.24	1.80			-3.602		**0.000**	
	Intez. akcija		334.90	72.51			7.220		**0.000**	
	Efik. akcija		0.74	2.07			-5.902		**0.000**	

Tabela 2. Rezultati ispitivanih varijabli kao odnos pobednika i pobeđenog u druge tri kategorije.

Kategorija	Varijable		Mean		N		t		p	
			L	W	L	W	L	W	L	W
86 kg	Bod. rund.	I runda	0.89	4.54	28	28	-5.196		**0.000**	
		II runda	0.75	3.21			-4.969		**0.000**	
	Bodovi po minut. u rundama	1. minut	0.21	1.18			-2.053		**0.022**	
		2. minut	0.07	1.79			-3.630		**0.000**	
		3. minut	0.61	1.57			-2.488		**0.008**	
		1. minut	0.14	0.96			-3.247		**0.001**	
		2. minut	0.25	1.11			-2.269		**0.014**	
		3. minut	0.36	1.14			-2.418		**0.010**	
	Dom. tehnike	Stojka	1.29	6.18			-7.092		**0.000**	
		Parter	0.11	1.29			-2.816		**0.003**	
	Intez. akcija		372.65	83.21			10.277		**0.000**	
	Efik. akcija		0.90	2.03			-5.837		**0.000**	
97 kg	Bod. rund.	I runda	0.54	3.58	24	24	-5.134		**0.000**	
		II runda	0.50	3.04			-5.179		**0.000**	
	Bodovi po minut. u rundama	1. minut	0.00	0.46			-2.037		**0.024**	
		2. minut	0.42	1.67			-2.508		**0.008**	
		3. minut	0.13	1.46			-3.729		**0.000**	
		1. minut	0.13	1.21			-3.384		**0.001**	
		2. minut	0.17	1.17			-3.178		**0.001**	
		3. minut	0.21	0.67			-1.718		**0.046**	
	Dom. tehnike	Stojka	0.83	5.04			-6.487		**0.000**	
		Parter	0.08	1.00			-2.298		**0.013**	
	Intez. akcija		521.27	104.25			5.702		**0.000**	
	Efik. akcija		0.73	1.93			-5.713		**0.000**	
125 kg	Bod. rund.	I runda	0.29	4.71	24	24	-7.196		**0.000**	
		II runda	0.75	2.79			-3.371		**0.001**	
	Bodovi po minut. u rundama	1. minut	0.00	1.29			-2.881		**0.003**	
		2. minut	0.21	1.46			-3.063		**0.002**	
		3. minut	0.08	1.96			-3.912		**0.000**	
		1. minut	0.38	1.29			-2.067		**0.022**	
		2. minut	0.17	0.83			-2.158		**0.018**	
		3. minut	0.21	0.67			-1.763		**0.042**	
	Dom. tehnike	Stojka	0.58	5.46			-8.495		**0.000**	
		Parter	0.42	1.58			-2.506		**0.008**	
	Intez. akcija		493.79	82.30			10.697		**0.000**	
	Efik. akcija		0.65	2.06			-5.782		**0.000**	

Kroz naredne tri tabele dati su rezultati varijabli, bodovna vrednost i njihova zastupljenost (Tabela 3), ali i precizno definisana zastupljenost svih realizovanih tehnika u borbama kroz odnos pobednika i poraženog na PEOI 2015. godine (Tabela 4). U poslednjoj tabeli je prikazana vrsta i zastupljenost načina ostvarivanja pobede po kategorijama (Tabela 5).

Tabela 3. – Učestalost akcija, njihove vrednosti.

Kategorija		57		65		74		86		97		125	
Izg./Pob.		L	W	L	W	L	W	L	W	L	W	L	W
1b. Stojka	Broj	7	5	14	12	4	16	10	17	6	11	4	15
	Sred. v.	0.37	0.26	0.54	0.46	0.16	0.64	0.36	0.61	0.25	0.46	0.17	0.63
	t	0.49		0.33		-2.56		-1.37		-1.08		-2.25	
	p	0.32		0.37		**0.01**		0.09		0.14		**0.01**	
1b. Parter	Broj	2	2	4	4	2	3	1	2	2	2	2	2
	Sred. v.	0.11	0.11	0.15	0.15	0.08	0.12	0.04	0.07	0.08	0.08	0.08	0.08
	t	0.00		0.00		-0.46		-0.58		0.00		0.00	
	p	0.50		0.50		0.32		0.28		0.50		0.50	
2b. Stojka	Broj	7	35	19	65	12	52	9	56	7	47	3	40
	Sred. v.	0.37	1.84	0.73	2.5	0.48	2.08	0.32	2	0.29	1.96	0.13	1.67
	t	-5.25		-4.23		-4.62		-6.27		-6.72		-6.62	
	p	**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**	
2b. Parter	Broj	3	19	6	15	2	20	1	17	0	11	4	18
	Sred. v.	0.16	1.00	0.23	0.58	0.08	0.8	0.04	0.61	0	0.46	0.17	0.75
	t	-3.28		-1.84		-3.23		-2.71		-2.30		-2.70	
	p	**0.00**		**0.04**		**0.00**		**0.00**		**0.01**		**0.00**	
4 boda	Broj	0	5	3	5	1	6	2	11	0	4	1	9
	Sred. v.	0.00	0.26	0.12	0.19	0.04	0.24	0.07	0.39	0	0.17	0.04	0.38
	t	-2.04		-0.76		-1.79		-2.50		-2.14		-2.41	
	p	**0.02**		0.23		**0.04**		**0.01**		**0.02**		**0.01**	

U Tabeli 3. uočavamo da dominiraju akcije za 2 boda (468), znatno manje akcije za 1 bod (149), a najmanje najatraktivnija bacanja (47).

Tabela 4. – Zastupljenost tehničkih elemenata.

Kategorija	57		65		74		86		97		125	
Izg./Pob.	L	W	L	W	L	W	L	W	L	W	L	W
Bacanje	0	6	2	4	2	5	3	7	0	3	0	5
Rušenje	0	8	4	11	2	10	1	11	1	8	1	12
Izguravanje	7	5	14	12	3	16	10	17	6	10	4	15
Kontra u s.	0	0	0	1	0	2	0	1	0	1	0	1
DNL u s.	7	26	16	54	10	40	6	46	6	40	3	31
DNL u p.	1	0	0	0	2	0	2	2	1	1	2	0
Zah. u p.	2	20	7	17	2	23	1	18	0	12	2	18
Kontra u p.	2	1	3	2	0	1	0	1	1	0	2	1
Tuš poz.	0	0	0	0	0	0	0	0	0	0	0	1

Od ukupnog broja realizovanih akcija, najzastupljenije su dolasci na leđa, zahvati u parteru i izguravanja iz kruga borilišta u obe ispitivane grupe (Tabela 4).

Tabela 5. – Način ostvarivanja pobeda po kategorijama

Kategorija	57	65	74	86	97	125
Na bod.	11	17	13	19	16	14
Teh. tuš	6	8	8	9	8	8
TUŠ	2	1	4	0	0	2

DISKUSIJA

Profesor Tunnemann (2013) ističe se da je ključno pitanje, za dalje unapređenje performansi u borilačkim sportovima, povećanje efikasnosti treninga. Polazna tačka za efikasnu kontrolu obuke je opis ciljne performanse koja garantuje uspeh (Eduardo & González, 2013). S tim u vezi, kroz dalju diskusiju rezultata ovog rada, uočićemo koji se to faktori više, a koji manje izdvajaju kao bitni za pobedu u borbi.

Posmatranjem rezultata po kategorijama (Tabele 1 i 2) uočava se statistička značajnost razlika u varijabli bodovi po rundama, za prvu i drugu rundu borbe, u svim težinskim kategorijama i to: za kategoriju 57 kg p=0.000 i p=0.000, 65 kg p=0.003 i p=0.000,74 kg p=0.000 i p=0.004, 86 kg p=0.000 i p =0.000, 97 kg p=0.000 i p=0.000, 125 kg p=0.000 i p=0.001. Ovim potvrđujemo očekivane zaključke, a to je da pobednici očigledno prave znatno veći broj bodova kako u prvoj tako i u drugoj rundi.

Sledeća varijabla predstavlja, podvarijablu prve ispitivane varijable, tj. detaljan prikaz ostvarenih bodova po minutima rundi. Ovi rezultati daju precizniju sliku, u kojem minute borbe, su pobednici statistički dominantniji, odnosno kada ostvaruju najveći broj uspešnih napada. U Tabeli 2 u kategorijama 86, 97 i 125 kilograma statistički značajna razlika javlja se u svim minutima borbe po broju ostvarenih bodova. U Tabeli 1 u kategoriji 57 kg statistička značajnost razlika uočava se u drugoj i trećoj minuti prve runde, kao i prvoj i drugoj minuti druge runde, u kategoriji 65 kg statistički značajna razlika javlja se u prvoj minuti prve runde, kao i prvoj i drugoj minuti druge runde, dok se u kategoriji 74 kg statistička značajnost razlika javlja u prvoj rundi, kao i prvoj minuti druge runde.

Rvanje karakterišu dva načina vođenja borbe: borba u stojećem stavu i borba u parteru. Individualne karakteristike svakog rvača ogledaju se u dominantnoj tehnici koju realizuju u borbi, u stojećem stavu ili u parteru, dok neki podjednako dobro ralizuju zahvate u obe borbene pozicije. Ako posmatramo prosečan broj ostvarenih bodova u borbi kao prosek bodova realizovanih u stojećem stavu i prosek bodova realizovanih u parternoj borbi, dobijamo dve merljive varijable. Na osanovu rezultata t testa varijable bodovi ostvareni u stojećem stavu, možemo uočiti da postoji statistički značajna razlika između ostvarenih bodova u stojci pobednika i pobeđenog takmičara u svih šest ispitivanih kategorija. Statistička značajnost u varijabli ostvareni bodovi u parteru, jedino se ne javlja u kategoriji 65 kilograma, mada je i tu na granici statističe značajnosti - p = 0.055.

Poslednje dve varijable u Tabelama 1 i 2 predstavljaju prosečnu vrednost vremena potrebnog za ostvarivanje akcije po kategorijama, kao i prosečnu bodovnu vrednost tih akcija odnosno efikasnost akcija. Varijabla inteziteta akcija, pokazuje brojčanu razliku potrebnog vremena za pravljenje akcije u borbi, gde se jasno uočava razlika i fizička dominantnost pobednika u svim kategorijama (p = 0.000). Što se tiče efikasnosti realizovanih akcija, uočavamo značajan podatak koji dopunjuje prethodnu varijablu, a to je postojanje statistički značajne razlike između pobednika i pobeđenih u prosečnoj vrednosti ostvarenih akcija u svim ispitivanim kategorijama (Tabela 1 i 2).

U Tabeli 3 predstavljeni su rezultati zastupljenosti i vrednosti akcija po kategorijama za obe grupe ispitanika. Kao najvažnije rezultate ove tabele možemo izdvojiti pojavljivanje statističke značajnosti u varijablama broja akcija za 2 boda u stojci i u parteru u svim kategorija, ali i varijabli broj akcija za 4 boda u kategorijama 57, 74, 86, 97, 125 kilogrma. Ovim su potvrđeni rezultati dosadašnjih istraživanja, pa su i na Prvenstvu Evrope 2014. godine dominirale tehnike za dva poena (Kasum i Marković, 2014).

Naredna tabela predstavlja brojčanu zastupljenost svih tehničkih dejstava u obrađenim kategorijama (Tabela 4). U ovoj tabeli se jasno vidi dominantnost pobednika u većini ispitivanih varijabli, a izdvaja se znatno veći broj bacanja i rušenja, zahvata u parteru, kao i znatno veći broj dolazaka na leđa. Dominantnost akcija sa malim procentom rizika je, između ostalog, posledica povećanja vrednosti akcije dolaska na leđa, koju karakteriše mali procenat rizika, što potvrđuju i dosadašnja istraživanja (Kasum i Marković, 2014; Marković i Kasum, 2013a; Tünnemann, 2013b). Takođe treba istaći da ukupan broj najatraktivnijih bacanja za obe ispitivane grupe nema trend porasta, kako je očekivano nakon poslednje izmene pravila, već blago opada u odnosu na prethodna istraživanja (Marković i Kasum, 2013b).

U Tabeli 5 uočavamo raznovrsniji način ostvarivanja pobede na takmičenju, što je dodatno dalo pozitivan efekat, pomak u atraktivnosti rvanja.

ZAKLJUČAK

Analiza takmičarske aktivnosti rvača slobodnim stilom na Prvim evropskim olimijskim igrama 2015. godine, predstavljena je kao jedna baza, tj. skup zapisa takmičarske aktivnosti u 6 težinskih kategorija, koje su uzete kao uzorak kako bi se izdvojili najdiskriminativniji faktori takmičarske aktivnosti koji karakterišu pobednika, tj. prostor u kome pobeđeni takmičar treba da napreduje.

Detaljnijom analizom varijabli, ali i posmatranjem prosečno ostvarenih bodova po minutima rundi, izvodi se zaključak da se dominantnost pobednika krije u konstantnim napadima na protivnika od samog početka borbe, ista taktika se realizuje i u drugoj rundi. Iz toga se može zaključiti da pobednici vode borbe visokog inteziteta, čime je ustanovljeno je da fizička pripremljenosti igra veoma važnu ulogu na tok meča.

Isto tako bitno je napomenuti da pobednici generalno više bodova prave u stojci ali i u parteru, u odnosu na grupu ispitanika koji nisu ostvarili pobedu. Iz toga se zaključuje da pobednici veliku pažnju posvećuju tehničkim dejstvima koja se realizuju u stojećem stavu, pa zbog toga imaju i veći procenat realizovanih najvrednijih akcija.

Takođe, bitan podatak je da je pobednicima prosečna vrednost akcija znatno veća, ali i prosečan broj realizovanih akcija po borbi je veći, pa zaključijemo da je pobednicima potrebno manje vremena za realizovanje jedne akcije, iz čega proizilazi znatno veći broj ostvarenih pobeda tehničkim tušem i tušem. Poslednja izmena pravila nameće zahteve za visokim tempom borbe, što znači da rvači moraju biti efikasni od samog starta rvačke borbe, tj. oni koji su uspeli da se trenažnim procesom prilagode na visok intezitet borbe i pri tome budu efikasni, zasigurno ostvaruju uspeh. Time je promena pravila povoljno uticala na to da borba postane zanimljivija za posmatrače, što se posebno ogleda kroz atraktivnije vođenje borbe, veći broj ostvarenih bodova i raznovrsniji način ostvarivanja pobede. Bez obzira u kom smeru će se vršiti dalje promene pravila rvačke borbe, uvek treba težiti celokupnom unapređenju, koje će imati povoljan uticaj na sve segmente rvačke borbe, ali i popularizaciju samog sporta.

Za trenera je veoma važna analiza tehničko-taktičke strukture pobednika, da bi analizu tehničkog kapaciteta njihovih sportista uporedili sa vrhunskim sportistima u težinskoj kategoriji, što je veoma važno za planiranje trenažnog procesa, kao i za usavršavanje koncepta obuke perspektivnih mladih rvača.

Analiza takmičarske aktivnosti je oblast koja ima ogromnu ulogu za unapređenje rvanja i sporta generalno, pa samim time treba naglasiti da je ovakav vid istraživanja neiscrpan izvor podataka, zbog čega možemo sa sigurnošću reći da će biti još istraživanja na ovu temu.

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ANALYSIS OF FREE STYLE WRESTLERS' COMPETITIVE ACTIVITY ON THE FIRST EUROPEAN OLYMPIC GAMES 2015

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INTRODUCTION

Researches of competitive activity today are getting more and more topical in contemporary sport's theory and practice and are getting more and more affirmed as a special group of research with a specific methodology. Competitive activity in different branches of sport is conditioned on the characteristics of those branches (Hughes and Franks, 2008). Results describing the competitive activity of athletes belong to indicators that depict, in the most direct way, the relationship between the process of preparation and competitive results in a certain sport branch (Tünnemann, 1996). Noticing and analysing the most significant parameters of competitive activity, quantitative determination of influences and mutual connection of those parameters, as well as explanation of their dependence and coherence with certain aspects of preparation, present a very important and delicate research task (Dopsaj, 2009). Of course, this type of research makes real sense only once it's realized in conditions of outstanding orientation towards maximum result, i.e. on the most significant competitions (Jovanović, Koprivica, Ćirković i Koropanovski, 2010).

Competitive activity in wrestling presents manifestation of competitors according to wrestling rules, and it is directly depends on their preparedness. Technical, tactical, psychological, conditional and theoretical preparation of the wrestler are put into the function of enhancing competitive activity, but also indicators of competitive activity directly influence all of the above stated segments of wrestler's preparation. Analysis of competitive activity unequivocally shows which techniques of element are applied the most, which details of tactic have special significance, those directions in which conditional and psychological preparedness of the wrestler should be directed. Success in wrestling is the indicator of the good coordination of all those factors, by which successful manifestation of required knowledge and skills are enabled, and indicators of competitive activity "reveal" the ways in which those factors of preparation are manifested in a wrestling fight (Tuenneman, 2004). That way, former researches reveal the specificity of competitive activity on European and World championships.

By analysing final fights of the European Championship 2013 (Marković i Kasum, 2013b), the following results of the competitive activity were obtained: 157 points were realized in 102 actions, out of which 50% of the points were realized by landing on the back, i.e. actions with small risk factor were dominating, and by observing the realized scoring actions per parts of the round, greater success in other parts of the round was noticed.

The analysis of the World Championship 2013 (Marković i Kasum, 2013a) has shown that in the free style wrestling, the trend of narrowing the repertoire of techniques applied has continued even after the change of rules. Number of points achieved in fights for medals has not changed significantly 166 points whereas the number of actions decreased by 20 percent. As a consequence to enhancement of landing on the back action value to 2 points.

The research that included the same sample (World Championship 2013) showed that the index of performances and efficiency of attacks improved, thus enormous progress towards attacking orientation in the fight. Formal increase of actions that carry 2 points leads to reduction of actions that carry 1 point, but does not lead to increase of actions that carry 3 and 5 points (Tünnemann, 2013).

Comparative analysis of free style wrestler's competitive activity on the European Championship 2013 and 2015 (Kasum and Marković, 2014) reveals that the number of points changed drastically, meaning that, significantly more points were realized on the European Championship in 2014 than the one in 2013. However, the number of realized actions remained the same, which goes in favor to the thesis that the performance of the competitors has not changed drastically, but the fight has become quite independent and interesting to the spectator because of the way of evaluation.

The subject of this work is elite free style wrestlers' competitive activity, which was analyzed on the First European Olympic Games in 2015. The subject of the research could be defined as the questioning of the most representative indicators that characterize competitors through wrestling fight and determination of their differentially diagnostic value.

The main aim of this work is the overview of the specificity of technical-tactical actions of the wrestlers that won the fight, but also of the defeated free style wrestlers, and based on the indicator of their competitive activity.

METHOD

The collecting of the data in this transversal research, has been carried out with the method of observation, i.e. analysis of the official reports (records-bulletin) and video materials of the First European Olympic Games 2015. Compared to the basic method, this work belongs to the category of the natural non-experimental research according to its character. Compared to the type of research, this work has characteristics of fundamental, as well as applied research as it provides the innovation of already existing common knowledge from the training technology field with elite free style wrestlers that can be practically applied. Basic method of knowledge in this work will be the inductive reasoning as the successfulness of wrestlers will be explained based on individual indicators of competitive activity.

As a sample of the research, 146 fights have been analyzed, i.e. 6 out of 8 Olympic categories realized on the competition. Processed categories were as follows: 57kg, 65kg, 74kg, 86kg, 97kg, 125kg (omitted categories 61kg and 70kg). Rational typologization of competitors has been carried out in an adequate way, based on competitors that won and those who didn't manage to win the fight, which resulted in possibility of applying comparative analysis. Based on the results of comparative analysis, it is possible to obtain exact indicators of every important element of one fight, as well as indicators according to individual categories, but also the competition in whole. By processing the big sample of fights, the main parameters are defined, as well as factors of success which characterize the winners on competitions mentioned, but clearly profilize indicators of competitive activity that characterize defeated wrestlers.

Variables of this research present some of the typical indicators of competitive activity, and those are number and value of the action, dominant period of time of realizing the action, frequency of scoring techniques, number of points made in standing position, as well as parterre. Competitive activity of the wrestler within the competition is presented through qualified indicators of frequency of appearance of every element and its sub modalities.

Raw results of all variables used in this research are exposed to the calculation of the basic descriptive statistic. For the needs of determining the differences between subsamples of the examinee, i.e. between individual variables of tested subsamples, the T test is used.

The obtained results should help and direct sport experts in wrestling sport to carry out modelling of the training activity appropriately, i.e. that training of the wrestler should enable the maximum efficiency of the fighter on the competition and thus help the wrestler achieve better success.

RESULTS

Roughly obtained results show that in all fights in the first round 762 points were realized, whereas in the second, 594 points were realized. Out of the total number of realized points in all fights the sample includes, 1011 were realized in standing position, whereas in parterre only 262 points, and 83 points were realizes through unsuccessful challenges and the passive way of leading the fight.

With further analysis of the competition, subsamples were created in order to obtain practically more useful and valuable results. This way, by grouping the data and analyzing competitive activity, factors which characterize the profile of the winner are determined, as well as deficiency of the defeated wrestler. In Table 1 and 2, results of the variables are shown, as well as points per round, points per minutes in round, dominant way of leading the fight, intensity of realizing every action, but also efficiency of those actions in the winner's case (**W**), as well as in the defeated competitor's case (**L**) in the fight, by which the relationship is determined, i.e. whether the statistically significant difference exists. In Table 1 the results of the following categories are shown: 57 kg, 65 kg, 74 kg.

Table 1. - Results of tested variables as the relationship between the winner and the defeated in the first three categories.

Categories:	Variables		Mean		N		t		p	
			L	W	L	W	L	W	L	W
57 kg	Points per round	I round	0.74	3.89	19	19	-3.697		**0.000**	
		II round	0.95	3.63			-3.908		**0.000**	
	Points in rounds per minute	1. minute	0.32	1.00			-1.606		0.059	
		2. minute	0.26	1.79			-3.101		**0.002**	
		3. minute	0.16	1.11			-2.470		**0.009**	
		1. minute	0.42	1.79			-2.460		**0.009**	
		2. minute	0.16	0.89			-2.326		**0.013**	
		3. minute	0.37	0.95			-1.665		0.052	
	Dominant technique	Stand. pos.	1.11	5.00			-5.808		**0.000**	
		Parterre	0.42	2.11			-3.240		**0.001**	
	Intensity of actions		300.58	86.53			4.356		**0.000**	
	Efficiency of actions		0.70	2.11			-6.430		**0.000**	
65 kg	Points per round	I round	1.92	4.19	26	26	-2.886		**0.003**	
		II round	1.38	3.77			-3.654		**0.000**	
	Points in rounds per minute	1. minute	0.38	1.27			-2.158		**0.018**	
		2. minute	0.81	1.38			-1.401		0.084	
		3. minute	0.73	1.54			-1.651		0.053	
		1. minute	0.38	1.54			-2.772		**0.004**	
		2. minute	0.42	1.15			-1.829		**0.037**	
		3. minute	0.58	1.08			-1.500		0.070	
	Dominant technique	Stand. pos.	2.46	6.23			-4.400		**0.000**	
		Parterre	0.62	1.31			-1.627		0.055	
	Intensity of actions		173.63	79.08			3.508		**0.000**	
	Efficiency of actions		1.41	1.99			-2.339		**0.012**	
74 kg	Points per round	I round	0.76	5.00	25	25	-5.913		**0.000**	
		II round	0.84	2.84			-2.797		**0.004**	
	Points in rounds per minute	1. minute	0.08	1.84			-3.949		**0.000**	
		2. minute	0.52	1.72			-2.585		**0.006**	
		3. minute	0.16	1.44			-4.064		**0.000**	
		1. minute	0.40	1.28			-2.211		**0.016**	
		2. minute	0.36	0.92			-1.537		0.065	
		3. minute	0.08	0.64			-1.948		0.029	
	Dominant technique	Stand. pos.	1.28	5.68			-6.390		**0.000**	
		Parterre	0.24	1.80			-3.602		**0.000**	
	Intensity of actions		334.90	72.51			7.220		**0.000**	
	Efficiency of actions		0.74	2.07			-5.902		**0.000**	

In Table 2 are shown results of the following categories: 86 kg, 97 kg, 125 kg.

Table 2. - Results of tested variables as the relatioship between the winner and the defeated in the second three categories.

Categories:	Variables		Mean		N		t	p
			L	W	L	W	L W	L W
86 kg	Points per round	I round	0.89	4.54	28	28	-5.196	**0.000**
		II round	0.75	3.21			-4.969	**0.000**
	Points in rounds per minute	1. minute	0.21	1.18			-2.053	**0.022**
		2. minute	0.07	1.79			-3.630	**0.000**
		3. minute	0.61	1.57			-2.488	**0.008**
		1. minute	0.14	0.96			-3.247	**0.001**
		2. minute	0.25	1.11			-2.269	**0.014**
		3. minute	0.36	1.14			-2.418	**0.010**
	Dominant technique	Stand. pos.	1.29	6.18			-7.092	**0.000**
		Parterre	0.11	1.29			-2.816	**0.003**
	Intensity of actions		372.65	83.21			10.277	**0.000**
	Efficiency of actions		0.90	2.03			-5.837	**0.000**
97 kg	Points per round	I round	0.54	3.58	24	24	-5.134	**0.000**
		II round	0.50	3.04			-5.179	**0.000**
	Points in rounds per minute	1. minute	0.00	0.46			-2.037	**0.024**
		2. minute	0.42	1.67			-2.508	**0.008**
		3. minute	0.13	1.46			-3.729	**0.000**
		1. minute	0.13	1.21			-3.384	**0.001**
		2. minute	0.17	1.17			-3.178	**0.001**
		3. minute	0.21	0.67			-1.718	**0.046**
	Dominant technique	Stand. pos.	0.83	5.04			-6.487	**0.000**
		Parterre	0.08	1.00			-2.298	**0.013**
	Intensity of actions		521.27	104.25			5.702	**0.000**
	Efficiency of actions		0.73	1.93			-5.713	**0.000**
125 kg	Points per round	I round	0.29	4.71	24	24	-7.196	**0.000**
		II round	0.75	2.79			-3.371	**0.001**
	Points in rounds per minute	1. minute	0.00	1.29			-2.881	**0.003**
		2. minute	0.21	1.46			-3.063	**0.002**
		3. minute	0.08	1.96			-3.912	**0.000**
		1. minute	0.38	1.29			-2.067	**0.022**
		2. minute	0.17	0.83			-2.158	**0.018**
		3. minute	0.21	0.67			-1.763	**0.042**
	Dominant technique	Stand. pos.	0.58	5.46			-8.495	**0.000**
		Parterre	0.42	1.58			-2.506	**0.008**
	Intensity of actions		493.79	82.30			10.697	**0.000**
	Efficiency of actions		0.65	2.06			-5.782	**0.000**

In the following tables, we will see results of variables, scoring value and their representation (Table 3), and also precisely defined representation of all realized techniques in fights through relationship of the winner and the defeated on FEOG 2015 (Table 4). In the last table, the type and the representation of the way of achieving the victory by categories is presented (Table 5).

Table 3. - Frequency of actions, their values.

Categories:		Frequency of actions, their values: 57		65		74		86		97		125	
Loser / Winner		L	W	L	W	L	W	L	W	L	W	L	W
1p. Standing posit.	N	7	5	14	12	4	16	10	17	6	11	4	15
	Mean.	0.37	0.26	0.54	0.46	0.16	0.64	0.36	0.61	0.25	0.46	0.17	0.63
	t	0.49		0.33		-2.56		-1.37		-1.08		-2.25	
	p	0.32		0.37		**0.01**		0.09		0.14		**0.01**	
1p. Parterre	N	2	2	4	4	2	3	1	2	2	2	2	2
	Mean.	0.11	0.11	0.15	0.15	0.08	0.12	0.04	0.07	0.08	0.08	0.08	0.08
	t	0.00		0.00		-0.46		-0.58		0.00		0.00	
	p	0.50		0.50		0.32		0.28		0.50		0.50	
2 p. Standing posit.	N	7	35	19	65	12	52	9	56	7	47	3	40
	Mean.	0.37	1.84	0.73	2.5	0.48	2.08	0.32	2	0.29	1.96	0.13	1.67
	t	-5.25		-4.23		-4.62		-6.27		-6.72		-6.62	
	p	**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**	
2 p. Parterre	N	3	19	6	15	2	20	1	17	0	11	4	18
	Mean.	0.16	1.00	0.23	0.58	0.08	0.8	0.04	0.61	0	0.46	0.17	0.75
	t	-3.28		-1.84		-3.23		-2.71		-2.30		-2.70	
	p	**0.00**		**0.04**		**0.00**		**0.00**		**0.01**		**0.00**	
4 Points	N	0	5	3	5	1	6	2	11	0	4	1	9
	Mean.	0.00	0.26	0.12	0.19	0.04	0.24	0.07	0.39	0	0.17	0.04	0.38
	t	-2.04		-0.76		-1.79		-2.50		-2.14		-2.41	
	p	**0.02**		0.23		**0.04**		**0.01**		**0.02**		**0.01**	

In Table 3, we see that actions that carry 2 points are dominant (468), significantly less dominant are the actions that carry 1 point (149), and the least the most attractive throws (47).

Table 4. - Frequency of technical elements.

	Frequency of technical elements:											
Categories:	57		65		74		86		97		125	
Loser/Winner	L	W	L	W	L	W	L	W	L	W	L	W
Throws	0	6	2	4	2	5	3	7	0	3	0	5
Takedowns	0	8	4	11	2	10	1	11	1	8	1	12
Pushouts	7	5	14	12	3	16	10	17	6	10	4	15
Counter	0	0	0	1	0	2	0	1	0	1	0	1
LOB	7	26	16	54	10	40	6	46	6	40	3	31
LOB in part.	1	0	0	0	2	0	2	2	1	1	2	0
Moves in part.	2	20	7	17	2	23	1	18	0	12	2	18
Counter in par.	2	1	3	2	0	1	0	1	1	0	2	1
Pin pos.	0	0	0	0	0	0	0	0	0	0	0	1

Out of the total number of realized actions, the most common ones are landings on the back, actions in parterre and pushouts from the fighting pit in both of the groups tested (Table 4).

Table 5. - Way of achieving victories by categories.

Way of achieving victories:						
Categories:	57	65	74	86	97	125
By scoring points	11	17	13	19	16	14
Technical pin	6	8	8	9	8	8
Pin	2	1	4	0	0	2

DISCUSSION

Professor Tunnemann (2013) states that the key question to the further enhancement of the performance in martial arts is the efficiency of the training. The starting point to the efficient control of the training is the description of target performance which guarantees success (Eduardo & González, 2013). Having that said, through further discussion of the results in this work, we will see which factors single out as important to the winning the most, and which the least.

Observing the results according to category (Tables 1 and 2), the statistical significance of differences in variables of the points per round, for the first and the second round of the fight in all categories can be noticed: for category 57 kg p=0.000 and p=0.000, 65 kg p=0.003 and p=0.000,74 kg p=0.000 and p=0.004, 86 kg p=0.000 and p =0.000, 97 kg p=0.000 and p=0.000, 125 kg p=0.000 and p=0.001. This confirms expected results, i.e. that winners apparently make significantly larger number of points in the first, as well as in the second round.

The following variable presents sub variable of the first variable that has been tested, i.e. the detailed representation of scored points per minutes in round. These results give a more precise picture of the minute of the fight in which the winners are statistically dominant, i.e. when they achieve the biggest number of successful attacks. In Table 2, in categories 86, 97 and 125 kilograms, statistically significant difference occurs in every minute of the fight per number of scored points. In Table 1, in category 57 kg, statistic significance of differences can be seen in the second and the third minute of the first round, as well as in the first and the second minute of the second round, in category 65 kg statistically significant difference occurs in the first minute of the first round, as well as in the first and the second minute of the second round, whereas in category 74 kg statistic significance of differences occurs in the first round, as well as in the first minute of the second round.

Two ways of leading the fight characterize wrestling: fight in standing position and fight in parterre. Individual characteristics of each wrestler are reflected in dominant technique they realize during the fight in standing position or in parterre, whereas some realize actions in both fighting positions equally well. If we take a look at the average number of scored points in the fight as an average of points realized in standing position and an average of points realized in parterre, we get two measurable variables. Based on the results of the t test of variable of points realized in standing position, we can see that there is a statistically significant difference between points scored in standing position of the winner and the defeated wrestler in all six of the categories that were tested. Statistical significance in variable of points realized in parterre, is absent only in 65 kilograms category, although even in this category it is on the edge of statistical significance - p = 0.055.

The last two variables in Tables 1 and 2 present an average value of the time needed to realize actions by categories, as well as the average scoring value of those actions, i.e. efficiency of actions. The variable of intensity of actions show numerical difference of time needed to realize an action in the fight where the difference and physical dominance of the winner can be clearly seen in all categories (p = 0.000). When it comes to the efficiency of realized actions, we can see the significant piece of information which completes the previous variable, and that is the existence of statistically significant difference between the winner and the defeated in the average value of realized actions in all of the categories tested (Tables 1 and 2).

In Table 3, results of the representation of the actions, as well as the values of the actions per categories for both groups of examinees are presented. As the most important results of this table, we can single out the emergence of statistical significance in variables of the number of actions that carry two points in standing position and in parterre in all categories, as well as variables of the number of actions that carry 4 points in categories 57, 74, 86, 97, 125 kilograms. With this information, results of the hitherto researches are verified, therefore techniques that carry two points dominated on the European Championship 2014 (Kasum and Marković, 2014).

The following table presents numerical representation of all technical actions in processed categories (Table 4). In this table, the dominance of the winner can be seen in majority of the tested variables, and significantly larger number of throws and takedowns singles out, as well as the number of actions in parterre and landings on the back. Dominance of the action with small percentage of risk is, among other things, the consequence of increase of values of landing on the back action, which is characterized by a small percentage of risk, which is also confirmed by hitherto researches. (Kasum and Marković, 2014; Marković and Kasum, 2013a; Tünnemann, 2013). Also, it is important

to point out that the total number of the most attractive throws for both groups has no growing trend as expected after the change of rules, but yet slightly decreasing compared to the previous researches (Marković and Kasum, 2013b).

In Table 5, we can see the diverse way of achieving victory in the competition, which additionally gave a positive effect, a shift in wrestling attractiveness.

CONCLUSION

Analysis of free style wrestler's competitive activity on the First European Olympic Games 2015 is presented as a single base, i.e. collection of data of competitive activity in 6 categories which are taken as a sample in order to single out the most discriminative factors of competitive activity that characterize the winner, i.e. the field in which the defeated wrestler should improve.

With a more detailed analysis of variables, but also the observation of averagely scored points per minutes of the round, it is concluded that the dominance of the winner lies in constant attacks from the very beginning of the fight, the same tactic is realized in the second round. From this, it can be concluded that winners lead high intensity fights, by which it is founded that the physical preparation plays a very big role when it comes to the flow of the match.

Also, it is important to mention that winners generally make more points in standing position, but in parterre as well, compared to the group of examinees that did not win. From that, it can be concluded that winner pay greater attention to technical actions which are realized in standing position, therefore they have bigger percentage of realized actions that are the most valuable.

It is also an important piece of information that the average value of actions significantly bigger with winners, but the average number of realized actions per fight as well, therefore we can conclude that some individuals take less time to realize one action, which means significantly larger number of realized victories by using technical pin and pin. The latest change in rules imposes the requirements for higher tempo of the fight, which means that wrestlers have to be efficient from the very beginning of the wrestling fight, i.e. those who managed to adjust to high intensity of the fight and thus be efficient by the training they have previously did, undoubtedly succeed. With this, the change in rules favorably influenced the fight to become more interesting to the viewer, which can be especially seen through the more attractive leading of the fight, bigger number of scored points and diverse way of winning the fight. No matter in what way the change of rules will evolve, it is always advisable to aspire to the overall improvement which will have favorable impact on all segments of the wrestling fight, but also the popularization of the sport itself.

To the coach, the analysis of technical-tactical structure of the winner is very important in order for him to compare the analysis of the technical capacity of his athlete to the elite athletes in weight category, which is very important for the planning of the training process, as well as for the perfecting of the concept of training the perspective young wrestlers.

Analysis of the competitive activity is a field which has an enormous role when it comes to advancement of the wrestling sport and sports in general, therefore it should be emphasized that this type of research is the unfailing source of information, and thus we can tell with certainty that there will be more researches on this subject.

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ANALIZA TELESNOG STATUSA ODBOJKAŠICA UZRASTA OD 11 DO 14 GODINA

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UVOD

Tehnologija je dostigla visine o kojima nismo mogli ni da sanjamo. Iako nam je pomogla i olakšala mnoge životne situacije, ipak je donela i jednu lošu stvar, a to je nedostatak kretanja, tačnije nedostatak fizičke aktivnosti. Čovek je postao sedentarno biće, nivo fizičke aktivnosti sveden je na minimum. Treba imati u vidu da postoje razlike u telesnom statusu dece koja se bave nekim sportom i dece koja se ne bave sportom, kao i da se u zavisnosti od vrste sporta kojom se bave javljaju različiti deformiteti, odnosno problemi.

Naime, kičmeni deformiteti predstavljaju spektar poremećaja koji se najčešće pojavljuje u detinjstvu i adolescenciji i može implicirati pojavu bola i deformiteta kod odraslih (d'Hemecourt & Hresko, 2012). Radi zdravog i srećnog života, preventivno-korektivni rad u školskom uzrastu je imperativ i moralna odgovornost trenera, nastavnika i lekara.

U svojoj studiji su Krneta, Protić-Gava, Vuković i Šćepanović (2012) na uzorku od 429 odbojkašica sa teritorije Vojvodine uzrasta od 11,5 do 16,5 godina, zaključili su da su najzastupljeniji poremećaji ramenog pojasa (kod oko 50% odbojkašica), lopatica i kičmenog stuba u frontalnoj ravni.

Istraživanje (Krneta i sar. 2012.) pokazuje da se u radu sa mladim odbojkašima ne sprovode u dovoljnoj meri ona vežbanja kojima se aktivira muskulatura bitna za održavanje pravilnog držanja tela. Zbog toga je potrebno raditi na povećavanju snage ekstenzora kičmenog stuba, mišića trbušnog zida i mišića zaduženih za pravilan status stopala.

Đurić, Ilić i Nešić (2013) su na uzorku od 30 polaznika škole odbojke, uzrasta od 9 do 16 godina došli do zaključka da pravilno stopalo ima svega 11,42%, dok 88,58% od ukupnog broja polaznika ima određeni stepen spuštenosti svodova stopala.

Cilj ovog rada je da putem analize telesnog statusa odbojkašica uzrasta između 11 i 14 godina utvrdi koji su to telesni deformiteti najzastupljeniji kod mladih odbojkašica i zatim pokuša da detektuje uzroke datih deformiteta. Na osnovu dosadašnjih saznanja postavljene su dve hipoteze.

Hipoteza 1- Deformiteti kičmenog stuba (kifoza, skolioza i lordoza) su najzastupljeniji kod devojčica uzrasta od 11 do 14 godina.

Hipoteza 2: Procenat ispitanica sa spuštenim stopalom će biti minimum 30%.

Kada saznamo koji su to telesni deformiteti najzastupljeniji kod odbojkašica koje se nalaze u periodu ubrzanog rasta i razvoja moći ćemo mnogo bolje da pristupamo trenažnom procesu.

METOD

Ovo je neeksperimentalno, kvantitativno istraživanje, a vrsta studije je retrospektivna. Za potrebe ovog rada su pregledani kartoni sportskog lekara, koji je beležio detektovane telesne deformitete odbojkašica uzrasta od 11-14 godina. Informacije o ovim telesnim deformitetima su obrađene u programu Microsoft Excel 2010. Za analizu informacija korišćena je osnovna deskriptivna statistika. Cilj ovog rada jeste da utvrdi koliki je procenat zastupljenosti telesnih deformiteta kod odbojkašica kluba ''Odbojka 013" iz Pančeva. Od opreme je korišćen samo podoskop, klinički list (Radisavljević, 2001) i olovka, lenjir i visak.

Ukupno 130 odbojkašica pančevačkog kluba ''Odbojka 013" je prisustvovalo sistematskom pregledu. Od 130 odbojkašica, koliko ih je ukupno učestvovalo na sistematskom pregledu, reprezentativni uzorak predstavlja njih 117, jer zadovoljavaju kriterijum da se odbojkom bave duže od godinu i po dana i da pripadaju uzrasnoj grupi od 11-14 godina. Za detektovanje telesnih deformiteta korišćen je metod somatoskopije, a za detektovanje deformiteta stopala korišćen je metod plantografije. Prisustvo lordoze, kifoze kao i narušen položaj lopatica utvrđivani su metodom neposrednog posmatranja statusa kičmenog stuba, odnosno metodom somatoskopije a prisustvo skolioze Banding testom. Pri posmatranju, ispitanica stoji leđima okrenuta ispitivaču na odstojanju od 1,5 do 3m. Prvo se vrši posmatranje kičme u celosti da bi se zatim kičmeni stub pregledao parcijalno. Nakon završenog posmatranja u stojećem stavu ispitanik vrši pretklon trupom (prilikom ovog pokreta sukcesivno se savijaju glava, vrat, rameni pojas, gornji deo leđa, donji deo leđa). Zatim je posmatran položaj karlice da bi se detektovao mogući deformitet genua valga tzv. ''x" i genua vara tzv."o" noge. Za utvrđivanje statusa svoda stopala korišćen je podoskop. Dobijeni rezultati se upisuju u klinički list i to ocenu 0 za dobar fiziološki položaj posmatranih segmenata tela, ocenu 1 za diskretno narušen položaj i ocenu 2 za izričito nefiziooški položaj određenog segmenta tela.

REZULTATI

Sistematski pregled odbojkašica kluba ''Odbojka 013" iz Pančeva izveden je u periodu između 8. i 11. juna 2015. godine u dispanzeru za medicinu sporta grada Pančeva. Odbojkašice je pregledao lekar Zoran Đurđev. Od ukupnog broja od 117 devojčica, kod jedne trećine detektovan je neki oblik deformiteta kičmenog stuba (i to skolioza kod 8, kifoza kod 28 i lordoza kod 4 odbojkašice), u procentima to iznosi 6.83%, 23.93% i 3.41%. Dvadeset i pet odbojkašica kluba ''Odbojka 013" ima neki vid spuštenog stopala. To je 21.36% od ukupnog broja odbojkašica. Od toga prvi stepen spuštenosti stopala ima 10.40%, drugi stepen spuštenosti stopala ima 9.36%, a treći 6.24%. Krilaste lopatice su primećene kod 33 ispitanice, što predstavlja 28.20% od ukupnog broja ispitanica. Deformiteti grudne kosti- izdubljene i ispupčene grudi nisu primećene ni kod jedne ispitanice. Deformitet ''O" noge nije detektovan ni kod jedne ispitanice, a deformitet ''H" noge je primećen kod 3 ispitanice (2.56%).

U tabeli 1 mogu se videti podaci o deformitetima koji su detektovani kod odbojkašica kluba ''Odbojka 013" iz Pančeva.

Tabela 1. Zastupljenost telesnih deformiteta kod igračica odbojkaškog kluba „Odbojka 013"

Deformitet	Broj ispitanica 117
skolioza	8
kifoza	28
lordoza	4
krilaste lopatice	33
''X" noge	3
''O" noge	0
ravna stopala	25
izdubljene grudi	0
ispupčene grudi	0

DISKUSIJA

Podatak da trećina devojčica ima neki deformitet kičmenog stuba vrlo je zabrinjavajuća, budući da onda kod devojčica koje se ne bave sportom možemo očekivati još veći postotak deformiteta. Zanimljivo je to da iako je lordoza karakterističniji deformitet za ženski pol (zbog karakterističnog položaja karlice) kod odbojkašica kluba ''Odbojka 013" od 117 ispitanica samo 4 ispitanice imaju izraženu lordotičnu krivinu u slabinskom delu kičmenog stuba. Nasuprot tome, kifoza je zastupljeniji

deformitet koji je detektovan kod 28 ispitanica. Odgovor možemo potražiti u karakterističnom položaju u kome odbojkašice provode veći deo treninga/ utakmice dočekujući loptu. To je položaj blagog pretklona u polučučnju, sa rukama pored tela, položaj u kome je torakalni deo kičmenog stuba najopterećeniji (Slika 1).

Relativno mali broj odbojkašica ima skoliotično držanje u odnosu na rezultate koji su dobijeni u sličnim istraživanjima, kao što je na primer istraživanje (Krneta, Protić-Gava, Vuković, Šćepanović, 2012) kojim je na uzorku od 429 odbojkašica sa teritorije Vojvodine uzrasta od 11,5 do 16,5 godina zaključeno su da su najzastupljeniji poremećaji ramenog pojasa lopatica i kičmenog stuba u frontalnoj ravni.

Slika 1. Položaj odbojkašica prilikom organizovanja odbrane

Prema istraživanju turskih naučnika utvrđeno je da odbojka dovodi do veoma malo strukturalnih promena na stopalu, za razliku od borilačkih sportova koji dovode do promene anatomske strukture stopala. (Aydos, L.; Uzun, A.; Kaya, M.; Kanatli, U.; Esen, E.; Uslu, S., 2012, 10). U sličnim istraživanjima broj ispitanika sa spuštenim stopalima je bio drastično veći (Đurić, Ilić, Nešić, 2013) i to gotovo 90%. U ovom istraživanju broj odbojkašica sa spuštenim stopalima je bio svega 21.36%. Skokovi, prenos težine sa noge na nogu i prednji deo stopala angažuju mišiće koji omogućavaju održavanje dobrog statusa stopala (Đurić, Ilić, Nešić, 2013). Ovim se može delimično objasniti relativno mali procenat odbojkašica koje imaju ravno stopalo ili stopala, ali i dalje je previše varijabli utiče na nastanak i progradiranje ovog deformiteta i zbog toga je potrebno sveobuhvatnije istraživanje kako bi se objasnili ovakvi rezultati. Ovim istraživanjem se takođe može objasniti pojava da nije zabeležen gotovo nijedan deformitet nogu (samo je kod 3 ispitanice detektovan deformitet „H noge“).

Podatak da nije bilo detektovanih deformiteta sternuma idu u prilog istraživanju Đurića, Ilića i Nešića koji tvrde da specifični pokreti u odbojci (kretanje napred, nazad, skokovi) uz pokrete rukama kao što su servis, blok, zakucavanje imaju višestruki povoljni uticaj kako na lokomotorni aparat tako i na kardio-vaskularni i respiratorni sistem. (Đurić, Ilić, Nešić, 2013). Poznata je činjenica da se preventivno i korektivno delovanje na deformitete grudne kosti postiže najlakše respitatornim vežbama. Snažni respiratorni mišići su ključni faktor preventivnog delovanja.

Kada se podvuče linija, možemo da zaključimo da preko 50% ispitanica ima jedan ili više telesnih defomiteta ili posturalnih poremećaja. Kada se osvrnemo na gore pomenuto istraživanje (Krneta, Protić-Gava, Vuković, Šćepanović, 2012) u kom je zaključeno da preko 50% ispitanica ima neki deformitet ramenog pojasa, kičmenog stuba ili lopatica, jasno je da se radi o trendu koji se ne može lako zaustaviti. Modernizacija savremenog društva je sveobuhvatna i sveprisutna i tiče se svakog pojedinca. Savremeni život donosi i hipokineziju koja je najvažniji faktor koji doprinosi nastanku telesnih deformiteta. Svakako da nije dovoljno da dete bude aktivno sat vremena, tri puta nedeljno, a ostalnih 165 sati da provede sedeći u klupi, za kompjuterom, u ležećem položaju.

ZAKLJUČAK

Na početku rada postavljene su dve hipoteze. Hipoteza 1- Deformiteti kičmenog stuba (kifoza, skolioza i lordoza) su najzastupljeniji kod devojčica uzrasta od 11 do 14 godina.

Hipoteza 2: Procenat ispitanica sa spuštenim stopalom će biti minimum 30%.

Na osnovu rezultata dobijenih istraživanjem prva hipoteza se prihvata jer je kod najvećeg broja devojčica detektovan neki deformitet kičmenog stuba (kifoza, lordoza ili skolioza).

Druga hipoteza je odbačena jer procenat odbojkašica koje imaju ravno jedno ili oba stopala 21.36%.

Iako je odbojka sport koji se često preporučuje sa ciljem prevencije telesnih deformiteta, rezulteti koji ukazuju da preko 50% ispitanica ima neki telesni deformitet su poražavajući. Poražavajući su najviše zbog toga što se ovde radi o fizički aktivnoj populaciji, koja se nalazi u periodu intenzivnog razvoja. Prema Đuriću, Iliću i Nešiću (2013), specifični pokreti ruke, položaj tela koji uključuje ekstenzore kičme i aduktore lopatice, utiču povoljno na prevenciju kifoze i drugih deformiteta kičme. Povoljno, ali ne i dovoljno, budući da su dobijeni ovakvi rezultati.

Pažnju treba usmeriti na detekciju i korekciju postojećih deformiteta, odbojka angažuje celo telo, predstavlja i dobar izbor sporta za mlade.

Treba se usmeriti na prevenciju, i korekciju postojećih deformiteta, informisati trenere kao i sve one koji rade sa mladim sportistima. Uvođenjem vežbi za jačanje mišića leđa, ali i trbuha, pravilnim izvođenjem pokreta, uvođenjem vežbi istezanja i vežbi koje bi delovale na povećanje amplitude pokreta, informisanjem o pravilno držanju tela, moglo bi se uspešno izaći na kraj sa ovim problemima.

Najveći broj navedenih poremećaja odnosi se na funkcionalni oblik, te predstavlja prvu fazu deformiteta. Adekvatnim korektivnim vežbanjem može se zaustaviti napredovanje deformiteta u teži stadijum i u velikoj meri ispraviti i dovesti u normalan položaj.

Budući da je period između 11. i 14. godine kritičan period u razvoju devojčica, treba obratiti pažnju na pravilnu ishranu i treba pravilno dozirati fizičku aktivnost, raditi na jačanju velikih mišićnih grupa koje su važne za posturu i držanje tela da bi se izbegla gojaznost ali i disbalans mišića kičmenog stuba i leđa koji je karakterističan za period rasta.

Ukoliko treneri nemaju vremena da se bave korekcijom telesnih deformiteta sa svojim odbojkašicama, potrebno je da znaju da detektuju posturalni poremećaj ili telesni deformitet i da upute odbojkašice na pregled u nadležnu ustanovu.

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POSTURAL STATUS ANALYSIS OF FEMALE VOLLEYBALL PLAYERS AGED 11-14

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INTRODUCTION

The technology has reached a level we could not even dream of. While it helped ease many of life situations, it also brought us a lot of negative effects like the lack of movement, namely the lack of physical activity. The man became a sedentary being, physical activity has been reduced to a minimum. We should be aware that there is a difference in the physical status of children involved in some sports and children who do not do sports. Depending on the type of sports they practice different deformities or problems may occur.

Spinal deformities represent spectrum of disorders that most often occurs in childhood and adolescence and can imply the occurrence of pain and deformity in adult period (d'Hemecourt & Hreško, 2012). In order to have healthy and happy life, preventive and corrective work at school age is imperative and moral responsibility of coaches, teachers and doctors.

In their study they Krnjeta, Protic-Gava, Vukovic and Scepanovic (2012) used a sample of 429 volleyball players from Vojvodina aged 11.5 to 16.5 years and got conclusion that the most common disorders are the shoulder area (about 50% female volleyball players), shoulder blades and spinal column in the frontal plane.

Research (Krneta et al., 2012) shows that exercises which activate the muscles essential for maintaining correct posture are not sufficient in work with young players. Therefore, it is necessary to work on increasing the power of extensors of the spinal column, the muscles of the abdominal wall and muscles responsible for proper foot status.

Djuric, Ilic and Nesic (2013) used a sample of 30 students of the school of volleyball, aged 9 to 16 years old and came to the conclusion that only 11.42% had proper foot shape hs and 88.58% of the total number of students had a certain degree of flattened arch. The aim of this research is to analyze the body status of volleyball players aged between 11 and 14 years is to determine deformities most common for young volleyball players and then try to detect the causes of deformity. Based on present knowledge two hypotheses were set.

Hypothesis 1: spinal deformities (kyphosis, scoliosis and lordosis) are the most common among girls aged 11 to 14 years.

Hypothesis 2: Percentage of patients with flattened arch will be a minimum 30%.

When we find out what they are most common deformities in volleyball players who are in a period of rapid growth and development we will be able better to approach the training process.

METHOD

This is a non-experimental, quantitative research, and the type of study is retrospective. For the purposes of this study were reviewed sport medicine records, who has recorded the detected physical deformities volleyball players aged 11-14 years. Information on these physical deformities are processed in Microsoft Excel 2010. For the analysis of the information we used basic descriptive

statistics. The aim of this study was to determine what percentage of representation of the physical deformities in female volleyball club ''Volleyball 013'' from Pančevo. The equipment that was used were only podoscope, clinical list (Radisavljević, 2001) and pencil, ruler and plumb.

The sample of subjects:

The total number of 130 volleyball players Pancevo club '' Volleyball 013 '' attended physical examination. From 130 volleyball players which participated in the systematic check up, a representative sample represents 117 of them, as they meet the criteria to practice volleyball more than one and a half year and they are age group of 11-14 years.

The sample of variables:

To detect the physical deformities the somatoscopy method was used, and to detect foot deformities plantogram method was used.

Description of deformity detection procedure:

The presence of lordosis, kyphosis and compromised position of the shoulder blades were determined by the method of direct observation of the status of the spinal column, or somatoscopy method and the presence of scoliosis using Banding test.

In observation, the participant stands with her back to the examiner at a distance of 1.5 to 3m. Firstly. we observed the spine in its entirety and then it wasexamined partially. After completing the observation in a standing position, the subject performs bend (during this movement successively bent head, neck, shoulder girdle, upper back, lower back). Then we observe the position of the pelvis to detect possible deformity of Genua valga -''X legs'' and Genua vara -''O leg''. To determine the status of the arch of the foot podoscope was used. The results are entered into a clinical evaluation sheet and rated 0 for good physiological position of the observed body segments, score 1 for discrete compromised position and score 2 to explicitly non- physiologically position of a certain segment of the body.

RESULTS

The physical examination of the volleyball players of the club ''Volleyball 013'' from Pančevo was carried out between 8 and 11 June 2015 in the outpatient clinic for sports medicine center of Pančevo. Volleyball players were examined by a doctor Zoran Đurđev.

Out of 117 girls, in one-third some form of spinal deformities were detected (scoliosis and at 8, kyphosis and lordosis in 28 in 4 women volleyball), a percentage that amounts to 6.83%, 23.93% and 3:41%.

Twenty-five volleyball players of the club ''Volleyball 013'' have some form of flatfoot. It is 21:36% of the total number of the volleyball. From that number first level down of the foot has a 10:40%, the second level down of the foot has a 9:36% and the third 6.24%.

Shoulder blades were observed in 33 players, representing 28.20% of the total number of respondents. Deformities of the sternum- hollowed and protruding breasts were not noticed in any of the respondents. Deformities '' O legs '' were not detected in any of the respondents, and deformity '' X legs'' was detected in 3 respondents (2.56%). Table 1 shows data of deformities detected in female players of volleyball club '' Volleyball 013 '' from Pančevo.

Table 1. Representation of body deformities of players Volleyball Club „Volleyball 013"

Deformities	Number of respondents
	117
scoliosis	8
kyphosis	28
lordosis	4
Winger blades	33
''X" legs	3
''O" legs	0
flat feet	25
carved chest	0
protruding breasts	0

DISCUSSION

The fact that a third of the girls has a deformity of the spinal column is very worrying, because then with girls who do not do sports, we can expect an even higher percentage of deformities. It is interesting that although the lordosis deformity is more characteristic for females (due to the characteristic position of the pelvis) in female volleyball club '' Volleyball 013 '' of the 117 respondents, only 4 respondents have expressed lordotic curve of the lumbal region of the spine. Contrary to that, kyphosis was more prevalent deformity and was detected in 28 subjects. The answer can be found in the characteristic position in which volleyball players spend most of their training / match expecting the ball. It is a position of slight bend in the crouch, hands next to the body, the position in which the thoracic part of the spinal column is the most loaded (Figure 1).

A relatively small number of female volleyball players has scoliosis posture in relation to the results obtained in similar studies, such as for example research (Krnjeta, Protic-Gava, Vukovic, Scepanovic, 2012), which in a sample of 429 volleyball players from the Vojvodina aged 11.5 to 16.5 years concluded that the most common disorders are the shoulder blades and spinal column in the frontal plane.

Figure 1. Position of volleyball player in organizing the defense

According to research by Turkish scientists determined that volleyball leads to very few structural changes on foot, unlike the martial arts that lead to changes in the anatomical structure of the foot. (Aydos, L.; Uzun, A.; Kaya, M.; Kanata, U.; Essen, E.; Uslu, S., 2012, 10). In similar survey respondents with flat feet was dramatically higher (Djuric, Ilic, Nesic, 2013) and almost 90%.

In this study, the number of female volleyball players with flat feet was only 21:36%.

Jumping, weight transfer from one leg to the front part of the foot engage the muscles that allow maintaining good status of the foot (Djuric, Ilic, Nesic, 2013). This can be partly explained by the relatively low percentage of female volleyball players who have flat feet or foot, but still has too many variables affect the onset and increase this deformity and therefore and we need a more comprehensive study to explain these results. This research may also explain phenomena that it has not been recorded any deformity of the legs (only in 3 respondents were detected deformity „X legs").

The fact that it was not detected deformities of the sternum in favor of researching Duric, Ilic and Nešić who argue that the specific movements in volleyball (forward, back, jumps) with hand movements such as service, block, dunk have multiple favorable impact on both the locomotor apparatus and in cardio-vascular and respiratory system. (Djuric, S.; Ilic, D.; Nesic, G., 2013, 39). It is a well known the fact that the preventive and corrective action to deformities of the sternum is easiest achieved with breathing exercises. Powerful respiratory muscles are the key factor of preventive action.

In conclusion, we can find that over 50% of subjects had one or more physical deformities or postural disorders. When you look at the above-mentioned research (Krnjeta, Protic-Gava, Vukovic, Scepanovic, 2012) in which it concluded that over 50% of subjects had a deformity of the shoulder girdle, the spinal column or blades, it is clear that this is a trend that cannot be easily stopped. The modernization of contemporary society's comprehensive and ubiquitous and concerns every individual. Modern life brings and hypokinesia, which is the most important factor in producing physical deformities. It is certainly not enough for the child to be active an hour, three times a week and the rest 165 hours to spend sitting at a desk, a computer, lying down...

CONCLUSION

At the beginning of the work there were two hypotheses.

Hypothesis 1: spinal deformities (kyphosis, scoliosis and lordosis) are the most common among girls aged 11 to 14 years.

Hypothesis 2: Percentage of patients with flatted foot will be a minimum 30%.

Based on the results obtained from research first hypothesis is accepted because with majority of girls a deformity of the spinal column was detected (kyphosis, lordosis, or scoliosis). The second hypothesis was rejected because the percentage of female volleyball players having flat one or both feet 21:36%.

Although volleyball is a sport that is often recommended in order to prevent physical deformity of results which indicate that over 50% of respondents have a physical deformity are devastating.

The most devastating point is this is a physically active population, which is in a period of intensive development. According to Djuric, Ilic and Nesic (2013), specific hand movements, body posture, which includes spine extensors and blades adductors has a favorable influence on the prevention of kyphosis and other spinal deformities. Preferably, but not sufficient, based on results we obtained.

Attention should be directed to the detection and correction of existing deformity. Volleyball engages the entire body, is also a good choice of sport for young people. It should focus on prevention, and correction of existing deformity, inform the coaches and all those who work with young athletes. The introduction of exercises to strengthen the back muscles, and abdomen, proper execution of movements, the introduction of stretching and exercises to work on increasing the range of motion, information about proper posture, you could successfully cope with these problems.

The largest number of these disorders refers to a functional form, and is the first stage deformity. Adequate corrective exercise can stop the progression of the deformity and largely correct and lead to the normal position.

Since the period between 11 and 14 years is a critical period in the development of girls should pay attention to proper diet and should be properly dosed physical activity, work on strengthening the large muscle groups that are important for posture and body posture to avoid obesity or an imbalance of the spinal column and back that is characteristic of the period of growth.

If coaches do not have time to deal with the correction of physical deformities, with their volleyball players, they need to know how to detect postural disorder or physical deformity and suggest players to take physical examination at the relevant institution.

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STATUS STOPALA DEVOJČICA MLAĐEG ŠKOLSKOG UZRASTA

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UVOD

Naučna i tehnološka dostignuća, automatizacija i kompjuterizacija u svim sferama života, dovode do hipokinezije, poznata u literaturi i kao „bolest XXI veka". Hipokinezija je prema izveštaju WHO (World health organization – Svetske zdravstvene organizacije) proglašena za samostalni rizi-ko faktor (Mitić, 2001). Kod dece školskog uzrasta je primećeno da je procenat zastupljenosti stopala 59% (Jen-Huei, C., i sar.,2010). U istom istraživanju osmogodišnjaci imaju 1.52 puta veće šanse da imaju ravna stopala od sedmogodišnjaka. Takođe je utvrđeno da oni koji su gojazni imaju 1.39 puta veće šanse da imaju ravna stopala, nego deca prosečne telesne težine.

Urbani uslovi i različiti vidovi sedentarnog ponašanja (boravak u zatvorenom prostoru, pasivne igre, vreme provedeno uz kompjutere, video-igrice, televiziju i sl.), svode čovekovo kretanje na minimum. Takav način života napada status lokomotornog aparata i izaziva brojne deformitete. Najpre se kod dece javljaju poremećaji u držanju tela i narušavanje telesnog statusa, koji često, ukoliko se preventivno i korektivno ne reaguje, prelaze u telesne deformitete.

Đurić, Ilić i Nešić (2013) su na uzorku od 30 polaznika škole odbojke, uzrasta od 9 do 16 godina došli do zaključka da pravilno stopalo ima svega 11,42%, dok 88,58% od ukupnog broja polaznika ima određeni stepen spuštenosti svodova stopala.

Sve je više dece sa ravnim stopalima. Ravno stopalo može da bude urođeno i stečeno (Radisavljević, 2001). Urođeno se retko javlja i predstavlja vrlo ozbiljan deformitet, jer je posledica promenjenog položaja skočne kosti, koja zauzima vertikalan položaj. Uzdužni i poprečni svod koga čine aktivni i pasivni tenzori: kosti, mišići i tetive imaju važnu ulogu pri stajanju i hodanju (Koturović, Jeričević, 1996). Od pravilne koštane građe stopala, kao i od dobrog balansa mišića koji učestvuju u kretanju i stajanju, zavise pravilan oblik i funkcija stopala. Ukoliko dođe do narušavanja ovog balansa dolazi do spuštanja svodova stopala.

Faktori koji utiču na nastanak ravnog stopala kod dece predškolskog uzrasta su: uzrast, pol, gojaznost, navika sedenja u W položaju i nestabilnost zglobova (Chen, K.C.,i sar., 2011)

Blagovremeno otkrivanje narušenosti statusa stopala je važno kako bi se što pre preduzele odgovarajuće mere. Iz tih razloga sistematski pregledi dece predškolskog i školskog uzrasta imaju značajnu ulogu.

Na osnovu svega pomenutih istraživanja i iskustva postavljene su dve hipoteze. Hipoteza: Devojčice sa prekomernom telesnom težinom imaju veće šanse da imaju ravna stopala.

METOD

Ovo je neeksperimentalno, kvantitativno istraživanje, a vrsta studije je retrospektivna. Informacije su obrađene u programu Microsoft Excel 2010. Za analizu informacija korišćena je osnovna deskriptivna statistika. Cilj ovog rada jeste da utvrdi koliki je procenat zastupljenosti ravnih stopala devojčica uzrasta 7-8 godina koje su članovi škole spora „Sportikus". Od opreme je korišćena oprema za uzimanje otisaka stopala, a za analiziranje plantograma olovka i lenjir. Istraživanje je sprovedeno 1.7. 2015. godine.

Ukupno 28 devojčica, članova škole sporta „Sportikus“ je učestvovalo u ovom istraživanju. Devojčice su uzrasta od 7-8 godina. Za detektovanje deformiteta stopala korišćen je metod somatoskopije kao i metod plantografije, a plantogram je analiziran Tomsenovom metodom.

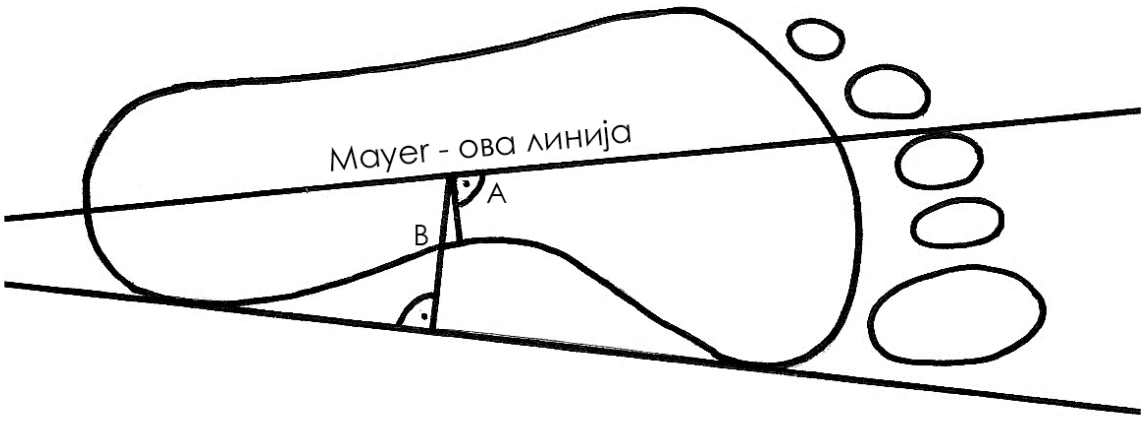
Stopalo je posmatrano sa prednje, zadnje, bočne i plantarne strane. Rezultati zapažanja su upoređeni sa pravilnim izgledom stopala. Radi utvrđivanja stepena spuštenosti stopala od ispitanika se zahtevalo da odignu pete i zadrže stav na prstima. U tom stavu naročito pažnja se usmerava na položaj Ahilovih tetiva. Njihova korekcija, odnosno vraćanje u vertikalan položaj u odnosu na kalkaneus, ukazuje da su promene još uvek funkcionalnog karaktera. Stopalo se zatim posmatra sa bočne strane. Utvrđuje se odnos između stopala potkolenice, zatim položaj i izgled uzdužnog svoda, a posebno navikularne kosti. Iz ovog položaja određuje se stepen spuštenosti svoda. Od ispitanika se zahteva podizanje jedne i održavanje stava na drugoj nozi. Pod uticajem sopstvene težine mišići potkolenice i stopala stajne noge se kontrahuju i odižu uzdužni svod stopala. Njegovo popravljanje i održavanje, ukazuje na tzv. mišićnu fazu spuštenog stopala (funkcionalne promene). Ukoliko se pri ovom testu uoči kratkotrajno popravljanje i ponovno spuštanje svoda, to je znak da su promene napredovale. Zadržavanje priljubljenog tabana uz podlogu prilikom ovog testa, ukazuje na ireduktibilnost deformiteta. Sa prednje strane posmatra se položaj prednjeg dela stopala, položaj prstiju i palac.

Kod plantografije se koristi metalna ili plastična posuda, na čijem dnu se postavlja višeslojna gaza, koja se ravnomerno obojila 5% rastvorom mastila. Iza posude se postave dva papira A4 formata. Tretirana osoba nakon ulaska obema nogama u posudu, iskorači jednom, pa drugom nogom, ostavljajući otisak tabana na sredini papira.

Analiza statusa stopala izvršena je Tomsenovom metodom sprovodi se na sledeći način: od centra pete, koji se na plantogramu precizno utvrdi, povlači se linija prema lateralnoj ivici trećeg prsta. Ona predstavlja graničnu liniju između normalnog i spuštenog stopala i naziva se Majerova linija. Ukoliko otisak stopala ne prelazi ovu liniju prema medijalnoj ivici stopala, to je prema kriterijumu ove metode pravilno stopalo. Prelazak otiska stopala preko ove linije ukazuje na određenu spuštenost uzdužnog svoda stopala i nalaže potrebu dalje analize plantograma. Dalja obrada podrazumeva povlačenje tangente koja spaja najistureniji deo otiska medijalne ivice pete sa otiskom prednjeg dela stopala. Nakon toga se lenjirom pod pravim uglom sa Majerovom linijom spaja najbliži deo otiska stopala oko sredine njegovog plantuma (duž A) izražena u milimetrima. Zatim iz iste tačke, sa Majerove linije, upravno na tangentu koja spaja petu i prednji deo stopala, povlači se (duž B) izražena u milimetrima. Po dobijanju ove dve vrednosti, radi izračunavanja indeksa procenata uzdužnog svoda stopala, one se stavljaju u međusobni odnos (A/B*100). Dobijen procenat označava veličinu spuštenosti uzdužnog svoda stopala, i to:

- 1 – 30 % predstavlja I stepen spuštenosti stopala,
- 31 – 60 % predstavlja II stepen spuštenosti stopala,
- preko 61 % predstavlja III stepen spuštenosti stopala.

Nedostatak ove metode je što osobe sa normalnim svodom stopala ostaju bez indeksa, odnosno indeks je nula, pa to otežava statističku obradu podataka.



Slika 1. Tumačenje plantograma Tomsenovom metodom

REZULTATI

Rezultati istraživanja ukazuju na to da veliki broj treniranih devojčica iz škole sporta „Sportikus“ ima narušen svod stopala, čak 60, 71% od ukupnog broja ispitanika. Ohrabrujuće je to što najveći broj njih ima prvi stepen deformiteta.

Kada analiziramo levo stopalo možemo da zaključimo da od ukupnog broja, 15 devojčica ima pravilno stopalo, 11 ima I stepen spuštenosti svoda stopala, 2 ispitanice imaju II stepen narušenosti, dok III stepen spuštenosti svoda stopala nije zabeležen kod ove grupe ispitanika.

Kada analiziramo desno stopalo možemo da zaključimo da od ukupnog broja, 13 devojčica ima pravilno desno stopalo, 11 ima I stepen narušenosti svoda stopala, 4 ispitanica ima II stepen narušenosti, dok III stepen narušenosti stopala nije primećen kod ove grupe ispitanika.

Tabela 1. Status stopala devojčica koje treniraju u školi sporta „Sportikus“

Ispitani uzorak	Broj ispitanika	Procenat ispitanika
Ukupan broj	**28**	**100%**
Pravilno stopalo	**11**	**39,29%**
Ravno stopalo	**17**	**60,71%**

DISKUSIJA

Devojčice su podeljene na dve grupe na osnovu indeksa telesne mase (BMI). Kada se uzme u obzir kriterijum Centra za kontrolu i prevenciju bolesti (Center for Disease Control and Prevention- CDC criteria) i kriterijum Iternacionalnog centra za gojaznost (International Obesity Task force- IOTF criteria), koji za uzrast sedam i osam godina u grupu sa prekomernom telesnom težinom ubraja sve one devojčice koje imaju BMI preko 17.5, odnosno 18.0, možemo zaključiti da u ovoj grupi ima 11 devojčica sa prekomernom telesnom teživnom. Ako devojčica zadovoljava samo jedan kriterijum da pripada grupi devojčica sa prekomernom telesnom težinom, ona će biti svrstana u tu grupu.

Sledeći zadatak je bio da vidimo koliko devočica koje imaju prekomernu telesnu težinu, a koliko devočica sa prosečnom telesnom težinom ima ravna stopala. Zabeleženo je 7 od 11 devojčica u grupi sa prekomernom telesnom težinom ima ravna stopala, a to je u procentima 63.63%. Kod grupe devojčica koja nema prekomernu telesnu težinu (kod njih 17) detektovano je 10 devojčica sa ravnim stopalima, što je 58.82%. Prema tome, možemo zaključiti da prekomerna telesna težina kod ove grupe ispitanika nije bila odlučujući faktor za nastanak ovog deformiteta stopala. Ali jedine četiri devojčice koje imaju drugi stepen spuštenosti stopala pripadaju grupi devojčica sa prekomernom telesnom težinom. Godine se nisu pokazale kao značajan faktor za formitanje ravnih stopala.

Od 17 devojčica kod kojih je zabeležen neki stepen spuštenig stopala, 7 devojčica ima samo jedno spšteno stopalo, a drugo pravilno. Koji je to faktor dominantno uticao na nastanak unilaterelnog ravnog stopala nismo mogli da zaključimo jer je uzorak ispitanika vrlo mali za tako nešto.

Iako prekomerna telesna težina nije uticala na nastanak ravnih stopala, moramo napomenuti da je kod četiri devojčice zabeležen drugi stepen spuštenosti stopala i da su sve četiri devojčice imale prekomernu telesnu masu. Na osnovu ovako malog uzorka ispitanika ne možemo sa sigurnošću tvrditi da li je prekomerna telesna težina dovela do ovakvog rezultata.

Rezultat da je kod 60.71% devojčica primećen deformitet ravno stopalo se potpuno slaže sa prethodnim istraživanjima (Đurić, Ilić, Nešić, 2013; Jen-Huei,i sar., 2010).

ZAKLJUČAK

Na početku rada postavljena je hipoteza. Hipoteza: Devojčice sa prekomernom telesnom težinom imaju veće šanse da imaju ravna stopala. Ova hipoteza nije prihvaćena jer je prisutan gotovo identičan procenat devojčica koje imaju ravno stopalo kod grupe sa prosečnom i kod grupe sa prekomernom telesnom težinom.

Ohrabrujuće je to što najveći broj njih ima prvi stepen deformiteta, ali je zabrinjavajuće to što je ovo istraživanje rađeno sa redovnim polaznicima jedne od vodećih škola sporta kod nas. Ovo znači da vežbanja koja se sprovode na treninzima nisu dovoljna preventivna mera i da je potrebno uvrstiti u trenažni proces više korektivnih vežbi.

Preventivne mere treba primenjivati od najranijeg uzrasta. U tom periodu treba omogućti nesmetan i pravilan razvoj. Potrebno je da dete što češće i što duže hoda boso po neravnom terenu, obzirom da takva podloga podstiče raznovrsne mehaničke nadražaje, koje dovode do aktiviranja i angažovanja mišića stopala, a posebno sitnih mišića tabana, čime se ostvaruje vrlo povoljan uticaj na pravilan razvoj stopala.

Neophodno je jačati mišiće stopala i potkolenica. Treba jačati dorzalne fleksore, naročito m.tibialis anterior, kao i plantarne ekstenzore, a posebno m.m.peroneus longus et brevis, m.tibialis posterior flexor i hallucis longus. Vežbe se mogu izvoditi u različitim početnim položajima, ali se uvek počinje od najlakšeg koji je u ovom slučaju sedeći. Stojeći položaj se može koristiti preventivno kada promene nisu toliko velike da bi stajanje i opterećenje negativno uticali na deformitet. Stopala su stalno izložena velikim opterećenjima pa se vežbama za to pripremaju i osposobljavaju.

Potrebno je detaljnije utvrditi koji su to faktori koji dovode do pojave ravnih stopala i ispitati da li je prekomerna težina jedan od najznačajnijih faktora koji mogu dovesti do ovog deformiteta.

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UDK 611.986:796-053.5

FOOT STATUS AMONG YOUNG SCHOOL AGE GIRLS

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INTRODUCTION

Science and technology, that are vildly ranged in all aspects of our life, led to hypokinesis which is well-known as "21th sentury desease". Acording to the report of the WHO (World health organization) hypokinesis is declared as risk factor (Mitić, 2001). It has been noticed that percent of flat feet among the children school year age is 59% (Jen-Huei, C., et al.,2010). In the same researche eight year olds are 1.52 more likely to have flat foot than seven year olds. Also, there have been noticed that those who are overweigh are 1.39 times more likely to have flat foot than average weighed children.

Urban life and sedentary behavior (spending time in close doors, pasive games, computer time, video games, television and similar) led to minimum randge of movement. Those kind of living habits is not good for postural status and causes number of deformities. Postural status is most commonly first to violate in children, and they often lead to body deformities, unles they are treated properly.

Đuric, Ilic and Nesic (2013) concluded that only 11.42%, had normal foot and 88.58% had flat foot, and these research was conducted with 30 school members, aged 9-16.

We have too many children with flat feet. Flat foot can be congenital or formed in some period of life (Radisavljević, 2001). Congenital flat foot is very rare and represent a very serious deformity, because the consequence can be malposition of talus, that can be almost vertical. Longitudinal and transversal arch, that is constructed of active and passive tensors: bones, muscles and tendons that have important role in standing and walking (Koturović, Jeričević, 1996). Normal foot status depends of several factors: right bone structures, good muscle balance…

Factors that causes forming flat foot in prescholl age children are: age, gender, obesity, sitting habit and joint laxity (Chen, K.C., et al., 2011).

Detecting foot status disorders are very important because you can prevent their progresion. Because of that sistematic controls of preschool and school age children are required.

Based on mentioned reserces and experience a following hypothesis is set: overweight girls are more likely to have flat foot than those girls who have normalweight.

METHOD

This is non-experimental, quantitative research, and the type of the study is retrospective. Information are procesed in Microsoft Excel 2010. For data analysis descriptive statistic was used. Main goal of this reserch is to establish how many girls aged 7-8 years, who are members of school of sport Sporticus, have flat feet and to se if overweight girls are more likely to have flat foot than those who are not overweight. For this research equipment for taking footprints are used and for analysing footprints pen and ruler was used. The research was conducted from 1st July 2015.

Sample of subjects:

Total number of subject is 28 girls, they were all members of school of sport "Sporticus". Girls are aged 7-8 years.

Sample of variables:

For detecting foot deformities somatoscopy was used, as well as planography method, and footprint was analyzed using Thomsen method.

Description of detecting deformities:

Foot is looked from front, back and sagital and plantar side. And then that was compared to normal foot. For detecting how much the foot of a subject is flat we asked them to stand on their toes (to lift their heels). Than we selected all our attention on Achil tendons. Their crorection, returning to normal position show that the changes are still functional. Then we look foot in the sagital plane. We estimated angle between leg and foot, and then the position and looks of longitudinal arch, and especially navicular bone. From this position we can subjectivly evaluate the flat foot degree.

Next, we ask our subjects to lift up one leg and to stand on the other. Grater force is now on that one standing foot and the muscles should contract and form longitudinal arch. If this is the case, we can conclude that it is a functional stadium of flat foot. But, if the longitudinal arch is formed, but then very quiqly disapeer that is the clear sing that the foot deformity has progresed. Then we are talking about structural changes of the foot. If the longitudinal arch was nevr formed in this test we can say that the foot status can't be fixed just doing the exercises.

When we look from the front, we evaluate position, looks of the foor and thoes.

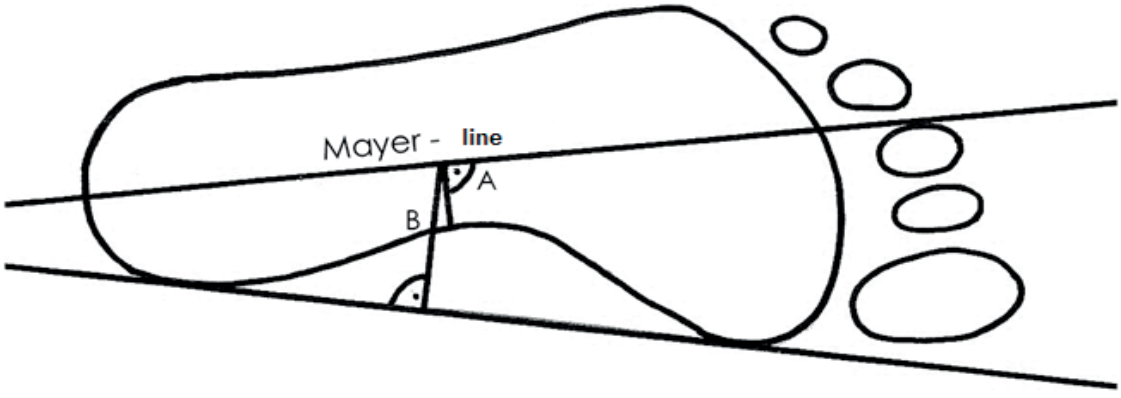
For takeing footprint we use metal or plastic plate, and on their botom is gauze which is overflow with 5% ink solution. Behind the plate two papers A4 format were set. Subject goes out from the plate with their both feet and then goes out of plate, putting one leg on one paper and the second leg on other paper leaving the footprint on the midle of the paper.

Analysis is conducted using Thomsen method. The description of the procedure is: From the center of the calcaneus we pull the line towards lateral side of the third thoe. This is the line called Mayer line and it represents the barier between normal and flat foot. If the footprint doesn't go acros this border that is normal foot. But if the footprint crosses this line, we have to analyse furter more. We do that by drawing a line that connects the most medial side of the hill and the most medial point of the front foot. After that, using a ruler we connect the closest point of footprint with previously drawn Mayer line (A line). Then from the same spot from Mayer line, we draw tangent wich connect with the previously drawn line that connects thoe and hill (B line). When we calculate how much milimetars this two lines are, than we can do the math.

Formula that we use is A/B*100. The result is number that represents degres of flat foot.

- 1 – 30 % I degree flat foot,
- 31 – 60 % II degree flat foot,
- преко 61 % III degree flat foot.

Persons with normalf foot are left with no index, and that is the lack of this method. Because of that statistic data analysis is dificult.



Picture 1. Analysing footprint using Thomsen method

RESULTS

Results of the research show that there is a big number of trained girls from school of sport "Sporticus" who have some form of flat foot, even 60.71% of the total number. Encouraging fact is that most of them have the first degree flat foot.

When it comes to right foot status, of total number, 13 have normal foot, 11 have first degree flat foot and 4 subjects have second degree flat foot. And when it comes to left foot status 15 subjects have normal foot, 11 have first degree flat foot and 2 of them have second degree flat foot. No one has third degree flat foot. It was noticed that some girls had one foot with normally distributed arch, but other foot flat.

Table 1. Foot status among girls who train in school of sport "Sporticus"

	Sample of subjects	Percent
Total number	**28**	**100%**
Normal foot	**11**	**39,29%**
Flat foot	**17**	**60,71%**

DISCUSION

Girls were split into two groups based on BMI. Respecting two criterias: Centers for Disease Control and Prevention (CDC) criteria and International Obesity Task Force (IOTF) criteria which for girls 7 and 8 years old counts every girl with 17.5, and 18,0 BMI clasifay as overweigh, we can conclude that 11 girls are overweighd. If some girl belonged in overweighed group respecting just one criteria she was recognised as overweigh or obese.

Next task was to see how many girls who were overweigh had flat foot, and how many girls who was in averege weighted group had flat foot. Seven girls of elevan (in overweigh group) had flat foot, and that is 63.63%. In other non-overweigh group there were ten of seventeen girls, or 58.82% with flat foot. Results shows that BMI wasn't relevant factor which influenced forming flat foot in this two groups of subjects.

Among 17 girls who had flat foot, 7 of them have just one flat feet, ant the other normal. Which factor dominatly influenced on forming unilateral flat foot, we couldn't conclude, because number of subjects was small. Even though high BMI wasn't relevant factor for influenceing forming flat foot, only four girls who had second degree flat foot was in overweighed group. In addition, ages did not have influence in forming flat foot, too. We can't be certain wheather high BMI led to this result.

Result that 60.71% of girls have flat foot is totally corresponding with previous researches (Đuric, Ilic, Nesic, 2013; Jen-Huei, C., et al., 2010).

CONCLUSION

In the beginning of the paper, hypothesis was set. Hypothesis: Girls who are overweighed are more likely to have flat foot. This hypothesis was not accepted because there were almost identical percentage of girls who have flat foot in overweighed and in non-overweighed group.

Encouraging fact is that most of them have second degree flat foot, but concerning is that this research was conducted in leading school of sport in our country. This means that exercises on trainings are not good prevention ant that more corrective exercises should be done.

Prevention should be considerate from childhood. In that period we should enable undisturbed and natural development. It is necessary for child to walk more often and longer on uneven terrene, because that kind of field irritate and activate muscles of the feet, and especially little sole muscles, so in that way we are enabling good influence on forming foot.

It is necessary to strengthen muscles of the foot and muscles below knees. We should strengthen dorsal flexors, and especially m.tibialis anterior, plantar extensors, especially mm.peroneus longus et brevis, m, m.tibialis posterior flexor и hallucis longus. Exercises can be performed in various positions, but always from the easiest, it this case from sitting position. Standing position can be used as prevention, when pathological changes are not so big, so the weight can't negatively influence on deformity. Feet are constantly exposed to the big loads, so we try to prepare them for that.

In conclusion, it is very important to estimate which factors lead to forming flat foot and to examine whether high BMI is one of the most important factors which can lead to this deformity.

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UDK 796.412.012.1-055.2

ZNAČAJ UKLJUČIVANJA DEVOJČICA MLAĐEG ŠKOLSKOG UZRASTA U REKREATIVNI PROGRAM RITMIČKE GIMNASTIKE

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UVOD

Motoričke sposobnosti predstavljaju veoma značajan faktor u razvoju deteta, jer utiču kako na biološki, tako i na psihološki i socijalni aspekt njihovog života. Razvoj motoričkih sposobnosti značajno doprinosi razvoju kognitivnih i perceptivnih sposobnosti (Bushnell & Boudreau, 1993; Von Hofsten, 2004; Smith & Thelen, 2003), a motoričko ispoljavanje nije moguće objasniti izvan karakteristika morfološkog i karaktera psihološkog razvoja (Kukolj, 2011).

Jedna od osnovnih potreba deteta je – potreba za kretanjem i fizičkom aktivnošću. Ova potreba izdvaja se kao jedan od najvažnijih faktora zdravlja. Kroz fizičku aktivnost deca razvijaju morfološke karakteristike i motoričke sposobnosti, kao i psihološke karakteristike, neophodne za normalan i kvalitetan život. Većina dece svoje potrebe za fizičkom aktivnošću zadovoljava kroz igru i rekreaciju, ali se sve više njih, rano usmerava ka organizovanim vidovima sportskih aktivnosti (različite sportske škole) kroz koje ne samo da zadovoljavaju potrebe za fizičkom aktivnošću, već unapređuju i usavršavaju motoričke sposobnosti uz sistemski rad i stručan pristup trenera. Imajući u vidu današnji sedentarni način življenja, posebno u gradskim sredinama, uloga sporta i organizovanih sportskih aktivnosti u razvoju motoričkih sposobnosti dece je od izuzetnog značaja. Polazeći od činjenice da mlađi školski uzrast (7-12 godina), predstavlja izuzetno osetljivu fazu za razvoj motoričkih sposobnosti i usavršavanje pokreta, veoma je važno u ovom periodu deci ponuditi sportske sadržaje koji će na adekvatan način stimulisati njihov fizički razvoj i razvoj motoričkih sposobnosti. Kada su u pitanju devojčice, prema Gužalovskom (1984), kritičan period kada je najveća osetljivost na stimulaciju većine motoričkih sposobnosti je od 9. do 12. godine. Ritmička gimnastika, bogatstvom i raznovrsnošću kretnih struktura, kao i dostupnošću i širokom primenljivošću njenih sadržaja, ima pozitivan uticaj kako na fizički, tako i na motorički razvoj devojčica, razvijajući podjednako pokretljivost, snagu, koordinaciju, brzinu i ravnotežu (Radisavljević i Moskovljević, 2011). Pored navedenih pozitivnih karakteristika ritmičke gimnastike, treba napomenuti da se njenom primenom razvija i estetska komponenta kod devojčica, tako da ona predstavlja jedan od najpogodnijih sportskih sadržaja koji se može ponuditi devojčicama u periodu rasta i razvoja.

U praksi se često postavljaju pitanja o razvoju fizičkih karakteristika i motoričkih sposobnosti pojedinaca u odnosu na nivo karakterističan za određeni uzrast, kao i o uticaju pojedinih aktivnosti na ove parametre. Da bi se dali odgovori na ova pitanja, od izuzetne je važnosti redovno praćenje fizičkog razvoja i razvoja motoričkih sposobnosti, kako celokupne populacije dece, tako i specifičnih sportskih grupa. Posle dužeg vremena u Srbiji je urađena velika studija, koja pruža potrebne informacije o prosečnoj razvijenosti pojedinih parametara fizičkog razvoja i motoričkih sposobnosti školske dece (Milanović i Radisavljević Janić, 2015). Autori ove studije su utvrdili kriterijumske referentne vrednosti za pomenute parametre, omogućivši na taj način nastavnicima fizičkog vaspitanja validno praćenje fizičkog razvoja i razvoja motoričkih sposobnosti učenika sa kojima rade. Pored toga, cilj praćenja fizičkog razvoja i razvoja motoričkih sposobnosti učenika u školama jeste da učenici steknu određena znanja, kako i na koji način mogu da održavaju ili usavršavaju njihovu opštu fizičku formu, kao i da se obrazuju o značaju fizičkog vežbanja za njihov optimalan rast i razvoj. Sa druge strane, postojanje parametara nastalih na reprezentativnom uzorku populacije učenika osnovne škole, daje mogućnost sportskim stručnjacima da izvrše poređenje tih vrednosti sa vrednostima fizičkog razvoja i motoričkih sposobnosti dece koje oni treniraju. Na osnovu toga treneri bi mogli da naprave

analizu njihove trenutne fizičke forme i provere da li načini rada i sportski sadržaji koje primenjuju u radu sa decom, doprinose poboljšanju njihovih fizičkih karakteristika i motoričkih sposobnosti.

Cilj ovog istraživanja je bio da se ispita na kom su nivou motoričke sposobnosti i neki parametri fizičkog razvoja mladih ritmičarki, u poređenju sa kriterijumskim referentnim vrednostima opšte populacije devojčica istog uzrasta.

METOD

Ovo je empirijsko istraživanje, transverzalnog karaktera, sprovedeno na uzorku devojčica koje treniraju ritmičku gimnastiku, kako bi se ispitao nivo njihovih motoričkih sposobnosti i nivo parametara fizičkog razvoja. Dobijeni rezultati upoređivani su sa kriterijumskim referentnim vrednostima populacije devojčica istog uzrasta.

Ispitanici

Istraživanje je sprovedeno na uzorku od 34 zdrave devojčice, uzrasta 9-10 godina (3. i 4. razred), koje se rekreativno bave ritmičkom gimnastikom u Sportskom klubu „In" iz Beograda. Sve devojčice su uključene u ovaj program vežbanja 1-2 godine i treniraju dva puta nedeljno u trajanju od 60 minuta. Uzorak je podeljen u dva subuzorka, devojčice 3. razreda (N=18) i devojčice 4. razreda (N=16).

Procedure

Istraživanjem je obuhvaćeno 9 varijabli, 3 za procenu fizičkog rasta i telesnog sastava i 6 za procenu motoričkog statusa. Mere fizičkog rasta i sastava tela koje su korišćene su telesna visina (TV) i telesna masa (TM), a iz dobijenih podataka izračunat je Indeks telesne mase (BMI). Za merenje telesne visine korišćen je stadiometar po Martinu (Seca Instruments Ltd.,Hamburg, Germany), a za merenje telesne mase vaga Tanita Inner Scan Model BC-578 (Tanita Europe GmbH., Sindelfingen, Germany). Indeks telesne mase izračunat je matematičkom formulom (BMI = TM/TV^2).

Testovi za procenu motoričkih sposobnosti korišćeni u ovom istraživanju su standardizovani, njihova pouzdanost je ranije potvrđena (Milanović i Radisavljević Janić, 2015). Isti ovi testovi, sa istim instrumentima korišćeni su i u istraživanju u kome su dobijeni rezultati postavljeni kao parametri populacije (Milanović i Radisavljević Janić, 2015), a koji su u ovom istraživanju korišćeni u obradi podataka. Korišćeni su sledeći testovi: Ležanje-sed za 30 sekundi (LiS) za procenu repetitivne snage, Skok udalj iz mesta (SuD) za procenu eksplozivne snage nogu, Ponovljeno trčanje na 20 m sa progresivnim povećavanjem brzine - "šatl ran" (SR) za procenu kardiorespiratorne izdržljiivosti, Pretklon u sedu (PuS) za procenu pokretljivosti, Čunasto trčanje 4 x 10 m (4x10) za procenu agilnosti i Izdržaj u zgibu (IuZ) za procenu izdržljivosti u snazi.

Testiranje

Testiranje je vršeno u prepodnevnim časovima u SRC "11. april" na Novom Beogradu. Ispitanice su bile sportskoj garderobi, a testiranju je prethodila standardna procedura zagrevanja. Pre izvođenja svakog testa ispitanicama su date neophodne instrukcije. Ispitanice su imale jedan probni pokušaj za sve testove, izuzev testa „šatl ran", koji zahteva duže vreme izvođenja, a ne predstavlja motorički složen zadatak. Sva merenja su sprovedena na jednom treningu, izuzev testa "šatl ran", koji je sproveden na prvom sledećem treningu. Isti merilac je obavio sva merenja u okviru određenog testa.

Ležanje-sed za 30 sekundi (LiS) izvodi se iz početnog položaja gde ispitanik leži na leđima sa pogrčenim nogama u kolenima pod uglom od 90^0 i sa rukama na potiljku, a partner mu fiksira noge. Ispitanik ima zadatak da u vremenu od 30 s izvede što veći broj pregibanja trupa, pri čemu se zahteva da svaki put laktovima dodirne kolena. Rezultat testa je broj pravilno izvedenih podizanja trupa u zadatom vremenu.

Skok udalj iz mesta (SuD) se izvodi na ravnoj, ne klizavoj površini na kojoj je obeleženo skakalište i mesto za odraz. Zadatak je da ispitanik sunožnim odsokom i doskokom skoči što dalje, a meri se rastojanje od linije odskoka do mesta gde ispitanik petom ostvari kontakt sa tlom. Izvode se tri skoka, a najbolji rezultat se uzima za analizu.

Ponovljeno trčanje na 20 m sa progresivnim povećavanjem brzine - "šatl ran" (SR) se izvodi trčanjem između dve linije na rastojanju od 20m, prateći tempo koji je diktiran zvučnim signalom

snimljenim na CD-u. Na svaki zvučni signal ispitanik mora stajati sa oba stopala iza linije. Cilj je pretrčati što veći broj deonica. Početna brzina je 8,5 km/h i svakog minuta se povećava za 0,5 km/h. Test se prekida kada ispitanik više ne može da prati zadati tempo, odnosno kada tri puta za redom ne uspe da pređe liniju na zvučni signal ili kada ispitanik sam odustane. Rezultat testa je proteklo vreme u sekundama, mereno štopericom.

Pretklon u sedu (PuS) izvodi se pomoću drvenog sanduka (dimenzija 45 cm x 35 cm x 32 cm) sa lenjirom i klizačem na gornjoj ploči (dimenzija 60 cm x 35 cm). Ispitanik bos sedi ispred sanduka, ispruženih nogu, i oslanja se stopalima na prednju stranu sanduka. Ispruženim rukama, koje se postavljaju jedna preko druge (tako da su srednji prsti jedan preko drugog) ispitanik se naginje napred i što je moguće više pomera klizač. Sa lenjira se očitava rezultat u centimetrima. Sve vreme se vrši kontrola da ispitanik ne savija kolena. Test se ponavlja dva puta, a bolji rezultat se uzima za analizu.

Čunasto trčanje 4 x 10 m (4x10) se izvodi na neklizajućoj podlozi, na stazi dužine 10 m, koja je obeležena dvema linijama dužine 1,2 m. Na kraju staze postavljaju se dva sunđera. Ispitanik treba da četiri puta pretrči obeleženu stazu u što kraćem vremenskom periodu, i to na sledeći način: na zadati znak počinje da trči što brže do linije na drugom kraju staze koju treba da pređe stopalom jedne noge, uzme jedan sunđer, brzo se okrene i vraća se nazad istim pravcem, prelazi ponovo jednim stopalom preko linije, ostavlja sunđer, zatim odlazi po drugi sunđer i sprintom protrčava preko startne linije. Meri se vreme za koje ispitanik istrči četiri deonice, a ukoliko ne pređe svaki put stopalom preko linije merenje se ponavlja.

Izdržaj u zgibu (IuZ) se realizuje na doskočnom vratilu. Ispitanik uz pomoć stolice ili pomoćnika hvata pritku vratila podhvatom u širini ramena, tako da mu se brada nalazi iznad ili u visini pritke. Kada zauzme položaj izmiče se stolica ili ga pomoćnik pušta. Merilac tada uključuje štopericu i meri vreme u kome ispitanik uspeva da održi zadati položaj. Štoprica se zaustavlja kada ispitanik spusti bradu ispod visine pritke. Tokom izvođenja testa ispitanik treba da drži opružene noge i ne sme da se ljulja. Rezultat se meri u sekundama.

Statistička obrada podataka

Svi podaci obrađeni su statističkim procedurama u programu SPSS 20.0. Iz prostora deskriptivne statistike određena je aritmetička sredina (SV), standardna devijacija (SD), kao i nivo poverenja dobijenih podataka (NP). Iz prostora komparativne statistike korišćen je t-test sa jednim uzorkom za poređenje dobijenih rezultata sa prosečnim vrednostima učenica opšte populacije istog uzrasta.

REZULTATI

U Tabeli 1 prikazani su deskriptivni pokazatelji fizičkih karakteristika, kao i rezultati motoričkih testova za devojčice 3. i 4. razreda.

Tabela 1. Fizičke karakteristike i motorički status mladih ritmičarki

	3. razred			4. razred		
	N	**SV (SD)**	**NP (95%)**	**N**	**SV (SD)**	**NP (95%)**
TV	18	143.3 (6.6)	3.27	16	145.0 (7.2)	3.86
TM	18	34.9 (5.1)	2.54	16	36.4 (7.3)	3.90
BMI	18	16.9 (1.7)	0.87	16	17.2 (2.1)	1.14
LS30	18	17.9 (3.3)	1.66	16	19.9 (3.1)	1.67
SuD	18	135.8 (15.5)	7.72	16	145.6 (15.5)	8.25
SR	18	217.1 (73.7)	36.64	16	209.8 (63.1)	33.65
PuS	18	29.8 (4.6)	2.32	16	28.4 (6.4)	3.38
4x10	18	13.5 (0.9)	0.44	16	12.9 (0.7)	0.33
IuZ	18	11.8 (7.3)	3.63	16	12.4 (5.7)	3.03

Legenda: SV(SD) – srednja vrednost (standardna devijacija); NP-nivo poverenja; TV – visina tela; TM – masa tela; BMI – indeks telesne mase; LS 30 – Ležanje-sed za 30s; SuD - Skok udalj; SR - Šatl ran PuS - Pretklon u sedu; IuZ - Izdržaj u zgibu; 4x10 - Čunasto trčanje 4x10 m.

U Tabeli 2 prikazane su srednje vrednosti pokazatelja fizičkog razvoja i rezultata motoričkih sposobnosti mladih ritmičarki, kao i prosečne vrednosti ovih parametara za devojčice opšte populacije odgovarajućeg uzrasta. Od pokazatelja fizičkog razvoja ističe se značajno manji BMI kod mladih ritmičarki obe uzrasne kategorije u odnosu na prosečne vrednosti devojčica opšte populacije istog uzrasta. Rezultati motoričkih testova mladih ritmičarki su bolji od prosečnih rezultata devojčica opšte populacije istog uzrasta u svim testovima izuzev u testu IuZ, i ova razlika je u većini testova značajna.

Tabela 2. Poređenje rezultata fizičkog razvoja i motoričkih testova mladih ritmičarki u odnosu na prosečne vrednosti devojčica opšte populacije istog uzrasta

	3. razred (N=18)					4. razred (N=16)				
	SV (SD) Ritmičarke	**SV(SD) opšta populacija**	**t**	**df**	***p***	**SV (SD) ritmičarke**	**SV(SD) opšta populacija**	**t**	**df**	***p***
TV	143.3 (6.6)	140 (0.070)	2.149	17	**.046**	145.0 (7.2)	146 (0.008)	-.553	15	.589
TM	34.9 (5.1)	35.2 (8.4)	-.258	17	.800	36.4 (7.3)	39.7 (9.3)	-1.803	15	.092
BMI	16.9 (1.7)	17.9 (3.3)	-2.367	17	**.030**	17.2 (2.1)	18.4 (3.4)	-2.330	15	**.034**
LS30	17.9 (3.3)	16.7 (4.7)	1.510	17	.149	19.9 (3.1)	17.9 (4.5)	2.517	15	**.024**
SuD	135.8 (15.5)	118 (19)	4.861	17	**.000**	145.6 (15.5)	127 (20)	4.814	15	**.000**
SR	217.1 (73.7)	157 (66)	3.458	17	**.003**	209.8 (63.1)	177 (77)	2.078	15	.055
PuS	29.8 (4.6)	20.5 (5.8)	8.552	17	**.000**	28.4 (6.4)	20.5 (6.1)	4.893	15	**.000**
4x10	13.5 (0.9)	14.0 (1.4)	-2.474	17	**.024**	12.9 (0.7)	13.6 (1.4)	-3.897	15	**.001**
IuZ	11.8 (7.3)	14 (13)	-1.292	17	.214	12.4 (5.7)	15 (14)	-1.786	15	.094

$p<0.05$ **Legenda:** SV(SD) – srednja vrednost (standardna devijacija); df – stepeni slobode; TV – visina tela; TM – masa tela; BMI – indeks telesne mase; LS 30 – Ležanje-sed za 30s; SuD - Skok udalj; SR - Šatl ran PuS - Pretklon u sedu; IuZ - Izdržaj u zgibu; 4x10 - Čunasto trčanje 4x10 m.

Tabela 3 prikazuje u kojim zonama se nalaze rezultati ritmičarki u odnosu na kriterijumske referentne vrednosti (prema Milanović i Radisavljević, 2015). Kriterijumi su postavljeni tako da u tzv. zoni očekivanih rezultata budu obuhvaćeni rezulati 50% učenika koji se kreću od 25-tog do 75-tog percentila (Tabela 3 – prosek). Rezultati koji ukazuju na postignuće koje je slabije od očekivanog imale su vrednost nižu od 25% (Tabela 3 – ispod proseka) percentila odgovarajućeg rezultata u datom testu. Vrednosti veće od 75-tog percentila predstavaljaju granicu koja treba da ukaže na rezultate koji su iznad proseka za dati test (prema Milanović i Radisavljević, 2015). Rezultati koje su mlade ritmičarke postigle, u najvećem procentu, nalaze se u zoni iznad proseka ili u zoni prosečnih rezultata, u zavisnosti od parametra fizičkog razvoja i motoričke sposobnosti koja se posmatra.

Tabela 3 Kriterijumske referentne vrednosti za devojčice 3. i 4. razreda i distribucija frekvencije rezultata mladih ritmičarki prema datim zonama

	3. razred						4. razred					
	ispod proseka	**%**	**prosek**	**%**	**iznad proseka**	**%**	**ispod proseka**	**%**	**prosek**	**%**	**iznad proseka**	**%**
BMI	15.5	**16.67**	15.5 ÷ 19.7	**77.78**	19.7	**5.56**	15.8	**25.00**	15.8 ÷ 20.4	**62.50**	20.4	**12.50**
LS30	14	**5.56**	14 ÷ 20	**66.67**	20	**27.78**	15	**0.00**	15 ÷ 21	**62.50**	21	**37.50**
SuD	105	**5.56**	105 ÷ 130	**22.22**	130	**72.22**	115	**0.00**	115 ÷ 140	**31.25**	140	**68.75**
SR	110	**0.00**	110 ÷ 193	**44.44**	193	**55.56**	124	**18.75**	124÷ 215	**18.75**	215	**62.50**
PuS	17	**0.00**	17 ÷ 25	**0.00**	25	**100.00**	17	**12.50**	17 ÷ 25	**0.00**	25	**87.50**
4x10	14.88	**5.56**	14.88 ÷ 13	**72.22**	13	**22.22**	14.37	**0.00**	14.37 ÷ 12.6	**81.25**	12.6	**18.75**
IuZ	5	**22.22**	5 ÷ 19	**55.56**	19	**22.22**	5	**0.00**	5 ÷ 21	**100.00**	21	**0.00**

Legenda: TV – visina tela; TM – masa tela; BMI – indeks telesne mase; LS 30 – Ležanje-sed za 30s; SuD - Skok udalj; SR - Šatl ran PuS - Pretklon u sedu; IuZ - Izdržaj u zgibu; 4x10 - Čunasto trčanje 4x10 m;

DISKUSIJA

Rezultati fizičkih karakteristika mladih ritmičarki pokazuju da ove devojčice imaju značajno manji BMI u odnosu na prosečne vrednosti opšte populacije devojčica i 3. i 4. razreda. U subuzorku mladih ritmičarki 3. razreda i telesna visina je značajno veća od prosečnih vrednosti opšte populacije, dok se subuzorak 4. razreda ne razlikuje značajno od prosečnih vrednosti vršnjakinja opšte populacije u telesnoj visini i masi, ali imaju značajno manji BMI. Više autora navode da devojčice koje se bave ritmičkom gimnastikom imaju manje masnog tkiva, a njihova telesna težina je za 5-10 kg niža od proseka populacije devojčica istog uzrasta (Hume i sar.,1993; Sanader, 2000; Jezdimirović i Tumin, 2011). U skladu sa tim, može se izvesti zaključak da rekreativni program vežbanja ritmičke gimnastike, i u relativno malom obimu treninga (2 puta nedeljno po 1 sat), ima pozitivan uticaj na BMI devojčica, mada bi za generalizaciju ovih rezultata trebalo sprovesti studiju na većem broju ispitanica.

Mlade ritmičarke pokazuju prosečno bolje rezultate u repetitivnoj snazi u oba subuzorka u odnosu na prosečne vrednosti devojčica opšte populacije, ali je ova razlika statistički značajna samo kod devojčica 4. razreda. Ritmička gimnastika obiluje vežbama za razvoj snage ovog tipa, i to kako primenom opštih vežbi snage za trbušne mišiće, tako i izvođenjem specifične tehnike bez rekvizita koja podrazumeva stalno angažovanje trbušnih mišića.

Kada je u pitanju eksplozivna snaga i pokretljivost, razlika između mladih ritmičarki i prosečnih vrednosti opšte populacije devojčica je najizraženija. Visok nivo pokretljivosti je jedna od najizraženijih sposobnosti ritmičarki, i vežbe za njen razvoj su sastavni deo svakog treninga ritmičke gimnastike, od rekreativnih do reprezentativnih grupa. Takođe, eksplozivna snaga nogu je motorička sposobnost koja se u treningu ritmičke gimnastike razvija primenom različitih poskoka i skokova, kao osnovnih strukturnih grupa elemenata telom. Dobrijević i sar. (2014), u istraživanju rađenom na uzorku ritmičarki, ukazuju da u periodu od 9. do 10. godine dominira razvoj eksplozivne snage, pa primena vežbi ovog tipa ima izuzetno veliki uticaj na njeno ispoljavanje.

Agilnost ritmičarki je značajno bolja u oba subuzorka u odnosu na prosečne vrednosti opšte populacije devojčica odgovarajućeg uzrasta. Ovaj period se karakteriše kao veoma osetljiv za razvoj ove sposobnosti kod dece (Casperson i sar. 2000, Bijelić i Simović, 2005), pa se uz odgovarajuću stimilaciju napredak u njenom razvoju lakše postiže. U istraživanju Dobrijevićeve i saradnika (2014) potvrđeno da se u ovom periodu agilnost intenzivno razvija kroz primenu sadržaja ritmičke gimnastike, tako da devojčice koje je treniraju su sigurno u prednosti kada je u pitanju ova sposobnost u odnosu na opštu populaciju devojčica, a posebno u odnosu na one koje se ne bave sportom.

Pri poređenju kardiorespiratorne izdržljivosti ritmičarki i prosečnih vrednosti devojčica opšte populacije, uočava se da ritmičarke ostvaruju bolje rezultate, iako razvijenost ove sposobnosti nije od presudnog značaja za ritmičku gimnastiku. Pretpostavlja se da sedentaran način života u današnjim savremenim uslovima, čini da se devojčice izuzetno malo kreću, pa svaka fizička aktivnost, čak i nekarakteristična za razvoj izdržljivosti, utiče na poboljšanje ove sposobnosti.

Kada je u pitanju izdržljivost u snazi, mlade ritmičarke su ostvarile neznatno slabije rezultate od prosečnih devojčica. Ovo je donekle i očekivano s obzirom na to da se u treningu ritmičke gimnastike ne primenjuju u velikoj meri vežbe koje posebno razvijaju izdržljivost u snazi ruku i ramenog pojasa. Ovaj rezultat bi mogao da posluži trenerima, ukazujući im da u planiranju trenažnog procesa treba voditi računa o optimalnom razvoju i ove motoričke sposobnosti.

ZAKLJUČAK

Usmerena fizička aktivnost dece od samo dva sata nedeljno pozitivno utiče na razvoj većine motoričkih sposobnosti devojčica, kao i na njihov telesni sastav. Devojčice koje se bave ritmičkom gimnastikom imaju značajno manje vrednosti BMI u odnosu na prosečne vrednosti devojčica njihovog uzrasta. U većini motoričkih testova mlade ritmičarke ostvarile su značajno bolje rezultate u odnosu na prosečne vršnjakinje, i njihovi rezultati su najčešće u zoni iznad proseka. Imajući u vidu dobijene rezultate može se zaključiti da se ritmička gimnastika sa svojim raznovrsnim kretnim strukturama i bogatstvom sadržaja može preporučiti devojčicama koje se nalaze u periodu rasta i razvoja, kao jedno od najpogodnijih vežbanja koje ima pozitivan uticaj kako na fizički, tako i na motorički razvoj devojčica.

Kao nedostatak ove studije, u smislu generalizacije rezultata, može se smatrati mali uzorak ispitanika. S tim u vezi, preporuka za neka buduća istraživanja je ispitati parametre fizičkog razvoja i motoričke sposobnosti mladih ritmičarki na većem uzorku ispitanika. Pored toga, značajno bi bilo ispitati uticaj rekreativnog bavljenja ritmičkom gimnastikom i kod drugih uzrasnih kategorija devojčica.

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THE IMPORTANCE OF INCLUDING YOUNGER SCHOOLGIRLS IN THE RECREATIONAL PROGRAM OF RHYTHMIC GYMNASTICS

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INTRODUCTION

Motor abilities are a very important factor in the development of a child since they influence not only the biological, but also the psychological and social aspects of his/ her life. The development of motor abilities enhances the growth of cognitive and perceptive abilities (Bushnell & Boudreau, 1993; Von Hofsten, 2004; Smith & Thelen, 2003); at the same time it is impossible to explain motor demonstration without entering into characteristics of the morphological and the character of psychological development (Kukolj, 2011).

One of the basic needs of a child is the need to move and to be physically active. This need is considered to be one of the basic factors of good health. Through physical activity children develop morphological characteristics and motor abilities as well as psychological characteristics essential for a normal and complete life. Most children fulfill this need for physical activity through games and recreation but the number of those who very early engage in organized sports activities (in various sports schools) is constantly growing; this way they not only satisfy their need for physical activity but also improve and upgrade motor abilities by systematic work aided by qualified trainers. When we consider the sedentary way of living nowadays, particularly in the cities, the role of organized sports activities and sport in general in the development of motor abilities is rapidly becoming crucial. Starting from the fact that junior school age (between 7 and 12) is an extremely sensitive phase for motor skills development and enhancement of movement it becomes very important to offer children of this age group sports contents that will adequately stimulate their physical fitness. As for the young girls, according to Gužalovski (1984), the critical period when sensitivity to stimulation of most motor abilities is at its peak is from 9 to 12 years of age. Rhythmic gymnastics, abounding in various movement structures, with its widely applicable and highly accessible contents, has a positive influence on the physical, as well as the motor development of young girls, improving simultaneously their flexibility, agility, strength, coordination, swiftness and balance (Radisavljević and Moskovljević, 2011). In addition to the aforementioned positive characteristics of rhythmic gymnastics we should also state that by engaging in it girls also develop a sense for the esthetic; all of these reasons combined make rhythmic gymnastics one of the most convenient sports contents to be offered to young girls in their period of growth and development.

In practice very often questions are raised concerning individual development of physical characteristics and motor abilities in comparison to the level common to a certain age group, as well as questions about how particular activities influence these parameters. In order to find answers to these questions it is very important to regularly monitor physical fitness in the total children population and in specific sports groups. It took a long time to complete an extensive study in Serbia which contains necessary information about the average development of specific parameters of physical fitness of school children (Milanović and Radisavljević Janić, 2015). The authors of this study have established criterion referenced standards for the abovementioned parameters and thus have provided teachers of physical education valuable reference to observe the physical fitness of their students. Additionally, the aim of monitoring physical fitness of pupils is to improve their own knowledge: how and in what way they can maintain and enhance

their general physical form, keep fit and teach them the importance of physical exercise for optimal growth and development. On the other hand, the very existence of parameters resulting from a representative sample of primary school children gives sport experts the opportunity to compare these values to the values of physical fitness of the children they train. Based on these results coaches could make an analysis of the current physical form of their students and thus check whether the method of teaching and sports contents they employ in their teaching contribute to the improvement of their trainees' physical characteristics and motor abilities.

The aim of this research is to determine the level of motor abilities and some parameters of physical development of young rhythmic gymnasts compared to the criteria benchmarks/ reference points for the general population of young girls of the same age.

METHOD

This study is an empiric research of a transversal nature conducted on a sample of young girls who train rhythmic gymnastics, to investigate the level of their motor abilities and the parameter level of their physical growth. The obtained results are compared to the criterion referenced standards of the general population of girls, their peers.

Participants

The research was carried out on a sample of 34 healthy girls, aged 9 to 10 (3rd and 4th grade) who practice rhythmic gymnastics as recreation in the Sports club "*In*" in Belgrade. All the girls have been engaged in this program of training for 1 or 2 years and have training sessions of 60 minutes twice a week. The sample is divided into two sub-samples: girls from the 3rd grade (N=18) and girls from the 4th grade (N=16).

Procedure

The research encompasses 9 variables: 3 for the assessment of physical growth and body composition and 6 to assess motor status. Measurements for physical growth and body composition are body height (BH) and body weight (BW); from the obtained data the body mass index (BMI) was calculated. Height was measured with Seca stadiometers to the nearest 0.1 cm Seca Instruments Ltd.,Hamburg, Germany), while the body mass was measured with pre-calibrated portable weighting scales (Tanita Inner Scan Model BC-578, Sindelfingen, Germany). The index of body mass was calculated using the mathematical formula (BMI = TM/TV^2).

The tests to assess motor abilities used in this research are standard; their reliability has already been proved (Milanović and Radisavljević Janić, 2015). These same tests with the same instruments were used in the study which established the obtained results as parameters for the general population (Milanović and Radisavljević Janić, 2015); the same parameters were used in this research in processing the data. The following tests were used: sit ups in 30 seconds (LS30) - to estimate dynamic muscular endurance, standing long jump (SuD) – to estimate explosive strength, 20 m progressive shuttle run test (SR) – to estimate cardiorespiratory endurance, sit and reach (PuS) – to estimate flexibility, running 4x10m (4x10) – to estimate agility, bent arm hang (IuZ) – to estimate static muscle endurance (functional strength).

Testing

Testing was conducted in the morning hours at SRC "11th April" in New Belgrade. The examinees wore light sports clothing and a standard warming up session was held preceding the testing itself. Before engaging in each separate test the examinees were given the necessary instructions. They all were given a trial attempt for each test except the shuttle run, since it takes a longer time to complete yet does not present a complex motor task. All the measuring was undertaken in one training period except the shuttle run which was completed during the next training session. The same record keeper did all the measuring required in by a single test.

Sit ups in 30 seconds (LS30) was performed from the start position where the examinee is lying on her back, legs bended at the knees at an angle of 90^0, arms folded under the back of the head, while her pair steadies the legs. In 30 sec the examinee has to make as many sit-ups, touching the knees with her elbows, as she can. The correctly performed raising of the body in the given time span is taken as a final result.

Standing long jump (SuD) is performed on an even, non-slippery surface on which the jumping area and start position are clearly marked. The task of the examinee is to leap and land on both feet as far as possible; the distance from the leap line and the place where the examinee touches the ground with her heel is measured. Three jumps are performed and the best result is taken for analysis.

20 m progressive shuttle run (SR) is performed by running between two lines positioned at a distance of 20 m following the pace set by a sound signal recorded on a CD. At each sound signal the examinee must be standing behind the line with both feet. The aim is to run as many laps as possible. The starting speed is 8.5 km/h and each minute it is increased by 0.5 km/h. The test is discontinued when the examinee can no longer follow the set pace, or when she cannot cross the line at the sound signal three times in a row, or she voluntarily stops running. The result of the test is the amount of actively spent time measured in seconds by a stopwatch.

Sit and reach (PuS) is performed with the aid of a wooden chest (measuring 45 cm x 35 cm x 32 cm) with a ruler and slide on the top surface (measuring 60 cm x 35 cm). The barefoot examinee sits before the chest, legs stretched forward, feet touching the front side of the chest. The arms are also stretched forward, one above the other (the middle finger of one hand above the middle finger of the other); the examinee bends forward pushing the slide as far as possible. The ruler measures the result in centimeters. Monitoring is conducted the whole time making sure that the examinee doesn't bend her knees. The test is repeated twice and the better result is taken for analysis.

Shuttle run 4x10 m (4x10) is executed on a non-slippery surface, on a track 10 m long marked by two lines, 1.2 m long. Two sponges are placed at the end of the track. The examinee must run the length of the marked track four times in shortest possible time in the following manner: at the signal she must begin to run to the line at the other end of the track, cross it with one foot, pick up one of the sponges, turn around and run back the same way, cross the start line with one foot, leave the sponge, then turn around and repeat the same action with the other sponge and sprint back through the start line. The time in which the examinee completes the four laps is measured; if the examinee does not cross the lines with one foot each time, the measuring is repeated.

Bent arm hang (IuZ) is performed on a horizontal bar. The examinee stands on a chair or is aided by a helper to reach the bar with an under grip in the width of her shoulders, with her chin over or in line with the bar. When the position is attained, the chair is removed, or the helper steps back. The timekeeper then starts the stopwatch and measures the time the examinee manages to hold the set position. The measuring is stopped when she drops her chin under the height of the bar. During the test her legs must be straight and the body must not swing. The result is recorded in seconds.

Statistical analysis of data

All obtained data were analyzed by statistical procedures in program SPSS 20.0. In the field of descriptive statistics the mean (M), standard deviation (SD), as well as the level of confidence (LoC), were determined. In the field of comparative statistics, T-test with one sample was used to compare results with the young girl population criterion referenced standards of the same age.

RESULTS

Table 1 presents the descriptive indexes of physical characteristics and the results of the motor tests for girls of the 3rd and 4th grade.

Table 1. Physical characteristics and motor status of young rhythmic gymnasts

	3rd grade			4th grade		
	N	**M (SD)**	**LoC (95%)**	**N**	**M (SD)**	**LoC (95%)**
TV	18	143.3 (6.6)	3.27	16	145.0 (7.2)	3.86
TM	18	34.9 (5.1)	2.54	16	36.4 (7.3)	3.90
BMI	18	16.9 (1.7)	0.87	16	17.2 (2.1)	1.14
LS30	18	17.9 (3.3)	1.66	16	19.9 (3.1)	1.67
SuD	18	135.8 (15.5)	7.72	16	145.6 (15.5)	8.25
SR	18	217.1 (73.7)	36.64	16	209.8 (63.1)	33.65
PuS	18	29.8 (4.6)	2.32	16	28.4 (6.4)	3.38
4x10	18	13.5 (0.9)	0.44	16	12.9 (0.7)	0.33
IuZ	18	11.8 (7.3)	3.63	16	12.4 (5.7)	3.03

Key: M – mean; SD – standard deviation; LoC-level of confidence; TV – body height; TM – body weight; BMI – body mass index; LS30 – sit ups in 30sec; SuD – Standing long jump; SR - Shuttle run; PuS – sit and reach; IuZ – bent arm hang; 4x10 - Shuttle run 4x10m.

Table 2 shows the mean values of indexes of physical growth and the results of the motor abilities of young rhythmic gymnasts, as well as the average values of the same parameters for girls of the general population of corresponding age. In the indexes of physical growth we noticed a significantly smaller value for BMI in the group of young rhythmic gymnasts of both age categories compared with the average results of young girls of the general population of the same age. The results of the motor tests of young gymnasts were better than the average results of their peers in the general population except test IuZ; the difference in most tests was significant.

Table 2. Comparison of the results of physical growth and motor tests of young rhythmic gymnasts with the average values for girls of the general population of the same age

	3rd grade (N=18)					4th grade (N=16)				
	M (SD) rhythmic gymnasts	**M (SD)** general population	**T**	**df**	***p***	**M (SD)** rhythmic gymnasts	**M (SD)** general population	**t**	**df**	***p***
TV	143.3 (6.6)	140 (0.070)	2.149	17	**.046**	145.0 (7.2)	146 (0.008)	-.553	15	.589
TM	34.9 (5.1)	35.2 (8.4)	-.258	17	.800	36.4 (7.3)	39.7 (9.3)	-1.803	15	.092
BMI	16.9 (1.7)	17.9 (3.3)	-2.367	17	**.030**	17.2 (2.1)	18.4 (3.4)	-2.330	15	**.034**
LS30	17.9 (3.3)	16.7 (4.7)	1.510	17	.149	19.9 (3.1)	17.9 (4.5)	2.517	15	**.024**
SuD	135.8 (15.5)	118 (19)	4.861	17	**.000**	145.6 (15.5)	127 (20)	4.814	15	**.000**
SR	217.1 (73.7)	157 (66)	3.458	17	**.003**	209.8 (63.1)	177 (77)	2.078	15	.055
PuS	29.8 (4.6)	20.5 (5.8)	8.552	17	**.000**	28.4 (6.4)	20.5 (6.1)	4.893	15	**.000**
4x10	13.5 (0.9)	14.0 (1.4)	-2.474	17	**.024**	12.9 (0.7)	13.6 (1.4)	-3.897	15	**.001**
IuZ	11.8 (7.3)	14 (13)	-1.292	17	.214	12.4 (5.7)	15 (14)	-1.786	15	.094

Key: SD – standard deviation; TV – body height; TM – body weight; BMI – body mass index; LS30 – sit ups in 30sec; SuD – Long jump; SR - Shuttle run; PuS – sit and reach; IuZ – bent arm hang; 4x10 - Shuttle run 4x10m. $p<0.05$

Table 3 shows the zones where the results of rhythmic gymnasts are placed compared to the criterion referenced standards (according to Milanović and Radisavljević, 2015). The criteria were founded in such a way to encompass within the zone of so-called expected results the results of 50% of the schoolgirls which range from the 25th to 75th percentage (Table 3- average). Results which indicate a poorer than expected performance have a value less than 25% (Table 3 –less than average) of the corresponding result for a specific test. Values higher than 75% present a limit which should point to an above average performance for a specific test (according to Milanović and Radisavljević, 2015). The results achieved by young rhythmic gymnasts in a large percentage are to be found in the zone of above average performance or in the zone of average performance depending on which parameter of physical growth and motor ability was taken under observation.

Table 3 Criterion referenced standards for girls of the 3rd and 4th grade and the distribution of the frequency of the results of young rhythmic gymnasts in the given zones

	3rd grade						4th grade					
	below average	%	average	%	above average	%	below average	%	average	%	above average	%
BMI	15.5	**16.67**	15.5 ÷ 19.7	**77.78**	19.7	**5.56**	15.8	**25.00**	15.8 ÷ 20.4	**62.50**	20.4	**12.50**
LS30	14	**5.56**	14 ÷ 20	**66.67**	20	**27.78**	15	**0.00**	15 ÷ 21	**62.50**	21	**37.50**
SuD	105	**5.56**	105 ÷ 130	**22.22**	130	**72.22**	115	**0.00**	115 ÷ 140	**31.25**	140	**68.75**
SR	110	**0.00**	110 ÷ 193	**44.44**	193	**55.56**	124	**18.75**	124÷ 215	**18.75**	215	**62.50**
PuS	17	**0.00**	17 ÷ 25	**0.00**	25	**100.00**	17	**12.50**	17 ÷ 25	**0.00**	25	**87.50**
4x10	14.88	**5.56**	14.88 ÷ 13	**72.22**	13	**22.22**	14.37	**0.00**	14.37 ÷ 12.6	**81.25**	12.6	**18.75**
IuZ	5	**22.22**	5 ÷ 19	**55.56**	19	**22.22**	5	**0.00**	5 ÷ 21	**100.00**	21	**0.00**

Key: BH – body height; BW – body weight; BMI – body mass index; LS30 – sit ups in 30sec; SuD – Long jump; SR - Shuttle run; PuS – sit and reach; IuZ – bent arm hang; 4x10 - Shuttle run 4x10m.

DISCUSSSION

Results of the physical characteristics of young rhythmic gymnasts show that they have a significantly lower BMI compared to the average values of the general population of young girls in the 3rd and 4th grade. In the sub-sample of young gymnasts of the 3rd grade their body height was also significantly greater than the average values of their peers in the general population; at the same time the sub-sample of 4th grade gymnasts did not differ greatly from their peers in the general population in body height and weight, but their BMI was significantly lower. A number of authors agree that young girls who practice rhythmic gymnastics have less fat tissue and their body weight is between 5 to 10 kg less than the average of the general population of their peers (Hume et. all,1993; Sanader, 2000; Jezdimirović and Tumin, 2011). Based on the similarities with the findings of previous research work we can conclude that the recreational program of training, even within a relatively small scope of training (twice a week,1 hour sessions), has a positive effect on the physical characteristics of young girls, although to safely generalize on the basis of these results would require a larger number of examinees to be taken for research.

Young rhythmic gymnasts in both sub-samples on average show better results in dynamic muscular endurance than the average values achieved by girls of the general population, but the difference is statistically significant only for 4th grade girls. Rhythmic gymnastics abounds with exercises that develop strength of this kind, particularly by applying general exercises for abdominal muscles strength together with performing specific techniques without apparatus which constantly engage the abdominal muscles.

Where explosive power and flexibility are concerned the difference between young gymnasts and the average values of the general population of young girls is most obvious. One of the outstanding

abilities of young gymnasts is the high level of flexibility, and exercises which contribute to its development form an integral part of every training session of rhythmic gymnastics, both on the recreational and representative levels. The explosive strength of the legs is a motor ability which in rhythmic gymnastics training is developed through series of hops and leaps; both constitute a basic structural group of body elements. Dobrijević et. all (2014) in a research conducted on a sample of rhythmic gymnasts demonstrate that in the age period between 9 and 10 the development of explosive strength dominates, so by applying exercises of this type, its manifestation is greatly stimulated.

The agility of the gymnasts was significantly better in both sub-samples compared to the average value of the general population of young girls of the same age. This period is considered to be very sensitive for the development of this ability in children (Casperson et all. 2000, Bijelić and Simović, 2005), so by ample stimulation it is easy to enhance its development. In the research by Dobrijević et all. (2014) it is confirmed that agility in this period is rapidly developed through the application of rhythmic gymnastics contents, so, in this respect, girls who train this sport have an advantage over girls of the general population, particularly those who do not practice any sport at all.

When comparing cardio-respiratory endurance of the gymnasts and the average values for young girls of the general population it can be noted that the gymnasts displayed better results, although the development of this ability is not decisively important in rhythmic gymnastics. The presumption is that the sedentary way of life in contemporary surroundings is responsible for that fact that young girls simply do not move enough, so any kind of physical activity, even if it is uncharacteristic for the development of endurance, has a positive effect on the enhancement of this ability.

Where endurance in strength is concerned, young rhythmic gymnasts showed slightly poorer results than the average girls. This was generally to be expected since rhythmic gymnastics training does not concentrate on exercises that specifically develop endurance in strength of the arms and shoulders. This finding could be important to trainers by inducing them to take into account the optimal development of this motor ability as well when planning their training process.

CONCLUSION

Guided physical activity, even if it lasts only two hours per week, has a positive effect on the development of most motor abilities of young girls as well as on their body composition. Girls who practice rhythmic gymnastics have significantly less values of BMI compared to the average values for young girls, their peers. In most of the motor tests the young rhythmic gymnasts achieved significantly better results than their average peers and their results were mostly in the above average zone. Taking into consideration the achieved results we can deduce that rhythmic gymnastics, with its various movement structures and variety of its contents, can be recommended to girls in the period of growth and development as one of the most suitable ways of exercising which has a positive effect on the physical fitness and motor development of young girls. One of the shortcomings of this study, as far as generalization is concerned, is the small number of examinees. Consequently, a recommendation for future research can be to analyze the parameters of physical fitness of young rhythmic gymnasts on a larger sample of examinees. It would also be valuable to investigate the influence of recreational training of rhythmic gymnastics on girls of other age groups.

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TREND PROMENA INICIJALNOG NIVOA MOTORIČKIH SPOSOBNOSTI STUDETKINJA POLICIJSKE AKADEMIJE

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UVOD

Različiti modeli edukacionih procesa predstavljaju obeležje savremenog sistema obrazovanja. Permanentna potreba za napretkom podrazumeva stalno unapređenje postojećih modela. Kako bi ovaj proces bio uspešan neophodan preduslov je poznavanje i kontrolisanje svih delova sistema. Pored toga, od posebnog značaja su selekcioni kriterijumi i početni nivo izabranih parametara na početku procesa obrazovanja.

Adekvatan nivo motoričkih sposobnosti predstavlja jedan od osnovnih preduslova za svakodnevno uspešno obavljanje policijskog posla, posebno u slučajevima sprovođenja zakona kao i u pružanju pomoći ugroženima u prirodnim katastrofama. Iz tog razloga, jedan od parametara u procesu selekcije za rad u policiji je kontrola nivoa motoričkih sposobnosti (Nutting and Maxwell, 1992; Copay and Charles, 1998; Lord, 1998; Anderson et al., 2001; Strating et al., 2010). Nakon selekcije, važno je motoričke sposobnosti policajaca dalje razvijati i održavati, jer njihov neadekvatan nivo može biti limitirajući faktor u obavljanju određenih poslova, dovesti do neadekvatne radne produktivnosti, povreda, dugotrajne nesposobnosti za rad i izazvati gubitak ljudskih resursa i neracionalne ekonomske troškove (Trottier and Brown, 1994; Lonsway, 2003). Između nivoa motoričkih sposobnosti i efikasnosti u policijskim poslovima postoji značajna statistička povezanost, a utvrđene su i statistički značajne korelacije između nivoa motoričkih sposobnosti i zdravstvenog statusa policajaca (Copay and Charles, 1998; Sorensen et al., 2000; Strating et al., 2010).

Karakteristike policijskog posla - stresne situacije, smenski i noćni rad, fizičko i mentalno opterećenje, obavljanje zadataka u svim klimatskim uslovima, neredovna i neadekvatna ishrana, sedentarni poslovi, izloženost društveno-profesionalnim i socijalnim pritiscima, mogu kumulativno negativno uticati na zdravstveni status, status motoričkih sposobnosti ili do nepoželjnih manifestacija u smislu negativnih promena strukture tela (Sorensen et al., 2000; De Loës and Jansson, 2002; Kales et al., 2009). Žene su zbog fizioloških specifičnosti podložnije povredama, u odnosu na muškarce kako u civilnoj tako i policijskoj populaciji (De Loës and Jansson, 2002). Sa aspekta fizičkih sposobnosti imaju niže pokazatelje u ispoljavanju snage (Boyce et al., 2008), manji nivo opšte i specifične spretnosti (Birzer and Craig, 1996), češće su izložene riziku profesionalne i socijalne diskriminacije (Wilkinson and Froyland, 1996; Spasić, 2008; Kesić, 2011). Sa aspekta telesnog sastava imaju drugačiju strukturu tela, sa manjim procentom mišićne ali većim procentom masne komponente (Boyce et al., 2008; Carroll et al., 2008; Dopsaj et al., 2015).

Navedeni razlozi nameću potrebu da se u populaciji devojaka - žena u policiji, sprovode istraživanja procesa selekcije, trenažnog rada i sistema kontrole (Janković i sar., 2008). Zbog značaja koje motoričke sposobnosti zauzimaju u sistemu selekcije, obuke, školovanja i kontrole njihovog nivoa, a u cilju poboljšanja radnih sposobnosti policijskih službenika, javlja se potreba za stalnim praćenjem, razvojem i usavršavanjem selekcionih kriterijuma, programa obuke i dostignutog nivoa motoričkih sposobnosti (Anderson et al., 2001; Dopsaj i Vučković, 2006; Dopsaj i sar., 2007; Strating, 2010; Vučković i sar., 2011).

Sistem prijemnog ispita na Kriminalističko-policijskoj akademiji (KPA) u Beogradu dizajniran je kao pozitivan četvorodimenzionalan selekcioni model koji se sastoji od: postignutog uspeha u prethodnom školovanju, zdravstvenog statusa, psihološkog profila i ličnih predispozicija, kao i

provere morfoloških karakteristika i procene nivoa fizičkih sposobnosti. Baterija testova za procenu nivoa fizičkih sposobnosti koncipirana je na osnovu potreba za efikasno savladavanje programa Secijalnog fizičkog obrazovanja. Tokom procesa selekcije za prijem na KPA, svi kandidati moraju da ispune propisane standarde nivoa fizičkih sposobnosti. Minimalni nivo fizičkih sposobnosti definisan je normativnim aktima Ministarstva unutrašnjih poslova Repubike Srbije, tako što je eliminaciona granica na 33.33 percentila populacije u R. Srbiji (Dopsaj i sar., 2007). Cilj ovog rada je utvrđivanje trenda promena inicijalnog nivoa motoričkih sposobnosti studetkinja KPA.

METOD

Istraživanje je obahvatilo rezultate sa prijemnog ispita iz 2011. godine - Gen_2011 (broj ispitanica - N=155), 2012. godine - Gen_2012 (N=159), 2013. godine - Gen_2013 (N=164) i 2014. godine - Gen_2014 (N=173). Pored ukupnog broja ostvarenih bodova (BMS), analizirana su i rezultati motoričkih sposobnosti procenjenih baterijom testova koja se koristi na prijemnom ispitu na KPA: Stisak šake (FmaxS) – izražen u kilonjutnima (kN), Sklekovi (SKL) – izraženi u broju ponavljanja (br), Podizanje trupa (TR) – izraženi u broju ponavljanja (br), Skok u dalj sa zamahom rukama (DALJ) – izražen u centimetrima (cm), Skok u vis sa zamahom rukama (ABAL) – izražen u cm, Grčenje-opružanje (GR) – izraženi u broju grešaka (br) i Kuperov test (KT) izražen u metrima (m). Sva merenja realizovana su u Metodičko-istraživačkoj laboratoriji KPA, od strane istih merilaca, u skladu sa standardizovanim procedurama (Kolaravic et al., 2014). Za utvrđivanje razlika na generalnom nivou korišćena je MANOVA, a na parcijalnom nivou Bonferoni test. Kriterijum statističke značajnosti bio je na nivou od 95%, odnosno $p < 0.05$ (Hair et al., 1998).

REZULTATI

U Tabeli 1. prikazani su rezultati prosečnih vrednosti ostvarenih na testovima za prijemni ispit na KPA. Takođe, prikazan je i prosečan broj bodova koji je ostvaren na osnovu postignutih rezultata na prijemnom ispitu iz bazično-motoričkih sposobnosti.

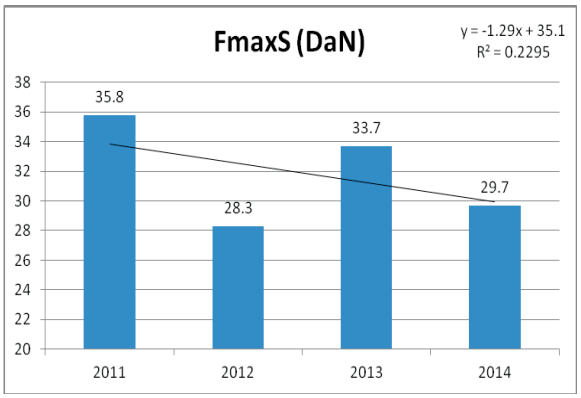
Tabela 1. Prosečne vrednosti rezultata ostvarene na testovima za prijemni ispit KPA

	FmaxS (kN)	**SK** (br)	**TR** (br)	**DALj** (cm)	**ABAL** (cm)	**GR** (br)	**KT** (m)	**BMS** (bod)
Gen_2011	35.8	6.1	22.0	171.5	33.1	4.4	2174.3	12.99
Gen_2012	28.3	5.6	20.9	173.9	28.7	5.5	2200.4	11.37
Gen_2013	33.7	6.1	22.0	176.7	30.3	3.9	2210.0	12.74
Gen_2014	29.7	6.0	21.7	172.0	31.1	5.6	2198.4	11.89

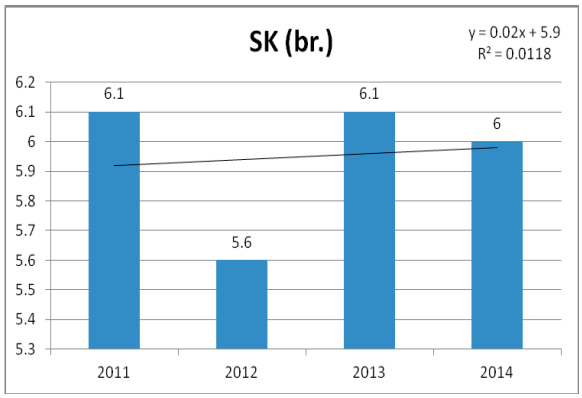
Rezulati MANOVE pokazuju da na generalnom nivou postoji statistčki značajna razlika između studentkinja u odnosu na godinu prijemnog ispita na nivou vrednosti Wilks' Lambde od 0.576 ($F = 16.198$, $p < 0.05$). Na parcijalnom nivou razlike su utvrđene u BMS ($F = 10.477$, $p = 0.00$) i kod testova FmaxS ($F = 80.390$, $p = 0.00$), TR ($F = 3.869$, $p = 0.01$), ABAL ($F = 24.082$, $p = 0.00$) i GR ($F = 5.806$, $p = 0.01$).

Na Grafikonima 1-8. prikazan je trend promena prosečnih rezultata ostvarenih na testovima za prijemni ispit na KPA, kao i trend promena ukupnog broja bodova koje su kandidatkinje ostvarile na delu prijemnog ispita iz bazično-motoričkih sposobnosti.

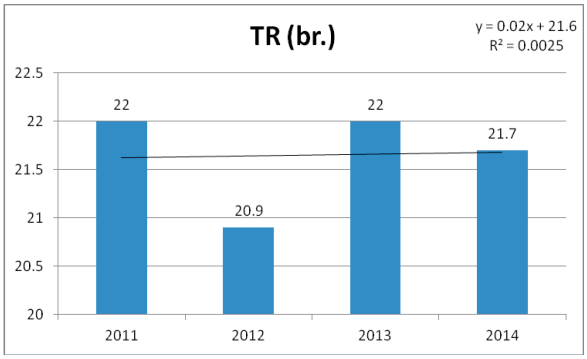
Grafikon 1. Trend promena prosečnih rezultata za FmaxS



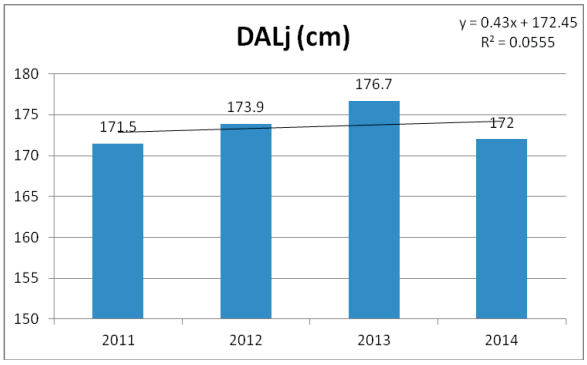
Grafikon 2. Trend promena prosečnih rezultata za SK



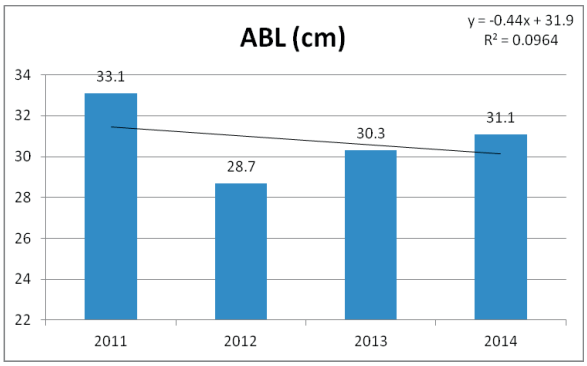
Grafikon 3. Trend promena prosečnih rezultata za TR



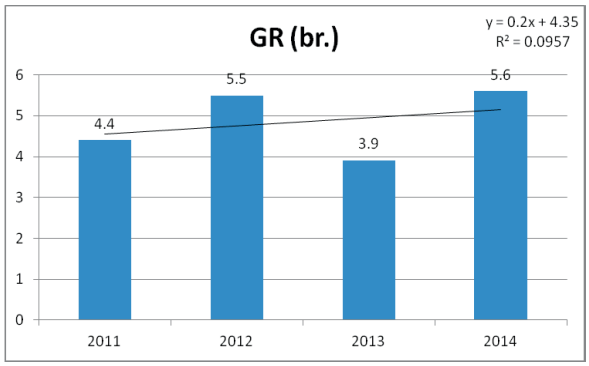
Grafikon 4. Trend promena prosečnih rezultata za DALJ



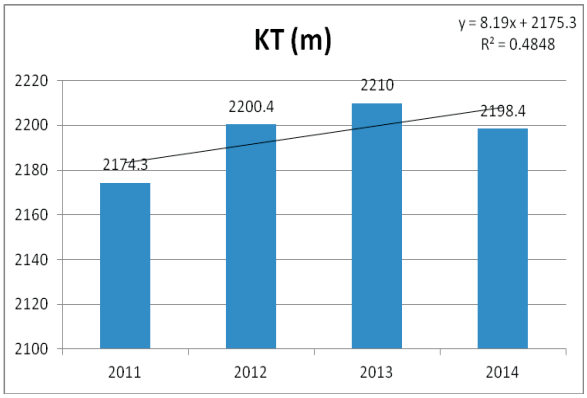
Grafikon 5. Trend promena prosečnih rezultata za ABL



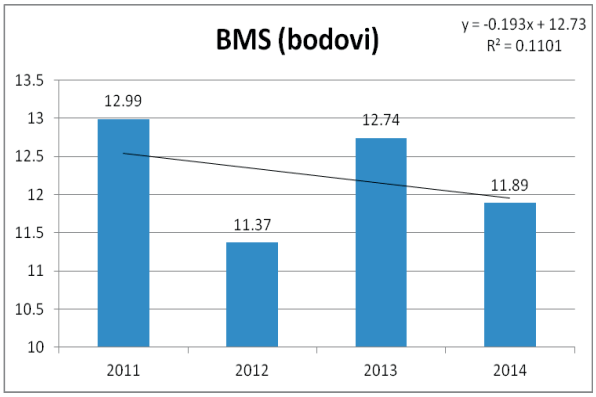
Grafikon 6. Trend promena prosečnih rezultata za GR



Grafikon 7. Trend promena prosečnih rezultata za KT



Grafikon 8. Trend promena prosečnih rezultata za BMS



DISKUSIJA

Rezultati MANOVE su pokazali da na generalnom nivou postoji statistički značajna razlika između inicijalnih nivoa bazično-motoričkih sposobnosti kod studentkinja koje su upisane na KPA. Na parcijalnom nivou, statistički značajne razlike utvrđene su kod rezultata ostvarenih na testovima FmaxS , TR, ABAL i GR. Takođe, statistički značajna razlika utvrđena je i za ukupan broj bodova ostvaren na delu prijemnog ispita iz bazično-motoričkih sposobnosti. Kod rezultata ostalih testova nisu dobijene statistički značajne razlike.

Detaljnijim uvidom u rezultate pojedinačnih testova može se zaključiti da kod procenjivanih motoričkih sposobnosti postoje različiti trendovi promena. Međutim, trendovi promena kod svih posmatranih varijabli nemaju pravilan linearan karakter, već su primetni varijabiliteti između posmatranih generacija. Pozitivan trend promena primećuje se kod testova SK, TR, DALJ i KT. Negativan trend promena primećuje se kod testova FmaxS , ABAL i GR. Ipak, i pored različitih trendova promena u rezultatima pojedinačnih testova, evidentan je negativan trend u ukupnom broju ostvarenih bodova (BMS).

Postoji više mogućih razloga negativnog trenda na generalnom nivou. Prvo, evidentni su trendovi smanjenja fizičke aktivnosti kod dece i adolscenata kao posledica savremenog načina života (Hass et al., 2001). Drugo, povezano sa prethodnim, aktuelni programi nastave realizuju se sa manjim brojem časova fizičkog vaspitanja na nižim nivoima obrazovanja. Treće, sistem sporta i školskog sporta u Srbiji, zbog celokupne materijalno-finansijske situacije, pruža sve manje mogućnosti srednjoškolskoj populaciji. Četvrto, u praćenom periodu broj prijavljenih kandidata se smanjivao. Peto, spuštanje eliminacione granice na prijemnom ispitu, u delu provere BMS, omogućio je veću prolaznost kandidatkinja sa nižim nivoom motoričkih sposobnosti.

Pored uglavnom negativnog trenda u rezultatima na testovima bazično-motoričkih sposobnosti primećuje se konstantno uvećanje broja upisanih kandida ženskog pola. Obzirom da rezultati bazično-motoričkih sposobnosti na prijemnom ispitu čine samo 20% ukupnog broja mogućih bodova, nameće se potreba za detaljnijim istraživanjima koja će utvrditi uzroke ovakvog odnosa. Konkretnije, razlozi mogu biti u većem broju bodova koji se ostavaruje na drugim delovima prijemnog ispita, lošijim rezultatima koje ostvaruju kandidati muškog pola na testovima bazično-motoričkih sposobnosti ili kombinacija ova dva prostora.

Rezultati ovog istraživanja upućuju na zaključak da je neophodna evaluacija eliminacionog nivoa u prostoru bazično-motoričkih sposobnosti na prijemnom ispitu. Povezano sa ovime, nameće se potreba za novim istraživanjima koja će utvrditi stanje bazično-motoričkih sposobnosti na nivou populacije u Republici Srbiji. Manjkavost ovog istraživanja ogleda se u relativno malom broju analiziranih generacija zbog čega neke od zaključaka treba prihvatiti sa rezervom. Konačno, ovo istraživanje potrebno je sagledati u širem kontekstu edukativnog procesa na KPA. I pored toga što se nivo motoričkih sposobnosti tokom studija povećava (Janković i sar., 2010), finalni nivo motoričkih sposobnosti ima trend opadanja u odnosu na prethodne periode. Ovo se potvrđuje kroz istraživanje Dimitrijević et al. (2014) koje ukazuje na negativne trendove zbog smanjenja broja časova Specijalnog fizičkog obrazovanja.

ZAKLJUČAK

Rezultati ovog istraživanja u skladu su sa prethodnim istrživanjima sprovedenim na sličnim populacijama. Trendovi smanjenja nivoa motoričkih sposobnosti evidentni su kako u procesu selekcije, tako i u procesu edukacije. Zbog toga se nameće potreba za evaluacijom prijemnog ispita i procesa nastave na KPA.

Napomena

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TREND OF CHANGES IN MOTOR ABILITIES INITIAL LEVEL IN THE FEMALE STUDENTS OF THE POLICE ACADEMY

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INTRODUCTION

Modern education system is featured by different models of teaching processes. The permanent need for education advancement implies continuous improvement of the existing models. Knowledge and control of all system components are a necessary precondition to make this process successful. In addition, the selection criteria and the initial level of chosen parameters at the beginning of the education process are of particular importance.

Adequate motor abilities level is one of the basic prerequisites for the successful conduct of daily police work, especially in cases of law enforcement as well as in providing help to people affected by natural disasters. For that reason, one of the parameters in the selection process for the work in the police is the control of the motor abilities level (Nutting and Maxwell, 1992; Copay and Charles, 1998; Lord, 1998; Anderson et al., 2001; Strating et al., 2010). After the selection, it is important to continue with development and maintain of police officers motor abilities because their inadequate level can be a limiting factor in the performance of certain tasks, resulting in inadequate labour productivity, injuries, long-term disability and also can cause loss of human resources and irrational economic costs (Trottier and Brown, 1994; Lonsway, 2003). There is a significant statistical correlation between the motor abilities level and efficiency in police job, as well as statistically significant correlation between the motor abilities level and health status of police officers (Copay and Charles, 1998; Sorensen et al., 2000; Strating et al., 2010).

The characteristics of police work - stressful situations, shift and night work, physical and mental load, performing tasks in all weather conditions, irregular and inadequate nutrition, sedentary jobs, exposure to socio-professional and social pressures may cumulate negative impacts on health status, motor ability or undesirable manifestations in terms of negative changes in the body structure (Sorensen et al., 2000; De Loës and Jansson, 2002; Kales et al., 2009). Due to physiological specificities, women are more prone to injuries compared to men in both civilian and police population (De Loës and Jansson, 2002). From the aspect of motor abilities women have lower indicators in the expression of muscular strength (Boyce et al., 2008), lower level of general and specific dexterity (Birzer and Craig, 1996), often are exposed to the risk of professional and social discrimination (Wilkinson and Froyland, 1996; Spasić, 2008; Kesić, 2011). From the aspect of body composition women have a different body structure, with lower percentage of muscle and higher percentage of fat mass (Boyce et al., 2008; Carroll et al., 2008; Dopsaj et al., 2015).

All these reasons impose the need to, for the female population in police, conduct research in selection process, training process and in systems control (Janković et al., 2008). Because of the importance that motor abilities have in the system of selection, training, education and their level control, and also in order to improve the working abilities of police officers, there is a need for constant monitoring, development and improvement of selection criteria, training program and level of motor abilities (Anderson et al., 2001; Dopsaj i Vučković, 2006; Dopsaj et al., 2007; Strating, 2010; Vučković et al., 2011).

The system of the entrance exam at the Academy of Criminalistic and Police Studies (ACPS) in Belgrade is designed as a four-dimensional positive selection model that consists of success achieved in previous education, health status, psychological profile and personal predisposition, as well as

checks of the morphological characteristics and assessment of the motor abilities level. The battery of tests for assessment of the motor abilities level is designed based on the needs for coping with the program of Specialized physical education. During the selection process for admission to the ACPS, all candidates must fulfil the prescribed standards of motor ability levels. The minimum level of motor abilities is defined by normative acts of the Ministry of Internal Affairs of the Republic of Serbia, so the elimination border is on the 33.33 percentile of the population in the Republic of Serbia (Dopsaj et al., 2007). The aim of this study was to determine the trend of changes in motor abilities initial level in the female students of the ACPS.

METHOD

The study included the results of the entrance exams in year 2011. - Gen_2011 (the number of respondents - N = 155), 2012. - Gen_2012 (N = 159), 2013. - Gen_2013 (N = 164) and 2014. - Gen_2014 (N = 173). In addition to the total number of points which represent the general level of basic motor abilities development (BMA), the results of single motor abilities were also analysed and assessed with a battery of tests used for entrance exam in the ACPS: "Hand grip" (FmaxHG) – expressed in kilonewton (kN), the Push-up (PU) – expressed in the number of repetitions (No), the Sit-up (SU) – expressed in No, the Long jump (LJ) – expressed in centimeters (cm), the Abalac (ABAL) – expressed in cm, the Body flexion-extension (FE) – expressed in No and the Cooper test (COOP) – expressed in meters (m). All measurements were realized in the ACPS methodical-research laboratory, by the same measurers, according to standardized procedures (Kolaravic et al., 2014). The existence of the general variability differences between groups was determined by using MANOVA, while for the determination of partial differences between pairs of variables Bonferroni test was used. Statistical significance was defined at the level of $p < 0.05$ (Hair et al., 1998).

RESULTS

Table 1. shows the results of the average values achieved in the tests for the entrance exam to the ACPS. Also, the average number of points of basic motor abilities achieved on the bases of the results on the entrance exam is shown.

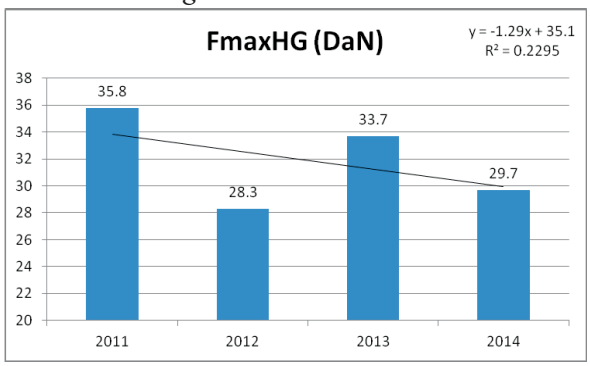
Table 1. Average values of the results achieved in tests for the entrance exam on ACPS

	FmaxHG (kN)	**PU** (No)	**SU** (No)	**LJ** (cm)	**ABAL** (cm)	**FE** (No)	**COOP** (m)	**BMA** (points)
Gen_2011	35.8	6.1	22	171.5	33.1	4.4	2174.3	12.99
Gen_2012	28.3	5.6	20.9	173.9	28.7	5.5	2200.4	11.37
Gen_2013	33.7	6.1	22	176.7	30.3	3.9	2210	12.74
Gen_2014	29.7	6	21.7	172	31.1	5.6	2198.4	11.89

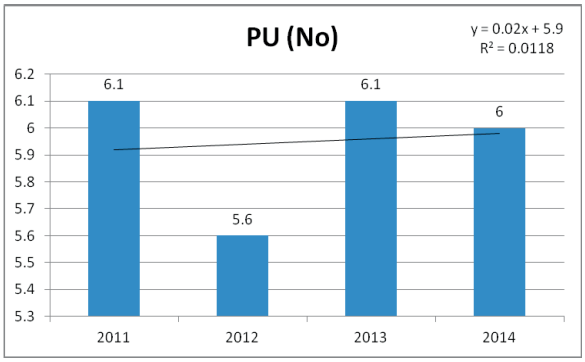
MANOVA results show that at a general level, there is a statistically significant difference between female students compared to the year of the entrance exam at the level of Wilks' Lambda 0.576 ($F=16.198$, $p < 0.05$). At the partial level differences were found for BMA ($F = 10.477$, $p = 0.00$), and also for the tests FmaxHG ($F = 80{,}390$, $p = 0.00$), SU ($F = 3.869$, $p = 0.01$), ABAL ($F = 24.082$, $p = 0.00$) and FE ($F = 5.806$, $p = 0.01$).

On the *Graphs 1-8.*, the trends of changes of the average values of the results achieved in tests for the entrance exam to the ACPS are shown, as well as the trend of the changes in total number of points that candidates achieved on the part of the entrance exam in basic motor abilities.

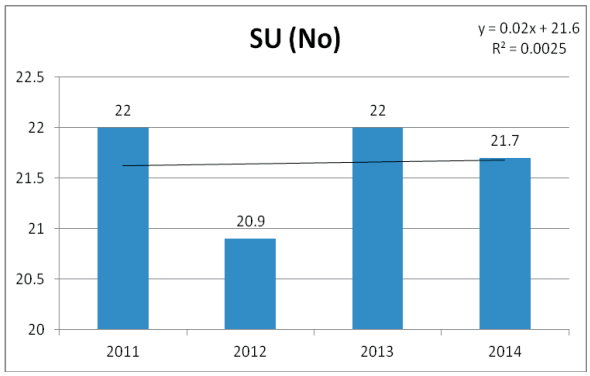
Graph 1. The trend of changes of FmaxHG average value



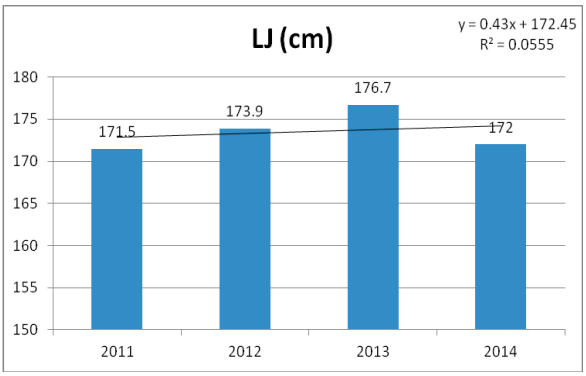
Graph 2. The trend of changes of PU average value



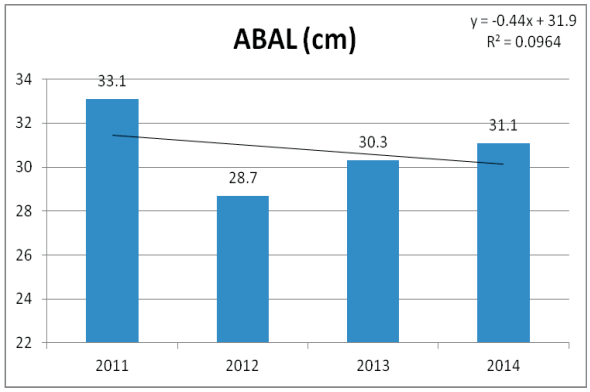
Graph 3. The trend of changes of SU average value



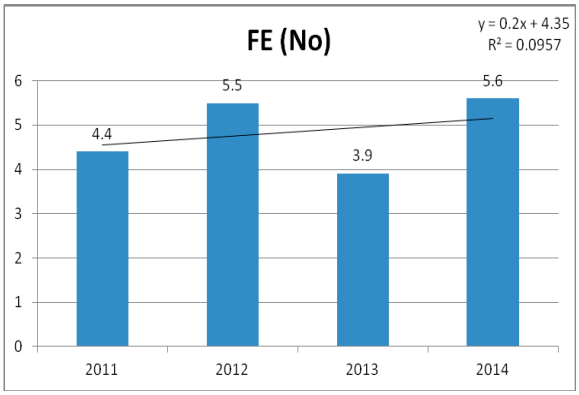
Graph 4. The trend of changes of LJ average value



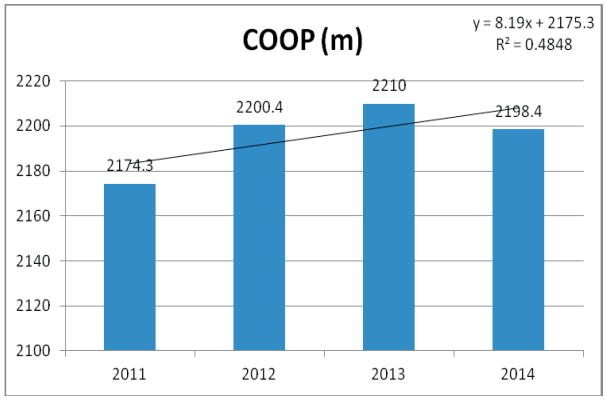
Graph 5. The trend of changes of ABAL average value



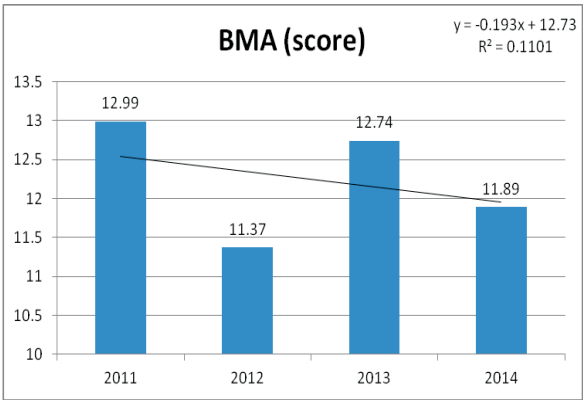
Graph 6. The trend of changes of FE average value



Graph 7. The trend of changes of COOP average value



Graph 8. The trend of changes of BMA average value



DISCUSSION

MANOVA results showed that on the general level there was a statistically significant difference between the initial levels of basic motor abilities of female students who enrolled ACPS. At the partial level, statistically significant differences were determined in the results achieved in tests FmaxHG, SU, ABAL and FE. Also, statistically significant differences were observed for the total number of points achieved for part of the entrance exam in basic motor abilities. In the results of other tests statistically significant differences were not found.

On the basis of the further insight into the results of individual tests, it can be concluded that different trends of changes exist in the assessed motor abilities. However, the trends of changes in all the observed variables do not have regular linear character, but variability is noticeable between different generations. The positive trend of changes is noticed in tests PU, SU, LJ and COOP. The negative trend of changes is noticed in tests FmaxHG, ABAL and FE. Still, despite the different trends of changes in the results of the individual tests, it is evident the negative trend in the total number of points (BMA).

There are several possible reasons for the negative trend on the general level. Firstly, evident trends of physical activity decrease in children and adolescents as a consequence of modern life (Haas et al., 2001). Secondly, related to the previous, current physical education programs at lower levels of education (in primary and secondary schools) are realized with a smaller number of classes. Thirdly, the system of sport and school sport in Serbia, due to the overall material and financial situation, provides less and less opportunities for the secondary school population. Fourth, in the monitored period, the total number of applicants decreased. Fifth, descent of elimination limits on the entrance exam, in the part of BMA assessment, enables greater enrollmentof female candidates with a lower level of motor abilities.

In addition to the generally negative trend in the results of the basic motor abilities, it can be observed that the number of enrolled female candidates is constantly increasing. Considering that the results of basic motor abilities on the entrance exam represent only 20% of the total number of points, there is a need for more detailed research to determine the causes of such relations. More specifically, the reasons may be in a number of points that were accomplished in other parts of the entrance exam, lower results achieved by the male candidates on tests of basic motor abilities or in a combination of these two areas.

The results of this study suggest that there is a need for the evaluation of elimination limits in the area of basic motor abilities on the entrance exam. Related to this, there is a need for new studies which will determine the current state of basic motor abilities on the population level in the Republic of Serbia. Deficiency of this study is reflected in the relatively small number of analyzed generations, and therefore, some of the findings should be taken with caution. Finally, this study should be observed in the wider context of the educational process on the ACPS. Despite the fact that the level of motor abilities during the studies increases (Jankovic et al., 2010), the final level of motor abilities has a declining trend compared to the previous periods. This is confirmed by research of Dimitrijevic et al. (2014), which indicates the negative trends due to decrease in the total number of Specialized physical education classes.

CONCLUSION

Results of this study are consistent with previous studies conducted in similar populations. The trends of decrease in the level of motor abilities are evident both in the selection process and the process of education. Therefore, there is a need for evaluation of the entrance exam and the education process at the ACPS.

Acknowledgement

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UPOREDNA ANALIZA TAKTIČKOG ISPOLJAVANJA FUDBALERA PARTIZANA NA UTAKMICAMA U EVROPSKIM TAKMIČENJIMA I SUPER LIGI SRBIJE

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UVOD

Kroz svoju evoluciju fudbalska igra se razvijala i na jedan specifičan način menjala. Najočiglednije promene u strukturi fudbalske igre desile su se u pravcu intenzifikacije aktivnosti igrača sa i bez lopte (Wallace and Norton, 2013). Proces intenzifikacije aktivnosti reflektovao se i na sve vidove priprema fudbalera (tehnika, taktika, kondicija...). Razvojne promene fudbalske igre, fudbalski eksperti definisali su praćenjem, prikupljanjem i analiziranjem dobijenih informacija, kako bi bolje razumeli dešavanja na terenu tokom takmičenja (Carling et al., 2005). Tumačenjem prikupljenih podataka, analizom takmičarske aktivnosti, sa klupskih i reprezentativnih takmičenja, fudbalski eksperti prate trendove razvoja fudbala, pokušavajući da definišu efikasna sredstva taktike i generalno taktička opredeljenja, koja su na direktan ili indirektan način povezana sa postizanjem pozitivnih rezultata u fudbalu.

U evaluaciji takmičarske aktivnosti, posmatrajući prostor taktike fudbala, u najvećoj meri analizirani su uspešni napadi, a posebno ona vrsta napada koja je završena postizanjem gola (Janković et al., 2011; Janković et al., 2009; Janković et al., 2011c). Takođe, uspešnost pas igre a posebno njena struktura, vrlo često je analizirana kako bi se efikasnost ovog tehničko-taktičkog elementa dovela u vezu sa ostvarenim rezultatom (Scoulding et al., 2004; Hughes and Franks 2005; Janković et al., 2011b). U novije vreme sve više je istraživanja koja imaju za cilj da statističke pokazatelje, tehničko--taktičke uspešnosti u igri, dobijene analizom, dovedu u vezu sa pozitivnim rezultatom, odnosno, da se definišu oni aspekti fudbalske igre koji najviše koreliraju sa rezultatom (Castelano et al., 2012; Liu et al., 2015; Lago et al., 2010; Janković et al., 2011a).

Učešće na fudbalskom takmičenju može biti na klupskom i reprezentativnom nivou. Pored toga, obe vrste takmičenja razlikuju se prema nivou, odnosno kvalitetu. Prema tome, klupsko takmičenje može biti nacionalnog nivoa ali i međunarodnog, koji se takođe kvalitativno deli na Liga Evrope i Liga Šampiona takmičenje (evropski okviri). Kvantitativna i kvalitativna uporedna analiza ovih takmičenja je bila predmet mnogih istraživanja (Luhtanen et al., 2001; Scwarc 2004; Scwarc 2007). Međutim, nema podataka o eventualnim razlikama u tehničko-taktičkoj efikasnosti igre istog tima u dva, po kvalitetu različita takmičenja.

Predhodno opisan analitički pristup, predstavlja neophodno sredstavo korenite, stručne, analize takmičenja u Super ligi Srbije, jer kao što je poznato fudbal u Srbiji, kako na klupskom tako i na reprezentativnom nivou, prolazi kroz jednu od najvećih stručnih i organizacionih kriza u svojoj istoriji (Janković et al., 2015). U prilog tome idu i rezultati koje ostvaruju srpski klubovi i seniorska reprezentacija tokom poslednje dve decenije na međunarodnim takmičenjima. Već godinama srpski klubovi na međunarodnim takmičenjima ne uspevaju da ostvare zapaženije rezultate. Tako je na primer, fudbalski klub „Partizan" u takmičarskoj sezoni 2014/2015, i pored takmičarskih uspeha u Super ligi Srbije, u kvalifikacijama za UEFA Ligu Šampiona ispao u trećem kolu kvalifikacija, dok je u Ligi Evrope zauzeo poslednje mesto u grupnoj fazi sa svega 2 osvojena boda. Mnogi eksperti i sportski analitičari pokušavaju da pronađu razloge takvih rezultatskih razlika, međutim, u dosadašnjoj teoriji i praksi nije definisan precizan odgovor na ovakve pojave.

Ovaj rad ima za cilj, između ostalog, i da otkrije eventualne razlike između taktičkog ispoljavanja fudbalera Partizana u Evropskim takmičenjima i Super ligi Srbije, a dobijeni rezultati mogu pomoći prilikom definisanja smernica za pripremu srpskih klubova za naredna učešća u evropskim takmičenjima.

METOD

Uzorak ispitanika

Analizom je obuhvaćeno taktičko ispoljavanje fudbalera Partizana na ukupno deset takmičarskih utakmica u evropskim takmičenjima, kvalifikacije za grupnu fazu takmičenja Liga šampiona, prvo kolo i grupna faza takmičenja Liga Evrope (LŠ/LE) i deset nasumično odabranih utakmica Super lige Srbije odigranih u istoj takmičarskoj sezoni (2014/2015).

Procedure

Procena tehničko-takmičarske uspešnosti fudbalera Partizana, u dva po kvalitetu različita takmičenja, vršena je na osnovu predhodno prikupljenih podataka posredstvom *Instats* tehnologije koja se bavi analizom takmičarske aktivnosti u fudbalu, a čije je usluge FK Partizan koristio u takmičarskoj sezoni 2014/2015.

Varijable koje su praćene ovim posmatranjem odabrane su kao primarne za predmet analize i koje su kao takve rezultat osnovnih teorijskih, praktičnih načela i principa, koji pripadaju fudbalskoj igri i njenoj evoluciji. U istraživanju su obrađeni parametri vezani za:

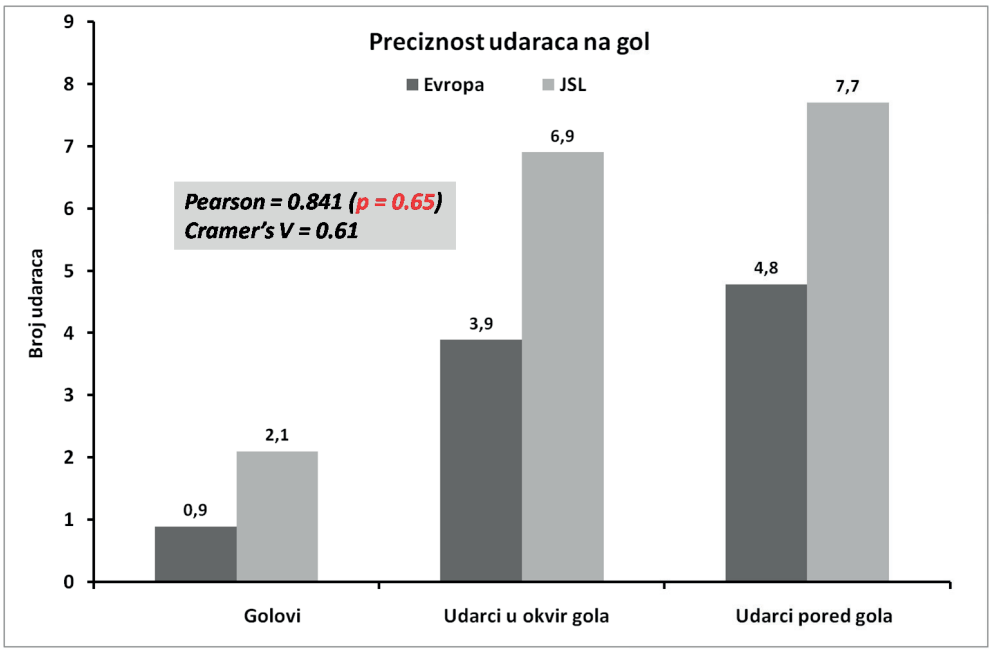
preciznost napada koji su završeni udarcem na gol protivnika (precizni, neprecizni, efikasni); vrsti primenjivanih napadčkih aktivnosti (kontinuirani, brzi i napadi iz prekida igre); posed lopte (ukupan broj poseda lopte, procenat poseda lopte, trajanje poseda lopte) i strukturi dodavanja u okviru realizacije napadačkih aktivnosti (broj dodavanja, procenat uspešnosti dodavanja i brzini dodavanja).

Statistička obrada podataka

U okviru kvantitativne analize korišćena je deskriptivna statistika. Od statističkih deskriptivnih prostora u analizi korišćene su: aritmetička sredina iz segmenta mera centralnih tendencija, i standardna devijacija iz mera disperzije. Iz prostora komparativne statistike koristila se neparametrijska diskriminativana analiza, Hi-kvadrat test, za procenu veza dve kategorijske promenljive. Svi statistički testovi obrađeni su korišćenjem SPSS 17.0 programa (SPSS INC, Chicago, IL)

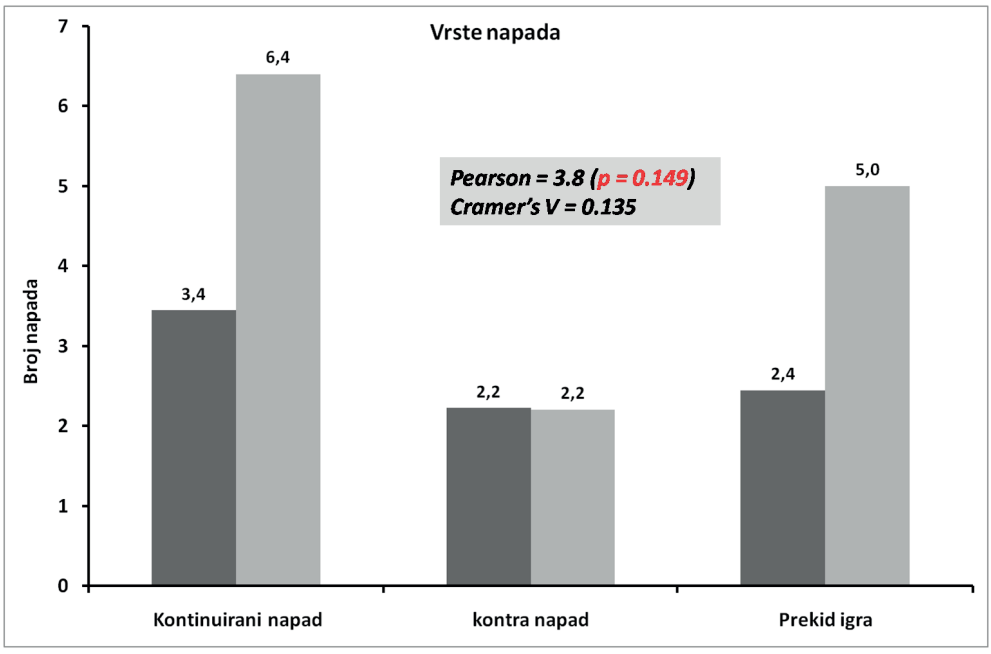
REZULTATI

Rezultati dobijeni ovim istraživanjem pokazuju da su fudbaleri Partizana bili daleko uspešniji u SLS takmičenju, kada se posmatra broj udaraca na gol protivnika. U evropskim takmičenjima udarce na gol prosečno su izvodili 9,6 puta, dok u nacionalnom prvenstvu broj udaraca na gol bio je značajno veći - 16,7. Interesantno je konstatovati da nema razlike u raspodeli udaraca na gol kada je njihova preciznost u pitanju (Grafikon 1). Dakle, ako posmatramo ovaj parametar može se konstatovati da je broj uspešnih napada direktno uticao na ostvareni rezultat.



Grafikon 1: *uporedni prikaz prosečnog broja udaraca ka golu protivnika i njihova preciznost u Super ligi Srbije i evropskim takmičenjima.*

Posmatrano prema vrsti primenjivanih napada, koji su završeni udarcem na gol, iz rezultata dobijenih ovim istraživanjem može se konstatovati da postoje razlike u njihovoj raspodeli, ali one ipak nisu statistički značajne (Grafikon 2). Fudbaleri Partizana su oba takmičenja ostvarili, prosečno jednak broj brzih napada (2,2) ali u LŠ/LE takmičenju nisu uspeli da zadrže broj kontinuiranih napada i napada iz prekida igre kao u SLS takmičenju.



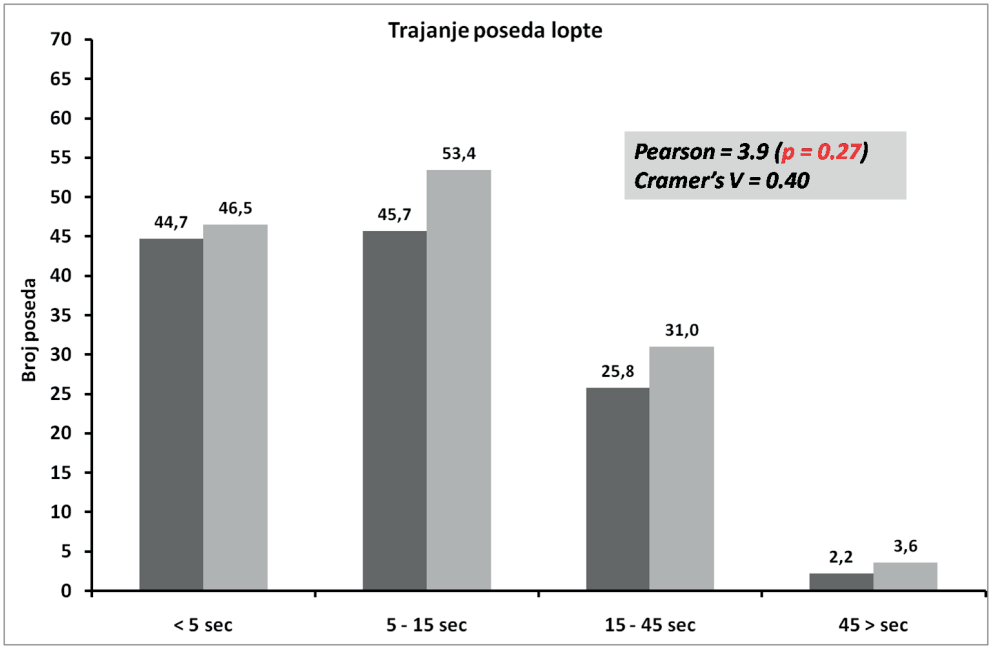
Grafikon 2: *Uporedni prikaz vrsta uspešnih napada i njihovog prosečnog broja u Super ligi Srbije i evropskim takmičenjima.*

Pre nego što se preciznije uporedi struktura igre u dva analizirana takmičenja, važno je istaći rezultat po kome je aktivno vreme trajanja igre u SLS takmičenju značajno kraće (≈ 6 min). Ukupan broj dolazaka u posed lopte fudbalera Partizana značajno je veći u SLS takmičenju (Tabela 1), dok se prosečno vreme zadržavanja lopte u posedu značajno ne razlikuje (11,2 sek. - 12,6 sek.). Ovakvi rezultati prouzrukuju i značajno manji procenat poseda lopte u LŠ/LE takmičenjima, prosečno 45, 3%, u odnosu na SLS takmičenje 57,1%. Posmatrajući učinak protivnika fudbalera Partizana u dva takmičenja iz tabele 1 se može videti da broj dolazaka u posed lopte nije značajno različit, ali je prosečno trajanje poseda lopte značajno veće u u LŠ/LE takmičenju (≈3 sek.).

Tabela 1: *Uporedni prikaz prosečnog trajanja aktivne igre u minutima, % poseda lopte, broja poseda, trajanja poseda, broja dodavanja, % uspešnosti dodavanja i brzina dodavanja fudbalera Partizana i njegovih protivnika u evropskim takmičenjima i Super ligi Srbije.*

	Evropa		***JSL***	
	Partizan	***Protivnik***	***Partizan***	***Protivnik***
Aktivna igra (min)	*23,6*	*28,9*	*27,7*	*20,2*
Posed %	*45,3*	*54,7*	*57,1*	*42,9*
Posed No.	*123,4*	*125,7*	*134,5*	*121,4*
Trajanje poseda	*11,2*	*13,6*	*12,6*	*10,2*
Broj dodavanja	*413,2*	*539,7*	*494*	*373,3*
% uspešnosti dod.	*78,1*	*85*	*75,6*	*72,4*
Brzina dodavanja	*14*	*16,4*	*13,5*	*13,1*

U odnosu na predhodno iznete rezultate, trajanje poseda lopte u određenim vremenskim intervalima nije pokazalo bitne razlike u oba takmičenja (Grafikon 3). Predhodno izneti rezultati, proizveli su i značajno manji broj dodavanja na utakmicama SLS takmičenja (413/494), dok su protivnici Partizana u LŠ/LE utakmicama imali drastično veći broj realizovanih dodavanja (539/373). Ovom podatku doprinela je i činjenica da je brzina dodavanja kod protivnika Partizana u LŠ/LE utakmicama značajno veća u odnosu na protivnike u drugom takmičenju ali i u odnosu na fudbalere Partizana u oba takmičenja.



Grafikon 3: *Uporedni prikaz prosečnog broja napada i vremenskog trajanja napada u Super ligi Srbije i evropskim takmičenjima.*

DISKUSIJA

Fudbaleri Partizana su u sezoni 2014/2015 u Super ligi Srbije osvojili prvo mesto na tabeli i prema tome može se konstatovati da je u ovom takmičenju ostvaren pozitivan rezultat. Sa druge strane, za učešće u evropskim takmičenjima to se ne može reći ako uzmemo u obzir neplasman u grupnu fazu Lige Šampiona, i osvajanje 2 boda u 6 utakmica grupne faze Liga Evrope (4 poraza i 2 nerešena rezultata). Uporednom analizom taktičkog ispoljavanja fudbalera Partizana u ova dva takmičenja dobijeni su rezultati koji u stručnom smislu mogu pomoći u definisanju uzroka neuspeha u evropskim takmičenjima. Jedan od rezultata ovog istraživanja pokazuje da su fudbaleri Partizana na analiziranim utakmicama u evropskim takmičenjima ostvarili prosečno 9,6 uspešnih napada (napada koji su se završeni udaracem ka golu protivnika), dok su protivnici Partizana prosečno imali 14,3 takva napada. U Super ligi Srbije situacija je dosta drugačija, jer su fudbaleri Partizana ostvarili prosečno 16,7 uspešnih napada dok su njihovi protivnici imali 7,8 uspešna napada. Prema rezultatima koji su dobijeni u sličnim istraživanjima, veći broj uspešnih napada predstavlja osnovni uslov za postizanje pozitivnog rezultata u savremenom fudbalu (Janković et al 2011a; 2011b).

Analizom rezultata, sa aspekta vrste primenjivanih napadačkih akcija, osim podataka koji govore da je učestalost realizovanih napada znatno veća u Super ligi Srbije, primećujemo i da su fudbaleri Partizana u oba takmičenja najviše udaraca na protivnički gol uputili posle kontinuiranih napada (3,4 udarca u evropskim takmičenjima i 6,4 udarca SLS takmičenju). Na osnovu ovog podatka možemo zaključiti da takva orjentacija u igri nije donela fudbalerima Partizana pozitivan rezultat u evropskim takmičenjima, ali jeste protivničkim timovima koji su takođe najviše udaraca na gol uputili posle kontinuiranih napada (u proseku 6,9 udaraca). Kada su u pitanju kontra napadi evidentno je da je izjednačen odnos primene ovakve vrste napada u oba takmičenja. Ovakav rezultat ukazuje na konstantnost u primeni brzih napada u igri ekipe Partizana. Međutim, treba uzeti u obzir razlike u kvalitetu protivnika u dva kvalitativno različita takmičenja. Veći broj udaraca na gol u SLS posle prekida (5 po utakmici) se takođe može okarakterisati kao posledica većeg poseda lopte u odnosu na protivnika, ali i lošijom organizacijom defanzivnog prekida Partizanovih protivnika u Super ligi Srbije. Ne može se sa sigurnošću tvrditi da veliki broj udaraca posle prekida proizilazi i kao posledica dobre organizacije ofanzivnog prekida fudbalera Partizana jer su u evropskim takmičenjima uputili svega 2,4 udarca na protivnički gol posle prekida u odnosu na već pomenutih 5 udaraca u SLS takmičenju.

Kao što je već napomenuto, fudbaleri Partizana su ostvarili značajno veći posed lopte u Super ligi Srbije u odnosu na evropska takmičenja (57,1% naspram 45,3%), pa se kao jedan od faktora koji su uticali na postizanje rezultata u tim takmičenjima može smatrati i posed lopte. Uporednom analizom poseda lopte (%) i broja dolazaka u posed sa vremenskim trajanjem poseda, vidimo da je i pored većeg broja dolazaka u posed u SLS takmičenju, u odnosu na evropska takmičenja (134,5 naspram 123,4), prosečno trajanje poseda lopte u SLS takmičenju trajalo samo 1,4 sekunde duže od poseda u evropskim takmičenjima (11,2 sekunde naspram 12,6 sekundi). Na osnovu ovih podataka može se konstatovati da su fudbaleri Partizana, u oba takmičenja, pokazali orjentaciju ka brzim napadima, na šta ukazuje i jednak broj udaraca na gol posle kontra napada u LŠ/LE i SLS takmičenjima. Sa druge strane, ako se analizira poseda lopte protivnika Partizana u evropskim takmičenjima dolazi se do zaključka da je upravo trajanje poseda lopte doprinelo postizanju pozitivnog rezultata, čemu u prilog idu i podaci prema kojima je posed lopte protivnika Partizana u SLS takmičenju bio značajno kraći (Tabela 1).

Osnovno sredstvo realizacije napadačkih aktivnosti u fudbalu jeste saradnja dva igrača dodavanjem lopte. Uporednom analizom ovog sredstva taktike može se videti da su Partizanovi protivnici u evropskim takmičenjima bili značajno uspešniji u tom segmentu igre, jer su i pored ukupnog obima u pas igri (prosečno 460 dodavanja) bili daleko uspešniji i u efikasnosti pas igre, gde su prosečno 85% svih dodavanja realizovali na precizan način. Sa druge strane, fudbaleri Partizana imali su 78,1% uspešnih dodavanja u evropskim takmičenjima i 75,6% uspešnih dodavanja u Super ligi Srbije. Dakle uočljivo je da je procentualno veći broj tačnih dodavanja ostvaren u evropskim takmičenjima nego u Super ligi Srbije, ali je i taj procenat i dalje značajno slabiji od protivnika u evropskim takmičenjima. Takođe, procenat uspešnosti pas igre, fudbalera Partizana, u SLS takmičenju veći je od procenta uspešnosti protivnika Partizana u istom takmičenju pa se prema tome može reći da je uspešnost u pas igri direktno uticala i na ostvareni rezultat. Slične rezlutate pokazale su i analize takmičenja poput Svetskih prvenstava i nacionalnih ligaških takmičenja (Janković et al., 2011a; Janković et al., 2011b). Ukupan broj dodavanja lopte na neki nači vezan je za brzinu dodavanja, odnosno broj dodavanja u jedinici vremena. Prema rezultatima ove analize jasno se može videti da je frekvencija pas

igre značajno veća kod protivnika u evropskim takmičenjima, ali i da je značajno manja kod protivnika u SLS takmičenju (Tabela 1). Brzina dodavanja, podrazumeva brzo oslobađanje u igri sa loptom, igru sa malim brojem kontakata sa loptom i bržim udarcima po lopti, kako bi se postigla veća dinamika igre i lakše destabilizovala odbrana protivnika. Prema tome, rezultati ovog istraživanja potvrđuju hipotezu po kojoj veći broj dodavanja i veći procenat tačnih dodavanja, kao i veća frekvencija dodavanja prilikom poseda lopte, utiču na postizanje pozitivnog rezultata u fudbalu.

Aktivno vreme trajanja igre u dva takmičenja pokazalo je značajne razlike, prema kojima se aktivno igra skoro 6 minuta više u evropskim takmičenjima. Ovakav podatak može se obrazložiti na više načina, i upravo ovaj problem bi mogao biti predmet nekih narednih istraživanja. Međutim, sa aspekta analize podataka ovog istraživanja, a u cilju donošenja preciznijih zaključaka, rezultate bi trebalo normalizovati sa aktivnim vremenom trajanja igre. Pa prema tome, rezultati značajno većeg poseda lopte, ukupnog broja dolazaka u posed, broja dodavanja jednim delom mogu se pripisati dužem periodu aktivne igre u evropskim takmičenjima.

ZAKLJUČAK

Dobijeni rezultati ovim istraživanjem, u jednom delu, otkrili su razlike u tehnučko-taktičkim zahtevima igre dva, po kvalitetu, potpuno različita takmičenja. Takođe, na osnovu pojedinih rezultata analize, defnisana su ona sredstva taktike fudbala koja su direktno povezana sa postizanjem pozitivnog rezultata. Uzimajući sve u obzir mogu se izvesti generalni zaključci istraživanja:

- Ukupno vreme trajanja igre u evropskim takmičenjima značajno je duže u poređenju sa Super ligom Srbije;
- Za postizanje pozitivnog rezultata, u dužem vremenskom periodu, posmatrano kroz ligaška takmičenja, potrebno je realizovati veći broj uspešnih napada u odnosu na protivnika;
- Za postizanje pozitivnog rezultata, u dužem vremenskom periodu, posmatrano kroz ligaška takmičenja, neophodna je zastupljenost svih vrsta napadačkih akcija (kontinuirani napad, kontra napad, napad iz prekida);
- Ukupan broj dolazaka u posed lopte kao i prosečno vreme trajanja poseda direktno je povezano sa postizanjem pozitivnog rezultata;
- Ukupan broj dodavanja na jednoj utakmici, uspešnost u realizaciji pas igre, kao i broj dodavanja po posedu lopte, direktno utiče na postizanje pozitivnog rezultata;

Na osnovu izvedenih zaključaka, tumačenjem rezultata ovog istraživanja, mogu se definisati smernice za neko naredno učešće Srpskih klubova u evropskim takmičenjima. Pre svega, smernice koje bi mogle biti u funkcije pripreme jednog tima za eventualno uspešnije učešće u takmičenjima kao što su Liga šampiona ili Liga Evrope.

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COMPARATIVE ANALYSIS OF TACTICAL MANIFESTATION OF THE FOOTBALL PLAYERS OF PARTIZAN IN THE GAMES OF EUROPEAN COMPETITIONS AND THE SERBIAN SUPERLEAGUE

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INTRODUCTION

Throughout its evolution the game of football has developed and changed in a specific way. The most evident changes in the play structure in football occurred in the direction of intensification of the players activity with and without the ball (Wallace and Norton, 2013). The process of activity intensification affected also all types of football players preparations (technique, tactics, conditioning...). Developmental changes of football play were defined by football experts through monitoring, collecting and analysing of the obtained data in order to better understand the performance on the pitch in the course of matches (Carling et al., 2005). By interpreting the obtained data, analysing competitive activities both in club and national team competitions, football experts monitor the tendencies in football development, trying to define efficient tactical instruments and general tactical preferences, which are either directly or indirectly connected with achievement of positive outcomes in football.

When evaluating the tactics-related competitive activities most attention was dedicated to the analysis of successful attacks, especially the type of attacks that resulted in scoring a goal (Janković et al., 2011; Janković et al., 2009; Janković et al., 2011c). Additionally, the successfulness of pass moves, especially their pattern was often analysed in order to establish a correlation between the successfulness of this technical-tactical element with the achieved scores (Scoulding et al., 2004; Hughes and Franks 2005; Janković et al., 2011b). Recently, an increasing number of research was aimed at demonstrating correlation between the statistically obtained indices of the technical-tactical success in the game and the positive outcome i.e. at defining those aspects of the game of football that correlate most with the score (Castelano et al., 2012; Liu et al., 2015; Lago et al., 2010; Janković et al., 2011a).

Participation in a football competition can be either on a club or national team level. Additionally, both types distinguish in competitive level i.e. quality. Thus, club completion can be on the national but also international level that again, based on quality, distinguishes Europa League and Champions League (European framework). Quantitative and qualitative comparative analysis of these competitions was subject of numerous studies (Luhtanen et al., 2001; Scwarc 2004; Scwarc 2007). However, there are no data on possible differences in technical-tactical efficiency of the performance of the same team in two competitions different in terms of quality.

The previously described analytical approach, presents an indispensable instrument of the root cause and professional analysis of the competitions in Serbian SuperLiga, since it is well-known that Serbian football is undergoing one of the biggest organizational and result crisis in its history (Janković et al., 2015). The results of Serbian clubs and the senior national team in international competitions in the last two decades back up this claim. For years now, the Serbian clubs at the international competition fail to achieve noticeable results. For example, football club (FK) Partizan in the competitive season 2014/2015, regardless of competitive success in the Serbian SuperLiga, only reached the third qualifying round for the UEFA Champions League, while it ranked the last

position in the group phase of the UEFA Evropa League with only 2 points gained. Many experts and sports analysts are trying to identify the reasons of such discrepancies in results, however, so far, neither theory nor practice has provided an accurate reply to such phenomena.

The aim of this paper, among other things, is to discover possible differences in tactical manifestations of the FK Partizan players both in European competitions and the Serbian SuperLiga so that the obtained results can help in defining guidelines for preparation of Serbian clubs for future participation in European competitions.

METHOD

Sample of respondents

The analysis included tactical manifestation of the FK Partizan players of at the total of ten competition matches in European competitions, qualifying rounds for the UEFA Champions League and the first stage and the group phase of the UEFA Europa League - CL/EL respectively, and ten randomly chosen games of the Serbian SuperLiga (SSL) played during the same competitive season (2014/2015).

Procedures

The assessment of technical-tactical success of the FK Partizan players, in the two competitions of different quality, was done based on the previously collected data by deploying the InStat technology for analysing competitive activities in football, which the FK Partizan used during the competitive season 2014/2015.

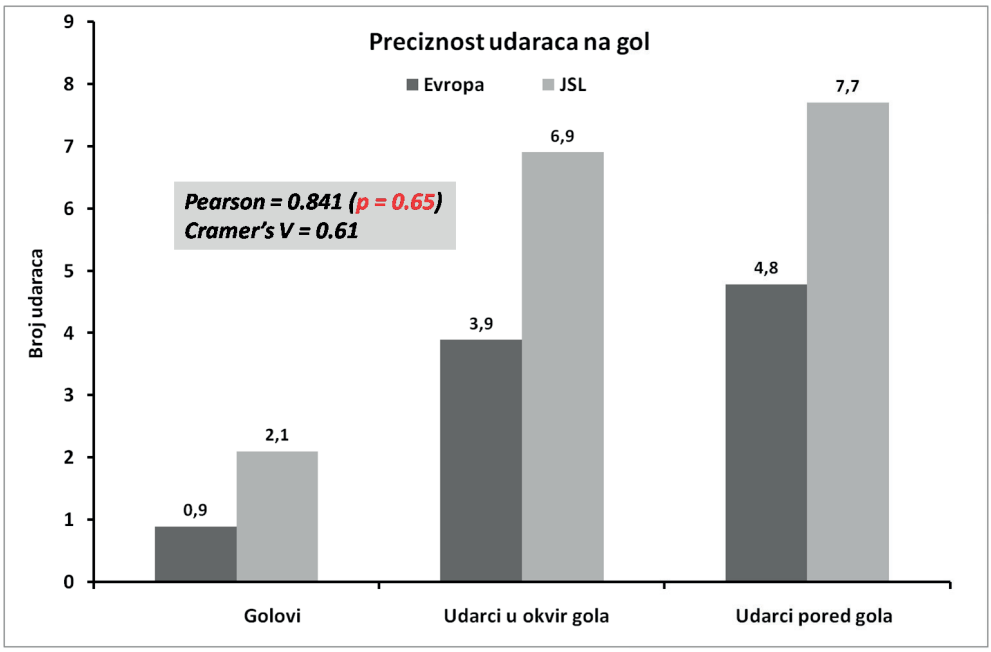
The variables monitored by this observation were chosen as primary for the subject of the analysis and that result from basic theoretical, practical principles of football play and its evolution. The following processed parametres refer to: shot accuracy (accurate, inaccurate, efficient), types of applied attacking moves (position, fast and set piece attacks) ball possession (overall number possessions of the ball, percentage of possessions, duration of the possessions) and structures of the passes within the realization of the attacking activities (number of passes, success in passing the ball and speed of passing).

Statistical data processing

Descriptive statistics was used for the quantitative analysis. The statistical descriptive analysis spaces used were mean value from the segment of central tendencies and standard deviation of dispersive measures. In the segment of comparative statistics, a nonparametric discriminate analysis, chi-squared test were used to assess connections of the two category variables All statistical tests were processed using SPSS 17.0 program (SPSS INC Chicago, IL).

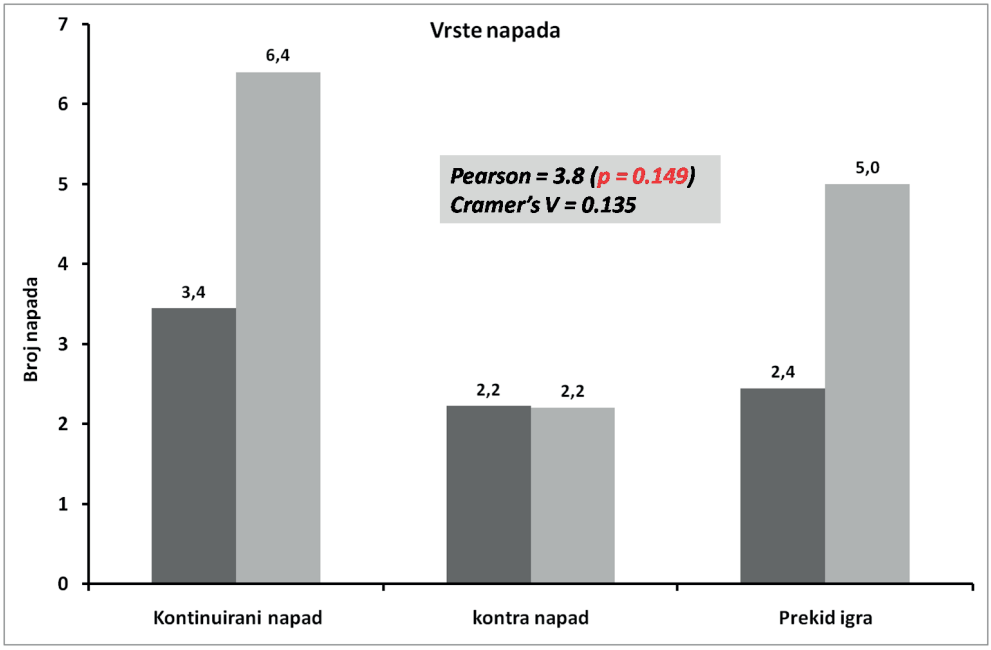
RESULTS

The results obtained by this research indicate that the FK Partizan players were far more successful in SSL competitions when it comes to the number of shots on the opponent's goal. In European competitions they executed shots on goal on average 9.6 times, while in the national competitions that number was significantly higher – 16.7. Interestingly, there was no difference in the distribution of shots on goal when it comes to their accuracy (Graph 1). Thus, if we observe this parameter it can be stated that the number of successful attacks directly affected the score.



Graph 1: *Comparative view of average number of shot on goal and their accuracy in the Serbian SuperLiga and European competitions.*

When observed according to the type of applied attacks finalized by a shot on goal, based on the results obtained in this research it can be ascertained that there are differences in their distribution but still they are not statistically significant (Graph 2). In both competitions, the FK Partizan players achieved on average an equal number of fast attacks (2,2) but in CL/EL matches they did not manage to maintain the number of position attacks and set pieces attacks as in the SSL matches.



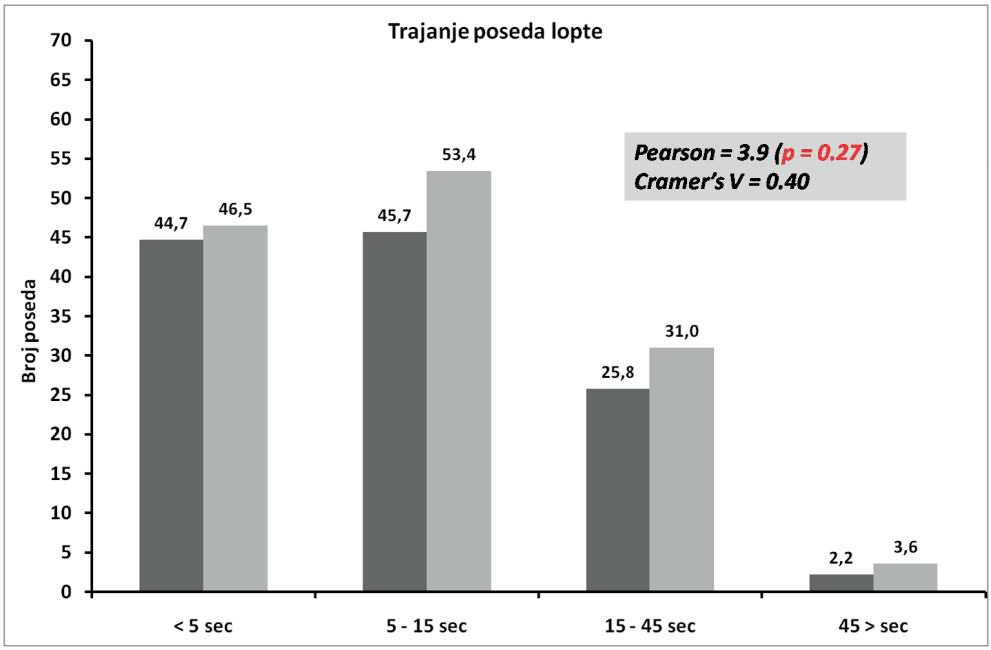
Graph 2: *Comparative view of types of successful attacks and their average number in the Serbian SuperLiga and European competitions.*

Prior to more precise comparison of the game structure in the two analysed competitions, it is important to underline the result that shows that active duration of the play in the SSL is significantly shorter (≈ 6 min). The overall number of gained possessions of the FK Partisan players is significantly higher in the SSL competition (Table 1), while the average time of keeping the ball in possession does not differ (11.2 and 12.6 seconds respectively). Such results cause a significantly lower percentage of possession of the ball in the CL/EL competitions, on average 45.3%, compared to 57.1% at the SSL competition. When the performance of the Partisan opponent's players is considered in the two competitions, Table 1 shows that the number of gaining the possession does not differ significantly, but the average duration of the possession of the ball is significantly higher in the CL/EL competitions (≈3 sec.).

Table 1: *Comparative view of the average duration of active game in minutes, % of ball possession, duration of possession, number of passes, % of success of passes and speed of passes for the FK Partisan players and its opponents in European competitions and Serbian SuperLiga.*

	Europe		*SLS*	
	Partizan	***Opponent***	***Partizan***	***Opponent***
Active play (min)	*23.6*	*28.9*	*27.7*	*20.2*
Possession %	*45.3*	*54.7*	*57.1*	*42.9*
Possession No.	*123.4*	*125.7*	*134.5*	*121.4*
Duration of possession	*11.2*	*13.6*	*12.6*	*10.2*
Number of passes	*413.2*	*539.7*	*494*	*373.3*
% success of passes	*78.1*	*85*	*75.6*	*72.4*
Speed of passes	*14*	*16.4*	*13.5*	*13.1*

With regard to the previously displayed results, the duration of the possession of the ball in certain time intervals did not show any significant differences in both competitions (Graph 3). The previously displayed otcomes, resulted in significantly lower number of passes in the SSL matches (413/494), while the Partizan opponents in CL/EL competition had drastically higher number of realized passes (539/373). This particular is supported by the fact that the speed of passes of the Partizan opponent in CL/EL competitions was significantly higher compared to the opponents in the other competition but also compred to the FK Partizan players in both competitions.



Graph 3: *Comparative view of the average number of attacks and duration of attacks in Serbian SuperLiga and European competitions.*

DISCUSSION

The FK Partizan players in the season 2014/2015 of the Serbian SuperLiga ranked first and therefore it can be ascertained that positive outcome was achieved in this competition. On the other hand, the same cannot be said for their participation in the European competition if we take into account the failure to qualify for the group phase of Champions league and gaining of only 2 points in the 6 games of the group phase of Europa League (4 losses and 2 draws). Comparative analysis of the tactical manifestations of the FK Partizan players in these two competitions generated the results that in professional sense can help defining the causes of failure in European competitions. One of the results of this research indicated that the FK Partizan players in the analysed matches of the European competitions achieved an average of 9.6 successful attacks (the attacks that resulted in a shot on goal), while their opponents had an average of 14.3 such attacks. In the Serbian SuperLiga the situation is quite different, because the FK Partizan players realized an average of 16.7 successful attacks while their opponents had only 7.8. According to the results obtained in the similar research greater number of successful attacks is a basic precondition for achievement of positive outcome in modern football (Janković et al 2011a; 2011b).

By analysing the results, from the aspect of types of applied attacking actions, apart from the data showing that frequency of the realized attacks is substantially greater in the Serbian SuperLiga, we noticed that the Partisan players in both competitions shot on target most after position attacks (3.4 shots in European competitions and 6.4 shots in SSL competitions). Based on this detail we can conclude that such an orientation in the game did not lead the Partisan players to positive outcome in European competition, but it certainly led their opponents who also shot on goal most after position attacks (on average 6.9 shots). When it comes to counterattacks it is obvious that the ratio of application of this type of attack is equal in both competitions. Such a result indicate to constancy in application of fast attacks in the play of the Partisan team. However, we should take into consideration the differences in opponents' quality in the two different competitive levels as for the quality. Greater number of shots on goal in the SSL after game stoppages (5 per match) can also be interpreted as a consequence of greater possession of the ball compared to the opponent, bus also of worse organization of defensive stoppage of the Partizan opponents in the SSL. It cannot be claimed with certainty that great number of shots after stoppage results from good organization of the offensive stoppage of the FK Partisan players because in European competitions they only realized 2.4 shots on goal after the stoppage compared the already mentioned 5 shots in the SSL competition.

As it was mentioned, the FK Partizan players realized significantly greater possession of the ball in the Serbian SuperLiga compared to European competitions (57,1% and 45,3% respectively), so, possession of the ball can also be considered as one of the factors that affected scoring in those competitions. After comparative analysis of the possession of the ball (%) and the number of gaining in possession with the duration of possession, we can see that regardless of greater gaining in possession in the SSL competitions, compared to European competitions (134.5 compared to 123.4), an average duration of possession of the ball in the SSL competition lasted only 1.4 seconds longer than the possession in European competitions (11.2 seconds compared to 12.6 seconds respectively). Based on these data it can be ascertained that the Partizan players in both competitions were oriented to fast attacks, which is supported also by the equal number of shots on goal after counterattacks in both CL/EL and SSL competitions. On the other hand, if we analyse the possession of the ball of the Partizan opponents in European competitions it can be concluded that it is exactly the duration of possession that contributed to achieving of positive outcome, which is backed up by the data according to which the possession of the ball of the Partizan opponents in the SSL competitions was significantly shorter (Table 1).

The basic tool for realization of attacking activities in football is the cooperation of two players passing the ball. By the comparative analysis of this tactics instrument it can be seen that Partizan's opponents in European competitions were significantly more successful in this segment of play, because besides the overall volume of the pass play (an average of 460 passes), they were also far more successful in the efficiency of the pass moves, where an average of 85% of all passes were accurately realized. On the other hand, the FK Partizan players had 78.1% of successful passes in European competitions and 75.6% in the Serbian SuperLiga. Thus, it is observed that greater percentage of accurate passes was realized in European competitions compared to the Serbian SuperLiga, but even that percentage was still significantly weaker than their opponent's in European competitions. Also, the percentage of success of the pass play of the Partizan players in the SSL competitions is higher

that the percentage of success of their opponents in the same competitions and thus it can be said that success in pass play directly affected the achieved score. Similar results were obtained by the analysis of competitions such as the World cups and National league competitions (Janković et al., 2011a; Janković et al., 2011b). The overall number of passes of the ball is in a way related to the speed of passing, i.e. number of passes in the unit of time. According to the results of this analysis it can be clearly seen that the frequency of pass play is significantly greater with the opponents in European competitions, but that it is also significantly lower in their opponents in SSL competition (Table 1). The speed of passes, implies fast release in the ball play, play with small number of contacts with the ball and faster kicks of the ball, in order to achieve greater dynamics of the play and to destabilize the opponent's defence more easily. Accordingly, the results of the research confirm the hypothesis that greater number of passes and greater percentage of accurate passes together with greater frequency of passes with the ball in possession affect achieving positive score in football.

Active duration of play in the two competitions showed significant differences, according to which the active play is 6 minutes longer in European competitions. This information can be supported in many ways and this issue could be a subject of some further research. However, form the aspect of the data analysis in this research and with an aim to make more accurate conclusions, the results should be normalized with the active play duration. Therefore, the results of significantly greater possession of the ball, overall number of gaining possession, number of passing can partially be attributed to longer period of active play in European competitions.

CONCLUSION

The results obtained in this research, on the one hand, discovered the differences in technical-tactical requirements of the play of the two completely different competitions in terms of quality. Additionally, based on certain results of the analysis, we have defined those football tactics tools that are directly related to achievement of positive outcome. Haven taken in the account all the above, the following general conclusions of the research can be drawn:

- The overall duration of play in European competitions is significantly longer compared to the Serbian SuperLiga;
- For achievement of positive outcome, in the long run, observed through league competitions, it is necessary to realize greater number of successful attacks compared to the opponent;
- For achievement of positive outcome, in the long run, observed through league competitions, it is necessary to apply all types of attacking actions (position attacks, counter attacks, set pieces attacks);
- The overall number of possessions of the ball and the average duration of possession of the ball is directly related to achievement of positive outcome;
- The overall number of passes per match, success in realization of pass play as well as the number of possessions of the ball directly affect the achievement of positive outcome;

The above conclusions and the interpretation of the results of this research, provide a base for defining guidelines for future participation of Serbian clubs in European competition. Primarily, those guidelines that could be used for preparation of a team for a possibly more successful participation in competitions such as Champions League or Europa League.

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TAKTIČKA EFIKASNOST REPREZENTACIJA OSVAJAČA SVETSKOG PRVENSTVA U FUDBALU 2010. I 2014. GODINE

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UVOD

Analiza takmičarske aktivnosti u fudbalu, razvojem savremene tehnologije, postala je efikasno sredstvo pripreme ekipa za postizanje vrhunskih rezultata. Pojavom sofisticiranih softvera za analizu, moguće je kvantifikovati uspešnost pojedinaca, grupe igrača ili celog tima, ali i kvalitativnom analizom identifikovati faktore uspeha. Uspešnost fudbalskih aktera ogleda se kroz rezultat postignut na najkvalitetnijim Svetskim takmičenjima, na kojima svaka ekipa nastoji da svoje sposobnosti prezentuje na najbolji mogući način. Kako je u fudbalu pobeda veći broj postignutih golova u odnosu na protivnika, potrebno je, u odnosu na karakteristike određenih igrača, pronaći najefikasniji i najracionalniji taktički plan igre kojim će se postići gol. A da bi se ostvario taj cilj, svaka ekipa mora da ima efikasan način osvajanja lopte, uspešnu organizaciju napada, dolazak u situaciju udarca na gol i na kraju postizanje gola sa visokom efikasnošću (Luhtanen et al. 2001).

Organizacija uspešnih napada, napada koji su završeni udarcem na gol protivnika, određuje uspeh ili neuspeh jedne fudbalske ekipe. Završetak svakog uspešnog napada ogleda se kroz sredstvo napadačke taktike, a to je udarac na gol. Postignuti golovi, u dosadašnjoj istraživačkoj aktivnosti, su najveća identifikovana komponenta izvođenja u fudbalskoj igri. Analiza postignutih golova i određivanje najprikladnijih strategija napada, samo je preduslov kvalitetnog i efikasnog takmičenja u savremenom fudbalu (Acar et al., 2007;). Pored toga, analizom svih napadčkih akcija koje se završavaju udarcem na gol, moguća je u širem smislu identifikacija efikasnih sredstava tehničko-taktičkog delovanja, koja se u takmičarskom pogledu potvrđuju.

Analize uspešnih i efikasnih napada već dugo su predmet istraživanja, autora koji se bave taktikom fudbalske igre. Praćenje i otkrivanje najefikasnijih metoda i sredstava takmičarske igre, omogućuje racionalizaciju trenažnog procesa i optimalizaciju trenažnih sadržaja. U dosadašnjoj istraživačkoj aktivnosti uspešni napadi analizirani su na najkvalitetnijim fudbalskim takmičenjima, kao što su Svetska prvenstva (Grant et al, 1999; Miljković et al, 2007; Acar et al, 2007), Evropska prvenstva (Luhtanen et al, 2001; Armatas Yiannakos, 2010; Janković et al., 2009), najkvalitetnija klupska takmičenja (Hughes & Franks, 2005; Szwarc, A., 2007). U poslednje vreme sve je veći broj studija koje imaju za cilj da otkriju tehničko-taktičke elemente fudbalske igre koji imaju direktan uticaj na rezultat (Janković et al., 2011; Janković et al., 2011a), kao i statističke podatke efikasnosti koji najviše koreliraju sa pozitivnim rezultatom (Castellano et al., 2012; Liu et al., 2015).

Svako veliko takmičenje obeležilo je, na neki način, jedan period razvoja fudbalske igre, i ukazalo na određene tendencije razvoja taktike fudbala. Svetska prvenstva, kao najkvalitetnija reprezentativna takmičenja, odnosno osvajači tih takmičenja, postavljaju standarde, pre svega u taktici fudbala. Pa prema tome analizom reprezentacija koje osvajaju ova takmičenja u kontinuitetu, mogu se definisati pravci razvoja fudbala, pa čak i predvideti određene tendencije razvoja.

Predmet ovog istraživanja je otkrivanje i praćenje taktičkih zakonitosti za ostvarivanje vrhunskog rezultata u fudbalskoj igri. Predmetom rada obuhvaćeno je prostorno taktičko ispoljavanje napada (odnosno, uspešno završenih napada). Pod taktičkim ispoljavanjem, prvenstveno se podrazumevaju tehničko-taktičke aktivnosti koje pojedinac, grupa igrača ili čitava ekipa preduzima, kako bi u odnosu na deo terena, taktičkim sredstvima, od protivnika preduzela racionalne i efikasne akcije u cilju postizanja gola.

Cilj istraživanja je da se na osnovu analize uspešnih napada, reprezentacija koje su osvojile poslednja dva Svetska prvenstva u fudbalu, otkriju pojedine tehničko-taktičke zakonomernosti i specifičnosti u igri obe selekcije, ali i da se na osnovu rezultata ovog istrživanja definišu budući pravci razvoja fudbalske igre u prostoru taktike.

METOD

Uzorak ispitanika

Analizom je obuhvaćeno taktičko ispoljavanje reprezentacije Španije, osvajača Svetskog prvenstva u fudbalu 2010. godine, koje se odigralo u Južno Afričkoj republici, i takričko ispoljavanje reprezentacije Nemačke, osvajača Svetskog prvenstva 2014. godine, koje se odigralo u Brazilu. Svaka od navedenih reprezentacija odigrala je ukupno sedam utakmica na turniru, koje su i bile predmet ovog istraživanja.

Postupak i tok istraživanja

Analizi, prethodno snimljenih, ukupno 14 utakmica reprezentacija, pristupilo se tako što se formirao protokol posmatranja (Carling et al, 2005). Takav protokol se koristio za svaku utakmicu posebno. Sistemom notacije, u predhodno oformljenom posmatračkom listu beležen je svaki uspešan napad posebno.

Opis varijabli i način njihovog merenja

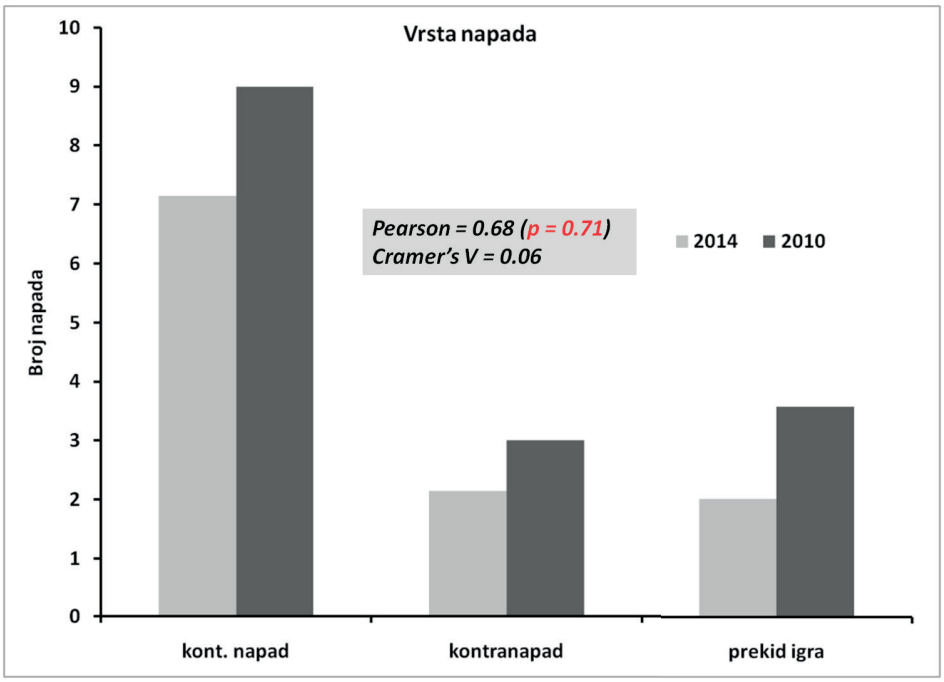
Varijable koje su praćene i analizirane u ovom istraživanju prikupljene su sistematskim posmatranjem video zapisa utakmica sa poslednja dva Svetska prvenstva u fudbalu. Materijali su preuzeti sa televizijskih kanala RTS i EUROSPORT. Analizom svih napadačkih aktivnosti, a radi komparacije i dobijanja relevantnih činjenica, posmatrani su i analizirani samo uspešni napadi (napadi koji su završeni udarcem na gol protivnika), da bi se utvrdila tendencija i trend savremene fudbalske igre. Svi uspešni napadi analizirani su sa više aspekata i to: Preciznosti uspešnih napada – precizni, neprecizni, efikasni; vrste uspešnih napada - kontinuirani, kontra napadi i napadi realizovani nakon prekida igre; Zone početka uspešnih napada - napadi započeti iz zone odbrane, manevra i napada; način dolaska u poziciju za udarac na gol (asistencija) - individualni napad, „druga lopta“, dubinsko dodavanje, povratna lopta, centrašut; distanca sa koje je upućen udarac na gol - < 5 m, 5 - 11 m, 11 - 16 m i 16 > m.

Statistička obrada podataka

U okviru kvantitativne analize korišćena je deskriptivna statistika. Od statističkih deskriptivnih prostora u analizi korišćene su: aritmetička sredina iz segmenta mera centralnih tendencija, i standardna devijacija iz mera disperzije. Iz prostora komparativne statistike koristila se neparametrijska diskriminativana analiza, Hi-kvadrat test, za procenu veza dve kategorijske promenljive. Svi statistički testovi obrađeni su korišćenjem SPSS 17.0 programa (SPSS INC, Chicago, IL)

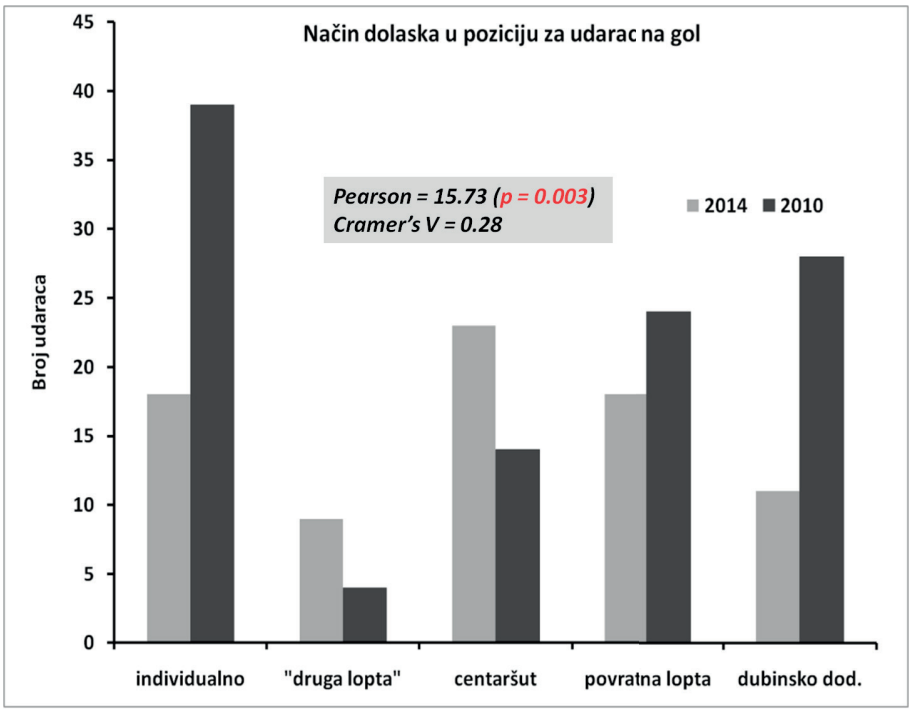
REZULTATI

Jedan od značajnijih pokazatelja efikasnosti organizacije napada jedne ekipe predstavlja broj izvedenih uspešnih napada na jednoj utakmici. Rezultati dobijeni ovim istraživanjem pokazuju da je reprezentacija Španije na Svetskom prvenstvu 2010. godine došla do prvog mesta sa značajno većim brojem uspešno izvedenih napada(15,57 po utakmici), ali sa slabijom efikasnošću (1,14 po utakmici) u odnosu na reprezentaciju Nemačke na Svetskom prvenstvu 2014. godine (11,3 uspešnih napada po utakmici, od čega su 2,6 bili efikasnih napada).



Grafikon 1. Prosečan broj pojedinih vrsta napada na jednoj utakmici osvajača Svetskih prvenstava 2010. i 2014. godine.

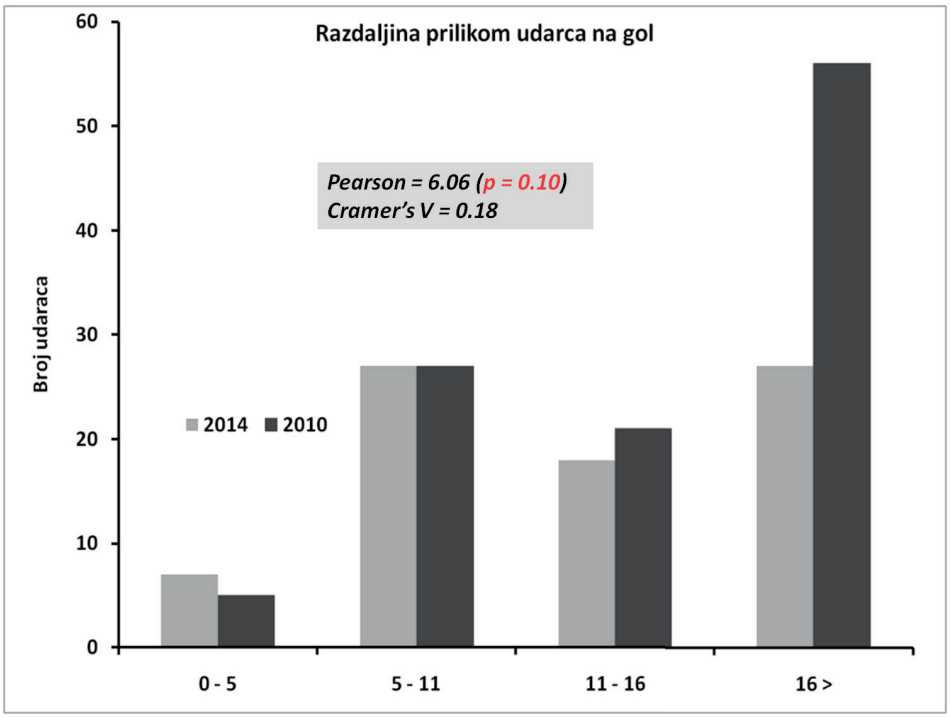
Igra u taktici napada, dve ekipe koje su osvojile dva poslednja Svetska prvenstva, nije se razlikovala kada se struktura njihove igre posmatra sa aspekta primene pojedinih vrsta napadačkih akcija. Prema rezultatima ove analize kod obe reprezentacije primena kontinuiranih napada činila je 60%, primena kontra napada 20% i primena napada realizovanih iz prekida igre 20% (Grafikon 1). Takođe, ukupan broj uspešnih napada započet iz zone odbrane, zone manevra i zone napada nije se razlikovao u izvoeđenju oba Svtetska prvaka. Dakle, reprezentacije Nemačke i Španije uspešne napade započinjale su u najvećoj meri iz napadačke zone (42%), zatim iz zone manevra (34%) i najmanji procenat uspešnih napada započet je iz zone odbrane (24%).



Grafikon 2. Način dolaska u poziciju za udarac na gol (asistencija) reprezentacija osvajača Steskih prvenstava 2010. i 2014. godine.

Na grafiku 2 predstavljene su ukupne vrednosti načina dolaska u poziciju za udarac na gol (asistencija), osvajača poslednja dva Svetska prvenstva. Prema rezultatima ove analize, reprezentacija Nemačke priliku za udarac ka golu najčešće imala posle završnih dodavanja sa bočnih pozicija, odnosno posle centaršuteva sa krila (3,3 po utakmici), dok su reprezentativci Španije svoje napade završavali najčešće individualnim probojima (5,57 po utakmici) i dubinskim dodavanjima (4 po utakmici).

Način dolaska u poziciju za udarac na gol u jednom delu uticao je i na distancu sa koje su fudbaleri ove dve reprezentacije upućivali udarce na gol protivnika. Prema tome, fudbaleri Španije na Svetskom prvenstvu 2010. godine najveći broj udaraca na gol izveli su sa distance, odnosno van prostora od 16m, dok su Nemci 2014. godine svoje napade uglavnom završavali udarcima iz kaznenog prostora protivnika, i to najviše iz prostora 5 - 11 metara (Grafikon 3).



Grafikon 3. Distanca sa koje su izvođeni udarci na gol reprezentacija osvajača Svetskih prvenstava 2010. i 2014. godine.

DISKUSIJA

Reprezentacije koje su osvajale Svetska prvenstva, u novijoj istoriji razvoja fudbalskog sporta, obeležile su svojim reprezentativnim ali i klupskim rezultatima čitav jedan višegodišnji ciklus, obično dve godine pre i dve godine posle odigravanja Svetskog prvenstva. Naime, Španska reprezentacija osvojila je Evropsko prvenstvo 2008. godine, ali i 2012. godine, dok je fudbalski klub Barselona upravo u tom četvorogodišnjem ciklusu dva puta bio pobednik u takmičenju Lige Šampiona. Sa druge strane, fudbalski klubovi iz Nemačke su u godinama pred Svetsko prventsvo 2014. godine igrali dominantnu ulogu u istom klupskom takmičenju (FK Bajern, FK Borusija).

Analizom i tumačenjem dobijenih rezultata ovom analizom može se konstatovati da postoje određene zajedničke karakteristike u taktičkom ispoljavanju reprezentacija osvajača dva poslednja Svetska prvenstva u fudbalu. Takođe, na osnovu pojedinih specifičnosti u taktičkom plani igre ove dve reprezentacije, uočavaju se ipak različiti pravci u određenim tehničko-taktičkim aspektima igre, dve očigledno različite fudbalske škole.

Reprezentacija Španije postala je prvak sveta tako što je imala značajno veći broj udaraca na gol protivnika od reprezentacije Nemačke. Međutim, broj postignutih golova govori da su Nemci bili daleko efikasniji. Prema tome, u ovom slučaju ne može se reći da je broj udaraca na gol prediktor pozitivnog rezultata, uzimajući u obzir činjenicu da su protivnici Nemačke na Svetskom prvenstvu 2014. godine ne retko imali veći broj udaraca na gol.

Kad se posmatraju sličnosti u taktičkom delovanju ove dve reprezentacije prvenstveno se misli na primenu pojedinih vrsta napada, koje ukazuju na orjentaciju u igri u pogledu protežiranja kreativnog ili direktnog fudbala. Analiza je pokazala da su obe selekcije dominantno koristile kontinuirani napad u kreaciji svojih ofanzivnih akcija, a da je kontra napadom i napadom iz prekida završen tek svaki peti uspešni napad. Dominantna primena kontinuiranih napada kod ekipa koje ostvaruju vrhunske rezultate u fudbalskoj igri, rezultat je i analiza koje su za predmet svog istraživanja imale najuspešnije ekipe u klupskom takmičenju Liga Šampiona (Janković et al., 2015a). Takođe, zona napada je prostor sa koga su obe ekipe započele najveći broj uspešnih napada (42%). Ovakav podatak ukazuje da je za potrebe vrhunskog rezultata primena presing igre na početak napada protivnika, pa i u situaciji gubitka poseda duboko na polovini protivnika, bitno sredstvo taktike odbrane, jer se na taj način napada nesređena odbrana protivnika. Primena napada koji su izrazito kratkog trajanja i realizuju se posle oduzimanja lopte na protivničkoj trećini terena ima visok stepen korelacije sa ostvarivanjem pozitivnog rezultata (Lago et al., 2010). Takođe, pojedina istraživanja ukazuju da se fudbalska igra sve više kreće u pravcu intezifikacije aktivnosti sa i bez lopte, gde se upravo reakcije presinga na malom prostoru koriste kao uslov za realizaciju brzih napada protiv manjeg broja igrača protivnika (Wallace & Norton, 2013).

Razlike u taktičkom ispoljavanju reprezentacija osvajača dva poslednja Svetska prvenstva u fudbalu ogledaju se u načinu sprovođenja uspešnih napada, pre svega u pogledu načina dolaska u poziciju za udarac na gol i distance sa koje su udarci upućivani. Selekcija Španije očigledno je koristila individualne kvalitete svojih igrača i u najvećoj meri udarac na gol se upućivao posle individualnih proboja. Pored toga, dubinskim dodavanjima i povratnim loptama uvek se tražila dubina u igri, pre svega utrčavanjima manevarskih igrača iz drugog plana. Interesantno je podatak prema kome su Španci najmanje udaraca na gol uputili posle centaršuteva i dobijenih tzv. „drugih lopti". Ovaj podatak ukazuje na činjenicu da je selekcija Španije na najbolji način koristila sve individualne vrline sa kojima je raspolagala, ako znamo da je najveća vrednost ovog tima bila u manevarskom prostoru sa brzim i pokretljivim igračima koje ne odlikuje kvalitet u skok i duel igri. Sa druge strane, selekcija Nemačke je upravo posle centaršuteva sa bočnih pozicija i dobijenih „drugih lopti" uputila najveći broj udaraca na gol. Naravno, i ovakav rezultat svoje opravdanje nalazi u tradicionalno dobroj skok i duel igri svih Nemačkih fudbalera, gde disciplinovanost i fizička pripremljenost u ovakvim situacijama dolaze do izražaja. Prema tome, i selekcija Nemačke je na pravi način afirmisala sve svoje individualne, grupne i timske kvalitete.

ZAKLJUČAK

Dobijeni rezultati ovim istraživanjem, u jednom delu, otkrili su razlike u tehnučko-taktičkim orjentacijama u igri dve reprezentacije koje su osvojile dva poslednja Svetska prvenstva u fudbalu ali i sa druge strane ukazali na one tehničko-taktičke parametre igre koji su zajednički za timove koji pretenduju na najviše rezultate. Uzimajući sve u obzir mogu se izvesti generalni zaključci istraživanja:

- Reprezentacije koje osvajaju Svetska prvenstva u fudbalu u realizaciji uspešnih napada imaju zastupljene sve vrste napada, ali dominantna vrsta napadačkih akcija je kontinuirani napad;
- Reprezentacije koje osvajaju Svetska prvenstva u fudbalu najveći broj svojih uspešnih akcija započinju iz protivničke trećine terena za igru;
- Postizanje vrhunskog rezultata u fudbalu, a osvajanje Svetskog prvenstva svakako to jeste, zahteva kreiranje takvog taktičkog plana igre kojim će se na najbolji mogući način koristiti sve individualne, grupne i timske vrednosti tima;
- Vrline reprezentacije Španije (osvajač Svetskog prvenstva 2010. godine) su svakako bile u kvalitetima igrača manevarskog prostora, demostrirane primenom kontinuiranih napada sa čestim ubacivanjem iz drugog plana igrača manevarskog prostora. Takođe, sloboda u igri ofanzivnih fudbalera u igri jedan na jedan;
- Vrline reprezentacije Nemačke (osvajač Svetskog prvenstva 2014. godine) su bile u besprekornoj fizičkoj pripremljenosti i disciplinovanoj igri, demonstrirane primenom kontinuiranih napada sa završnicom po bočnim pozicijama. Takođe, značajan broj realizovanih sekundarnih napada nakon osvajanja „druge lopte".

Na osnovu izvedenih zaključaka, tumačenjem rezultata ovog istraživanja, mogu se definisati osnovni postulati u taktici fudbala koji karakterišu najefikasnije timove u savremenom fudbalu. Takođe, specifičnosti selekcija, bazirane na nacionalnim vrednostima i karakteristikama, mogu imati izuzetnu vrednost ako se iskoriste u smislu prilagođavanja i opredeljivanja ka onim taktičkim varijantama koje će te vrednosti na pravi način afirmisati.

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TACTICAL EFFICIENCY OF THE WINNING FOOTBALL NATIONAL TEAMS AT THE 2010 AND 2014 FIFA WORLD CUP

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INTRODUCTION

The analysis of competitive activity in football as a result of innovative technology development, became a powerful tool for preparation of the teams to achieve top results. The emerging sofisticated softwares for analysis enabled quantification of successfulness of an individual, group of players or the entire team, but also identification of success factors by using qualitative analysis. Success of football performers is reflected in the result achieved in the top international competitions, in which each team strives to present best its abilites. As winning in football means greater number of scores compared to the opponent, it is necessary, in line with characteristics of certain players, to find the most efficient and most rational tactical plan of the play to score a gaola. In order to reach that objective, eadh team must have efficient way to secure a ball, to successfully organize an attack, come into position to shoot on goal and finally to score a goal with great efficiency (Luhtanen et al. 2001).

The organization of successful attacks, attacks finalized with a shot on opponent's goal determins succes or failure of a football team. The finalzation of each successful attack is reflected in the tool of attacking tactics which is the shot on goal. The research so far identified scored goals as the major component of performance in the game of football. The analysis of scored goals and determination of the most appropriate attacking strategies are only preconditions of quality and efficient competition in modern football (Acar et al., 2007;). Additionally, by analysing all attacking actions resulted in the shot on goal, it is possible to identify in broader sense the efficient tools of technical-tactical actions, confirmed in the competitive aspct.

For a long time, analyses of successful and efficient attacks have been subject of investigation by the authors addressing tactics of football play. Monitoring and discovering most efficient methods and tools of competitive play enables rationalization of the training process and optimization of the training contents. In the studies so far, successful attacks were analysed for the top quality football competitions such as World Cups (Grant et al, 1999; Miljković et al, 2007; Acar et al, 2007), European Championships (Luhtanen et al, 2001; Armatas Yiannakos, 2010; Janković et al., 2009), highest quality club competitions (Hughes & Franks, 2005; Szwarc, A., 2007). Recently, an increasing number of studies are aimed at detecting those technical-tactical elements of football play that directly affect the result (Janković et al., 2011; Janković et al., 2011a), together with statistical data of efficiency that correlate most with positive outcome (Castellano et al., 2012; Liu et al., 2015).

Each great competition has marked in some way a period in the development of football play and has indicated certain tendencies in development of football tactics. World Cups, as the top quality competitions of national teams, i.e. winners of those competitions, set standards in the football tactics before all. Therefore, the analysis of the national teams that win such competitions in sequence, can define directions of football development and even foresee certain developmental tendencies.

The subject of this research was to reveal and follow up tactical validity to achieve top result in the game of football. The subject included spatial tactical manifestation of attacks (i.e. of successfully completed attacks). Tactical manifestation, primarily implies technical-tactical activities that an individual, group of players or the whole team undertakes in order to, depending on the part of the field, by deploying rational and efficient actions tactical patterns, score a goal.

The aim of this paper was to reveal, on the basis of the analysis of successful attacks of the national teams that won the last World cups, certain technical-tactical regularities and specificities in the play of both national teams, but also to define, based on the findings of this research, future directions in the development of football play regarding tactics.

METHOD

Sample of respondents

The analysis included tactical manifestation of the Spanish national team, winner of the 2010 FIFA World Cup in South Africa, and tactical manifestation of the German national team, winner of the 2014 FIFA World Cup, held in Brazil. Each of the two national teams played an overall of seven matches in the tournaments which were subjects of this research.

Procedures and course of research

The analysis of the previously recorded total of 14 matches played by the national teams was approached by designing the observing protocol (Carling et al, 2005). That protocol was used for each individual match. Notation system was used to record each successful individual attack in a previously created observation sheet.

Description of variables and method of their measurement

The variables monitored and analysed in this research were collected by systemic observation of video footage of matches from the last FIFA World Cups. Video materials were taken over form the channels of Serbian Broadcasting Company and EUROSPORT. The analysis of all attacking activities, for the purpose of comparison and obtaining relevant facts, included successful attacks only (attacks that resulted with a shoot on opponent's goal), in order to establish tendencies and trends in the modern football play. All significant attacks were analysed from multiple aspects including: Accuracy of successful attacks – accurate, inaccurate, efficient; Type of successful attacks - position, counter attacks and set pieces attacks; Zone of initiation of successful attacks – attacks initiated form the defence, middle or attack zone; Way of getting a ball possession (assists) – individual attack, „long ball", deep pass, back ball, cross; Distance from which it was shot on goal - < 5 m, 5 - 11 m, 11 - 16 m and 16 > m.

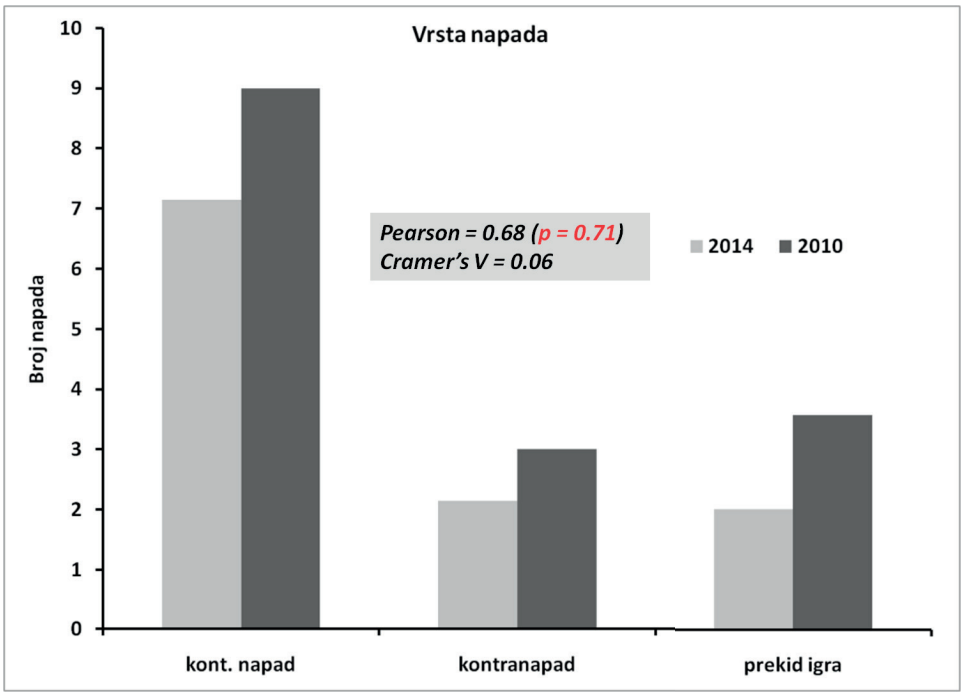
Statistical data processing

Descriptive statistics was used within quantitative analysis. The following statistic descriptive areas were used: arithmetic mean from the segment of measures of central tendencies and standard deviation of dispersion measures. From the aread of com

In the segment of comparative statistics, a nonparametric discriminate analysis, chi-squared test were used to assess connections of the two category variables All statistical tests were processed using SPSS 17.0 program (SPSS INC Chicago, IL).

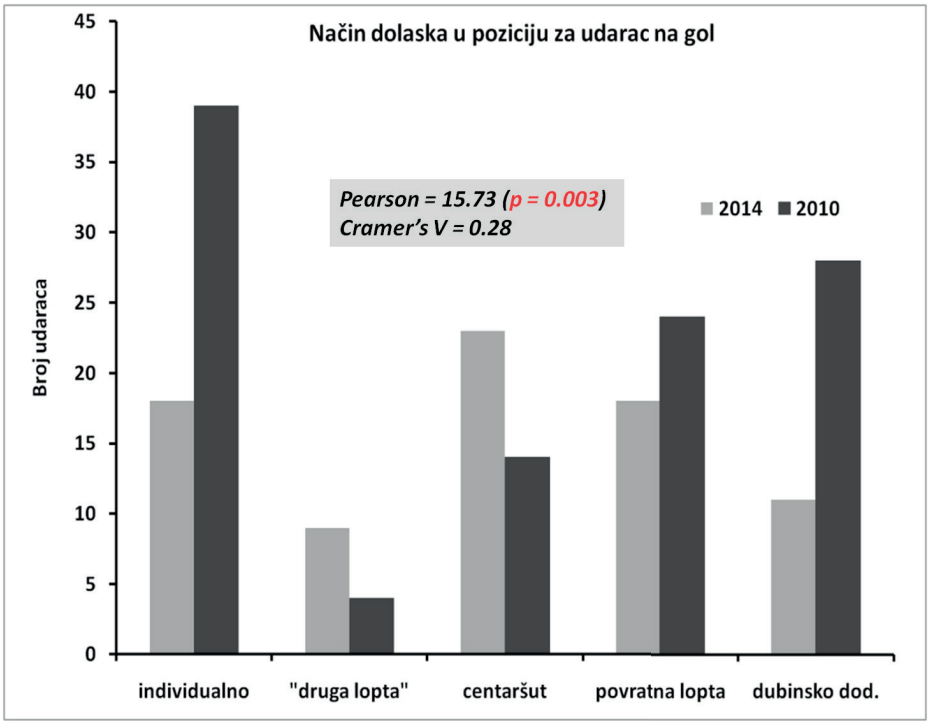
RESULTS

One of the most relevant indices of efficiency in attack organization of a team is represented by the number of successful attacks performed in one match. The results obtained in this research show that the Spanish national team in the 2010 World Cup ranked in the first position with significantly greater number of successfully performed attacks (15.57 per match), but with lower efficiency (1.14 per match) compared to the German national team in the 2014 World Cup (11.3 successful attacks per match, out of which 2.6 were efficient attacks).



Graph 1. Average number of certain types of attacks in a single match of the wining national teams in the World Cups in 2010 and 2014

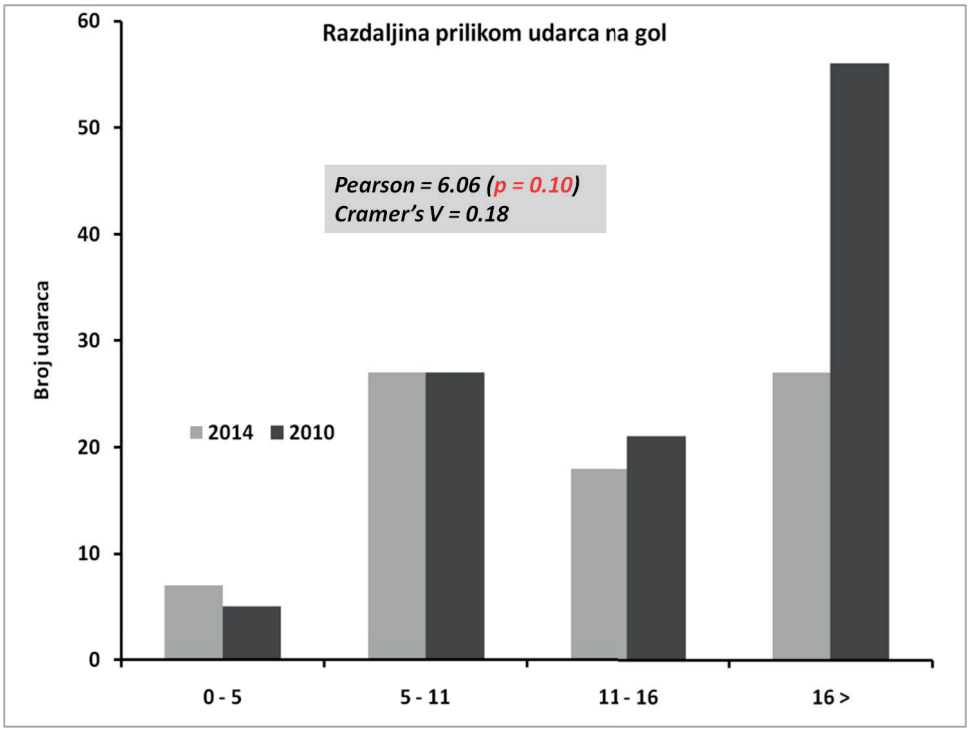
Regarding the attacking tactics in the play, the two wining national teams in the last World Cups did not differ when the structure of their play is observed from the aspect of certain types of attacking actions. According to the findings of this analysis, the application of position attacks represented 60%, counter attacks 20% and set pieces attacks 20% of attacks of both national teams (Graph 1). Additionally, the overall number of successful attacks initiated from the defence zone, middle zone and attacking zone did not differ with both World Cup winners. Thus, both German and Spanish national teams initiated successful attacks mostly from the attacking zone (42%), followed by middle zone (34%) with the less successful attacks initiated from the defence zone (24%).



Graph 2. Way of getting a ball possession (assists) of the wining national teams in the World Cups in 2010 and 2014

Graph 2 presents the overall values of the ways of getting a ball possession (assists) of the last World Cup winners. According to the findings of this analysis, the German national team had an opportunity to shoot on goal most often after final passes from lateral positions, i.e. after delivering a cross from wing positions (3.3 per match), while the Spanish national team players finished their attacks most often by individual breakthrough (5.57 per match) and deep passes (4 per match).

The way of getting in position to shoot on goal partially affected the distance from which the players of the two national teams shot on opponent's goal. Therefore, Spanish players in the 2010 World Cup performed the greatest number of shots on goal, i.e. outside 16-meter area, while German players in 2014 finished their attacks with the opponent's penalty area, mostly from the 5 – 11-meter area (Graph 3).



Graph 3 Distance from which it was shot on goal of the wining national teams in the World Cups in 2010 and 2014

DISCUSSION

The national teams that won World cups, in recent history of football development, marked with their national team and club results a multi-year cycle, usually two years prior to and two years after the World Cup tournaments. Namely, the Spanish national team won the 2008 European Championship but also in 2012, while FC Barcelona in the same 4-year cycle was twice winner in the UEFA Champions League. On the other hand, German football clubs were dominant in the same club competition (FC Byern, FC Borussia) in years prior to the 2014 World Cup.

The analysis and interpretation of the findings of the obtained in this analysis ascertain that there are certain mutual features in tactical manifestations of the national teams winning the last World Cups in football. Also, based on some particularities in the tactical plan of play of the two national teams, we can still identify different directions in certain technical-tactical aspects of play, of the two evidently different football schools.

The Spanish national team won the World Cup with significantly greater number of shots on opponent's goal than the German national team. However, the number of scored goals shows that the German team was far more successful. Therefore, in this case it cannot be said that the number of shots on goal is predictor of positive outcome, having in mind the facts that the opponents of Germany in the 2014 World Cup rather often had greater number of shots on goal.

When it comes to similarities in tactical performance of the two national teams, it primarily addresses the application of certain types of attacks that indicate play organization in the aspect of either creative or direct football. The analysis showed that both teams dominantly deployed position attack in creating their offensive actions and that only every fifth successful attack resulted from counter attack and set piece attack. Dominant application of position attack with the teams that achieve top results in club competition the UEFA Champions League (Janković et al., 2015a). Also, the attack zone is the area from which both teams initiated major number of their successful attacks (42%). This detail indicates the that, for the top results, the application of pressing play at the beginning of opponent's play, even in the situation of losing the possession of the ball deep in the opponent's half, is an essential tool of the defence tactics, because in this way the unorganized opponent's defence is attacked. The application of markedly short attacks realized after taking over the ball on the opponent's third of the field has high level of correlation with positive outcome (Lago et al., 2010). Additionally, some studies indicate that football play is increasingly moving has towards intensification of activities with and without the ball, and it is exactly why the reaction of pressing on a small area are used as precondition for realization of fast attacks against fewer opponent's players (Wallace & Norton, 2013).

Differences in tactical manifestations of the national teams winners of the last two football World Cups reflect in the way of implementing successful attacks, primarily in the way of getting in the position for shooting on goal and the distance from which such shots were performed. Obviously, the Spanish national team used individual qualities of its team and to the greatest degree the shot on goal was performed after individual breakthrough. Additionally, deep play was always sought by deep passes and back balls primarily by running in of the midfilders from the second plan. Interestingly, the Spanish team attempted least shots on goal after crosses and the so called „second balls". This detail indicate to the fact that Spanish national team used best all individual virtues they possessed, if we know that the greatest value of this team was in the middle area with fast and movable players who do not excel in jump and duel play. On the other hand, German national team shot on goal most after crosses from lateral positions and obtained „long balls". Surely, even this result is justified by good jump and duel play of all German players, with discipline and physical preparedness are emphasized in such situations. Therefore, even the German national team affirmed in the best way their individual group and team qualities.

CONCLUSION

The results obtained in this research, on the one hand, discovered the differences in technical-tactical orientations of the play of the two national teams that won the last World Cups in football, but on the other hand indicated those technical-tactical parameters of play that were common for the teams that strive for the top results . Haven taken in the account all the above, the following general conclusions of the research can be drawn:

- The national teams that win football World Cups apply all types of attacks in realization of successful attacks but still the position attack is the dominant one;
- The national teams that win football World Cups start most of their successful actions from the opponent's third of the pitch;
- Achieving top results in football, which the World Cups surely is, requires designing of a tactic plan of play that will best deploy all individual, group and team values of one team;
- The virtues of the Spanish national team (winner of the 2010 world Cup) were certainly in the quality of the quality of the middle zone players quality, demonstrated by application of position attacks with frequent throws from the second plan by the players of the middle zone. Additionally, freedom in the play of the offensive players in one-on-one play;
- The virtues of the German national team (winner of the 2014 World Cup) were in impeccable physical preparedness and disciplined play, demonstrated by application of position attacks with final moves at lateral positions. Additionally, significant number of realized secondary attacks after winning "the second ball".

Based on the above conclusions and the interpretation of the findings of this research one can define the basic postulates in football tactics that characterize the most efficient teams in modern

football. Also, specificities of the national teams that incorporate national values and features can play significant role when used for the purpose of adjusting and selecting those tactical options that will promote best such values.

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RAZLIKE U ISPOLJAVANJU OPŠTIH I SPECIFIČNIH MOTORIČKIH SPOSOBNOSTI ODBOJKAŠICA I NETRENIRANIH DEVOJČICA STAROSTI 15 GODINA

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UVOD

Adaptacija je karakteristika živih bića koja postoji radi opstanka. Njena suština je u tome što u organizmu održava relativno isto stanje uprkos velikom broju promena spoljašnje sredine (Bompa, 2005). Čovek nastoji da adaptivno odgovara na te promene. Karakteristika odgovora na spoljne uticaje izražava individualnost organizma, i uslovljava da li će postati iskustvo, zdravlje ili bolest. Učvršćivanje unutrašnje sredine bitan je preduslov za normalan život. Što je organizam na višem stupnju evolutivne lestvice, to je sposobniji za adaptacije na uslove života (Stefanović i dr., 2010). Fizičko vežbanje u izvesnoj meri doprinosi procesima adaptacije čoveka na spoljašnje uslove života (Bokan, 2009). Fizičko opterećenje koje se ostvaruje u različitim oblicima fizičke kulture, je agens koji deluje kako na fizičku, tako i na psihičku komponentu ljudske ličnosti (Knežević i dr. 2011).

Ovo istraživanje je sprovedeno da bi se utvrdilo da li se i u kojoj meri odbojkašice i netrenirane devojčice uzrasta 15 godina, sa kojima su u tekućoj školskoj godini obrađivani sadržaji iz odbojke, razlikuju po pitanju antropometrijskih karakteristika i opštih i specifičnih motoričkih sposobnosti. Drugim rečima, da li dodatna angažovanost u vančasovnim aktivnostima devojčica ovog uzrasta, ima dodatni uticaj na rast i razvoj sposobnosti (Višnjić i dr., 2004).

Proučavajući školsku populaciju, a posebno decu u pubertetu, pojedini autori došli su do zaključka da postoje razlike u ispoljavanju motoričkih sposobnosti u korist dece koja se dodatno bave sportom (Nešić at al, 2013; Đurić, 2014). Ipak, pojedina istraživanja potvrđuju da razlika u motoričkim sposobnostima dece zavisi od testa koji se koristi za procenu određenih sposobnosti (Voyer, Voyer, & Bryden, 2004; Fratrić, 2012). Istraživanja koja su sprovedena mahom su ukazala na značajno bolje rezultate treninrane u odnosu na netreniranu decu, u pogledu motoričkih sposobnosti.

Dobijeni rezultati ovog istraživanja, mogu poslužiti kao orjentir prilikom redukovanja programa fizičkog vaspitanja, i njegovog prilagođavanja potrebama i osobenostima savremenog đaka (Batričević, 2008; Kovačević i dr. 2011). Takođe, mogu dati odgovore na pitanja, šta je to što je u nastavi dobro, a šta zapostavljeno. Da li odbojka, kao nastavni sadržaj može doprineti lakšem ostvarenju cilja fizičkog vaspitanja? Sa druge strane, rezultati govore trenerima u kojoj meri su oni uspešni u ostvarenju svojih kratkoročnih i dugoročnih planova (Galić i dr., 2005).

Predmet istraživanja je komparativna analiza opštih i specifičnih motoričkih sposobnosti učenica uzrasta 15 godina koje se aktivno bave odbojkom, i netreniranih učenica istog uzrasta koje su u tekućoj školskoj godini na časovima fizičkog vaspitanja obrađivale nastavne sadržaje vezane za odbojku.

Cilj istraživanja je da se izmere i procene opšte i specifične motoričke sposobnosti učenica uzrasta 15 godina i da se prikažu i analizuju rezultati komparativne analize rezultata odbojkašica i onih učenica koje se sportom ne bave aktivno. Na osnovu predmeta i cilja istraživanja, definisani su sledeći zadaci: prikupljanje i analiza dostupne literature, merenje antropometrijskih osobina i procena motoričkih sposobnosti obe grupe ispitanika, obrađivanje i upoređivanje dobijenih rezultata i tumačenje rezultata istraživanja i izvođenje zaključaka.

Na osnovu cilja i zadataka istraživanja, postavljene su dve hipoteze:

H_1 – Postoje statistički značajne razlike u pogledu opštih motoričkih sposobnosti odbojkašica i netreniranih devojčica uzrasta 15 godina, u prilog odbojkašica.

H_2 – Postoje statistički značajne razlike u pogledu specifičnih motoričkih sposobnosti odbojkašica i netreniranih devojčica uzrasta 15 godina, u prilog odbojkašica.

METOD

Tip istraživanja je bio *„ex-post facto"* istraživanje, sa dve grupe ispitanika od kojih je eksperimentalna grupa uključena u trenažni proces (odbojka), a druga grupa se ne bavi fizičkom aktivnošću van časova fizičkog vaspitanja (Ristić, 2006). Uzorak ispitanika činio je 60 učenica uzrasta 15 godina, pri čemu eksperimentalnu grupu čine odbojkašice OK „Radnički" iz Beograda, a kontrolnu netrenirane učenice Prve beogradske gimnazije. Korišćena je sledeća baterija testova sa standardnim procedurama: za merenje antropometrijskih karakteristika - telesna masa, telesna visina i indeks telesne mase; za procenu opštih motoričkih sposobnosti - *„Sargent"*-ov test iz mesta, *„Sargent"*-ov test iz zaleta, „X" test, Pretklon na klupici, Bacanje medicinke, Ležanje - sed za 30 sekundi, Trčanje 20 metara; za procenu specifičnih motoričkih sposobnosti - *„Russell-lange"*-ovi testovi.

Podaci su obrađeni pomoću programa SPSS 19.0, a za utvrđivanje odnosa između rezultata korišćen je *t-test* za nezavisne uzorke.

Radi lakšeg praćenja rezultata istraživanja, najpre će biti data tabela sa šiframa testiranih varijabli, kao i instrumenti kojima su varijable merene, odnosno procenjivane (tabela 1).

Tabela 1. Šifre varijabli

Šifra	Varijabla	test
TM	Telesna visina	Merenje antropometrom po Martinu
TV	Telesna masa	Merenje portabl vagom
BMI	Indeks telesne mase	Izračunavanje po formuli
Sargent_m	Brzinska snaga ekstenzora nogu	„Sargent" - skok u vis iz mesta
Sargent_z	Eksplozivna snaga ekstenzora nogu	„Sargent" - skok u vis iz zaleta
X_test	Agilnost	„X" test
Pretklon	Pokretljivost u zglobu kuka	Pretklon na klupi
BM	Brzinska snaga ramenog pojasa	Bacanje medicinke iz stojećeg stava
Flex_trupa	Repetitivna snaga mišića pregibača trupa	"Ležanje – sed" za 30 sekundi
Sprint_20m	Brzina lokomocije	Sprint 20m
UHP	Preciznost odigravanja lopte "prstima"	„Russell-lange" - test "odigravanje prstima"
OHP	Preciznost odigravanja lopte "čekićem"	„Russell-lange" - test"odigravanje čekićem"
Serv	Preciznost serviranja	„Russell-lange"- test servis

REZULTATI

U tabelama rezultata deskriptivne statistike prikazane su: minimalna (Min.), maksimalna (Max.) i srednja vrednost (Mean) uzoraka, zatim standardna devijacija (SD), vrednosti parametara simetričnosti raspodele (Skewness, Kurtosis), kao i koeficijent varijacije (CV%).

Tabela 2. Rezultati deskriptivne statistike odbojkašica uzrasta 15 godina

	N	Min	Max	Mean	SD	Skewness		Kurtosis		CV%
	Stat.	Stat.	Stat.	Stat.	Stat.	Stat.	Std. Error	Stat.	Std. Error	Stat.
Age	30	16.00	15.00	15.00	.00	.	.	.	.	0.00
TM	30	53.00	72.00	61.07	5.19	-.014	.427	-.887	.833	8.50
TV	30	1.62	1.90	1.75	.06	.291	.427	.862	.833	3.39
BMI	30	16.85	21.97	20.04	1.20	-.817	.427	.398	.833	6.00
Sargent_m	30	17.00	36.00	29.57	4.27	-.716	.427	1.278	.833	14.45
Sargent_z	30	18.00	48.00	37.83	5.71	-1.071	.427	3.952	.833	15.08
X_test	30	7.20	13.83	9.42	1.39	.883	.427	2.180	.833	14.71
Pretklon	30	-13.00	18.00	7.10	6.06	-1.055	.427	2.925	.833	85.34
BM	30	4.60	9.60	7.64	1.32	-.319	.427	-.723	.833	17.29
Flex_trupa	30	16.00	40.00	28.23	5.01	.027	.427	.528	.833	17.74
Sprint_20m	30	3.10	4.71	3.87	.33	.071	.427	.913	.833	8.63
UHP	30	12.00	30.00	20.67	4.63	.450	.427	-.470	.833	22.39
OHP	30	13.00	37.00	25.37	5.72	-.152	.427	.018	.833	22.55
Serv	30	1.00	9.00	6.07	2.13	-.596	.427	-.034	.833	35.15

Tabela 3. Rezultati deskriptivne statistike netreniranih devojčica uzrasta 15 godina

	N	Min	Max	Mean	SD	Skewness		Kurtosis		CV%
	Stat.	Stat.	Stat.	Stat.	Stat.	Stat.	Std. Error	Stat.	Std. Error	Stat.
Age1	30	16.00	15.00	15.00	.00	.	.	.	.	0
TM1	30	46.00	68.00	57.97	6.69	-.101	.427	-.930	.833	11.54
TV1	30	1.55	1.80	1.70	.07	-.569	.427	-.579	.833	4.05
BMI1	30	18.08	22.49	20.11	1.25	.224	.427	-.990	.833	6.20
Sargent_m1	30	18.00	34.00	25.50	4.45	.281	.427	-.617	.833	17.44
Sargent_z1	30	22.00	46.00	30.60	5.57	.784	.427	.668	.833	18.22
X_test1	30	9.45	14.17	10.95	1.00	1.709	.427	3.75	.833	9.15
Pretklon1	30	-8.00	22.00	7.17	6.79	-.340	.427	.181	.833	94.78
BM1	30	4.30	7.20	5.47	.83	.275	.427	-.902	.833	15.15
Flex_trupa1	30	17.00	32.00	24.30	4.24	-.028	.427	-1.06	.833	17.43
Sprint_20m1	30	3.65	4.58	4.16	.25	.002	.427	-.727	.833	6.09
UHP1	30	3.00	20.00	10.80	4.23	.252	.427	-.490	.833	39.16
OHP1	30	7.00	24.00	14.07	5.30	.327	.427	-1.103	.833	37.66
Serv1	30	.00	9.00	2.87	2.83	.725	.427	-.637	.833	98.55

U tabeli rezultata komparativne statistike prikazane su vrednosti: razlika u srednjim vrednostima (Mean Difference), standardna devijacija ukupnog uzorka (Std. Deviation), standardna greška (Std. Error Mean), intervali pouzdanosti, t vrednost (t) kao i značajnost t vrednosti (Sig.).

Tabela 4. Rezultati komparativne statistike

	Paired Differences					t	Sig. (2-tailed)
	Mean Defference	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			
				Lower	Upper		
TM - TM1	3.10	9.35	1.71	-0.39	6.59	1.82	0.08
TV - TV1	0.05	0.10	0.02	0.01	0.09	2.61	**0.01**
BMI - BMI1	-0.07	1.73	0.32	-0.72	0.58	-0.22	0.82
Sargent_m - Sargent_m1	4.07	7.16	1.31	1.39	6.74	3.11	**0.00**
Sargent_z - Sargent_z1	7.23	9.32	1.70	3.75	10.71	4.25	**0.00**
X_test - X_test1	-1.53	1.85	0.34	-2.22	-0.84	-4.53	**0.00**
Pretklon - Pretklon1	-0.07	10.13	1.85	-3.85	3.71	-0.04	0.97
BM - BM1	2.17	1.77	0.32	1.51	2.84	6.71	**0.00**
Flex_trupa - Flex_trupa1	3.93	7.07	1.29	1.29	6.57	3.05	**0.00**
Sprint_20m - Sprint_20m1	-0.29	0.48	0.09	-0.47	-0.12	-3.38	**0.00**
UHP - UHP1	9.87	6.10	1.11	7.59	12.14	8.87	**0.00**
OHP - OHP1	11.30	8.20	1.50	8.24	14.36	7.55	**0.00**
Serv - Serv1	3.20	3.66	0.67	1.83	4.57	4.79	**0.00**

DISKUSIJA

Između vrednosti telesne mase odbojkašica (TM) i netreniranih učenica (TM1) ne postoji statistički značajna razlika (p=0,08), iako odbojkašice imaju nešto veću prosečnu telesnu masu. Ovakvi dobijeni rezultati se mogu objasniti time što odbojkašice imaju veću i prosečnu telesnu visinu, pa samim tim i neznatno veću masu.

Kada se uporede prosečne vrednosti telesne visine eksperimentalne grupe (TV) i kontrolne grupe (TV1), dolazi se do zaključka da postoji statistički značajna razlika između ovih vrednosti (p=0,01) u prilog odbojkašica. Ovakvi rezultati proizilaze iz činjenice da je selekcija u odbojci usmerena upravo ka odabiru viših igrača i igračica. Poznato je da je telesna visina jedan od presudnih faktora koji određuje nivo uspešnosti u odbojkaškoj igri (Grgantov i dr., 2007.). Ova razlika se ne može okarakterisati kao trenažnim procesom izazvana pojava, znajući da je telesna visina u najvećoj meri genetski determinisana, i da nije dokazano da fizička aktivnost pozitivno utiče na njeno povećanje (Šegregur i dr.,2010).

T-test za male nezavisne uzorke pokazao je da između vrednosti indeksa telesne mase odbojkašica (BMI) i netreniranih učenica (BMI1) ne postoji statistički značajna razlika (p=0,82). Indeks telesne mase se direktno izračunava iz telesne visine i telesne mase, pa je usled nepostojanja značajnih razlika u masi izostala i razlika u BMI.

Što se tiče rezultata testova opštih motoričkih sposobnosti, značajne statističke razlike (p=0,00) u rezultatima postoje kada su u pitanju testovi: Sargent iz mesta i iz zaleta, X test, bacanje medicinke, fleksija trupa, kao i sprint na 20 metara, sve u korist odbojkašica.

To što odbojkašice imaju bolje rezultate u testovima Sargent iz mesta i iz zaleta, delom se može pripisati tome što su uključene u trenažni proces, pa su im brzinska snaga i eksplozivna sila mišića nogu na višem nivou nego kod netreniranih odbojkašica, a delom tome što je ovakva vrsta skoka karakteristična za odbojku, pa im je tehnika izvođenja ovog zadatka poznata. Netrenirane ispitanice nisu imale ovakve vidove naprezanja i adaptacija koje iz tog tipa opterećenja proizilaze i samim tim imaju značajno slabije rezultate na ovim testovima (Jovanović, 2007).

Bolji rezultati odbojkašica u X testu nam ukazuju na to da one imaju bolje razvijenu agilnost, što podrazumeva veću uspešnost prilikom kretanja velikom brzinom sa čestim promenama pravca i smera (Nešić i dr., 2013; Grbović, 2013). Ovo je takođe uzrok sadejstva bolje fizičke pripremljenosti i iskustva koje ovim ispitanicima pruža sama struktura takmičarske aktivnosti u odbojci, koja se zasniva na ovakvim kretanjima.

Bacanje medicinke je takođe jedan od testova gde odbojkašice pokazuju bolje rezultate, što je i logično, s obzirom na to da su ruke i trup u odbojci angažovane tako reći uvek, a opterećenje je takvo da kod sportista izaziva razvoj brzinske snage mišića kako trupa, tako i ruku. Način na koji se izvodi sam test, a koji uključuje bacanje, u velikoj meri podseća na pokret koji odbojkašice izvode na gotovo svakom treningu, a to je pokret trupa i ruku pri smeču. Adaptacija na ovakav vid kako pokreta, tako i opterećenja dovodi do ishoda da odbojkašice imaju značajno bolje rezultate na testu bacanje medicinke.

Repetitivna snaga mišića pregibača trupa (TRBUH) i brzina lokomocije (T20M) su opšte motoričke sposobnosti, na koje odbojka kao specifična motorička aktivnost, nema puno direktnog uticaja, ali su svakako sposobnosti koje neosporno čine svakog sportistu i koje se u treningu kao takve neminovno poboljšavaju.

Od svih testova koji su rađeni sa ciljem procene opštih motoričkih sposobnosti, jedino kod rezultata testa za procenu gipkosti zadnje lože buta i pokretljivosti u zglobu kuka ne postoji statistički značajna razlika (p=0,97) između odbojkašica (PRE) i netreniranih učenica (PRE1), čak se može reći da su grupe izjednačene po rezultatima. Može se konstatovati da obe grupe imaju slabe prosečne rezultate, iako je i kod odbojkašica i kod netreniranih učenica veća frekvencija natprosečnih rezultata. Mogući uzrok ovakvog stanja stvari je to što ni profesori fizičkog vaspitanja, ni treneri, u periodu od 8. do 10. godine kada treba da se počne sa razvojem ove sposobnosti (po R. Medvedevu, 1987), tome ne poklanjaju dovoljnu pažnju. Sa druge strane, to je motorička sposobnost koja se najlakše „gubi" usled neadekvatnog treninga.

Rezultati T-testa, pokazali su da kod sva tri testa specifičnih motoričkih sposobnosti UPH--UPH1, OHP-OHP1 i Serv-Serv1 postoje statistički značajne razlike (p=0,00) u rezultatima između odbojkašica i netrenirani učenica u prilog odbojkašica. Ova činjenica je i očekivana, iako su i netrenirane učenice na nastavi fizičkog vaspitanja obrađivale elemente odbojkaške tehnike, vreme provedeno na časovima fizičkog vaspitanja, kao i intenzitet vežbanja tih elemenata ne može da se poredi sa onim koje je prisutno u odbojkaškom treningu. Odbojkašice provode znatno više vremena uvežbavajući ove elemente, pa samim tim imaju i bolje rezultate.

ZAKLJUČAK

Na osnovu prikazanih rezultata može da se zaključi da je prva hipoteza delimično potvrđena, s obzirom da postoje statistički značajne razlike između odbojkašica i netreniranih devojčica uzrasta 15 godina kada se posmatraju sve varijable opšteg motoričkog prostora, izuzev fleksibilnosti gde nisu pronađene značajne razlike između ova dva uzorka. Brzinska i eksplozivna snaga nogu, agilnost, brzinska snaga ramenog pojasa, repetitivna snaga pregibača trupa i ukupna brzina lokomocije su značajno bolje razvijene sposobnosti kod odbojkašica u odnosu na netrenirane ispitanice. Odbojkaški trening, koji sadrži veliki broj opterećenja, kako u smislu skokova u bloku ili odbojkaškom smeču, tako i u smislu naglih i brzih kretnji i promena pravaca u sklopu odbrane sopstvenog polja, je izazvao adaptacije na ovakve tipove naprezanja. Uobičajena nastava fizičkog vaspitanja koju su pohađale ispitanice iz uzorka netreniranih nije u tolikoj meri uticao na razvoj pomenutih sposobnosti, pa su one imale slabije rezultate u svim testovima koji procenjuju opšte motoričke sposobnosti.

Na osnovu rezultata komparativne statistike na testovima za procenu specifičnih motoričkih sposobnosti može da se zaključi da je druga hipoteza u potpunosti potvrđena, odnosno ispitanice iz uzorka odbojkašica su imale statistički značajno bolje rezultate na ovim testovima. Odigravanje lopte prstima, čekićem i serviranje su tehnički elementi na kojima počiva cela odbojkaška igra i sastavni su deo svakog odbojkaškog treninga. Veliki broj ponavljanja, učestalost tih ponavljanja, kao i pažnja posvećena njihovom pravilnom izvođenju su uslovili da odbojkašice u značajno većoj meri savladaju ove elemente i samim tim imaju bolje rezultate na testovima koji te elemente sadrže. Ispitanice iz uzorka netreniranih, pored toga što su u okviru fizičkog vaspitanja imali kao nastavnu jedinicu odbojku, nisu imale niti dovoljan obim, niti dovoljan kvalitet pri obuci tih elemenata kako bi ih usavršile u dovoljnoj meri da mogu rezultatima da „pariraju“ odbojkašicama.

Ukupno uzevši odbojkašice su opšte motorički spremnije i specifično motorički spretnije od netreniranih učenica istog uzrasta (Nešić, 2002). Uzrok ovih razlika pre svega proizilazi iz karakteristika odbojkaškog treninga, kako u kvantitativnom smislu broja ponavljanja i opterećenja na koja se u toku treninga adaptiraju, tako i u kvalitativnom smislu gde je akcenat na pravilnom i efikasnom izvođenju tehničkih elemenata na svakom treningu prisutan. Značaj ove studije jeste u prepoznavanju odbojke kao dobrog „pokretača“ pozitivnih promena opštih motoričkih sposobnosti kod dece starijeg školskog uzrasta. Kao takva, odbojka može da zauzme značajnije mesto u nastavi fizičkog vaspitanja u osnovnim školama i time eventualno doprinese ukupnom boljem razvoju mladih.

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DIFFERENCES BETWEEN GENERAL AND SPECIFIC MOTOR ABILITIES IN VOLLEYBALL PLAYERS AND UNTRAINED GIRLS AGED 15

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INTRODUCTION

Adaptation is a characteristic of all living beings and their need for survival. The essence of adaptation is that it maintains a relatively stable condition in the organism, despite numerous changes in the external environment (Bompa, 2005). Man seeks to respond to these changes adaptively. Characteristic response to external conditions is individual and varies in different organisms, and it determines whether they will become experience, health or illness. Stabilizing the internal environment is an important precondition for a normal life. The higher an organism is evolved the more capable it will be to adapt to different conditions (Stefanović et al, 2010). Physical exercise contributes to the adaptation process to a certain extent (Bokan, 2009). Physical load that is expressed in different forms of physical culture is an agent that influences both physical and mental component of the human personality (Knežević et al, 2011).

This research was conducted in order to determine whether there are differences between volleyball players and untrained girls aged 15 that participated in volleyball classes during this school year, in terms of anthropometric characteristics as in general and specific motor abilities. In other words, to determine whether additional engagement in extracurricular activities in girls of this age has further impact on their growth and abilities development (Višnjić et al, 2004).

Studying the school population, especially children that are in puberty, certain authors have reached a conclusion that there are differences in motor abilities in favor of children that are engaged in sports outside the school (Nešić at al, 2013; Đurić, 2014). However, some research confirm that the difference in motor abilities depends on the test that is used to evaluate those abilities (Voyer, Voyer, & Bryden, 2004; Fratrić, 2012). Research that was conducted on this topic points to significantly better results in trained children compared to untrained children, in terms of motor abilities.

Results of this research could serve as a landmark for reduction of the physical education program and its adjustment to the needs and individual characteristics of the modern student (Batričević, 2008; Kovačević et al, 2011). They can also provide answers to questions regarding what is adequately and inadequately defined in the curriculum. Can voleyball as educational content contribute to easier realization of physical education? On the other hand, the results show the coaches to what extent their short-term and long-term plans were realized (Galić et al, 2005).

The subject of this research is a comparative analysis of general and specific motor abilities between female students aged 15 that are actively involved in volleyball practices and untrained female students of the same age that have been involved in volleyball classes during the current school year, as a part of physical education classes.

The aim of this research is to measure and evaluate motor abilities in female students aged 15 and to display and analyze the comparative analysis results between volleyball players and untrained girls. Based on the subject and aim of this research, the following tasks have been defined: gathering and analysis of the available literature, measuring anthropometric characteristics and evaluation of motor abilities in both groups, processing and comparing results, interpreting research results and drawing conclusions.

Based on the research tasks and objectives, two hypothesis were defined:

H_1 – There are statictically significant differences in terms of general motor abilities between volleyball players and untrained girls aged 15, in favor of volleyball players.

H_2 – There are statictically significant differences in terms of specific motor abilities between volleyball players and untrained girls aged 15, in favor of volleyball players.

METHOD

The *„ex-post facto"* method was used in this research, and two groups of subjects participated in the research process. The experimental group was involved in the training processs (volleyball), and the other group was engaged in physical activity outside of school classes (Ristić, 2006). There were 60 subjects - female students aged 15, with the experimental group consisting of volleyball players from the volleyball club „Radnički" Belgrade, and the control group consisting of untrained girls that are attending the First Belgrade Gymnasium. The following tests with standard procedures were used: measuring anthropometric characteristics – body mass, body height and body mass index; evaluation of general motor abilities - *„Sargent"* test from standing position, *„Sargent"* test from run-up, „X" test, torso flexion on a bench, medicine ball throw, "lie/sit" for 30 seconds, 20m sprint; evaluation of specific motor abilities - *„Russell-lange"* tests.

Obtained data was processed using the SPSS 19.0 software, and in order to determine the ratio between the results, *t-test* was used for independent samples.

In order to monitor the research results easily, a table with variable codes will be defined, as well as the instrumets that were used to measure and evaluate the said variables (table 1).

Table 1. Variable codes

Code	Variable	Test
TM	Body height	Martin anthropometer measuring
TV	Body mass	Measuring using a portable scale
BMI	Body mass index	Calcuating using a defined formula
Sargent_m	Leg extensor speed	„Sargent" test from standing position
Sargent_z	Leg extensor explosive power	„Sargent" test from run-up
X_test	Agility	„X" test
Flx	Mobility of hip joint	Torso flexion on a bench
BM	Shoulder power	Medicine ball throw from a standing position
Abd	Repetitive power of the flexor muscle	"Lie – sit" for 30 seconds
Sprint_20m	Locomotion speed	Sprint 20m
UHP	Accuracy during setting	„Russell-lange" – setting test
OHP	Accuracy during bumping	„Russell-lange" – bump test
Serv	Serve accuracy	„Russell-lange"- serve test

RESULTS

The table with descriptive statistics results displays the following: minimum (Min.), maximum (Max.) and mean sample values (Mean), standard deviation (SD), symmetrical distribution parameters (Skewness, Kurtosis), as well as the variation coefficient (CV%).

Table 2. Descriptive statistics results in volleyball players aged 15

	N	Min	Max	Mean	SD	Skewness		Kurtosis		CV%
	Stat.	Stat.	Stat.	Stat.	Stat.	Stat.	Std. Error	Stat.	Std. Error	Stat.
Age	30	16.00	15.00	15.00	.00	.	.	.	.	0.00
TM	30	53.00	72.00	61.07	5.19	-.014	.427	-.887	.833	8.50
TV	30	1.62	1.90	1.75	.06	.291	.427	.862	.833	3.39
BMI	30	16.85	21.97	20.04	1.20	-.817	.427	.398	.833	6.00
Sargent_m	30	17.00	36.00	29.57	4.27	-.716	.427	1.278	.833	14.45
Sargent_z	30	18.00	48.00	37.83	5.71	-1.071	.427	3.952	.833	15.08
X_test	30	7.20	13.83	9.42	1.39	.883	.427	2.180	.833	14.71
Flx	30	-13.00	18.00	7.10	6.06	-1.055	.427	2.925	.833	85.34
BM	30	4.60	9.60	7.64	1.32	-.319	.427	-.723	.833	17.29
Abd	30	16.00	40.00	28.23	5.01	.027	.427	.528	.833	17.74
Sprint_20m	30	3.10	4.71	3.87	.33	.071	.427	.913	.833	8.63
UHP	30	12.00	30.00	20.67	4.63	.450	.427	-.470	.833	22.39
OHP	30	13.00	37.00	25.37	5.72	-.152	.427	.018	.833	22.55
Serv	30	1.00	9.00	6.07	2.13	-.596	.427	-.034	.833	35.15

Table 3. Descriptive statistics results in untrained girls aged 15

	N	Min	Max	Mean	SD	Skewness		Kurtosis		CV%
	Stat.	Stat.	Stat.	Stat.	Stat.	Stat.	Std. Error	Stat.	Std. Error	Stat.
Age1	30	16.00	15.00	15.00	.00	.	.	.	.	0
TM1	30	46.00	68.00	57.97	6.69	-.101	.427	-.930	.833	11.54
TV1	30	1.55	1.80	1.70	.07	-.569	.427	-.579	.833	4.05
BMI1	30	18.08	22.49	20.11	1.25	.224	.427	-.990	.833	6.20
Sargent_m1	30	18.00	34.00	25.50	4.45	.281	.427	-.617	.833	17.44
Sargent_z1	30	22.00	46.00	30.60	5.57	.784	.427	.668	.833	18.22
X_test1	30	9.45	14.17	10.95	1.00	1.709	.427	3.75	.833	9.15
Flx1	30	-8.00	22.00	7.17	6.79	-.340	.427	.181	.833	94.78
BM1	30	4.30	7.20	5.47	.83	.275	.427	-.902	.833	15.15
Abd1	30	17.00	32.00	24.30	4.24	-.028	.427	-1.06	.833	17.43
Sprint_20m1	30	3.65	4.58	4.16	.25	.002	.427	-.727	.833	6.09
UHP1	30	3.00	20.00	10.80	4.23	.252	.427	-.490	.833	39.16
OHP1	30	7.00	24.00	14.07	5.30	.327	.427	-1.103	.833	37.66
Serv1	30	.00	9.00	2.87	2.83	.725	.427	-.637	.833	98.55

The table with comparative statistics results displays the following: difference in mean values (Mean Difference), standard deviation of the total sample (Std. Deviation), standard error (Std. Error Mean), confidence intervals, t value (t), as well as t value significance (Sig.).

Table 4. Comparative statistics results

	Paired Differences					t	Sig. (2-tailed)
	Mean Defference	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			
				Lower	Upper		
TM - TM1	3.10	9.35	1.71	-0.39	6.59	1.82	0.08
TV - TV1	0.05	0.10	0.02	0.01	0.09	2.61	**0.01**
BMI - BMI1	-0.07	1.73	0.32	-0.72	0.58	-0.22	0.82
Sargent_m - Sargent_m1	4.07	7.16	1.31	1.39	6.74	3.11	**0.00**
Sargent_z - Sargent_z1	7.23	9.32	1.70	3.75	10.71	4.25	**0.00**
X_test - X_test1	-1.53	1.85	0.34	-2.22	-0.84	-4.53	**0.00**
Flx - Flx1	-0.07	10.13	1.85	-3.85	3.71	-0.04	0.97
BM - BM1	2.17	1.77	0.32	1.51	2.84	6.71	**0.00**
Abd - Abd1	3.93	7.07	1.29	1.29	6.57	3.05	**0.00**
Sprint_20m - Sprint_20m1	-0.29	0.48	0.09	-0.47	-0.12	-3.38	**0.00**
UHP - UHP1	9.87	6.10	1.11	7.59	12.14	8.87	**0.00**
OHP - OHP1	11.30	8.20	1.50	8.24	14.36	7.55	**0.00**
Serv - Serv1	3.20	3.66	0.67	1.83	4.57	4.79	**0.00**

DISCUSSION

There is no statistically significant difference (p=0,08) between body mass of volleyball players (TM) and untrained girls (TM1), although the average body mass of volleyball players is slightly higher. This result can be explained with the fact that, on average, volleyball players are taller than untrained girls, therefore their body mass is also slightly higher.

When comparing the average values of body height in the experimental (TV) and control group (TV1), we can conclude that there is a statistically significant difference between these values (p=0,01) in favor of volleyball players. These results stem from the fact that the selection in volleyball teams is based on taller players. It is general knowledge that body height is one of the key factors that determines the level of success in volleyball (Grgantov i dr., 2007.). This difference can be characterized as a phenomenon that is influenced by the training process, having in mind that body height is mostly genetically determined, and that thare is no evidence supporting the claim that physical activity has a positive influence on height increase (Šegregur et al, 2010).

T-test for small independent samples has shown that there is no statistically significant difference (p=0,82) between body mass index in volleyball players (BMI) and untrained girls (BMI1). Body mass index is calculated using body height and body mass, therefore there is no significant difference in BMI because of similarities in body mass.

As for the general motor abilities test results, there are statistically significant differences (p=0,00) between test results in: Sargent test from standing position, X test, medicine ball throw, torso flexion, as well as 20m sprint, all in favor of volleyball players.

The fact that volleyball players have displayed better results in Sargnet tests from standing and run-up positions can partly be attributed to the fact that they are involved in the training process,

which is why their speed and explosive power in leg muscles are higher than in untrained girls, and partly to the fact that this type of jump is present in volleyball, which means that volleyball players are familiar with the technique of this jump. Untrained girls haven't previously experienced these types of loads and related adaptations, therefore they have displayed significantly lower results in these tests (Jovanović, 2007).

Better results in the X test that volleyball players have displayed indicate that they are more agile, which means higher performance in high speed movements with frequent changes of direction (Nešić et al, 2013; Grbović, 2013). This agility is also caused by physical condition and experience that trained girls encounter on a daily basis as a part of competitive activities in volleyball, which is based on these high speed movements.

Medicine ball throw is also one of the tests where volleyball players display better results, which is logical considering the fact that arms and torso are fully and constantly engaged in volleyball, and that the load influences the develompent of muscle power in arms and torso. The way this test is conducted, and it includes throwing the ball, resembles a move that volleyball players make on every practice, specifically torso and arm movement during spike. Adaptation to this kind of movement and also to the load results in volleyball players displaying significantly better performance in the medicine ball throw test.

Repetitive power of flexor muscles (Abd) and locomotion speed (Sprint_20m) are general motor abilities which are not directly influenced by volleyball as a specific motor ability. However, it is undeniable that these abilities are a fundamental part of every athlete and they are constantly improved during the training process.

Of all the test that were conducted with the purpose of evaluating general motor abilities, the only one that didn't show statistically significant difference (p=0.97) between volleyball players (Flx) and untrained girls (Flx1) was the hamstring agility and hip joint mobility test, and we can even say that both groups had very similar results. We can conclude that average results of both groups are rather low, even though both volleyball players and untrained girls had bigger frequency of above average results. A probable cause of this is the fact that both physical education teachers and coaches do not focus on developing this ability, especially between ages 8 and 10 when the development should start (R. Medvedev, 1987). On the other hand, it is a type of motor ability that can easily be "lost" due to inadequate training.

T-test results have shown that all three specific motor ability tests, including UPH-UPH1, OHP-OHP1 and Serv-Serv1, display statistically significant differences (p=0,00) between results in volleyball players and untrained girls, in favor of volleyball players. This is an expected result considering the fact that even though untrained girls had the opportunity to practice certain elements of volleyball techniques during physical education classes, the time they spent in those classes, as well as the intensity of practice, can't compare to the intensity that is characteristic for a volleyball practice. Volleyball players spend more time mastering these elements and, therefore, display higher results.

CONCLUSION

Based on the displayed results, we can conclude that the first hypothesis was partially confirmed, considering the fact that statistically significant differences between volleyball players and untrained girls aged 15 were displayed, observing all the variables of general motor abilities, apart from flexibility, where no significant differences between the two groups were displayed. Speed and explosive power in legs, agility, shoulder strength, repetitive strength of flexor muscles and total locomotion speed are better developed in volleyball players in comparison to untrained girls. Volleyball practice, which incorporates various types of loads, in terms of vertical jumps, spikes and frequent changes of direction during volleyball movements, caused the organism to adapt to such types of loads. Regular physical education classes that untrained girls attend did not influence the development of mentioned abilities to such extent, therefore they displayed lower results in all the tests that evaluate general motor abilities.

Based on comparative statistics results for specific motor ability tests, we can conclude that the second hypothesis was completely confirmed, with volleyball players displaying significantly higher results in these tests. Setting, bump and serve are technical elements which volleyball is based

on and are an integral part of every volleyball practice. Large number of repetitions, frequency of repretitions, as well as attention that is paid in order to properly execute volleyball moves caused the volleyball players to better master those elements and therefore display higher results in tests that include the said elements. The group with untrained girls, apart from not having volleyball as a part of their physical education classes, did not have the opportunity to adequately master these elements in order to display results that are similar to those of volleyball players.

Overall, volleyball players are more developed than untrained girls of the same age, in terms of general and specific motor abilities (Nešić, 2002). These differences are mainly caused by the nature of volleyball practices, in terms of number of repetitions and different loads that the body adapts to during practices, but also in terms of attention that is paid to proper execution of technical elements that are an integral part of every volleyball practice. The importance of this study lies in identifying volleyball as a good „influencer" of positive changes in general motor abilities in older children. As such „influencer", volleyball can have a significant role in physical education classes in elementary schools, and eventually contribute to a better development of young students.

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MOTIVACIJA ŽENA ZA GRUPNE FITNES PROGRAME

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UVOD

U prirodi svakog čoveka, kao neponovljive individue, leži potreba za kretanjem. Nažalost, i pored te potrebe u svima nama, jedna od tekovina savremene civilizacije koja se javlja je pojava hipokinezije (nedostatak kretanja).

Pored problema hipokinezije javlja se i problem pravilnog korišćenja slobodnog vremena, odnosno dokolice. Čovek svoje slobodno vreme može koristiti za zadovoljenje svojih potreba za kretanjem, kroz primenu različitih oblika fizičkog vežbanja, i time može poboljšati funkcionalne sposobnosti svog organizma. U savremenim uslovima života i rada jedno od najaktuelnijih područja fizičke kulture je područje rekreacije. Definiciju rekreacije izvodili su mnogi autori, a u svim definicijama većina ih je saglasna da je rekreacija dobrovoljno izabrana aktivnost, a nikako nametnuta aktivnost. Relac (1975) ovu delatnost definiše na sledeći način: „Rekreacija znači celokupnu čovekovu aktivnost izvan profesionalnih obaveza, izabranu po želji, a doprinosi razvoju stvaralaštva, očuvanju telesnog i duševnog zdravlja, održavanju vitalnosti, odmoru, osvežavanju i razonodi." "To je slobodno izabrana, individiialna ili organizovana društvena delatnost, koja sredstvima fizičkog vežbanja i sportsko rekreativnim aktivnostima omogućuje ljudima aktivan odmor i zdravu zabavu i razonodu, koja im pomaže da održe dobro zdravlje, fizičku i radnu kondiciju i da ispolje svoje stvaralaštvo, koje im je specijalizovanim radom u velikoj meri uskraćeno" (Teofilović, 2012). Kreativnost kao bitna odlika čoveka, u uslovima automatizovane proizvodnje svedena je na minimum. Primenom odgovarajućih aktivnosti u slobodnom vremenu kreativnost i stvaralačke sposobnosti dolaze do izražaja. Takođe u slobodnom vremenu, primena oblika fizičkog vežbanja koji okuplja veći broj ljudi, omogućava druženje i lakšu socijalizaciju ličnosti u društvu, nasuprot otuđenosti koja je takođe jedan od negativnih produkata savremene civilizacije.

Aktivno i kreativno provođenje slobodnog vremena uz zadovoljenje potrebe za kretanjem može u potpunosti da se ostvari kroz neki od mnogobrojnih prvobitnih ili novonastalih grupnih fitnes programa koji se nude po fitnes centrima i teretanama širom sveta.

Grupni fitnes programi su svi programi koje se izvode organizovano u grupi, uglavnom uz muzičku pratnju. U grupne fitnes programe spadaju: aerobno vežbanje, vežbe snage i bodi i majnd programi. Aerobni programi su najrasprostranjeniji i najrazvijeniji.

Tako da nas ne iznenađuje podatak da danas egzistira mnoštvo grupnih fitnes programa u okviru rekreacije koji nam omogućavaju da odaberemo onaj koji nam najviše odgovara, kojim ostvarujemo postavljene ciljeve i koji je naravno, u pozitivnoj korelaciji sa našim opštim zdravstvenim stanjem. S obzirom na postojanje odnosa potreba-motivacija, definicija "motivacije" se može prema Rot-u iskazati kao: "Proces pokretanja aktivnosti radi ostvarivanja određenih ciljeva, usmeravanje aktivnosti naodređene objekte i regulisanje načina na koji će se postupiti, nazivamo motivacijom". On takođe dodaje: "One unutrašnje činioce koji pokreću na aktivnost, koji je usmeravaju i njome upravljaju-radi ostvarivanja određenih ciljeva, nazivamo motivima. Motivi su organski i psihološki činioci koji pokreću ili usmeravaju ponašanje čoveka ito kako njegove postupke tako i njegovo opažanje, mišljenje i učenje" (Rot, 1978).

Problemom motivacije za učešćem u rekreativnim aktivnostima bavili su se do sada mnogi autori, među kojima su: Havelka-Lazarević (1980), Volf (1975), Stefanović (1980), Mitić (1992), Stojiljković (1995), Havelka i Lazarević (1980) u svom delu: "Motivacija za bavljenjem sportom", iznose

svoja razmišljanja o ne-sportistima, rekreativcima: "Ako izuzmemo pojedince koji se profesionalno bave sportom, naradnom mestu sport se javlja prvenstveno kao rekreativna komponenta samih uslova rada glavno prisustvo sporta u životu radnih i ljudi ipak je uslovljeno njegovim prisustvom u socijalnim prostorima izvan radnog mesta, u situacijama u kojima pojedinac ima slobodu izbora i u kojima sam uobličava okolnosti pod kojima će zadovoljiti svoje istaknute potrebe".

Svrha ovog rada je istraživanje motivacije žena za grupne fitnes programe.

METOD

Metod teorijske analize je korišćen kao osnovni metod korišćen u radu, a pored toga urađen je transferzalni presek manifestne motivacije za vežbanje, dok je latentni proctor motivacije urađena faktorsk analiza. Istraživanje je sprovedeno na uzorku od 105 žena koje su vežbale u šest fitnes centara u Beogradu: Hillgym 1, Hillgym 2, Aerobic team, Agoga, SnLuxFitnescentar, Mozzart gym, Hercules fitnes, Elle fitnes. Fitnes centri se nalaze u Beogradu: na Banovom brdu, Vidikovcu, Skojevskom naselju, Voždovcu, Žarkovu i Kumodražu. Grupni fitnes programi koji su vežbačice praktikovale su: "Pilates", "Tabata", Step aerobik, "Zumba" i "Tae bo".

Uzorak varijabli je razvrstan u dve grupe:

1. Opšti podaci: uzrast ispitanika, telesna visina, telesna masa, bračno stanje, kvalifikacija, iskustvo u vežbanju, fitnes status, nivo fizičkih sposobnosti, broj fitnes centara u kojima su vežbali, raniji sportovi kojima su se bavili, fitnes programi koje su vežbali i broj instruktora sa kojima su vežbali.

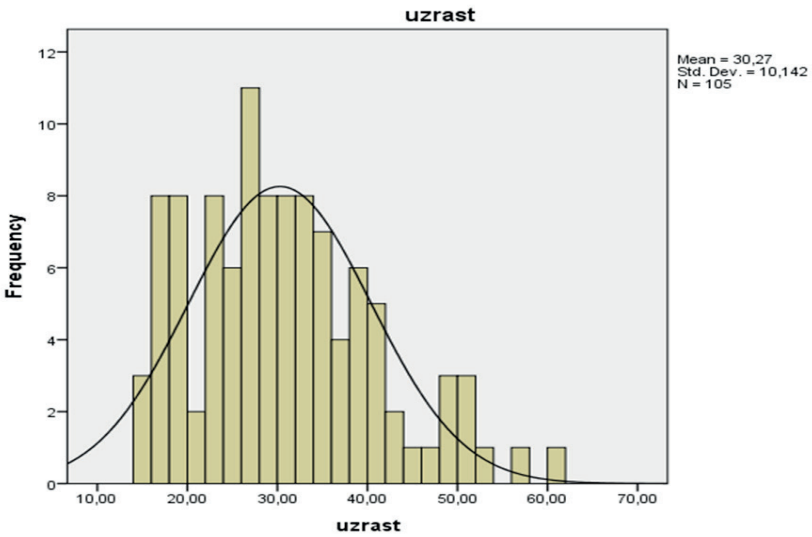
2. Motivacija za vežbanje grupnih fitne sprograma

Instrument za merenje varijabli ovog istraživanja je bio anketni upitnik. Sastojao se od 12 opštih pitanja, i 48 pitanja koja su se odnosila direktno na motivaciju žena za grupne fitnes programe. Kao instrument korišćen je modifikovan upitnik MP-M od Petkovšeka. Sadrži 48 pitanja Likertovog tipa sa odgovorima na petostepenoj skali, modifikovan od strane Zagorc (1985), koje je doradio Mitić 1994. Za potrebe ovog istraživanja urađeno je usklađivanje tremina aerobik u grupno vežbanje, odnosno vežbanje, u zavisnosti od konstelacije pitanja.

Svi podaci, do kojih je istraživač mogao da dođe u procesu istraživanja, su obrađeni postupcima deskriptivne statistike kod manifestnog prostora motivacije i korišćenjem odgovarajuće faktorske analize kod latentnog prostora motivacije. Obrada podataka je izvšena na personalnom računaru, uz korišćenje aplikacionog programa SPSS17.

REZULTATI SA DISKUSIJOM

Analizom dobijenih rezultata i primenom odgovarajućih statističkih metoda za obradu podataka, dobijeni su rezultati koji treba da pruže informacije o motivaciji žena za grupne fitnes programe u 2015. Prosečna starost vežbačica je 30 godina, u rasponu od 15 godina koliko ima najmlađa ispitanica do 60 godina. Na Grafikonu 1. zapažamo da ima najviše vežbačica starosti 27-28 godina, a najmanje od 45-48 i 53-60 godina. Standrdna devijacija iznosi 10,14 što govori o homogenosti uzoraka.



Grafikon 1. Uzrast vežbačica grupnih fitnes programa 2015. g.

Za potrebe komparacije rezultata i dalje analize uzorak smo podelili u tri grupe na bazi percentilnog rango tako da imamo tri približno slične uzrasne kategorije:

- mlađi 33,3%, do 25 godina,
- srednji 40,0%, od 26 do 36 godina,
- stariji uzrast 26,7%, od 37 godina.

Grupne fitnes programe najviše upražnjavaju žene mlađeg i srednjeg uzrasta (73,3%) što se skoro poklapa sa procentom udatih i neudatih vežbačica, dok manje žene starijeg uzrasta (26,7%).

Neprekidnim, dinamičnim razvojem i uvođenjem novih zanimljivih vrsta grupnih fitnes programa, ovakav način vežbanja opstaje kao dominantan u protoru ponuda koje daje fitnes industrija. Uočavamo povećanje broja redovnih vežbačica, a takođe i broj početnika koji pred sobom imaju veći izbor grupnih fitnes prorama.

Srednja vrednost telesne visine iznosi 169cm, a varirala je od od 156cm, koliko je imala najniža vežbačica, do 185cm koliko je imala najviše vežbačice a standardna devijacija bila je 6,17.

Srednja vrednost TM 59,43kg a varirala je od minimalne vrednosti od 43kg, do maksimalne vrednosti od 98kg, a standarna devijacija 7,8. Najveći broj vežbačica se kreće u rasponu od 52 do 62 kg što predstavlja normalne vrednosti telesne mase.

Bodi mas indeks uzoraka iz 2015. u proseku iznosi 20,8 što spada u opseg normalne uhranjenosti (18,5 do 25). Pohvalno je što su vežbačice u dobroj formi i što uz pomoć fizičke aktivnosti (a sigurno i ishranom), održavaju dobar odnos telesne visine i mase. Najveći broj vežbačica je u rasponu od 18 do 22, a standardna devijacija iznosi 2,48. Minimalne vrednosti 15,99 su ispod normalnih granica, što spada u pothranjenost, pojava koja se sve češće javlja u našoj zemlji i svetu. Dok maksimalne vrednosti koje su 32,00 spadaju u gojaznost prvog stepena. U Srbiji je gojazno ili ima prekomernu težinu oko 17 odsto žena iz čega možemo da zaključimo da populacija devojaka i žena koje redovno vežbaju neki od grupnih fitnes programa značajno odstupa od populacije je im je BMI u akegoriji prosečnog.

Kod analize varijable iskustva u vežbanju, dominantna je kategorija sa manjim ranijem iskustvom sa 58,09% ispitanica, sledi kategorija sa velikim iskustvom u vežbanju od 35,24%, dok mali broj od 6,67% nije imao nikakva ranija iskustva pre početka sa grupnim fitnes programima.

Korisnice grupnih fitnes programa su svoj nivo fizičkih sposobnosti okarakterisale kao prosečan u 70,48% slučajeva, 17,14% se izjašnjavaju sa nivoom iznad proseka i visokim (9,52%). Niko nije u kategoriji nizak nivo sposobnosti a ispod proseka je svega 2,86% ispitanica.

Svaka vežačica je vežbala u proseku u tri fitnes kluba pre fitnes kluba u kome je upražnjavala neki od vidova grupnih fitnes programa. Što se tiče sportskog iskustva, u proseku svaka žena je imala kontakt sa dva sporta pre bavljenja grupnim fitnes programima.

Iskustvo vežbanja procenjivali smo i brojem instruktora grupnih fitnes programa, sa kojima su vežbale. Raspon je od 1 do 12 instruktora a prosek je 4 instruktora koja su joj vodila neki tip grupnih fitnes programa.

Na osnovu odgovora učesnica u grupnim fitnes programima uočavamo da su u manifestnom prostoru najjače izraženi motivi:

- korisno po zdravlje 4.83,
- poboljšanje telesne kondicije 4.69,
- jer nakon vežbanja osećam smanjenje psihičke napetosti4.66,
- da bih imala lepšu figuru 4.63,
- vitalnost, uživanje u vežbanju...

Iz tabele 1. vidimo prvih deset motiva koji su razlog bavljenja grupnih fitnes programa žena u 2015. Raste svest o značaju redovne fizičke aktivnosti na zdravlje, pa nije iznenađujuće što nailazimo na tu činjenicu da je to jedan od najjačih motiva za učešće žena u grupnim fitnes programima. Mala je procentualna razlika izmedju ostalih devet motiva pa se može zaključiti da su žene podjednako svesne pozitivnih uticaja fizičke aktivnosti na njihovo telesno i duhovno zdravlje i opuštanje.

Tabela 1. Prvih deset rangiranih motiva iz 2015.

Motivacione varijable	**Rang**	**Prosečna vrednost**
Jer sam sigurna da to koristi mom zdravlju	1	4,83
Da bih poboljšala telesnu kondiciju	2	4,69
Jer nakon vežbanja osećam smanjenje psihičke napetosti	3	4,66
Da bih imala lepšu figuru	4	4,63
Jer mi nakon rada prija vežbanje	5	4,57
Jer želim da još dugo ostanem mlada i vitalna	6	4,48
Jer uživam u vežbanju	7	4.47
Zato što uživam u vežbanju uz muziku	8	4,43
Jer se na grupnom vežbanju telesno i duhovno opuštam	9	4,41
Jer su žene koje se bave vežbanjem lepše građene	10	4,36

Tabela 2. Objašnjenje varijanse u faktorskoj analizi

Faktor	POČETNA VREDNOST			SUME KVADRATA OPTEREĆENJA			ROTACIJA SUME KVADRATA OPTEREĆENJA		
	Zbir	% Varianse	Kumulativni %	Zbir	% Varianse	Kumulativni %	Zbir	% Varianse	Kumulativni %
1	21.780	45.374	45.374	21.780	45.374	45.374	19.877	**41.411**	41.411
2	4.590	9.563	54.937	4.590	9.563	54.937	6.216	**12.949**	54.360
3	1.913	3.984	58.921	1.913	3.984	58.921	2.121	**4.418**	58.778
4	1.785	3.719	62.640	1.785	3.719	62.640	1.854	**3.862**	62.640

U latentnom prostoru je izdvojeno, faktorskom analizom oblimin rotacijom, 4 nezavisnih faktora koji objašnjavaju 62,5% ukupne varijanse sistema (tabela 2.). Izdvojeni su faktori koje smo radno nazvali:

- Samoaktualizacija prikuplja 41,4% ukupne varijanse sistema
- Psihološko opuštanje 12,9%,
- Uticaj propagande 4,4%,
- Zadovoljstvo 3,8%.

Faktor koji se izdvoji sa najvećim procentualnim udeom od 41,4%, "Samoaktualizacija", iz čega zaključujemo da su žene vođene prihvatanjem i ispoljavanjem unutrašnjeg Ja, odnosno postizanje potpunog razvoja ličnih potencijala, što je i prema Maslovu osnovni ljudski motiv.

Drugi motiv, koji smo radno nazvali "Psihološko opuštanje", sa 12,9%, što pokazuje da su vežbačice svesne pozitivnog uticaja bavljenja fizičkom aktivnošću ne samo na telesno nego i na mentalno zdravlje i opuštanje. Takodje pored svesnosti ove činjenice one pronalaze u njoj i pokretač za bavljenjem grupnim fitnes programima.

Uticaj propagande sa 4,4% je očekivan ali se vidi da ovaj faktor nema veliki uticaj na motivaciju žena za bavljenjem grupnim fitnes programima kao što to imaju prethodno navedeni unutrašnji motivi. Nezavisni faktor "Zadovoljsto", iako sa svojih 3,8% čini mali udeo od 62,5% ukupne varijanse sistema, svakako daje jasnu sliku da su žene izabrale neki od vidova grupnih fitnes programa kao sredstvo za zadovoljenje svojih unutrašnjih potreba.

Za potrebe dalje analize povezanosti motivacije za grupno vežbanje sa drugim sociodemografskim karakteristikama urađeno je ravrstavanje motivacije za vežbanje u tri kategorije. Za potrebe dalje analize uradili smo kategorizaciju motivacije za grupno vežbanje na tri kategorije na bazi 33 percentilnog ranga.

Srednje razvijena motivacija u rasponu od 120 do 180 ulazi 41% žena, dok sa slabim i jakim motivima ima podjednak iznos od 29,5%, pri čemu je prosečna vrednost 171,63 i standardnom devijacijom 33,84.

Tabela 3. Povezanost kategorija uzrasta i motiva

			Kategorije motivacije			
			Slaba	Srednja	Razvijena	Zbir
Kategorije uzrasta	Mlađe	Izračunat % u katuzrast	**5**	**11**	**19**	**35**
			14.3%	*31.4%*	*54.3%*	*100.0%*
	Srednji uzrast	Izračunat % u katuzrast	**16**	**17**	**9**	**42**
			38.1%	*40.5%*	*21.4%*	*100.0%*
	Stariji uzrast	Izračunat % u katuzrast	**10**	**15**	**3**	**28**
			35.7%	*53.6%*	*10.7%*	*100.0%*
Zbir		Izračunat % u katuzrast	**31**	**43**	**31**	**105**
			29.5%	*41.0%*	*29.5%*	*100.0%*

1. Žene iz prve kategorije tj. mlađeg uzrasta imaju izražene srednje i jake motive sa ukupno 85,7%, dok samo 14,3% slabe motive za bavljenje grupnim fitnes programima.

2. 78,6% čine srednji i jaki motivi kod žena srednjeg uzrasta, dok 21,4% slabi motivi.

3. Sa porastom godina, stariji uzrast, dolazi do promene u jačini motiva, pa najveći procenat pripada slabim i srednjim, a samo 10,7% jakim motivima.

ZAKLJUČAK

Na uzorku od 105 žena u Beogradu koje su vežbale redovno tokom 2015. godine, najznačajnije se manifestuju motivi u manifestnom prostoru: korisno po zdravlje 4.83, poboljšanje telesne kondicije 4.69, osećanje smanjenosti psihičke napetosti 4.66, radi lepše figuru 4.63, vitalnost, uživanje u vežbanju. Faktorskom analizom oblimin rotacijom u latentnom prostoru izdvojila su se četri nezavisna faktora koja objašnjavaju 62,5% celokupne varijanse sistema. Izdvojeni su faktori koje smo radno nazvali: "Samoaktualizacija" koja objašnjava 41,4% ukupne varijanse sistema, "Psihološko opuštanje" 12,9%, "Uticaj propaganda" 4,4% i "Zadovoljstvo" 3,8%. Jačina motiva kod žena koje su se bavile grupnim fitnes programima u 2015. se razlikuje i u odnosu na kategorije uzrasta. Iz sprovedenog istraživanja se vidi da vežbačice mlađeg i srednjeg uzrasta imaju izražene srednje i jake motive kod 79,65% slučajeva, a slabe motive 17,85%. Sa porastom godina, stariji uzrast, dolazi do promene u jačini motiva, pa najveći procenat pripada slabim i srednjim, a samo 10,7% jakim motivima.

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MOTIVATION OF WOMEN FOR GROUP FITNESS PROGRAMS

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INTRODUCTION

In the nature of a man, as unrepeated individual, there is a need for movement. Unfortunately, despite this need in all of us, one of the achievements of modern civilization that appears is a phenomenon of hypokinetics (lack of movement).

Besides the problem of hypokinetics, there is also a problem of proper use of leisure time, that is to say idleness. Men can use leisure time to satisfy their need for mobility, through the use of various forms of physical exercise, and thus can improve the functional capabilities of their body. In modern conditions of life and work, one of the most contemporary areas of physical education is an area of recreation. Many authors defined recreation, and in all definitions, most of them agree that the recreation is voluntarily chosen activity, and not imposed activity. Relac (1975) defines this category as follows: "Recreation means the whole man's activity beyond professional obligations, selected as desired, and contributes to the development of creativity, preservation of physical and mental health, maintaining vitality, rest, freshness and pleasure." "This is free chosen individual or organized social activity which by physical exercise and sports and recreational activities enables people an active and healthy fun and entertainment, which helps them to maintain good health, physical and working condition and to express their creation which is, by specialized work, largely deprived " (Teofilovic, 2012). Creativity as an essential characteristic of a man, in terms of automated production is reduced to a minimum. By applying of the appropriate leisure activities, creativity and creative abilities come to the fore. Also in their free time, the application forms of physical exercise which brings together a number of people, enable socialization and easier socialization of personality in society, as opposed to alienation, which is also one of the negative products of modern civilization.

Active and creative use of free time while satisfying the need for mobility can be fully realized through one of the many original or new group fitness programs offered at fitness centers and gyms around the world.

Group fitness programs are all programs that are running in an organized group, mainly with musical accompaniment. Group fitness programs include: aerobic exercise, strength training and body and mind programs. Aerobic programs are the most abundant and most developed.

Thus, we are not surprised by the fact that today there are a lot of group fitness programs in recreational settings that enable us to choose the one that best suits us, by which we achieve our aims and which is in a positive correlation with our state of health.

Given the existence of a need-motivation, the definition of "motivation" may be what Rot stated as: "The process of launching activities aimed at achieving certain goals, directing activities on undetermined facilities and regulation of the way they will be treated, we call it motivation."

He also adds: "These internal factors that drive the activity, which direct and manage - to achieve their goals, we call them motives. The motives are organic and psychological factors that trigger or direct the man's behavior clearly in a manner of his actions and his perception, opinion and learning "(Roth, 1978).

With the problem of motivation to participate in recreational activities many authors have dealt with it so far, including: Havelka-Lazarevic (1980), Wolf (1975), Stefanovic (1980), Mitic (1992), Stojiljkovic (1995), Havelka and Lazarevic (1980) in their book: "The motivation for playing sports,"

share their opinions on non-sportsmen: "If we exclude individuals who are professionally involved in sports, on a workplace sport occurs primarily as a recreational component of the very conditions of operation, the presence of sport in lives of working and people are still conditioned by its presence in social spaces outside the workplace, in situations in which the individual has freedom of choice in which they alter the circumstances under which it will meet its outstanding needs."

The purpose of this study was to investigate the motivation of women for group fitness programs in 2015.

METHOD

The main method used in this paper is a method of theoretical analysis, and authors used transverse cross-section and comparing non-parametric methods. For the needs of the paper, it was planned to investigate the motives of women for group fitness programs. Therefore, it meant a large number of fitness centers, that is to say, group fitness programs. Fitness centers in which the research was conducted on a sample of 2015, 105 women were: Hillgym 1, Hillgym 2, aerobics team, Agogo, SN Lux fitnes centar, Mozart gym, Hercules Fitness, Elle fitness. All fitness centers are located in Belgrade on Banovo Brdo, Vidikovac, Skojevsko, Voždovac, Žarkovo and Kumodraž. Group fitness programs that trainees have practiced are: Pilates, Tabata, step aerobik, Zumba and Tae bo.

The sample of variables is classified into two groups:

1. General information: age, body height, weight, marital status, qualifications, experience in training, fitness status, level of physical ability, the number of fitness centers, previous sports, the former fitness styles and number of instructors.

2. Motivation.

Instrument for measuring variables of this study was a questionnaire. It consisted of 12 general questions and 48 questions that are directly related to the motivation of women for group fitness programs. We used a modified questionnaire MP-M from Petkovšek. It contains 48 Likert-type questions with answers on a five-point scale, modified by Zagorc (1985). All data, to which the researcher could come in the research process were analysed by using descriptive and comparative non-parametric statistics. Data processing was done on a personal computer, using SPSS-15 application program.

RESULTS WITH DISCUSSION

By the analysis of the results and the application of appropriate statistical methods for data processing, the obtained results provided information on the motivation of women for group fitness programs in 2015. The average age of the trainees was 30 years, ranging from 15 years as youngest respondents up to 60 years. The most trainees were 27-28 years old, followed by of 45-48 and 53-60 years-olds. Standard deviation is 10.14 which indicates the homogeneity of the samples.

For the purpose of result comparison and further analysis, the sample was divided into three groups based on Percentile Ranking so we have three approximately similar age categories:

- younger 33.3%, to 25 years,
- middle-aged 40.0%, from 26 to 36 years,
- older was 26.7%, from 37 years.

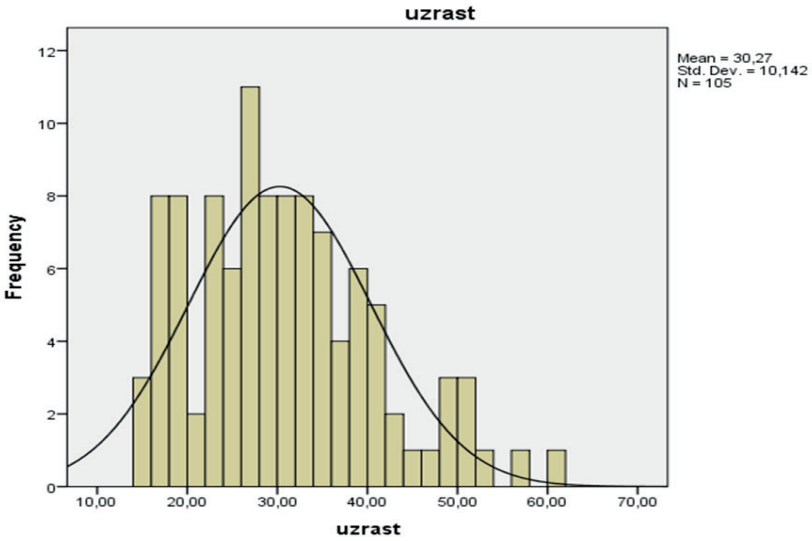

Figure 1. Age of women in group fitness programs 2015.

Group fitness programs are mostly practiced by younger and middle aged women (73.3%), which almost coincides with the percentage of married and unmarried trainees have, but less women of older age (26.7%).

By continuous, dynamic development and introduction of new interesting types of group fitness programs, this kind of practice persists as dominant and leading sport and recreation way of using free time. It is certainly one of the main reasons regular increasing number of ordinary trainees and also the number of beginners who are facing a greater selection of group fitness programs.

Body height of trainees in 2015 ranged from 156 cm (height of the shortest trainee) to 185cm (height most trainees have). The middle value of body height is 169cm, and the standard deviation 6.17. It was concluded that the minimum values of body mass are 43kg and 98kg maximum. The middle value TM 59,43kg and Standard Deviation 7.8. Majority of trainees are in the range of 52 to 62 kg, which represents a normal body weight values (considering that we are familiar with their body height).

We notice that the minimum and maximum values of body weight (43-98 kg) are outside the scope of normal values, which will be more precisely determined using the body mass index.

Body mass index of samples from the 2015, is on average 20.8 which falls within the scope of normal weight (18.5 to 25). It is commendable that the trainees have been in good shape and that with the help of physical activity (and of diet certainly), they maintain a good balance of body height and weight. Majority of trainees between 18 and 22, and the standard deviation is 2.48. Minimum values of 15.99 are below the normal range, which belongs to malnutrition, a phenomenon that is increasingly occurring in our country and the world. While the maximum values of 32.00 fall into obesity of the first degree. In Serbia, about 17% of women are obese or overweight, and it is not the case with the research in 2015, that is to say the percentage of obese women is significantly lower.

Majority of samples from 2015, about the experience in practice, belongs to a group with less prior experience (58.09%) and extensive experience in practice (35.24%), while a minority (6.67%) had no previous experience before starting with group fitness programs.

The level of their physical abilities the trainees of group fitness programs have characterized the average level of ability in considerate extent (70.48%), while the number of those who identify themselves with a level above average (17.14%) and high (9.52%). The low level of capacity (0%) and below the average (2.86%), almost insignificant number.

Each trainee practiced on average in three fitness clubs before fitness club where they practiced some form of group fitness programs. As for the sports experience, on average, every woman has had a contact with two sports before practicing group fitness programs. A slightly higher number appears when it comes to instructors of group fitness programs, with a minimum number of 1 and a maximum of 12. On average, each trainee has changed 4 instructors that led some type of group fitness programs.

During 2015, in the manifest area all basic motivation variables are strongly expressed:

- useful to health 4.83,
- improvement of physical condition 4.69,
- because after exercise I feel reduction in psychological tension 4.66,
- I would have more beautiful figure 4.63,
- vitality, enjoyment of exercise ...

Table 1. The top ten ranked motives from 2015

Motivation variable	Range	Average
Because I am sure it is beneficial for my health	1	4,83
In order to improve my physical condition	2	4,69
Because I feel less tense after exercising	3	4,66
In order to have better body	4	4,63
Because I feel better after exercising	5	4,57
Because I want to be vital and beautiful as long as possible	6	4,48
Because I enjoy exercising	7	4.47
Because I enjoy exercising with music	8	4,43
Because I feel physically and spiritually better in group exercising	9	4,41
Because women who exercise have better body shape	10	4,36

From Chart 1 we see the first ten motives that are the reason for women group fitness programs in 2015. It is commendable, as is the large number of trainees have to be regularly engaged in group fitness programs, as well as attitudes towards dealing with the same. The importance of practicing physical activity on health is increasingly recognizable, so it is not surprising that we find the fact that this is one of the strongest motives for participation of women in group fitness programs. The percentage of difference between the other nine motives is small, so it can be concluded that women are equally aware of the positive impact of physical activity on their physical and spiritual health and relaxation.

Table 2. Explanation of variance in the factor analysis

COMPONENT	INITIAL VALUE			SUMS OF LOAD SQUARES			ROTATION OF THE SUMS OF LOAD SQUARES		
	Total	% Variances	Cumulative %	Total	% Variances	Cumulative %	Total	% Variances	Cumulative %
1	21.780	45.374	45.374	21.780	45.374	45.374	19.877	**41.411**	41.411
2	4.590	9.563	54.937	4.590	9.563	54.937	6.216	**12.949**	54.360
3	1.913	3.984	58.921	1.913	3.984	58.921	2.121	**4.418**	58.778
4	1.785	3.719	62.640	1.785	3.719	62.640	1.854	**3.862**	62.640

In the latent space 4 independent factors that explain 62.5% of the total variance of the system (Chart 2) have been allocated. We separated factors with draft names as follows:

- Self-actualization 41,4%,
- Psychological relaxation 12,9%,
- The influence of propaganda 4,4%,
- Satisfaction 3,8%.

The factor that stands out with the highest percentage of the share of 41.4% is self-actualization, from which we conclude that women are guided by accepting and manifestation of the inner self, that is to say, achievement of the full development of personal potentials. According to Maslow, this is a basic human motive.

Another motive is psychological relaxation with 12.9%, indicating that the trainees have been aware of the positive impact of their sports activities not only on physical, but also on mental health and relaxation. Also, in addition to awareness of this fact, they find in it a driving force for dealing with group fitness programs.

Nowadays the influence of commercials (4.4%) is inevitable, but the percentage shows that this factor has no major impact on the motivation of women to become involved in group fitness programs as previously mentioned inner motives have. Independent satisfaction factor, though, with its 3.8% makes a small share of 62.5% of the total variance of the system, certainly provides a clear picture that the women have chosen some form of group fitness programs as a mean to meet their internal needs.

For the purposes of further analysis of association between motivations for group exercise with other sociodemographic characteristics, motivation for exercise is classified into three categories. The motives collectively appear in the greatest number in the range of from 120 to 180, of the maximum of 250, and with the average of 171.63 and a standard deviation of 33.84. By dividing the motives collectively, three categories are obtained:

- low,
- medium,
- strong motives.

41% of women belong to the second category, with medium motives, while the low and strong motives have an equal amount of 29.5%. From the results we can conclude that the trainees have been well motivated for participation in group fitness programs.

Table 3. Correlation between age categories and motives

			catmot			
			1,00	2,00	3,00	Total
Cat.age	1,00	Calculated % in catage	**5**	**11**	**19**	**35**
			14.3%	*31.4%*	*54.3%*	*100.0%*
	2,00	Calculated% in catage	**16**	**17**	**9**	**42**
			38.1%	*40.5%*	*21.4%*	*100.0%*
	3,00	Calculated % in catage	**10**	**15**	**3**	**28**
			35.7%	*53.6%*	*10.7%*	*100.0%*
Total		Calculated % in catage	**31**	**43**	**31**	**105**
			29.5%	*41.0%*	*29.5%*	*100.0%*

1. Women in the first category i.e. younger age have expressed medium and strong motives with a total of 85.7%, while only 14.3% of low motives for engaging in group fitness programs.

2. 78.6% are medium and strong motives of middle aged women, while 21.4% are low motives.

3. With the ages (older age) there is a change in the strength of the motives, and the highest percentage belongs to low and medium, and only 10.7% to strong motives.

CONCLUSION

In a sample of 105 women in Belgrade who exercised regularly in 2015, the most important motives are manifested in the manifest space: 4.83 useful to health, improvement of physical condition 4.69, feeling of reduction of psychological tension 4.66, for more beautiful figure 4.63, vitality, enjoyment of exercise. By factor analysis rotations in latent space four independent factors stand out that explain 62.5% of the total variance of the system. Separated factors with draft names are: self-actualization 41.4%, 12.9% psychological relaxation, the influence of commercials 4.4% and 3.8% satisfaction. The strength of the motives of women who were involved in group fitness programs in 2015 is different in relation to age categories. From the research conducted, it is shown that younger and middle aged trainees have expressed medium and strong motives with an average of 79.65% and 17.85% of low motives. With the ages (older age) there is a change in the strength of the motives, and the highest percentage belongs to low and medium, and only 10.7% to strong motives.

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UDK 371.8

KVALITET ŽIVOTA DECE I OMLADINE ŠKOLSKOG UZRASTA

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UVOD

Kvalitet života, kao termin u medicinskoj literaturi se pojavio krajem 70-tih godina XX. veka, a kao predmet iztraživanja je doživeo veliku ekspanziju u poslednjoj deceniji XX. veka. Sa današnjeg aspekta proučavanja ima značajno mesto u praksi zdravstvene zaštite i naučno-istraživačkom radu. Razmatran je i u okviru društvenih nauka, od strane sociologa koji kvalitet života vezuju za materijalne uslove jedinke i osećanja u vezi sa tim. Za procenu kvaliteta života sociolozi koriste skup parametara među koje spadaju telesno i emocionalno stanje, vitalnost, funkcionalnost, lična i duhovna ispunjenost, adekvatnost stanovanja i ishrane, zaposlenost, socijalna integrisanost, socijalno okruženje i podrška društvene okoline (Sociološki rečnik, 2007: 281). Sa razvojem društva, razvijaju se i indikatori kvaliteta života, tako da se pored materijalnih uslova procenjuju i duhovne vrednosti, kao što su zadovoljstvo, lični razvoj i pripadnost zajednici. Subjektivni indikatori kvaliteta života imaju veze sa osećanjima, odnosno, emocionalnim blagostanjem i životnim zadovoljstvom, dok se objektivno stanje procenjuje ekonomskim indikatorima.

Veliko interesovanje za kvalitet života, u okviru medicine, uslovljen je razvojem nauke o zdravlju i zdravstvenoj zaštiti, od momenta kada je WHO (Svetska zdravstvena organizacija) definisala zdravlje kao «Stanje potpunog fizičkog, mentalnog i socijalnog blagostanja, a ne samo odsustvo bolesti i onesposobljenosti» (navod prema Kvrgić, S., 2001:10). Mada je ideja o procenjivanju kvaliteta života široko prihvaćena od strane istraživača različitih oblasti, nema jedinstvene definicije. Usled toga i indikatori kvaliteta života nisu jasno određeni, već obuhvataju širok spektar različitih mera, pri čemu su male razlike između skala za procenu kvaliteta života i onih za merenje ukupnog zdravlja. Ipak, najveći broj autora posmatra kvalitet života kao kompleksnu funkciju koja sadrži više oblasti ili domena u životu i radu individue, uključujući fizičke i socijalne funkcije, mentalni status, težinu simptona, ili zdravstvenu oslabljenost i ličnu percepciju zdravlja. ***Predmet*** ove pilot studije je uporedno sagledavanje kvaliteta života dece školskog uzrasta, sa aspekta mogućnosti primene fizičke aktivnosti kod dece sa zdravstvenim tegobama i prikaz trenutnog stanja kod uzorka ispitanika različitog etničkog porekla. Zdravstvena oslabljenost se manifestuje slabljenjem ili ograničenjem fizičke, čulne i mentalne funkcije, ili funkcije delovanja unutrašnjih organa, koje brane aktivno i punopravno učešće takvih pojedinaca u fizičkom vaspitanju i sportu. Ključni ***problem***, kao i celokupna problemska orijentacija ovog istraživanja, vezuje se za analizu 11 tematskih celina ($C_{1)}$ -($C_{11)}$ odnosno pojedinih segmenata upitnika (Q) za procenu ***Zdravlja i kvaliteta života*** (HSW) učenika viših razreda osnovne škole. U Konvenciji o pravima deteta, usvojenoj (1989) od strane UN (Ujedinjenih nacija), ističe se da deca imaju pravo na zdravlje i blagostanje. Otuda je ***cilj*** ove pilot studije ispitivanje stavova učenika viših razreda osnovne škole, primenom adaptiranog jedinstvenog upitnika. Shodno tome, u istraživanju su postavljeni operativni ***zadaci***: da se prikažu uporedni parametri pojedinih obeležja/stavki u okviru I. ($C_{1)}$ do (C_{11}) XI. segmenta upitniku, u odnosu na stavove dve grupe ispitanika različitog etničkog porekla; b) da se utvrde razlike između stavove dve grupe ispitanika u odnosu na primenjene stavke u okviru pojedinih segmenta ($C_{1)}$ do ($C_{11)}$ upitnika; c) da se definišu karakteristike svakog sub-uzorka ispitanika, u odnosu na primenjene stavke u oviru pojedinih segmenata (C_1) do (C_{11}) upitnika; d) da se odredi doprinos celina (C) karakteristikama grupa različitog etničkog porekla.Uzimajući u obzir prethodna iskustva, osnovu problema, predmeta i ciljeva istraživanja, kao i metodološki pristup u ovom istraživanju, mogu se postaviti osnovne hipoteze:

- $\mathbf{H_0}$ Ne postoji razlika između *„grupa ispitanika"* (različitog etničkog porekla), u odnosu na ispitivane stavke u okviru pojedinih segmenata upitnika Q (HSW), definisanih kao celine $C_{1)} - C_{11)}$.
- $\mathbf{A_0}$ Postoji razlika između *„grupa ispitanika"* u odnosu na ispitivane stavke u okviru pojedinih segmenata upitnika Q (HSW), definisanih kao celine $C_{1)} - C_{11)}$.

S' obzirom na mali broj istraživanja, sprovednih u ovoj oblasti u našoj zemlji, koja se bave merenjem kvaliteta života dece, ovo istraživanje je delimično zasnovano na modelu, koji je realizovala Kvrgić, S. (2001) i publikovala kao monografiju *Kvalitet života školske dece i omladine* (priređena magistarska teza «*Procena zdravlja i kvaliteta života školske dece i omladine u Jugoslaviji*», koje se smatra za prvo istraživanje ove vrste u bivšoj Jugoslaviji.

Sledeće značajno istraživanje u ovoj oblasti je sprovedeno od strane Samuilidou, E. (2004) i publikovano kao monografija *Stimulacija motornog razvoja učenika sa mentalnom retardacijom* (priređena doktorska teza «*Značaj programiranog somatopedskog tretmana u procesu profesionalnog osposobljavanja hendikepiranih učenika*» odbranjena 2001. godine na Defektološkom fakultetu u Beogradu.

METOD

Za razliku od prikazanog modela, u ovoj pilot studiji je primenjena verzija Upitnika koja se odnosi na sagledavanje komponenti zdravlja samo od strane dece školskog uzrasta. Posmatrane promenljive su obeležja/stavke. Obeležja u odnosu na koja se deli uzorak na subuzorke/grupe su kriterijumska obeležja. Više obeležja, koja su međusobno smisleno povezana i čine logičnu celinu (C), zovu se jednostavno „celina" (segment/skala). Sve posmatrane tematske celine čine prostor istraživanja. Analiziraće se razlika u odnosu na kriterijum ***grupe različitog etničkog porekla***. Povezanost sa socijalno-demografskim karakteristikama nije ispitivana, niti je prikazan socijalni status roditelja, kao uvodni deo upitnika.

Ispitanici

Analizirano je 45 ispitanika, učenika viših razreda osnovne škole, oba pola, podeljen u dva sub-uzorka/grupe u odnosu na njihovo različito etničko poreklo: GRE-1 (N=15), učenici stranog/grčkog državljanstva (sa Krita) i SRB-2 (N=30), učenici domaćeg/srpskog državljanstva (iz Niša).

Instrument istraživanja

Upitnik (Q) je konstruisan za procenu kvaliteta života, zdravlja i socijalnog blagostanja (HSW), dece oba pola, školskog uzrasta. Uvodni deo upitnika sadrži stavke (1-7) koje se odnose na neke socijalno-demografske pokazatelje u vezi članova porodice ispitanika (oca, majke), koji u ovoj pilot studiji nisu prikazani. Ostali deo Upitnika (Q) se odnosi na izjašnjavanje ispitanika u pogledu pojedinih segmenata/ celina (C), kojih ima ukupno 11, a ponuđena su četiri modaliteta (stepena) izjašnjavanja, tipa Likert-a, intenziteta od 1 do 4. Nazivi i opisi pojedinih skala (u ovoj studiji) navedeni su prema Kvrgić, S. (2001): str. 22-24 (Izvor: *The CHQ User's Manual.* Landgraf, Ware, Abetz, 1996).

Prostor istraživanja

Prostor ovog istraživanja sadrži 11 tematskih celina ($C_1 – C_{11}$) koje su analizirane u odnosu na različite „grupe" vezano za etničku pripadnost (GRE-1; SRB-2):

C_1 – *Skala fizičkog funkcionisanja*, koju čine stavke: SFF8, SFF9, SFF10;

C_2 – *Skala ostvarivanja socijalne uloge (zavisno od fizičkog zdravlja)*, koju čine stavke: SSR11, SSR12;

C_3 – *Skala globalnog zdravlja*, koju čine stavke: SGH13, SGH14, SGH15;

C_4 – *Skala telesnog bola*, koju čine stavke: SBP16, SBP17;

C_5 – *Skala psihološkog uticaja na roditelje*, koju čine stavke: SPI18, SPI19.

C_6 – *Skala ostvarivanja socijalne uloge - zavisno od emocionalnog stanja i ponašanja*, koju čine stavke: SSR20, SSR21, SSR22, SSR23;

C_7 – *Skala samoprocene*, koju čine stavke: SES24, SES25, SES26, SES27, SES28;

C_8 – *Skala mentalnog zdravlja,* koju čine stavke: MHS29, MHS30;

C_9 – *Skala ponašanja*, koju čine stavke: BHS31, BHS32, BHS33;

C_{10} – *Skala porodičnih aktivnosti i porodične povezanosti,* koju čine stavke: SFR34, SFR35, SFR36;

C_{11} – *Skala promena u zdravlju,* koju čini stavka/item: SHC37.

Statistička obrada podataka

Podaci su obrađeni odgovarajućim matematičko-statističkim postupcima, potpuno različitim u odnosu na one, primenjene u istraživanju Kvrgić, S. (2001), tako da nisu prikladni za uporednu analizu. Primenjeni postupci i njihov redosled primene imaju svoje mesto u naučno-istraživačkom radu. Redosled primene postupaka je od izuzetne važnosti, kako za zaključivanje, tako i za blagovremenu eliminaciju i uključivanje pojedinih obeležja, koja će omogućiti kvalitetnije tumačenje rezultata istraživanja. Analiza je sprovedena u tri koraka i to: testirnje hipoteza o sličnosti ili razlikama, određivanjem mere razlika sa definisanjem karakteristika i grafičkim prikazom (koji je izostao, zbog ograničenog obima rada).

Obeležja celina (C), sa navedenim stavkama imaju neparametrijska svojstva i analizirane su neparametrijskim postupcima, prema učestalosti modaliteta. Primenjeni su i multivarijantni postupci: multivarijantna analize varijanse i diskriminativna analiza. Od univarijantnih postupaka primenjen je Roy-ev test, Pirsonov koeficijent kontingencije (χ), koeficijent multiple korelacije (R).

Pri testiranju hipoteza koristi se kritična vrednost **p**, koja predstavlja rizik zaključivanja. Ako je $\mathbf{p > 0.1}$ nema razloga da se ne prihvati početna hipoteza. Za odbacivanje početne hipoteze ustanovljena su dva praga značajnosti. U slučaju kada je $\mathbf{0.1 > p > 0.05}$ prihvata se alternativna hipoteza sa povećanim rizikom zaključivanja, kada je $\mathbf{p < 0.05}$ prihvata se alternativna hipoteza i tada postoje značajne (signifikantne) razlike.

- ***Postupkom multivarijantne analize varijanse (MANOVA) se testira hipoteza H_1***

H_1 Ne postoje značajne razlike između „grupa" za posmatranu tematsku celinu.

A_1 Postoje značajne razlike između „grupa" za posmatranu tematsku celinu.

- ***Postupkom diskriminativne analize (DISCRA) se testira hipoteza H_2***

H_2 Ne postoji jasno definisana granica između „grupa" za posmatranu tematsku celinu.

A_2 Postoji jasno definisana granica između „grupa" za posmatranu tematsku celinu.

- ***Postupkom univarijantne analize ili Roy-evog testa se testira hipoteza H_3***

H_3 Ne postoji značajna razlika između „grupa" po pojedinim obeležjima.

A_3 Postoji značajna razlika između „grupa" po pojedinim obeležjima.

REZULTATI

Da bi se izbeglo gubljenje informacija na neparametrijskim veličinama, izvršeno je skaliranje podataka na tabelama kontingencije. Ovim postupkom je, na osnovu učestalosti, svakoj klasi pridružen realan broj, koji odražava intenzitet modaliteta stavke u okviru pojedinih segmenata upitnika.

Napomena: Nazivi i opisi pojedinih skala, sa blagim korekcijama, navedeni su prema Kvrgić, S. (2001): 22-25 (Izvor: The CHQ User's Manual. Landgraf, Ware, Abetz, 1996).

Uporedni prikaz pojedinih segmenata Q HSW i stavki u odnosu na različite „grupe"

- **C_1 – SKALA FIZIČKOG FUNKCIONISANJA** - meri prisustvo i obim fizičkih ograničenja, uslovljenih zdravstvenim problemima, a obuhvata 3 važne dimenzije: *samobrigu, pokretljivost i aktivnosti koje iziskuju veće napore*. Prisustvo i stepen limitacije se procenjuje na 4-stepenoj skali od „da, dosta je limitirano" do „ne, nije limitirano". Nizak skor označava da zdravstveni problemi znatno ograničavaju dete u izvođenju svih fizičkih aktivnosti (FA), dok visok skor znači da dete izvodi FA bez ograničenja (Tabela 2-4).
- **C_2 – SKALA OSTVARIVANJA SOCIJALNE ULOGE – ZAVISNO OD FIZIČKOG ZDRAVLJA** - ranije procenjivana na osnovu izostanaka iz škole, danas se smatra da je od izuzetnog značaja sposobnost socijalizacije i slaganja sa drugima. Na 4-stepenoj skali procenjuje se u kojoj meri fizičko zdravlje remeti svakodnevne školske aktivnosti i aktivnosti sa drugovima. Nizak skor označava visok stepen limitacije, dok visok skor znači da ograničenje ne postoji (Tabela 10-11).
- C_3 – **SKALA GLOBALNOG ZDRAVLJA** - U ovom delu Q ispitanici subjektivno procenjuju prošlo, sadašnje i buduće zdravstveno stanje, kao i podložnost bolestima, izražavajući svoju saglasnost sa stavovima na 4-stepenoj skali. Nizak skor znači da je dečije zdravlje sagledano kao loše, sa tendencijom pogoršanja, dok visok skor ukazuje na odlično zdravlja i verovanje da će takvo i ostati (Tabela 17-19).
- C_4 – **SKALA TELESNOG BOLA** - uključuje stavke, predviđene da mere intenzitet i učestalost bola, kao indikatora fizičkog zdravlja. Intenzitet bola se procenjuje kroz odgovore koji variraju od "nema bola" do "prisutan veoma jak bol" (sa vremenskim ograničenjem na poslednje 4 nedelje, od dana anketiranja). Nizak skor znači da dete ima ekstremno jak, učestao i ograničavajući bol, dok visok skor govori o odsustvu bola ili ograničenja (Tabela 25-26).
- C_5 – **SKALA UTICAJA NA RODITELJE** - Istraživanja ukazuju da postoji direktna korelacija između procenjenog zdravlja deteta i stepena do kog se roditelj oseća fizički i emocionalno pogođen. Da bi se izmerio uticaj dečijeg zdravlja na roditelje, konstruisane su i objedinjene dve skale: *Skala vremenskog uticaja* i *Skala emocionalnog uticaja*. Skala vremenskog uticaja meri koliko je ograničeno vreme koje roditelj posvećuje sebi zbog dečijeg fizičkog zdravlja, emocionalnih problema, sposobnosti pažnje ili učenja, sposobnosti da se slaže sa drugima i dečijeg ponašanja. Skala je 4-stepena, a odgovori se kreću od „da, dosta je limitirano" do „ne, nije limitirano". Nizak skor označava visok stepen limitacije u vremenu raspoloživom za lične potrebe, zbog dečijeg fizičkog i/ili psihosocijalnog zdravlja. Visok skor znači da roditelj ne doživljava takva ograničenja. Skala emocionalnog uticaja govori o patnji i brizi roditelja zbog dečijeg zdravlja. Nizak skor označava znatnu emocionalnu patnju i veliku brigu zbog dečijeg fizičkog i/ili psiho-socijalnog zdravlja, dok visok skor znači da briga i patnja ne postoje (Tabela 32-33).
- C_6 – **SKALA OSTVARIVANJA SOCIJALNE ULOGE – ZAVISNO OD EMOCIONALNOG STANJA I PONAŠANJA** - Za ostvarivanje socijalne uloge, koja podrazumeva svakodnevne aktivnosti, pored fizičkog zdravlja, od značaja je emocionalno stanje i ponašanje. Skale koje mere ovaj uticaj konstruisane su kao 4-stepene i mogu biti odvojene i jedinstvene koje govore o kombinovanom uticaju emocija i ponašanja na ostvarivanje socijalne uloge. Nizak skor znači da je dete, zbog svog ponašanja ili emocionalnih problema, znatno limitirano u vršenju školskih ili ostalih svakodnevnih aktivnosti sa prijateljima, dok visok skor znači da limitacija ne postoji (Tabela 39-42).
- C_7 – **SKALA SAMOPROCENE** - Samoprocena je multidimenzionalni fenomen koji se pojavljuje u vreme pre-adolescencije, a uključuje 3 esencijalne komponente: *socijalnu sigurnost, školske sposobnosti* i *samopoštovanje*. Skala je konstruisana kao 4-stepena i obuhvata sledeće dimenzije: zadovoljstvo školskim i fizičkim sposobnostima; zadovoljstvo izgledom; sposobnost slaganja sa drugovima i sa članovima porodice; zadovoljstvo celokupnim životom. Odgovori variraju od «veoma zadovoljan» do «veoma nezadovoljan», pri čemu nizak skor ukazuje na veoma nezadovoljno dete, dok visok skor ukazuje na zadovoljnstvo sposobnostima, izgledom, porodičnim odnosima i životom uopšte (Tabla48-52).
- C_8 – **SKALA MENTALNOG ZDRAVLJA** - Meri učestalost pozitivnih i negativnih stanja. Za analizu učestalosti korišćena je 4-stepena skala intenziteta, na kojoj odgovori variraju od «stalno» do «nikad». Nizak skor mentalnog zdravlja govori o osećanju anksioznosti i

depresije koji su prisutni stalno, dok visok skor znači da je dete smireno i srećno (Tabela 58-59).

- C_9 – **SKALA PONAŠANJA** - Učestalost problema vezanih za ponašanje procenjuje se na 4-stepenoj skali intenziteta, čiji odgovori variraju od «veoma često» do «nikad». Skala je tako dizajnirana da obuhvata 4 dimenzije ponašanja: *agresiju, delinkvenciju, hiperaktivnost i socijalnu odbačenost*. Nizak skor upućuje na agresivno, nezrelo i delinkventno ponašanje deteta, dok visok skor znači da dete nikada ne ispoljava takvo ponašanje (Tabela 65-67).
- C_{10} – **SKALA PORODIČNIH AKTIVNOSTI I PORODIČNE POVEZANOSTI** - Porodična situacija je od izuzetnog značaja za dečije zdravlje, a takođe se zna da zdravstveno stanje deteta može uticati na porodične odnose. Ovim upitnikom autori su želeli da procene nivo ograničenja koji porodica doživljava zbog dečijeg zdravlja. Ova 4-stepena skala intenziteta, dizajnirana je tako da meri učestalost poremećaja/ograničenja u uobičajenim porodičnim aktivnostima koje mogu biti uslovljene fizičkim i/ili emocionalnim problemima, kao i poremećajima pažnje i ponašanja deteta. Odgovori se kreću u rasponu od «često» do «nikad», pri čemu nizak skor znači da dečije zdravlje često remeti porodične aktivnosti ili je uzrok porodične tenzije, dok visok skor označava da dečije zdravlje nikada nije uzrok tenzije, niti remeti uobičajene aktivnosti. Za procenu povezanosti u porodici razvijen je poseban item, gde ispitanik treba da odgovori koliko se dobro članovi porodice slažu među sobom, pri čemu odgovori variraju od "odlično" do "loše". Nizak skor znači da je sposobnost slaganja ocenjena kao loša, a visok skor upućuje na odličnu sposobnost slaganja (Tabela 73-75).
- C_{11} – **SKALA PROMENA U ZDRAVLJU** - Ovom skalom registruju se promene u zdravlju u odnosu na prethodnu godinu. Odgovori se kreću od "mnogo bolje sad" do "mnogo lošije sad", tako da nizak skor govori o pogoršanju, a visok skor o poboljšanju zdravlja (Tabela 81).

Napomena: Za sve skale, osim za promene u zdravlju, porodičnu povezanost i globalno zdravlje koristi se period sećanja od 4 nedelje. Promene u zdravlju procenjuju se u odnosu na prethodnu godinu, dok se za ostale dve skale period sećanja ne koristi.

Tabela 1-4. Brojčana (n) i procentualna (%) zastupljenost modaliteta stavki I. segmenta Q

Tabela 2	***FF08 - Da li je samobriga učenika ograničena zbog zdravstvenog stanja?***					
Modalitet	***FF08 (2)***		***FF08 (3)***		***FF08 (4)***	
Stav	*većinom ograničena*		*delimično ograničena*		*nema ograničenja*	
Abs/Rel Frq	***n***	***%***	***n***	***%***	***n***	***%***
GRE-1	***6.***	***40.0****	***5.***	***33.3***	***4.***	***26.7***
SRB-2	***1.***	***3.3***	***7.***	***23.3***	***22.***	***73.3****
Tabela 3	***FF09 - Koliko su svakodnevne aktivnosti ograničene zbog zdravstvenog stanja učenika?***					
Modalitet	***FF09 (2)***		***FF09 (3)***		***FF09 (4)***	
Stav	*povremeno ograničene*		*malo ograničene*		*nema ograničenja*	
Abs/Rel	***n***	***%***	***n***	***%***	***n***	***%***
GRE-1	***7.***	***46.7****	***3.***	***20.0***	***5.***	***33.3***
SRB-2	***4.***	***13.3***	***2.***	***6.7***	***24.***	***80.0****

Tabela 4	***FF10 - Koliko zdravstveno stanje učenika utiče na izvođenje fizičkih aktivnosti većeg napora?***							
Modalitet	***FF10 (1)***		***FF10 (2)***		***FF10 (3)***		***FF10 (4)***	
Stav	*potpuno*		*povremeno*		*delimično*		*nema ograničenja*	
Abs/Rel	***n***	***%***	***n***	***%***	***n***	***%***	***n***	***%***
GRE-1	***0.***	***.0***	***5.***	***33.3****	***4.***	***26.7****	***6.***	***40.0***
SRB-2	***2.***	***6.7***	***3.***	***10.0***	***2.***	***6.7***	***23.***	***76.7****

Tabela 3-11. Brojčana (n) i procentualna (%) zastupljenost modaliteta stavki II. segmenta Q

Tabela 4	***SSR11 - U kojoj meri fizičko zdravlje remeti svakodnevne školske aktivnosti učenika?***					
Modalitet	***SSR11 (2)***		***SSR11 (3)***		***SSR11 (4)***	
Stav	*povremeno ograničenje*		*delimično ograničenje*		*nema ograničenja*	
Abs/Rel	n	%	n	%	n	%
GRE-1	4.	26.7	6.	40.0*	5.	33.3
SRB-2	6.	20.0	5.	16.7	19.	63.3*

Tabela 51	***SSR12 - U kojoj meri fizičko zdravlje remeti svakodnevne aktivnosti sa prijateljima?***							
Modalitet	***SSR12 (1)***		***SSR12 (2)***		***SSR12 (3)***		***SSR12 (4)***	
Stav	*kompletno ograničava*		*povremeno ograničava*		*delimično ograničava*		*ne ograničava*	
Abs/Rel	n	%	n	%	n	%	n	%
GRE-1	0.	.0	4.	26.7	7.	46.7*	4.	26.7
SRB-2	3.	10.0	5.	16.7	1.	3.3	21.	70.0*

Tabela 6-19. Brojčana (n) i procentualna (%) zastupljenost modaliteta stavki III. segmenta Q

Tabela 7	***SGH13 - Kakva je subjektivna procena zdravlja učenika u protekloj godini?***					
Modalitet	***SGH13-(2)***		***SGH13-(3)***		***SGH13-(4)***	
Stav	*povremeno slabo*		*većinom dobro*		*odlično*	
Abs/Rel	n	%	n	%	n	%
GRE-1	2.	13.3*	8.	**53.3**	5.	33.3
SRB-2	0.	.0	14.	46.7	16.	**53.3**

Tabela 18	***SGH14 - Kakva je subjektivna procena trenutnog zdravstvenog stanja učenika?***					
Modalitet	***SGH14-(2)***		***SGH14-(3)***		***SGH14-(4)***	
Stav	*podložan bolestima*		*dobro, sa tendencijom poboljšanja*		*odlično*	
Abs/Rel	n	%	n	%	n	%
GRE-1	5.	33.3*	5.	33.3	5.	33.3
SRB-2	3.	10.0	7.	23.3	20.	66.7*

Tabela 19	***SGH15 - Kakva je subjektivna procena budućeg zdravstvenog stanja učenika?***							
Modalitet	***SGH15-(1)***		***SGH15-(2)***		***SGH15-(3)***		***SGH15-(4)***	
Stav	*loše, sa pogoršanjem*		*dobro, sa tendencijom poboljšanja*		*vrlo dobro*		*biće izvrsno*	
Abs/Rel	n	%	n	%	n	%	n	%
GRE-1	0.	.0	7.	46.7*	3.	20.0	5.	33.3
SRB-2	2.	6.7	3.	10.0	8.	26.7	17.	56.7

Tabela 8-26. Brojčana (n) i procentualna (%) zastupljenost modaliteta stavki IV. segmenta Q

Tabela 9	***SBP16 - Kakva je subjektivna procena bola, kao indikatora zdravstvenog statusa učenika?***							
Modalitet	***SBP16-(1)***		***SBP16-(2)***		***SBP16-(3)***		***SBP16-(4)***	
Stav	*prisutan jak bol*		*manji bol*		*nelagodnost*		*nema bola*	
Abs/Rel Frq	n	%	n	%	n	%	n	%
GRE-1	2.	13.3	4.	26.7	6.	40.0*	3.	20.0
SRB-2	1.	3.3	7.	23.3	3.	10.0	19.	63.3*
Tabela 26	***SBP17 - Kakva je subjektivne procene učestalosti bola, kao indikatora zdravstvenog statusa?***							
Modalitet	***SBP17-(2)***		***SBP17-(3)***		***SBP17-(4)***			
Stav	*bol prisutan skoro svaki dan*		*povremena nelagodnost*		*nema bola*			
Abs/Rel Frq	n	%	n	%	n	%		
GRE-1	1.	6.7	11.	73.3*	3.	20.0		
SRB-2	2.	6.7	10.	33.3	18.	60.0*		

Tabela 10-33. Brojčana (n) i procentualna (%) zastupljenost modaliteta stavki kod V. segmenta Q

Tabela 11	***SPI18 - Kako učenici procenjuju ograničeje vremena za lične potrebe roditelja zbog dečijeg fizičkog i psiho-socijalnog zdravlja?***							
Modalitet	***SPI8-(1)***		***SPI18-(2)***		***SPI18-(3)***		***SPI18-(4)***	
Stav	*da, limitirano je*		*povremeno limitirano*		*delimično limitirano*		*nije ograničeno*	
Abs/Rel Frq	n	%	n	%	n	%	n	%
GRE-1	0.	.0	5.	33.3*	8.	53.3*	2.	13.3
SRB-2	18.	60.0*	2.	6.7	6.	20.0	4.	13.3
Tabela 33	***SPI19 - Kako učenici procenjuju roditeljsku patnju i brigu, zbog dečijeg fizičkog i/ili psiho-socijalnog zdravlja?***							
Modalitet	***SPI19-(1)***		***SPI19-(2)***		***SPI19-(3)***		***SPI19-(4)***	
Stav	*velika emocionalna zabrinutost*		*razumna briga*		*blaga zabrinutost*		*nema zabrinutosti*	
ABS/Rel Frq	n	%	n	%	n	%	n	%
GRE-1	3.	20.0	8.	53.3*	4.	26.7	0.	.0
SRB-2	2.	6.7	6.	20.0	14.	46.7	8.	26.7*

Tabela 12-42. Brojčana (n) i procentualna (%) zastupljenost modaliteta stavki VI. segmenta Q

Tabela 13	***SSR20 - Koliko je limitirano obrazovanje i školske obaveze učenika, zbog zdravlja?***							
Modalitet	***SSR20-(2)***		***SSR20-(3)***		***SSR20-(4)***			
Skala	*povremeno ograničenje*		*delimično ograničenje*		*nema ograničenja*			
Abs/Rel Frq	n	%	n	%	n	%		
GRE-1	5.	33.3	10.	66.7*	0.	.0		
SRB-2	4.	13.3	10.	33.3	16.	53.3*		
Tabela 40	***SSR21 - Koliko su ograničene aktivnosti sa vršnjacima zbog medicinskih razloga?***							
Modalitet	***SSR21-(1)***		***SSR21-(2)***		***SSR21-(3)***		***SSR21-(4)***	
Skala	*potpuno ograničene*		*povremeno ograničene*		*malo ograničene*		*nema ograničenja*	
Abs/Rel Frq	n	%	n	%	n	%	n	%
GRE-1	0.	.0	5.	33.3	10.	66.7*	0.	.0
SRB-2	2.	6.7	7.	23.3	2.	6.7	19.	63.3*
Tabela 41	***SSR22 - Kakvo je emotivno stanje učenika zbog zdravstvenog ograničenja?***							
Modalitet	***SSR22-(1)***		***SSR22-(2)***		***SSR22-(3)***		***SSR22-(4)***	
Skala	*depresija*		*promenljivo raspoloženje*		*dobro raspoloženje*		*izvrsno raspoloženje*	
Abs/Rel Frq	n	%	n	%	n	%	n	%
GRE-1	0.	.0	9.	60.0*	6.	40.0	0.	.0
SRB-2	1.	3.3	4.	13.3	10.	33.3	15.	50.0*
Tabela 42	***SSR23 - Kakvo je ponašanje učenika u odnosu na ograničenja zbog zdravstvenih uslova?***							
Modalitet	***SSR23-(1)***		***SSR23-(2)***		***SSR23-(3)***		***SSR23-(4)***	
Skala	*neprimereno*		*povremeni ispadi*		*primereno*		*pozitivno*	
Abs/Rel Frq	n	%	n	%	n	%	n	%
GRE-1	0.	.0	6.	40.0*	9.	60.0*	0.	.0
SRB-2	1.	3.3	3.	10.0	7.	23.3	19.	63.3*

Tabela 14-59. Brojčana (n) i procentualna (%) zastupljenost modaliteta stavki VIII. segmenta Q HSW

Tabela 15	***MHS29 – Kako često je učenik zabrinut zbog sopstvenog mentalnog zdravlja?***							
Modalitet	***MHS29-(1)***		***MHS29-(2)***		***MHS29-(3)***		***MHS29-(4)***	
Stav	*nikad*		*ponekad*		*skoro uvek*		*stalno*	
Abs/Rel	n	%	n	%	n	%	n	%
GRE-1	0.	.0	4.	26.7*	10.	66.7*	1.	6.7
SRB-2	2.	6.7	0.	.0	9.	30.0	19.	63.3*
Tabela 169	***MHS30 – Kako često je učenik sretan zbog svog fizičkog i medicinskog statusa?***							
Modalitet	***MHS30-(1)***		***MHS30-(2)***		***MHS30-(3)***		***MHS30-(4)***	
Stav	*nikad*		*ponekad*		*skoro uvek*		*stalno*	
Abs/Rel	n	%	n	%	n	%	n	%
GRE-1	0.	.0	4.	26.7	10.	66.7*	1.	6.7
SRB-2	7.	23.3*	5.	16.7	10.	33.3	8.	26.7

Tabela 17-52. Brojčana (n) i procentualna (%) zastupljenost modaliteta stavki VII. segmenta Q

Tabela 18	***SES24 - Kako je student zadovoljan sopstvenim akademskim dostignućem?***							
Modalitet	***SES24-(1)***		***SES24-(2)***		***SES24-(3)***		***SES24-(4)***	
Stav	*jako nezadovoljan*		*uglavnom nezadovoljan*		*većinom zadovoljan*		*jako zadovoljan*	
Abs/Rel Frq	n	%	n	%	n	%	n	%
GRE-1	0.	.0	1.	6.7	13.	86.7*	1.	6.7
SRB-2	2.	6.7	1.	3.3	10.	33.3	17.	56.7*
Tabela 49	***(SES25) Kako je učenik zadovoljan svojim fizičkim sposobnostima?***							
Modalitet	***SES25-(2)***			***SES25-(3)***			***SES25-4***	
Stav	*većinom nezadovoljan*			*većinom zadovoljan*			*jako zadovoljan*	
Abs/Rel Frq	n	%	n		%		n	%
GRE-1	0.	.0	14.		93.3*		1.	6.7
SRB-2	1.	3.3	16.		53.3		13.	43.3*
Tabela 50	***SES26 - Kako je učenik zadovoljan sopstvenim izgledom?***							
Modalitet	***SES26-(1)***		***SES26-(2)***		***SES26-(3)***		***SES26-(4)***	
Stav	*jako nezadovoljan*		*većinom nezadovoljan*		*većinom zadovoljan*		*jako zadovoljan*	
Abs/Rel Frq	n	%	n	%	n	%	n	%
GRE-1	0.	.0	1.	6.7	13.	86.7*	1.	6.7
SRB-2	3.	10.0	2.	6.7	8.	26.7	17.	56.7*
Tabela 51	***SES27 - Kakvo je slaganje učenika sa prijateljima i članovima porodice?***							
Modalitet	***SES27-(2)***			***SES27-(3)***			***SES27-(4)***	
Stav	*većinom nezadovoljno*			*većinom zadovoljno*			*jako zadovoljno*	
Abs/Rel Frq	n	%	n		%		n	%
GRE-1	1.	6.7	13.		86.7*		1.	6.7
SRB-2	4.	13.3	9.		30.0		17.	56.7*
Tabela 52	***SES28 - Koliko je učenik zadovoljan sopstvenim životom?***							
Modalitet	***SES28-(1)***		***SES28-(2)***		***SES 28-(3)***		***SES28-(4)***	
Stav	*jako nezadovoljan*		*većinom nezadovoljan*		*većinom zadovoljan*		*jako zadovoljan*	
Abs/Rel Frq	n	%	n	%	n	%	n	%
GRE-1	0.	.0	2.	13.3	12.	80.0*	1.	6.7
SRB-2	1.	3.3	3.	10.0	5.	16.7	21.	70.0*

Tabela 19-67. Brojčana (n) i procentualna (%) zastupljenost modaliteta stavki IX. segmenta Q

Tabela 20	***(BHS31) - Koliko često učenik ispoljava agresivno ponašanje?***					
Modalitet	***BHS31-(2)***		***BHS31-(3)***		***BHS31-(4)***	
Stav	*često*		*ponekad*		*nikad*	
Abs/Rel	n	%	n	%	n	%
GRE-1	2.	13.3	12.	80.0*	1.	6.7
SRB-2	4.	13.3	13.	43.3	13.	43.3*

Tabela 216	***BHS32 - Kako često je učenik kažnjavan zbog delinkventnog ponašanja?***							
Modalitet	***BHS32-(1)***		***BHS32-(2)***		***BHS32-(3)***		***BHS32-(4)***	
Stav	*stalno*		*često*		*ponekad*		*nikad*	
Abs/Rel	n	%	n	%	n	%	n	%
GRE-1	0.	.0	5.	33.3*	9.	60.0*	1.	6.7
SRB-2	2.	6.7	0.	.0	8.	26.7	20.	66.7*

Tabela 67	***BHS33 – Koliko često učenik ispoljava hiperaktivnost/impulsivnost?***							
Modalitet	***BHS33-(1)***		***BHS33-(2)***		***BHS33-(3)***		***BHS33-(4)***	
Stav	*stalno*		*često*		*ponekad*		*nikad*	
Abs/Rel	n	%	n	%	n	%	n	%
GRE-1	0.	.0	4.	26.7	10.	66.7*	1.	6.7
SRB-2	1.	3.3	11.	36.7	8.	26.7	10.	33.3*

Tabela 22-75. Numerička (n) i procentualna (%) zastupljenost modaliteta stavki X. segmenta Q

Tabela 23	***SFR34 - Kako učenikovo okruženje globalno procenjuje dečije ponašanje?***							
Modalitet	***SFR34-(1)***		***SFR34(2)***		***SFR34-(3)***		***SFR34-(4)***	
Stav	*loše*		*dobro*		*vrlo dobro*		*odlično*	
Abs/Rel	n	%	n	%	n	%	n	%
GRE-1	0.	.0	5.	33.3	9.	60.0*	1.	6.7
SRB-2	2.	6.7	5.	16.7	8.	26.7	15.	50.0*

Tabela 24	***SFR35 - Koliko dečije zdravlje remeti normalne porodične aktivnosti, ili stvara porodičnu tenziju?***							
Modalitet	***SFR35-(1)***		***SFR35-(2)***		***SFR35-(3)***		***SFR35-(4)***	
Stav	*stalno*		*često*		*ponekad*		*nikad*	
Abs/Rel	n	%	n	%	n	%	n	%
GRE-1	0.	.0	1.	6.7	13.	86.7*	1.	6.7
SRB-2	1.	3.3	1.	3.3	7.	23.3	21.	70.0*

Tabela 25	***SFR36 - Kako se članovi učenikove porodice slažu međusobno?***							
Modalitet	***SFR36-(1)***		***SFR36-(2)***		***SFR36-(3)***		***SFR36-(4)***	
Stav	*loše*		*dobro*		*vrlo dobro*		*odlično*	
Abs/Rel	n	%	n	%	n	%	n	%
GRE-1	0.	.0	8.	53.3*	6.	40.0*	1.	6.7
SRB-2	2.	6.7	2.	6.7	5.	16.7	21.	70.0*

Tabela 26. Brojčana (n) i procentualna (%) zastupljenost modaliteta stavke XI. segmenta Q

Tabela 81	***Kako učenik procenjuje promene u zdravlju tokom prošle godine?***							
Modalitet	***SHC37-(1)***		***SHC37-(2)***		***SHC37-(3)***		***SHC37-(4)***	
Stav	*mnogo gore sada*		*tendencija pogoršanja*		*tendencija poboljšanja*		*mnogo bolje sada*	
Abs/Rel	n	%	n	%	n	%	n	%
GRE-1	0.	.0	0.	.0	12.	80.0*	3.	20.0
SRB-2	1.	3.3	1.	3.3	12.	40.0	16.	53.3*

DISKUSIJA

Na osnovu izloženog, vidi se da je na skaliranim podacima moguća primena MANOVA-e, DISCRA-e i drugih parametrijskih postupaka i metoda, a od univarijantnih postupaka primenjen je Roy-ev test, Pirsonov koeficijent kontingencije (χ) i koeficijent multiple korelacije (R). Na osnovu uporednih analiza i dobijenih vrednosti (**F; p**), odbacuju se hipoteze H_1 i prihvataju se alternativne hipoteze A_1, i A_2, što znači da postoji razlika i jasno definisana granica između «**grupa**» *ispitanika* (GRE-1; SRB-2) kod svih segmenata Q, koji procenjuje *Zdravlje i socijalno blagostanje* (HSW) i *Kvalitet života* učenika

Tabela 27. MANOVA i DISCRA analiza značajnosti razlike između „grupa" u odnosu na skale (Q)

(Q) HSW	Stavke	MANOVA		DISCRA	
Segment/Skala	n	F	p	F	p
I. segment Q	3	6.739	.001	6.574	.001
II. segment Q	2	10.316	.000	11.583	.000
III. segment Q	3	3.634	.021	3.545	.023
IV. segment Q	2	6.190	.003	6.646	.003
V. segment Q	2	15.004	.000	17.684	.000
VI. segment Q	4	13.995	.000	13.995	.000
VII. segment Q	5	8.296	.000	7.981	.000
VIII. segment Q	2	16.001	.000	19.048	.000
XI. segment Q	3	14.649	.000	14.292	.000
X. segment Q	3	18.498	.000	18.046	.000
XI. segment Q	1	7.432	.009	7.259	.010

Izračunavanjem koeficijenta diskriminacije (***k.dsk***) izdvajaju se obeležja koja određuju specifičnost sub-uzoraka i vrši se redukcija posmatranog prostora. Takođe, prikaz procene homogenosti sub-uzoraka, i distance između njih ima za cilj bolje izučavanje posmatrana pojava.

Tabela 28.Značajnost razlike između «grupa» u odnosu na stavke pojedinih segmenata Q prema utvrđenim koeficijentima diskriminacije (k.dsk)

I. segment	χ	***R***	***F***	***p***	***k.dsk***
FF08	.470	.533	16.672	.000	**.184**
FF09	.418	.460	11.277	.002	.005
FF10	.411	.451	10.718	.002	.075
II. segment	***c***	***R***	***F***	***p***	***k.dsk***
SSR11	.289	.302	4.227	.046	.003
SSR12	.511	.595	23.043	.000	**.451**
III. segment	χ	***R***	***F***	***p***	***k.dsk***
SGH13	.315	.332	5.189	.028	.012
SGH14	.328	.348	5.773	.021	.009
SGH15	.396	.431	9.563	.004	**.097**
IV. segment	χ	***R***	***F***	***p***	***k.dsk***
SBP16	.424	.469	11.825	.001	***.137***
SBP17	.364	.390	7.551	.009	.035
V. segment	***c***	***R***	***F***	***p***	***k.dsk***
SPI18	.525	.617	25.846	.000	**.550**
SPI19	.429	.475	12.266	.001	.227
VI. segment	χ	***R***	***F***	***p***	***k.dsk***
SSR20	.466	.527	16.154	.000	.016
SSR21	.593	.736	49.636	.000	**.572**
SSR22	.508	.590	22.425	.000	.150
SSR23	.537	.637	28.737	.000	.017
VII. segment	χ	***R***	***F***	***p***	***k.dsk***
SES24	.474	.539	17.183	.000	.127
SES25	.372	.401	8.028	.007	.000
SES26	.506	.586	21.990	.000	.025
SES27	.476	.542	17.468	.000	.032
SES28	.549	.657	31.892	.000	**.192**
VIII. segment	χ	***R***	***F***	***p***	***k.dsk***
MHS29	.549	.657	31.855	.000	**.674**
MHS30	.399	.435	9.781	.003	.149
IX. segment	χ	***R***	***F***	***p***	***k.dsk***
BHS31	.361	.387	7.401	.009	.052
BHS32	.570	.694	38.961	.000	**.823**
BHS33	.382	.414	8.683	.005	.143
X. segment	χ	***R***	***F***	***p***	***k.dsk***
SFR34	.434	.482	12.739	.001	.029
SFR35	.534	.632	27.947	.000	.400
SFR36	.566	.687	37.518	.000	**.682**
XI. segment	χ	***R***	***F***	***p***	***k.dsk***
SHC37	.358	.384	7.259	.010	**.173**

Legenda: k.dsk je koeficijent diskriminacije (**boldirane** vrednosti ukazuju na stavke koje najviše doprinose međugrupnoj diskriminaciji unutar pojedinih segmenata)

- Kako je **p < .1** kod svih stavki u okviru pojedinih segmenata Q, (između .046 - .000), koeficijenat diskriminacije upućuje na stavke, koje imaju najveći doprinos diskriminaciji između *grupa*, odnosno **prihvata se alternativna hipoteza A_3**, to znači da postoji značajna razlika između *grupa* ispitanika različitog etničkog porekla (sumarni prikaz u Tabeli 6). Na osnovu vrednosti **χ2 - testa**, postoji ***umerena povezanost*** između ***grupa*** i svojstava, s' obzirom na χ vrednosti.

Karakteristike i homogenost grupa ispitanika u odnosu na modalitete stavki Q HSW

Na osnovu dosadašnjih razmatranja i analize uzorka Totala od 45 ispitanika, u skladu sa primenjenom metodologijom, određene su karakteristike i homogenosti svake ***„grupe"*** ispitanika i distance između njih. Činjenica da je primenom DISCRA-e analize utvrđena signifikantna međugrupna razlika kod svih segmenata Q, znači da postoji jasno definisana granica između ***„grupa"*** i moguće je odrediti njihove karakteriske u odnosu na primenjene stavke u okviru skala Q-HSW (sumarni prikaz u Tabeli 7).

Tabela 29.Karakteristike i homogenost"grupa" u odnosu na stavke pojedinih segmenta Q-HSW

I. *Skala fizičkog funkcionisanja*	GRE-1	SRB-2	dpr %
FF08	FF8-2*	FF8-4*	**69.697**
FF10	FF10-2*, FF10-3*	FF10-4*	28.409
FF09	FF9-2*	FF9-4*	1.894
n/m (hmg %)	10/15 (66.67)	25/30 (83.33)	
II. *Skala socijalne pov*ezanosti	GRE-1	SRB-2	dpr %
SSR12	SSR12-3*	SSR12-4*	**99.339**
SSR11	SSR11-3*	SSR11-4*	.661
n/m (hmg %)	11/15 (73.33)	24/30 (80.00)	
III. *Skala globalnog zdravlja*	GRE-1	SRB-2	dpr %
SGH15	SGH15-2*	;;pt15;; je -,	**82.203**
SGH13	SGH13-2*	;;pt13;; je -,	10.169
SGH14	SGH14-2*	SGH14-4*	7.627
n/m (hmg %)	7/15 (46.67)	25/30 (83.33)	
IV. *Skala telesnog bola*	GRE-1	SRB-2	dpr %
SBP16	SBP16-3*	SBP16-4*	**79.651**
SBP17	SBP17-3*	SBP17-4*	20.349
n/m (hmg %)	12/15 (80.00)	22/30 (73.33)	
V. *Skala psihološkog uticaja*	GRE-1	SRB-2	dpr %
SPI18	SPI18-(2)*, SPI18-(3)*	SPI18-(1)*	**70.785**
SPI19	SPI19-(2)*	SPI19-(4)*	29.215
n/m (hmg %)	14/15 (93.33)	21/30 (70.00)	
VI. *Skala socijalnih odnosa*	GRE-1	SRB-2	dpr %
SSR21	SSR21-3*	SSR21-4*	**75.762**
SSR22	SSR22-2*	SSR22-4*	19.868
SSR23	SSR23-2*, SSR23-3*	SSR23-4*	2.252
SSR20	SSR20-3*	SSR20-4*	2.119
n/m (hmg %)	15/15 (100.00)	25/30 (83.33)	
VII. *Skala samoprocene*	GRE-1	SRB-2	dpr %
SES28	SES28-3*	SES28-4*	**51.064**
SES24	SES24-3*	SES24-4*	33.777
SES27	SES27-3*	SES27-4*	8.511
SES26	SES26-3*	SES26-4*	6.649
SES25	SES25-3*	SES25-4*	.000
n/m (hmg %)	14/15 (93.33)	25/30 (83.33)	
VIII. *Skala mentalnog zdravlja*	GRE-1	SRB-2	dpr %
MHS29	MHS29-2*, MHS29-3*	MHS29-4*	**81.896**
MHS30	MHS30-3*	MHS30-1*	18.104
n/m (hmg %)	14/15 (93.33)	25/30 (83.33)	
IX. *Skala ponašanja*	GRE-1	SRB-2	dpr %
BHS32	BHS32-2*, BHS32-3*	BHS32-4*	**80.845**
BHS33	BHS33-3*	BHS33-4*	14.047
BHS31	BHS31-3*	BHS31-4*	5.108
n/m (hmg %)	14/15 (93.33)	23/30 (76.67)	
X. *Skalu porodične aktivnosti i porodične povezanosti*	GRE-1	SRB-2	dpr %
SFR36	SFR36-2*, SFR36-3*	SFR36-4*	**61.386**
SFR35	SFR35-3*	SFR35-4*	36.004
SFR34	SFR34-3*	SFR34-4*	2.610
%	14/15 (93.33)	27/30 (90.00)	
XI. *Skala promena u zdravlju*	GRE-1	SRB-2	dpr %
SHC37	SHC37-3*	:SHC37-4*	100.000
n/m (hmg %)	12/15 (80.00)	18/30 (60.00)	

hmg - homogenost; dpr % - doprinos obeležja karakteristikama

Računanjem Mahalanobisove distance između «**grupa**», kod svih XI segmenata upitnika Q, dobijen je još jedan pokazatelj sličnosti ili razlika. Distance ukazuju na **veće** rastojanje između **«grupa» (od 2.45 – 1.07**), osim kod XI. segmenta, gde je utvrđeno manje rastojanje (.86), zbog činjenice da ovaj segment Q sadrži samo jednu stavku.

ZAKLJUČAK

Primenjeni Upitnik (Q) za ocenu Kvaliteta života, odnosno, Zdravlja i socijalnog blagostanja (HSW) sadrži 11 segmenata i 30 stavki u okviru njih, sa mogućnošću ispitanika da biraju između četiri modaliteta ponuđenih odgovora na Likert-ovoj skali (stepena 1-4). Na osnovu sprovedenih matematičko-statističkih procedura, kod uporedne analize rezultata i njihove interpretacije, mogu se izvesti sledeći zaključci koji ukazuju na utvrđene značajne razlike. Međugrupnim razlikama najviše su doprinele karakteristike i homogenost grupa, u odnosu na stavke pojedinih segmenta, učestalost odgovora, odnosno, različito opredeljivanje za pojedine modalitete stavki. Ispitanici GRE-1 su imali veću razuđenost stavova, koji nisu bili graničnih intenziteta, dok su se ispitanici SRB-2, sa jednim izuzetkom, opredeljivali za najveći intenzitet (4*) kod svih stavki u okviru pojedinih segmenata, što je značajno doprinelo utvrđenim razlikama. Ograničenja ove pilot-studije se odnose, pre svega, na mogućnost generalizacije rezultata istraživanja, zbog malog uzorka ispitanika, učenika stranog državljanstva. Drugo ograničenje je povezano sa prethodnim, pošto je zbog neujednačenog odnosa ispitanika različitog pola, kod sub-uzorka učenika stranog porekla, sprovedena međugrupna analiza samo na uzorcima totala, obe grupe, bez isticanja polnih karakteristika i eventualnih razlika. Uvodni deo upitnika HSW, koji se odnosi na pokazatelje skale Socijalnog statusa roditelja ispitanika, nije prikazan, kao uporedni pokazatelj, zbog ograničenog obima rada i drugih okolnosti, koje su pratile ovo istraživanje. Donekle, rezultati ove pilot-studije mogu da se uporede sa rezultatima prethodnog istraživanja, sprovedenog od strane Popović, R. (2015) na istom uzorku ispitanika, domaćih državljana, gde su bili prikazani uporedni pokazatelji i polne razlike između homogenih sub-uzoraka učenika (n=15) i učenica (n=15) viših razreda (VI i VIII) osnovne škole «Sveti Sava» u Nišu (merenje je sprovedeno u decembru, 2014. godine). Međutim, ozbiljnija uporedna analiza nije moguća, pošto je prikaz navedenog istraživanje zasnovan samo na numeričkim i procentualnim pokazateljima učestalosti ispoljavanja modaliteta prikazanih stavki, u okviru pojedinih segmenata upitnika za procenu Kvaliteta života, odnosno, Zdravlja i socijalnog blagostanja dece i omladine uzrasta od 12 do 15 godina, bez dodatne statističke obrade podataka.

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THE QUALITY OF LIFE OF SCHOOL AGE CHILDREN AND YOUTH

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INTRODUCTION

The quality of life, as a term in medical literature has appeared in the late 70s of the XX. Century. Quality of life, from the temporary aspect of studying has an important place in the practice of health care and scientific-research work. He has long been discussed within the framework of social sciences, by sociologists. That quality of life mostly associated with the material conditions of individuals and feelings in relation to these conditions. The quality of life by sociologists mainly means a set of parameters which include the physical and emotional status, vitality, functionality, personal and spiritual fulfillment, the adequacy of housing and nutrition, employment, social integration, social environment and support of the social environment *(Dictionary of Sociology,* 2007: 281). In accordance with this approach, health is only one component of the broader concept. With the development of society are being developed the indicators of quality of life, so that in addition to material conditions, are evaluate spiritual values as well, such as satisfaction, personal development and community affiliation. The subjective indicators of the quality of life have connection with a feeling, that is, emotional well-being and life satisfaction, while the real situation is assesses with economic indicators.

Large interest within medicine, for the quality of life, is conditioned by the development of the science of health and health care, from the moment when the WHO (World Health Organization), defined health as "a state of complete physical, mental and social well-being and not merely the absence of disease and disability" (according to Kvrgić, S., 2001:10). Although the idea of assessing the quality of life, using various measuring instruments widely accepted by the researches of different areas, even yet has no unique definition. As a result, the indicators of the quality of life are not clearly defined, but include wide range of different measures, with a little difference between the scales for the assessment of the quality of life and those for measuring overall health. However, many of authors observe quality of life as a complex function that contains more areas or domains of life and work of individuals, including physical and social function, mental status and mode of symptoms, or health weakened and personal perception of health. The **object** of this pilot study was a comparative analysis of the quality of life of the school-age children in terms of the physical activity application possibilities for children with health problems and the presentation of the current status in the sample of respondents of different ethnic origin. *The health weakened* is manifests by weakening or limitation of physical, sensory and mental functions, or the functions of internal organs, which defend active and full participation of such individuals in physical education and sport. The key ***problem,*** and the whole problem orientation of this research is related to the analysis of 11 thematic sections $_{(C\text{-}1)\text{-}}(C_{11})$ or some segments of questionnaire **(Q)** for the assessment of ***Health and quality of life*** (HSW) in primary school students of higher grades. The Convention on Children Rights, adopted (1989) by the UN (United Nations), point out that children have a right to health and well-being. Hence, ***objective*** of this pilot study is to assess the health and quality of life in school-age children, i.e. testing of attitudes of higher grades of primary school in students, using the adapted comprehensive questionnaire. The specific objective is to assess the components of health and quality of life from the aspect of the primary school children of the higher grade, or consideration of the health situation which may affect their ability to engage in activities

of physical education, as well as the sense of social well-being. Accordingly, in the study are set following operational ***tasks:*** To present the basic parameters of certain items within the ($C_{1)}$ to (C_{11}) segment of the Questionnaire in relation to the attitudes of two sub-samples of examinees of different ethnic origin; To determine the differences of the attitudes between two sub-samples in relation to the applied items within some segments ($C_{1)}$ to (C_{11}) of Questionnaire; To define the characteristics of each sub-sample of respondents, in relation to applied items within the some segments ($C_{1)}$ to (C_{11}) of Questionnaire; To determine the contribution to the wholes (C) to the characteristics of the sub-samples of different ethnic origins. Taking into account the previous experience, the basis of the problem, subject and goals of the research, as well as the methodological approach in this study, can be set up Global hypothesis as follows:

- $\mathbf{H_0}$ There is no difference between *"group of the respondents of different ethnic origin"*, in relation to the tested items within certain segments of the questionnaire Q (HSW), defined as a wholes $C_{1)} - C_{11)}$.
- $\mathbf{A_0}$ There is a difference between *"group of the respondents of different ethnic origin"*, in relation to the tested items within certain segments of the questionnaire Q (HSW), defined as a wholes $C_{1)} - C_{11)}$.

Considering the small number of researches elaborated in this field in our country, dealing with the measurement of quality f life of children, this study is partly based on the model, which is implemented Kvrgić, S. (2001) and published as a monograph *Quality of life of school children and youth* (adapted master's theses *"Assessment of health and quality of life* of *school children and youth in Yugoslavia",* defended in 2000. at the Medical Faculty in Novi Sad), which is considered to be first research of its kind in the former Yugoslavia.

The following important research in this area is conducted by Samouilidou, E. (2004) and published as a monograph Stimulation *of the motor development in the* pupils *with mental retardation* (adapted doctoral thesis *"The importance of programmed somatopedic treatment in the professional training of disabled students"* defended in 2001. at the Faculty of Special Education and Rehabilitation in Belgrade.

METHOD

Unlike the model presented in the former research, in this pilot study was performed one version of the questionnaire relating to the consideration of the health components only in school-age children. The observed variables are items. Characteristics in relation to the dividing sample to the sub-samples are criterion. More items, which are connected to each other meaningfully and make a logical order (C) are called simply "whole" (segment/scale). All observed thematic sections make a field of exploration. It examines the differences in relation to the criteria ***groups of different ethnic origin.*** Reference to the socio-demographic characteristics did not examined, nor shown social status of the parents, as an introductory part of the questionnaire.

The research sample

It examines the Total sample of 45 subjects, students in higher grades of primary schools, of both genders, divided into two sub-samples according to their different ethnic origin: GRE-1 (N=15), students of foreign (Greek) nationality (from Northern-Aegean Region) and SRB-2 (N=30), students of home country (Serbian) citizenship, from Nis.

Instrument of Research

Questionnaire **(Q)** is designed to assess the quality of life, health and social wellness (HSW), in school-age children of both genders. Introductory part of the **(Q)** containing items (1-7) dealing with some socio-demographic indicators regarding the the family members of the respondents (father, mother), which are not presented in this pilot study. The rest of the **(Q)** refers to the declaration of the respondents in terms of individual segments/wholes (C), which have in total of 11, and are offered four modalities (degree) of statements/declaration, Likert-type and the intensity of 1 to 4.

Research Area

The area of this research consists of 11 thematic sections ($C_1 – C_{11}$) which are analyzed in relation to different groups/sub-samples, related to ethnic affiliation (GRE-1; SRB-2): C_1 – *Scale of physical functioning,* consisting of three items: SFF8, SFF9, SFF10; C_2 – *Scale of social roles implementations (depending on physical health),* which comprise two items: SSR11, SSR12; C_3 – *Scale of Global health* consisting of three items: SGH13, SGH14, SGH15; C_4 – *Scale of bodily pain,* consisting of two items: SBP16, SBP17; C_5 – *Scale of the psychological impact on parents,* which consists of two items: SPI18, SPI19. C_6 – *Scale of social roles implementation - depending on the emotional state and behavior,* consisting of four items: SSR20, SSR21, SSR22, SSR23; C_7 – *Scale of self-assessment,* consisting of five items: SES24, SES25, SES26, SES27, SES28; C_8 – *Scale of Mental Health,* which consists of two items: MHS29, MHS30; C_9 – *Scale of behavior,* consisting of three items: BHS31, BHS32, B HS33; C_{10} – *Scale of family activities health changes,* which makes the item: SHC37.

Statistical data procession

Data was processed with the appropriate mathematical and statistical procedures, completely different compared to those applied in the previous research, elaborated by Kvrgić, S. (2001), so they are not suitable for comparative analysis. The applied methods and their order of application have their place in scientific research. The order of the procedures application is of utmost importance, both for the conclusion and for the timely elimination or the inclusion of certain variables, which will enable us to improve the quality of the research results explanation of. The analysis was conduct in three steps as follows: hypothesis testing about the similarities or differences, specifying measures of the differences with defining characteristics and graphic representation (not presented, due to paper volume).

Variables of the wholes C_1- C_{11}, with applied items, have nonparametric properties and accordingly are analyzed with nonparametric methods, according to the frequency and modalities. It will be used multivariate procedures: Multivariate Analysis of Variance (MANOVA) and Discriminate analysis (DISCRA). From univariate methods was applied Roy's test, Pearson's coefficient of contingency (χ), multiple correlation coefficient (R). The purpose of the application of mathematical and statistical analysis aims to determine the characteristics of each sub-sample, homogeneity and the distance between them in relation to the estimated characteristics for the reason of reliable and accurately prediction and prognosis with certain significance The methods of proving the existence of similarities or differences between sub-samples confirm the hypothesis or reject it (confirm an alternative hypothesis), or indicate the existence of a differences. When testing the hypothesis it is used critical value **p,** which means the risk of conclusion. If **p > 0.1** there is no reason not to accept the initial hypothesis. For the rejection of the initial hypotheses are used two levels of significance. In the case where **0.1 > p > 0.05** accepts the alternative hypothesis with an increased risk of conclusion, when **p < 0 .05** accepts the alternative hypothesis and says that there are substantial (significant) differences.

- ***Procedure of Multivariate Analysis of Variance (MANOVA) to test the hypothesis H_1:***

H_1 There are no significant differences between sub-samples for the given thematic unit.

A_1 There are significant differences between sub-samples for the given thematic unit.

- ***Procedure*** of ***Discriminative analysis (DISCRA) to test the hypothesis H_2:***

H_2 There is no clearly defined boundary between the sub-samples for the given thematic unit.

A_2 There is a clearly defined boundary between the sub-samples for the given thematic unit.

- ***Procedure of Univariate s analysis or Roy's-test to test the hypothesis H_3***

H_3 There is no significant difference between sub-samples by individual variables.

A_3 There is a significant difference between some sub-samples by individual variables

RESULTS

To avoid losing of information, finding the finest links and information's, on nonparametric values, data scaling is performed on the tables of contingency. This procedure, based on the unit frequency, for each class is given a real number, which reflects the intensity modalities of item, within certain segments of the questionnaire.

Comparative review of the segments and items of the (Q) relative to different *"Groups"*

C_1 - THE SCALE OF PHYSICAL FUNCTIONING measure the presence and extent of physical limitations caused by heats problems, and includes three important dimensions: self-care, mobility and activities that require more effort. The presence and degree of limitation is estimated on 4-point scale, up "very limited" to "not limit". A low score indicates that health problems significantly limit the child in performing all physical activities (PA), whereas a high score means that a child perform PA without restrictions. (Table 2-4).

C_2 – SCALE OF SOCIAL ROLES (*depending on physical health)* – The realization of social role previously mainly estimated on the basis of absences from school, and now is considered being of great importance as for the ability to socialize and get along with others. Accordingly, this 4-point scale assess to what extent physical health interfere children with everyday school activities and with friends. The low score point out on high degree of limitations, while high score means that there is no restriction (Table 10-11).

C_3 – SCALE OF GLOBAL HEALTH – In this part of the questionnaire respondents subjectively evaluate past, present and future health status, as well as susceptibility to diseases, by expressing its agreement with the statements on the 4-point scale. A low score means that the children's health is assessed as poor, with a worsening trend, whereas a high score comes to evaluating health as excellent and the belief that it will remain so (Table 17-19).

C_4 – SCALE OF BODILY PAIN – designed to measure the intensity and frequency of pain, as one of the indicators of physical health. The pain or discomfort is assessed through responses ranging from "no pain" to "present a very strong pain "(with a time limit on the last 4 weeks, from the day the survey). A low score means that the child fills extremely strong, frequent and restrictive pain, whereas a high score speaks of the absence of pain or restriction (Table 25-26).

C_5 – THE SCALE OF PSYCHOLOGICAL/EMOTIONAL IMPACT ON THE PARENTS – Surveys indicate that there is a direct correlation between the estimated health of the child and the degree to which the parent feels physically and emotionally affected. In order to measure the impact of child health at the parents there have been constructed two scales: *Scale of time impact* and the *Scale of emotional impact.* The time scale assess to which extent are the restriction period, that the parent give to herself because of child physical health, emotional problems, attention abilities, or studying, the ability to come up with others and child behavior. The Scale is 4-point, and the responses are in range from "that is quite limited" to "not limited". A low score point out on high degree of limitation in the time available for personal needs, due to child physical and/or psycho-social health. A high score means that a parent do not to experiencing such a restrictions. The Scale of emotional impact is about suffering and care of their parents due to child health. A low score point out on considerable emotional distress and grave concern because of child physical and/or psycho-social health, whereas a high score means that the concern and suffering do not exist (Table 32-33).

C_6 – THE SCALE OF SOCIAL ROLES INPLEMENTATION *(depending on the emotional state and behavior)* – For the realization of social role, which includes daily activities, such are school activities, and with friends, in addition to the physical health of the importance are the emotional state and behavior. The Scales, which measures this effect have been constructed as a 4-points and can be separated, but also can be a unique-form scale that talks about the combined impact of emotions and behaviors for the realization of social role. A low score means that the child is, because of his behavior or emotional problems, substantially limited in performing school or other daily activities with friends, while high score means that the limitation does not exist (Table 39-42).

C_7 – THE SELF EVALUATION – The self-assessment is a multi-dimensional phenomenon that occurs during pre-adolescence period and shape and redefines during the life-time, and includes three essential components: *social security , academic skills* and *self-esteem*. The Scale is designed as a 4-point and includes the following dimensions: satisfaction with the school and

physical abilities; satisfaction with appearance; satisfaction with the ability of agreement with others, as well as with the family members; satisfaction with overall life. Answers vary from "very satisfied" to "very dissatisfied" whereas the low score points out that a child is very dissatisfied, and the high points out that the child is very satisfied with their abilities, appearance, family relationships and overall satisfaction with life (Table 48-52).

C_8 – THE SCALE OF MENTAL HEALTH – measures the frequency of positive and negative states. To analyze the frequency of answers were used a 4-point scale of intensity, on which answers vary from "continuous" to "never." The low score of mental health talk about feelings of anxiety and depression that are present continuously, while a high score means that the child is calm and happy (table 58-59).

C_9 – THE SCALE OF BEHAVIOUR – which comprise items: BHS31, BHS32, and BHS33. Frequency of problems related to behavior is assessed on a 4-point scale of intensity, whose responses ranged from "very often" to "never". The scale is designed so that it includes four dimensions of behavior: aggression, delinquency, hyperactivity/impulsivity, and social rejection. A low score indicates a potentially aggressive, immature and delinquent behavior, while a high score means that the child never manifest such behavior (Table 65-67).

C_{10} – THE SCALE OF FAMILY ACTIVITIES AND FAMILY CONNECTIONS –The family situation is of great importance for children's health, and also is know that the child health condition can affect family relationships. With this (Q), the authors wanted to assess the level of restrictions that families experience because of their children's health. This 4-point intensity scale is designed to measure the frequency of disorders/restrictions in common family activities, which may be conditioned by the physical and/or emotional problems, as well as with attention disorders and child behavior. Replies are ranging from "often" to "never", when the low score point out that the child health often has disturb the family activities, or it cause the family tensions, while high score means that child health never produced tensions nor disturb ordinary activities. For the assessment of family connections has been developed one item, where respondent should answer how well the members their family agree among themselves, whereas the responses vary from "excellent" to «bad». The mean score means that the ability to connections assessed as «bad», whereas the high score point out on excellent connections ability (Table 73-75).

***C_{11}* – SCALE OF CHANGES IN HEALTH** - This scale registers the health changes over the previous year. Answers range from "much better now" to "much worse now", so that the low score tells of deterioration, and a high score on the improvement of health (Table 81).

Table 2 -4. *Numeric (n) and percentage (%) representation of item modalities of the I. scale of* ***Q***

Table 2	***FF08 - Is the student's self-care limited due to a medical condition?***					
Modality	***FF8 (2)***		***FF8 (3)***		***FF8 (4)***	
Attitude	*most limited*		*partially limited*		*no restrictions*	
Abs/Rel	***n***	***%***	***n***	***%***	***n***	***%***
GRE-1	***6.***	***40.0****	***5.***	***33.3***	***4.***	***26.7***
SRB-2	***1.***	***3.3***	***7.***	***23.3***	***22.***	***73.3****

Table 3	***FF09 - How the everyday activities are limited because of the health status of student's?***					
Modality	***FF9 (2)***		***FF9 (3)***		***FF9 (4)***	
Attitude	*occasionally restricted*		*a little limited*		*there are no restrictions*	
Abs/Rel	***n***	***%***	***n***	***%***	***n***	***%***
GRE-1	***7.***	***46.7****	***3.***	***20.0***	***5.***	***33.3***
SRB-2	***4.***	***13.3***	***2.***	***6.7***	***24.***	***80.0****

Table 4	***FF10 - How the student's health status affects the physical activity of a greater effort?***							
Modality	***FF10 (1)***		***FF10 (2)***		***FF10 (3)***		***FF10 (4)***	
Attitude	*completely*		*occasionally*		*partially*		*no restriction*	
Abs/Rel	***n***	***%***	***n***	***%***	***n***	***%***	***n***	***%***
GRE-1	***0.***	***.0***	***5.***	***33.3****	***4.***	***26.7****	***6.***	***40.0***
SRB-2	***2.***	***6.7***	***3.***	***10.0***	***2.***	***6.7***	***23.***	***76.7****

Table 10 -11. *The numeric (n) and percentage (%) representation of item's modalities on II. Scale of* ***Q***

Table 10	***SSR11 - To what extent physical health interfere with everyday student's school activities?***					
Modality	***SSR11 (2)***		***SSR11 (3)***		***SSR11 (4)***	
Attitude	*occasionally limitation*		*partially limitation*		*there are no restrictions*	
Abs/Rel	n	%	n	%	n	%
GRE-1	4.	26.7	6.	40.0*	5.	33.3
SRB-2	6.	20.0	5.	16.7	19.	63.3*

Table 11	***SSR12 - To what extent physical health interfere with everyday activities with the friends?***							
Modality	***SSR12 (1)***		***SSR12 (2)***		***SSR12 (3)***		***SSR12 (4)***	
Attitude	*complete limitation*		*occasionally limitation*		*partially limitation*		*not limitation*	
Abs/Rel	n	%	n	%	n	%	n	%
GRE-1	0.	.0	4.	26.7	7.	46.7*	4.	26.7
SRB-2	3.	10.0	5.	16.7	1.	3.3	21.	70.0*

Table 17 -19. *The numeric (n) and percentage (%) representation of item's modalities on III. Scale of* ***Q***

Table 17	***SGH13 - What's subjective assessment of student's health during the past year?***					
Modality	***SGH13-(2)***		***SGH13-(3)***		***SGH13-(4)***	
Attitude	*occasionally week*		*mostly well*		*excellent*	
Abs/Rel	n	%	n	%	n	%
GRE-1	2.	13.3*	8.	**53.3**	5.	33.3
SRB-2	0.	.0	14.	46.7	16.	**53.3**

Table 18	***SGH14 - What's subjective assessment of the current health situation of the student's?***					
Modality	***SGH14-(2)***		***SGH14-(3)***		***SGH14-(4)***	
Attitude	*an subject to diseases*		*well, tendency of improvement*		*excellent*	
Abs/Rel	n	%	n	%	n	%
GRE-1	5.	33.3*	5.	33.3	5.	33.3
SRB-2	3.	10.0	7.	23.3	20.	66.7*

Table 19	***SGH15 - What's subjective assessment of the future health situation of the student's?***							
Modality	***SGH15-(1)***		***SGH15-(2)***		***SGH15-(3)***		***SGH15-(4)***	
Attitude	*week, tendency of worsening*		*well, tendency of improvement*		*very good*		*will be perfect*	
Abs/Rel	n	%	n	%	n	%	n	%
GRE-1	0.	.0	7.	46.7*	3.	20.0	5.	33.3
SRB-2	2.	6.7	3.	10.0	8.	26.7	17.	56.7

Table 25 -26 *The numeric (n) and percentage (%) representation of item's modalities on IV. Scale of Q*

Table 1	***SBP16 - What's subjective assessment of pain as an indicator of student's health status?***							
Modality	***SBP16-(1)***		***SBP16-(2)***		***SBP16-(3)***		***SBP16-(4)***	
Attitude	*present severe pain*		*small pain*		*discomfort*		*no pain*	
Abs/Rel	n	%	n	%	n	%	n	%
GRE-1	2.	13.3	4.	26.7	6.	40.0*	3.	20.0
SRB-2	1.	3.3	7.	23.3	3.	10.0	19.	63.3*

Table 26	***SBP17 - What's subjective assessment of the frequency of pain as an indicator of student's health status??***					
Modality	***SBP17-(2)***		***SBP17-(3)***		***SBP17-(4)***	
Attitude	*pain present almost every day*		*occasional discomfort*		*no pain*	
Abs/Rel	n	%	n	%	n	%
GRE-1	1.	6.7	11.	73.3*	3.	20.0
SRB-2	2.	6.7	10.	33.3	18.	60.0*

Table 32 -33. *The numeric (n) and percentage (%) representation of item's modalities on V. Scale of Q*

Table 2	***SPI18 - How the students assesses parental constraint of time for their personal needs because of for child's physical and psychosocial health?***							
Modality	***SPI8-(1)***		***SPI18-(2)***		***SPI18-(3)***		***SPI18-(4)***	
Attitude	*yes, it is limited*		*occasionally limited*		*partially limited*		*not limited*	
Abs/Rel	n	%	n	%	n	%	n	%
GRE-1	0.	.0	5.	33.3*	8.	53.3*	2.	13.3
SRB-2	18.	60.0*	2.	6.7	6.	20.0	4.	13.3

Table 33	***SPI19 - How the students assesses parental distress and concern, because child's physical and/or psychosocial health?***							
Modality	SPI19-(1)		SPI19-(2)		SPI19-(3)		SPI19-(4)	
Attitude	*great emotional concern*		*reasonable concern*		*small concern*		*no worries*	
ABS/Rel	n	%	n	%	n	%	n	%
GRE-1	3.	20.0	8.	53.3*	4.	26.7	0.	.0
SRB-2	2.	6.7	6.	20.0	14.	46.7	8.	26.7*

Table 39-42. *The numeric (n) and percentage (%) representation of item's modalities on VI. Scale of* ***Q***

Table 39	***SSR20 How is, according to the student personal judgment, limited education and school compulsories due to health condition??***					
Modality	***SSR20-(2)***		***SSR20-(3)***		***SSR20-(4)***	
Attitude	*occasionally limited*		*partially limited*		*not imitated*	
Abs/Rel	n	%	n	%	n	%
GRE-1	5.	33.3	10.	66.7*	0.	.0
SRB-2	4.	13.3	10.	33.3	16.	53.3*

Table 40	***SSR21 - How is, according to the student personal judgment, limited activities with his peers due to medical reasons?***							
Modality	***SSR21-(1)***		***SSR21-(2)***		***SSR21-(3)***		***SSR21-(4)***	
Attitude	*fully restricted*		*occasionally limited*		*partially limited*		*not imitated*	
Abs/Rel	n	%	n	%	n	%	n	%
GRE-1	0.	.0	5.	33.3	10.	66.7*	0.	.0
SRB-2	2.	6.7	7.	23.3	2.	6.7	19.	63.3*

Table 41	***SSR22 - What kind of is the student's emotional state in relation to the restrictions on health grounds?***							
Modality	***SSR22-(1)***		***SSR22-(2)***		***SSR22-(3)***		***SSR22-(4)***	
Attitude	*depression*		*changeable mood*		*good mood*		*excellent mood*	
Abs/Rel	n	%	n	%	n	%	n	%
GRE-1	0.	.0	9.	60.0*	6.	40.0	0.	.0
SRB-2	1.	3.3	4.	13.3	10.	33.3	15.	50.0*

Table 42	***SSR23 - What kind of is the student's behavior in relation to limitation due to health conditions?***							
Modality	***SSR23-(1)***		***SSR23-(2)***		***SSR23-(3)***		***SSR23-(4)***	
Attitude	*inappropriate*		*occasional outbursts*		*appropriate*		*positive*	
Abs/Rel	n	%	n	%	n	%	n	%
GRE-1	0.	.0	6.	40.0*	9.	60.0*	0.	.0
SRB-2	1.	3.3	3.	10.0	7.	23.3	19.	63.3*

Table 48 -52. *The numeric (n) and percentage (%) representation of item's modalities on VII. Scale of* ***Q***

Table 48	***SES24 – How is the student satisfied with his own academic achievement?***							
Modality	***SES24-(1)***		***SES24-(2)***		***SES24-(3)***		***SES24-(4)***	
Attitude	*very unsatisfied*		*mostly dissatisfied*		*mostly satisfied*		*very satisfied*	
Abs/Rel	n	%	n	%	n	%	n	%
GRE-1	0.	.0	1.	6.7	13.	86.7*	1.	6.7
SRB-2	2.	6.7	1.	3.3	10.	33.3	17.	56.7*

Table 49	***SES25 - How is the student satisfied with his physical abilities?***					
Modality	***SES25-(2)***		***SES25-(3)***		***SES25-4***	
Attitude	*mostly dissatisfied*		*mostly satisfied*		*very satisfied*	
Abs/Rel	n	%	n	%	n	%
GRE-1	0.	.0	14.	93.3*	1.	6.7
SRB-2	1.	3.3	16.	53.3	13.	43.3*

Table 50	***SES26 - How is the student satisfied with his own appearance?***							
Modality	***SES26-(1)***		***SES26-(2)***		***SES26-(3)***		***SES26-(4)***	
Attitude	*very unsatisfied*		*mostly dissatisfied*		*mostly satisfied*		*very satisfied*	
Abs/Rel	n	%	n	%	n	%	n	%
GRE-1	0.	.0	1.	6.7	13.	86.7*	1.	6.7
SRB-2	3.	10.0	2.	6.7	8.	26.7	17.	56.7*

Table 51	***SES27 - According to student's personal judgment what kind of is his agreement with the friends and family members?***					
Modality	***SES27-(2)***		***SES27-(3)***		***SES27-(4)***	
Attitude	*mostly unsatisfied*		*mostly satisfied*		*very satisfied*	
Abs/Rel	n	%	n	%	n	%
GRE-1	1.	6.7	13.	86.7*	1.	6.7
SRB-2	4.	13.3	9.	30.0	17.	56.7*

Table 52	***SES28 - How much is student satisfied with his own life?***							
Modality	***SES28-(1)***		***SES28-(2)***		***SES 28-(3)***		***SES28-(4)***	
Attitude	*very unsatisfied*		*mostly unsatisfied*		*mostly satisfied*		*very satisfied*	
Abs/Rel	n	%	n	%	n	%	n	%
GRE-1	0.	.0	2.	13.3	12.	80.0*	1.	6.7
SRB-2	1.	3.3	3.	10.0	5.	16.7	21.	70.0*

Table 58 -59. *The numeric (n) and percentage (%) representation of item's modalities on VIII. Scale of* ***Q***

Table 58	***MHS29 – How often is the student concerned about his own mental health?***							
Modality	***MHS29-(1)***		***MHS29-(2)***		***MHS29-(3)***		***MHS29-(4)***	
Attitude	*never*		*sometimes*		*almost always*		*constantly*	
Abs/Rel	n	%	n	%	n	%	n	%
GRE-1	0.	.0	4.	26.7*	10.	66.7*	1.	6.7
SRB-2	2.	6.7	0.	.0	9.	30.0	19.	63.3*
Table 59	***MHS30 – How often is the student happy about his physical and medical status?***							
Modality	***MHS30-(1)***		***MHS30-(2)***		***MHS30-(3)***		***MHS30-(4)***	
Attitude	*never*		*sometimes*		*almost always*		*constantly*	
Abs/Rel	n	%	n	%	n	%	n	%
GRE-1	0.	.0	4.	26.7	10.	66.7*	1.	6.7
SRB-2	7.	23.3*	5.	16.7	10.	33.3	8.	26.7

Table 65 -67. *The numeric (n) and percentage (%) representation of item's modalities on IX. Scale of* ***Q***

Table 65	***(BHS31) - How often do students exhibit aggressive behavior?***					
Modality	***BHS31-(2)***		***BHS31-(3)***		***BHS31-(4)***	
Attitude	*often*		*sometimes*		*never*	
Abs/Rel	n	%	n	%	n	%
GRE-1	2.	13.3	12.	80.0*	1.	6.7
SRB-2	4.	13.3	13.	43.3	13.	43.3*
Table 66	***BHS32 - How often has student punished for delinquent behavior?***					
Modality	***BHS32-(1)***		***BHS32-(2)***		***BHS32-(3)***		***BHS32-(4)***	
Attitude	*constantly*		*often*		*sometimes*		*never*	
Abs/Rel	n	%	n	%	n	%	n	%
GRE-1	0.	.0	5.	33.3*	9.	60.0*	1.	6.7
SRB-2	2.	6.7	0.	.0	8.	26.7	20.	66.7*
Table 67	***BHS33 – How often do students exhibits the hyperactivity / impulsivity?***							
Modality	***BHS33-(1)***		***BHS33-(2)***		***BHS33-(3)***		***BHS33-(4)***	
Attitude	*constantly*		*often*		*sometimes*		*never*	
Abs/Rel	n	%	n	%	n	%	n	%
GRE-1	0.	.0	4.	26.7	10.	66.7*	1.	6.7
SRB-2	1.	3.3	11.	36.7	8.	26.7	10.	33.3*

Table 73-75**.The numeric (n) and percentage (%) representation of item's modalities on X. Scale of **Q

Table 73	***SFR34 - How the student's environment in global estimated child behavior?***							
Modality	***SFR34-(1)***		***SFR34(2)***		***SFR34-(3)***		***SFR34-(4)***	
Attitude	*bad*		*good*		*very good*		*excellent*	
Abs/Rel	n	%	n	%	n	%	n	%
GRE-1	0.	.0	5.	33.3	9.	60.0*	1.	6.7
SRB-2	2.	6.7	5.	16.7	8.	26.7	15.	50.0*
Table 74	***SFR35 - How the child health disturbs normal family activities, or causes family tension?***							
Modality	***SFR35-(1)***		***SFR35-(2)***		***SFR35-(3)***		***SFR35-(4)***	
Attitude	*constantly*		*often*		*sometimes*		*never*	
Abs/Rel	n	%	n	%	n	%	n	%
GRE-1	0.	.0	1.	6.7	13.	86.7*	1.	6.7
SRB-2	1.	3.3	1.	3.3	7.	23.3	21.	70.0*
Table 75	***SFR36 - How the members of the student's family agrees to each other?***							
Modality	***SFR36-(1)***		***SFR36-(2)***		***SFR36-(3)***		***SFR36-(4)***	
Attitude	*bad*		*good*		*very good*		*excellent*	
Abs/Rel	n	%	n	%	n	%	n	%
GRE-1	0.	.0	8.	53.3*	6.	40.0*	1.	6.7
SRB-2	2.	6.7	2.	6.7	5.	16.7	21.	70.0*

***Table 81**. The numeric (n) and percentage (%) representation of item's modalities on XI. Segment of Q*

Table 81	***How Student assesses changes in health during the past year ?***							
Modality	***SHC37-(1)***		***SHC37-(2)***		***SHC37-(3)***		***SHC37-(4)***	
Attitude	*much worse now*		*tendencies to worsening*		*tendencies to improvement*		*much better now*	
Abs/Rel	n	%	n	%	n	%	n	%
GRE-1	0.	.0	0.	.0	12.	80.0*	3.	20.0
SRB-2	1.	3.3	1.	3.3	12.	40.0	16.	53.3*

For all scales, except for the health changes, family connection and global health are used the memories period of 4 weeks. The changes in health are assessed in relation to the previous year, while for the other two scales remembrance period is not used, considering the fact that they speak about health and family relationships in general. ***Note:*** The titles and descriptions of certain scales, with slight corrections are listed according to Kvrgić, S. (2001): 22-25 (Source: The CHQ User's Manual. Landgraf, Ware, Abetz, 1996).

DISCUSSION

Based on the above mentioned, it is evident that on the scaled data is possible application of multivariate analysis of variance (MANOVA), discriminative analysis (DISCRA) and other parametric procedures and methods. From univariate methods was applied Roy's test, Pearson's coefficient of contingency (χ) and multiple correlation coefficient (R). On the basis of elaborated MANOVA and DISCRA comparative analyzes and the obtained values (**F; p**), must be rejected the hypothesis H_1 and H_2 in all segments of the (Q), and accepted the alternative hypothesis A_1, and A_2, which means that there is a difference and clearly defined border between ***"groups of respondents"*** (GRE-1; ENG-2) in all segments **Q** , which assesses the **Health and Social Wellness** (HSW), and **Quality of life of *students of different ethnic origins* .**

Table 5 . *MANOVA and DISCRA analysis of the between groups significance of differences in relation to particular segments of the questionnaire (Q) for the assessment of the Health and Social welfare - HSW*

(Q) HSW	Items	MANOVA		DISCRA	
Segments/Scales	n	F	p	F	p
I. segment Q	3	6.739	.001	6.574	.001
II. segment Q	2	10.316	.000	11.583	.000
III. segment Q	3	3.634	.021	3.545	.023
IV. segment Q	2	6.190	.003	6.646	.003
V. segment Q	2	15.004	.000	17.684	.000
VI. segment Q	4	13.995	.000	13.995	.000
VII. segment Q	5	8.296	.000	7.981	.000
VIII. segment Q	2	16.001	.000	19.048	.000
XI. segment Q	3	14.649	.000	14.292	.000
X. segment Q	3	18.498	.000	18.046	.000
XI. segment Q	1	7.432	.009	7.259	.010

By calculating the coefficient of discrimination ***(c.dsc)*** are extracted features that define sub-samples specificity and parameters that need to be excluded from further processing, i.e., performs the reduction of the observed space. Furthermore, this paper estimates the sub-samples homogeneity, the distance between them and cluster analysis, aims to get as close as possible explore the observed phenomenon.

***Table 6**. The significance of the between "groups" differences relative to items of some segments of Q according to the established coefficients of discrimination (c.dsc)*

I. segment	***χ***	***R***	***F***	***p***	***c.dsc***
FF08	.470	.533	16.672	.000	**.184**
FF09	.418	.460	11.277	.002	.005
FF10	.411	.451	10.718	.002	.075
II. segment	***χ***	***R***	***F***	***p***	***c.dsc***
SSR11	.289	.302	4.227	.046	.003
SSR12	.511	.595	23.043	.000	**.451**
III. segment	***χ***	***R***	***F***	***p***	***c.dsc***
SGH13	.315	.332	5.189	.028	.012
SGH14	.328	.348	5.773	.021	.009
SGH15	.396	.431	9.563	.004	**.097**
IV. segment	***χ***	***R***	***F***	***p***	***c.dsc***
SBP16	.424	.469	11.825	.001	***.137***
SBP17	.364	.390	7.551	.009	.035
V. segment	***χ***	***R***	***F***	***p***	***c.dsc***
SPI18	.525	.617	25.846	.000	**.550**
SPI19	.429	.475	12.266	.001	.227
VI. segment	***χ***	***R***	***F***	***p***	***c.dsc***
SSR20	.466	.527	16.154	.000	.016
SSR21	.593	.736	49.636	.000	**.572**
SSR22	.508	.590	22.425	.000	.150
SSR23	.537	.637	28.737	.000	.017
VII. segment	***χ***	***R***	***F***	***p***	***c.dsc***
SES24	.474	.539	17.183	.000	.127
SES25	.372	.401	8.028	.007	.000
SES26	.506	.586	21.990	.000	.025
SES27	.476	.542	17.468	.000	.032
SES28	.549	.657	31.892	.000	**.192**
VIII. segment	***χ***	***R***	***F***	***p***	***c.dsc***
MHS29	.549	.657	31.855	.000	**.674**
MHS30	.399	.435	9.781	.003	.149
IX. segment	***χ***	***R***	***F***	***p***	***c.dsc***
BHS31	.361	.387	7.401	.009	.052
BHS32	.570	.694	38.961	.000	**.823**
BHS33	.382	.414	8.683	.005	.143
X. segment	***χ***	***R***	***F***	***p***	***c.dsc***
SFR34	.434	.482	12.739	.001	.029
SFR35	.534	.632	27.947	.000	.400
SFR36	.566	.687	37.518	.000	**.682**
XI. segment	***χ***	***R***	***F***	***p***	***c.dsc***
SHC37	.358	.384	7.259	.010	**.173**

Legend: c.dsc is the coefficient of discrimination (**bolded** values indicate items that the most contributed to the «group» discrimination within individual segments)

As the $p < .1$ for all items within particular segments of Q, (.046-.000), the coefficient of discrimination refers to items that have the greatest contribution to the between *groups* discrimination, or has to **accept the alternative hypothesis** A_3, it means that there is a significant difference between the *groups of respondents* different ethnic origin (a summary in Table 6).

Features and homogeneity of the *group* of respondents in relation to the modalities of items of individual segment Q HSW

Based on the previous discussion and analysis of a sample of 45 respondents, in accordance with the applied methodology, the logical sequence of the research is the determination of the characteristics and homogeneity of each ***"group"*** of examinees and the distance between them. The fact that the application of DISCRA analysis established significant between group differences in all segments of Q, means that there is clearly defined border between the two groups of students, and is possible to determine the features of each "***group"*** in relation to the applied items within scales of **Q-HSW** (a summary in Table 7).

Table 7 . The Characteristics and Homogeneity of the «groups» relative to the items of some scales of the (Q)

I. *The scale of physical functioning*	GRE-1	SRB-2	ctrb. %
FF08	FF8-2*	FF8-4*	**69.697**
FF10	FF10-2*, FF10-3*	FF10-4*	28.409
FF09	FF9-2*	FF9-4*	1.894
n/m (hmg %)	10/15 (66.67)	25/30 (83.33)	
II. *The Scale of Social relationships*	GRE-1	SRB-2	ctrb. %
SSR12	SSR12-3*	SSR12-4*	**99.339**
SSR11	SSR11-3*	SSR11-4*	.661
n/m (hmg %)	11/15 (73.33)	24/30 (80.00)	
III. *The Scale of Global health*	GRE-1	SRB-2	ctrb. %
SGH15	SGH15-2*	;;pt15;; is -,	**82.203**
SGH13	SGH13-2*	;;pt13;; is -,	10.169
SGH14	SGH14-2*	SGH14-4*	7.627
n/m (hmg %)	7/15 (46.67)	25/30 (83.33)	
IV. *The Scale of Bodily pain*	GRE-1	SRB-2	ctrb. %
SBP16	SBP16-3*	SBP16-4*	**79.651**
SBP17	SBP17-3*	SBP17-4*	20.349
n/m (hmg %)	12/15 (80.00)	22/30 (73.33)	
V. *The Scale of Psychological impact*	GRE-1	SRB-2	ctrb. %
SPI18	SPI18-(2)*, SPI18-(3)*	SPI18-(1)*	**70.785**
SPI19	SPI19-(2)*	SPI19-(4)*	29.215
n/m (hmg %)	14/15 (93.33)	21/30 (70.00)	
VI. *The Scale of Social relations*	GRE-1	SRB-2	ctrb. %
SSR21	SSR21-3*	SSR21-4*	**75.762**
SSR22	SSR22-2*	SSR22-4*	19.868
SSR23	SSR23-2*, SSR23-3*	SSR23-4*	2.252
SSR20	SSR20-3*	SSR20-4*	2.119
n/m (hmg %)	15/15 (100.00)	25/30 (83.33)	
VII. The *Scale of Self-evaluation*	GRE-1	SRB-2	ctrb. %
SES28	SES28-3*	SES28-4*	**51.064**
SES24	SES24-3*	SES24-4*	33.777
SES27	SES27-3*	SES27-4*	8.511
SES26	SES26-3*	SES26-4*	6.649
SES25	SES25-3*	SES25-4*	.000
n/m (hmg %)	14/15 (93.33)	25/30 (83.33)	
VIII. *The Scale of Mental health*	GRE-1	SRB-2	ctrb. %
MHS29	MHS29-2*, MHS29-3*	MHS29-4*	**81.896**
MHS30	MHS30-3*	MHS30-1*	18.104
n/m (hmg %)	14/15 (93.33)	25/30 (83.33)	
IX. *The Scale of Behavior*	GRE-1	SRB-2	ctrb. %
BHS32	BHS32-2*, BHS32-3*	BHS32-4*	**80.845**
BHS33	BHS33-3*	BHS33-4*	14.047
BHS31	BHS31-3*	BHS31-4*	5.108
n/m (hmg %)	14/15 (93.33)	23/30 (76.67)	
X. *The Scale of Family activities and Family connections*	GRE-1	SRB-2	ctrb. %
SFR36	SFR36-2*, SFR36-3*	SFR36-4*	**61.386**
SFR35	SFR35-3*	SFR35-4*	36.004
SFR34	SFR34-3*	SFR34-4*	2.610
%	14/15 (93.33)	27/30 (90.00)	
XI. *The Scale Change in health*	GRE-1	SRB-2	ctrb. %%
SHC37	SHC37-3*	:SHC37-4*	100.000
n/m (hmg %)	12/15 (80.00)	18/30 (60.00)	

hmg – homogeneity; **ctrb %** - contribution of item's to the characteristics

By calculating of Mahalanobi's distance between ***"groups",*** in all segment of the Q, one more indication of the similarities or differences is presented. Distances indicate on the ***greater*** distance between the ***"groups" (2.45-1.07),*** except for the XI. segment, where is established closer distance (.86), mainly due to the fact that this segment of Q contains only one item.

CONCLUSION

Applied Questionnaire (Q) for the assessment of the Quality of life, i.e., the Health and Social welfare (HSW) contains 11 segments and 30 items within them, with the possibility of the respondents to choose between four modalities of offered answers on the Likert-type scale (degree1-4) . On the basis of the conducted mathematical-statistical procedures, in the comparative analysis of the results and their interpretation, can be the following conclusions formulated, that indicates on the determined significant differences. To the between-groups differences mostly have contributed the characteristics and homogeneity of the groups, in relation to items of particular segments , the frequency of responses, i.e., a different opting for individual modalities of items. Respondents of GRE-1 had greater variability of the attitudes, which were not of the huge distance intensity of response modalities (2*-3*) while the participants of SRB-2, with one exception (1*), opted for the highest intensity of response modality (4*) for the most items within particular segments, which has significantly contributed to the established differences.Restrictions of the pilot-study are relating primarily to the possibility of research results generalization, due to the small sample of examinees, students of foreign citizenship. The second limitation is related to the previous, while is due to uneven size of subjects of opposite-sex, within sub-sample of the students of foreign origin, the elaborated between-group analysis was done only on the total samples, of both groups, without notification of gender characteristics and possible differences. The introductory part of the questionnaire HSW, which refers to the indicators of the Social status scale of the parents of respondents, has not shown, as a comparative indicator, due to limited paper volume, and other circumstances that accompanied this research selection. To some extent, the results of this pilot study can be compared with the results of the previous research, conducted by Popović, R. (2015), on the same sample of the home country participants, where they were shown the comparative indicators and gender differences, between homogeneous sub-samples of boys (n=15), and girls (n=15), of upper graders (VI and VIII) of Elementary school "Saint-Sava" in Nis (measurement was conducted in December, 2014).

However, more serious comparative analysis is not possible, while the presentation of the above mentioned study was based only on numerical and percentage indicators of the frequency of expressing items modalities, within certain segments of the Q for the assessment of the quality of life, or Health and Social well-being of children and youth aged 12 to 15 years , with no additional statistical data processing.

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