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Dragi čitaoci,

Časopis ”Sportske nauke i zdravlje” ulazi u svoju sedmu godinu izlaženja sa puno uspjeha i ostvarenih rezultata. Nažalost, ovaj broj izlazi bez dosadašnjeg glavnog urednika prof. dr Miladina Jovanovića koji se nije izborio protiv teške bolesti koja ga je zadesila.

In memoriam

Prof. dr Miladin Jovanović

Kao i u prethodnim časopisima tako i u ovom broju imaćete priliku pročitati vrlo zanimljive i interesantne radove naših saradnika. Naši saradnici (autori) iz Hrvatske, Bosne i Hercegovine i Srbije ponudili su nam značajne informacije svojih istraživačkih aktivnosti. Oni su nam u ovom broju pripremili priloge o biomehaničkim parametrima koji utiču na postizanje sportskih rezultata u bacanju kugle, stavovima studenata Akademije dramskih umjetnosti u odnosu na fizičko vježbanje, o psihološkom talentu i obilježjima mentalnog zdravlja rukometaša i rukometašica, istraživanjima eksplozivne snage u košarci, motoričkim dostignućima u košarci učenika osnovnoškolskog uzrasta, razvojnoj neuronauci u funkciji senzornog i perceptivnog razvoja djece ranog uzrasta, kao i o rezultatima ispitivanja zdravstvene bezbjednosti vode otvorenih bazena.

Zaista sjajni prilozi koji vam mogu poslužiti na razne načine kao lijep izvor zanimljivih tema iz oblasti sporta, zdravlja, rekreacije itd. Autorima radova koji su našli svoje mjesto u ovom broju časopisa želimo da se zahvalimo, jer na ovaj način na najbolji način doprinose našim nastojanjima da ovaj Časopis bude što čitaniji i što kvalitetniji.

Takođe se zahvaljujemo i svim onim koji svojim primjedbama i sugestijama doprinose na referentnosti časopiosa Sportske nauke i zdravlje.

Uvjereni smo da će naša saradnja u narednom periodu biti još bolja i kvalitetnija, a sve u cilju dostizanja visoko postavljenih standarda i ciljeva.

UREDNIŠTVO ČASOPISA

DearReaders,

The Journal “Sports Science and Health“ enters its seventh year of publication with lots of success and results. Unfortunately, this number is being published without its editor-in-chief, prof. dr Miladin Jovanovic, who did not manage to fight against the serious illness that he suffered from.

In memoriam

Prof. Dr Miladin Jovanovic

As in the previous journals and in this issue as well, you will have the opportunity to read very interesting papers of our associates. Our contributors (authors) from Croatia, Bosnia and Herzegovina and Serbia offered us some important information on our research activities. In this issue, they prepared annexes on biomechanical parameters that influence the achievement of sports results in the throwing of the ball, the attitudes of the students of the Academy of Dramatic Art in relation to physical exercise, the psychological talent and characteristics of the mental health of handball players and handball players, exploration of explosive power in basketball, motoric achievements in basketball played by the pupils of elementary school, developmental neuroscience in the function of sensory and perceptive development of children of early age, as well as the results of testing the health safety of open swimming pools.

Truly great contributions that can serve you in various ways as a nice source of interesting topics in the fields of sports, health, recreation, etc. We wish to thank the authors of the papers, who found their place in this issue of the magazine, because in this way they contribute to our efforts to make this Journal as readable and as good as possible.

We also thank all those who contribute to the references of Journal “Sports Science and Health” with their remarks and suggestions.

We are confident that our cooperation in the future will be even better and better, with the aim of achieving high standards and goals.

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Psychological Sporting Talent and Indicators of Mental Health at Young Male and Female Handball Players

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Abstract: The main goal of the research is to determine gender differences in the subscales within Multidimensional Scale of Sports' Psychological Talents (MSSPT): Mental Energy Scale (MES), Modified Big Five Inventory (MBFI), Modified Short Hardiness Scale (MSHS), Modified Athletic Engagement Scale (MAES), Modified Athletic Identity Scale (MAIS), Psychological Skills Inventory for Sports (MPSIS) and Modified Optimism Scale (OS)-R. The samples of 105 male (M) and 54 female (F) handball players were examined (age range 12-16 years), members of the teams Prvo plinarsko društvo, Metalac (Zagreb) and Zamet (Rijeka) (M); Zamet (Rijeka) and Samobor (F), in the beginning of 2015. The results revealed that six statistically significant gender differences are found: enthusiasm and motivation (higher means for females), extraversion, resilience, self-confidence and concentration (higher means for males). The results provide the information about possible differentiated approach of the coaches when working with male and female handball players.
Key words: measuring instruments, psychological talents, sport performance, health.

Introduction

The objective of this article is to gain insight into the gender differences in psychological characteristics that reflect sports talents and some indicators of mental health in top young handball players.

Interdisciplinary approach in handball is necessary for sport development of the athletes, to enable them to fulfill the tasks during the processes of sport competition or/and sport training (Abernethy, 2005; Morrow & James, 2005). Handball is dynamic sports game, which requests high-level demands on the athletes. Handball implies highly intensive

Psihološki talent i obilježja mentalnog zdravlja kod rukometaša i rukometašica

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Apstrakt: Osnovni cilj istraživanja bio je utvrditi razlike u subskalama unutar Višedimenzionalne Skale Psiholoških Sportskih Talenata (MSSPT): Modificirane skale mentalne energije (MES), Modificiranog Big Five Inventara (MBFI), Modificirane skale sportskog zalaganja (MAES), Modificirane skale psiholoških vještina (MPSIS) i Modificirane skale optimizma (MOS). Ispitani su uzorci od 105 rukometaša (M) i 54 rukometašice (Ž) (dobni raspon 12-16 godina), članova momčadi timova Prvo plinarsko društvo, Metalac (Zagreb) i Zamet (Rijeka) (M), Zamet (Rijeka) i Samobor (Ž), početkom 2015. godine. Rezultati su pokazali da je pronađeno šest statistički značajnih spolnih razlika: u entuzijazmu i motivaciji (veće aritmetičke sredine za žene), ekstraverzija, ustrajnost, samopouzdanje i koncentracija (veće aritmetičke sredine za muškarce). Dobiveni rezultati daju informacije o mogućem diferenciranom pristupu trenera pri radu s rukometašima i rukometašicama.
Ključne riječi: mjerni instrumenti, psihološki talenti, sportska izvedba, zdravlje.

Uvod

Tema ovog članka je stjecanje uvida u spolne razlike u psihološkim karakteristikama koje odražavaju sportski talent i u nekoliko indikatora mentalnog zdravlja kod vrhunskih mladih rukometaša.

Interdisciplinarni pristup u rukometu je potreban za sportski razvoj pojedinca, koji će mu omogućiti da ispuni zadatke tijekom procesa sportskog natjecanja i / ili sportskog treninga (Abernethy, 2005; Morrow & James, 2005). Rukomet je dinamična sportska igra koja postavlja sportašima zahtjeve na visokoj razini. Rukomet podrazumijeva visoko intenzivnu motoričku aktivnost, te iziskuje visoku razinu bazičnih i specifičnih

motor activity needs high level of basic and specific motor abilities (e.g. explosive strength, agility and speed).

The importance of detecting psychological sports talents

Top athletes in certain sports are very often equalized among themselves in many relevant elements of sport-related characteristics (morphological, psychological, motor, etc.) (Rogulj et al., 2006). Therefore, psychological characteristics could sometimes be decisive in competition and training processes, by differentiating between successful and less successful teams or individual athletes. Numerous studies are conducted to investigate important psychological characteristics of the athletes. Very often, the focus in these studies was the motivation of the athletes (Seifriz, Duda & Chi, 1992; Mead, Drowatzky & Hardin-Crosby, 2000), traits and moods (Berger et al., 1997), etc. Except the motivation, the athletes' behaviors in critical situations during a competition and during training process are particularly important (James & Collins, 1997; Wiggins, 1998), as same as in situations that emphasize anxiety (Dunn & Nielsen, 1996). The importance of detecting psychological sports talents is particularly important when investigating relevant psychological characteristics in young players.

Multidimensional Scale of Sports' Psychological Talents

In this study, several psychological characteristics are chosen to be examined in male and female handball players, within new battery of measuring instruments called Multidimensional Scale of Sports' Psychological Talents (MSSPT) (Sindik, Missoni & Horvat, 2015; Sindik, Botica & Fiškuš, 2015; Sindik & Bauer Čuk, 2016; Schuster, Sindik & Kavran, 2016).

Athlete engagement is a concept developed by Lonsdale, Hodge and Jackson (2007). The concept of athlete engagement consists of four dimensions: confidence, dedication, vigor, and enthusiasm (Lonsdale et al., 2007). *Mental energy* describes specific biological processes involved in the capacity of brain neurons to do physical work, i.e. to perform physical activity. It is related to the mood or motivational and cognitive processes (Sindik et al., 2015). *Five-Factor Model* and the *Big Five Model* assume that personality can be described with a small number of fundamental constructs (Macdonald, Bore & Munro, 2008). According to these theories, five factors of personality can be described: extraversion, agreeableness, conscientiousness, emotional stability and openness to experience (Pervin & John, 1997). The concept of *optimism* describes expectancies for the future. Optimists assume that adver-

motoričkih sposobnosti (npr. eksplozivna snaga, agilnost i brzina).

Važnost otkrivanja psiholoških sportskih talenata

Vrhunski sportaši u pojedinim sportovima često su izjednačeni međusobno u mnogim relevantnim elementima za sport povezanih karakteristika (morfoloških, psiholoških, motoričkih, itd.) (Rogulj i sur., 2006). Dakle, psihološke karakteristike ponekad mogu biti odlučujuće u procesima treninga i natjecanja, kao i u razlikovanju između uspješnih i manje uspješnih timova ili pojedinih sportaša. Brojne studije su provedene kako bi se istražile važne psihološke karakteristike sportaša. Vrlo često, naglasak u ovim studijama je motivacija sportaša (Seifriz, Duda i Chi, 1992; Mead, Drowatzky & Hardin-Crosby, 2000), osobine i raspoloženja (Berger et al., 1997), itd. Osim motivacije, ponašanje sportaša u kritičnim situacijama tijekom natjecanja i tijekom trenažnog procesa je posebno važno (James & Collins, 1997; Wiggins, 1998), kao i u situacijama koje naglašavaju tjeskobu (Dunn & Nielsen, 1996). Otkrivanje psiholoških sportskih talenata je posebno važno kada se istražuju relevantne psihološke karakteristike u mladih igrača.

Višedimenzionalna Skala Psiholoških Sportskih Talenata (MSSPT)

U ovom istraživanju je više psiholoških karakteristika izabrano da bude ispitano u rukometaša i rukometašica, primjenom nove baterije mjernih instrumenata nazvane Višedimenzionalna Skala Psiholoških Sportskih Talenata (MSSPT) (Sindik, Missoni i Horvat, 2015, Sindik, Botica i Fiškuš 2015; Sindik-Bauer Ćuk, 2016, Schuster, Sindik-Kavran, 2016). *Sportska angažiranost* je koncept koji su razvili Lonsdale, Hodge i Jackson (2007). Koncept sportska angažiranost sastoji se od četiri dimenzije: povjerenja, posvećenosti, snage i entuzijazma (Lonsdale et al., 2007). *Mentalna energiziranost* opisuje specifične biološke procese, uključene u neuronima mozga za fizički rad, tj. obavljanje fizičke aktivnosti. Odnosi se na raspoloženje ili motivacijske i kognitivne procese (Sindik i sur., 2015). *Pet-Faktorski model i Velepetori model ličnosti* pretpostavljaju da se ličnost može opisati s malim brojem osnovnih konstrukata (Macdonald, Bore & Munro, 2008). Prema tim teorijama, pet je faktora ličnosti: ekstraverzija, ugodnost, savjesnost, emocionalna stabilnost i otvorenost prema iskustvu (Pervin & John, 1997). Koncept *optimizma* opisuje očekivanja vezana za budućnost. Optimisti pretpostavljaju da se nevoljama može uspješno rukovati, dok su pesimisti neodlučni i imaju tendenciju predviđanja katastrofa (Seligman, 1990). *Psihološke vje-*

sity can be handled successfully, while the pessimists are more doubtful, hesitant, and tend to anticipate disaster (Seligman, 1990). *Psychological skills* (Cox, Liu & Qiu, 1996; Meyers, Bourgeois, LeUnes, & Murray, 1999) are invented to differentiate between the mental skills in various sport quality levels, from the recreational to elite level athletes (Cox et al., 1996; Meyers et al., 1999). *Mental toughness* could is the natural or developed psychological ability that enable to someone to cope better than his/her opponents with the many demands (of the competition, training and lifestyle) in sport situation. Mentally tough individual tends to remain determined, focused, confident, and in control under pressure (Jones, 2002). *Hardiness* is a set of attitudes, beliefs, and behavioral tendencies, with three positively linked components: commitment, control and challenge (Kobasa, 1979; Hanton, Evans & Neil, 2003). In the concept of hardiness in MSSPT, the original hardiness scales are combined with the aspect of resilience in mental toughness. *Athletic identity* describes the degree of strength and exclusivity to which a person is identified with her/his athlete role (Brewer, Van Raalte, & Linder, 1990). It is a significant social dimension of self-concept, which is affected by experience, relations with others and involvement in sport activities (Cornelius, 1995).

In previous studies, the researchers found that the most significant differences are found in dimensions of MSSPT between the players of different age groups, while no differences are found according to winning medals in junior state championship or according to the membership in the junior national team (Sindik & Bauer Čuk, 2016). Two profiles of male handball players are found in this study: in the first cluster were older players with higher means in self-esteem and mental energy as strength while making errors, while in the second cluster were grouped younger players with higher means in all other psychological characteristics (Sindik & Bauer Čuk, 2016). In this and all other studies conducted using MSSPT (Sindik, Missoni & Horvat, 2015; Sindik, Botica & Fiškuš, 2015; Schuster, Sindik & Kavran, 2016), satisfactorily reliability type internal consistency is found almost in all psychological concepts and subscales, except in Modified Big Five Inventory (MBFI). In MBFI, all subscales were unsatisfactorily reliable (Sindik, Missoni & Horvat, 2015).

On the other hand, all abovementioned psychological characteristics are reflecting both sports talents and some indicators of mental health as well. Namely, all chosen psychological characteristics are desirable from the aspect of psychological mental health, directly (neuroticism, anxiety control, ability to cope with stress) or indirectly. The insight in gender differences could provide the informacije o karakteristikama koje su važne za trenera da bi usredotočio svoju pozornost na njih, kada radi sa sportašima u muškoj ili ženskoj rukometnoj momčadi.

štine (Cox, Liu & Qiu, 1996; Meyers, Bourgeois, LeUnes i Murray, 1999) su izmišljene da bi razlikovale mentalne sposobnosti sportaša različitih razina sportske kvalitete, od rekreativnih do elitnih sportaša (Cox et al., 1996; Meyers et al., 1999). *Mentalna čvrstoća* je prirodna ili razvijena fizička ili psihološka sposobnost koja omogućuje nekome da se nosi bolje od drugih sportaša s brojnim zahtjevima (natjecanje, trening i način života) u sportskoj situaciji. Psihički čvrst pojedinac teži da ostane određen, usredotočen, uvjeren, i pod kontrolom kad je pod pritiskom (Jones, 2002). *Otpornost* je skup stavova, uvjerenja i sklonosti u ponašanju, s tri pozitivno povezane komponente: predanost, kontrola i izazov (Kobasa, 1979; Hanton, Evans & Neil, 2003). U konceptu mentalne čvrstoće u MSSPT, izdržljivost je dana u kombinaciji s tri aspekta otpornosti. *Sportski identitet* opisuje stupanj snage i ekskluzivnost na kojoj se osoba poistovjećuje sa sportaševom ulogom (Brewer, Van Raalte & Linder, 1990). To je značajna društvena dimenzija koncepta o sebi, koji je pod utjecajem iskustva, odnosa s drugima i uključivanja u sportske aktivnosti (Cornelius, 1995).

U prethodnim studijama, istraživači su otkrili da su najznačajnije razlike pronađene u dimenzijama MSSPT između rukometaša različitih dobnih skupina, a nema pronađene razlike prema osvajanju medalje na juniorskom državnom prvenstvu ili prema članstvu u juniorskoj reprezentaciji (Sindik i Bauer Čuk, 2016). Dva profila rukometaša pronađena su u ovoj studiji: u prvom klasteru bili su stariji igrači s više samopouzdanja i mentalne energije u situacijama počinjenih pogreški, dok su u drugom klasteru bili grupirani mlađi rukometaši s naglašenijim ostalim psihološkim karakteristikama (Sindik & Bauer Čuk, 2016). U ovoj i svim drugim studijama korištenjem MSSPT (Sindik, Missoni & Horvat, 2015; Sindik, Botica & Fiškuš, 2015; Schuster Sindik & Kavran, 2016), zadovoljavajuća pouzdanost tipa unutarnje konzistencije je pronađena u gotovo svim psihološkim konceptima i subskalama, osim za Modificirani inventar Big Five (MBFI). U MBFI, sve subskale su bile nepouzdane (Sindik, Missoni i Horvat, 2015).

S druge strane, sve gore navedene psihološke karakteristike odražavaju i sportske talente i nekoliko indikatora mentalnog zdravlja istovremeno. Naime, sve izabrane psihološke karakteristike su poželjne s aspekta psihološkog mentalnog zdravlja, izravno (neuroticizam, kontrola anksioznosti, sposobnost nošenja sa stresom) ili posredno. Uvid u spolne razlike može pružiti informacije

mation about the characteristics that are more important to coaches to focus their attention, when working with the athletes in male or female handball team.

The main goal of this research is to determine gender differences in subscales within Multidimensional Scale of Sports' Psychological Talents (MSSPT): Mental Energy Scale (MES), Modified Big Five Inventory (MBFI), Modified Athletic Engagement Scale (MAES), Modified Athletic Identity Scale (MAIS), Modified Short Hardiness Scale (MSHS), Modified Psychological Skills Inventory for Sports (MPSIS) and Modified Optimism Scale (MOS).

Method

Sample

The research was conducted on a purposeful sample of 159 subjects 105 male (M) and 54 female (F) handball players (age range 12-16 years), members of the handball teams: Prvo plinarsko društvo (N=68), Metalac (N=14) (Zagreb) and Zamet (N=23) (Rijeka) (M); Zamet (N=19) (Rijeka) and Samobor (N=35) (F), in the beginning of 2015. Average age of the subjects was 13.80±4.12 years, while their experience of training handball was 5.31±3.61 years.

Measuring instruments

In this study, seven measuring instruments from Multidimensional Scale of Sports' Psychological Talents (MSSPT) are used. The theoretical frameworks of these psychological measuring instruments are obtained from belonging measuring instruments, but with significant modifications: Modified Life Orientation Test (in this study MOS, 10 items) (Scheier, Carver & Bridges, 1994), Modified Big Five Inventory-10 (MBFI, 10 items) (Rammstedt & John, 2007), Modified Athlete Engagement Questionnaire (MAES, 16 items) (Lonsdale, Hodge & Jackson, 2007), Modified Short Hardiness Scale (MSHS, 15 items), Modified Athletic Identity Scale (MAIS, 11 items), Mental Energy Scale (MES, 14 items) (Sindik, Botica & Fiškuš, 2015) and Psychological Skills Inventory for Sports (MPSIS, 44 items) (Mahoney et al., 1987). In all the questionnaires, the five-point Likert-type scale is used, in range from 1 (absolutely disagree) to 5 (absolutely agree). In this study, as well as in previous study conducted only in males (Sindik, Missoni & Horvat, 2015), MBFI obtained unsatisfactorily reliable subscales. All other subscales in all questionnaires revealed satisfactorily reliability type internal consistency (Cronbach's alpha), in range from 0.55 to 0.92. All subscales and their belonging to certain psychological concepts are observable in Table 1.

Glavni cilj ovog istraživanja bio je utvrditi spolne razlike u subskalama unutar Višedimenzionalne Skale Psiholoških Sportskih Talenata (MSSPT): Skale mentalne energije (MES), Modificiranog inventara Big Five (MBFI), Modificirane skale sportskog angažmana (MAES), Modificirane skale sportskog identiteta (MAIS), Modificirane kratke skale otpornosti, Modificiranog inventara sportskih psiholoških vještina (MPSIS) i Modificirane skale optimizma (MOS).

Metoda

Uzorak

Istraživanje je provedeno na namjernom uzorku od 159 ispitanika, 105 rukometaša (M) i 54 rukometašica (Ž) (raspon dobi od 12-16 godina), članova rukometnih klubova: Prvo plinarsko društvo (N=68), Metalac (N=14) (Zagreb) i Zamet (N = 23) (Rijeka) (M); Zamet (N=19) (Rijeka) i Samobor (N=35) (Ž), na početku 2015. godine. Prosječna dob ispitanika bila je 13,80 ± 4,12 godina, a iskustvo treninga rukometa bilo je 5,31 ± 3,61 godina.

Mjerni instrumenti

U ovom istraživanju, koristilo se sedam mjernih instrumenata iz Višedimenzionalne Skale Psiholoških Sportskih Talenata (MSSPT). Teoretski okviri tih psiholoških mjernih instrumenata dobiveni su iz pripadnih mjernih instrumenata, ali sa značajnim modifikacijama: Modificirana skala optimizma (u ovom istraživanju MOS, 10 stavki) (Scheier, Carver & Bridge, 1994), Modificirani inventar Big Five (MBFI, 10 stavki) (Rammstedt & John, 2007), Modificirana skala sportske angažiranosti (MAES, 16 stavki) (Lonsdale, Hodge i Jackson, 2007), Modificirana kratka skala otpornosti (MSHS, 15 stavki), Modificirana skala sportskog identiteta (MAIS, 11 stavki), Skala mentalne energije (MES, 14 stavki) (Sindik, Botica i Fiškuš, 2015) i Modificirana skala psiholoških sportskih vještina (MPSIS, 44 stavki) (Mahoney i sur., 1987). U svim anketama, koristila se petostupanjska Likertova skala, u rasponu od 1 (uopće se ne slažem) do 5 (potpuno se slažem). U ovom istraživanju, kao i u prethodnom istraživanju provedenom samo na rukometašima (Sindik, Missoni i Horvat, 2015), za MBFI su subskale bile nezadovoljavajuće pouzdane subskale. Sve ostali subskale u svim ostalim upitnicima pokazale su zadovoljavajuće pouzdanosti tipa unutarnje konzistencije (Cronbach alfa), u rasponu od 0,55 do 0,92. Sve subskale i njihove pripadnosti određenim psihološkim konceptima vidljivi su u tablici 1.

Procedure

According to the Ethical Codex of the Croatian Psychological Chamber, psychologists conducted the measurement of psychological characteristics. The subjects voluntarily and anonymously took part in the research, with the consent of their coaches, clubs' managements and themselves, as well as with the parents' signing of the informed consent, for all the players.

Statistical analysis

The overall results for certain subscales have been defined as simple linear combinations for the estimations on each item of the certain subscale. Cronbach alpha coefficients are used to determine internal consistency reliability of the subscales in psychological measuring instruments. Gender differences were tested using Man Whitney U-test. Statistical analyses were conducted using the statistical program IBM SPSS 23.0, while all statistical significances are commented on the level of $p<0.05$.

Results and Discussion

Among all analyzed gender differences in psychological talents and characteristics of mental health in young handball players, six statistically significant differences are found, in the subscales, as following: enthusiasm and motivation (higher means for females), extraversion, resilience, self-confidence and concentration (higher means for male handball players) (Table 1).

Table 1. *Gender differences in psychological talents and characteristics of mental health in young handball players*

Postupak

Prema Etičkom kodeksu Hrvatske psihološke komore, psiholozi su proveli mjerenje psiholoških karakteristika. Ispitanici su dobrovoljno i anonimno sudjelovali u istraživanju, uz suglasnost njihovih trenera, klubova i uprave, uz potpisivanje informiranog pristanka roditelja za sve sportaše.

Statistička analiza

Ukupni rezultati za pojedine subskale definirani su kao jednostavne linearne kombinacije za procjene za svaku stavku određene subskale. Cronbach alfa koeficijenti koristili su se za utvrđivanje pouzdanosti tipa unutarnje konzistencije, za sve subskale u psihološkim mjernim instrumentima. Spolne razlike su testirane pomoću Man Whitneyeva U-testa. Statističke analize provedene su pomoću statističkog programa IBM SPSS 23.0, dok su sve statistički značajne razlike komentirane na razini rizika $p<0.05$.

Rezultati i rasprava

Među svim analiziranim spolnim razlikama u psihološkim talentima i karakteristikama mentalnog zdravlja u mladih rukometaša/ica, šest statistički značajnih razlika pronađeno je u subskalama: entuzijazma i motivacije (veće aritmetičke sredine za rukometašice), ekstraverzija, ustrajnost, samopouzdanje i koncentracija (veće aritmetičke sredine za rukometaše) (tablica 1).

Tablica 1. *Spolne razlike u psihološkim talentima i obilježjima mentalnog zdravlja kod mladih rukometaša i rukometašica*

Varijable / *Variables*	Spol / *Gender*	Arit. sred. / *Mean*	Std. raspršenje / *Std. Deviation*	Man Whitney U-test (p)
samocijenjenje / *self-esteem*	Muški / *Male*	4.048	0.815	.153
	Ženski / *Female*	4.318	0.623	
posvećenost / *dedication*	Muški / *Male*	4.381	0.708	.426
	Ženski / *Female*	4.511	0.526	
energija / *energy*	Muški / *Male*	4.433	0.702	.223
	Ženski / *Female*	4.627	0.438	
entuzijazam / *enthusiasm*	Muški / *Male*	4.641	0.665	**.044**
	Ženski / *Female*	**4.830**	0.249	
mentalna energiziranost / *mental energy*	Muški / *Male*	4.270	0.732	.657
	Ženski / *Female*	4.344	0.470	
ekstraverzija / *extraversion*	Muški / *Male*	**3.680**	0.901	**.001**
	Ženski / *Female*	3.136	0.581	
savjesnost / *conscientiousness*	Muški / *Male*	3.494	0.745	.643
	Ženski / *Female*	3.409	0.781	
ugodnost / *agreeableness*	Muški / *Male*	4.192	0.708	.565
	Ženski / *Female*	4.091	0.796	

otvorenost / *openness to experience*	Muški / *Male*	4.404	0.707	.560
	Ženski / *Female*	4.500	0.577	
neuroticizam / *mental stability*	Muški / *Male*	4.180	0.964	.909
	Ženski / *Female*	4.205	0.648	
vlastiti identitet / *self-identity*	Muški / *Male*	4.265	0.747	.896
	Ženski / *Female*	4.288	0.528	
ekskluzivnost / *exclusivity*	Muški / *Male*	4.308	0.626	.555
	Ženski / *Female*	4.394	0.479	
socijalni identitet / *social identity*	Muški / *Male*	4.385	0.558	.480
	Ženski / *Female*	4.477	0.475	
negativni afektivitet / *negative affectivity*	Muški / *Male*	3.859	0.793	.568
	Ženski / *Female*	3.750	0.768	
predanost / *commitment*	Muški / *Male*	4.436	0.429	.524
	Ženski / *Female*	4.372	0.356	
kontrola / *control*	Muški / *Male*	4.470	0.541	.620
	Ženski / *Female*	4.408	0.425	
izazov / *challenge*	Muški / *Male*	4.184	0.509	.293
	Ženski / *Female*	4.310	0.432	
ustrajnost / *resilience*	Muški / *Male*	**3.776**	0.665	.026
	Ženski / *Female*	3.421	0.600	
motivacija / *motivation*	Muški / *Male*	4.047	0.733	**.018**
	Ženski / *Female*	**4.264**	0.159	
samopouzdanje / *self-confidence*	Muški / *Male*	**3.387**	0.784	.002
	Ženski / *Female*	2.843	0.442	
anksioznost / *anxiety*	Muški / *Male*	2.617	0.612	.705
	Ženski / *Female*	2.561	0.625	
mentalna pripremljenost / *mental preparedness*	Muški / *Male*	2.745	0.876	.542
	Ženski / *Female*	2.621	0.718	
naglasak na momčad / *emphasis on team*	Muški / *Male*	3.474	0.490	.103
	Ženski / *Female*	3.669	0.489	
koncentracija / *concentration*	Muški / *Male*	**2.905**	0.584	**.003**
	Ženski / *Female*	2.491	0.500	
optimizam / *optimism*	Muški / *Male*	4.052	0.513	.525
	Ženski / *Female*	4.128	0.401	

Legend - *subscales: Modified Big Five Inventory (MBFI) - extraversion, agreeableness, conscientiousness, emotional stability, intellect; Modified Athletic Engagement Scale (MAES) - dedication, self-esteem, enthusiasm and energy; Mental Energy Scale (MES) - mental energy; Modified Short Hardiness Scale (MSHS) – commitment, control, challenge and resilience; Modified Athletic Identity Scale (MAIS) - self-identity, exclusivity, negative affectivity and social identity; Modified Optimism Scale (MOS) – optimism; Modified Psychological Skills Inventory for Sports (MPSIS): motivation, self-confidence, anxiety, mental preparedness, emphasis on team, concentration*

Legenda - *subskale: Modificirani inventar Big Five (MBFI) – ekstraverzija, savjesnost, ugodnost, otvorenost, neuroticizam; Modificirana skala sportske angažiranosti (MAES) – samocijenjenje, posvećenost, energija, entuzijazam; Skala mentalne energije (MES) - mentalna energiziranost; Modificirana kratka skala otpornosti (MSHS) – predanost, kontrola, izazov, ustrajnost; Modificirana skala sportskog identiteta (MAIS) - vlastiti identitet, ekskluzivnost, socijalni identitet, negativni afektivitet; Modificirana skala optimizma (MOS) – optimizam; Modificirana skala psiholoških sportskih vještina (MPSIS): motivacija, samopouzdanje, anksioznost, mentalna pripremljenost, naglasak na momčad, koncentracija*

The main findings obtained reflect six statistically significant gender differences. Enthusiasm (the subscale of Modified Athletic Engagement Scale) and motivation (aspect of Modified Psychological Skills Inventory for Sports) are more emphasized in female handball players. The most

Glavni dobiveni rezultati odražavaju šest statistički značajnih spolnih razlika. Entuzijazam (subskala MAES) i motivacija (aspekt MPSIS) su izraženiji u rukometašica. Najrazumnije objašnjenje moglo bi se naći u ulozi

reasonable explanation could be found in a specific role of handball coaches, who could ensure high level of enthusiasm of female players (Lonsdale et al., 2007), what could have an impact on keeping high level of motivation. Moreover, higher level of extraversion, resilience, self-confidence and concentration in male handball players could be also explained in terms of role of the coach in certain club, but also related with specific features of certain group of players. Unexpected results could be only higher level of extraversion in male handball players, which is contrary to the expectations (Macdonald et al., 2008). It could be explained in terms of specific features of certain group of players, but also the period of adolescence, with high importance of the peers in this life period. Although, extraversion is a subscale from MBFI, which is not enough reliable.

The benefit of this research is the application of MSSPT in investigating gender differences among the athletes, particularly in young handball players, with confirming good psychometrical characteristics of all psychological subscales, except those from MBFI.

The main shortcoming of the research is the fact that MSSPT is still in the phase of developing, while the MBFI has to be replaced with better measuring instrument, maybe with more items. Moreover, in spite of relative equalizing of the participants according to the level of sport excellence, the samples are not randomized.

In future research it would be useful to improve the quality of MBFI (in terms of its psychometric properties), applying it on a larger and more representative samples of athletes. Practical implication of this study could be focused on determining orientation gender-adjusted standards in chosen psychological characteristics in MSPPT. Namely, these results obtained provide the information about possible differentiated approach of the coaches when working with male and female handball players (Nideffer & Bond, 2012).

Conclusion

Six statistically significant gender differences are found. For enthusiasm and motivation, higher means are found for females), while for extraversion, resilience, self-confidence and concentration, higher means are found for male handball players. In spite of similar characteristics in many psychological and mental health features, across the genders, the results provide the information about differentiated approach of the coaches, when working with male or female handball players.

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The authors have contributed equally.

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rukometnih trenera, koji mogu osigurati visoku razinu entuzijazma kod rukometašica (Lonsdale et al., 2007), što bi moglo imati utjecaja na održavanje visoke razine motivacije. Također, viša razina ekstraverzije, otpornosti, samopouzdanja i koncentracije kod rukometaša mogu istovjetno biti objašnjeni ulogom trenera u nekom klubu, ali može biti i povezana sa specifičnim obilježjima određene skupine igrača. Neočekivani rezultati mogu biti samo viša razina ekstraverzije kod rukometaša, što je suprotno očekivanjima (MacDonald et al., 2008). To bi se moglo objasniti u smislu posebnih obilježja određene skupine igrača, ali i razdoblja adolescencije, s visokim važnosti vršnjaka u tom životnom periodu. Međutim, ekstraverzija je i subskala iz MBFI, koja nije dovoljno pouzdana.

Praktična korist ovog istraživanja je primjena MSSPT u istraživanju spolnih razlika među sportašima, osobito kod mladih rukometaša, a potvrđene su i dobre psihometrijske karakteristike većine psiholoških subskala, osim onih iz MBFI.

Glavni nedostatak istraživanja je činjenica da je MSSPT još uvijek u fazi razvoja, a MBFI mora se zamijeniti s boljim mjernim instrumentom, možda s većim brojem stavki. Osim toga, unatoč relativnom izjednačavanju sudionika prema razini sportske izvrsnosti, uzorci nisu slučajno odabrani.

U budućim istraživanjima bilo bi korisno poboljšati kvalitetu MBFI (u smislu njegovih psihometrijskih svojstava), primjenom na većim i reprezentativnijim uzorcima sportaša. Praktična implikacija ovog istraživanja može biti usmjerena na određivanje orijentacijskih spolno prilagođenih standarda u odabranim psihološkim karakteristikama unutar MSPPT. Naime, ovi rezultati daju informacije o mogućem diferenciranom pristupu trenera pri radu s rukometašima i rukometašicama (Nideffer & Bond, 2012).

Zaključak

Pronađeno je šest statistički značajnih spolnih razlika. Za entuzijazam i motivaciju (izraženije su kod rukometašica), dok su za ekstraverziju, otpornost, samopouzdanje i koncentraciju, više vrijednosti prosječnih rezultata pronađene za rukometaše. Unatoč sličnim karakteristikama u mnogim psihološkim obilježjima i pokazateljima mentalnog zdravlja, podaci o spolnim razlikama daju informacije o mogućnostima diferenciranog pristupa trenera, kada radi s rukometašima ili rukometašicama.

Izjava autora
Autori pridonijeli jednako.

Konflikt interesa
Mi izjavljujemo da nemamo konflikt interesa.

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Influence of Angular Values of Body Segments on the Distance of the Throw Out In (Z) Axis

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Abstract: This research was carried out on atop atlete, representative of Bosnia and Herzegovina, with the aim of determining the significance and magnitude of the angle value impact (A) of the body segments in the projection (Z) or the sphere length of the sphere 0.1 s before the spit.

When selecting variables, it was taken into account that they satisfy the basic metric characteristics (validity, relievability, objectivity, sensitivity ...) and that they are aligned with the technology and instrumentation used to capture and determine their kinematic parameters. In order to determine the magnitude and size of the influence of kinematic parameters of the individual shot put elements (A) in the projection (Z) or 0.1 s before the ball spout (predictor set of variables) on the length (range) of the sphere (criterion variable), regression analysis was used. The regression results of the analysis indicate that there is a statistically significant influence of the angle position (A) of the body segments in the projection (X) or the length of the sphere 0.1 s before the throw-out.

Analysis of the influence of individual variables of the angular position (A) in the axis (Z), shows that the most statistically positive impact on the criterion variable length in the ejection time of 0.1 seconds before ejection has a variable angular position of the left shoulder of the level of the seventh cervical vertebra (AzLC7R). The time span up to 0.1 seconds before the angular position of the left shoulder to the level of the seventh cervical vertebra to the axis (Z) there is as a result of the angular connection (A) of movement in the vertical extension expressed body axis (Z) relative to the projection of the moment of casting and reconciliation.

Keywords: shot put, rotational technique, kinematics, regression analysis

Uticaj uglovnih vrijednosti segmenata tijela na dužinu izbačaja kugle u projekciji (z) ose

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Sažetak: Istraživanje je provedeno na uzorku vrhunskog bacača kugle, reprezentativca BiH, s ciljem utvrđivanja značajnosti i veličine uticaja uglovnih vrijednosti (A) segmenata tijela u projekciji (z) ose na dužinu izbačaja kugle 0.1 s prije izbačaja. Uzorak varijabli predstavljali su uglovni položaji (A) segmenata tijela snimljeni 0.1 s prije izbačaja kugle, njih dvadeset jedan, koji su činili prediktorski skup varijabli. Prilikom izbora varijabli vodilo se računa da one zadovoljavaju osnovne metrijske karakteristike (validnost, relijabilnost, objektivnost, osjetljivost) i usklađene sa tehnologijom i instrumentarijem koji je korišten prilikom snimanja i utvrđivanja njihovih kinematičkih parametara. Za utvrđivanje značajnosti i veličine uticaja kinematičkih parametara pojedinih segmenata tijela bacača kugle – uglovnih (A) vrijednosti u projekciji (z) ose 0.1 s prije izbačaja kugle (prediktorski skup varijabli) na dužinu izbačaja (domet) kugle (kriterijska varijabla), primjenjena je regresiona analiza. Rezultati regresione analize ukazuju na to da postoji statistički značajan uticaj uglovnog položaja (A) segmenata tijela u projekciji (x) ose na dužinu izbačaja kugle 0.1 s prije izbačaja. Analizom uticaja pojedinačnih varijabli uglovnog položaja (A) u projekciji (z) ose, može se vidjeti da najveći i statistički značajan pozitivan uticaj na kriterijsku varijablu, dužina izbačaja u vremenu 0,1 s prije izbačaja ima varijabla, *uglovni položaj lijevog ramena u nivou sedmog vratnog pršljena (AzLC7R)*. U trenutka izbačaja do 0.1 s prije ugaonog položaja lijevog ramena u nivou sedmog vratnog pršljena u osi (z) došlo je kao posljedica povezanosti uglovnog (A) kretanja u vertikalnom opružanju tijela ose (z) u odnosu na projekciju kretanja sprave odnosno trenutka izbačaja.

Ključne riječi: bacanje kugle, rotaciona tehnika, kinematika, regresiona analiza

Introduction

Shot put rotational technique is characterized by very complex structure of the movement to be performed with high speed and to a limited area of the lot. For easier analysis of technique, training techniques and the purpose of scientific research, shot put rotational technique is divided into four phases, while biomechanical analysis can be divided into seven phases, but it is complete so that in its implementation the transition from phase to phase is not notice. Due to the large angular deviation during movement, ie. any errors that occur in one phase, can have possible manifestation on the proper execution of movements of the body in the next phase and after casting balls, which calls into question the achievement of the maximum range casting.

Kinematic analysis aimes to describe and quantify linear and angular displacement between the launchers body segments or movements in relation to the environment and to calculate the velocity and acceleration. Determination of distance traveled, position and movement of the body or body parts and certain segments of the body is achieved by identifying markers positioned on the characteristic anatomical points. Kinematics based on 2D and 3D reconstruction is increasingly present in sports, sports prophylaxis and rehabilitation.

Evaluating of the success of shot put throw is simple, because the length of the throw is only result which is evaluated and graded. The length is most dependent on the way in which the forces acts on the ball, which is related to the speed of ejection, corner of ejection and the amount of ejection (Stepanek & Sušanka, 1987; Palm, 1990; Gemer, 1990; Bartonietz, 1994; Goldman et. Al., 1997; Luhtanen et. al., 1997; Goldman et. al., 1997; Lanka, 2000; Hubbard et. al., 2001, Linthorne., 2001; Rasmussen, 2005).

The complexity of the shot put rotational technique stems from 3D - dimensional movement of the shot-putter from limited space and a short period of timing.

Due to the complexity of movement that produces a force acting on the ball, limited space and short time, analyzing these disciplines is a very complex task for trainers, experts and academics. From the above, in this paper, emerged a short timing or ejections 0.1 seconds prior to casting and change of values in the cast 0.1 seconds before casting.

The objective of this study to determine the effect of specific angular value of the body segment length of the projection of the ejection balls in (Z) axis.

Uvod

Rotacionu tehniku bacanja kugle karakterišu veoma kompleksne strukture kretanja koje se izvode sa velikom brzinom i pravilima definisanom prostoru. Radi lakše analize tehnike, usavršavanja tehnike i u svrsi naučnog istraživanja, rotaciona tehnika bacanja kugle podijeljena je u četiri faze, a u biomehaničkoj analizi može se podijeliti na sedam faza, ali ipak ona je cjelovita tako da se kod njenog izvođenja ne primjećuje prelaz iz faze u fazu. Zbog velikog uglovnog odstupanja prilikom kretanja, tj. eventualne greške koja nastane u jednoj fazi, moguće je ispoljavanje njenog uticaja na pravilno izvođenje kretanja tijela u sljedećoj fazi i poslije izbačaja kugle, što dovodi u pitanje postizanje maksimalnog dometa izbačaja.

Kinematska analiza odnosi se na opisivanje i kvantifikovanje linearnog i ugaonog pomaka između segmenata tijela bacača ili kretanja u odnosu na okolinu kao i izračunavanje brzine i ubrzanja. Određivanje prijeđenog puta, položaja i pokreta tijela ili dijelova tijela i pojedinih segmenata tijela ostvaruje se identifikacijom markera pozicioniranim na karakterističnim anatomskim tačkama. Kinematika bazirana na 2D i 3D rekonstrukciji sve više je prisutna u sportu, sportskoj profilaksi i rehabilitaciji.

Ocjenjivanje uspješnosti bacanja kugle veoma je jednostavno, jer je dužina bacanja jedini rezultat koji se vrednuje i boduje. Dužina je najviše zavisna od puta na kojem sile djeluju na kuglu, što se manifestuje u brzini izbacivanja, uglu izbacivanja i visini izbacivanja (Stepanek & Sušanka, 1987; Palm, 1990; Gemer, 1990; Bartonietz, 1994; Goldman et. al.,1997; Luhtanen et. al., 1997; Goldman et. al., 1997; Lanka, 2000; Hubbard et. al., 2001; Rasmussen, 2005).

Kompleksnost bacanja kugle rotacionom tehnikom proističe iz 3D – dimenzionalnog kretanja bacača kugle iz ograničenog prostora i kratkog vremenskog tajminga.

Zbog kompleksnosti kretanja koji proizvode silu djelovanja na kuglu, ograničenosti prostora i kratkog vremena, analiziranje ove atletske discipline predstavlja vrlo složen zadatak za trenere, stručnjake i naučne radnike. Iz navedenog je u ovom radu i proizašlo kratko vrijeme trenutka izbačaja 0.1 sekunde prije izbačaja i promjena vrijednosti uglobnih veličina segmenata tijela kod izbačaja 0.1 sekunde prije izbačaja.

Metod rada

Uzorak ispitanika

Istraživanje je provedeno na uzorku vrhunskog bacača kugle, bosansko-hercegovačkom državnom reprezentativcu u bacanju kugle sa ličnim rekordom od 20.73 m.

Methods

The sample

This research was carried out on a top shot put athlete, member of the national team with a personal record of 20.73 m. The examinee is Hamza Alić, 27 years old; height 1.95 m; weight 129.5 kg; a representative of Bosnia and Herzegovina national team, a silver medalist at the European Championship, participant of Olympic Games, World Championships, Mediterranean Games, Balkan Games and many other domestic and international competitions.

The sample of variables

When selecting variables that should enable achieving the objective research, we took into account that they meet basic metric characteristics: validity, reliability, objectivity, sensitivity, discrimination, standardization, economics etc. The selection of variables is aligned with a specific sample of respondent and that is conditioned by sensors mounted to a segment of the body of subjects when shooting. For the determination of kinematic parameters software with three-dimensional recording with the help of synchronized cameras (Sony DVCAM DSR-300 PK) and (Sony TRV840) was used.

To estimate the kinematic parameters four parameters: the distance traveled (S), velocity (V), the angle (A) and angular velocity (w) were applied.

To determine the kinematic parameters, the acceleration of the individual body segments (A) of the shot putter in the projection of (Z) axis, the following variables were applied:

1. L5 lumbal vertebra and S1 sacral region.....AzL5S1
2. L4L3 lumbar vertebrae.....AzL4L3
3. T9T8 thoracic vertebrae .....Az T9T8
4. T1 thoracic vertebra and C7 cervical vertebra AzT1C7
5. C1 cervical vertebra and head AzC1GL
6. The right cervical vertebra C7 and shoulder AzDC7R
7. Right shoulder ..... AZDR
8. Right elbow ..... AzDLAK
9. Right wrist .....AzDRZG
10. Left C7 cervical vertebra and the shoulder AzLC7R
11. left shoulder.....AzLRAM
12. Left-elbow .....AzLLAK
13. Left wrist ..... AzLRZG
14. Right hip.....AzDKUK
15. Right knee .....AzDKLJ
16. Right ankle ..... AzDNZG
17. Right foot..... AzDSTO
18. Left hip ..... AzLKUK
19. Left knee..... AzLKLJ
20. Left ankle.....AzLNZG
21. Left foot.....AzLSTO

Ispitanik je Hamza Alić, star 27 godina; visina 1.95 m; težina 129.5 kg; reprezentativac Bosne i Hercegovine, osvajač srebrne medalje na dvoranskom prvenstvu Evrope, učesnik Olimpijskih igara, Svjetskog prvenstva, Mediteranskih igara, Balkanskih igara i mnogih drugih domaćih i međunarodnih takmičenja.

Uzorak varijabli

Prilikom izbora varijabli koje treba da omogućite ostvarenje postavljenog cilja istraživanja, vodilo se računa da one zadovoljavaju osnovne metrijske karakteristike: validnost, pouzdanost, objektivnost, osjetljivost, diskriminativnost, standardizovanost, ekonomičnost. Izbor varijabli je usklađen sa uzorkom ispitanika koji je u ovom istraživanju specifičan i koji je uslovljen postavljenim senzorima na pojedine segmente tijela ispitanika prilikom snimanja. Za utvrđivanje kinematičkih parametara korišten je softver sa trodimenzionalnim snimanjem uz pomoć sinhronizovanih kamera (SONY DVCAM DSR-300 PK) i (SONY TRV840E).

Prediktorski skup varijabli

Za procjenu kinematičkih parametara primijenjena su četiri parametra: prijeđeni put (S), brzina (V), ugao (A) i ugaona brzina (w).

Za utvrđivanje kinematičkih parametara, uglovne vrijednosti (A) pojedinih segmenata tijela bacača kugle u projekciji (z) ose, primijenjene su sljedeće varijable:

1. L5 lumbalni pršljen i S1 krsni region.....AzL5S1
2. L4L3 lumbalni pršljenovi.....AzL4L3
3. T9T8 grudni pršljenovi.....Az T9T8
4. T1 grudni pršljen i C7 vratni pršljen AzT1C7
5. C1 vratni pršljen i glava AzC1GL
6. Desni C7 vratni pršljen i rame..... AzDC7R
7. Desno rame..... AzDRAM
8. Desni lakat..... AzDLAK
9. Desni ručni zglob .....AzDRZG
10. Lijevi C7 vratni pršljen i rame AzLC7R
11. Lijevo rame .....AzLRAM
12. Lijevi lakat.....AzLLAK
13. Lijevi ručni zglob ..... AzLRZG
14. Desni kuk.....AzDKUK
15. Desno koljeno.....AzDKLJ
16. Desni nožni zglob..... AzDNZG
17. Desno stopalo ..... AzDSTO
18. Lijevi kuk ..... AzLKUK
19. Lijevo koljeno ..... AzLKLJ
20. Lijevi nožni zglob.....AzLNZG
21. Lijevo stopalo.....AzLSTO

Criterion set of variables

The criterion variable for estimating the kinematic parameters of the ball pitcher is the length of the throw (range) (36 correct legal throws).

Conditions and measurement techniques

The recording and measurement of the rotational technique of the examinee, member of the of Bosnia and Herzegovina national team was conducted in September 2011 in the competition phase (achievement of the Olympic Standards) and the preparation phase for the Olympic Games in London in 2012.

Recording was done on the "Šiška" stadium in Ljubljana and at the city stadium in Kranj. Shot put circle diameter of 2,135 m, with segments and gauged metal meter according to IAAF standards was used. The terrain and weather conditions for the test were extraordinary. For testing, 85 shots were taken. Field and time conditions were favorable for testing. The test recoreded 85 throws.

The athlete throws the ball with the right hand. In the final analysis 36 legal shots were taken into account. Recording was done with two synchronized cameras (Sony DVCAM DSR-300 PK) placed at an angle of 90 ° to their optical axis. The third camera (Sony TRV840) is set at a height of 4 m directly above the center circle for throwing (Figure 1 and 2).

Analyzed space circle was calibrated with the reference frame dimensions 1m x 1m x 2m, while eight reference edges were taken as calibration points (Figure 2). Length of the analyzed movement is defined by (X) axis, the height by (Y) axis, and depth by (Z) axis. For the determination of the kinematic parameters of the techniques 3-D softwer APAS (Ariel Dynamics Inc., San Diego, Ca) was used.

Digitalisation of the 15-segment model of body launcher which we defined with 18 reference points, was conducted. Eighteenth point was defined with the center of the sphere. Segments of the models show parts of the body associated with dotted joints. Mass and center of gravity segments as well as the center of gravity of the body were calculated on the basis of antropometric model (Dempster, 1955). Coordinates of physical point were smoothened with the seventh degree Buterworth digital filter. Information on path (S), velocity (V), A-corner (A), w-angular speed (w) in the X, Y and Z axes were obtained with the software package ARIEL.

Kriterijski skup varijabli

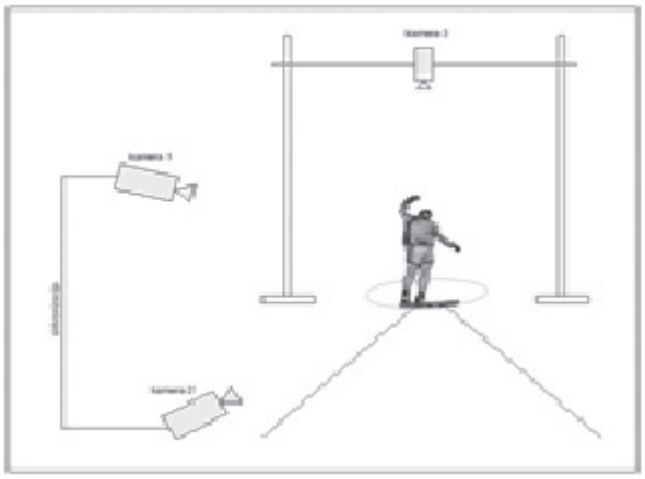
Kriterijske varijable za procjenu kinematičkih parametara bacača kugle čine dužine izbačaja (domet) kugle tretiranih 36 ispravnih hitaca.

Uslovi i tehnike mjerenja

Snimanje i mjerenje rotacione tehnike bacanja kugle kod ispitanika - člana reprezentacije Bosne i Hercegovine izvedeno je u mjesecu septembru 2011. godine u takmičarskoj fazi (postizanje olimpijske norme) i fazi priprema za Olimpijske igre u Londonu 2012. godine. Snimanje je obavljeno na stadionu „Šiška" u Ljubljani i na gradskom stadionu u Kranju. Korišten je krug za bacanje kugle prečnika 2.135m, sa segmentom i baždarenim metalnim metrom prema standardima IAAF. Teren i vremenski uslovi za testiranje bili su povoljni za realizaciju testiranja. Testiranje je provedeno u prijepodnevnim časovima. Na testiranju je snimljeno 85 hitaca - izbačaja. Atletičar baca kuglu sa desnom rukom. Kod konačne obrade podataka analizirano je 36 ispravnih hitaca. Snimanje je obavljeno sa dvije sinhronizovane kamere (SONY DVCAM DSR-300 PK) stavljene pod uglom 90° na njihovu optičku osovinu. Treća kamera (SONY TR-V840E) postavljena je na visini 4 m tačno iznad centra kruga za bacanje (Šematski prikaz 1 i slika 2).

Analizirani prostor kruga bio je kalibriran sa referentnim okvirom dimenzije 1m x 1m x 2m, a pri tome je za kalibriranje uzeto osam referentnih rubova (slika 2). Dužina analiziranog kretanja definisana je sa (X) osom, visina sa (Y) osom i dubina sa (Z) osom. Za determinisanje kinematičnih parametara tehnike upotrijebljen je 3-D softwer APAS (Ariel Dynamics Inc., San Diego, Ca).

Obavljena je digitalizacija 15-segmentnog modela tijela bacača definisanih sa 18 referentnih tačaka. Osamnaesta tačka bila je definisana sa centrom kugle. Segmenti modela prikazuju dijelove tijela povezane sa tačkastim zglobovima. Mase i centri gravitacije segmenata kao i centar gravitacije tijela izračunati su na osnovi antropometričnog modela (Dempster,1955). Koordinate tjelesnih tački izglađene su sa digitalnim Buterworthovim filtrom 7. stepena. Sa programskim paketom ARlEL dobijeni su podaci o putu (S), brzini (V), A-uglu (A) , w-ugaonoj brzini (w) u X, Y i Z osi.



Šematski prikaz 1. *Raspored postavljenih kamera*
Sheme 1. *Schedule of set cameras*

Slika 1. *Kamera za snimanje (SONY TRV840E)*
Figure 1. *Recording camera (SONY TRV840E)*

Methods of data processing

In order to determine the impact of predictor values of kinematic parameters of individual body segments shot putters - angular A value in the Z axis at the time of casting (predictor set of variables) of the length of range (criterion variable), regression analysis was applied.

Results and Discussion

Regression analysis of the criterion variable type of the length of ejections was based on variable angular value (A) in (z) axes 0.1 seconds before casting is shown in Table 1.

Table 1. *Regression analysis of the criterion variable of the throw disatnce in the manifest space of the angle value variables (A) of the body segments in the projection (z) axis or 0.1 s before the throw-out*

Metode obrade podataka

Za utvrđivanje značajnosti i veličine uticaja kinematičkih parametara pojedinih segmenata tijela bacača kugle – uglovnih A vrijednosti u projekciji (Z) ose u trenutku izbačaja (prediktorski skup varijabli) na dužinu dometa kugle (kriterijska varijabla), primijenjena je regresiona analiza.

Rezultati i diskusija

Regresiona analiza kriterijske varjable dužine izbačaja na osnovu varijabli uglovnih vrijednosti (A) u projekciji (Z) ose 0.1 s prije izbačaja prikazana je u tabeli 1.

Tabela 1. *Regresiona analiza kriterijske varijable dužina izbačaja kugle u manifestnom prostoru varijabli uglovnih vrijednosti (A) segmenata tijela u projekciji (Z) ose 0.1 s prije izbačaja*

Model Summary

Model		R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
						R Square Change	F Change	df1	df2	Sig. F Change
dimension	1	.887[a]	.786	.466	.26389	786	2.454	21	14	.044

a. Predictors: (Constant), AzLSTO, AzDC7R, AzDRZG, AzL4L3, AzDKLJ, AzC1GL, AzLNZG, AzLLAK, AzLRZG, AzDSTO, AzLRAM, AzLKUK, AzLC7R, AzDRAM, AzLKLJ, AzL5S1, AzDLAK, AzDKUK, AzDNZG, AzT9T8, AzT1C7

ANOVAb

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.589	21	.171	2.454	.044[a]
	Residual	.975	14	.070		
	Total	4.564	35			

a. Predictors: (Constant), AzLSTO, AzDC7R, AzDRZG, AzL4L3, AzDKLJ, AzC1GL, AzLNZG, AzLLAK, AzLRZG, AzDSTO, AzLRAM, AzLKUK, AzLC7R, AzDRAM, AzLKLJ, AzL5S1, AzDLAK, AzDKUK, AzDNZG, AzT9T8, AzT1C7
b. Dependent Variable: Dužina

Coefficientsa

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	40.779	21.797		1.871	.082			
	AzL5S1	-.137	.044	-2.165	-3.092	.008	-.019	-.637	-.382
	AzL4L3	1.156	.794	2.143	1.456	.167	-.007	.363	.180
	AzT9T8	-.306	.267	-1.787	-1.148	.270	-.053	-.293	-.142
	AzT1C7	-.845	.896	-2.445	-.942	.362	.333	-.244	-.116
	AzC1GL	.910	.795	2.894	1.144	.272	.322	.292	.141
	AzDC7R	-.090	.064	-.793	-1.406	.182	-.214	-.352	-.174
	AzDRAM	-.007	.007	-.434	-1.021	.325	-.137	-.263	-.126
	AzDLAK	.025	.016	1.391	1.533	.148	-.095	.379	.189
	AzDRZG	.000	.006	.032	.082	.936	-.022	.022	.010
	AzLC7R	.157	.069	.772	2.295	.038	.164	.523	.283
	AzLRAM	.040	.028	.617	1.460	.166	-.052	.363	.180
	AzLLAK	-.047	.031	-.477	-1.510	.153	-.134	-.374	-.187
	AzLRZG	.001	.011	.023	.079	.938	.351	.021	.010
	AzDKUK	.048	.038	1.256	1.269	.225	.116	.321	.157
	AzDKLJ	-.013	.027	-.439	-.462	.651	-.002	-.123	-.057
	AzDNZG	-.027	.032	-.920	-.849	.410	-.102	-.221	-.105
	AzDSTO	.008	.031	.254	.267	.794	-.124	.071	.033
	AzLKUK	-.041	.041	-.514	-.999	.335	.137	-.258	-.123
	AzLKLJ	.042	.027	1.195	1.563	.140	.146	.385	.193
	AzLNZG	-.003	.018	-.080	-.166	.870	.336	-.044	-.021
	AzLSTO	-.005	.013	-.072	-.352	.730	.003	-.094	-.044

a. Dependent Variable: Dužina / *Length*

Legenda / Legend: *Multiple R - koeficjent multiple korelacije; R Squore - kvadrat koeficjenta multiple korelacije; T – test - test vrijednosti značajnosti regresijskih koeficjenata; SIG-T značajnost koeficjenta parcijalne regresije, df1 i df2 stepeni slobode; F - uobičajni F-test za testiranje značajnosti koeficjenata multiple 2 korelacije; Signif F - nivo statističke značajnosti koeficijenta multiple korelacije i Standard Error - standardna greška rezultata u kriterijskoj varijabli.*

By analyzing the parameters of the regression analysis of the predictive system of the angular values of the individual body segments in the projection (Z) axis 0.1 seconds before the throw out with the criterion variable of the ball throwing length (Table 1) it is apparent that the coefficient of multiple correlation is R = .88 with the coefficient of determination of R Squere = .78. On the basis of the obtained results it can be concluded that in the explanation of the general influence of predictors on the criterion satisfies a high proportion of isolated variance, while the remaining part of the 22% variance of the waste falls on other segments not used in this assay.

Further analysis can be accessed, because the conditions met statistical significance level of p <.05, partial impact predictor system angular values of individual body segments in the (Z) axis at the moment of casting with criteria variable length shot put.

Statistically significant Beta coefficients at the level

Analizom parametara regresione analize prediktorskog sistema uglovnih vrijednosti pojedinih segmenata tijela u projekciji (Z) ose 0.1 s prije izbačaja sa kriterijskom varijablom dužina bacanja kugle (tabela 1) vidljivo je da koeficijent multiple korelacije iznosi R=.88 sa koeficijentom determinacije od R Squere =.78. Na osnovu dobijenih rezultata može se konstatovati da u objašnjenju generalnog uticaja prediktora na kriterij zadovoljava visok udio izolovane varijanse (78%), dok preostali dio varijanse od 22 % otpada na druge segmente koji u ovom israživanju nisu primijenjeni.

Daljem analiziranju se može pristupiti, jer su ispunjeni uslovi statističke značajnosti na nivou od p< .05 parcijalnog uticaja prediktorskog sistema uglovnih vrijednosti pojedinih segmenata tijela u (z) osi u trenutku izbačaja sa kriterijskom varijablom dužina bacanja kugle.

Statistički značajane Beta koeficijente na nivou p<.01 ima uglovna vrijednost varijable *L5 lumbalni pr-*

of p <.01 has angular value of the variable *lumbar vertebra L5 and S1 sacral region - AzL5S1* (Beta = -2.16), whose projections on the criterion variable have a negative sign. The value of the angle to the *left shoulder and C7 cervical vertebra - AzLC7R* (beta = .77), had statistically significant individual impact on the level of p <.05 whose projections on the criterion variable were with a positive sign. No variable had negative impact on the projections of individual criterion variable with statistical significance P <.05.

Thus, it can be concluded that less value angles in variable *L5 lumbar vertebra and S1 sacral region* (AzL5S1), which lead to the fulfillment of 0.1 seconds before casting contribute to greater lenght shots as criterion variables. Angular positions of body segments 0.1 seconds before casting occurs as a result of active angular (A) movement predictor modeled kinematic variables in the axis (Z). From the analysis of the influence of individual variables angular position (A) in the z axis (Table 2), it can be noticed that the largest contribution to the criterion variable length in the range of 0.1 seconds before the moment of casting has a variable *lumbar vertebra L5 and S1 sacral region*. At a time of 0.1 seconds prior to the time span up to the angular position L5 lumbar vertebrae and S1 sacral region in the axis (Z) came as a result of the delayed angular connection (A) of movement in the vertical extension expressed bodies along the axis relative to the projection of reconciliation to time casting . Therefore we can say that the greater length shots realized when the pitcher has less fluctuations in the vertical extension expressed bodies and tilting back and forth when performing these technique.

Also, it can be concluded that the increase of corners left shoulder in the level of the seventh cervical vertebra exercised influence on the length of realized results in the shot put. 0.1 seconds before the moment of ejection occurs as a result of active angular (A) movement predictor modeled kinematic variables in the z axis. From the analysis of the influence of individual variables angular position (A) in the axis (Z) (Table 1), we conclude that the largest and statistically positive impact on the criterion variable length in the range of 0.1 seconds before the moment of casting has a variable *angular position of the left shoulder level seventh cervical vertebra* (AzLC7R .038). Range of throws (competitive result) is defined by the length of effect offorce on the ball, which is affected by the speed ejection (eng. release velocity), the angle of ejection (eng. angle of release) and the amount of ejection (eng. height of release) (Stepanek & Sušanka, 1987; Palm, 1990; Gemer, 1990; Bartonietz, 1994; Oesterreich et. al., 1997; Luhtanen et. al., 1997; Lanka, 2000; Hubbard et. al., 2001; Linthorne, 2001; CoH and

šljen i S1 krsni region – AzL5S1 (Beta = -2.16), čije su projekcije na kriterijsku varijablu sa negativnim predznakom. Statistički značajan pojedinačni uticaj na nivou p<.05 imaju vrijednosti ugla lijevo rame i C7 vratni pršljen – AzLC7R (Beta = .77), čije su projekcije na kriterijsku varijablu sa pozitivnim predznakom. Negativne projekcije pojedinačnog uticaja na kriterijsku varijablu sa statističkom značajnošću p < .05 nema niti jedna varijabla.

Dakle, može se konstatovati da manje vrijednosti uglova u varijabli *L5 lumbalni pršljen i S1 krsni region (AzL5S1)*, koji su ostvareni 0,1 s prije izbačaja doprinose većoj dužini hica kao kriterijskoj varijabli. Uglovni položaji segmenata tijela 0,1 s prije izbačaja se dešava kao posljedica aktivnog uglovnog (A) kretanja prediktorskih modelovanih kinematičkih varijabli u osi (Z). Analizom uticaja pojedinačnih varijabli uglovnog položaja (A) u osi Z (tabela 2), može se vidjeti da najveći doprinos na kriterijsku varijablu dužina dometa u 0.1 sekunde prije trenutka izbačaja ima varijabla, *L5 lumbalni pršljen i S1 krsni region*. U vremenu 0.1 s prije trenutka izbačaja do ugaonog položaja L5 lumbalnog pršljena i S1 krsnog regiona u osi (Z) došlo je kao posljedica povezanosti zakašnjelog uglovnog (A) kretanja u vertikalnom opružanju tijela u Z osi u odnosu na projekciju kretanja sprave prema trenutku izbačaja. Shodno tome može se reći da su veće dužine hica ostvarene onda kada bacač ima manje oscilacije u vertikalnom opružanju tijela i naginjanju naprijed-nazad prilikom izvođenja tehnike.

Takođe, može se zaključiti da se sa povećanjem uglova lijevog ramena u nivou sedmog vratnog pršljena ostvaruje uticaj na dužina ostvarenog rezultata u bacanju kugle. 0.1 s prije trenutka izbačaja se dešava kao posljedica aktivnog uglovnog (A) kretanja prediktorskih modelovanih kinematičkih varijabli u projekcij (Z) ose. Analizom uticaja pojedinačnih varijabli uglovnog položaja (A) u osi (Z) (tabela 1), može se vidjeti da najveći i statistički pozitivan uticaj na kriterijsku varijablu dužina dometa u 0.1 s prije trenutka izbačaja ima varijabla, uglovni položaj *lijevog ramena u nivou sedmog vratnog pršljena (AzLC7R .038)*. Domet bacanja (rezultat takmičenja) definisana je dužinom puta djelovanja sile na kuglu, na koju utiču brzina izbacivanja (eng. release velocity), ugao izbacivanja (eng. angle of release) i visina izbacivanja (ang. height of release) (Stepanek & Sušanka, 1987; Palm, 1990; Gemer, 1990; Bartonietz, 1994; Oesterreich et. al., 1997; Luhtanen et. al., 1997; Lanka, 2000; Hubbard et. al., 2001; Mikić & Biberović, 2001; Čoh i Štuhec, 2008). U vremenu 0.1 sekunde prije trenutka izbačaja do ugaonog položaja lijevog ramena u nivou

Gall, 2008). At 0.1 seconds before the moment of casting to the angular position of the left shoulder to the level of the seventh cervical vertebra in the z axis came as a result of the angular connection (A) of movement in the vertical axis of the body extension expressed in relation to the projection of reconciliation or point ejections.

In analyzing the results of the regression analysis predictor system of variables angular position values of individual body segments (A) in (Z) axes 0.1 seconds before casting, which predictor system of variables contribute to the impact of the treated criterion variable of this study, it can be concluded that the length of the casting balls depend on the angular position (A) of individual body segments in a particular projection of X, Y and Z axis, 0.1 seconds before the ejection, which confirms a statistically significant effect of predictors on the criterion with axes, while they have not been confirmed by X and (Y) axis.

Conclusion

Based on the results of the regression analysis of the angle values (A) of the body segments observed for 0.1 seconds prior to the discharge of the device (balls) it can be concluded that the angular values in the projection (Z) axis have the most significant prediction values on the distance.

Results of regression analysis showed that increasing the angle of the left shoulder to the level of the seventh cervical vertebra has a statistically significant impact on the length of the result achieved in the shot put 0.1 seconds before the moment of casting that occurs as a result of active angular (A) movement predictor modeled kinematic variables in the axis (Z). The analysis of the influence of individual variables angular position (A) to the axis (Z), shows that the largest and statistically positive impact on the criterion variable length in the range of 0.1 seconds before casting has a variable angular position of the left shoulder to the level of the seventh cervical vertebra (AzLC7R). The time span up to 0.1 seconds before the angular position of the left shoulder to the level of the seventh cervical vertebra to the axis (Z) there is as a result of the angular connection (A) of movement in the vertical extension expressed body axis (Z) relative to the projection of the moment of casting and reconciliation. Analysis of the results of the regression analysis predictor system of variables angular position values of individual body segments (A) to (Z) axes 0.1 seconds before casting, which predictor system of variables contribute to the impact of the treated criterion variable of this study shows that the length of the casting balls depends of the angular position (A) of particular segments of the body in each projection (X), (Y) and (Z) axes 0.1 seconds before sedmog vratnog pršljena u osi (Z) došlo je kao posljedica povezanosti uglovnog (A) kretanja u vertikalnom opružanju tijela ose Z u odnosu na projekciju kretanja sprave odnosno trenutka izbačaja.

U analizi rezultata regresione analize prediktorskog sistema varijabli uglovnih vrijednosti položaja pojedinih segmenata tijela (A) u (Z) osi 0.1 s prije izbačaja, koji prediktorskim sistemom varijabli doprinose uticaj na tretiranu kriterijsku varijablu ovog istraživanja, može se zaključiti da će dužina izbačaja kugle zavisiti od uglovnog položaja (A) pojedinih segmenata tijela u pojedinoj projekciji X, Y i Z osi, 0.1 s prije izbačaja, čime je potvrđen statistički značajan uticaj prediktora na kriterij u projekciji (Z) ose, dok ista nije potvrđena za (X) i (Y) osu.

Zaključak

Na osnovu rezultata regresione analize uglovnih vrijednosti (A) praćenih segmenata tijela 0.1 s prije izbačaja kugle može se zaključiti da najznačajnije prediktorske vrijednosti na dužinu izbačaja imaju uglovne vrijednosti u projekciji (Z) ose. Rezultati regresione analize pokazuju da povećanje ugla lijevog ramena u nivou sedmog vratnog pršljena ima statistički značajan uticaj na dužina ostvarenog rezultata u bacanju kugle 0,1 s prije trenutka izbačaja koji se dešava kao posljedica aktivnog uglovnog (A) kretanja prediktorskih modelovanih kinematičkih varijabli u projekciji (Z) ose. Analizom uticaja pojedinačnih varijabli uglovnog položaja (A) u projekciji (Z) ose, može se vidjeti da najveći i statistički pozitivan uticaj na dužina dometa u 0.1 s prije izbačaja (kriterijska varijabla) ima varijabla, *uglovni položaj lijevog ramena u nivou sedmog vratnog pršljena (AzLC7R)*. U trenutka izbačaja do 0.1 s prije ugaonog položaja lijevog ramena u nivou sedmog vratnog pršljena u projekciji (Z) ose došlo je kao posljedica povezanosti uglovnog (A) kretanja u vertikalnom opružanju tijela ose (Z) u odnosu na projekciju kretanja sprave odnosno trenutka izbačaja. U analizi rezultata regresione analize prediktorskog sistema varijabli uglovnih vrijednosti položaja pojedinih segmenata tijela (A) u projekciji (Z) ose 0.1 s prije izbačaja, koji prediktorskim sistemom varijabli doprinose uticaju na tretiranu kriterijsku varijablu ovog istraživanja, može se zaključiti da dužina izbačaja kugle zavisi od uglovnog položaja (A) pojedinih segmenata tijela u pojedinoj projekciji (X), (Y) i (Z) ose 0.1 s prije izbačaja, čime je potvrđen statistički značajan uticaj prediktora na kriterij u projekciji (Z) ose, dok ista nije potvrđena za (X) i (Y) osu.

Dobijeni rezultati istraživanja mogu imati svoju praktičnu vrijednost i primjenljivost u procesu progra-

casting, which confirms a statistically significant effect of predictors on the criteria in (the) axis, while the same is not confirmed for (X) and (Y) axis.

The results of this research can have practical value and applicability in the process of programming the training of the ball pitchers in order to objectively evaluate and improve the performance of the ball throwing technique as well as identify the remaining athletes' potential to improve sport achievements.

Authorship statement
The authors have contributed equally.

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miranja trenažnog rada bacača kugle u cilju objektivnog procjenjivanja i usavršavanja izvođenja tehnike bacanja kugle kao i identifikacija preostalih potencijala sportiste za poboljšanje sportskih dostignuća.

Izjava autora
Autori pridonijeli jednako.

Konflikt interesa
Mi izjavljujemo da nemamo konflikt interesa.

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Research Review of the Development of the Explosive Strength in Basketball

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Apstract: The ultimate performance in every sport, including basketball, is the result of a series of "bricks" stacked in the correct order. One of the dice is definitely an explosive power that is defined as the ability to manifest the maximum power for the maximum short time. The aim of this study was to gather previous studies that dealt with the development of the explosive strength in basketball. Total amount of 49 studies published between 2001 and 2016 was collected and subjected to analysis. The results showed that, for the development of the explosive strength, the plyometric training method is usually used, both with male and female basketball players. Also, the explosive force can be developed by using the complex training; the aquatic plyometric training; a combination of plyometric training and some other kind of training (dynamic stretching, strengthening without weights, sprinting, weight training, training of strength (no lifting)); specific sprint training; SAQ training; skipping rope; training consisting of strength training, different types of stamina and basketball technique; circuit breaker program; circuit training; combination of the sprint training exercises with weights; the plyometric training with additional load and the training of dynamic stretching.
Keywords: basketball, development, explosive strength, motor skills, players, research review.

Introduction

Basketball consists of a number of explosive movements, such as: short sprints, sudden stops and acceleration of speed, the change in direction of moving, different rebounds, throwing and passing the ball (Nikolić,Kocić, Berić & Jezdimirović, 2015). Explosive power, the ability to generate maximum muscular force in a short period of time (Santos & Janeiro, 2008), is an extremely important motor skill for playing basketball (Lehnert, Hulka, Malý, Fohler & Zahálka, 2013; Zhang, 2013). Vertical jumps, which require an appropriate level of the explosive strength (Bober, Rutkowska-Kucharski, Pietraszewski &

Pregled istraživanja razvoja eksplozivne snage u košarci

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Sažetak: Vrhunski rezultati u svakom sportu, pa tako i u košarci, rezultat su niza „kockica" poslaganih pravilnim redosledom. Jedna od tih kockica je svakako eksplozivna snaga koja se definiše kao sposobnost ispoljavanja maksimalne snage za maksimalno kratko vreme. Cilj ovog rada bio je da se prikupe dosadašnja istraživanja koja su se bavila razvojem eksplozivne snage u košarci. Prikupljeno je i podvrgnuto analizi ukupno 49 istraživanja objavljenih u periodu od 2001. do 2016. godine. Rezultati su pokazali da se za razvoj eksplozivne snage najčešće koristi pliometrijska metoda treninga, kako kod košarkaša, tako i kod košarkašica. Takođe, eksplozivnu snagu moguće je razviti i: kompleksnim treningom; vodenim pliometrijskim treningom; kombinacijom pliometrijskog treninga i nekog drugog treninga (dinamičko istezanje, vežbe snage bez tegova, sprint; treningom sa tegovima; treningom snage (bez tegova)); specifičnim treningom sprinta; SAQ treningom; preskakanjem konopca; treningom koji se sastoji od treninga snage, različitih tipova izdržljivosti i košarkaške tehnike; circuit breaker programom; kružnim treningom; kombinacijom treninga sprinta sa vežbama sa tegovima; pliometrijskim treningom sa dodatnim opterećenjem i treningom dinamičkog istezanja.
Ključne reči: košarka, razvoj, eksplozivna snaga, motoričke sposobnosti, košarkaši, pregled istraživanja.

Uvod

Košarka se sastoji iz mnogobrojnih eksplozivnih kretnji, kao što su: kratki sprintevi, brza zaustavljanja i ubrzavanja, promene pravca kretanja, različiti skokovi, bacanja i dodavanja lopte (Nikolić, Kocić, Berić & Jezdimirović, 2015). Eksplozivna snaga, sposobnost da se generiše maksimalna mišićna sila u što kraćem vremenskom periodu (Santos & Janeira, 2008), je izuzetno važna motorička sposobnost za bavljenje košarkom (Lehnert, Hůlka, Malý, Fohler & Zahálka, 2013; Zhang, 2013). Vertikalni skokovi, koji zahtevaju odgovarajući nivo eksplozivne snage (Bober, Rutkowska-Kucharska,

Lesiecki, 2006), are of great importance for success in sports such as basketball (Nedeljković, 2004; Bobbert, 1990), and are manifested in situations such as jump shot and jump towards the ball (Manojlovic & Erčulj, 2013). In men's professional basketball a player has to jump 46 ± 12 times (Castagna, Chaouachi, Rampinini, Chamari & Impellizzeri, 2009), and some authors claim that basketball in the whole match (40min games) takes up to 100 different jumps (Manojlović & Erčulj, 2013). A lot of researches show how important jumps are for basketball as the representatives of the explosive strength. Okur, Tetik & Koc (2013) in a sample of 51 players found that the success of the competition positively correlated with the result in the vertical jump. Šeparović, Alice-partition & Užičanin (2009) in a regression analysis found that jumps, among other indicators of situational efficiency, have a significant impact on the final result of the game finals championship of Bosnia and Herzegovina and the result of the game in the regional basketball league. Jovanović & Jovanović (2006) in the analysis of the 24 best teams participating in the World Championship in 2006 in basketball for seniors in Japan found that a better qualified team, among other things, successfully captured rebounds under the basket of the opponents (rebound).

The subject of this paper is the explosive power of a player. *The aim* of this study was the collection and analysis of the previous studies published on the development of the explosive strength in basketball.

Research Methods

For collection, classification and analysis of the targeted research, descriptive methods and theoretical analysis were used, and researches that were done were searched on Google, Google Scholar, PubMed and Kobson. Additional literature in the form of textbooks was also used. The search was limited to works that were published between 2001 and 2016. The keywords used during the search were: ***explosive power, development and basketball.***

Results

For better clarity all the previous studies are presented in Table 1. A total of 49 studies are presented. The smallest number of respondents was in the research Adorable Caparin & Abba (2011) and it amounted to nine participants and the biggest was in the research Bavli (2012) with 91 respondents. In nine of the researches, the respondents were female basketball players (Chang, Hsu, Chen & Lin, 2005; Chaudhary & Jhajharia, 2010; Adibpour, Bakht & Behpour, 2012; Komal & Singh, 2013; Zarić, 2014; Attene at al., 2014; McCormick et al., 2015;

Pietraszewski & Lesiecki, 2006), su od velikog značaja za uspeh u sportu kao što je košarka (Nedeljković, 2004; Bobbert, 1990), a manifestuju se u situacijama kao što su skok šut i skok za odbijenom loptom (Manojlović & Erčulj, 2013). U muškoj profesionalnoj košarci, u toku utakmice igrač načini po 46±12 skoka (Castagna, Chaouachi, Rampinini, Chamari & Impellizzeri, 2009), a neki autori tvrde da košarkaš na celoj utakmici (40min igre) izvodi i do 100 različitih skokova (Manojlović & Erčulj, 2013). Koliko su skokovi, kao reprezenti eksplozivne snage bitni za košarku govore i mnoga istraživanja. Okur, Tetik & Koc (2013) su na uzorku od 51 košarkaša utvrdili da je uspešnost na takmičenju pozitivno povezana sa rezultatom u vertikalnom skoku. Separović, Alić-Partić & Užičanin (2009) su regresijskom analizom utvrdili da skokovi, pored ostalih pokazatelja situacijske efikasnosti, imaju značajan uticaj na konačni rezultat utakmica završnice prvenstva Bosne i Hercegovine i rezultat utakmica u Regionalnoj košarkaškoj ligi. Jovanović & Jovanović (2006) su analizom 24 najboljih reprezentacija učesnica Prvenstva sveta 2006. godine u košarci za seniore u Japanu utvrdili da bolje plasirale reprezentacije, između ostalog, uspešnije hvataju odbijene lopte pod košem protivnika (skok u napadu).

Predmet ovog rada je eksplozivna snaga košarkaša. Cilj ovog rada bio prikupljanje i analiza dosadašnjih istraživanja objavljenih na temu razvoja eksplozivne snage u košarci.

Metod istraživanja

Za prikupljanje, klasifikaciju i analizu ciljanih istraživanja korišćena je deskriptivna metoda i teorijska analiza, a istraživanja do kojih se došlo pretraživana su na: Google, Google Scholar, PubMed i Kobson. Korišćena je i dopunska literatura u vidu udžbenika. Pretraga je ograničena na radove koji su objavljeni u periodu od 2001. do 2016. godine. Ključne reči koje su korišćene prilikom pretrage su: explosive power, development i basketball.

Rezultati

Radi boljeg pregleda sva dosadašnja istraživanja predstavljena su u Tabeli 1. Ukupno je predstavljeno 49 istraživanja. Najmanji broj ispitanika bio je u istraživanju Adorable Caparino & Abbu (2011) i iznosio je devet ispitanika, a najveći u istraživanju Bavli (2012)a sa 91. ispitanikom. Kod devet istraživanja ispitanici su bili ženskog pola - košarkašice (Chang, Hsu, Chen & Lin, 2005; Chaudhary & Jhajharia, 2010; Adibpour, Bakht & Behpour, 2012; Komal & Singh, 2013; Zarić, 2014; Attene at al., 2014; McCormick at al., 2015; Benis, Rossi, Russo & La

Benis, Rossi, Russo & La Torre, 2015; Khazali & Hematfar, 2015), in two studies they were both male and female (Bavli, 2012; Ramachandran & Pradhan, 2014), and in all other studies they were male. The youngest sample of respondents was in the research of Khazali & Hematfar (2015) and ranged from 11 to 12 years old and the oldest was in the study Morsal at al. (2014) and ranged from 24 to 30 years. The experimental treatment was the shortest in research Ramachandran & Pradhan (2014) and it lasted for two weeks. The experimental treatment lasted longest for 12 weeks and it was the case in *five* studies (Chang, Hsu, Chen & Lin, 2005; Shallaby, 2010; Bavli, 2012; Abraham, 2015; Ademović, 2016). In most of the works the program involved the training exercise 2 to 3 times a week.

Torre, 2015; Khazai & Hematfar, 2015), kod dva istraživanja su bili i muškog i ženskog pola (Bavli, 2012a; Ramachandran & Pradhan, 2014), a kod svih ostalih istraživanja su bili muškog pola. Najmlađi uzorak ispitanika bio je u istraživanju Khazai & Hematfar (2015) i iznosio je od 11 do 12 godina, a najstariji u istraživanju Morsal at al. (2014) i iznosio od 24 do 30 godina. Eksperimentalni tretman je najkraće trajao u istraživanju Ramachandran & Pradhan (2014) i iznosio je dve nedelje. Eksperimentalni tretman je najduže trajao 12 nedelja i to kod *pet* istraživanja (Chang, Hsu, Chen & Lin, 2005; Shallaby, 2010; Bavli, 2012a; Abraham, 2015; Ademović, 2016). U najvećem broju radova program je podrazumevao vežbanje 2 do 3 puta nedeljno.

Tabela 1. *Dosadašnja istraživanja ekspozivne snage u košarci (od 2001-2016. godine)*

Reference	Uzorak ispitanika			Eksperimentalni tretman				
	N	G.St	P	trajanje	Br. Gr.	mereni parametri	rezultati	razlike između grupa
Matavulj, Kukolj, Ugarkovic, Tihanyi & Jaric (2001)	/	J	M	/	K; P_{50}; P_{100}	VvS (CMJ)	povećanje VvS kod obe **P** grupe	nema razlike između **P** grupa
Cheng, Lin & Lin (2003)	16	16-19	M	8 nedelja (3x nedeljno)	Ko;T	EsN	poboljšanje eksplozivne snage kod **Ko**	**Ko** veći napredak na nekim testovima EsN od **T**
Chang, Hsu, Chen & Lin (2005)	16	16.53 ± 0.77	Ž	12 nedelja (3x nedeljno)	P_{30}; P_{40}; P_{50}; K	SJ, CMJ i CJ	**P** i **K** napredak na CMJ i CJ, nema napretka na SJ	P_{50} veći napredak od P_{40} i P_{50}
Zushi (2006)	10	/	M	7 nedelja (3x nedeljno)	P	VvS	značajan napredak	/
Boraczyński & Urnia (2008)	14	20,3 ± 1,9	M	8 nedelja (3x nedeljno)	P	EsN	Napredak EsN	/
Santos & Janeira (2008)	25	14-15	M	10 nedelja (2x nedeljno)	Ko; K	SJ, CMJ, ABA, i MBT	napredak **Ko** na testovima SJ, ABA i MBT	/
Kukrić, Karalejić, Petrović i Jakovljević (2009)	20	16-17	M	10 nedelja (2x nedeljno)	Ko; K	VvS (CMJ i SJ)	**Ko** napredak VvS	/
Shaji & Isha (2009)	45	18-25	M	4 nedelje (2x nedeljno)	Di; P; DiP	VvS	povećanje VvS kod **Di**, **P** i **DiP**	**DiP** veći napredak u VvS od **P** i **Di**
Kukrić, Petrović, Dobraš i Guzina (2010)	20	J	M	10 nedelja (2x nedeljno)	P; K	EsN (CMJ i SJ)	**P** napredak kod CMJ i SJ	**/**
Chaudhary & Jhajharia (2010)	20	18-22	Ž	6 nedelja	P; K	VvS	**P** napredak VvS	**K** nema napredak
King & Cipriani (2010)	32	14-16	M	6 nedelja (2x nedeljno/ 20-30min)	Psr; Pfr	VvS	**Psr** napredak u VvS	**Pfr** nema napredak
Khlifa at al. (2010)	27	/	M	10 nedelja (2-3x nedeljno)	P; K; Po	VvS	**P** i **Po** napredak VvS	**Po** veći napredak od **P**
Shallaby (2010)	20	16	M	12 nedelja (3x nedeljno/ 120min)	P; K	VvS	**P** napredak VvS	**P** veći u odnosu na **K**
Tsimahidis et al. (2010)	26	J	M	10 nedelja	K; TSp	VvS (SJ, CMJ i DJ)	**TSp** napredak na gotovo svim testovima nakon 5 i 10 nedelja	**/**
Wee, Mudah & Tan (2011)	20	20-23	M	4 nedelja (2x nedeljno)	P; K	VvS	**P** i **K** napredak VvS	**P** veći napredak u od **K** (11,7% naspram 2,12%)
Santos & Janeira (2011)	24	14-15	M	10 nedelja (2x nedeljno)	P; K	EsN (SJ, CMJ, ABA, DJ)	**P** napredak EsN	**/**
Draganović & Marković (2011)	23	J	M	6 nedelja (2x nedeljno)	P; K	VvS	**P** napredak VvS	VvS poboljšana za 6cm

Adorable Caparino & Abbu (2011)	9	St	M	10 nedelja	P	VvS	povećanje VvS	/
Sharma & Multani (2012)	40	/	M	4 nedelje	P; K	EsN	**P** napredak EsN	**K** nema napredak
Asadi & Arazi (2012)	16	19-20	M	6 nedelja (2x nedeljno/ 55min)	P; K	EsN (VvS i SLJ)	napredak **P** u EsN	**P** veći napredak od **K**
Adibpour, Bakht & Behpour (2012)	16	20.38±3.7	Ž	8 nedelja (3x nedeljno)	Ko; K	VvS	**Ko** napredak VvS	**Ko** veći napredak od **K**
Bavli (2012)a	91	15-17	MŽ	12 nedelja (3x nedeljno)	P; K; Pv	VvS	napredak VvS kod **P** i **Pv**	između **P** i **Pv** nema razlike / **P** i **Pv** veći napredak od **K**
Bavli (2012)b	24	20,7 ± 2,6	M	6 nedelja	P; K	VvS	**P** napredak VvS	**P** veći napredak od **K**
Arazi, Coetzee & Asadi (2012)	18	18,81 ± 1,46	M	8 nedelja (3x nedeljno/40 min)	P; Pv; K	VvS	**Pv** i **P** napredak VvS	nema razlike između **Pv** i **P**
Kukrić, Karalejić, Jakovljević Petrović i Mandić (2012)	30	16-17	M	10 nedelja (2x nedeljno)	P; K; Ko	VvS	**P** i **Ko** napredak VvS	nema razlike između **P** i **Ko**
Andrejić (2012)	21	12-13	M	6 nedelja (2 x nedeljno/ 90min)	S; Ps	SLJ, VvS, MBT	**Ps** napredak u VvS, SLJ i MBT; **S** napredak u MBT	**Ps** veći napredak od **S**
Boccolini, Costa & Alberti (2012)	28	/	M	4 nedelje (3x nedeljno/ 20min)	K; Knp	CMJ (izvođen na jednoj i obe noge)	**Knp** poboljšanje CMJ na desnoj nozi (7.24%)	**K** nema napredak
Javorac (2012)	40	16-18	M	10 nedelja (2x nedeljno)	Ko; K	VvS, TrM, SLJ	**Ko** značajan napredak VvS, TrM, SLJ	**Ko** veći napredak od **K**
Santos & Janeira (2012)	25	14-15	M	10 nedelja (2x nedeljno)	T; K	SJ, CMJ, ABA, DJ i MBT	**T** napredak na svim testovima	**/**
Komal & Singh (2013)	45	16-18	Ž	8 nedelja	P; K; T	VvS	**P** i **T** napredak VvS	**P** i **T** veći napredak od **K**
Zhang (2013)	17	18-24	M	4 nedelje (3x nedeljno/ 60min)	P	VvS sa leve noge, VvS sa desne noge, VvS - sunožni skok	nema poboljšanja VvS - sunožni skok	poboljšanje VvS sa leve noge i VvS sa desne noge
Asadi (2013)	20	20.1 ± 1.3	M	6 nedelja (2x nedeljno	P; K	VvS i SLJ	**P** napredak VvS i SLJ	/
Nabizadeh, Bararpour, Chaleh & Najafnia (2013)	30	19,2	M	8 nedelja (3x nedeljno/ 20min)	P_{50}; P_{60}; P_{70}	VvS	$\mathbf{P_{50}}$,$\mathbf{P_{60}}$ i $\mathbf{P_{70}}$ napredak VvS	nema razlike između grupa
Robert & Murugavel (2013)	30	19-25	M	8 nedelja (3x nedeljno)	P; Sp; T	VvS	napredak kod **P**,**Sp** i **T**	**P** veći napredak od **Sp** i **T**
Lehnert, Hůlka, Malý, Fohler & Zahálka (2013)	12	24,36 ± 3,9	M	4 nedelje (2x nedeljno) + 2 nedelje (4x nedeljno)	P	EsN	nema poboljšanja EsN	/
Zarić (2014)	13	17.76±0.43	Ž	6 nedelja	E	EsN (SJ, CMJ, CMJ Free arms)	napredak na testu SJ (12,65%)	/
Roden, Lambson & DeBeliso (2014)	20	juniori	M	6 nedelja (2x nedeljno)	Ko_1; Ko_2	VvS	$\mathbf{Ko_1}$ i $\mathbf{Ko_2}$ napredak VvS (7,7% i 5,1%)	nema razlike između $\mathbf{Ko_1}$ i $\mathbf{Ko_2}$ (p = 0,077)
Attene at al. (2014)	36	14,9 ± 0,9	Ž	6 nedelja	P; K	VvS	**P** i **K** napredak VvS	**P** veći napredak od **K** (15,4% naspram 7,5%)
Ramachandran & Pradhan (2014)	30	20.4 ± 1.73	M Ž	2 nedelje (3x nedeljno)	DiP	VvS, agilnost	poboljšanje agilnosti i VvS	/
Morsal at al. (2014)	30	24-30	M	6 nedelja (3x nedeljno)	P; K	EsN	povećanje EsN	/
Zribi at al. (2014)	51	pube-rtet	M	9 nedelja	P; K	EsN	napredak EsN	/
Gottlieb, Eliakim, Shalom, Dello-Iacono & Meckel (2014)	19	16.3±0.5	M	8 nedelja (2x nedeljno)	P; Sp	VvS	**P** napredak VvS	/
Nageswaran (2014)	30	18-22	M	10 nedelja	P; K; Ko	EsN	**P** i **Ko** napredak EsN	**Ko** veći napredak od **P**
Ramateerth & Kannur (2014)	21	12-13	M	6 nedelja (2x nedeljno/ 90min)	S; Ps	VvS, SLJ, MBT	**Ps** napredak kod VvS, SLJ, MBT	**Ps** veći napredak od **S**
Abraham (2015)	80	13-18	M	12 nedelja (3x nedeljno)	P; K; Kt; Bp	EsN i EsR	napredak **P**, **Kt** i **Bp** kod EsN i EsR	**/**
McCormick at al. (2015)	14	Srš	Ž	6 nedelja	Psr; Pfr	EsN (SLJ, VvS, LHT/L, LHT/R)	napredak **Psr** i **Pfr** grupe na svim testovima	**Psr** bolje rezultate u VvS od **Pfr, Pfr** bolje u LHT/L i LHT/R od **Psr**
Benis, Rossi, Russo & La Torre (2015)	24	15.9 ± 0.8	Ž	8 nedelja	K; P	VvS	**P** napredak u VvS	nema napretka kod **K**

Khazai & Hematfar (2015)	16	11-12	Ž	4 nedelje (3x nedeljno/ 60min)	K; P	VvS	**P** napredak VvS	/
Ademović (2016)	15	18-26	M	12 nedelja (3x nedeljno/ 90min)	Sk	EsN	napredak EsN	**/**

Legenda: N - *ukupan broj ispitanika;* **G.St** - *godine starosti;* **P** - *pol ispitanika;* **Br.Gr** - *broj grupa;* **P** - *grupa koja je bila podvrgnuta pliometrijskom programu;* **K** - *kontrolna grupa;* **Ko_1**- *visoki intenzitet mali broj ponavljanja,* **Ko_2**-*srednji intenzitet veći broj ponavljanja;* **T** - *grupa koja je podvrgnuta treningu sa tegovima;* **Ko** - *grupa koja je bila podvrgnuta kompleksnom treningu;* **Ps** - *grupa koja je bila podvrgnuta kombinaciji pliometrijskog treninga i treninga snage (bez tegova);* **S** - *grupa koja je bila podvrgnuta treningu sa vežbama snage (bez tegova);* **Sp** - *grupa koja je bila podvrgnuta specifičnom treningu sprinta;* **Di** - *grupa koja je bila podvrgnuta dinamičkom istezanju;* **DiP** - *grupa koja je bila podvrgnuta kombinaciji dinamičkog istezanja i pliometrijskih vežbi;* **Kt** - *grupa koja je bila podvrgnuta kružnom treningu;* **Bp** - *grupa koja je bila podvrgnuta circuit breaker programu;* **Po** - *grupa koja je bila podvrgnuta pliometrijskom treningu sa dodatnim spoljašnjim opterećenjem u vidu prsluka;* **Pv** - *grupa koja je bila podvrgnuta vodenom pliometrijskom programu;* **Psr** - *grupa koja je izvodila pliometrijske skokove u sagitalnoj ravni;* **Pfr** - *grupa koja je izvodila pliometrijske skokove u frontalnoj ravni;* **P_{30}, P_{40}, P_{50}, P_{60}, P_{70} i P_{100}** - *grupe koje su bile podvrgnute pliometrijskim dubinskim skokovima sa klupica visina 30, 40, 50, 60, 70 i 100cm;* **Sk** - *grupa koja je bila podvrgnuta SAQ treningu;* **TSp** - *grupa koja je bila podvrgnuta kombinaciji sprinta sa vežbama sa tegovima;* **Knp** - *grupa koja je bila podvrgnuta treningu skokova sa konopcem;* **E** - *grupa u kojoj se trenažni proces sastojao od treninga snage,različitih tipova izdržljivosti, košarkaške tehnike;* **J** - *juniori;* **St** - *studenti;* **Srš** - *srednjoškolci;* **VvS** - *visina vertikalnog skoka;* **EsN** - *eksplozivna snaga nogu;* **EsR** - *eksplozivna snaga ruku;* **CMJ** *(Countermovement Jump) - skok iz čučnja sa pripremom;* **SJ** *(Squat Jump) - skok iz čučnja;* **CJ** *(Continuous Jump) - ponavljajući skokovi;* **ABA** - *Abalakov test;* **MBT** *(Medicine Ball Throw) - bacanje medicinke;* **DJ** *(Drop Jump) - dubinski skok;* **SLJ** *(Standing Long Jump) - skok udalj iz mesta;* **TrM** - *troskok iz mesta;* **LHT/L** - *lateral hop test left;* **LHT/R** - *lateral hop test right.*

Table 1. *Previous studies of the explosive power in basketball (from 2001 to 2016.)*

References	Sample of respondents			Experimental treatment				
	N	A	G	duration	No. Gr.	measured parameters	results	differences among groups
Matavulj, Kukolj, Ugarkovic, Tihanyi & Jaric (2001)	/	J	M	/	C; P_{50}; P_{100}	HVJ (CMJ)	increase of HVJ with both **P** groups	no difference among **P** groups
Cheng, Lin & Lin (2003)	16	16-19	M	8 weeks (3x a week)	Co;W	ELS	improvement of explosive strength with **Co**	**Co** greater improvement at some tests in ELS than **T**
Chang, Hsu, Chen & Lin (2005)	16	16.53 ± 0.77	F	12 weeks (3x a week)	P_{30}; $P_{40;}$ P_{50}; C	SJ, CMJ and CJ	**P** and **C** improvement in CMJ and CJ, no improvement in SJ	P_{50} bigger improvement than P_{40} and P_{50}
Zushi (2006)	10	/	M	7 weeks (3x a week)	P	HVJ	great improvement	/
Boraczyński & Urnia (2008)	14	20,3 ± 1,9	M	8 weeks (3x a week)	P	ELS	improvement in ELS	/
Santos & Janeira (2008)	25	14-15	M	10 weeks (2x a week)	Co; C	SJ, CMJ, ABA, and MBT	improvement with **Co in tests of** SJ, ABA and MBT	/
Kukrić, Karalejić, Petrović i Jakovljević (2009)	20	16-17	M	10 weeks (2x a week)	Co; C	HVJ (CMJ and SJ)	**Co** improvement in HVJ	/
Shaji & Isha (2009)	45	18-25	M	4 weeks (2x a week)	Ds; P; DSP	HVJ	improvement in HVJ with **DS**, **P** and **DSP**	**DSP** greater improvement in HVJ Than **P** and **Ds**
Kukrić, Petrović, Dobraš i Guzina (2010)	20	J	M	10 weeks (2x a week)	P; C	ELS (CMJ and SJ)	**P** improvement in CMJ and SJ	**/**
Chaudhary & Jhajharia (2010)	20	18-22	F	6 weeks	P; C	HVJ	**P improvement in HVJ**	**C no improvement**
King & Cipriani (2010)	32	14-16	M	6 weeks (2x a week/ 20-30min)	Psp; Pfp	HVJ	**Psp improvement in HVJ**	**Pfp no improvement**
Khlifa at al. (2010)	27	/	M	10 weeks (2-3x a week)	P; C; Po	HVJ	**P and Po improvement in** HVJ	**Po greater improvement than P**
Shallaby (2010)	20	16	M	12 weeks (3x a week/ 120min)	P; C	HVJ	**P improvement in** HVJ	**P greater compared to C**
Tsimahidis et al. (2010)	26	J	M	10 weeks	C; TSp	HVJ (SJ, CMJ and DJ)	**TSp improvement in almost all the tests after 5 and 10 weeks**	**/**

Wee, Mudah & Tan (2011)	20	20-23	M	4 weeks (2x a week)	P; C	HVJ	**P and C improvement in** HVJ	**P greater improvement compared to C (11,7% to 2,12%)**
Santos & Janeira (2011)	24	14-15	M	10 weeks (2x a week)	P; C	EIS (SJ, CMJ, ABA, DJ)	**P improvement in EIS**	**/**
Draganović & Marković (2011)	23	J	M	6 weeks (2x a week)	P; C	HVJ	**P improvement in** HVJ	**HVJ improved for 6cm**
Adorable Caparino & Abbu (2011)	9	St	M	10 weeks	P	HVJ	**growth of** HVJ	**/**
Sharma & Multani (2012)	40	/	M	4 weeks	P; C	EIS	**P improvement in EIS**	**C no improvement**
Asadi & Arazi (2012)	16	19-20	M	6 weeks (2x a week 55min)	P; C	EIS (HVJ and SLJ)	**improvement P in EIS**	**P greater improvement than C**
Adibpour, Bakht & Behpour (2012)	16	20.38±3.7	F	8 week (3x a week)	Co; C	HVJ	**Co improvement in HVJ**	**Co greater improvement than C**
Bavli (2012)a	91	15-17	MF	12 weeks (3x a week)	P; C; Pw	HVJ	**improvement in HVJ with P and Pw**	**no difference between P and Pw/ P and Pw greater improvement than C**
Bavli (2012)b	24	20,7 ± 2,6	M	6 weeks	P; C	HVJ	**P improvement in HVJ**	**P greater improvement than C**
Arazi, Coetzee & Asadi (2012)	18	18,81 ± 1,46	M	8 weeks (3x a week/40 min)	P; Pw; K	HVJ	**Pw and P improvement in HVJ**	**no difference between P and Pw**
Kukrić, Karalejić, Jakovljević Petrović i Mandić (2012)	30	16-17	M	10 weeks(2x a week)	P; C; Co	HVJ	**P and Co improvement in HVJ**	**no difference between P and Co**
Andrejić (2012)	21	12-13	M	6 weeks(2 x a week/ 90min)	F; Pf	SLJ,HVJ, MBT	**Pf improvement in HVJ, SLJ and MBT; F improvement in MBT**	**Pf greater improvement than F**
Boccolini, Costa & Alberti (2012)	28	/	M	4 weeks (3x a week/ 20min)	C; Tjr	CMJ (performed on one and both legs)	**Kjr improvement in CMJ of right leg (7.24%)**	**C no improvement**
Javorac (2012)	40	16-18	M	10 weeks (2x a week)	Co; C	HVJ, TjS, SLJ	**Co great improvement i HVJ,Tjs, SLJ**	**Co greater improvement than C**
Santos & Janeira (2012)	25	14-15	M	10weeks (2x a week)	W; C	SJ, CMJ, ABA, DJ and MBT	**W improvement in all the tests**	**/**
Komal & Singh (2013)	45	16-18	F	8 weeks	P; C; W	HVJ	**P and W improvement in HVJ**	**P and W greater improvement than C**
Zhang (2013)	17	18-24	M	4 weeks (3x a week/ 60min)	P	HVJ off the left leg, HVJ off the right leg, HVJ – two feet jump	**no improvement in HVJ – two feet jump**	**improvement in HVJ off left leg and HVJ off right leg**
Asadi (2013)	20	20.1 ± 1.3	M	6 weeks (2x a week	P; C	HVJ and SLJ	**P improvement in HVJ and SLJ**	**/**
Nabizadeh, Bararpour, Chaleh & Najafnia (2013)	30	19,2	M	8 weeks (3x a week/ 20min)	P50; P60; P70	HVJ	**P50,P60 i P70 improvement in HVJ**	**no differences among groups**
Robert & Murugavel (2013)	30	19-25	M	8 weeks (3x a week)	P; Sp; W	HVJ	**improvement with P, Sp and W**	**P greater improvement than Sp and W**
Lehnert, Hůlka, Malý, Fohler & Zahálka (2013)	12	24,36 ± 3,9	M	4 weeks(2x a week) + 2 weeks (4x a week)	P	EIS	**no improvements in EIS**	**/**
Zarić (2014)	13	17.76±0.43	F	6 weeks	E	EIS (SJ, CMJ, CMJ Free arms)	**improvement in test SJ (12,65%)**	**/**
Roden, Lambson & DeBeliso (2014)	20	juniors	M	6 weeks(2x a week)	Co1; Co2	HVJ	**Ko1 and Ko2 improvement in HVJ (7,7% i 5,1%)**	**no difference between Co1 and Co2 (p = 0,077)**
Attene at al. (2014)	36	14,9 ± 0,9	F	6 weeks	P; C	HVJ	**P and C improvement in HVJ**	**P greater improvement than C (15,4% to 7,5%)**
Ramachandran & Pradhan (2014)	30	20.4 ± 1.73	M Ž	2 weeks (3x a week)	DsP	HVJ, agility	**improvement of agility and HVJ**	**/**

Morsal at al. (2014)	30	24-30	M	6 weeks (3x a week)	P; C	EIS	**improvement in EIS**	**/**
Zribi at al. (2014)	51	puberty	M	9 weeks	P; C	EIS	**improvement in EIS**	**/**
Gottlieb, Eliakim, Shalom, Dello-lacono & Meckel (2014)	19	16.3±0.5	M	8 weeks (2x a week)	P; Sp	HVJ	**P improvement in HVJ**	**/**
Nageswaran (2014)	30	18-22	M	10 weeks	P; C; Co	EIS	**P and Co improvement in EIS**	**Co greater improvement than P**
Ramateerth & Kannur (2014)	21	12-13	M	6 a week (2x a week/ 90min)	F; Pf	HvJ, SLJ, MBT	**Pf improvement in HVJ, SLJ, MBT**	**Ps greater improvement than F**
Abraham (2015)	80	13-18	M	12 weeks(3x a week)	P; C; Ct; Bp	EIS and EpA	**improvement with P, Ct and Bp in EIS and EpA**	**/**
McCormick at al. (2015)	14	HSS	F	6 weeks	Psp; Pfp	EIS (SLJ, HVJ, LHT/L, LHT/R)	**improvement Psp and Pfp groups in all the tests**	**Psp better results in HvJ than Psp, Pfp better in LHT/L i LHT/R than Psp**
Benis, Rossi, Russo & La Torre (2015)	24	15.9 ± 0.8	F	8 weeks	C; P	HVJ	**P improvement in HVJ**	**no improvement with C**
Khazai & Hematfar (2015)	16	11-12	F	4 weeks (3x a week/ 60min)	C; P	HVJ	**P improvement in HVJ**	**/**
Ademović (2016)	15	18-26	M	12weeks (3x a week/ 90min)	Sq	EIS	**improvement in EIS**	**/**

Legend: N - *total number of subjects;* **A** - *age;* **H** - *half of the respondents;* **No. G** - *the number of groups;* **P** - *a group that has been subjected to a plyometric program;* **C** - *control group;* **Co1**- *high intensity low reps,* **St2**-*medium intensity greater number of repetitions;* **W** - *a group which is subjected to training with weights;* **Once** - *a group that has been subjected to a complex training;* **Pf** - *the group that had been subjected to a combination of plyometric training and the training force (no lifting);* **F** - *a group that was subjected to training with the exercise force (no lifting);* **Sp** - *a group that has undergone specific training sprint;* **Ds** - *a group that has been subjected to dynamic stretching;* **Dsp** - *a group that has been subjected to a combination of dynamic stretching and plyometric exercises;* **Ct** - *a group that has been subjected to circuit training;* **Bp** - *a group that has been subjected to a circuit breaker program;* **After** - *a group that has been subjected to plyometric training with additional external load in the form of vests;* **Pw** - *a group that has been subjected to the aquatic plyometric program;* **Psp** - *group which is executed plyometric jumps in the sagittal plane;* **Pfp** - *group which is executed plyometric jumps in the frontal plane;* **P30, P40, P50, P60, P70 and P100** - *groups which have been subjected to in-depth polymetricI jumps from the bench height of 30, 40, 50, 60, 70 and 100cm;* **Sq** - *a group that has been subjected SAQ training;* **TSP** - *a group that was subjected to combination with sprinting exercises, with weights;* **KNP** - *a group that has been subjected to training jumps with a rope;* **E** - *group in which the training process composed of strength training, various types of durability, basketball technique;* **J** - *juniors;* **St** - *students;* **HSS** - *high school students;* **HVJ** - *height of vertical jump;* **ELS** - *explosive leg strength;* **EPA** - *explosive power arm;* **CMJ** - *countermovement jump;* **SJ** - *Squat jump;* **CJ** - *Continuous Jump;* **ABA** – *Abalak's test;* **MBT** - *medicine ball throw;* **DJ** - *drop jump (depth jump);* **SLJ** - *standing long jump;* **TRM** - *triple jump out of the spot;* **LHT/L** - *lateral hop test block;* **LHT/R** - *right lateral hop test.*

Discussion

Numerous studies from Table1 show that the explosive power of players can be developed with the help of the plyometric training methods. Matavulj Kukolj, Ugarković, Tihanyi & Jarić (2001) found that the plyometric training leads to the improvements in vertical jump of junior basketball players. Similar results were obtained by Kukrić, Petrović, Dobraš and Guzina (2010). The authors found that the plyometric training for a period of 10 weeks (2x weekly), in which the number of exercises and the number of jumps per training increased from week to week, and in which the pause between a series is three, and between the exercises five minutes, leads to an increase in height of the vertical jump of junior basketball players.

Diskusija

Veliki broj istraživanja iz Tabele 1. pokazuje da se eksplozivna snaga košarkaša može razviti uz pomoć *pliometrijske metode* treninga. Matavulj, Kukolj, Ugarkovic, Tihanyi & Jaric (2001) su utvrdili da pliometrijski trening dovodi do poboljšanja visine vertikalnog skoka kod juniorskih košarkaša. Slične rezultate dobili su i Kukrić, Petrović, Dobraš i Guzina (2010). Autori su utvrdili da pliometrijski trening u trajanju od 10 nedelja (2x nedeljno), u kome se se broj vežbi i broj skokova po treningu povećava iz nedelje u nedelju i u kome je pauza između serija tri, između vežbi pet minuta, dovodi do povećanja visine vertikalnog skoka košarkaša juniorskog uzrasta.

Shaji & Isha (2009) found that plyometric training for a period of four weeks (2x per week) leads to the increase in the vertical jump height of basketball players by an average 3,6cm (7.9%), while Wee, Mudah & Tan (2011) found that the increase in height of vertical jump with the aid of plyometric training within the aforementioned time duration amounts to 11.7%. Sharma & Multani (2012) and Zhang (2013) proved that the plyometric training for four weeks leads to an improved vertical jump height on a sample of male basketball players, and Khazali & Hematfar (2015) on a sample of female basketball players.

On the other hand, Asadi & Arazi (2012) found that plyometric training for a period of six weeks (2x per week) leads to significant improvements in the vertical jump of basketball players on average by 23%, while Attene at al. (2014) on a sample of female basketball players determined that the plyometric training for a period of six weeks leads to a significant increase in the height of vertical jump for 15.4%. Similar results were obtained by Draganović & Marković (2011). The authors found that plyometric training within the time of duration leads to an improved vertical jump height of junior basketball players for 6cm. These results show that even though the plyometric training for four weeks leads to an improved vertical jump height of basketball players, the mentioned training method gives better results in the long term.

Zushi (2006) as a method of plyometric training used the depth jump (*drop jump*) and found that the plyometric training for a period of seven weeks (3 times a week) leads to an improved jumping ability of basketball players. That fact that drop jump can be a good plyometric exercise for developing the explosive power of basketball players was also determined by Nabizadeh, Bararpour, Chaleh & Najafnia (2013). The authors have shown that plyometric training for a period of eight weeks (3x weekly / 20min), which consisted of the drop jumps from the bench after which the respondents immediately jumped in advance over a certain obstacle (*drop jump to standing long jump*), resulted in significant improvements of the vertical jump height of basketball players. Similar results were obtained by Asadi & Arazi (2012), but, besides the *drop jump* and *drop jump to standing long jump*, they also used the *squat jump*.

Particular studies have shown that plyometric training should not take long to have positive effects on the development of the explosive power of players. Arazi, Coetzee & Asadi (2012) found that eight weeks of plyometric training performed 3 times per week for a period of 40min results in a significant improvement of the vertical jump height of basketball players. King & Cipriani (2010) found that six weeks of plyometric training which is performed

Shaji & Isha (2009) su utvrdili da pliometrijski trening u trajanju od četiri nedelje (2x nedeljno) dovodi do povećanja visine vertikalnog skoka kod košarkaša u proseku za 3,6cm (7,9%), dok su Wee, Mudah & Tan (2011) utvrdili da povećanje visine vertikalnog skoka uz pomoć pliometrijskog treninga u pomenutom vremenskom trajanju iznosi 11,7%. Da pliometrijski trening u trajanju od četiri nedelje dovodi do poboljšanja visine vertikalnog skoka utvrdili su i Sharma & Multani (2012), kao i Zhang (2013) na uzorku košarkaša, a Khazai & Hematfar (2015) na uzorku košarkašica. S druge strane Asadi & Arazi (2012) su utvrdili da pliometrijski trening u trajanju od šest nedelja (2x nedeljno) dovodi do značajnog poboljšanja visine vertikalnog skoka košarkaša u proseku za 23%, dok su Attene at al. (2014) na uzorku košarkašica utvrdili da pliometrijski trening u trajanju od šest nedelja dovodi do značajnog povećanja visine vertikalnog skoka za 15,4%. Slične rezultate su dobili i Draganović & Marković (2011). Autori su utvrdili da pliometrijski trening u pomenutom vremenskom trajanju dovodi do poboljšanja visine vertikalnog skoka košarkaša juniorskog uzrasta za 6cm. Ovi rezultati pokazuju da iako pliometrijski trening u trajanju od četiri nedelje dovodi do poboljšanja visine vertikalnog skoka košarkaša, bolje rezultate daje pomenuta metoda treninga u dužem vremenskom trajanju.

Zushi (2006) je kao metodu pliometrijskog treninga koristio skok u dubinu (*drop jump*) i utvrdio da pliometrijski trening u trajanju od sedam nedelja (3x nedeljno) dovodi do poboljšanja sposobnosti skakanja košarkaša. Da skok u dubinu (*drop jump*) može biti povoljna pliometrijska vežba za razvoj eksplozivne snage košarkaša utvrdili su i Nabizadeh, Bararpour, Chaleh & Najafnia (2013). Autori su dokazali da pliometrijski trening u trajanju od osam nedelja (3x nedeljno/20min), koji se sastojao od skokova u dubinu sa klupice nakon kojih su ispitanici odmah skakali unapred preko određene prepreke (*drop jump to standing long jump*), doveo do značajnog poboljšanja visine vertikalnog skoka košarkaša. Slične rezultate su dobili i Asadi & Arazi (2012), s tim što su oni pored *drop jump*-a i *drop jump to standing long jump-a* koristili i *squat jump*.

Pojedina istraživanja su pokazala da trening pliometrije ne mora da traje dugo da bi imao pozitivne efekte na razvoj eksplozivne snage košarkaša. Arazi, Coetzee & Asadi (2012) su utvrdili da osam nedelja pliometrijskog treninga koji se izvodi 3x nedeljno u trajanju od 40min dovodi do značajnog poboljšanja visine vertikalnog skoka košarkaša. King & Cipriani (2010) su utvrdili da šest nedelja pliometrijskog treninga koji se izvodi 2x

2x a week for 20 to 30 min results in a significant improvement of vertical jump height of basketball players. Similar results were obtained by Bavli (2012)b who found that plyometric training for 30 min, which is executed right after the basketball training, for a period of six weeks, leads to significant improvements of the vertical jump height of basketball players. Nabizadeh, Bararpour, Chaleh & Najafnia (2013) found that even the 20min plyometric training is enough (eight weeks, 3 times a week) in order to enhance the explosive power of basketball players.

That plyometric training lasting between six and 10 weeks improves the explosive power of basketball players was determined by many other studies shown in Table 1 (Boraczyñski & Urnia, 2008; Khlifa at al., 2010; Shallaby, 2010; Santos & Janeira, 2011; Adorable, Caparino & Abbu, 2011; Kukrić, Karalejić, Jakovljevic, Petrović & Mandić, 2012; Asadi, 2013; Robert & Murugavel, 2013; Nageswaran, 2014; Zribi at al., 2014; Morsal at al., 2014; Abraham, 2015). In the aforementioned studies, the training was applied 2 to 3 times a week. Khlifa at al. (2010) in a sample of 27 basketball players determined that plyometric exercises with the use of an additional external load in the form of vest (10-11% of the total weight) for 10 weeks (2-3 times per week) caused a significant increase in the height of vertical jump. The authors also found that plyometric exercises with an additional external load are significantly more effective in increasing the height of the vertical jump than the plyometric exercises without an additional load.

The results in Table 1 show that, except for basketball players, plyometric training lasting between six and 12 weeks leads to the development of the explosive strength with female basketball players, too (Chang, Hsu, Chen & Lin, 2005; Chaudhary & Jhajharia, 2010; Bavli, 2012a; Komal & Singh, 2013; Attene at al., 2014; Benis, Rossi, Russo & La Torre, 2015; McCormick et al., 2015).

One of the few studies in which plyometric training has not led to a significant increase in height of the vertical jump of basketball players is the research by Lehnert, Hulka, Malý, Fohler & Zahálka (2013). In their study, the subjects were an average age of 24.36 ± 3.9 years, and the experimental program lasted for six weeks (2x per week from the first to the fourth week of the program and 4x per week in the fifth and sixth week of the program). In the last two weeks, the plyometric exercises for the lower limbs were combined with the resistance training exercises for the upper body on one workout and vice versa. The number of jumps gradually increased during the program. In addition to the plyometric program, the basketball players were still subject to the conditional training exercises that included speed, aerobic endurance, the resistance train-

nedeljno u trajanju od 20 do 30min dovodi do značajnog poboljšanja visine vertikalnog skoka košarkaša. Slične rezultate dobio je i Bavli (2012)b i utvrdio da pliometrijski trening u trajanju od 30min, koji se izvodi odmah nakon košarkaškog treninga, u periodu od šest nedelja, dovodi do značajnog poboljšanja visine vertikalnog skoka košarkaša. Nabizadeh, Bararpour, Chaleh & Najafnia (2013) su utvrdili da je i 20min pliometrijskog treninga dovoljno (osam nedelja, 3x nedeljno) da bi se poboljšala eksplozivna snaga košarkaša.

Da pliometrijski trening u trajanju izmedju šest i 10 nedelja poboljšava eksplozivnu snagu košarkaša utvrdila su još mnoga istraživanja prikazana u Tabeli 1. (Boraczyñski & Urnia, 2008; Khlifa at al.,2010; Shallaby, 2010; Santos & Janeira, 2011; Adorable, Caparino & Abbu, 2011; Kukrić, Karalejić, Jakovljević, Petrović & Mandić, 2012; Asadi, 2013; Robert & Murugavel, 2013; Nageswaran, 2014; Zribi at al., 2014; Morsal at al., 2014; Abraham, 2015). U pomenutim istraživanjima trening je sprovodjen 2 do 3 puta nedeljno. Khlifa at al. (2010) su na uzorku od 27 košarkaša utvrdili da pliometrijske vežbe u kojima se koristi dodatno spoljašnje opterećenje u vidu prsluka (10-11% ukupne težine) u trajanju od 10 nedelja (2-3x nedeljno) dovode do značajnog povećanja visine vertikalnog skoka. Autori su takođe utvrdili da su pliometrijske vežbe sa dodatnim spoljašnjim opterećenjem značajno efikasnije u povećanju visine vertikalnog skoka od pliometrijskih vežbi bez dodatnog opterećenja.

Rezultati iz Tabele 1. pokazuju da osim kod košarkaša, pliometrijski trening u trajanju između šest i 12 nedelja dovodi do razvoja eksplozivne snage i kod košarkašica (Chang, Hsu, Chen & Lin, 2005; Chaudhary & Jhajharia, 2010; Bavli, 2012a; Komal & Singh, 2013; Attene at al., 2014; Benis, Rossi, Russo & La Torre, 2015; McCormick at al., 2015).

Jedno od retkih istraživanja u kome pliometrijski trening nije doveo do značajnog povećanja visine vertikalnog skoka košarkaša je istraživanje Lehnert, Hůlka, Malý, Fohler & Zahálka (2013). U njihovom istraživanju ispitanici su bili prosečne starosti 24,36 ± 3,9 godina, a eksperimentalni program je trajao šest nedelja (2x nedeljno od prve do četvrte nedelje programa i 4x nedeljno u petoj i šestoj nedelji programa). U poslednje dve nedelje pliometrijske vežbe za donje ekstremitete su kombinovane sa vežbama sa opterećenjem za gornje ekstremitete na jednom treningu i obrnuto. Broj skokova se postepeno povećavao tokom programa. Pored pliometrijskog programa košarkaši su i dalje bili izloženi kondicionoj pripremi koja je obuhvatala vežbe brzine, aerobne izdržljivosti, trening sa opterećenjem i td. Do sličnih re-

ing and so on. Similar results were obtained by Gottlieb, Eliakim, Shalom, Dello-Iacono & Meckel (2014). In their research, they found that plyometric training for a period of eight weeks (2x per week) does not lead to significant advances of height of the vertical jump of basketball players. It is possible that in the aforementioned studies, due to the scope of the program, the basketball players entered the state of overtraining so there was no progress in the measured ability. In addition to the aforementioned, King & Cipriani (2010) in a sample of basketball players found that the plyometric exercises with jumps in the frontal plane, for a period of six weeks (2x per week / 20-30min), do not lead to improvements in the vertical jump height.

In addition to plyometric training, the *complex training* also proved to be a good method for developing the explosive power of basketball players. Nageswaran (2014) on a sample of basketball players determined that the combination of plyometric training and weight training (*complex training*) for 10 weeks led to a significant improvement of the explosive power. The author also found that the combination leads to significantly better progress in the explosive power than only a plyometric training for 10 weeks. Similar results were obtained by Cheng, Lin & Lin (2003), Santos & Janeira (2008), Kukrić, Karalejić, Petrović and Jakovljević (2009), Javorac (2012), Kukrić, Karalejić, Jakovljević Petrović and Mandić (2012) and Roden , Lambson & DeBeliso (2014) on a sample of basketball players, and Adibpour, Bakht & Behpour (2012) on a sample of female basketball players. Complex training in these studies lasted from 6 to 10 weeks (2-3 times per week).

Some studies have shown that plyometric jumps, except with the exercises with weights (complex training), can be combined with other training methods to develop the explosive power of basketball players. Ramachandran & Pradhan (2014) on a sample of female basketball players found that a combination of plyometric training and the dynamic stretching for a period of two weeks (3 times weekly) leads to significant improvements in vertical jump height. In this study, the dynamic stretching was performed 10min before and after the plyometric exercises that lasted for 30min. Similar results on a sample of basketball players were found by Shaji & Isha (2009) but in their research, the experimental treatment lasted for four weeks (2x per week). The authors also found that the combination provides significantly more progress in the height of the vertical jump than when the plyometric training and dynamic stretching are used separately. The improvement of the explosive power of basketball players can also be a result of combination of plyometric training and strength training (*rubber cord exercises* and *body weight exercises*)

zultata su došli i Gottlieb, Eliakim, Shalom, Dello-Iacono & Meckel (2014). Oni su u svom istraživanju utvrdili da pliometrijski trening u trajanju od osam nedelja (2x nedeljno) ne dovodi do značajnog napretka visine vertikalnog skoka kod košarkaša. Moguće je da su pomenutim istraživanjima, zbog obima programa, košarkaši ušli u stanje pretreniranosti pa nije došlo do napretka merene sposobnosti. Pored pomenutog King & Cipriani (2010) su na uzorku košarkaša utvrdili da pliometrijske vežbe sa skokovima u frontalnoj ravni, u trajanju od šest nedelja (2x nedeljno/20-30min), ne dovode do poboljšanja visine vertikalnog skoka.

Pored pliometrijskog treninga i *kompleksni trening* se pokazao kao dobra metoda za razvoj eksplozivne snage košarkaša. Nageswaran (2014) je na uzorku košarkaša utvrdio da trening kombinacije pliometrijskog treninga i treninga sa opterećenjem (*kompleksni trening*) u trajanju od 10 nedelja dovodi do značajnog poboljšanja eksplozivne snage. Autor je takođe utvrdio da pomenuta kombinacija dovodi do značajno boljeg napretka eksplozivne snage nego samo pliometrijski trening u trajanju od 10 nedelja. Slične rezultate dobili su i Cheng, Lin & Lin (2003), Santos & Janeira (2008), Kukrić, Karalejić, Petrović i Jakovljević (2009), Javorac (2012), Kukrić, Karalejić, Jakovljević Petrović i Mandić (2012) i Roden, Lambson & DeBeliso (2014) na uzorku košarkaša, kao i Adibpour, Bakht & Behpour (2012) na uzorku košarkašica. Kompleksni trening u pomenutim istraživanjima trajao je od 6 do 10 nedelja (2-3x nedeljno).

Neka istraživanja su pokazala da se pliometrijski skokovi, osim sa vežbama sa tegovima (kompleksni trening), mogu kombinovati i sa drugim metodama treninga u cilju razvoja eksplozivne snage košarkaša. Ramachandran & Pradhan (2014) su na uzorku košarkašica utvrdili da kombinacija pliometrijskog treninga i dinamičkog istezanja u trajanju od dve nedelje (3x nedeljno) dovodi do značajnog poboljšanja visine vertikalnog skoka. U tom istraživanju dinamičko istezanje je vršeno 10min pre i posle pliometrijskih vežbi koje su trajale 30min. Do sličnih rezultata, na uzorku košarkaša, došli su došli i Shaji & Isha (2009) s tim što je u njihovom istraživanju eksperimentalni tretman trajo četiri nedelje (2x nedeljno). Autori su, takođe, utvrdili da pomenuta kombinacija daje značajno veći napredak visine vertikalnog skoka nego kada se pliometrijski trening i dinamičko istezanje koriste zasebno. Do poboljšanja eksplozivne snage košarkaša može dovesti i kombinacija pliometrijskog treninga i treninga snage (*rubber cord exercises* i *body weight exercises*) u trajanju od 6 nedelja (2x nedeljno). Ta kombinacija daje bolje rezultate u razvoju eksplozivne snage u odno-

for a period of 6 weeks (2x weekly). This combination gives better results in the development of the explosive strength in relation to the strength training when used alone (Andrejić, 2012; Ramateerth & Kannur, 2014).

The strength training with weights also leads to a significant development of the explosive power of basketball players. Santos & Janeira (2012) in a sample of 25 basketball players aged 14-15 years found that the strength training with weights for the upper and lower extremities leads to a significant improvement in the results of the tests: *squat jump, countermovement jump, Abalak test, drop jump* and *medicine ball throw*. Komal & Singh (2013) found that the aforementioned method of training can also be effective in improving the explosive power of even older basketball players (16-18 years) than in the previous survey. Similar results were found by Cheng, Lin & Lin (2003) and Robert & Murugavel (2013). The strength training with weights can develop the explosive power even when combined with the sprint training (Tsimahidis et al., 2010).

In addition to these, some other training methods have proven effective in developing the explosive power of basketball players. Andrejić (2012) found that the strength training without weights (*rubber cord exercises* and *body weight exercises*) for a period of 6 weeks (2x weekly) leads to a significant improvement of the results on the tests of throwing a medicine for basketball players. Bavli (2012) on a sample of male and female basketball players found that the aquatic plyometric training in the period of 12 weeks (3x weekly) leads to significant improvements in the vertical jump height. That the aquatic plyometric training can be a good method to improve the vertical jump height of basketball players was also determined by Arazi, Asadi & Coetzee (2012). Robert & Murugavel (2013) in a sample of basketball players found that *sprint training* for a period of 8 weeks (3 times weekly) leads to significant improvements in the vertical jump height. Ademović (2016) on a sample of basketball players found that SAQ training (speed, agility, quickness, agility, explosive power) for 12 weeks (3 times a week / 90min) leads to a significant development of the explosive strength. Boccolini, Costa and Alberti (2012) in a sample of basketball players found that the *jump training with a rope* for 20 minutes (4 weeks, 3x a week) leads to a significant improvement in the explosive strength. Zarić (2014) on a sample of female basketball players found that a combination of strength training, endurance and basketball techniques for a period of six months, leads to a significant development of the explosive strength. Abraham (2015) on a sample of basketball players found that the *circuit training*, as well as su na trening snage kad se koristi samostalno (Andrejić, 2012; Ramateerth & Kannur, 2014).

Trening snage sa tegovima, takođe, dovodi do značajnog razvoja eksplozivne snage košarkaša. Santos & Janeira (2012) su na uzorku od 25 košarkaša starosti 14-15 godina utvrdili da trening snage sa tegovima za gornje i donje ekstremitete dovodi do značajnog poboljšanja rezultata na testovima: *squat jump, countermovement jump, abalakov test, drop jump i medicine ball throw*. Komal & Singh (2013) su utvrdili da pomenuta metoda treninga može biti efikasna u poboljšanju eksplozivne snage i kod nešto straijih košarkaša (16-18 godina) nego u prethodnom istraživanju. Do sličnih rezultata su došli i Cheng, Lin & Lin (2003) i Robert & Murugavel (2013). Trening snage sa tegovima može razviti eksplozivnu snagu i ukoliko se kombinuje sa treningom sprinta (Tsimahidis et al., 2010).

Pored pomenutih još neke metode treninga su se pokazale efikasnim u razvoju eksplozivne snage košarkaša. Andrejić (2012) je utvrdio da trening snage bez tegova (*rubber cord exercises i body weight exercises*) u trajanju od 6 nedelja (2x nedeljno) dovodi do značajnog poboljšanja rezultata na testu bacanje medicinke kod košarkaša. Bavli (2012) je na uzorku košarkaša i košarkašica utvrdio da vodeni pliometrijski trening u trajanju od 12 nedelja (3x nedeljno) dovodi do značajnog poboljšanja visine vertikalnog skoka. Da vodeni pliometrijski trening može biti povoljna metoda za poboljšanje visine vertikalnog skoka košarkaša utvrdili su i Arazi, Coetzee & Asadi (2012). Robert & Murugavel (2013) su na uzorku košarkaša utvrdili da *sprinterski trening* u trajanju od 8 nedelja (3x nedeljno) dovodi do značajnog poboljšanja visine vertikalnog skoka. Ademović (2016) je na uzorku košarkaša utvrdio da SAQ trening (speed, agility, quickness - brzina, agilnost, eksplozivna snaga) u trajanju od 12 nedelja (3x nedeljno/90min) dovodi do značajnog razvoja eksplozivne snage. Boccolini, Costa & Alberti (2012) su na uzorku košarkaša utvrdili da je *trening skokova sa konopcem* u trajanju od 20 minuta (4 nedelje-3x nedeljno) dovodi do značajnog poboljšanja eksplozivne snage. Zarić (2014) je na uzorku košarkašica utvrdio da kombinacija treninga snage, izdržljivosti i košarkaške tehnike u trajanju od šest meseci dovodi do značajnog razvoja eksplozivne snage. Abraham (2015) je na uzorku košarkaša utvrdio da *kružni trening,* kao i *circuit breaker program* u trajanju od 12 nedelja (3x nedeljno) dovode do značajnog poboljšanja eksplozivne snage. Shaji & Isha (2009) su na uzorku košarkaša utvrdili da *dinamičko istezanje* u trajanju od 4 nedelje (2x nedeljno) dovodi do značajnog poboljšanja visine vertikalnog skoka.

the *circuit breaker program* for a period of 12 weeks (3x a week) lead to a significant improvement in the explosive strength. Shaji & Isha (2009) in a sample of basketball players found that the *dynamic stretching* for a period of 4 weeks (2x per week) leads to significant improvements in the vertical jump height.

Conclusion

Based on the previous researches, it was concluded that for the development of the explosive strength, the usually used method is the *plyometric method of training*, at both male and female basketball players. For the development of the mentioned skills, it is necessary that the training process lasts from four to 12 weeks. In most studies, this training method involved the exercise 2-3 times a week. With regard to the recommendations of the author, the plyometric method should be used cautiously, with prior preparation and with the development of muscular endurance, in order to prevent injuries and overtraining of young basketball players. Another method that has proved effective for developing of the explosive power of basketball players is the *complex training*. The authors believe that the combination of plyometric training and weight training can be more effective than weight training and plyometric training when used separately. *Aquatic plyometric training* may also be a suitable method for developing the explosive power of basketball players. The advantage of water over the coastal plyometric training is that it reduces the muscle pain, stress and injury. A review of past researches shows that, in addition to the aforementioned, the explosive power of basketball players can also be developed with the help of the following training methods: a combination of plyometric training and any other training (dynamic stretching, strength exercises without weights, sprint); weight training; strength training (without weights); specific sprint training; SAQ training (speed, agility, quickness, agility, explosive strength); skipping rope; training consisted of strength training, various types of durability and basketball technique; circuit breaker program; circuit training; a combination of sprint training combined with the exercises with weights; plyometric training with additional load; training of dynamic stretching.

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Zaključak

Na osnovu dosadašnjih istraživanja konstatovano je da se za razvoj eksplozivne snage najčešće koristi *pliometrijska metoda treninga*, kako kod košarkaša, tako i kod košarkašica. Da bi došlo do razvoja pomenute sposobnosti neophodno je da trenaži proces traje od četiri do 12 nedelja. U najvećem broju istraživanja ova metoda treninga je podrazumevala vežbanje 2-3 x nedeljno. S obzirom na preporuke autora, pliometrijsku metodu treba koristiti obazrivo, sa prethodnom pripremom i razvojem mišićne izdržljivosti, kako ne bi došlo do povreda i pretreniranosti mladih košarkaša. Još jedna metoda koja se pokazala efikasnom za razvoj eksplozivne snage košarkaša jeste *kompleksni trening*. Autori smatraju da kombinacija pliometrijskog treninga i treninga sa tegovima može biti efikasnija nego trening sa tegovima ili pliometrijski trening kada se koriste zasebno. *Vodeni pliometrisjki trening*, takođe, može biti metoda pogodna za razvoj eksplozivne snage košarkaša. Prednost vodenog u odnosu na kopneni pliometrijski trening je u tome što smanjuje bolove u mišićima, stres i povrede. Pregled dosadašnjih istraživanja pokazuje da se, osim pomenutim, eksplozivna snaga košarkaša može razviti i uz pomoć sledećih metoda treninga: kombinacijom pliometrijskog treninga i nekog drugog treninga (dinamičko istezanje, vežbe snage bez tegova, sprint); treningom sa tegovima; treningom snage (bez tegova); specifičnim treningom sprinta; SAQ treningom (speed, agility, quickness - brzina, agilnost, eksplozivna snaga); preskakanjem konopca; treningom koji se sastoji od treninga snage, različitih tipova izdržljivosti i košarkaške tehnike; circuit breaker programom; kružnim treningom; kombinacijom treninga sprinta sa vežbama sa tegovima; pliometrijskim treningom sa dodatnim opterećenjem; treningom dinamičkog istezanja.

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Kratko saopštenje

Attitudes of Students of the Academy of Dramatic Arts in Banja Luka on Physical Exercise

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Abstract: Contemporary theatre and film production require actors with extraordinary physical abilities, harmonious physical appearance and good looking body, which is a cult propagated by Hollywood – the dream factory. Today, theatre and film repertoire require a cast with extraordinary body skills, quick reflexes and acrobatic flexibility. Whether it is done as a part of regular curricular or as extracurricular activities, there is no doubt that regular physical exercise has a very important role in training young students of dramatic arts for their top-quality achievements. In order to determine the students' attitudes on the importance of physical exercise and their interest for certain sports, there has been a survey among 27 first, second and third-year students of the Academy of Dramatic Arts in Banja Luka, Acting course. In accordance with the requirements set by the modern theatre and film production, this survey confirmed a very positive attitude and interest of students towards physical exercise and sports activities. Therefore, there is need for creating a clear concept of physical training of students, as a long-term project, which will contribute to raising quality of life as well as work and artistic creativity with students at the Academy of Dramatic Arts, University of Banja Luka.
Key words: students of Dramatic Arts, attitudes, interests, physical exercise.

Introduction

Physical activities are an constituent part of everyday life. Regular physical exercise or abstemious physical exercise have a positive effect on health and prevent various diseases.

Results of studies from around the world show that about 80% of the population is insufficiently physically active, and that in most developed countries over 50% of the population is overweight (Ostojić, Mazić & Dikić, 2010). Modern trends of social networks, seden-

Stavovi studenata akademije dramskih umjetnosti u Banjoj Luci prema fizičkom vježbanju

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Sažetak: Savremena pozorišna i filmska produkcija zahtijeva glumce izuzetnih fizičkih sposobnosti, skladnog izgleda i tijela, gotovo izvajanog i taj kult najviše propagira Holivud – fabrika snova. Pozorišni i filmski repertoari u današnjem svijetu imaju potrebu za glumcima izvanrednih tjelesnih sposobnosti, brzih refleksa i akrobatske gipkosti. Nesumnjivo je da redovno fizičko vježbanje, u nastavnom i vannastavnom vremenu, ima izuzetnu ulogu u pripremi mladih studenata glume za njihova vrhunska ostvarenja. U cilju utvrđivanja stavova studenata Akademije dramskih umjetnosti u Banjoj Luci, smjer gluma, o važnosti bavljenja fizičkim vježbanjem i njihovim interesima prema pojedinim sportskim granama, anketirano je 27 studenata prve, druge i treće godine studija. Shodno zahtjevima koje pred njih postavlja savremena pozorišna i filmska produkcija, ovo istraživanje je potvrdilo izrazito pozitivan stav i interes studenata glume prema fizičkom vježbanju i sportskim aktivnostima. Dakle, postoji potreba da se jasno profiliše koncept fizičkog vježbanja studenata, kao dugoročni projekt, koji će doprinijeti podizanju kvaliteta života ali i rada i umjetničkog stvaralaštva kod studenata glume Univerziteta u Banjoj Luci.
Ključne riječi: studenti glume, stavovi, interesi, fizičko vježbanje.

Uvod

fizičke aktivnosti su sastavni dio svakodnevnog života. Redovno fizičko vježbanje, odnosno umjerena fizička aktivnost, pozitivno utiče na očuvanje zdravlja i prevenciju raznih oboljenja.

Rezultati studija iz cijelog svijeta pokazuju da je oko 80% populacije nedovoljno fizički aktivno, te da u većini razvijenih zemalja preko 50% populacije ima višak kilograma (Ostojić, Mazić i Dikić, 2010). Savremeni trendovi društvenih mreža, sjedalačke obaveze na fakultetima, mali fond časova koji se odnose na fizičko

tary duties at universities and a small number of classes that are related to physical exercise contribute to many health problems and bad shape of students. The research results by Hackney (2006) highlight the importance of physical exercise in reducing body fat, increasing muscle mass, metabolism accelerating and in endocrine system which function is to prevent excess weight. Students as representatives of a very important part of the society and social development bearers are nowadays even less involved in physical activities or any form of physical exercise. A survey by Stephens, Jacobs and White (1985) has shown that the level of physical activity declines during the period between adolescence and adulthood, which is crucial for building and maintaining the habits of physical exercise. Vračan, Pisačić and Slačanac (2009) came to a conclusion that students are familiar with the huge importance of physical exercise. Even though 94% of questioned students consider the physical exercise to be very important, the fact that 56% of them are not active in any kind of extracurricular physical exercise is concerning.

Actors of the 21st century have to be in a good shape to fit in the high demanding roles given by authors, scenarists and directors. The goal of this paper is to identify the attitudes of students of Academy of Dramatic Arts on the importance of physical exercise and habits of exercising. In addition, this survey will cover the students' preferences towards certain sports or recreative activity.

Methods

The students of Academy of Dramatic Arts, course Acting, University of Banja Luka participated in this survey. Since this is a very specific department at the University which consists of a small number of students, only 27 of its regular students participated in the survey, 15 male and 12 female students. The questioned students are age 21.59±1.62 yeras old. The survey was done during the winter semester of academic year 2016/2017.

The research method used in the survey is one of sociological methods used in data collection. It consists of a series of questions prepared in advance to which students are required to answer (Haralambos & Holborn, 2002). Apart from general information about the subject, the questionnaire included questions focused on gathering information about the attitude of students of the Academy of Dramatic Arts towards physical exercise.

Interests of students to engage in a particular sport activity or recreation were identified at the end of the survey. The study covered the preferences of students towards 25 sports by behaviour intentions scale (Bosnar & Prot,

vježbanje, doprinose mnogim zdravstvenim problemima i lošoj fizičkoj kondiciji studenata. Rezultati istraživanja Hackneya (2006) ukazuju na značaj fizičkog vježbanja u smanjenju potkožnog masnog tkiva, povećanja mišićne mase, ubrzanje metabolizma, te na hormonski sistem koji svojim djelovanjem sprječava pojavu viška kilograma. Studenti kao važan dio zajednice i nosioci društvenog razvoja sve manje su uključeni u fizičke aktivnosti ili bilo koji vid fizičkog vježbanja. Istraživanje koje su proveli Stephens, Jacobs i White (1985) je pokazalo da nivo fizičke aktivnosti opada u razdoblju između adolescentskog i dobi odrasle osobe, koje je ključno za usvajanje i zadržavanje navika prema fizičkom vježbanju. Vračan, Pisačić i Slačanac (2009) zaključuju da su studenti dosta dobro upućeni u značaj bavljenja fizičkim vježbanjem, čak 94% studenata smatra fizičko vježbanje vrlo važnim, ali zabrinjava podatak da 56% studenata iz uzorka istraživanja nije uključeno niti u jedan oblik tjelesnog vježbanja u vannastavnim aktivnostima.

Glumci u 21. vijeku moraju imati dobru fizičku kondiciju kako bi odgovorili na visoke zahtjeve pisaca tekstova, scenarija i reditelja. Upravo cilj ovog rada jeste da se utvrde stavovi studenata banjalučke Akademije dramskih umjetnosti, smjer gluma, o značaju fizičkog vježbanja i navikama ka vježbanju. Takođe, istraživanjem će biti obuhvaćene i preferencije studenata prema određenoj sportskoj ili rekreativnoj aktivnosti.

Metode

Uzorak ispitanika su činili studenti Akademije dramskih umjetnosti, smjer gluma, Univerziteta u Banjoj Luci. Obzirom da se radi o vrlo specifičnom obliku studija, koji ima mali broj upisanih studenata, uzorak ispitanika je obuhvatio svega 27 redovnih studenata Akademije dramskih umjetnosti, 15 muškog i 12 ženskog pola. Starosna dob ispitanika bila je 21.59±1.62 godina starosti. Istraživanje je provedeno u zimskom semestru akademske 2016/17. godine.

U istraživanju je primijenjena metoda ankete koja pripada sociološkim metodama za prikupljanje podataka. Sastoji se od niza pripremljenih pitanja na koja se od studenata traži odgovor (Haralambos i Holborn, 2002). Osim opštih informacija o ispitaniku, upitnikom su obuhvaćena pitanja usmjerena na dobijanje informacija o stavu studenata Akademije dramskih umjetnosti prema fizičkom vježbanju.

Na kraju je određen interes studenata za bavljenje pojedinom sportskom ili rekreativnom aktivnošću. Obrađene su preferencije studenata prema 25 sportova skalom bihejvioralnih namjera (Bosnar i Prot, 1993). Ispitanik

1993). Each participant of the survey rated each sport on a five-level scale, according to which every mark expresses the desired intensity of practicing a specific sport activity. Mark 5 represents a sport in which a student would definitely like to do if there is a possibility for it. Grade 4 indicates a sport that a student would be happy to do. Rating 3 denotes a sport in which a student would occasionally like to do or in appropriate circumstances. Rating 2 denotes all those sports which a student would do only in case there is no other choice or possibility. Grade 1 indicates a sport which a student would never do.

Standard methods of descriptive statistics were used in data processing. The collected data was processed by IBM SPSS Statistics 21.0 programme system.

Results and Discussion

Considering the goal of the survey, which was identifying the attitude of students of the Academy of Dramatic Arts on physical exercise, the first two survey questions were created. The first question was on how much importance do students attach to physical exercise. According to the Likert's five-level scale, the students attached great importance to physical exercise. This is supported by the fact that not a single student rated physical exercise with grade 1 or 2. The major percentage of the survey participants, even 59.26% of them, rated the physical exercise as very important. Namely, similar results were provided in the survey made with students at Faculty of Geodesy and Architecture at the University of Zagreb (Vračan et al., 2009).

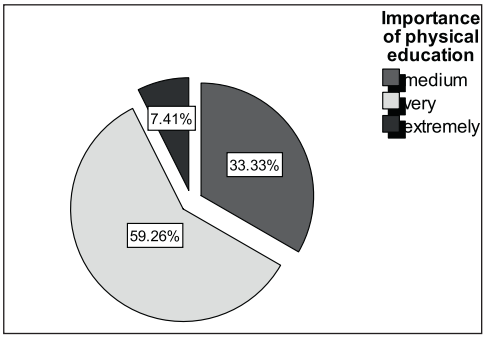


Figure 1. *The importance of physical exercise for students of the Academy of Dramatic Arts in Banja Luka expressed in percentages*

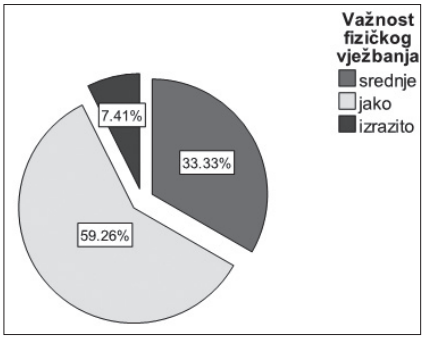
Furthermore, the survey tried to get information on how much time a week do students of this Academy spend doing the physical exercise. The results are shown in the Figure 2 and they are indicating satisfactory weekly physical activity of the students. Only one of the students answered that he or she is not doing any physical exercise at all. The majority of survey participants,

je svaki sport ocijenio na petostepenoj skali prema kojoj svaka ocjena iskazuje željeni intenzitet bavljenja određenom sportskom aktivnošću. Naime, ocjena 5 označava sport kojim bi se ispitanik svakako želio baviti. Ocjena 4 označava sport kojim bi se ispitanik rado bavio. Ocjena 3 označava sport kojim ispitanik nije siguran da bi se bavio, odnosno bavio bi se njime povremeno ili u pogodnim okolnostima. Ocjena 2 označava sport kojim bi se ispitanik bavio samo ukoliko ne bi imao drugi izbor ili mogućnost. Ocjenu 1 ispitanik dodjeljuje sportu kojim se nikako ne bi želio baviti.

U obradi podataka korištene su standardne metode deskriptivne statistike. Dobijeni podaci su obrađeni programskim sistemom IBM SPSS Statistics 21.0.

Rezultati i diskusija

S obzirom na cilj istraživanja, odnosno na utvrđivanje stava studenata Akademije dramskih umjetnosti prema fizičkom vježbanju, konstruisana su i prva dva anketna pitanja. Prvo pitanje je bilo vezano za važnost koju ispitanici pridaju fizičkom vježbanju. Anketirani studenti su svojim odgovorima na petostepenoj skali Likertovog tipa izrazili izuzetno pozitivan stav prema fizičkom vježbanju. U prilog tome ide činjenica da niti jedan student nije izrazio stav da mu je fizičko vježbanje nebitno ili čak malo bitno. Naime, najveći procenat ispitanika, čak 59.26%, je odgovorio da im je fizičko vježbanje jako važno. Vrlo slične rezultate su dobili Vračan i saradnici (2009) na uzorku studenata Arhitektonskog i Geodetskog fakulteta Sveučilištva u Zagrebu.



Grafikon 1. *Važnost fizičkog vježbanja za studente Akademije dramskih umjetnosti u Banjoj Luci izraženo u postocima*

Dalje, istraživanjem se pokušala dobiti informacija o vremenu koje studenti Akademije dramskih umjetnosti posvećuju fizičkom vježbanju tokom sedmice. Dobijeni rezultati prikazani u Grafikonu 2 ukazuju na zadovoljavajuću sedmičnu fizičku aktivnost studenata. Samo jedan student je odgovorio da se uopšte ne bavi bilo kakvim fizičkim vježbanjem. Najveći broj ispitanika, njih 66.66%

66.66% of them, do the physical exercise actively three times a week or more. This can really be considered as a sufficient time spend on physical activity by students of Dramatic Arts, regarding to other surveys (Lolić, Nešić, Fratrić & Srdić, 2012; Vračan et al., 2009) which gave a clear warning signal due to less engagement of young people in regular physical exercise.

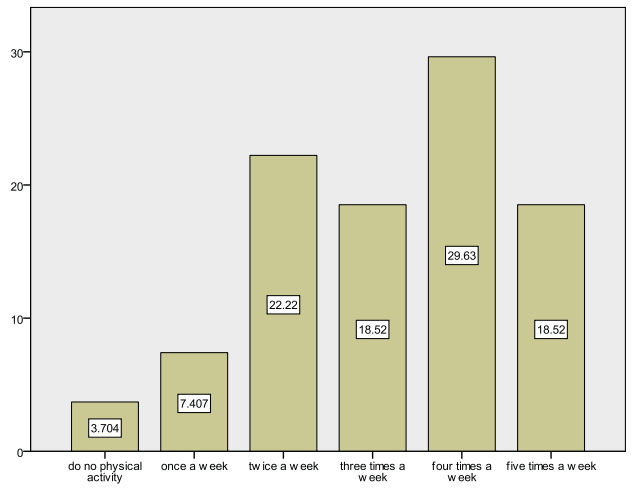
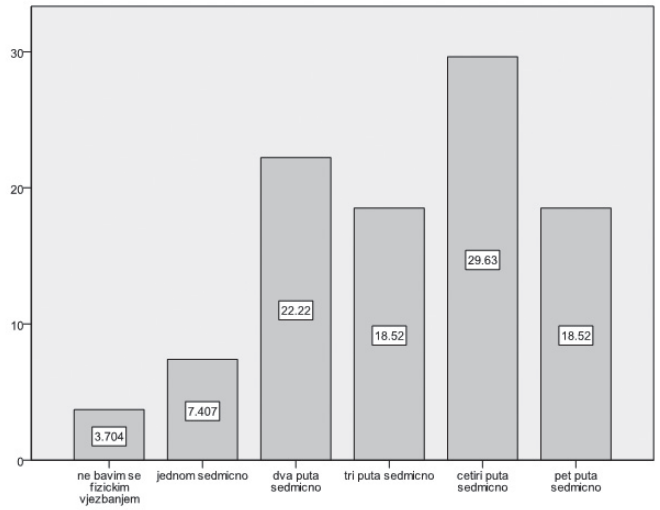


Figure 2. *Weekly time spent on doing some kind of sport activities by students of the Academy of Dramatic Arts in Banja Luka expressed in percentages*

In the Table 1 the results show the interest of students for doing some of the sport or recreative activities. Results are ranked on the chart according to frequency and percentage in each category of a five-level scale. Students of the Academy of Dramatic Arts have shown the greatest interest for swimming, horseback riding, dance and shooting sport/archery/paintball. Swimming is the sport that the majority of questioned students would like to do every day (88.8%), dance and horseback riding are on the second place (74.1%) and shooting sport/archery/paintball on the third place (66.6%). On the other hand, 59.3% of Academy of Dramatic Arts students have no interests in doing bocce, ragby is next in the chart (51.9%) and football (48.1%).

se fizičkim vježbanjem aktivno bavi tri ili više puta sedmično. Ovo se zaista može smatrati kao zadovoljavajuća fizička aktivnost studenata dramskih umjetnosti, obzirom da su druga istraživanja (Lolić, Nešić, Fratrić i Srdić, 2012; Vračan i saradnici, 2009) dala jasan signal upozorenja s obzirom na to da se mladi sve manje bave redovnim fizičkim vježbanjem.



Grafikon 2. *Sedmično vrijeme koje studenti Akademije dramskih umjetnosti u Banjoj Luci provedu baveći se nekom vrstom sportske aktivnosti izraženo u postocima*

U Tabeli 1 prikazani su rezultati prema interesu studenata za bavljenje pojedinom sportskom ili rekreativnom aktivnošću. Rezultati su rangirani na osnovu frekvencija i procenata u svakoj kategoriji petostepene skale. Studenti Akademije dramskih umjetnosti najveći interes su iskazali za plivanje, sportsko jahanje, ples i streljaštvo/peintbol/streličarstvo. Plivanje je sport kojim bi se najviše njih rado bavili ili svakako željeli baviti sa 88.8%, slijede ples i sportsko jahanje sa 74.1%, i streljaštvo/peintbol/streličarstvo sa 66.6%. Sa druge strane, 59.3% studenata Akademije dramskih umjetnosti se nikako ne bi željelo baviti boćanjem, slijedeći sport je ragbi sa 51.9%, te fudbal sa 48.1%.

Table 1. *Preferences of students of the Academy of Dramatic Arts in Banja Luka towards different kinds of sports or recreational activities*

Tabela 1. *Preferencije studenata Akademije dramskih umjetnosti u Banjoj Luci prema pojedinim sportskim ili rekreativnim aktivnostima*

SPORTSKA AKTIVNOST / *SPORTS ACTIVITIES*	**nikako se ne bih bavio/la / *never***		**bavio/la bih se ukoliko nemam drugi izbor / *if I have no other choice***		**bavio/la bih se povremeno / *occasionally***		**rado bih se bavio/la / *gladly***		**svakako bih se bavio/la / *certainly***	
	f	**%**	**f**	**%**	**f**	**%**	**f**	**%**	**f**	**%**
Trčanje/pješačenje/planinarenje / *Running/walking/hiking*	1	3.7	4	14.8	5	18.5	10	37.0	7	25.9
Fitnes/aerobik / *Fitness/aerobics*	7	25.9	6	22.2	4	14.8	6	22.2	4	14.8
Gimnastika / *Gymnastics*	3	11.1	5	18.5	9	33.3	3	11.1	7	25.9
Jedrenje/surfanje / *Sailing/Surfing*	3	11.1	4	14.8	8	29.6	9	33.3	3	11.1
Rukomet / *Handball*	4	14.8	9	33.3	9	33.3	3	11.1	2	7.4
Borilački sportovi / *Martial arts*	5	18.5	5	18.5	4	14.8	10	37.0	3	11.1
Fudbal / *Football*	13	48.1	3	11.1	2	7.4	6	22.2	3	11.1
Odbojka / *Volleyball*	2	7.4	9	33.3	3	11.1	9	33.3	4	14.8
Košarka / *Basketball*	5	18.5	6	22.2	7	25.9	4	14.8	5	18.5
Ragbi / *Rugby*	14	51.9	6	22.2	3	11.1	3	11.1	1	3.7
Atletika / *Athletics*	5	18.5	5	18.5	11	40.7	3	11.1	3	11.1
Rolanje / *Skating*	8	29.6	5	18.5	7	25.9	5	18.5	2	7.4
Plivanje / *Swimming*	-	-	1	3.7	2	7.4	13	48.1	11	40.7
Boćanje / *Bocce*	16	59.3	4	14.8	6	22.2	1	3.7	-	-
Ronjenje / *Diving*	4	14.8	3	11.1	4	14.8	10	37.0	6	22.2
Streljaštvo/peintbol/streličarstvo / *Shooting sport/paintball/archery*	5	18.5	-	-	4	14.8	9	33.3	9	33.3
Šah / *Chess*	10	37.0	2	7.4	6	22.2	4	14.8	5	18.5
Tenis/stoni tenis / *Tennis/table tennis*	4	14.8	3	11.1	3	11.1	8	29.6	9	33.3
Vaterpolo / *Water polo*	8	29.6	5	18.5	6	22.2	6	22.2	2	7.4
Veslanje/kajak / *Rowing/kayaking*	8	29.6	6	22.2	6	22.2	6	22.2	1	3.7
Ples / *Dance*	1	3.7	1	3.7	5	18.5	6	22.2	14	51.9
Skijanje/klizanje / *Skiing/Ice skating*	2	7.4	5	18.5	3	11.1	9	33.3	8	29.6
Biciklizam / *Cycling*	1	3.7	5	18.5	12	44.4	4	14.8	5	18.5
Kuglanje / *Bowling*	7	25.9	6	22.2	8	29.6	2	7.4	4	14.8
Sportsko jahanje / *Horseback riding*	2	7.4	2	7.4	3	11.1	4	14.8	16	59.3

Regarding the students of Academy of Dramatic Arts, martial arts have a great role in their future profession. It was expected that more students are interested in doing this particular art. The results of this survey are worrying to some extent since there are genres in which the action represents an essential and dominant part – the key component, and where the priority in selecting an actor/actress for the role have those who have had the experience in or are good at martial arts.

Almost identical results were provided in the survey made with students at Faculty of Geodesy and Architec-

Naime, u slučaju studenata Akademije dramskih umjetnosti, veoma bitnu ulogu imaju borilački sportovi. Očekivao se veći procenat studenata koji bi se željeli baviti ovom vrstom sportske aktivnosti. Dobijeni rezultati su donekle zabrinjavajući obzirom da dominacija žanrova u kojima je akcija bitna – ključna komponenta, prioritet u izboru glumaca imaju oni koji su u svom iskustvu imali sklonosti ka borilačkim sportovima.

Gotovo identične rezultate su dobili Vračan i saradnici (2009) na uzorku studenata Arhitektonskog i Geodetskog fakulteta u Zagrebu. Da je plivanje izrazito

ture at the University of Zagreb (Vračan et al., 2009). The fact that swimming is extremely popular sport among students proved the results of a survey which was made with students of Philosophical Faculty in Zagreb (Špehar, Gošnik & Topolovac, 2007).

Conclusion

in accordance with the requirements placed on them by modern theatre and film production, a positive attitude and interests of the students of the Academy of Dramatic Arts (acting course) in physical exercise and sport in general was more than expected. That is exactly what has been proved by the results of this survey. Students have evaluated highly the advantage and importance of physical exercise and recreational activities. Also, it should be noted that there is a correlation of their attitudes about the importance of physical exercise and practicing these activities. 2/3 of students at the Academy of Dramatic Arts do actively some kind of physical exercise three times a week or more. This result is more valuable regarding to the previous studies that were made among students which indicated the decreasing of physical activity among young people (Lolić et al., 2012; Vračan et al., 2009).

Swimming proved as attractive and extremely popular sport among students of Academy of Dramatic Arts. Low-ranking sports by the survey are team sports. What is more interesting is the fact that decreased interest for football is very visible although it is one of the most popular team sports in the area. Certainly, students of the Academy of Dramatic Arts should pay more attention to martial arts due to even more demanding contemporary theatre and film production of today.

Due to the great interest for sports and recreational activities by students of the Academy of Dramatic Arts in Banja Luka, there is a need to develop the concept of physical training of students clearly, as a long-term project, which will contribute to raising the quality of life as well as work and artistic creativity with students of this University. In accordance with these characteristics, it would be necessary to plan and develop these sport activities within the physical education curriculum of the University programme. Only after it has been developed and well planned, we can anticipate those sport activities to be the best motivation for students in being active in different physical activities and eventually in achieving the greatest results in their future profession.

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The authors have contributed equally.

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We declare that we have no confl icts of interest.

privlačna sportska aktivnost za studente ukazuju i rezultati koje su dobili Špehar, Gošnik i Topolovac (2007) na uzorku studenata Filozofskog fakulteta u Zagrebu u periodu od šest akademskih godina.

Zaključak

shodno zahtjevima koje pred njih postavlja savremena pozorišna i filmska produkcija očekivao se pozitivan stav i interesi studenata Akademije dramskih umjetnosti, smjer gluma, prema fizičkom vježbanju i sportu uopšte. Rezultati ovog istraživanja su upravo to i potvrdili. Studenti vrlo visoko procjenjuju korisnost i važnost fizičkog vježbanja i rekreativnih aktivnosti. Takođe, valja istaći da postoji korelacija njihovih stavova o važnosti fizičkog vježbanja i bavljenja tim aktivnostima. Oko 2/3 studenata Akademije dramskih umjetnosti se fizičkim vježbanjem aktivno bavi tri ili više puta sedmično. Ovakav rezultat dobija na vrijednosti imajući u vidu ranija istraživanja među studentskom populacijom koja su ukazivala na sve manju fizičku aktivnost mladih (Lolić i saradnici, 2012; Vračan i saradnici, 2009).

Plivanje je sportska aktivnost koja najviše privlači pozornost studenata Akademije dramskih umjetnosti. Nisko su rangirani ekipni sportovi, a interesantan je pad interesa za fudbal koji je na području balkana sasvim sigurno najzastupljeniji sport. Svakako, borilački sportovi bi trebali zauzeti veću pozornost studenata Akademije dramskih umjetnosti obzirom na sve zahtjevniju savremenu pozorišnu i filmsku produkciju.

Obzirom na veliki interes studenata Akademije dramskih umjetnosti u Banjoj Luci za sportske i rekreativne aktivnosti postoji potreba da se jasno profiliše koncept fizičkog vježbanja studenata, kao dugoročni projekt, koji će doprinijeti podizanju kvaliteta života ali i rada i umjetničkog stvaralaštva kod studenata glume Univerziteta u Banjoj Luci. U skladu sa tim karakteristikama bilo bi potrebno planirati i programirati one rekreativne sadržaje unutar nastave fizičkog vaspitanja na Univerzitetu. Samo tako možemo očekivati da će upravo ti sportski sadržaji dati najbolje rezutate u smislu aktiviranja i poticanja studenata na različite oblike fizičkog vježbanja, odnosno uključivanja u različite programe sportskih aktivnosti.

Izjava autora
Autori pridonijeli jednako.

Konflikt interesa
Mi izjavljujemo da nemamo konflikt interesa.

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Kratko saopštenje

Motor Achievements Differences In Basketball for Junior High School Students

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Abstract: The aim of this research has been determination of differences in motor achievements in basketball for junior high school students. This research involved 280 participants, male gender, devided in four subsamples each of them 70 participants. Each subsample has represented one grade between 6th-9th grade. Motor achievements test in basketball have estimated achievements using five tests, which have required application of catching and passing, dribbling and shooting on basket techniques. For data processing analysis of variance (ANOVA) has been used, while post hoc analysis Bonferroni method has been used for determining the partial differences between subsamples. Partial differences have been proved in motor achievemnets test of catching and passing in set position, catching and passing in movement, as well as dribbling in slalom and shooting on basket in 30 sec , while in shooting on basket from different positions in 60 sec test those differences have not been proved. Using post hoc analysis has been confirmed that in most tests there have been no differences between subsamples of 6th and 7th, as well as between 8th and 9th grade.

There is existance of deffernces between younger and older tested subsamples due to higher level of motor skills, which has been developed by teaching process and developement of motor abilities, on the other hand which have been influenced by faster growing and developing process, that has been especially noticable in older tested subsamples. Lack of significant differences between the results in 6th and 7 th, 8th and 9th grade indicates necessity of longer involvment in teaching process in order to have significant changes in features, among others motor skills and motor abilities, which contribute to better results in tested variables. Better effects of teaching process can be expected if we analyze implementation plan and program, which includes assessment of presented teaching contains during the classes and which methodical organisation forms of work have been implemented, as well as evaluation of implemented plan and program in order to get feedback about success of implementation.

Razlike motoričkih dostignuća u košarci kod učenika osnovne škole

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Sažetak: Cilj istraživanja je utvrditi razlike motoričkih dostignuća u košarci kod učenika osnovne škole. U istraživanju je učestvovalo 280 ispitanika, muškog spola, podjeljeni u četiri subuzorka po 70 ispitanika. Svaki subuzorak je predstavljao razrede od VI-IX razreda. Testovi motoričkih dostignuća u košarci su procjenjivali dostignuća sa pet testova u kojim se zahtjevala primjena tehnike hvatanja i dodavanja lopte, vođenja lopte i šutiranja lopte na koš. U obradi podataka koristila se analiza varijanse (ANOVA), dok je post hoc analizom metodom Bonferroni analizirano između kojih subuzoraka postoje parcijalne razlike. Dokazane su parcijalne razlike u testovima motoričkih dostignuća *hvatanje i dodavanje lopte u mjestu, hvatanje i dodavanje lopte u kretanju, vođenje lopte u slalomu i šutiranje lopte na koš za 30 sekundi, dok nisu dokazane u testu šutiranje na koš sa različitih pozicija za 60 sekundi.* Post hoc analizom je potvrđeno da u većini testova nema parcijalnih razlika između subuzoraka šestog i sedmog razred, te osmog i devetog. Međutim, razlike su utvrđene između rezultata šestog i sedmog razreda sa rezultatima osmog i devetog razreda. Pojavi razlika između mlađih i starijih testiranih subuzoraka doprinosi povećan nivo motoričkog znanja, koji je nastao djelovanjem nastavnog procesa i razvoj motoričkih sposobnosti na koje pored nastavnog procesa doprinosi ubrzan proces rasta i razvoja, koji je naročito izražen kod starijih testiranih subuzoraka. Nepostojanje značajnih razlika između rezultata šestog i sedmog i osmog i devetog razreda pokazuje da je potreban duži vremenski period učestvovanja u nastavnom procesu kako bi nastale značajnije promjene u obilježjima, između ostalog motoričkim znanjima i motoričkim sposobnostima, koje doprinose boljim rezultatima u testiranim varijablama. Bolje efekte nastavnog procesa možemo očekivati ako uradimo analizu izvedbenih planova i programa, koja obuhvata provjeru zastupljenosti nastavnih sadržaja na nastavi i koji su metodičko-organizacioni oblici rada primjenjivani, kao i evaluaciju provedenog plana i programa rada na osnovu koje će se dobiti povratna informacija u kojoj mjeri se uspjelo sa provodjenom zamišljenog plana.

Key words: motor achievements, basketball, students, junior high school

Introduction

Besides implemention of teaching process, educators need to follow periodically certain features of students (Neljak, 2013; Hadžikadunić & Mađarević, 2004). Obtained results need to show effects of implemented teaching process, in order to correct program in case of lack of certain changes. Sport games, especially basketball need to be followed and checked as well in PE teaching process. Besides estimation of learned motor skills in basketball, educator estimates motor achievements. Motor achievements represent a link between motor skills and motor abilities in order to achieve personal best result (Neljak,2013). Accomplishing of good result in some motor achievements tests depends of learning level of motor skills, as well as development of motor abilities (Janković-Golubović, 2004; Hadzić, 2007; Karalejić, Jakovljević & Janković 2008; Bajrić & Srdić, 2015). It is necessary not to ignore a fact that for accomplishing results in motor achievements there is an influence of other anthropological features: morphological characteristics (Jašarević, I., Jašarević, Z., Biberović & Džibrić, 2013; Aruković, 2013), cognitive abilities and connative characteristics (Mirvić, 2006).

Analysing of results in this research we will determine whether the students with longer involvement in teaching process in PE have better results in motor achievements tests in basketball.

Methods

Participants sample

This research involved 280 participants, male gender, devided in four subsamples each of them 70 participants. Students attend First and Second junior high school in Konjic. Subsample of 6th grade is 11+/-6 months old with average body height and weight (M_{height}=1.55±0.08m; M_{weight}=46.10±11.28kg). Subsample of 7th grade is 12 +/-6 months old with average body height and weight (M_{height}=1.62±0.08m;M_{weight}=48.54, ±8.33kg). Subsample of 8th grade is 13+/-6 months old with average body height and weight (M_{height}=1,68±0.09m; M_{weight}=56.57±12.09 kg). Subsample of 9th grade is 14+/- 6 months old with average body height and weight (M_{height}=1,76±0.09m; M_{weight}=61,95±13.17kg). All participants are regular students of PE. Before carrying out this research parents consent has been given that each participant can be included in the research and all partcipants have partici-

Ključne riječi: motorička dostignuća, košarka, učenici, osnovna škola

Uvod

Pored provođenja nastavnog procesa, edukatori imaju obavezu periodičnog praćenja određenih obilježja kod učenika (Neljak, 2013; Hadžikadunić i Mađarević, 2004). Dobijeni rezultati trebaju da pokažu efekt provedenog nastavnog procesa, kako bi se program korigirao u slučaju da nije došlo do određenih promjena, koje su predmet procjene. Predmet praćenja i provjeravanja u nastavi tjelesnog odgoja predstavljaju i sportske igre, među njima i košarka. Pored procjene usvojenosti motoričkog znanja u košarci, edukator procjenjuje i motorička dostignuća. Motorička dostignuća predstavljaju spregu motoričkih znanja i motoričkih sposobnosti s ciljem postizanja osobno najboljeg rezultata (Neljak,2013). Ostvarivanje dobrog rezultata u pojedinim testovima motoričkih dostignuća zavisi od nivoa usvojenosti motoričkog znanja, kao i razvijenosti motoričkih sposobnosti (Janković-Golubović, 2004; Hadzić, 2007; Karalejić, Jakovljević i Janković 2008; Bajrić i Srdić, 2015). Ne smije se zanemariti činjenica da na ostvarivanje rezultata u motoričkim dostignućima utječu i druga antropološka obilježja: morfološke karakteristike (Jašarević, I., Jašarević, Z., Biberović i Džibrić, 2013; Aruković, 2013), kognitivne sposobnosti i konativne karakteristike (Mirvić, 2006).

Analizom dobijenih rezultata u ovom istraživanju biće utvrđeno da li učenici koji su duži vremenski period u nastavnom procesu tjelesnog i zdravstvenog odgoja imaju bolje rezultate u testovima motoričkih dostignuća u košarci.

Metode rada

Uzorak ispitanika

U istraživanje je bilo uključeno 280 učenika, muškog spola podjeljeni u četiri subuzorka po 70 ispitanika. Učenici pohađaju Prvu i Drugu osnovnu školu u Konjicu. Subuzorak šestog razreda je uzrasta 11 +/-6 mjeseci i prosječne tjelesne visine i težine (AS_{visina}=1.55±0.08m; $AS_{težina}$=46.10±11.28kg). Subzorak sedmog razreda je uzrasta 12 +/-6 mjeseci i prosječne tjelesne visine i težine (AS_{visina}=1.62±0.08m;$AS_{težina}$=48.54±8.33kg). Subzorak osmog razreda je uzrasta 13 +/-6 mjeseci i prosječne tjelesne visine i težine (AS_{visina}=1,68±0.09m; $AS_{težina}$=56.57±12.09 kg). Subzorak devetog razreda je uzrasta 14 +/-6 mjeseci i prosječne tjelesne visine i težine (AS_{visina}=1,76±0.09m; $AS_{težina}$=61,95±13.17kg). Ispitanici redovno pohađaju nastavu tjelesnog i zdravstvenog odgoja. Prije provođenja istraživanja dobijena je saglasnost od roditelja da ispita-

pated voluntarily in this testing.

Sample of variables

The research has been caried out on set of five variables which has been used for estiamting motor achievements in basketball. Set of five variables has been used for this research: catching and passing in a set position (OKBLRZ), dribbling in slalom (OKVLS),shooting on basket in 30s (OKBLK), catching and passing in movement (OKBLRK) and shooting from different positions in 60s (OKSRP).

Data processing methods

In the date analysis the central and dispersion parameters of mean and standard deviation have been calculated.The differences between grades have been determined by univariate analysis of variance (ANOVA), while the post hoc analysis by Bonferroni method has been used for estimating existance of differences between groups

Results

Table 1. *Analysis of variance (ANOVA) results for motor achievements for junior high school students*

Variables	AS				SD				ANOVA		L - test	p
	VI	VII	VIII	IX	VI	VII	VIII	IX	F	p		
OKBLRZ	18.69	20.67	25.08	26.52	6.74	5.32	4.82	4.89	34.27	0.00	0.45	0.72
OKVLS	10.38	10.07	9.61	9.50	1.23	1.35	1.10	1.10	10.05	0.00	0.89	0.45
OKBLK	4.17	5.66	7.33	7.36	2.08	2.80	3.23	3.69	20.00	0.00	1.29	0.28
OKBLRK	17.58	18.87	20.90	20.48	3.59	2.92	2.60	3.83	15.47	0.00	4.35	0.01
OKSRP	2.51	3.30	3.37	3.10	2.00	2.23	2.31	2.14	2.30	0.08	0.40	0.76

Legend: *M- mean, SD – standard deviation, F – F test, p-significance, L-test- Levenov test and p –significance, Catching and passing in set position in 30s (OKBLRZ), dribbling in slalom (OKVLS), shooting on basket in 30s (OKBLK), catching and passing in movement in 30s(OKBLRK), shooting on basket from different positions in 60s (OKSRP)*

Before analysis of variance carring out the procedure for determing homogeneity of variance had been done. By applying Leven`s test (L-test) disturbed homogeneity on the level ($p \leq 0.01$) in catching and passing in movement tests has been determined. Because of it, for calculating of univariance significance stricter alpha level will be used for this variable (Tabachnick & Fidell, 2007). Stricter alpha level is ($p \leq 0.01$)

By analaysis variance existance of statistically significant differences in tested variables for the signifi-

nici mogu biti uljučeni u proces istraživanja i učenici su dobrovoljno učestvovali u testiranju.

Uzorak varijabli

Istraživanje je urađeno na setu od 5 varijabli kojima su procjenjivana motorička dostignuća u košarci. Set od pet varijabli koji se koristio u ovom istraživanju čine: *hvatanje i dodavanje lopte u mjestu za 30s (OKBLRZ), vođenje lopte slalom (OKVLS), bacanje lopte u koš (OKBLK), hvatanje i dodavanje lopte u kretanju za 30s (OKBLRK) i šutiranje lopte sa različitih pozicija na koš (OKSRP)*

Metode obrade podataka

U analizi podataka izračunati su centralni i disperzivni parametri aritmetička sredina i standardna devijacija. Razlike između razreda utvrđena univarijatnom analizom varijanse (ANOVA), dok je post hoc analizom metodom Bonferroni utvrđeno između kojih razreda i u kojima varijablama su se pojavile razlike.

Rezultati

Tabela 1. *Analiza varijanse (ANOVA) rezultata motoričkih dostignuća između učenika osnovne škole*

Legenda: AS- *aritmetička sredina, SD – standardna devijacija, F – F test, p- signifikantnost, L-test- Levenov test i p –signifikantnost, hvatanje i dodavanje lopte u mjestu za 30s* **(OKBLRZ),** *vođenje lopte slalom* **(OKVLS),** *bacanje lopte u koš za 30 s* **(OKBLK),** *hvatanje i dodavanje lopte u kretanju za 30s* **(OKBLRK) i** *šutiranje lopte sa različitih pozicija na koš za 60 sekundi* **(OKSRP)**

Prije provođenja analize varijanse provedena je procedura utvrđivanja homogenosti varijanse kako bi se krenulo u dalju proceduru. Levenovim testom (L-test) potvrđena je narušena homogenost na nivou ($p \leq 0.01$) u testu *hvatanje i dodavanje lopte u kretanju u košarci*. Pošto je utvrđeno narušavanje pretpostavke o jednakosti varijanse koristit će se strožiji nivo alfa za izračunavanje značajnosti univarijatnog F-testa za tu varijablu (Tabachnick & Fidell.2007). Strožiji nivo alfa iznosi ($p \leq 0.01$)

Analizom varijanse je utvrđeno postojanje statistič-

cance level ($p \leq 0.05$) has been determined. Absence of diferences has not been determined only in shooting on basket from different positions test ($F=2.30$, $p=0.08$).

Table 2. *(Post hoc analysis difference between groups in basketball by Bonferroni method)*

Post Hoc analiza Bonferroni metod					
Varijable	(I) Klase	(J) Klase	AS razlike (I-J)	St. greška	P
(OKBLRZ)	6.00	8.00	-1.00	0.14	0.00
		9.00	-1.27	0.14	0.00
	7.00	8.00	-0.73	0.14	0.00
		9.00	-1.00	0.14	0.00
	8.00	6.00	1.00	0.14	0.00
		7.00	0.73	0.14	0.00
	9.00	6.00	1.27	0.14	0.00
		7.00	1.00	0.14	0.00
(OKVLS)	6.00	8.00	0.67	0.16	0.00
		9.00	0.79	0.16	0.00
	7.00	9.00	0.49	0.16	0.01
	8.00	6.00	-0.67	0.16	0.00
	9.00	6.00	-0.79	0.16	0.00
		7.00	-0.49	0.16	0.01

Legend: *Catching and passing in set position in 30s (OKBLRZ), dribbling in slalom (OKVLS), shooting on basket in 30s (OKBLK), shooting on basket from different positions in 60s (OKSRP)*

Post hoc analysis by Bonferroni method, there can be noticed exsistance of differences on the significant level ($p \leq 0.05$) in tested variables. In catching and passing in movement test there will be used stricter alpha criterion ($p \leq 0.01$). Achieved results of 6th grade are statistically different from other grades only in shooting on basket in 30s variable in favor of elder ages. In other tests exsistance of statistically significant differences has not been determined for 7th grade, however, it has been determined for elder grades (8th and9th). In 7th grade results have been statistically significant different in comparison with results for 8th and 9th grade in shooting on basket in 30s and catching and passing in movement tests; while in dribbling in slalom test statistically significant differences have been determined in comparison with results for 9th grade. Post hoc analysis by Bonferroni method has been determined that in tested variables in basketball between 8th and 9th grade students statistically significant differences don`t exist.

ki značajnih razlika u testiranim varijablama na nivou značajnosti ($p \leq 0.05$), nepostojanje razlika nije utvrđeno samo u testu šutiranje lopte na koš sa različitih pozicija ($F=2.30$, $p=0.08$).

Tabela 2. *(Post hoc analiza razlika između grupa u košarci metodom Bonferroni)*

(OKBLK)	6.00	7.00	-0.54	0.15	0.00
		8.00	-1.04	0.15	0.00
		9.00	-0.99	0.15	0.00
	7.00	6.00	0.54	0.15	0.00
		8.00	-0.50	0.15	0.01
		9.00	-0.45	0.15	0.02
	8.00	6.00	1.04	0.15	0.00
		7.00	0.50	0.15	0.01
	9.00	6.00	0.99	0.15	0.00
		7.00	0.45	0.15	0.02
(OKBLRK)	6.00	8.00	-0.91	0.16	0.00
		9.00	-0.83	0.16	0.00
	7.00	8.00	-0.61	0.16	0.00
		9.00	-0.52	0.16	0.01
	8.00	6.00	0.91	0.16	0.00
		7.00	0.61	0.16	0.00
	9.00	6.00	0.83	0.16	0.00
		7.00	0.52	0.16	0.01

Legenda: *hvatanje i dodavanje lopte u mjestu za 30s* **(OKBLRZ),** *Vođenje lopte slalom* **(OKVLS),** *Bacanje lopte u koš* **(OKBLK),** *hvatanje i dodavanje lopte u kretanju za 30s* **(OKBLRK)**

Analizirajući razlike između grupa u motoričkim dostignućima u košarci, koje su utvrđene analizom varijanse, dodatnom post hoc analizom metodom Bonferroni uočava se postojanje razlika na nivou ($p \leq 0.05$) u testiranim varijablama. U varijabli *hvatanje i dodavanje lopte u kretanju* koristit će se strožiji alfa kriterij ($p \leq 0.01$). Postignuti rezultati šestog razreda statistički se razlikuju sa ostalim razredima samo u varijabli šutiranje lopte na koš za 30 sekundi u korist starijih uzrasta. U ostalim testovima nije utvrđeno postojanje statistički značajnih razlika sa učenicima sedmog razreda, dok su značajne razlike utvrđene sa starijim razredima (osmi i deveti). U sedmom razredu rezultati se statistički značajno razlikuju u odnosu na rezultate osmog i devetog razreda u testovima šutiranje lopte na koš za 30 sekundi *i hvatanje i dodavanje lopte u kretanju*, dok je utvrđeno postojanje statistički značajne razlike u testu *vođenje lopte u slalomu* u korist devetog razreda. Post hoc analizom metodom Bonferroni utvrđeno je da ne postoje statistički značajne razlike u testiranim varijablama u košarci između učenika osmog i devetog razreda.

Discussion

Analyazing of differences in some of the anthropological spaces between different groups, as for the gender so for the ages, enables feedback about development dynamic of specific anthropological features. Since the subject of this research is motor achievements in basketball we have to say that besides growing dynamic and development of specific anthropological features which are on the other hand genetic and evolutionary determined, growing dynamic and improving of motor achievements is connected to the learning process. Since human beings have an access to specific fund of biotic motor skills,which are phylogenetically conditioned,they are mutual to each person and enable performing of everyday`s tasks (Bourtonu and Milleru, 1998). However, convencional motor skills (Sekulić, 2007) have been defined by set of rules and are common for specific sport disclipine, in this case basketball. In order to master convencional moror skills practicing is necessary (Coker, 2009). But only repeating of certain move won`t be enough. The most important aspect of exercising for developing motor program is building of inhibitory controls,in order to inhibite musculature which doesn`t paticipate in model (Kosinac, 2011). Therefore, occured differences between certain subsamples of the same gender have not occured just due to process of growth and development of anthropological features, than as a result of motor learning. Respectively actions of educator through performing of teaching process which will enable adaption of certain motor skills on the certain level (Pistonik, 2003).

By results difference analyzing of motor achievements in basketball in relation of age,there can be concluded that the differences have occured mostly between youngest and oldest tested subsamples. Since motor achievements represent connection between motor skills and motor abilities (Hadžikadunić & Mađarević, 2004), obtained test results cannot be credited only to motor learning. In our case existance of differences, besides learning of certain motor convencional skills specific for basketball have occured as a result of motor abilities changing. Period of testing junior high school subsamples has been during sexual maturation period (Mikić, 2000). What characterizes that period is faster growth and development, coordination abilities develop slowly, due to sudden body growth and elongation of muscles, on the other hand there is growth of maximum strenght and speed especially in starting phase of this period, what is more often with boys than girls (Meinel & Schnabel, 2004). If there is analyzing of movement structure in basketball,which were used for assessment of motor achievement, there can be

Diskusija

Analiziranje razlika u nekom od antropoloških prostora između različitih grupa, kako prema spolu tako i uzrastu omogućava dobijanje povratne informacije o dinamici razvijenosti određenog antropološkog obilježja. Kako su predmet istraživanja ovog rada motorička dostignuća u košarci moramo konstatovati da pored dimanike rasta i razvoja određenih antropoloških obilježja koji su genetički i evolutivno determinisani, dinamika rasta i poboljšanja motoričkih dostignuća je vezana i za proces učenja. Kako čovjek raspolaže određenim fondom biotičkih motoričkih znanja, koja su filogenetski uvjetovana, svojstvena su svakom čovjeku i omogućavaju mu izvođenje svakodnevnih zadataka (po Bourtonu i Milleru, 1998). Međutim, konvencionalna motorička znanja (Sekulić, 2007) su definisana određenim pravilima i svojstvena su za određene sportske discipline, u ovom slučaju košarka. Međutim, s ciljem ovladavanja konvencionalnim motoričkim znanjima potrebno je izvođenje istih, kako bi došlo do usavršavanja određenog motoričkog znanja (Coker, 2009). Najvažniji aspekt vježbanja u svrhu razvijanja motoričkog programa je izgradnja inhibicijske kontrole, da bi muskulatura koja ne treba da učestvuje u modelu, bila inhibirana (Kosinac, 2011). S toga, nastale razlike između određenih subuzoraka istog spola nisu nastale samo kao rezultat procesa rasta i razvoja antropoloških obilježja, nego i kao rezultat motoričkog učenja, odnosno djelovanja edukatora kroz provođenje nastavnog procesa koji će omogućiti usvajanje određenih motoričkih znanja na određenom nivou (Pistonik, 2003).

Analizirajući dobijene rezultate razlika u rezultatima motoričkih dostignuća u košarci u odnosu na uzrast može se konstatovati da se razlike najviše pojavljuju između najmlađih i najstarijih testiranih subuzoraka. Kako motorička dostignuća predstavljaju spregu motoričkih znanja i motoričkih sposobnosti (Hadžikadunić i Mađarević, 2004), postignuti rezultati u testovima ne mogu se pripisati samo motoričkom učenju. U ovom slučaju pojava razlika, pored usvajanja određenih motoričkih konvencionalnih znanja specifičnih za košarku, nastale su i kao rezultat promjena motoričkih sposobnosti. Period u kome je testiran subuzorak osnovne škole se nalazi u periodu polnog sazrijevanja (Mikić, 2000). U tom periodu dolazi do ubrzanog rasta i razvoja, koordinacijske sposobnosti se sporije razvijaju, zbog naglog rasta organizma i izduženosti mišića, dok je prisutan porast maksimalne snage i brzine naročito u početnoj fazi ovog perioda rasta i razvoja, pri čemu je taj porast više izražen kod dječaka nego kod djevojčica (Meinel & Schnabel, 2004). Ako se analiziraju kretne strukture u košarcisa kojima su provjeravama motorička dostignuća,

noticed that in tests there is domination of biotic knowledge to manipulation of elements like: throwing, catching, passing as well as dribbling. Therefore, rough motor programs have been formed in advance, what enable faster motor learning of convencional motor skills specific for basketball. Despite of modified biotic motor skill, there can be noticed that for forming of so called specialized motor skills (Miletić, 2012) several stages period of motor learning is necessary (Čoh, Jovanović-Golubović & Bratić, 2003; Neljak, 2013). That has been confirmed due to obtained results in basketball, with no differences between tests results for 6th and 7th grade, as well as results between 8th and 9th grade participants. There can be concluded that for 6th and 7th grade students there is starting phase of motor learning according to some authors irradiation phase (Mikić, 2000), generalizations phase (Pistonik, 2003) development of rough coordination phase (Meinel & Schnabel, 2004), basic movement coordiantion phase (Čoh, Jovanović-Golubović & Bratić, 2003), no matter the name we use all of them have something in common: excessive use of power, demaged performing rhythm, demaged or insufficient movement connection, insufficient amplitude of reverse movement, lack of movement tempo (Meinel & Schnabel, 2004) and mental fatigue (Mikić, 2000). In older ages there has been noticed stabilizing of movement structures, so called development of fine coordination (Meinel & Schnabel, 2004) coordination phase or differentiation (Pistonik, 2003; Mikić, 2000), performance of movements has been easier, excessive use of power has been decreased, useful range of motion, performing tempo, performance constancy has been increased. However, we need to point out that there has been no differences for more complex shooting on basket from different position test, what confirms that in junior high school education there has been noticed move to higher level of motor learning, what requires longer learning period of certin motor skill. Since the results of motor achievements represent connection between motor skills and motor abilities, there need to be point out an important segment which appears in PE teaching for 9th grade. Myriads of students by entering in 9th grade, especially approaching the end of school year, have faced lower motivation level what was the case with this testing as well. High number of 9th grade students, especially at the end of the school year have not been particularly motivated especially for repeated tests. Lack of motivation in tests performing needs to be considered. All students have not been 100% motivated during testing, what can be noticed in tests for participants with bad level of motor skills. How to motivate participants during testing is a huge problem (Fetz & Kornexel, 1993).

vidi se da u testovima dominiraju biotička znanja za manipulisanja predmetima tipa bacanja, hvatanja i dodavanja, te vodjenja lopte, tako da unaprijed kod ispitanika postoje grubo formirani programi, koji omogućavaju brže motoričko učenje konvencionalnih motoričkih znanja specifičnih za košarku. I bez obzira na to što se radi o modificiranim biotičkom motoričkom znanju, uočava se da je za formiranje tzv. specijaliziranih motoričkih znanja (Miletić, 2012) potreban period motoričkog učenja koji prolazi kroz nekoliko faza (Čoh, Jovanović-Golubović i Bratić, 2003; Neljak, 2013). To potvrđuju postignuti rezultati u testovima u košarci gdje se kod većine testova rezultati šestog i sedmog razreda ne razlikuju, kao i rezultati između ispitanika osmog i devetog razreda. Tako se može konstatovati da kod učenika šestog i sedmog razreda postoji početna faza motoričkog učenja prema nekim autorima, faza iradijacije (Mikić, 2000), faza generalizacije (Pistonik, 2003), faza razvoja grube koordinacije (Meinel i Schnabel, 2004), faza osnovne koordinacije pokreta (Čoh, Jovanović-Golubović i Bratić, 2003), ali bez obzira kako ih nazivali specifično im je pretjerana upotreba snage, narušen ritam izvođenja, narušeno ili nedovoljno povezivanje pokreta, nedovoljna amplituda povratnih pokreta, nepostojanje tempa pokreta (Meinel i Schnabel, 2004), te psihičko zamaranje (Mikić, 2000). Kod starijih uzrasta dolazi do stabilizacije kretnih struktura, tzv. razvoja fine koordinacije (Meinel & Schnabel, 2004), faze koncentracije ili diferencijacije (Pistonik, 2003; Mikić, 2000) pokreti se lakše izvode, pretjerano učešće snage je smanjeno, svrsishodan obim pokreta, tempo izvođenja, povećava se konstantnost u izvođenju. Međutim, mora se naglasiti da se u složenijem testu šutiranja lopte na koš sa različitih pozicija nisu pojavile razlike, što pokazuje da je u periodu osnovnog obrazovanja došlo do prelaska na viši nivo motoričkog učenja, što zahtjeva duži period usvajanja određenog motoričkog znanja. Obzirom da rezultati motoričkih dostignuća predstavljaju spregu motoričkih sposobnosti i motoričkog znanja, moramo naglasiti bitan segment koji se pojavljuje u nastavi tjelesnog i zdravstvenog odgoja, a odnosi se na pristup predmetu tjelesnog i zdravstvenog odgoja u devetom razredu. Kod velikog broja učenika ulaskom u deveti razred, a naročito pred kraj školske godine smanjuje se motivacija za radom što je bio i slučaju u ovom testiranju. Nedostatak motivacije u izvođenju testova, naročito kod školskog uzrasta treba da bude uzet u obzir. Svi učenici ne uspjevaju biti u potpunosti motivisani za vrijeme testiranja, to može biti izraženo u testovima u kojima ispitanici imaju loš nivo motoričkih znanja. Problem motivacije u testiranju predstavlja značajan problem, a to je, kako na istraživanju imati visoko motivisane ispitanike (Fetz i Kornexel, 1993).

Conclusion

Obtained results show that statistically significant differences between tested subsamples have been determined. However, post hoc analyses by Bonferroni method has confirmed that there is no difference between 6th and 7th grade students, but in shooting on basket in 30 sec test, while between students of 8th and 9th grade in any of tested variables existance of difference has not been confirmed. As the great number of students by entering the 6th grade have a chance to practice basketball for the first time, weaker results have been expected.However, second basketball cycle on classes in 7th grade has been insufficient in order to increase level of motor skills to be able to make differences between 6th and 7th grade students.There is the same case in students of 8th and 9th grade. Their results are much better in comparison with younger age, but in mutual comparison differences have not been proved. According to this there can be notice existance of two phases of motor learning, iradiation phase specific for students of 6th and 7th grade and fine coordination development phase specific for students of higer junior high school grades. We can conclude that there are two phases of motor learning, one for 6th and 7th grade students and another for elder grades students. Mere motor skills don`t contribute to existance of differences between subsamples, on the other hand motor abilities contribute to it, which besides influence of teaching process, have been changed by growing and developing processes which have been noticable in older school age. However, lower motivation level can not be neglected in students of final junior high school grade, what have influenced test results besides cited features; as well as lack of differences between older grades. Physical education teachers in organization of teaching process must analyze implemented plans and evaluate implemented programs in order to get information how many times there has been repeating of certain teaching contains, what methodical organisation form of work have been used, and how good the motivation was. This kind of analysis will require correction which will include frequence of cretain teaching contains, with special highlight on transfer of motor skills, retroactive inhibition and aimed anthropological changes, more complex methodical organisation form of work, all that in order to get higher level of motor skills, as well as development of motor abilities, and higher children`s motivation (Neljak,2013). Results of analysis have proved that teachers must have serious approach to planing and implementing of teaching process, which will be based on scientific principles, which on the other hand have occured as a result of practical and theoretical knowledge in teaching process of PE (Hadžikadunić & Mađarević, 2004; Neljak, 2013). Such kind of approach will increase PE`s contribution on person`s formative process, what is one of the purpose of this subject.

Zaključak

Dobijeni rezultati pokazuju da su utvrđene statistički značajne razlike između testiranih subuzoraka. Međutim, post hoc analiza metodom Bonferroni je potvrdila da ne postoji razlika u rezultatima između učenika šestog i sedmog razreda, osim u testu šutiranje lopte na koš za 30 sekundi, dok nije utvrđeno postojanje razlike ni u jednoj od testiranih varijabli između subuzorka osmog i devetog razreda. Kako većina učenika dolaskom u šesti razred prvi put ima priliku izvođenja kretnih struktura iz košarke, mogli smo i očekivati najslabije rezultate. Međutim, drugi ciklus košarke na nastavi u sedmom razredu nije bio dovoljan da se poveća nivo motoričkih znanja kako bi se razlikovali učenici šestog i sedmog razreda. Slična pojava se dešava i kod učenika osmog i devetog razreda. Njihovi rezultati su bolji od učenika mlađih uzrasta, ali u međusobnom poređenju nisu dokazane značajne razlike. S toga se može konstatovati postojanje dvije faze motoričkog učenja, faza iradijacije u kojoj se nalaze učenici šestog i sedmog razreda i faza razvoja fine koordinacije gdje se nalaze učenici starijih razreda osnovne škole. Motorička znanja sama ne doprinose pojavi razlike između subuzoraka, tome sigurno doprinose i motoričke sposobnosti, koje se pored utjecaja nastavnog procesa, mjenjaju zahvljujući i procesima rasta i razvoja koji su naročito izraženi u starijem školskom uzrastu. Međutim, ne smije se ni zanemariti problem nižeg nivoa motivacije kod učenika završnog razreda osnovne škole, što je sigurno pored gore navedenih obilježja rezultiralo slabijim razultatima u testovima, a time i izostanku razlika između starijih razreda. Nastavnici u organizaciji nastavnog procesa moraju raditi analize izvedbenih planova rada i evaluaciju provedenog programa na osnovu kojih će se dobiti informacije u kojoj mjeri su se ponavljali određeni nastavni sadržaji, kakvi su metodičko organizacijski oblici rada korišteni, te da li su uspjeli dovoljno motivisati učenike na rad. Takva analiza će zahtjevati korekcije gdje će se povećati frekvencija određenih nastavnih sadržaja, pri čemu će se paziti o transferu motoričkog znanja, retrokativnoj inhibiciji i ciljanosti antropoloških promjena, primjenjivat će se složeniji metodičko organizacijski oblici rada što bi trebalo rezultirati većem nivou motoričkih znanja, kao i razvoju motoričkih sposobnosti, te većoj motiviranosti djece za radom (Neljak,2013). Rezultati analize su potvrdili da nastavnici moraju pristupiti ozbiljno planiranju i provođenju nastavnog procesa, koji će biti zasnovnan na naučnim principima, koji su nastali kao rezultat praktične i teoretske spoznaje u nastavnom procesu tjelesnog i zdravtsvenog odgoja (Hadžikadunić i Mađarević, 2004; Neljak,2013). Takvim odnosom će se povećati doprinos tjelesnog i zdravstvenog odgoja u formiranju cjelokupne ličnosti, što je i jedna od zadaća ovog predmeta.

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Short notice

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Kratko saopštenje

Results of the Health Security Open Swimming Pools and Recreation Center “Fortuna” Banja Luka

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Summary: Man is by living in urban areas, exposed to a variety of factors that directly or indirectly affect its health, living conditions and the only life. People feel a lack of spatial freedom, a growing number of nervousness, depression, accidents in traffic, deformities, degenerative diseases, etc.. To prevent all this, one must increasingly move because certain physical activities increase the functional capability of all organ systems. Swimming is a physical activity that is at the effectiveness of the head, and a significant number of people, temporarily or permanently, to use swimming pools. Recreational activities at the pools could endanger health, so it is necessary to the proper management of the pools, to the negative impact of reduced to the smallest possible measure. Tests confirmed that the quality of the water depends on the proper disciplinary proceeding purification and disinfection of water, depending on the workload of the pool, the implementation of appropriate sanitary-hygienic measures and user behavior as a contributory factor to water pollution.
Keywords: quality, risk, rizki, microorganisms, chemicals

Introduction

The need for recreation as one of the ways to maintain psycho-physical health and performance is an essential need of modern man because it was determined that a man by living in the wider or narrower community, especially in large, urban areas, exposed to a variety of factors that directly or indirectly affect its health and living conditions, his ability to work and the only life. In both the amended working and residential environment with depleted physical and nervous condition, with no possibility for an appropriate active and passive relaxation, people feel a lack of spatial freedom. A growing number of anxiety, depression, trauma traffic, respiratory disease,

Rezultati ispitivanja zdravstvene bezbjednosti vode otvorenih bazena rekreacionog centra „Fortuna“ Banja Luka

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Sažetak: Potreba za rekreacijom kao jednim od načina održavanja psihofizičkog zdravlja i radne sposobnosti, je bitna potreba savremanog čovjeka. Značajan broj ljudi, povremeno ili stalno, koristi u te svrhe bazene. Međutim, rekreativne aktivnosti na bazenima, mogu da ugroze zdravlje, od kojih je rizik obolijevanja prouzrokovan mikrobiološkom i hemijskom kontaminacijom vode bazena najveći, tako da je neophodno odgovarajuće upravljanje bazenima kako bi se taj uticaj sveo na što manju mjeru. Cilj ovog rada je da se ispita higijenska ispravnost i kvalitet vode otvorenih bazena SRC „Fortuna“ u periodu 2015 i 2016. godine i na osnovu rezultata ispitivanja procijeni bezbjednost korisnika bazena. Ispitivanjima je utvrđeno da je voda bezbjedna za kupanje, čime je potvrđena uspostavljena radna hipoteza “da kvalitet vode u bazenima zavisi od pravilno vođenog postupka prečišćavanja i dezinfekcije vode u zavisnosti od opterećenosti bazena, provođenja odgovarajućih sanitarno-higijenskih mjera i ponašanja korisnika kao doprinosnih činioca onečišćenja vode”.
Ključne riječi: kvalitet, opasnost, rizk, mikroorganizmi, hemikalije

Uvod

Potreba za rekreacijom kao jednim od načina održavanja psihofizičkog zdravlja i radne sposobnosti je bitna potreba savremenog čovjeka jer je utvrđeno da čovjek živjeći u široj ili užoj zajednici, pogotovo u većim, urbanim sredinama, izložen dejstvu različitih faktora koji direktno ili indirektno utiču na njegovo zdravlje i životne uslove, na njegovu radnu sposobnost i na samo trajanje života. U tako izmijenjenoj radnoj i stambenoj sredini, sa osiromašenom tjelesnom i nervnom kondicijom, bez mogućnosti za odgovarajućim aktivnim i pasivnim odmorom, ljudi osjećaju nedostatak prostorne slobode. Raste broj nervoza, depresija, traumatizma u saobraćaju, oboljenja respiratornih organa,

deformity, especially in children, degenerative diseases, etc. Less physical activity leads to degenerative changes in bone and joint and muscle systems, weakening of the function of the respiratory and cardiovascular systems, atherosclerosis because of precipitation of excess fatty substances, metabolism disorders, reducing the amount of protective immune substances against infectious diseases and cancer, increase in the amounts of free radicals, etc. . To prevent all this, one has to sit less and must be all the more moving because certain physical activities increase the functional capability of all organ systems and thus preserve and promote health, (Biberović, 2005). A significant number of people temporarily or permanently, to use swimming pools.

In addition to its primary purpose as a function of the user of the pool, there are unintended contradictions, because the recreational activities at the pools, but also use for the purposes of treatment and recovery can endanger health, so it is necessary to the proper management of the pools, to the negative impact of reduced what lesser extent, (Dalmatia, 2001).

Each type of the well has a variety of potential problems associated with its operation and use, that is, users may be exposed to slightly different hazards or different degrees of the risk of the same need to fear, (Antonić, 2014). They are used by people of all ages and different physical abilities. Some user groups are exposed to potential dangers than others. A typical example of the children, increasing the risk of injuries for them themselves and other road users due to their often uncontrollable exuberance and desire to excel and attract attention. Children are also usually too disregard the rules of safety and hygiene. Culture and self-discipline swimmers are contributory factors to their safety, (Kurtovic, 2008). Realization approach to quality control of such a system includes adequate care of water quality, which was the subject of this study, system, facilities, inspection immediate and wider environment, and the implementation of measures to protect bathers' health, and those reasons must access control of critical points all the facilities for recreation, at all levels and at all times, (Dalmatia, 2001).

Pool water has to be unsafe for swimmers, no content of micro-organisms, parasites and chemicals, which alone or in combination with other substances present a risk to consumers' health pools, (Sl.gl.RS, No.68, 2014). In order to preserve the health of bathers, in all parts of the pool must be provided with sanitary-technical and hygienic conditions which prevent the transmission of infectious disease agents and eliminate other causes that can harm the health of users of the pool. Users pools abide

deformiteta, naročito kod djece, degenerativnih oboljenja itd. Sve manje fizičkih aktivnosti dovodi do degenerativnih promjena koštano-zglobno-mišićnog sistema, slabljenja funkcije respiratornog i kardiovaskularnog sistema, arterioskleroze zbog taloženja suviška masnih materija, poremećaja u metabolizmu, smanjenja količine odbrambenih imunih materija protiv zaraznih bolesti i raka, porasta količine slobodnih radikala i dr. Da bi se sve to spriječilo, čovjek mora sve manje sjediti i mora se ponovo sve više kretati, jer određene fizičke aktivnosti povećavaju funkcionalnu sposobnost svih organskih sistema i time čuvaju i unapređuju zdravlje (Biberović i Mačković, 2005), te značajan broj ljudi, povremeno ili stalno, u te svrhe koristi bazene. Propagatori zdravstvenih vrijednosti plivanja uglavnom su jedinstveni u stavu da se čitav niz urođenih i stečenih tjelesnih deformiteta može djelimično ili potpuno otkoloniti sportsko-rekreativnim aktivnostima, a naročito plivanjem. Tako npr. kod skolioze (iskrivljenje kičme ustranu), koje nastaju usljed naglog rasta djeteta – plivanje je gotovo jedina terapija. Kod djece koja su u dojenačkom dobu preboljela rahitis i kod kojih su ostali znakovi ovog oboljenja na grudnom košu (tzv. kokošije grudi i izvijena rebra), plivanjem se ojačava grudna muskulatura, što djeluje na ispravljanje koštanog sistema (Kurtović, 2008).

Pored svoje osnovne nemjene u funkciji korisnika bazena, postoje i neželjene suprotnosti, jer rekreativne aktivnosti na bazenima, ali i korištenje u svrhe liječenja i oporavka mogu da ugroze zdravlje, tako da je neophodno odgovarajuće upravljanje bazenima, kako bi se taj negativni uticaj sveo na što manju mjeru (Dalmacija i Ivančev-Tumbas, 2001). Svaki tip bazena ima različite potencijalne probleme vezane za njegovo funkcionisanje i korištenje, odnosno korisnici mogu biti izloženi različitim opasnostima ili različitim stepenima rizika od iste opasnosti. (Antonić, Mihajlović, Antonić, 2014). Koriste ih osobe svih godišta i različitih fizičkih sposobnosti. Pojedine grupe korisnika izloženije su potencijalnim opasnostima od drugih. Tipičan primjer su djeca, koja povećavaju rizik povreda za njih sama i po ostale korisnike, zbog njihove, često, nekontrolisane živahnosti i želje za isticanjem i privlačenjem pažnje. Djeca se, takođe, obično previše ne obaziru na pravila sigurnosti i higijene. Kultura i samodisciplina kupača su doprinosni činioci njihovoj bezbjednosti. Realizacija pristupu kontroli kvaliteta takvih sistema, podrazumijeva adekvatnu brigu o kvalitetu vode, što je i bio predmet ovog ispitivanja, sistemu, objektima, inspekciji uže i šire okoline, kao i sprovođenju mjera zaštite zdravlja kupača, te se iz tih razloga mora pristupiti kontroli kritičnih tačaka u svim objektima za rekreaciju, na svim nivoima i u svako vrijeme.(Dalmacija i Ivančev-Tumbas, 2001). Bazenska voda mora biti bezbi-

by the house rules prescribed by the managing authority pool (Sl.gl.RS, No.68, 2014). The quality of the pool water depends on the sanitary conditions higijenskuh operation and maintenance of the pool and the area around it, but also the behavior of customers who need to comply with specific hygiene rules (Antonic, 2014). Infectious diseases that can be obtained by bathing may be different with different symptoms depending on which way pathogen entered the body. Swimming in inadequately maintained pools in the summer, we usually get infected by viruses from the group of enteroviruses. Pathogens enter the body via the digestive tract by ingestion of water through the lining or by inhaling an aerosol, (islands, 2001). Frequent contamination of pool water and water in swimming pools with spas Fung nefekalnog origin and cause of the fungal infection of the hair, nails and skin. Infections of the skin of the foot (normally between prstiji), is described as' tinea pedis ", or more frequently," athlete's foot ". Symptoms include maceracuju, cracking and peeling of the skin with intense itching and unpleasant odors. Prevention of these phenomena is customer education in the use of "sanitary wells" - dezobarijera, before entering the pool. (Dalmatia, 2001). As a consequence of the water retention in the external voice channel in summer as well as the effect of increased expression in pools Psedomonasa expires, inflammation of the external ear or the so-called. "Swimmer's ear". The actual risk of the infectious disease in the majority of cases is small, especially in healthy adults and children of school age. Risk group, in which the risk of infection increased by small children under three years of age, especially infants, pregnant women, chronic patients with damaged immune systems. During his stay in the pool should be limited to small children, because they do not have a developed immune system, as is the propensity to disease increased, and the manner of their bathing favors the development of infections (choking and swallowing water). On the other side is not advisable to swim in the pools for people who have skin and venereal diseases, suffering from ear infections or the conjunctiva (conjunctivitis) or inflammation of the upper airways. (Grapple, 2016). Chemical hazards in the pool water can come from a number of sources, and are the following: residues of disinfectants and products of chemical reactions between them and the organic and inorganic materials from water which are toxic (trihalomethanes), as well as those substances imported strawberries from customers themselves (residues soap , cosmetics, oils, sunbathing, etc.). Basically it is a dermal contact, direct ingestion or inhalation of aerosols

jedna za kupače, bez sadržaja mikroorganizama, parazita i hemijskih materija koje same ili u kombinaciji sa drugim materijama predstavljaju opasnost za zdravlje korisnika bazena (Sl.gl.RS,br.68, 2014). Radi očuvanja zdravlja kupača, u svim dijelovima bazena moraju biti obezbijeđeni sanitarno-tehnički i higijenski uslovi koji onemogućavaju prenošenje uzročnika zaraznih bolesti i eleminišu druge uzroke koji mogu narušiti zdravlje korisnika bazena. (Danojević, Stoisavljević, Balaban, 2009). Korisnici bazena pridržavaju se kućnog reda koji je propisao organ upravljanja bazenom (Sl.gl.RS,br.68, 2014). Kvalitet bazenske vode zavisi od sanitarno higijenskuh uslova funkcionisanja i održavanja bazena i prostora oko njega, ali i od ponašanja kupača koji se moraju pridržavati određenih higijenskih pravila**.** (Antonić i sar. 2014). Zarazne bolesti koje se mogu dobiti kupanjem, mogu biti različite i sa različitim simptomima zavisno kojim je putem uzročnik ušao u organizam. Kupanjem u neadekvatno održavanim bazenima ljeti se najčešće možemo zaraziti virusima iz grupe enterovirusa. Uzročnici ulaze u organizam preko probavnog sistema gutanjem vode, preko sluznica ili udisanjem vodenog aerosola.(Dalmacija i Ivančev-Tumbas, 2001). Česta je kontaminacija bazenske vode i vode u bazenima banja sa fungima nefekalnog porijekla, a uzrok su gljivičnih infekcija kose, noktiju i kože. Infekcija kože stopala (uobičajeno između prstiji), opisana je kao „tinea pedis“ ili češće „atletsko stopalo“. Simptomi uključuju maceracuju, pucanje i ljuštenje kože sa intenzivnim svrabom i neprijatnim mirisima. Prevencija ovim pojavama je edukacija kupača u korištenju „sanitarnog bazenčića“ – dezobarijera, prije ulaska u bazen (Dalmacija i Ivančev-Tumbas, 2001). Kao posljedica zadržavanja vode u vanjskom zvučnom kanalu ljeti, kao efekat povećanog prisustva Psedomonasa u bazenima ističe se upala spoljašnjeg uha ili tzv. „plivačko uho“. Stvarni rizik od pojave navedenih zaraznih bolesti u većini slučajeva je malen, naročito kod zdravih odraslih osoba i djece školskog uzrasta. Rizične grupa, kod kojih j rizik od pojave infekcije veći su mala djeca do tri godine starosti, naročito dojenčad, trudnice, hronični bolesnici sa oštećenim imunološkim sistemom. Vrijeme boravka u bazenu treba ograničiti za malu djecu, jer ona nemaju razvijen imunološki sistem, pa je sklonost oboljevanju veća, a sam način njihovog kupanja pogoduje nastanku infekcije (zagrcavanje i gutanje vode). Sa druge strane ne preporučuje se kupanje u bazenima osobama koje imaju kožne i polne bolesti, koje boluju od upale uha ili spojnice oka (konjuktivitisa) ili upale gornjih dišnih puteva. (Grabež i Rudić-Grujić, 2016). Hemijski hazardi u bazenskim vodama mogu da potiču od više izvora, a ističu se: ostaci dezinfekcionih sredstava i produkti hemijskih reakcija između njih i organskih i neorganskih materija iz vode koji su toksični (triha-

or volatile chemicals. When it comes to the application of ozone, the risks of disinfection byproducts generated are minimal, (Ivančev-Tumbas, 1998). Contributory factors of the origination of trihalomethanes in the water as nitrogen ingredients in the sweat and urine, which can be found in the pool water (urea, ammonia, amino acids, creatinine, etc.)., As a possible precursor of the chlorinated by-products. (Ivančev-Tumbas, 1998). Trihalomethanes may occur in the air above the surface of the pool water, thanks to its light volatility, typically an elevated temperature and water turbulence caused by movement of water recipients, (Antonić, 2016). Imput in the reaction of precursors and chemical constituents is dependent on the number of customers, urine, oil residues, applied cosmetics, soap and so on. The formation of disinfection by-products, one can substantially reduce the different measures: reduction in the intake of precursors derived from the user via the body hygiene, removing the precursor from its water treatment or by dilution with fresh water and accurate disinfection process, (Antonić, 2014).

Bearing in mind the remarks made, originated the aim of this work to investigate the hygienic water quality and outdoor pools SRC "Fortuna" and based on the results of tests assess the safety profile of the pool.

Based on the prominent problems and goals and is the object of research, established and working hypothesis:

R.H. "The quality of the water depends on the proper disciplinary proceeding purification and disinfection of water, depending on the workload of the pool, the implementation of appropriate sanitary-hygienic measures and user behavior as a contributory factor to water pollution." Due to the set working hypothesis was formed and auxiliary hypotheses:

P. H. "Failure to meet any of the proceedings of the working hypothesis can not get the desired and expected quality and safety of water for swimming and recreation."

Methodology

Uzimnje water samples outdoor pools in RC "Fortuna" Banja Luka, during the bathing season in the period 2015 and 2016, carried out by representatives of the Institute for Public Health of the Republic of Serbian Banja Luka in the presence of the person responsible for the operation of the pool, and included:

- The water filling the pool - entry,
- Preparation of water - clean, treated water and
- Water from the pool, and comprised:

lometani), kao i one materije porijekolom od samih kupača (ostaci sapuna, kozmetike, ulja za sunčenje i sl.). Uglavnom se radi o dermalnim kontaktima, direktnom ingestijom ili inhalacijom aerosola ili volatilnih hemijskih materija**.** Kada je u primjeni ozon, rizici od stvorenih nusprodukata dezinfekcije su minimalni (Ivančev-Tumbas, 1998). Doprinosni činioci nastanka trihalometana u vodi su azotni sastojci u znoju i urinu koji se mogu naći u bazenskim vodama (urea, amonijak, aminokiseline, kreatinin i dr.), kao mogući prekursori za hlorisane nusprodukte (Ivančev-Tumbas, 1998). Moguća je pojava trihalometana u vazduhu iznad površine bazenske vode, zahvaljujući svojoj lakoj isparljivosti, obično povišenoj temperaturi vode i turbulencijama vode izazvanu kretanjem korisnika. (Antonić i sar., 2016). Imput u reakciji prekursora i hemijskih konstituenata je zavisan od broja kupača, količine urina, rezidua ulja, primijenjenih kozmetičkih sredstava, sapuna itd. Nastajanje sporednih proizvoda dezinfekcije, može se u značajnoj mjeri smanjiti različitim mjerama: smanjenje unosa prekursora koji potiču sa tijela korisnika putem održavanja higijene, uklanjanjm prekusora iz vode njenom obradom ili razblaživanjem svježom vodom i tačnim vođenjem procesa dezinfekcije (Danojević, Stoisavljević, Balaban, 2009; Antonić i sar., 2014; Grabež, Rudić-Grujić, 2016).

Imajući u vidu naprijed učinjene napomene, proistekao je i cilj ovog rada, da se ispita higijenska ispravnost i kvalitet vode otvorenih bazena SRC „Fortuna" i na osnovu rezultata ispitivanja procijeni bezbjednost korisnika bazena. Na osnovu istaknutog problema i postavljenog cilja i objekta istraživanja, uspostavljena je i radna hipoteza:

R.H. „Da kvalitet vode u bazenima u mnogome zavisi od pravilno vođenog postupka prečišćavanja i dezinfekcije vode u zavisnosti od opterećenosti bazena, provođenja odgovarajućih sanitarno-higijenskih mjera i ponašanju korisnika kao doprinosnih činioca onečišćenja vode".

S obzirom na postavljenu radnu hipotezu, formirana je i pomoćna hipoteza:

P.H. „ Da neispunjenjem bilo kog postupka iz radne hipoteze se ne može dobiti željeni i očekivani kvalitet i bezbijednost vode za kupanje i rekreaciju".

Metodologija

Uzimanje uzoraka vode otvorenih bazena u RC „Fortuna" Banja Luka, tokom kupališne sezone 2015 i 2016 godine, izvršili su predstavnici JZU Instituta za javno zdravstvo RS Banja Luka u prisustvu lica odgovornog za rad bazena, a obuhvatala su:

- Voda za punjenje bazena – ulazna,
- Priprema vode – čista, prerađena voda i
- Voda iz bazena, a obuhvatalo je:

- Open a large swimming pool and
- Open a small pool (children)

The test was performed in an accredited (EN ISO / IEC 17025) laboratory methods for testing the pool water (Official Gazette of the RS no. 68/14, Appendix IV). Parametric tests of physico-chemical and microbiological parameters were carried out according to the Ordinance on technical and sanitary-hygienic conditions (Official Gazette of the RS no. 68/14).

Results

Studies used retrospective results of the physico-chemical and microbiological tests of samples of pool water outdoor pools RC “Fortuna” Banja Luka in the period 2015 and 2016. In the two-year study period was analyzed 40 samples of water from swimming pools, and which is always preceded by examinations of clean processed water and the water to fill the well with the defined parameters of the test. In Table 1 and Table 2 presents the results of physical-chemical analysis of water open large and small pools for the year 2015/16.

Table 1. *Results of physical-chemical analysis of water open a large pool for the year 2015/16*

Datum / *Date*	2015						Datum / *Date*	2016					
	Cl	pH	Boja	Mut	OKS	THM		Cl	pH	Boja	Mut	OKS	THM
2.6.	0.3	7.35	< 5	0.02	0.5		31.5.	0.4	7.1	< 2.5	<0.02	0	
15.6.	0.5	7.27	<5	1.05	0.9	79.4	8.6.	0.35	7.32	< 2.5	<0.02	0	76.3
29.6.	0.6	7.31	< 5	0.02	0		17.6.	0.5	7.28	< 2.5	<0.02	0	
7.7.	0.4	6.98	< 5	0.13	0	56	27.6.	0.4	7.33	< 2.5	0.12	0	54.5
14.7.	0.3	7.03	< 5	0.01	0		7.7.	0.4	7.33	< 2.5	<0.02	0	
29.7.	0.5	7.4	< 5	0.02	0	65.2	20.7.	0.4	7.1	< 2.5	<0.02	0	60.12
4.8.	0.45	6.99	< 5	0.25	0		28.7.	0.4	7.55	< 2.5	0.31	0	
8.8.	0.6	7.5	< 5	0.02	0	70.2	3.8.	0.4	7.15	< 2.5	<0.02	0	11.3
15.8.	0.4	7.35	< 5	0.02	0.1		19.8.	0.35	7	< 2.5	0.44	0	
26.8.	0.3	7.6	< 5	0.02	0	52.9	30.8.	0.4	7.01	< 2.5	<0.02	0.5	48.4

We analyzed six physical - chemical parameters of quality of pool water (free chlorine, pH, color, turbidity, oxidizability and content of trihalomethanes in accordance with statutory provisions.

- Otvoreni veliki bazen i
- Otvoreni mali bazen (dječiji)

Ispitivanje je izvršeno u akreditovanoj (BAS EN ISO/IEC 17025) laboratoriji JZU Instituta za javno zdravstvo RS, metodama za ispitivanje bazenske vode (Sl.glasnik RS br. 68/14, prilog IV). Analizirano je 40 uzorka vode iz bazena. Parametri spitivanja fizičko-hemijskih i mikrobioloških pokazatelja su izvršena shodno Prilogu 3, a okvir ispitivanja naveden je u Prilogu 5. Pravilnika o sanitarno-tehničkim i higijenskim uslovima (Sl. glasnik RS br. 68/14).

Rezultati ispitivanja sa diskusijom

U ispitivanjima su korišteni retrospektivni rezultati fizičko-hemijskih i mikrobioloških ispitivanja uzoraka bazenske vode otvorenih bazena RC „Fortuna“ Banja Luka u periodu 2015. i 2016. godine. U tom periodu kupališne sezone shodno Prilogu 5. Pravilnika.

Tabela 1. *Rezultati fizičko- hemijske analize vode otvorenog velikog bazena za 2015/16 godinu*

Legenda: Cl-hlor *pH-koncentracija H^+ jona Mut-mutnoca OKS-oksidativnost THM-trihalometani*

Table 2. *Results of physical-chemical analysis of water open small pools for the year 2015/16*

Datum / *Date*	2015						Datum / *Date*	2016					
	Cl	pH	Boja	Mut	OKS	THM		Cl	pH	Boja	Mut	OKS	THM
2.6.	0.3	7.35	< 5	0.02	0		31.5.	0.4	7.1	< 2.5	<0.02	0	
15.6.	0.6	7.27	<5	0.61	0	74.8	8.6.	0.35	7.32	< 2.5	<0.02	0	76
29.6.	0.6	7.44	< 5	0.02	0		17.6.	0.45	7.28	< 2.5	<0.02	0	
7.7.	0.4	7.01	< 5	0.13	0.2	56	27.6.	0.4	7.33	< 2.5	0.12	0	12
14.7.	0.3	7.03	< 5	0.02	0		7.7.	0.45	7.1	< 2.5	<0.02	0	
29.7.	0.5	7.4	< 5	0.02	0	8.51	20.7.	0.4	7.55	< 2.5	<0.02	0	50.08
4.8.	0.45	6.8	< 5	0.02	0.1		28.7.	0.4	7.15	< 2.5	0.31	0	
8.8.	0.6	7.1	< 5	0.02	0	70.8	3.8.	0.4	7	< 2.5	<0.02	0	41.5
15.8.	0.45	7.15	< 5	0.02	0.1		19.8.	0.35	7.11	< 2.5	0.44	0	
26.8.	0.5	6.99	< 5	0.02	0	42.6	30.8.	0.4	7.01	< 2.5	<0.02	0	53

Tabela 2. *Rezultati fizičko- hemijske analize vode otvorenog malog bazena za 2015/16 godinu*

Legenda: Cl-hlor *pH-koncentracija H^+ jona Mut-mutnoca OKS-oksidativnost THM-trihalometani*

We analyzed six physical - chemical parameters of quality of pool water (free chlorine, pH, color, turbidity, oxidizability and content of trihalomethanes in accordance with statutory provisions.

Discussion

Oxidizabilities is a common measure for the determination of water pollution by organic and oxidisable inorganic substances. The results of the two-year seasonal tests of water open big and small swimming pools (Table 1, Figure 1) show low oxidizability, which is far below the allowable concentration, except for a slight exceedance of water at the large swimming pool (0.9). The high content of organic matter in the water that is chlorinated may represent precursors to the formation of toxic trihalomethanes.

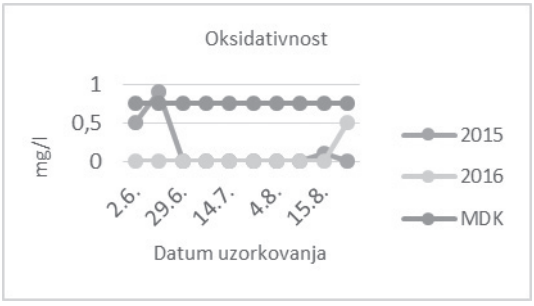
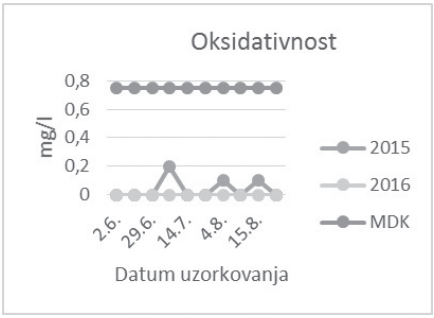


Figure 1. *Oxidizing*

Free chlorine, as well as epidemiological safety parameters, in the pool water is limited from a minimum of 0.12 mg / l up to a maximum of 1.02 mg / l, and the test results (Table no.1 and 2, Figure 2) show that the established values were in the specified range and that

Diskusija parametara i dobijenih rezultata fizičko-hemijskih i mikrobioloških ispitivanja izvršena su isključivo na osnovu normativa Pravilnika o sanitarno-tehničkim i higijenskim uslovima (Sl.glasnik RS br. 68/14), propisanih za bazene za kupanje i rekreaciju. Oksidabilnost je uobičajena mjera za određivanje zagađenja vode organskim i oksidabilnim neorganskim materijama. Rezultati dvogodišnjeg sezonskog ispitivanja vode otvorenog velikog i malog bazena za kupanje (Tabela 1, Grafikon 1), pokazuju nisku oksidabilnost, koja je daleko ispod dozvoljne koncentracije, izuzev jednog neznatnog prekoračenja kod vode velikog bazena (0,9). Visok sadržaj organskih materija u vodi koja se hloriše može predstavljati prekursore za stvaranje toksičnih trihalometana.



Grafikon 1. *Oksidativnost*

Legenda: MDK- *maksimalno dozvoljena koncentracija*

Slobodni hlor, kao parametara epidemiološke sigurnosti, je u bazenskoj vodi limitiran od minimalno 0,12 mg/l do maksimalno 1,02 mg/l, a rezultati ispitivanja (Tabela.1 i 2, Grafikon 2) pokazuju da su utvrđene vrijednosti bile u propisanim granicama i da su se kretale od minimalno 0,3

the range from a minimum of 0.3 mg / l to more than 0.6 mg / l.

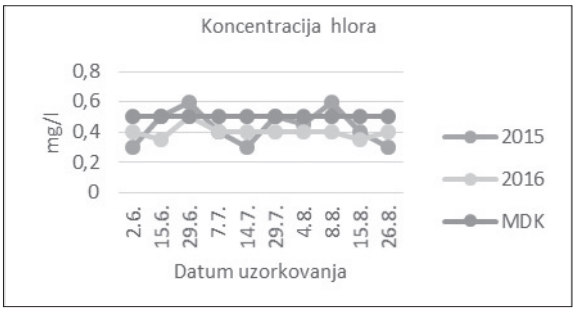


Chart 2. *The concentration of Cl ions*

pH value as a condition for successful proviođenje a water treatment procedure in the application of means for coagulation and flocculation, as well as a requirement for successful and effective disinfection of water according to the provisions of the Rules ranges, for swimming pool water, in the range from 6.5 to a maximum of a minimal 7.6 . Trials it was found that the pH value of the water is within the prescribed value (Table 1 and 2, Figure 3).

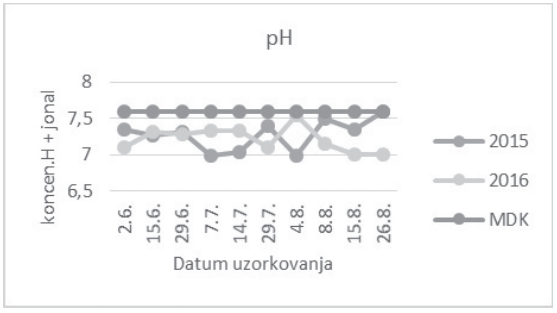


Figure 3. *Concentration pH*

Turbidity (turbidity) is defined by regulations to be monitored only in the water basin for bathing and as determined by a maximum value of 0.4 NTU. Trials it was established (Table 1 and 2.Grafikon 4) to this value ranged well below this value, from a minimum of 0.02 to a maximum of 0.35 NTU and in small and large pool.

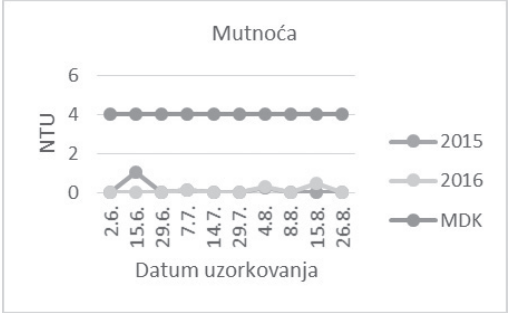
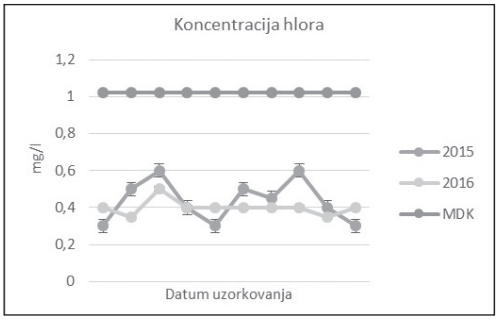


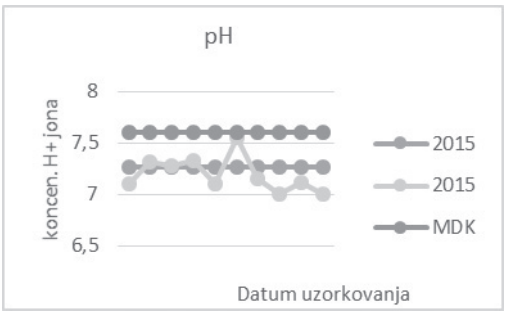
Figure 4. *Turbidity*

mg/l do maksimalno 0,6 mg/l. Utvrđena maksimalna vrijednost se može povećati do maksimalne vrijednosti limitirane propisima, a u zavisnosti od opterećenosti bazena.



Grafikon 2. *Koncentracija Cl jona*

pH vrijednost kao uslov za uspješno provođenje postupaka prečišćavanja vode u primjeni sredstava za koagulaciju i flokulaciji, ali i kao uslova za uspješnu i efikasnu dezinfekciju vode s e prema odredbama Pravilnika kreće, za bazensku vodu, u granicama od minimalnih 6,5 do maksimalnih 7,6. Ispitivanjima je utvrđeno da se pH vrijednosti vode u bazenima nalazi u okviru propisanih vrijednosti (Tabela 1 i 2, Grafikon 3.).



Grafikon 3. *Koncentracija pH*

Mutnoća vode (zamućenost) je propisima određeno da se prati samo u vodi bazena za kupanje i kao maksimalno određena vrijednost od 0,4 NTU. Ispitivanjima je utvrđeno, (Tabela 1i 2.Grafikon 4) da se ta vrijednost kretala daleko ispod te vrijednosti, od minimalno 0,02 do maksimalno 0,35 NTU i u velikom i malom bazenu, što ukazuje na korektan rad uređaja za prečišćavanja vode.

Grafikon 4. *Mutnoća*

Trihalomethanes, as disinfection by-products formed by the reaction of chlorine as a disinfectant with organic impurities from the water. Their amount depends on the temperature, the concentration of halogen-free, organic substances, and pH. The reaction between the precursors of trihalomethanes and chlorine during the chlorination of water is not instantaneous and can last several days. Rules provide that the trihalomethanes determined as total trihalomethanes whose maximum value is 100 mg / liter.

Testing was done at the two-year monitoring of the seasonal period, (table 1 and 2, Figure 5) show that the amount of trihalomethanes ranged from 11.3 to 79.4 g / l. Although the amount of trihalomethanes created is not current, the determined content may be associated with increased oksidativnošću in this test period.

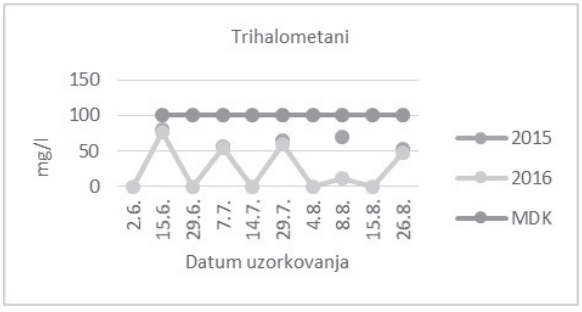


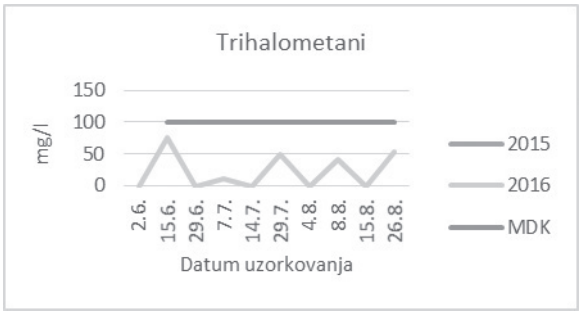
Figure 5. *The content of trihalomethanes*

Microbiological testing included the following parameters: Pseudomonas aeruginosa, Escherichia coli and total number of aerobic bacteria at 370C / 48 h.

Table 3. *Results of microbiological tests open a large pool for the year 2015/16*

Tabela 3. *Rezultati mikrobioloških ispitivanja otvorenog velikog bazena za 2015/16 godinu*

Trihalometani, kao sporedni proizvodi dezinfekcije nastaju u reakcijama hlora kao dezinfekcionog sredstva sa organskim materijama iz vode. Prema nekim autorima u procesu dezinfekcije vode hlorom, kao dezinfekcionim sredstvom, nastaje oko 200 različitih organohlornih jedinjenja od kojih su četiri kancerogeni trihalometani: hloroform, bromdihlormetan, bromoform i dibromhlormetan. Njihova količina zavisi od temperature, koncentracije halogena, organskih materija i pH. Reakcija između prekursora trihalometana i hlora za vrijeme hlorisanja vode nije trenutna i može trajati i nekoliko dana. Pravilnikom je predviđeno da se trihalometani određuju kao ukupni trihalometani čija je maksimalna vrijednost 100 µg/l. Ispitivanja vršena u dvogodišnjem sezonskom periodu praćenja, (Tabela 1 i 2, Grafikon 5) pokazuju da se količina trihalometana kretala od 11,3 do 79,4 µg/l. Iako količina stvorenih trihalometana nije trenutna, ovaj utvrđeni sadržaj se može dovesti u vezu sa povećanom oksidativnošću u tom terminu ispitivanja.Nastajanje sporednih proizvoda dezinfekcije, može se u značajnoj mjeri smanjiti različitim mjerama: smanjenje unosa prekursora koji potiču sa tijela korisnika putem održavanja higijene, uklanjanjm prekusora iz vode njenom obradom ili razblaživanjem svježom vodom i tačnim vođenjem procesa dezinfekcije.



Grafikon 5. *Sadržaj trihalometana*

Mikrobiološka ispitivanja su obuhvatala sljedeće parametre: Pseudomonas aeruginisa, Escherichia coli i Ukupan broj aerobnih bakterija pri 37^{0}C/48 h.

2015				2016			
Datum / *Date*	**Pseudomonas aeruginosa**	**Escherichia coli**	**Ukupna broj aerobnih bakterija pri 37 °C / *Total aerobic bacteria at 37 °C***	**Datum / *Date***	**Pseudomonas aeruginosa**	**Escherichia coli**	**Ukupan broj aerobnih bakterija pri 37 °C / *Total aerobic bacteria at 37 °C***
2.6.	0.00	0.00	5.00	31.5.	0.00	0.00	10.00
15.6.	0.00	0.00	1.00	8.6.	0.00	0.00	0.00
29.6.	0.00	0.00	0.00	17.6.	0.00	0.00	0.00
7.7.	0.00	5.00	15.00	27.6.	5.00	0.00	20.00
14.7.	0.00	0.00	35,00	7.7.	0.00	10.00	0.00
29.7.	0.00	0.00	15.00	20.7.	0.00	0.00	0.00
4.8.	0.00	0.00	15.00	28.7.	0.00	0.00	100
8.8.	0.00	0.00	5.00	3.8.	0.00	0.00	5.00
15.8.	0.00	0.00	10.00	19.8.	0.00	0.00	0.00
26.8.	0.00	0.00	5.00	30.8.	0.00	0.00	5.00

Table 4. *Results of microbiological tests open small pools for the year 2015/16*

Tabela 4. *Rezultati mikrobioloških ispitivanja otvorenog malog bazena za 2015/16 godinu*

2015				2016			
Datum / *Date*	Pseudomonas aeruginosa	Escherichia coli	Ukupna broj aerobnih bakterija pri 37 °C / *Total aerobic bacteria at 37 °C*	Datum / *Date*	Pseudomonas aeruginosa	Escherichia coli	Ukupna broj aerobnih bakterija pri 37 °C / *Total aerobic bacteria at 37 °C*
2.6.	0.00	0.00	5.00	31.5.	0.00	0.00	0.00
15.6.	0.00	0.00	1.00	8.6.	0.00	0.00	0.00
29.6.	0.00	0.00	0.00	17.6.	0.00	0.00	0.00
7.7.	0.00	10.00	12.00	27.6.	5.00	0.00	10.00
14.7.	0.00	0.00	20.00	7.7.	0.00	0.00	0.00
29.7.	0.00	0.00	10.00	20.7.	0.00	10.00	0.00
4.8.	0.00	0.00	5.00	28.7.	0.00	0.00	0.00
8.8.	0.00	0.00	5.00	3.8.	0.00	0.00	5.00
15.8.	0.00	0.00	10.00	19.8.	0.00	0.00	0.00
26.8.	0.00	0.00	5.00	30.8.	0.00	0.00	5.00

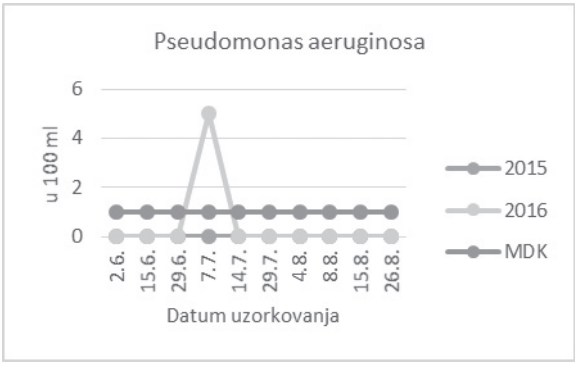


Figure 6. *The concentration of Pseudomonas aeruginosa*

Grafikon 6. *Koncentracija pseudomonas aeruginos*

Results of testing the pool water, the two-year follow-up period, seasonal, show that only one sample of water large and small (children's) pool showed the presence of Pseudomonas aeruginisa in 2016 (Table 6 3.Grafikon).

Rezultati ispitivanja bazenske vode, u dvogodišnjem sezonskom periodu praćenja, pokazuju da je samo u jednom uzorku vode velikog i malog (dječjeg) bazena utvrđeno prisustvo Pseudomonas aeruginisa u 2016 godini (Tabela 3. Grafikon 6).

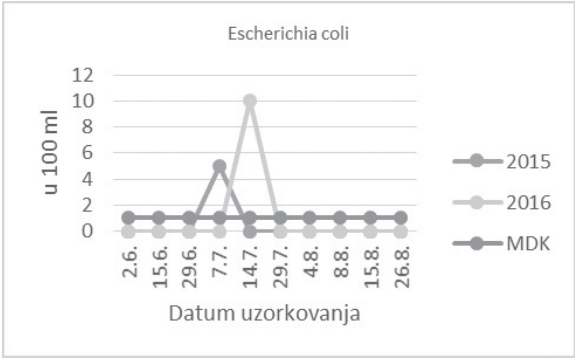
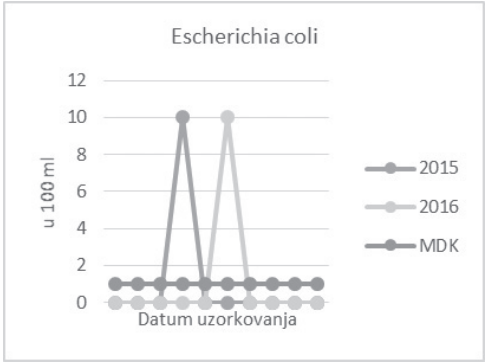


Chart 7. *The concentration of Escherichia coli*



Grafikon 7. *Koncentracija Escherichia coli*

The presence of Escherichia coli has been shown in one sample above the allowable values and a large and a small pool in the season in 2015 and 2016 (Table 3.grafikon 7).

Prisustvo Escherichia colli dokazano je u po jednom uzorku iznad dozvoljenih vrijednosti i u velikom i malom bazenu u sezoni 2015 i 2016 godine (Tabela 3.grafikon 7).

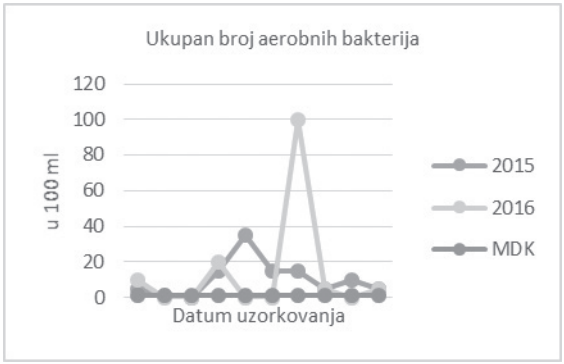


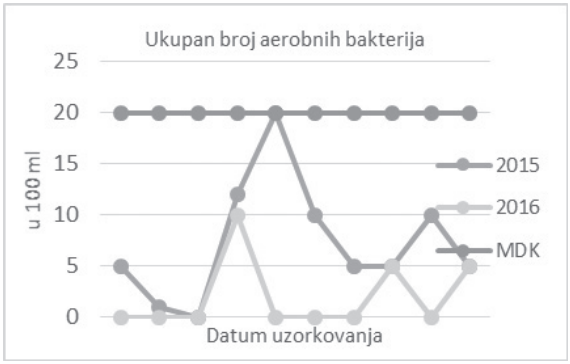
Figure 8. *Total number of aerobic bacteria at 37 ° C*

Are not detected aerobic bacteria, as well as indicators of water contamination, above the maximum allowed value (in the 200 370C / 48 h). All microbiological deviations are repaired, a successful rehabilitation extraordinary analysis as such and confirmed. The results obtained in this assay correspond to the test results of said test sites and objects (Grabež, 2016 and Antonić, 2016).

Conclusions

Based on the test results of water outdoor pools for swimming and recreation in seasonal two-year study period, we can conclude the following:

- The results of all physical and chemical parameters are within the permissible values and their maintenance as these do not threaten the health of users of the pool.
- By-products of disinfection of water is also placed within the allowable value, but they can be more significantly reduced by various measures: reduction in the intake of precursors derived from the bodies of users by means of hygiene, uklanjanjm precursor from the water to its treatment or by dilution with fresh water and accurate the disinfection process.
- Results of microbiological parameters are within prescribed values, with sporadic exceedances, upon receiving the information that the corrective measures repaired, and confirmed the successful remediation interim analysis. Swimming pool, open or closed, carries with it certain health risks associated with microbiological quality of water. Water Treatment reduces the extent of that risk, but that most of the security measures users can achieve only disinfection of water in the pool and the constant maintenance of a residual concentration dezinfikcionog assets.
- Test results confirmed the working hypothesis „that the quality of the water depends largely on the proper disciplinary proceeding purification and disinfection of water, depending on the workload of the pool, the implementation of appro-



Grafikon 8. *Ukupna* broj aerobnih *bakterija pri 37 °C*

Nije utvrđeno prisustvo aerobnih bakterija, kao indikatora zaprljanosti vode, iznad dozvoljenih vrijednosti (200 pri 370C/48 h a što je u saglasnosti i sa utvrđenom malom vrijednošću mutnoće. Sva mikrobiološka odstupanja su sanirana, a uspješna sanacija vanrednom analizom kao takva i potvrđena.

Dobijeni rezultati u ovom ispitivanju korespondiraju sa rezultatima ranijih ispitivanja navedenog lokaliteta i objekta ispitivanja, a rezultat su provođenja preventivnih aktivnosti na obezbjeđenju zdravstveno bezbjedne vode za kupanje i rekreaciju, prije svega primjenom principa dobre higijenske prakse. (Danojević, Stoisavljević, Balaban, 2009; Grabež, Rudić, 2016; Antonić i sar. 2016).

Zaključci

Na osnovu rezultata ispitivanja vode otvorenih bazena za kupanje i rekreaciju u dvogodišnjem sezonskom periodu ispitivanja, može se zaključiti sljedeće:

- Rezultati ispitivanja svih fizičko-hemijskih parametara se nalaze u granicama dozvoljenih vrijednosti i njihovim održavanjem kao takvih ne ugrožavaju zdravlje korisnika bazena.
- Sporedni proizvodi dezinfekcije vode se, takođe, nalaze u okviru dozvoljenih vrijednosti, ali se one mogu još značajno smanjiti različitim mjerama: smanjenje unosa prekursora koji potiču sa tijela korisnika putem održavanja higijene, uklanjanjm prekusora iz vode njenom obradom ili razblaživanjem svježom vodom i tačnim vođenjem procesa dezinfekcije.
- Rezultati mikrobioloških parametara se nalaze u propisanim vrijednostima, sa sporadičnim prekoračenjima, koje je po saznanju korektivnim mjerama sanirano, a uspješna sanacija potvrđena vanrednom analizom. Korištenje bazena, otvorenog ili zatvorenog tipa, nosi sa sobom i određeni zdravstveni rizik povezan sa mikrobiološkim kvalitetom vode. Prećišćavanje vode smanjuje dijelom taj rizik, ali se najveća mjera sigurnosti korisnika može ostvariti tek dezinfekcijom vode u bazenu i stalnim održavanjem rezidualne koncentracije dezinfikcionog sredstva.
- Rezultatima ispitivanja je potvrđena radna hipote-

priate sanitary-hygienic measures and user behavior, as contributory factors of water pollution.”
- Culture and self-discipline swimmers are contributory factors to its security.

za „da kvalitet vode u bazenima u mnogome zavisi od pravilno vođenog postupka prečišćavanja i dezinfekcije vode u zavisnosti od opterećenosti bazena, provođenja odgovarajućih sanitarno-higijenskih mjera i ponašanju korisnika, kao doprinosnih činioca onečišćenja vode“.
- Kulatura i samodisciplina kupača su doprinosni činioci njenoj bezbijednosti.

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The authors have contributed equally.

Financial disclosure
We declare that we have no confl icts of interest.

Izjava autora
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Konflikt interesa
Mi izjavljujemo da nemamo konflikt interesa.

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Stručni članak

Developmental neuroscience in the function of sensory and perceptual development of children

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Professional paper

Abstract: This paper seeks to explore the role of developmental neuroscience in the context of sensory and perceptual development of young children. Nurseries are places that provide conditions for such a development through nurturing as a part of educational process. Sensory and perceptual development makes a basis to which different sensory impressions, woven into social experience and mental reworking, are added so that they make perception. Nursery workers are of great importance in a child's life and they have to be seen as people who are capable of recognizing children's feelings, of "getting to them", guiding them and providing them with contents that will lead to the fulfillment of all of their potentials.
Key words: infants and toddlers, nurseries, developmental neuroscience, sensory and perceptual development, educator.

Introduction

Upbringing and nurturing infants and toddlers is a formative process that implies creating a stimulating environment where children acquire experiences of their own and explore themselves and the world around them by participating in it in accordance with their needs and abilities (*Pravilnik o Opštim osnovama predškoskog programa,* 2006; Lazić, 2013). A nursery is a place where a child lives, spends time, grows up and learns life skills, starting as early as the age of six months (Colić, 1997; Miljak, 2009; *Zakon o predškolskom vaspitanju i obrazovanju,* 2010). It is a place where a nursery worker directly participates and explores the educational process in terms of conditions in which it is realized. A nursery worker offers but does not impose, listens but does not insist, always encouraging each child's uniqueness and authenticity. He/she approaches children with respect to their

Razvojna neuronauka u funkciji senzornog i perceptivnog razvoja dece

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Apstrakt: Predmet rada je uviđanje doprinosa razvojne neuronauke u kontekstu senzornog i perceptivnog razvoja dece ranog uzrasta. U jaslicama se to ostvaruje kroz proces nege koja je sastavni deo vaspitanja. Senzorni i perceptivni razvoj čine bazu na koju se nadovezuju čulne impresije protkane kroz socijalno iskustvo i mentalnu preradu i kao takve tvore doživljaj. Zbog značaja koji ima u životu deteta, vaspitača u dečjim jaslicama je potrebno razumeti kao nekoga ko je sposoban da prepozna dečja osećanja, da 'uđe' u njih, da ih usmerava i da ponudi sadržaje kojima će podstaći ostvarivanje detetovog punog potencijala.
Ključne reči: dete ranog uzrasta, dečje jaslice, razvojna neuronauka, senzorni i perceptivni razvoj, vaspitač.

Uvod

Vaspitanje i nega dece do 3 godine je formativni proces koji se vrši kroz stvaranje podsticajne sredine u kojoj dete stiče iskustva po sopstvenom programu, u kojoj otkriva sebe i svoju okolinu i u kojoj je aktivno u skladu sa svojim potrebama i mogućnostima (*Pravilnik o Opštim osnovama predškoskog programa,* 2006; Lazić, 2013). Dečje jaslice su mesto u kojem dete već od 6. meseca života živi, boravi, razvija se i uči životne veštine (Colić, 1997; Miljak, 2009; *Zakon o predškolskom vaspitanju i obrazovanju,* 2010), mesto u kojem je vaspitač direktni učesnik obrazovne prakse, istraživač vaspitno-obrazvnog procesa u uslovima u kojima ga realizuje. On nudi, a ne nameće, osluškuje a ne insistira, podržava različitost i autentičnost deteta. Deci prilazi u skladu sa onim što što ih odlikuje, sa ciljem pronalaženja i podsticanja potencijala i njihove kvalitativne nadogradnje u vidu mnogostranih razvojnih aspekata koji će ići u pravcu ostvari-

personal characteristics, aiming to reveal and encourage their potentials which will be further enhanced in various developmental aspects, leading to positive outcomes both in terms of a child's subjectivity and the educational process (Klemenović, 2009; Siegel & Payne Bryson, 2015). A nursery worker is aware of the fact that human brain is a social organ that undergoes quantitative and qualitative changes with experience (Siegel & Payne Bryson, 2015), which is the reason why the lower part of the brain and its right side responsible for emotions are more developed in infants, while understanding of reality comes later, depending on social context. Therefore, a nursery worker helps children to achieve integration of emotions and comprehension, thus carrying out a process-model curriculum which, with its flexibility and ability to adapt to new situations and different activities, becomes a goal in itself, with its own inner value (Klemenović, 2009), encouraging an adult person to develop and further enhance its quality.

The subject of this paper is the contribution of neuroscience in the context of sensory and perceptual development of infants and toddlers, and its aim is to define sensory and perceptual development as a framework for achieving a child's general benefit and to point out certain activities that can enable a qualitative advancement in a child's growth.

Sensory and perceptual development in infancy and early childhood

The first three years in a child's life represent a period of intense development when a child – a helpless being completely dependant on the care and attention of an adult person – gradually becomes capable of expressing his/her needs in a clear and unambiguous way, understanding basic causal links and participating actively in the social context (Vigotski, 1977; Pijaže & Inhelder, 1988; Čuturić, 1993). During this period, a child grows more, learns more, moves more, and fights more than at any other time. Babies use their natural drive to be mobile, they fall over and get up again, learn about their surroundings through obstacles, develop proprioception and achieve sensory integration (*The Secret Life of Babies,* 2014; Pekçetin et al., 2016). What they achieve through these experiences is the ability to use resources more successfully, and to understand themselves and the world around them more effectively.

Receiving sensory impressions from our environment, interpreting and organizing them make a complex psychological function that melts feelings and experiences and is known as perception (Vojvodić, 2016). Since education is a pre-planned, organized and purposeful activity whose aim is developing every single child's potentials, perception in nurseries is more than mere noticing. It is a deliberate activ-

vanja pozitivnih ishoda dečjeg subjektiviteta i vaspitno-obrazovnog procesa (Klemenović, 2009; Siegel & Payne Bryson, 2015). Svestan je činjenice da je mozak socijalni organ koji ostvaruje kvantitativne i kvalitativne promene zahvaljujući iskustvima (Siegel & Payne Bryson, 2015), zbog čega deca ranog uzrasta imaju razvijeniji donji deo mozga i njegovu desnu polovinu koje odlikuju osećanja, dok razumevanje stvarnosti dolazi kasnije i zavisno je od socijalnog konteksta. Zbog toga pomaže deci da dosegnu integraciju osećanja i razumevanja. Na ovaj način ostvaruje proces-model kurikulum koji svojom fleksibilnošću i mogućnostima prilagođavanja novonastalim uslovima i promenjenim aktivnostima postaje sam sebi cilj sa svojstvenom unutrašnjom vrednošću (Klemenović, 2009), ohrabrujući odraslu osobu da ga kvalitativno nadograđuje i unapređuje.

Predmet rada je uviđanje doprinosa razvojne neuronauke u kontekstu senzornog i perceptivnog razvoja dece ranog uzrasta. Cilj rada je definisanje senzornog i perceptivnog razvoja kao okosnice dosezanja opšte dobrobiti deteta i ukazivanje na aktivnosti kojima se omogućava njihov kvalitativni iskorak. Primenjeno je teorijsko istraživanje i analiza sadržaja kao pripadajući istraživački postupak.

Senzorni i perceptivni razvoj dece jaslenog uzrasta

Prve tri godine života su period intenzivnog razvoja deteta koje od nemoćnog bića, u potpunosti zavisnog od brige i pažnje odrasle osobe, postaje sposobno da iskaže svoje potrebe na jasan i nedvosmislen način, da razume osnovne uzročno-posledične veze i da aktivno učestvuje u socijalnom kontekstu (Vigotski, 1977; Pijaže & Inhelder, 1988; Čuturić, 1993). U to vreme raste više, uči više, kreće se više i bori više nego što će to ikada činiti, koristi prirodnu potrebu za pokretom, pada i ustaje, upoznaje stvarnost kroz prepreke, razvija propriocepciju i ostvaruje senzornu integraciju (*The Secret Life of Babies,* 2014; Pekçetin et al., 2016). Posledice koje kroz ta iskustva nosi, pomažu detetu u uspešnijem korišćenju resursa, potpunijem razumevanju sebe i stvarnosti.

Primanje utisaka iz okruženja putem čula, njihova prerada i organizacija čini složenu psihičku funkciju poznatu pod imenom opažanje, kojom se sjedinjuju osećaji i iskustvo (Vojvodić, 2016). S obzirom na to da je vaspitanje planirana, organizovana, svrhovita delatnost koja se sprovodi sa ciljem razvoja potencijala svakog deteta, opažanje u jaslicama je više od pukog primećivanja. Ono je namerna aktivnost koja se sprovodi radi potpunijih čulnih percepcija, njihovog prepoznavanja u

ity that results in improved sensory perceptions, their recognition in repeated situations and adequate transferring of the acquired knowledge to new contexts. Perception is a function that babies learn, and nurseries provide an environment that offers a number of experiences that will enhance their sensory and perceptual development (*Pravilnik o Opštim osnovama predškolskog programa,* 2006).

Sight

Immediately after the birth, a newborn's eyes are looking for a human face and within twenty minutes the baby is able to imitate facial expressions of adults. A newborn baby can see most clearly at the distance of 20 cm, which is the distance of a mother's eyes from the baby during feeding (*The Secret Life of Babies*, 2014). Consequently, adults instinctively lean towards a baby to position themselves at this distance, and their facial expressions become slower and exaggerated.

Hearing

Although a newborn's ears are entirely covered with liquid, they work quite well after the birth, so that babies can hear all the sounds around them (*The Secret Life of Babies*, 2014). They get used to loud sounds during the prenatal period when they listen to their mother's heartbeats which is the sound with dB level ranging from 80-110 decibels. This corresponds to the sound made by a vacuum cleaner, a car on a flat road or a symphonic orchestra (Delić, 2014). Even number of hearing organs, which make the real sound through refraction, reduces echo. Adults, who seem to be (un)aware of this fact, instinctively pronounce simple repetitive sounds.

Touch

This powerful sense is used to express love and concern for others, it enables us to explore the world around us, make connections, build up confidence and form an image of the significant Other (Stefanović-Stanojević, 2005). It is an instance of evolutionary adaptation, a form of an instinctive behaviour developed in the childhood, whose function is to protect a child from danger, and is reflected in children's keeping close to their custodian (Stojić, Divljan & Avramov, 2010; *The Secret Life of Babies,* 2014). Unfortunately, not all children are blessed with supporting adults, so that their touch, which should be a touch of love, to some children mean everything but that (Lazić, Muškinja, Majkić, 2016). Consequently, there are significant differences in brain size, to the advantage of children who grow up in a supportive environment. Children who have negative experiences build

ponovljenim slučajevima i otiskivanja na nove slučajeve koji pogoduju primeni prethodno saznatog. Opažanje je funkcija koja se uči, zbog čega su jaslice okruženje koje može pružiti značajan broj iskustava u senzornom i perceptivnom razvoju (*Pravilnik o Opštim osnovama predškolskog programa,* 2006).

Čulo vida

Odmah po rođenju, bebine oči traže ljudsko lice i već u prvih 20 minuta u stanju je da oponaša mimiku koju ima odrasli iz njegovog vidnog polja. Novorođenče najbolje vidi na udaljenosti od 20 cm, što odgovara udaljenosti majčinih očiju od bebe dok je doji / hrani (*The Secret Life of Babies,* 2014). Ova fokusiranost bebe na ljudsko lice za posledicu je dala intuitivno približavanje odraslih upravo na ovu udaljenost i usporenu i prenaglašenu mimiku.

Čulo sluha

Iako su u potpunosti prekrivene tečnošću, bebine uši po rođenju veoma dobro rade, te čuju sve zvuke oko sebe (*The Secret Life of Babies,* 2014). Naviknute su na glasne zvuke jer je u prenatalnom periodu beba slušala otkucaje majčinog srca koji se nalaze u rasponu od 80 do 110 decibela, što odgovara zvucima nekih usisivača, automobila na ravnom putu i simfonijskog orkestra (Delić, 2014). Paran broj organa čula sluha koji prelamanjem daje pravi zvuk, za rezultat daje manji eho. Odrasli koji se staraju o detetu su toga (ne)svesni, te intuitivno izgovaraju jednostavne glasove koje ponavljaju.

Čulo dodira

Ovim moćnim čulom se iskazuju ljubav i pažnja, omogućava upoznavanje sveta, ostvarivanje vezanosti, sticanje osnovnog poverenja i formiranje predstave o značajnom drugom (Stefanović-Stanojević, 2005). U pitanju je evoluciona adaptacija, oblik instinktivnog ponašanja koje se razvija tokom detinjstva, sa funkcijom zaštite deteta od opasnosti preko blizine staratelja (Stojić, Divljan & Avramov, 2010; *The Secret Life of Babies,* 2014). Nažalost, život nije svoj deci podario podržavajuće odrasle, pa njihov dodir, koji bi trebalo da je dodir ljubavi, nekoj deci je sve samo ne to (Lazić, Muškinja, Majkić, 2016). Zbog toga se ostvaruju značajne posledice i na veličinu mozga, u korist deteta koje odrasta u podržavajućem okruženju. Dete, usled iskustava kojima je izloženo, gradi odnos nepoverenja, što doprinosi još većem stepenu njegove nesigurnosti, teskobe i anksioznosti.

a relationship of distrust, which further increases their feelings of insecurity, anguish and anxiety.

Taste and smell

Breastfeeding provides everything a baby needs during the first six months of life (Kiš Miljković, 2015), and after that solid food, which fosters intensive growth and development of infants, is introduced. The introduction of solids starts with sweet food that provides energy and tastes familiar to babies. Babies have a clear aversion towards vegetables and intuitively reject green food, which might be connected to the inherited fear of poisonous plants and/or thorns (*The Secret Life of Babies,* 2014). Smell is closely connected to taste, and in working with young children the greatest attention is devoted to different tastes and smells of food. Apart from that, smells are also connected to hygiene and spending time in the open air (*Pravilnik o Opštim osnovama predškolskog programa,* 2006).

Gross motor skills

Gross motor skills are the basis of psychomotor development (Čuturić, 1993). Once they have stood up and tried to walk, babies will never give up. Movement is a natural need of the human body, and its urge to be mobile is inexorable. The process of moving changes the perception of reality and through this important activity children learn about their environment, their own place in it and they begin to understand causal links.

Communication

In the first two years of life babies communicate and show their feelings by cooing, waving hands in joy or clearly expressing distress and anger. The development of speech organs is stimulated by smiling and laughing. Smiling is inherited, and all babies smile even if they have never seen a smile or heard anyone laughing before (*The Secret Life of Babies,* 2014). Babies utter sounds that are common to all languages, and they possess exceptional potentials for learning more than one language (*When Children Speak More Than One Language,* 2014).

Discussion

Every time an educator talks or pays attention to a child, he/she exposes the child to sensory experiences and makes the child's brain grow. In interaction with adults, children interpret their own experiences thus stimulating different parts of the brain, which enables creating new ideas, insights and creative thinking. These connections become stronger every time they make an eye contact,

Čulo ukusa i mirisa

Ishrana majčinim mlekom u prvih šest meseci života obezbeđuje bebi sve što joj je potrebno (Kiš Miljković, 2015), nakon čega se uvodi čvrsta hrana. Njome se potpomaže intenzivan rast i razvoj odojčeta. Započinje se sa slatkom hranom koja ima dovoljno energije, a ukusom podseća na poznato. Bebe iskazuju jasan otpor prema konzumiranju povrća i intuitivno ne vole da jedu zelenu hranu, što se objašnjava nasleđenom distancom od biljaka zbog otrova i/ili trnja (*The Secret Life of Babies,* 2014). Čulo mirisa je u tesnoj vezi sa čulom ukusa, pa se u radu sa decom ranog uzrasta najveća pažnja obraća na različite ukuse i mirise hrane. Odvojeno, mirisi se vezuju za higijenu i boravak na vazduhu (*Pravilnik o Opštim osnovama predškolskog programa,* 2006).

Krupna motorika

Krupna motorika je okosnica psihomotornog razvoja (Čuturić, 1993). Kada se jednom popne u stojeći položaj i pokuša da hoda, dete ne odustaje, jer je pokret prirodna potreba ljudskog tela, a želja da postane pokretno je nezaustavljiva. Kroz proces hodanja percepcija stvarnosti postaje drugačija, a dete kroz ovu značajnu aktivnost uči o okruženju, svom mestu u njemu i počinje da razume uzročno-posledične veze.

Komunikacija

Prve dve godine života dete komunicira, pa su jezici poput gukanja, radosnog mahanja rukama, jasnog iskazivanja uznemirenosti i besa, pokazatelji njegovih stanja i osećanja. Razvoj govornog aparata neguje se osmehom i smehom. Osmeh je nasledna radnja i čine je sve bebe, čak i slepe, iako nikada nisu videle osmeh niti smeh (*The Secret Life of Babies,* 2014). Bebe izgovaraju glasove koji odlikuju sve jezike sveta, a iskazuju izuzetne potencijale za učenje više od jednog jezika (*When Children Speak More Than One Language,* 2014).

Diskusija

Svaki put kada vaspitač priča sa detetom, bavi se njime, izlaže ga čulnim iskustvima i čini da mu mozak raste. U interakciji sa odraslima dete povezuje svoja iskustva, samim tim i različite delove mozga koji omogućavaju stvaranje novih ideja, uvida i kreativnog mišljenja. Te veze se osnažuju svaki put kada se ostvari kontakt očima, svaka nova reč koja se razmeni sa detetom, svaki put kada se u socijalnom kontekstu dete nasmeje (Shlain et al., 2012). Život se upoznaje življenjem i iskustvenim učenjem, a senzorni i perceptivni stimulusi pogoduju razvoju čulnog opažanja i razumevanju sebe i drugih.

hear a new word or smile in a social context (Shlain et al., 2012). Life is comprehended through living and learning from experience, and sensory and perceptual stimuli invigorate the development of sensory perception and children's understanding of both themselves and others.

A child's brain keeps record of every experience. The lack of selection of (un)important information and their huge influx activates the lower part of the brain responsible for feelings so that a child becomes overflowed with emotions, which is the cause of tantrums (Siegel, Payne-Bryson, 2015). In that case, the educator should make a connection with the child and help him/her calm down (comfort the child in a soothing voice, hug him or hold him tight – depending on the situation) and move him/her away – physically and symbolically – from the dominant feeling of unpleasantness. After that, the upper part of the brain, responsible for thinking, should be engaged by focusing the child's attention by questions, insights and negotiations.

Conclusion

Fulfilling children's true potentials in nurseries should be viewed holistically. It means that educators must be aware that a child lives in the given moment, as well as of the influence of every single experience on a child's overall development. All the experiences that children are exposed to from the age of six months in this form of educational work affect their perception of the world. Sensory and perceptual development makes a basis to which sensory impressions are added. These impressions are woven into social experience and its mental reworking thus creating a perception. It means that a stimulating environment "invites" young children to participate in it actively and provides them with an opportunity to play out what they have experienced, to establish behaviour patterns, to comprehend previous and anticipate future experiences. Besides, such an environment enhances the development of neural networks and builds up an adequate attitude towards the challenges of growing up.

Dečji mozak beleži svako proživljeno iskustvo. Izostanak selekcije u mozgu za prijem (ne)bitnih informacija i njihov visoki priliv, aktivira donji deo mozga kojim dete oseća, pa bude preplavljeno osećanjima, što uzrokuje tantrume (Siegel, Payne-Bryson, 2015). Vaspitač bi tada trebalo da se poveže sa detetom i pomogne mu da se smiri (u zavisnosti od situacije - tešenjem i umirujućim glasom; grljenjem; čvrstim stiskom i grljenjem), te ga fizički i simbolično odmakne od dominantnog osećaja neprijatnosti. Onda nastupa angažovanje gornjeg dela mozga, zaduženog za razmišljanje, tako što se dete zainteresuje pitanjima, uvidima i pregovorima koje čini odrasla osoba.

Zaključak

Ostvarivanje detetovih punih potencijala u jaslicama je neophodno shvatiti holistički. To znači da je vaspitač svestan uticaja svakog pojedinačnog iskustva na celokupni razvoj deteta, kao i činjenice da dete ranog uzrasta živi u trenutku. Zbog toga sva iskustva kojima se izlažu deca od 6. meseca života u ovom obliku vaspitno-obrazovnog rada, utiču na njihovo razumevanje sveta. Senzorni i perceptivni razvoj čine bazu na koju se nadovezuju čulne impresije koje su protkane kroz socijalno iskustvo i mentalnu preradu i kao takve tvore doživljaj. To znači da se deci ranog uzrasta kroz stimulativno okruženje koje ih 'poziva' na aktivno učešće, omogućava proigravanje proživljenog iskustva, utvrđivanje obrazaca ponašanja, razumevanje prethodnih i predviđanje budućih iskustava. Pored toga, ovo okruženje deci omogućava i osnaživanje uspostavljenih neuronskih veza i pravilno postavljanje prema izazovima odrastanja.

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Submissions to the journal will initially be evaluated by the Editorial Board using several criteria: the appropriateness of the topic and content for the journal; the editing (preparation of the manuscript) and format; and "general" merit. If these criteria are met, the submission will undergo a double-blind review process by at least two acknowledged and independent reviewers, with the review process taking up to 8 weeks.

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