ISSN 1986-6089

SPORTLOGIA

Naučno-stručni časopis o antropološkim aspektima sporta, fizičkog vaspitanja i rekreacije
Scientific-Expert Journal of Antropological Aspects of Sports, Physical Education and Recreation

1/2013
Vol. 9, Issue 1, Jun 2013

9 771986 608009

Publisher:

Fakultet fizičkog vaspitanja i sporta, Univerzitet u Banjoj Luci
Faculty of Physical Education and Sports, University of Banja Luka

Printed by

Grafid, *Banja Luka, Bosnia and Herzegovina*

Copies

500

Editorial Office

Fakultet fizičkog vaspitanja i sporta / Faculty of Physical Education and Sports
Univerzitet u Banja Luci / University Banja Luka
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E-mail: ffvis@blic.net
Web site: http://sportlogia.com (full text available free of charge)

Abstract or Indexed-in:

Academic Search Premier, CAB Abstracts, DOAJ, EBSCO SPORTDiskus with Fulltext, EBSCOhost Research Databases, Fulltext Sources Online, Global Health, Google Scholar, Index Copernicus, INASP - International Network for the Availability of Scientific Publication, Open Access Map, Open J-gate, Science Gate, WorldCat.

Catalogued in:

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SportLogia journal (print ISSN 1986-6089, e-ISSN 1986-6119, CD-ROM ISSN 1986-6097) is published two times in one volumen per year (every June and December) by Faculty of Physical Education end Sports, University of Banja Luka, Bulevar Vojvode Petra Bojovića 1A, 78000 Banja Luka, Bosnia and Herzegovina. Subscriptions are available on a calendar year basis for 25 euros, one issue 15 euros + post-office delivery costs. Printed in Bosnia and Herzegovina.
According to Ministry of science and technology in Gouvernment of Republic of Srpska SportLogia Journal is the best scientific journal in our country.
SportLogia Journal won the first prize in the Festival of science under the patronage of Ministry of scinece and technology in 2011.

SportLogia
www.sportlogia.com

Jun / Jun, 2013
Vol. 9
Issue 1

Articles

Članci

SportLogia
2013, 9(1), 1–13
ISSN 1986-6089
e-ISSN 1986-6119
CD-ROM ISSN 1986-6097

www.SportLogia.com

ŽENA I SPORT

WOMEN AND SPORTS

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EDITORIAL ARTICLE
OWERVIWV PAPER
doi: 10.5550/sgia.130901.en.001P
doi: 10.5550/sgia.130901.se.001P
UDK: 796.035-055.2

UVODNIČKI ČLANAK
PREGLEDNI ČLANAK
COBISS.BH-ID: 3812888
COBISS.BH-ID: 3812376

SUMMARY

Regular physical activity is important for the health of both sexes. However, the physiological, anatomical, psychological and socio-cultural specificities of women require special considerations in all aspects of their sports. Puberty brings gender differences that result from different sexual functioning of endocrine axis. Despite the identical mechanisms of adaptation to physical activity, sexually mature women and men have inherited anatomical and physiological differences in body composition, aerobic capacity-building and muscle strength. In particular, it relates to the more complex female reproductive system. The female reproductive system is a functional part of the human body most sensitive to stress caused by heavy physical exertion. The most common disorders whose risk was significantly increased in physically active women are eating disorder, disturbed menstrual cycle, infertility, intimidated fractures, rupture of the anterior cruciate ligament, or even death. Mainly those are result of blunders and ignorance. Fortunately, they are largely preventable.

Key Words: physical activity, eating, menstrzal cycle, intimedated fractures, female athlete triad.

SAŽETAK

Redovna fizička aktivnost važna je za zdravlje oba pola. Međutim, fiziološke, anatomske, psihološke i socijalno-kulturološke specifičnosti ženskog pola zahtijevaju posebne obzire u svim sferama njihovog bavljenja sportom. Pubertet donosi razlike među polovima koje su posljedica različitog funkcionisanja polne endokrine osovine. Uprkos identičnim mehanizmima adaptacije na fizičku aktivnost polno zrele žene i muškarci imaju nasljeđene anatomske i fiziološke različitosti u tjelesnoj kompoziciji, aerobnom kapacitietu i mišićnoj snazi. Naročito se odnosi na mnogo složeniji ženski reproduktivni sistem. Ženski reproduktivni sistem predstavlja funkcionalni dio ljudskog tijela najosjetljiviji na stres izazvan teškim fizičkim naporom. Najčešći poremećaji čiji rizik se znatno povećava kod fizički aktivnih žena su poremećaj ishrane, narušen menstrualni ciklus, infertilitet, stres frakture, rupture prednjeg ukrštenog ligamenta ili čak smrt. Uglavnom su posljedica grubih grešaka i neznanja. Srećom, dobrom prevencijom uglavnom ih je moguće spriječiti.

Ključne riječi: fizički napor, ishrana, menstrualni ciklus, stres fraktire, ženska sportska trijada.

INTRODUCTION

Historical medical record U.S. Surgeon General's Report on Physical Activity and Health gave solid scientific evidence that regular physical activity is very important for the health of both men and women, with the recommendation of active participation in all aspects of physical activity and sports (U.S. Department of Health and Human Services, 1996). However, the physiological, anatomical, psychological and socio-cultural specificities of females require special considerations in all aspects of their sports (Greydanaus & Patel, 2002). Women now have available all sports venues, but it was not always the case. The first Olympic Games (776 B.C.) were privilege and pleasure of men only. Women have sought their satisfaction in the Games in honour of the goddess Hera, the protector of women of that age. First modern Olympic Games, held in 1896, had a similar trend for women, meaning they were without the possibility to participate (Ponorac, 2008).

Beginning of the 20 century made progress in this regard and women were slowly included in a broader range of sporting activities. That is how, slowly but surely, they became a part of sporting life. On the other Olympics 12 women were competing in tennis and golf, so-called upper class sports (Pfister, 2000). The increase in female participation in sports happened in the second half of the 20th century, and on 23 July 1972 dawned another 8 March, this time in sports. U.S. President Nixon signed the famous *Title IX* (Education Amendment Act) which provides that "no person in the United States may not, on the basis of sex, be excluded from participation in, denied the benefits of, or be subjected to discrimination in any educational program or activity financed by public funds "(Mitchell & Ennis, 2007).

Since the signing of the Title IX until the 80's of the last century, the number of awarded scholarships and so women actively involved in the sport as well, has increased by 700%, and during the 90's for another 50%. At the beginning of the new millennium, one of three high school students in the United States was actively involved in the sport as opposed to one of 27 in 1972 (Ireland & Ott, 2004). The London 2012 achieved yet another record, a record number of participants, 46% of over 10.000 participants, while in 1908 the ratio was 53:1 in favour of men.

Playing sports gives women many benefits. It is proven that girls active in sports have better success in school, are less likely to face unwanted pregnancies in their teen age, have higher self-esteem and self-confidence, more easily and more often enrol in colleges and universities, and less frequently have prob-

UVOD

Istorijski medicinski dokument US Surgeon General's Report On Physical Activity And Health je dao čvrste naučne dokaze da je redovna fizička aktivnost veoma važna za zdravlje, kako muškaraca tako i žena, sa preporukom aktivnog učešća u svim vidovima fizičke aktivnosti i sporta (U.S. Department of Health and Human Services, 1996). Međutim, fiziološke, anatomske, psihološke i socijalno-kulturološke specifičnosti ženskog pola zahtijevaju posebne obzire u svim sferama njihovog bavljenja sportom (Greydanaus i Patel, 2002). Ženama su danas dostupn asva sportska borilišta, ali nije oduvijek bilo tako. Prve Olimpijske igre (776. god. pne.) bile su privilegija i zadovoljstvo dato samo muškarcima. Žene su satisfakciju potražile na Igrama u čast boginje Here, zaštitnice žena toga doba. I prve moderne Olimpijske igre, održane 1896. godine, imale su sličan trend za žene, znači, bez mogućnosti da one na njima učestvuju (Ponorac, 2008).

Početak 20. vijeka donosi progres u tom pogledu, a žene se polako uključuju u sve veći broj sportskih aktivnosti. Tako, polako ali sigurno, postaju dio sportskog života. Na drugim Olompijskim igrama učestvovalo je 12 žena, takmičeći se u tenisu i golfu, takozvnim sportovim više klase (Pfister, 2000). Porast učešća žena u sportu buknuo je u drugoj polovini 20-tog vijeka, a 23. jula 1972. godine osvanuo je još jedan 8. mart, ovog puta u sportu. Američki predsjednik Nikson potpisao je čuveni *Title IX* (Education Amendment Act) koji kaže da "niti jedna osoba u SAD-u ne može, na bazi pola, biti isključena iz učešća, uskraćena od olakšica ili biti predmet diskriminacije za bilo koji edukativni program ili aktivnost finansiranu iz državnih sredstava" (Mitchell i Ennis, 2007).

Od trenutka potpisivanja Titla IX do 80-tih godina prošlog vijeka broj stipendiranih pa tako i žena aktivno uključenih u sport porastao je 700%, a tokom 90-tih za još 50%. Početkom novog milenijuma, 1 od 3 srednjoškolke u SAD-u aktivno je učestvovala u sportu za razliku od 1 od 27 u 1972. godini (Ireland i Ott, 2004). U Londonu 2012. postignut je još jedan rekord, rekordan broj učesnica, njih 46% od preko 10,000 učesnika, dok je 1908 godine taj odnos bio 53:1 u korist muškaraca.

Bavljenje sportom daje ženama mnoge prednosti. Potvrđeno je, da djevojčice aktivne u sportu imaju bolji uspijeh u školi, rjeđe se suočavaju sa neželjenom trudnoćom u tinejdžerskom dobu, posjeduju veće samopoštovanje i samopouzdanje, lakše se i češće upisuju na koledže i fakultete i mnogo rjeđe imaju problema sa zloupotrebama opojnih droga i boles-

lems with drug abuse and dependence diseases. Exercises with weight load have inestimable benefit to the development and maintenance of bone mass in females at all ages (Hagen, 2005).

However, nature has not signed the declaration on gender equality in sport. As for the physical activity a long time ago people said that women are "the weaker gender". Along with the trend that all sports can be practiced for the sake of gender equality, in women it leads to the development of many features that evolutionarily characterized men. According to Nikola Grujic, during the evolution biology already made gender differences in the relation to especially their *reproductive role*, so the "interference in her affairs" responses with the consequences that are unforeseen and which price is extremely expensive in every case. This price can be paid as an eating disorder, disturbed menstrual cycle, infertility, intimidated fractures, rupture of the anterior crossed ligament, or even death. Is it worth? These aspects will be discussed in the following sections.

SPECIFIC PHYSIOLOGICAL AND ANATOMICAL CHARACTERISTICS OF FEMALE ATHLETES

Since today most sports are equally available to both genders, the sports results are often surprising. Differences in world records in men's and women's events are not as drastic and they vary within a range of 15%. For science, especially of sports, raise new questions, whether it is the result of real biological differences between the genders and where is the fine line between physiology and pathology?

Pre-puberty boys and girls have comparable physical abilities, in general, they can play in the same teams and compete against each other until the age of 10 (Ireland & Ott, 2004).

Puberty causes significant differences between the genders as a result of various sexual functioning of endocrine axis, and the presence of testosterone and one with oestrogen and progesterone on the other. In particular, it relates to the more complex female reproductive system.

Despite the identical mechanisms of adaptation to physical activity, sexually mature women and men have inherited anatomical and physiological differences that are reflected in body composition, aerobic capacity and muscle strength.

Body composition of women is characterized by lower total mass, a lower percentage of muscle tissue and increasing percentage of fat.

tima zavisnosti. Vježbe sa težinskim opterećenjem imaju neprocjenjivu korist za razvoj i održavanje koštane mase kod žena u svim životnim dobima (Hagen, 2005).

Međutim, priroda nije potpisala deklaraciju o ravnopravnost polova u sportu. Što se fizičke aktivnosti tiče narod je još davno rekao da su žene „slabiji pol". Paralelno sa trendom da se svi sportovi mogu upražnjavati, zarad ravnopravnosti polova, kod žena dolazi do razvoja mnogih karakteristika koje su evolucijski karakterisale muški pol. Po riječima Nikole Grujića, biologija je kroz evoluciju već napravila razlike u polovima u odnosu, pre svega na svoje *reproduktivne uloge*, pa „mešanje u njene poslove" za odgovor ima posledice koje su nesagledive i čija je cena u pojedinačnom slučaju izuzetno skupa. Ta cijena može biti plaćena kao poremećaj ishrane, narušen menstrualni ciklus, infertilitet, stras frakture, rupture prednjeg ukrštenog ligamenta ili čak smrt. Da li se isplati? O njima ćemo diskutovati u narednim odjeljcima.

FIZIOLOŠKE I ANATOMSKE SPECIFIČNOSTI SPORTISTKINJA

Pošto je danas većina sportova podjednako dostupna za oba pola, tako su i sportski rezultati često iznenađujući. Razlike u vrijednostima svjetskih rekorda u muškim i ženskim disciplinama nisu više tako drastične i kreću se unutar raspona do 15%. Pred nauku, posebno fiziologiju sporta, postavljaju se nova pitanja, da li je to rezultat stvarnih bioloških razlika među polovima i gdje se prelazi tanka granica između fioziologije i patologije?

Prepubertalni dječaci i djevojčice imaju uporedive fizičke sposobnosti, uopšteno, mogu da igraju u istim timovima i da se takmiče jedni protiv drugih do 10-te godine starosti (Ireland i Ott, 2004).

Pubertet uzrokuje značajne razlike među polovima koje su posljedica različitog funkcionisanja polne endokrine osovine, odnosno prisustva testosterona sa jedne te estrogena i progesterona sa druge strane. Naročito se to odnosi na mnogo složeniji ženski reproduktivni sistem.

Uprkos identičnim mehanizmima adaptacije na fizičku aktivnost polno zrele žene i muškarci imaju nasljeđene anatomske i fiziološke različitosti koje se ogledaju u tjelesnoj kompoziciji, aerobnom kapacitetu i mišićnoj snazi.

Tjelesnu kompozicaju žena karakteriše manja ukupna masa, manji procenat mišićnog tkiva, a veći masnog.

The smaller muscle mass mainly refers to small diameter of single muscle fibre. This is logical given the anabolic effect of testosterone and a slight predominance of type I muscle fibres, which have a smaller diameter. Thus, women have less ability to generate absolute power, especially in the upper extremities, which is as much as 50% less than men. But when power is expressed in relative muscle mass, body mass and cross-section of muscle those differences are significantly reduced. Women have an average of 5-15% less aerobic capacity. These differences do not stem from differences in muscle fibres (capillarization, mitochondrial content and enzymes of aerobic metabolism) than in the ability to receive oxygen. Women have a lower stroke volume and thus cardiac output. The smaller blood volume, hematocrit and haemoglobin contribute to a lower aerobic capacity. This difference is also attributed to testosterone, which besides an anabolic effect also serves as a stimulus for erythropoietin (Kenney, Wilmore, & Costil, 2012)

A higher percentage of body fat females owe to estrogens. It stimulates the disposal of fat in the subcutaneous tissue, breast tissue, especially in the gluteus region and thighs. High lipoprotein lipase activity during puberty causes the deposition of fat in these areas which is hard to lose. Along with the expansion of the pelvis this causes a distinctive feature of the female figure. Often this look is a source of great dissatisfaction with women, with high neglects of its real role. During the last trimester of pregnancy and throughout lactation activity of lipoprotein lipase is reduced and decomposition begins, which suggests that fat is stored here only as an energy support to pregnancy and breastfeeding and extension of our species (Bjorntorp, 1986).

The most striking anatomical difference is related to the dimensions of the pelvis, which is by a greater width subordinated to the birth process. Consequently it is altered to anatomical position and manner of movement of the lower limbs (Ireland & Ott, 2004). The so-called Miserable Misalignment Syndrome is a set of anatomical variations of the lower extremities, which probably make women predisposed to instability, knee pain and finally frequent anterior cruciate ligament injury (Myer & Ford, 2004). In extreme cases it is composed out of femoral anteversion, accompanied by a quadriceps angle (Q-angle) greater than 15 degrees, external tibial torsion, increased foot pronation, flattening foot (pes planus) and hypoplastic musculus vastus medial obliqus (Figure 1). This syndrome, with differences in neuromuscular response, hormonal status (effect of estrogen recep-

Manja mišićna masa odnosi se uglavnom na manji promjer pojedinačnog mišićnog vlakna To je logično uzevši u obzir anabolički efekat testosterona i blagu predominaciju mišićnih vlakna Tip I koja su sama po sebi manjeg promjera. Tako žene imaju manju sposobnost da generišu apsolutnu silu, posebno u gornjim ekstremitetima koja je čak za 50% manja u odnosu na muškarce. Ali kada se snaga izrazi po relativnoj mišićnoj masi, masi tijela ili poprečnom presjeku mišića razlike se znatno smanjuju. Žene imaju i prosječno za 5-15% manji aerobni kapacitet. Ove razlike ne potiču od razlika u mišićnim vlaknima (kapilarizacija, sadržaj mitohondrija i enzima aerobnog metabolizma) nego u sposobnosti da se kiseonik dopremi do njih. Žene imaju manji udarni volumen pa tako i minutni volumen. Manji volumen krvi, hematokrit i hemoglobin dopirnose manjem aerobnom kapacitetu. I ova razlika se pripisuje testosteronu koji pored anaboličkog ima ulogu i stimulacije hormona eritropoetina (Kenney, Wilmore i Costil, 2012).

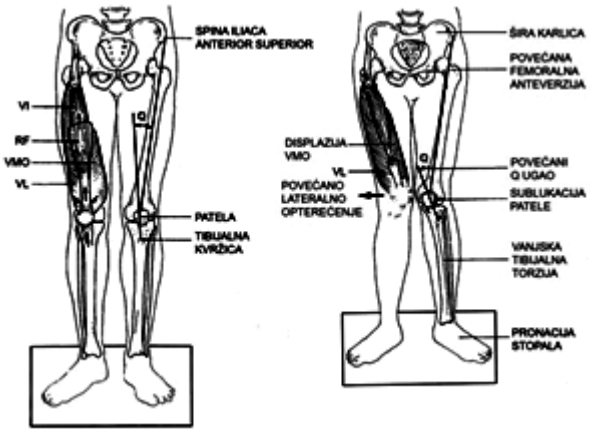
Veći procenat tjelesne masti žene duguju hormonu estrogenu. On stimuliše odlaganje masti u potkožno tkivo, tkivo dojke i posebno u glutealni predio i butine. Visoka aktivnost lipoproteinske lipaze tokom puberteta uzrokuje deponovanje masti u ovim područjima i njeno teško gubljenje. Zajedno sa širenjem karlice ovo daje posebno obilježje ženske figure. Često je ovakva izgled izvor nezadovoljstva žene pri čemu se grubo zanemaruje njegova stvarna uloga. Tokom zadnjeg trimestra trudnoće i cijele laktacije aktivnost lipoproteinske lipaze se samnjuje i započinje razgradnju, što navodi na zaključak da je mast ovdje uskladištena isključivo kao energetska podrška trudnoći, dojenju pa tako i produžetku vrste (Bjorntorp, 1986).

Najupečatljivija anatomska razlika se odnosi na dimenzije karlice, koja je većom širinom podređene procesu rađanja. Posljedično je izmjenjena anatomskoj poziciji i načinu kretanja donjih ekstremiteta (Ireland i Ott, 2004). Takozvani Sindrom Lošeg Poravnanja (miserable malaligment syndrom) predstavlja skup anatomskih varijacija donjih ekstremiteta žene koji vjerovatno daju predispoziciju za nestabilnost, bol u koljenu i konačno učestalije povređivanje prednjeg ukrštenog ligamenta (Myer i Ford, 2004). Njega u ekstremnim slučajevima čine femoralna anteverzija, na koju se nadovezuje ugao kvadricepsa (q-ugao) veći od 15 stepeni, vanjska tibijalna torzija, povećana pronacija stopala, zaravnjeno stopalo (pes planus) i hipoplastičan musculus vastus medijalis obliqus (Slika 1). Ovaj sindrom, uz razlike u neuromuskularnom refleksnom odgovoru, hormonskom statusu (uticaju estrogenih receptora na ligamente), i naravno razlikama u treningu uzrokuje i do 7 puta veću učestalost

tors on ligaments), and of course, differences in training, causes up to 7 times more common injuries of anterior cruciate ligament and patellar syndrome with female than male athletes (Ireland & Ott, 2004).

FIGURE 1
Misalignment Syndrome.

SLIKA 1
Maligament sindrom.



MEDICAL ASPECTS OF FEMALE SPORTS

Female athlete triad

Increasing number of females participating in sports has increased the risk for any negative consequences that follow sports. The danger is accentuated because women are starting to compete in the *endurance* sports without any limitations. A number of typically female profile sporting disciplines with a strong emphasis on the external appearance of a woman is also increasing.

The female reproductive system is a functional part of human body most sensitive to the stress caused by hard physical labor and sports (Yeager, Agostini, Nattiv, & Drinkwater, 1993).

In the early 90`s of the last century the connection between women athlete *eating disorders, menstrual cycle disorders and disorders of bone metabolism (mineralization) became apparent*. Yeager et al. (1993)included them in the syndrome known as the *Female Athlete Triad*. Since the gymnast Christy Henrich died in 1994 in the age of 22 and with 29 kg in weight due to a bizarre remark of her trainer that she is "too fat" for the Olympic team, the medical community turned on red warning light for each of the individual symptoms of the Triad. The potential impact of each disorder or a combination of several of them has proven to be harmful for the health and success in sports (Drink-

MEDICINSKI ASPEKTI BAVLJENJA SPORTOM KOD ŽENA

Ženska sportska trijada

Povećanje broja žena koje učestvuju u sportu povećao je i opasnost od rizika za sve negativne posljedice koje prate bavljenje sportom. Opasnost je naglašena pošto žene počinju bez ikakvih ograničenja da se takmiče u sportovima tipa *izdržljivosti*. Razvija se i veći broj sportskih disciplina tipično ženske profilisanosti sa jakim naglašavanjem spoljašnjeg izgleda žene.

Ženski reproduktivni sistem predstavlja funkcionalni dio ljudskog tijela najosjetljiviji na stres izazvan teškim fizičkim naporom i sportom (Yeager, Agostini, Nattiv i Drinkwater, 1993).

Ranih 90-tih prošlog vijeka je postala vidljiva povezanost između *poremećaja ishrane sportistkinja, poremećaja menstrualnog ciklusa i poremećaja matabolizma (mineralizacije) kosti*. Njih je Yeager i sardnici (1993) ukloplio u sindrom poznatiji kao *Ženska Sportska Trijada (Female Athlete Triad)*. Otkako je gimnastičarka Christy Henrich umrla 1994. godine u 22-oj godini i sa 29 kg težine, zbog bizarne primjedbe trenera da je „predebela" za olimpijski tim, u medicinskim krugovima upaljeno je crveno svjetlo upozoronja za svaki od pojedinačnih simptoma Trijade. Potencijalni uticaj svakog pojedinačnog poremećaja ili kombinacija više njih dokazali su se štetnim kako za zdrav-

water, Loucks, Sherman, Sundgot-Borgen, & Thompson, 2005).

Three angles of the Triad are mutually multiply intertwined by physiological and psychological mechanisms, and the presence of one of the symptoms requires immediate testing for the presence of others (Barrack, Ackerman, & Gibbs, 2013).

Eating disorders

Eating disorders are disorders of the continuous model. It ranges from abnormal eating *habits* in order to reduce weight to serious clinical conditions that result even with death (Goldstein, Dechant, & Beresin, 2011).

In the continuum there are clinical disorders *Anorexia Nervosa, Bulimia Nervosa and special category Eating disorders not otherwise specified - EDNOS* ("Diagnostic and statistical manual of mental disorders", 1994).

- *Anorexia Nervosa* is the most severe eating disorder that often results in fatal outcome. The sick person sees himself "too fat" and suffers from a fear of weight gain, although it often weights even 15% less than the expected.
- *Bulimia Nervosa* is characterized by cycles of restrictions in diet or fasting to track the phases of uncontrolled overeating for so-called psychological hunger, followed by a phase of cleaning. Cleaning includes induced vomiting, use of laxatives or diuretics (purging type) and starvation and extreme exercise (non-purging type), with the aim of returning to the old state. Women athletes with bulimia are often normal weight (Sundgot-Borgen & Larsen,1993).
- *Eating disorders not otherwise specified (EDNOS)* apply to a wide range of eating disorders that do not meet all the criteria of clinical disorders. People have normal weight; however, there is a preoccupation with diet, body weight, shape and body composition.
- *Subclinical forms of eating disorders* exist in many cases of eating disorder where woman athlete is trying to reduce body weight or fat percentage by exposing herself to the restrictions on food (diet), avoiding certain food or practicing other abnormal eating habits without reaching the criterion for eating disorders (Sabatini, 2001).
- *Low Energy Availability* is the state in sports that is caused by decreased energy intake, diet or significantly increased energy use through physical activity. Energy deficit without eating disorder is often associated with disturbances

lje tako i za uspjeh u sportu (Drinkwater, Loucks, Sherman, Sundgot-Borgen i Thompson, 2005).

Tri ugla Trijade su međusobno višestruko isprepletani fiziološkim i psihološkim mehanizmima, a prisustvo jednog od simptoma zahtijeva neodložno ispitivanje osobe i na prisustvo ostalih (Barrack, Ackerman i Gibbs, 2013).

Poremećaji ishrane

Poremećaji ishrane predstavljaju kontinuirani model poremećaja. Kreće se od abnornalnih *navika* pri ishrani sa ciljem redukcije tjelesne težine, pa do ozbiljnih kliničkih stanja koja završe i smrću (Goldstein, Dechant i Beresin, 2011).

U kontinuumu se nalaze klinički poremećaji, *Anorexia Nervosa, Bulimia Nervosa i posebna kategorija Nespecifikovani Poremećaji Ishrane (Eating disorders not otherwise specified - EDNOS)* ("Diagnostic and statistical manual of mental disorders", 1994).

- *Anorexia Nervosa* predstavlja najteži poremećaj ishrane koji često završava letalno. Oboljela osoba sebe doživljava "predebelom" i pati od straha prema povećanju tjelesne težine, iako često ima i 15% manje od očekivane tjelesne mase.
- *Bulimija Nervosa* se karakteriše cilkusima restrikcije u ishrani ili gladovanju koje prate faze nekontrolisanog prejedanja radi tzv. psihološke gladi, nakon čega slijedi faza čišćenja. Čišćenje podrazumijeva indukovano povraćanje, upotrebu laksativa ili diuretika (purging tip) i gladovanje i ekstremno vježbanje (non-purging tip), sa ciljem vraćanja na staro stanje. Sportistkinje sa bulimijom najčešće su normalne težine (Sundgot-Borgen i Larsen,1993).
- *Nespecifikovani poremećaji ishrane (EDNOS)* odnose se na široki spektar poremećaja ishrane koji ne zadovoljavaju sve kriterije kliničkih poremećaja. Osobe su normalne težine, međutim, prisutna je preokupacija ishranom, tjelesnom težinom, oblikom i tjelesnom kompozicijom.
- *Subkliničke forme poremećaja ishrane* postoje u mnogim slučajevima poremećene ishrane gdje sportistkinja pokušava da smanji tjelesnu težinu ili procenat tjelasne masti izlažući se restrikcijama ishrane (dijeta), izbjegavanju određene vrste namirnica ili praktikujući druge nenormalne navike u ishrani bez postizanja kriterija za poremećaje ishrane (Sabatini, 2001).
- *Energetski deficit (Low Energy Availability)* predstavlja stanje u sportu koje je uzrokovano smanjenim energetskim unosom ishranom ili znatno povećanom energetskom potrošnjom putem

of the menstrual cycle and presents a "starting point" for the development of the Triad.

The exact percentage of athletes with eating disorder is difficult to determine because it is a symptom of Triad that is often overlooked and unspoken. Studies show a higher incidence of eating disorders in athletes compared to non-athletes, women athletes compared to men athletes (Coelho et al., 2013). Female athletes who participate in sports with strong aesthetic appearance (dance, gymnastics, ballet), endurance sports (athletics, swimming, cycling) and those that compete in weight categories (martial arts) are at the higher risk level. The incidence of anorexia and bulimia by DSM-IV criteria in normal population ranges from 1% to 3%, while the percentage of eating disorders in athlete population ranges from 15% to 62%, depending on the type of sports (Sundgot-Borgen & Torstveit, 2004).

Literature states following possible causes for eating disorders:

- *Diets - Restrictive diet* to reduce weight is the primary cause for the development of eating disorders.
- *Calorie Deficit.* The rapid increase in the volume of training can cause a calorie deficit.
- *Start of sport-specific exercise before puberty.* Female athletes with identified eating disorders began with their careers earlier than other athletes (Thomson & Sherman, 1999). If sport-specific exercise begins before puberty, rapid growth and development can lead to a mismatch between the body shapes and requires of the chosen sport, which as a consequence can have a change of body composition by strong restriction diet (Deimel & Dunlap, 2012).
- *Traumatic experiences.* The most common traumatic experiences that influence the development of eating disorders are changes or loss of coach and athlete's illness or injury, manifested by difficulties in training. This often leads to weight gain, or in some cases, the fear of it, leading to subsequent compensatory reduction of food intake. Possible trauma are also random interruptions and comments regarding physical appearance, poor school success, problems with your partner or parents, death of a friend, and finally, and often, sexual abuse by a coach (Drinkwater et al., 2005).
- *Beliefs that reduce of body weight or fat percentage leads to improved physical fitness.* The initial weight loss can often improve physical fitness. This initial

fizičke aktivnosti. Energetski deficit bez poremećaja u ishrani često je udružen sa poremećajima menstrualnog ciklusa i predstavlja „polaznu tačku" za razvoj Trijade.

Tačan procenat sportistkinja sa poremećenom ishranom je teško utvrditi jer je to simptom Trijade koji se najčešće prešućuje i previđa. Studije pokazuju veću učestalost poremećaja u ishrani kod sportista u odnosu na nesportiste, sportistkinja u odnosu na sportiste (Coelho i saradnici, 2013). Pod velikim rizikom su sportistkinje koje učestvuju u sportovima sa naglašenim estetskim izgledom (ples, gimnastika, balet), sportovima tipa izdržljivosti (atletika, plivanje, biciklizam) kao i one koje se takmiče po težinskim kategorijama (borilački sportovi). Učestalost anoreksije i bulimije po DSM-IV kriterijima u normalnoj populaciji iznosi od 1% do 3% dok procenat poremećaja ishrane u populaciji sportistkinja iznosi od 15% do 62%, zavisno od vrste sporta (Sundgot-Borgen i Torstveit, 2004).

Kao moguće uzroke poremećaja ishrane litaretura navodi:

- *Dijete - Restriktivna ishrana* sa ciljem smanjenja tjelesne mase je primarni uzrok u razvoju poremećaja ishrane.
- *Kalorijski deficit.* Nagli porast u obimu treninga može uzrokovati kalorijski deficit.
- *Početak sport-specifičnog treninga prije puberteta.* Sportistkinje kod kojih su utvrđeni poremećaji ishrane započinjale su karijeru ranije u odnosu na ostale sportistkinje (Thomson i Sherman, 1999). Ukoliko sport-specifični trening započne prije puberteta, nagli rast i razvoj mogu dovesti do nesklada između oblika tijela i zahtijeva izabranog sporta, što kao posljedicu može imati pokušaj promjene tjelesne kompozicije snažnom restrikcijom ishrane (Deimel i Dunlap, 2012).
- *Traumatska iskustva.* Najčešća traumatska iskustva koja utiču na razvoj poremećaja ishrane su promjena ili gubitak trenera te bolest ili povreda sportiste, što se manifestuje poteškoćama u treningu. Ovo često dovodi do povećanja tjelesne mase ili u nekim slučajevima do straha od toga, što vodi ka posljedičnom kompenzatornom redukovanju unosa hrane. Moguće traume su i slučajne upadice i komentari u odnosu na tjelesni izgled, loše uspjeh u školi, problemi sa partnerom ili roditeljima, smrt prijatelja i konačno, a nerijetko, seksualno zlostavljanje od strane trenera (Drinkwater i saradnici, 2005).
- *Ubijeđenja da smanjenje tjelesne mase ili procenta masti dovodi do poboljšanja fizičke sposobnosti.* Početni gubitak mase često može poboljšati fizičku

success can stimulate the athlete to continue with mass loss until the very development of eating disorder. Athletes often commented, "It just happened, it was never planned".

Coaches often give a contribution to this risk factor by stimulating this unhealthy and unnatural way of improving physical fitness of their athletes.

Official stance of the IOC is that coaches cannot assess body composition of athlete nor make suggestions. It is recommended that they can only express their concern or attitude about it and direct athlete to a doctor or dietitian-nutritionists specialist. He will, after careful consideration and review, together with the athlete decide on the measures on how to correct body mass (Ibid).

Health effects that eating disorders leave behind affect many systems, and mortality caused by anorexia nervosa, as the most severe one, is 6%.

The early effects are decrease in basal metabolic rate, extraction of glycogen from muscle and liver, decreased in muscle mass and dehydration. This makes the athlete more susceptible to fatigue and musculoskeletal injuries due to disturbed endurance, strength, movement coordination and concentration. Electrolyte imbalance can lead to serious heart rhythm disorders, and endocrine system and thermoregulation are also affected. Bulimics suffer from severe gastrointestinal problems and enlargement of parotid gland and erosion of tooth enamel as a result of frequent vomiting (Otis, Drinkawater, Johnson, Loucks, & Wikmore, 1997).

Late effects are estrogen deficit and menstrual cycle disorder, which presents the *link between first two symptoms of Triad.*

Menstrual cycle disorders

Monthly menstrual cycle is a complex interaction between the endocrine and reproductive system of a women. Normal, regular menstrual cycle (*eumenorrhea*) lasts 24-36 days, an average of 28 days. It most commonly begins with *menarche* - first menstrual bleeding in the average age of 12.88 years in North America and 13 in Europe (Ibid).

A wide range of menstrual cycle disorders can be found in physically active women, especially athletes.

- *Oligomenorrhea* as a term refers to irregular menstrual cycles with bleeding interval longer than 36 days or 3 to 6 times per year.
- *Primary amenorrhea* is defined as the non-appearance of menstrual cycle by age of 16 in girls with the presence of secondary sexual characteristics or non-menstrual bleeding and by 14 years with the underdevelopment of secondary

spremnost. Taj početni uspjeh može uticati na sportistkinju da nastavi sa gubljnjem mase do granica razvoja poremećaja ishrane. Sportisti to često komentarišu "jednostavno se desilo, nikad nije ni planirano".

Treneri često daju svoj prilog ovom faktoru rizika, stimulišući na taj štetan i neprirodan način poboljšanja fizičke sposobnosti svojih sportista.

Zvaničan je stav IOC-a, da treneri ne mogu da procjenjuju tjelesnu kompoziciju sportistkinje, čak ni da daju sugestije. Preporučeno je da mogu samo da izraze svoju zabrinutost ili stav oko toga i upute sportistu ljekaru ili specijalisti dijetetičaru-nutricionisti. On će nakon pažljive procjene i pregleda, zajedno sa sportistom odlučiti o mjerama za korekciju tjelesne mase (Ibid).

Posljedice na zdravlje koje ostavljaju poremećaji ishrane zahvataju mnoge sisteme, a smrtnost od anorexie nervose, kao najteža iznosi 6% .

Rane posljedice su smanjenje bazalnog metabolizma, crpljenje rezervi glikogene u mišićima i jetri, smanjenje mišićne mase i dehidracija. Ovo sportistu čini osjetljivijim na zamor i mišićno-koštane povrede zbog narušene izdržljivosti, snage, koordinacije pokreta i koncentracije. Elektrolitni disbalans može dovesti do ozbiljnih poremećaja ritma srca, a pogođeni su i endokrini sistem i termoregulacija. Bulimičari pate od ozbiljnih gastro-intestinalnih problema a uvećanje parotidnih žlijezda i erozia zubne gleđi su posljedica učestalog povraćanja (Otis, Drinkawater, Johnson, Loucks i Wikmore, 1997).

Kasne posljedice predstavljaju deficit estrogena i posljediči poremećaji menstrualnog cikluca, *što predstavlja vezu između prva dva simptoma Trijade.*

Poremećaji menstrualnog ciklusa

Mjesečni menstrualni ciklus predstavlja složenu interakciju između endokrinog i reproduktivnog sistema žene. Normalan, regularan menstrualni ciklus (*eumenoreja*) traje od 24-36 dana, prosječno 28 dana. Najčešće se počinje *menarhom* - prvim menstrualnim krvarenjem u dobi od prosječno 12,88 godina u Sjevernoj Americi i 13 godina u Evropi (Ibid).

Širok spektar poremećaja menstrualnog ciklusa može se pronaći kod fizički aktivnih žena, naročito sportistkinja.

- *Oligomenoreja* kao termin odnosi se na nepravilne menstrualne cikluse sa intervalom pojave krvarenja dužim od 36 dana ili 3 do 6 perioda u godini.
- *Primarna amenoreja* definiše se kao nepojavljivanje menstrualnog ciklusa do dobi od 16 godina kod djevojaka sa prisustvom sekundarnih polnih odlika ili nepojavljivanje menstrualnog

sexual characteristics.

- *Secondary amenorrhea* is defined as the absence of three or more consecutive menstrual cycles after menarche in the absence of pregnancy, or less than three periods per year (Nativ et al., 2007).

Frequency of menstrual dysfunctions with normal, adult population ranges from 2% to 5%, while in sports it varies significantly depending the type of sports, competition rang and a lot of other parameters, and they range from 20% to incredible 70% in certain samples (Elford & Spence, 2002). In general, the highest frequency was noticed in endurance sports, sports with weight categories and sports with emphasized aestetic performance. Ponorac derived similar results when he examined the sample of elite national women athletes. The frequency of all menstrual dysfunctions was greater in groups of athletes in relation to the control group. Primary amenorrhea was determined in 8.33% and oligomenorrhea in 13.09% of female athletes (Ponorac, Rašeta, Radovanović, Matavulj, & Popadić-Gaćeša, 2011)

One of the most appropriate mechanisms of menstrual disorders in sports includes also eating disorders. Energy access/availability is defined as the energy calorie intake minus the energy consumed during physical activity. The imbalance between energy expenditure during exercise and caloric intake causes the body to receive information about the inadequate energy storage necessary to support reproduction and fetal development. The body then enters a state of "energy conservation" and the reproductive system, as a luxury feature, is very effectively extinguished with the goal of self-defense, or by informal terminology enters a "shut down" state. This type of amenorrhea is named *Functional hypothalamic amenorrhea (HPA), and often as a synonym appears the term Sports amenorrhea* (Catherine & Gordon, 2010).

Amenorrhea is neither desired nor "normal" condition caused by sports. In amenorrheic female athletes ovulation is difficult to predict, what causes the possibility of unwanted pregnancy, which is especially difficult in the season of important events. The risk of endometrial hyperplasia and adenocarcinoma of the uterus is also increased.

However, the most severe consequence, *and at the same time the third symptom of the Triad, is bone mass loss and subsequent osteoporosis* (Thein-Nissenbaum, 2013).

Disorder of bone metabolism (Osteoporosis)

Bone is a metabolically active tissue, and bone remodeling involves the reabsorption and bone for-

krvarenja do 14 godine uz nerazvijenost sekundarnih polnih odlika .

- *Sekundarna amenoreja* definisana je kao izostanak tri ili više uzastopnih menstrualnih ciklusa nakon menarhe a u odsustvu trudnoće, ili manje od tri perioda godišnje (Nativ i saradnici, 2007).

Učestalost menstrualnih disfunkcija u normalnoj, odrasloj populaciji iznosi 2%-5% dok u sportu široko variraju u zavisnosti od vrste sporta, ranga takmičenja i mnogih drugih parametara i kreću se od 20% i do nevjerovatnih 70 % u pojedinim uzorcima (Elford i Spence, 2002). Generalno, najveća učestalost je zabilježena u sportovima tipa izdržljivosti, sportovima sa težinskim kategorijama i sportovima sa naglašenim estetskim izgledom. Do sličnih podataka došao je i Ponorac ispitujući uzorak elitnih nacionalnih sportiskinja. Učestalost svih menstrualnih disfunkcija bila je veća u grupama sportistkinja u odnosu na kontrolnu grupu. Primarna amenoreja nađena je kod 8,33%, a oligomenoreja kod 13,09% sportistkinja (Ponorac, Rašeta, Radovanović, Matavulj i Popadić-Gaćeša, 2011).

Jedan od najprihvatljivijih mehanizama nastanka menstrualnih poremećaja u sportu obuhvata i poremećaje ishrane. Energetska dostupnost/raspoloživost je definisana kao energetski kalorijski unos umanjen za energiju potrošenu tokom fizičke aktivnosti. Neravnoteža između energetske potrošnje tokom fizičke aktivnosti i kalorijskog unosa uzrokuje da tijelo prima informacije o neadekvatnim energetskim skladištima neophodnim za podršku reprodukciji i razvoju fetusa. Organizam tada ulazi u stanje "konzervacije energije" a reproduktivni sistem, kao luksuzna funkcija, se u cilju samozaštite veoma efikasno gasi, odnosno po neformalnoj terminologiji ulazi u "shut down" stanje. Ova vrsta amaenoreje je nazvana *funkcionalna hipotalamička amenoreja (HPA), a često kao sinonim ima i termin Sportsku Amenoreju* (Catherine i Gordon, 2010).

Amenoreja nije niti željeno niti "normalno" stanje uzrokovano sportom. Ovulaciju kod amenoreičnih sportistkinja je teško predvidjeti, pa su moguće neželjene trudnoće što je posebno komplikovano u sezoni važnih takmičenja. Povećan je rizik od endometrijalne hiperplazije i adenokarcinoma uterusa.

Međutim, najtežu posljedicu, *a i treći simptom Trijade čini gubitak koštane mase i posljedična osteoporoza* (Thein-Nissenbaum, 2013)

Poremećaj metabolizma kosti (Osteoporoza)

Kost je metabolički aktivno tkivo, a remodelovanje kosti koje podrazumijeva resorpciju i formiranje

mation, a process that takes a lifetime. The balance between these two processes enables the maintenance of overall bone mass and bone morphology. At least 60-70% of the maximum bone mass is gained during puberty and adolescence, the so-called "window of opportunity", and to 90% by the end of the second decade of life (Barnekow-Bergkvist, 2005). Positive effects for reaching the maximum (peak) bone mass of young female come from various forms of physical activity, the level of growth hormone and IGF-I, and preserved physiological menstrual cycle (Jurimae & Jurimae, 2008).

Low energy availability with or without eating disorder, amenorrhea and osteoporosis, individually or connected as Triad, present a significant health risk for a women bone. Estrogen deficit caused by the HPA undermines the achievement of maximum bone mass in young women and can significantly reduce the positive effect of physical activity on bone (Ducher & Eser, 2009). Consequentially arises the *osteoporosis*, one of the most difficult bone diseases, when mineral content and bone may be so reduced that stress fractures occur even after a minimal load (Barrack et al., 2013).

Additional deficit of calcium and protein due to an eating disorder, plus delayed menarche, are more favorable to premature osteoporosis of female athlete.

In accordance with the latest recommendations, the primary treatment of Triad begins with fight against eating disorders. As the best solution proved to be an increase in energy intake and reduced training volume in order to increase the energy level to the extent that would allow reestablishment gender shaft of a woman. That also solves the third symptom, by stopping the loss of bone density, including osteoporosis (Ibid).

CONCLUSION

In response to one of these questions at the beginning of the text, we can conclude the following. Most of these medical conditions that often affect physically active women and female athletes have a high price for sports, essentially healthy activity. Also, the intention was to show the delicate border where sports ends and medicine begins. Fortunately, most of the described disorders are the result of errors during the training process and can be prevented with certain measures. It has long been said that "prevention is better than the cure". Introducing female athletes, coaches, parents and doctors with this problem is also the first step.

kosti, proces koji se odvija cijelog života. Ravnoteža između ova dva procesa omogućava održavanje ukupne koštane mase i morfološke građe kosti. Najmanje 60-70% maksimalne koštane mase postiže se tokom puberteta i adolescencije kroz takozvani "prozor mogućnosti" (Window of opportunity), a i do 90% do kraja druge dekade života (Barnekow-Bergkvist, 2005). Na postizanje maksimalne (peak) koštane mase mladih žena pozitivno utiču različiti oblici fizičke aktivnosti ali i nivo hormona rasta i IGF-I, kao i očuvan fiziološki menstrualni ciklus (Jurimae i Jurimae, 2008).

Mala energetska dostupnost (low energy availability) sa ili bez poremećaja ishrane, amenoreja i osteoporoza, pojedinačno ili povezani kao Triada predstavljaju značajan zdravstveni rizik za kost žene. Deficit estrogena uzrokovan HPA narušava postizanje maksimalne koštane mase kod mladih žena i može da značajno umanji pozitivan efekat fizičke aktivnosti na kost (Ducher i Eser, 2009). Posljedičnoj tome nastaje i *osteoporoza*, jedno od najtežih oboljenja kosti, a mineralni sastav kosti može biti toliko smanjen da se stress frakture javljaju i nakon minimalnog opterećenja kosti (Barrack i saradnici, 2013).

Dodatni deficit kalcijuma i proteina usljed poremećaja ishrane, te odgođena menarha još više pogoduju prevremenoj osteoporozi kod sportiskinja.

U skladu sa najnovijim preporukama primarni tretman Trijade započinje borbom protiv poremećaja ishrane. Kao najbolje riješenje su se pokazali povećanje energetskog unosa i smanjenje obima treninga da bi se energetski nivo povećao u mjeri koja će omogućiti ponovno usposltavljanje polne osovine žene. Takose riješava i treći simptom, zaustavljanjem gubljenje mineralne koštane gustine, pa tako i nastanka osteoporoze (Ibid).

ZAKLJUČAK

U odgovoru na jedno od navedenih pitanja sa početka teksta možemo da zaključimo sljedeće. Većina navedenih medicinskih stanja koja češće pogađaju fizički aktivne žene i sportiskinje su visoka cijena za bavljenje sportom, suštinski zdravom aktivnošću. Isto tako, namjera nam je bila da prikažemo tu nježnu granicu gdje završava sport a počinje medicina. Na sreću, većina opisanih poremećaja su rezultat grešaka tokom trenažnog procesa i mogu spriječiti preventivnim mjerama. Davno je rečeno da je „bolje spriječiti nego liječiti". Upoznavanje sportiskinja, trenera, roditelja i ljekara sa ovom problematikom predstavlja ujedno i prvi korak.

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Received: May 23, 2013
Revision received: Jun 19, 2013
Accepted: Jun 19, 2013

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Primljeno: 23. maj 2013. godine
Izmjene primljene: 19. jun 2013. godine
Odobreno: 19. jun 2013. godine

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DONNA E SPORT

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L'attività fisica regolare è importante per la salute di entrambi i sessi. Però, le caratteristiche fisiologiche, anatomiche, psicologiche e socio-culturali del sesso femminile richiedono le considerazioni speciali in tutti gli aspetti delle loro attività sportive. La pubertà porta le differenze tra i sessi che derivano dal diverso funzionamento della base sessuale endocrina. Nonostante i meccanismi identici di adattamento all'attività fisica, le donne e gli uomini sessualmente maturi hanno le differenze anatomiche e fisiologiche ereditate nella loro composizione corporea, nella capacità aerobica e nella forza muscolare. Questo, in particolare, riguarda il sistema riproduttivo femminile molto più complesso. Il sistema riproduttivo femminile rappresenta la parte funzionale del corpo umano più sensibile allo stress causato dagli sforzi fisici intensi. I disturbi più comuni il cui rischio aumenta notevolmente nelle donne fisicamente attive sono: i disturbi alimentari, i disturbi del ciclo mestruale, l'infertilità, le fratture da stress, le rotture del legamento crociato anteriore o addirittura la morte. La maggior parte delle dette condizioni mediche che più spesso colpiscono le donne fisicamente attive e le atlete sono un prezzo altissimo da pagare per praticare lo sport,

l'attività sostanzialmente sana. L'intento di questo articolo è quello di mostrare il limite delicato dove finisce lo sport ed inizia la medicina. Fortunatamente, la maggior parte dei disturbi descritti sono il risultato degli errori durante il processo di allenamento e possono essere prevenuti con le misure preventive. Molto tempo fa è stato detto " prevenire è meglio che curare". Nello stesso tempo informare le atlete, gli allenatori, i genitori ed i medici di questa problematica rappresenta il primo passo.

Le parole chiavi: lo sforzo fisico, la nutrizione, il ciclo mestruale, la frattura da stress, la triade femminile dell'atleta

SportLogia
2013, 9(1), 14–26
ISSN 1986-6089
e-ISSN 1986-6119
CD-ROM ISSN 1986-6097

www.SportLogia.com

SPORTSKI IDOLI SPORTISTA SENIOROSKOG UZRASTA

SPORTS IDOLS OF SENIOR ATHLETES

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ORIGINAL SCIENTIFIC PAPER
doi: 10.5550/sgia.130901.en.002I
doi: 10.5550/sgia.130901.se.002I
UDK: 796.012.1-053.2

ORGINALNI NUČNI ČLANAK
COBISS.BH-ID: 3813400
COBISS.BH-ID: 3813144

SUMMARY

The aim of this paper is to identify idols of senior athletes. And based on the identification of idols some conclusions can be made with respect to the system of values some person. The sample included 318 Serbian professional senior athletes (183 male and 135 female), 18 to 40 years old. Respondents were engaged in 28 different sports, mostly volleyball, water polo, basketball, karate, bocca, savate, handball, kyokushin. The independent variables were gender and selected idol and dependent variables were sport, gender, actuality and origin of idol. Senior athletes for their sports idols, in most cases elect Roger Federer, Michael Jordan, Milorad Čavić. It turns out that the majority of male and female athletes are selected for their idol person that comes out of their sport, but also that there are some differences in the choice of idols and characteristics of idols in male and female athletes.

Key Worlds: idolization, Serbia, values.

SAŽETAK

Cilj sprovedenog istraživanja je identifikacija idola sportista seniorskog uzrasta, budući da se putem identifikacije idola osoba mogu donijeti zaključci u vezi sa njihovim sistemima vrijednosti. Uzorkom je bilo obuhvaćeno 318 srpskih profesionalnih sportista seniora (183 sportista i 135 sportistkinja), uzrasta 18 - 40 godina. Ispitanici su dolazili iz 28 različitih sportova, pretežno odbojke, vaterpola, košarke, karatea, boćanja, savatea, rukometa, kjokušinkaija. Nezavisne varijable su bile pol i odabrani idol, a zavisne varijable sport, pol, aktuelnost i porijeklo odabranog idola. Sportisti seniori su za svog sportskog idola najčešće birali Rodžera Federera, Majkla Džordana, Milorada Čavića. Pokazalo se i da većina sportista i sportistkinja biraju za svog idola sportistu koji se bavi njihovm sportom, ali i da postoje neke razlike u izboru idola i njihovim obilježjima između sportista i sportistkinja.

Ključne riječi: idolizacija, Srbija, vrijednosti.

INTRODUCTION

Sport is a social product and cultural phenomenon: it is an integral part of cultural heritage and a genuine sort of collective activity. It reveals a lot about the values and norms which are dominant, emergent and residual in cultures and subcultures of society. Unlike other heroes, those idols that have emerged from sports are popular not only because of superior athleticism or impressive statistics, but also because of inspiring stories and symbolic feats. They are self-made heroes which became popular by their results and efforts. The status of a sports hero is not something

UVOD

Sport je društveni proizvod i kulturološki fenomen: on je sastavni dio kulturnog naslijeđa i predstavlja istinsku vrstu kolektivne aktivnosti. Sport mnogo otkriva o vrijednostima i normama koje se pojavljuju, dominiraju i ostaju kao tekovine u kulturi i/ili subkulturama određenog društva. Za razliku od drugih heroja, idoli koji dolaze iz svijeta sporta su popularni ne samo zbog svoje atletske građe ili impresivne statistike već i zbog svojih inspirativnih životnih priča i simboličkih podviga. Oni su heroji koji su to postali sopstvenim zaslugama i koji su postali popularni

that can be inherited, nor bought. It must be earned. And the more difficult the way to stardom was, the brighter the star shines. Sports heroes are always seen as representatives of good values. These good values are something that has meaning for the whole society. So it is essential that sports heroes have a society, a country or a sports club, that they represent. This is also case in economically poor countries, where question of success, victory or defeat, of nation sports idol, team, or representation becomes a state question and all eyes are on them. If he/she/they win, it is a nation success and they are glorified by all: public, journalist, families, politicians and everyone wants to be close and/or connected with them on some way. Sports celebrities are more than entertainers; they are expected to uphold their culture's values and morals at all times (Jones & Schumann, 2000).

That is the reason why high profile professional sports stars enjoy extended coverage in media and they influence in society generally. Such attitude tout professional athletes as role models through uplifting tales of triumph over adversity, the importance of a positive outlook, and the value of a virtuous character can have different implications. Sports icons are interviewed before, during and after broadcasted sporting events and used as special guests of commentators in broadcasting of sports events. Newspapers, internet sites and sports news cable channels report on professional athletes' contracts, legal issues, and personal successes. Different magazines, tabloids and newspapers in theirs articles offer intimate details about sports celebrities' lives and their private life. Ads with sport celebrity endorsers have become increasingly popular; relative to the preceding 35 years, print ads of this type proliferated during the 1990s (Ibid).

This is also case in Serbia, so as mixture of sports and politicians. In almost every sports club and national federation management exist some politician and, in turn, athletes and clubs are used as mascots or symbols whose role is to send a message to certain group of electors and represent some target group. Namely, famous athletes stand to affect the attitudes and behaviors of those who idolize them (Chung, 2003). Athletic idols are very important part of their champagne because of their power to send a message, especially to the younger voters.

An idol is someone whose talents, achievements, status, and/or physical appearance are appreciated and celebrated by fans (Yue & Cheung, 2000). Idolatry, manifested in worshipping and modeling behaviors, peaks during adolescence (Raviv, Bar-Tal, Raviv,

zbog svojih rezultata i uloženog truda i napora. Status sportskog heroja je nešto što se ne može naslijediti, niti kupiti. To se mora zaslužiti. I što je teže bilo stići do statusa zvijezde, tim je uvažavanje tog heroja veće. Sportski heroji se uvijek doživljavaju kao osobe koje reprezentuju dobre vrijednosti. Te dobre vrijednosti predstavljaju nešto što je značajno za cijelokupnu društvenu zajednicu. Stoga je od ključne važnosti da sportski heroji imaju društvo, državu ili klub koje mogu predstavljati. Ovo je naročito važno za ekonomski siromašne države, u kojima pitanje uspjeha, pobjede ili poraza nacionalnog sportskog idola, kluba ili reprezentacije postaje državno pitanje i oči nacije su usmjerene na njih. Ukoliko pobijede, to je nacionalni uspjeh i svi ih veličaju: publika, novinari, porodica, političari i svi žele biti u njihovoj blizini ili na neki način povezani s njima. Slavni sportisti su više od medijskih zvijezda; od njih se očekuje da podrže vrijedosti svoje kulture, ali i morala kao takvog i to u svakom pogledu (Jones i Schumann, 2000).

Zbog toga slavni sportisti imaju nepodijeljenu pažnju medija i imaju uticaj na društvo kao takvo, u cjelini. Takav pristup naprosto vrbuje profesionalne sportiste da postanu modeli ponašanja putem širenja i konstruisanja urbanih legendi o pobjedama i nadvladavanju brojnih teškoća, kao i naglašavanjem pozitivnog imidža u javnosti i vrijednosti i čvrstine njihovog karaktera, a sve to može imati različite manifestacije i posljedice. Sportski idoli se intervuišu prije, za vrijeme i nakon prenosa sportskih događaja ili se dovode kao specijalni gosti ili komenatatori. Novine, internet portali i kablovske mreže izvještavaju o ugovorima profesionalnih sportista, pravnim pitanjima ali i ličnim uspjesima. Različiti časopisi, tabloidi i novine u svojim člancima nude detalje iz njihovog privatnog života. Novinski dodaci posvećeni slavnim sportistima su postali veoma popularni i u odnosu na situaciju od prije 35 godina, štamana izdanja i dodaci ovog tipa su doživjeli svoju ekspanziju tokom 1990-ih (Ibid).

Ovo je takođe slučaj i u Srbiji, kao i miješanje politike u sport. U upravama gotovo svakog sportskog kluba i nacionalnih sportskih saveza postoji bar neki političar, dok se zauzvrat sportisti i klubovi koriste kao maskote ili simboli čija je zapravo uloga slanje određenih poruka određenoj grupi glasača i predstavnicima neke ciljne grupe. Naime, pokazalo se da slavni sportisti imaju uticaja na stavove i ponašanja osoba čiji su oni idoli (Chung, 2003). Sportski idoli su zapravo veoma važan dio njihove kampanje jer imaju moć da pošalju određenu poruku, naročito mlađim glasačima.

Idol je neko čiji su talenti, postignuća, status i/ili fizički izgled prepoznati i vrijednovani od strane obožavalaca (Yue i Cheung, 2000). Idolatrija se manifestuje u obožavanju idola i oblikovanju sopstvenog ponašanja, naročito u periodu adolescencije (Raviv, Bar-Tal, Raviv i Ben-Horin, 1996). Obožavanje

& Ben-Horin, 1996). Worshipping may be expressed by collecting idol-related memorabilia or trying to meet the idol (Dubner, 2003); modeling is the effort to emulate an idol by mimicking his or her appearance, speech, and activities (Raviv et al., 1996).

De Ruyter and Conroy (2002) argue that the internalization is a dual process. An ideal becomes part of a person's ideal identity because she desires to be like an ideal person or to poses an ideal character trait. This involves not only a cognitive assessments, the person also deeply desires to become a certain person. Once it is part of her ideal identity, the ideal itself motivates her to strive towards its realization and act accordingly. This is the case when a person believes she is able to influence herself in the direction of her ideals and mean of person can reach it is an idolization, ie. choice of sports idol.

Symbolic benefits are referred to the identification (Maddux & Rogers, 1980) and internalization (Kamins, Brand, Hoeke, & Moe, 1989) experienced by the sport consumer in relation to the sport idol. Identification occurs when the sport consumer perceives the sport celebrity brand image as being attractive (Ibid), and is the "orientation of the self in regard to other objects including a person or group that results in feelings or sentiments of close attachments" (Maddux & Rogers, 1980). Internalization has been described as taking place when an individual embraces the attitudes and behaviors of other individuals because of conformity in the values of the individuals (Premeaux, 2005). The appeal of sport stars is believed to be far more than just inspirational. Sport celebrities are believed to impact the lives of others to such a degree that they can shape the values and behaviors of those that admire them (Wann, Melnick, Russell, & Pease, 2001). The attractiveness of the celebrity relies on the similarity, familiarity and liking of that celebrity by consumers (Erdogan 1999; Erdogan, Baker, & Tagg, 2001; Maddux & Rogers, 1980; McGuire, 1985). Adolescents view sport celebrities as the most heroic celebrities and that is why appealing athletic skills, pro-social behaviors, and traits of a star player can contribute to adolescents' identity construction (Stevens, Lathrop, & Bradish, 2003) and later as adults, they idolize sport celebrities more intensely than other celebrities (McCutcheon, Lange, & Houran, 2002).

So, at a very obvious level, it is reasonable to suppose that some sports stars inspire young players, since the phenomenon of idolization is a characteristic of adolescence. An idol is someone whose talents, achievements, status, or physical appearance are esse može manifestovati kao skupljanje predmeta, uspomena i suvenira ili kao pokušaj da se upozna određeni idol ili stupi u kontakt s njim (Dubner, 2003); dok oblikovanje ponašanja predstavlja pokušaj da se osoba ugleda na svog idola putem oponašanja njegovog izgleda, govora ili aktivnosti (Raviv i saradnici, 1996).

De Ruyter i Conroy (2002) tvrde da je internalizacija dvostruki proces. Ideal postaje dio idealnog identiteta neke osobe jer ona želi da bude poput te idealne osobe ili da posjeduje neke njene karakterne osobine. Ovo uključuje ne samo kognitivnu procjenu, već osoba zaista duboko želi da postane poput te idealne osobe. Kada jednom postane dio njenog idealnog identiteta, sam taj ideal je motiviše da teži ka njegovoj manifestaciji i da djela u skladu s tim. To se dešava onda kada osoba vjeruje da je sposobna da usmjerava sebe u pravcu svojih ideala, a način na koji to može postići je idolizacija, odnosno izbor sportskog idola.

Određene simboličke beneficije se povezuju sa identifikacijom (Maddux i Rogers, 1980) i internalizacijom (Kamins, Brand, Hoeke i Moe, 1989) koju potrošači i konzumenti sporta doživljavaju u odnosu na svog sportskog idola. Identifikacija počinje kada potrošač počne da opaža slavnog sportistu kao brend koji mu je iz nekog razloga privlačan (Ibid) i zapravo predstavlja "usmjeravanje selfa u pravcu drugih objekata uključujući tu i osobe ili grupe, a što ima za rezultat doživljaj ili osjećaj bliske povezanosti" (Maddux i Rogers, 1980). Internalizacija se opisuje kao proces koji se odvija kada osoba usvaja stavove i ponašanje drugih osoba uslijed želje za usklađivanjem sa vrijednostima drugih osoba i konformizma (Premeaux, 2005). Apel koji upućuju sportske zvijezde ne predstavlja puku inspiraciju već nešto čemu se vjeruje. Smatra se da slavni sportisti imaju uticaja na živote drugih u tom stepenu da mogu oblikovati vrijednosti i ponašanja onih koji im se dive (Wann, Melnick, Russell i Pease, 2001). Snaga privlačnosti slavnih ličnosti počiva u sličnosti, bliskosti i dopadljivosti sa njihovim obožavaocima (Erdogan 1999; Erdogan, Baker i Tagg, 2001; Maddux i Rogers 1980; McGuire 1985). Adolescenti slavne sportiste smatraju najvećim herojma među poznatima i zbog toga privlačnost fizičkih vještina, prosocijalno ponašanje i osobine ličnosti slavnih sportista mogu doprinijeti konstruisanju identiteta adolescenata (Stevens, Lathrop i Bradish, 2003) i kasnije, u odraslom dobu, oni idoliziraju slavne sportiste u većoj mjeri u odnosu na ostale poznate ličnosti (McCutcheon, Lange, & Houran, 2002).

Stoga je razložno pretpostaviti da neke sportske zvijezde inspirišu mlade sportiste, budući da je femonen idolizacije karakterističan za adolescenciju. Idol je neko čiji talenti, uspjesi, položaj ili izgled bivaju prepoznati i uvaženi od strane njegovih/njenih obožavalaca. Gledajući uspjehe, socijalni status i bogatstvo sportista koji se takmiče u seniorskim kategori-

pecially recognized and appreciated by his or her fans. Watching success and social status and wealth of senior athletes, young people, and especially young athletes, at the beginning of their career can be dazzled by them and that may have an influence on their choice of sport and decisions about their sport career and also their inner, adopted values. But also, as times goes by, with many years spend in sport, and with certain experience, winning and losing, athlete opinion about certain sports success and personality of top athletes and their personality inevitably changes.

Perhaps more famous for their celebrity status than for their greatness or heroism (Boorstin, 1961), professional athletes qua athletes are immortalized by their fans and have substantial influence on young admirers (Jones & Schumann, 2000). Although sports heroes are recognized for their athletic greatness and sports celebrities are recognized for their fame (Stevens et al., 2003), characterizations such as idol, role model, and star are used synonymously (Bush, Martin, & Bush, 2004; Lines, 2001). Young fans' reactions to a favorite celebrity may be called adoration, infatuation, and idolatry (Raviv et al., 1996); for athletes, such reactions may be sport dependent (Martin, 1996). Notwithstanding Charles Barkley's well-known protestations, sports role models can shape young admirers' attitudes and behaviors. For example, adolescents' demeanor, fashion, language, and mindset may all be influenced by the analogous traits of favored sports celebrities (Lines, 2001).

Sports heroes play a central role in the nation-building process, and in the creation of the national image, but in they are also used in image making and for the promotion of international corporations. These heroes can present a healing choice in hard times or times of national crisis. A sports hero can also function as a symbol of time. Sports heroes can symbolize economic growth. Or they can act as symbols of the process of internationalization of the whole society.

Role models, heroes and idols are a part of everyday life and therefore are thought to have a significant impact on the beliefs and actions of individuals. They are also frequently used in programs to deliver messages to a target group in order to evoke behaviour change. Research about athletic role models more commonly examines the influence of personally known role models, such as parents, peers, and coaches. As such, little is known about how and why famous or professional athletes are chosen and what influence they have on the athletes who admire them (Harris, 1986). The present study sought to contribute to the

jama, mladi ljudi, a naročito mladi sportisti, koji su na početku karijere mogu biti zaslijepljeni time što može imati uticaja na izbor sporta kojim će se baviti, na odluke koje donose u svojoj sportskoj karijeri ali i njihove unutrašnje, usvojene vrijednosti. Ali, kako vrijeme prolazi, nakon godina provedenih u sportu i sa određenim nivoom iskustva, pobjedama i porazima, mišljenje sportista o određenim sportskim uspjesima i rezultatima, kao i ličnosti vrhunskih sportista, ali i o njihovoj sopstvenoj ličnosti, se neminovno mijenja.

Iako poznatiji po svom statusu slavnih sportista nego po svojoj ljudskoj veličini ili herojskim djelima (Boorstin, 1961), o profesionalnim sportistima se stvaraju mitovi od strane njihovih obožavalaca i zbog toga oni imaju znatan uticaj na mlade (Jones i Schumann, 2000). Mada su sportski idoli prepoznati prvenstveno zbog svojih sportskih uspjeha, slavni sportisti su poznati i zbog svoje slave i medijske eksponiranosti (Stevens i saradnici, 2003) i stoga se u njihovom slučaju izrazi idol, uzor, model ponašanja, "zvijezda" koriste kao sinonimi (Bush, Martin i Bush, 2004; Lines, 2001). Reakcije mlađih obožavalaca na svog idola mogu se okarakterisati kao divljenje, zanesenost i idolopoklonstvo (Raviv i saradnici, 1996); dok za same sportiste, reakcija na takve pojave može biti i zavisnost od sporta i fizičke aktivnosti (Martin, 1996). Uprkos poznatom protestu Čarlsa Barklija (da sportski idoli ne mogu vaspitavati djecu umjesto njihovih roditelja) sportisti kao modeli ponašanja mogu ipak oblikovati ponašanja i stavove njihovih mladih obožavalaca, npr. na ponašanje, oblačenje, izražavanje i način razmišljanja fanova mogu uticati njihove analogije i poređenje da osobinama omiljenih slavnih sportista (Lines, 2001).

Sportski heroji imaju centralnu ulogu u procesu građenja nacionalne svijesti i procesu formiranja imidža nacije, ali se takođe koriste i za potrebe stvaranja imidža i promocije globalnih korporacija. Ovi idoli mogu predstavljati (mentalno i socijalno) zdrave uzore u teškim vremenima i/ili periodima nacionalnih kriza. Sportski idol takođe može imati i ulogu simbola jednog vremena. Sportski idoli mogu biti simbol i ekonomskog napretka. Ili, pak, mogu biti simbol procesa internacionalizacije određenog društva.

Uzori, heroji i idoli su dio svakodnevnice i stoga se smatra da oni posjeduju značajan uticaj na uvjerenja i djela pojedinaca. Takođe, oni se često pojavljuju u programima ili akcijama kako bi prenijeli poruku nekoj ciljnoj grupi u pokušaju da se izvrši određena promjena u ponašanju ili svijesti te grupe. Istraživanja o ulozi sportskog idola najčešće se bave ispitivanjem uticaja ličnosti poznatih modela i uzora kao što su roditelji, vršnjaci i treneri. Stoga se malo toga zna o tome kako i zašto se slavni ili profesionalni sportisti biraju za idole i kakav uticaj oni imaju na one sportiste koji im se dive (Harris, 1986). Ovo istraživanje ima za cilj doprinos stručnoj javnosti tako što će dati odgovore na nekoliko do sada neodgovorenih pitanja u vezi sa tim ko su sportski idoli, kog su pola ali

literature by addressing several unanswered questions about the prevalence, gender and some other characteristics of sports idols, particularly in domain of sport as profession. And especially uninvestigated area is examining of sports idols among athletes.

METHODS

The sample included 318 Serbian proffesional senior athletes (183 man and 135 woman), 18 to 40 years old (*M*=21; *SD*=3.5). Respondents were engaged in 28 different sports (mostly volleyball, water polo, basketball, karate, bocca, savate, handball, kyokushin) and with significant sports' experience (*M*=11, *SD*=4).

The independent variables were gender and selected idol and dependent variables were sport, gender, actuality (actual or retrieved) and origin (domestic or foreign) of an idol.

The instrument was constructed specially for this purpose and consisted of demographic data and open question about respondents' idol.

Data were analysed by chi-square and frequencies.

RESULTS

Senior athletes for their sports idols, in most cases elect Roger Federer, followed by Michael Jordan, Milorad Čavić, Usein Bolt and Novak Đoković. However, there was no statically significant difference according to gender (χ^2=125.025; *df*=101; *p*<.053). For male athletes idols are Michael Jordan, Milorad

i nekim drugim njihovim odlikama, naročito u domenu profesionalnog sporta. Tim prije što je posebno rijetko istraživano područje sportskih idola samih sportista.

METHODE

Uzorkom je bilo obuhvaćeno 318 srpskih profesionalnih sportista seniora (183 sportista i 135 sportistkinja), 18-40 starosti (*M*=21; *SD*=3,5). Ispitanici su se bavili sa 28 različitih sportova (najviše odbojkom, vaterpolom, košarkom, karateom, boćanjem, savateom, rukometom, kjokušinom) a imali su u veliko sportsko iskustvo (*M*=11; *SD*=4).

Nezavisne varijable su bile pol i odabrani idol a zavisne sport, pol , aktuelnost (aktivan ili bivši sportista) i porijeklo idola (domaći ili strani).

Anketa je sačinjena u svrhe ovog istraživanja i sastojala se od pitanja o demografskim podacima ispitanika i pitanja otvorenog tipa o sportskom idolu.

Dobijeni podaci su obrađeni pomoću χ^2 i frekvencija.

RESULTS

Sportisti seniori su za svoje sportske idole u najvećem broju proglasili Rodžera Federera, Majkla Džordana, Milorada Čavića, Useina Bolta i Novaka Đokovića. Ali, nisu dobijene statistički značajne razlike između sportista i sportistkinja (χ^2 =125,025; *df*=101; *p*<0,053). Sportisti su za svoje idole proglasili Majkla Džordana, Milorada Čavića i Rodžera Feder-

TABLE 1
List of sports idols of senior athletes.

TABELA 1
Rang lista of sportskih idola sportista seniora.

Rank	Total		Male		Female	
	Athlete	%	Athlete	%	Athlete	%
1	Roger Federer	8.5	Michael Jordan	19.0	Roger Federer	11.0
2	Michael Jordan	8.2	Milorad Čavić	16.0	Novak Đoković	9.0
3	Milorad Čavić	7.5	Roger Federer	16.0	Milorad Čavić	8.0
4	Usein Bolt	6.0	Usein Bolt	11.0	Usein Bolt	8.0
5	Novak Đoković	5.0	Novak Đoković	7.0	Andrea Lekić	7.0
6	Rafael Nadal	3.5	Rafael Nadal	6.0	Michael Jordan	7.0
7	Andrea Lekić	2.2	Michael Felps	5.0	Jasna Šekarić	5.0
8	Vladimir Vujasinović	2.2	Aleksandr Karelin	4.0	Rafael Nadal	5.0
9	Jasna Šekarić	1.9	Vladimir Vujasinović	4.0	Jelena Janković	4.0

Legend/Legenda: Rank - Rang; Total - Ukupno; Male - Muškarci; Female - Žene; Athlete - Sportista.

Čavić and Roger Federer and for female athletes idols are Roger Federer, Novak Đokovic, Milorad Čavić and Usein Bolt.

It turns out that there is significant difference between male and female athletes according to gender of idol (χ^2=37.607; *df*=1; *p*<.000). Both male and female athletes dominantly choose male athlete as their idol, but female athletes have larger percent of female idols. Actually, only four men choose female athlete as his idol. Senior female athletes select for their idols 87.4% male athletes and 12.6% female athletes.

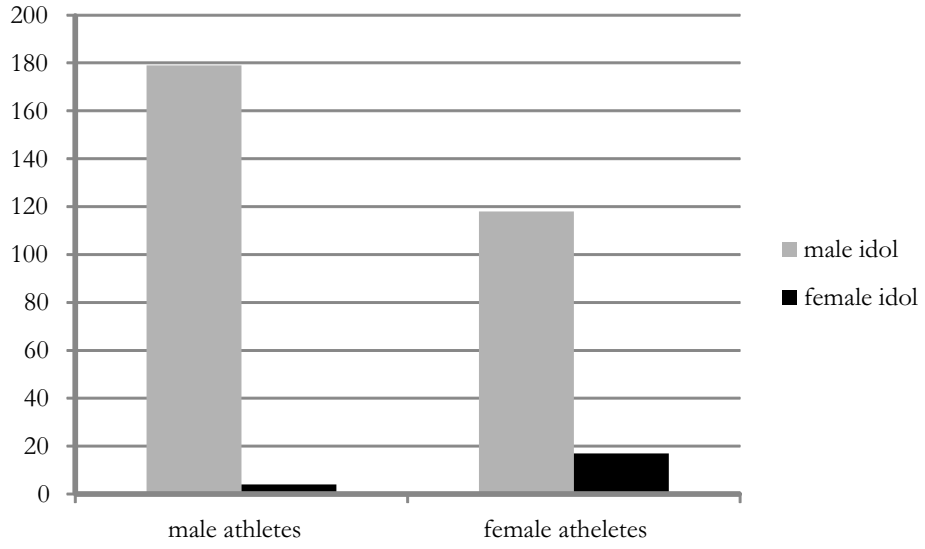
era a sportistkinje Rodžera Federera, Novaka Đokovića, Milorada Čavića i Useina Bolta.

Ispostavilo se da postoji značajna razlika između sportista i sportistkinja kada je u pitanju pol odabranog idola (χ^2=37,607; *df*=1; *p*<0,000). Oba pola dominantno biraju muškarce za svoje idole, ali sportistkinje ipak biraju veći procenat ženskih idola. Zapravo, samo četiri muškarca su izabrala ženu za svog sportskog idola. Sportistkinje senirskog uzrasta za svog idola u 87,4% slučajeva biraju sportistu a u 12,6% sportistkinju.

Postoji i značajna razlika u polu idola između

FIGURE 1
List of sports idols of senior athletes.

SLIKA 1
Rang lista of sportskih idola sportista seniora.



Legend/Legenda: Male idol - Muški idoli; Female idol - Ženski idoli; Male athletes - Sportisti; Female athletes - Sportistkinje.

There is also significant difference between athletes of different branches of sport according to gender of their idol (χ^2=42.829; *df*=27; *p*<.027). Only handball players choose more female than male idols. Senior savate and jiu jitsu fighters choose none of female idols, so as athletics.

It turns out that the majority of athletes selected for their idol person that comes out of their sport (χ^2=2292.355; *df*=702; *p*<.000). This was the case among soccer, water polo, basketball and handball players and also among athletics (track and field), gymnastics and wrestling. Exceptions were volleyball players who dominantly chose their idol among basketball players and tennis players. The same case was with dance, fencing and karate who chose their idol from tennis and jiu jitsu fighters chose their idol from swimming.

sportista koji se bave različitim sportovima (χ^2=42,829; *df* =27; *p*<0,027). Jedino rukometaši biraju više ženske nego muške idole. Savate i džiu džicu borci, kao ni atletičari, ne biraju žene za svoje idole.

Većina sportista za svog idola bira osobu koja se bavi njihovim sportom (χ^2=2292,355; *df*=702; *p*<0,000). Ovo je naročito bio slučaj u fudbalu, vaterpolu, košarci, rukometu, atletici, gimastici i rvanju. Izuzeci su bili odbojkaši koji su svoje idole tražili u košarci i tenisu. Isti slučaj je bio i sa plesom, mačevanjem i karateom, gdje su idoli traženi među teniserima, dok su dži džicu borci idole tražili među plivačima.

Idoli sportista seniora uglavnom dolaze iz tenisa, košarke i plivanja ali postoji statistički značajna razlika u odnosu na pol (χ^2=45,965; *df*=26; *p*<.009). Naime, sportisti oba pola biraju idole iz svijeta tenisa i košarke, ali sportisti više biraju idole u košarci, plivanju i fud-

Idols of senior athletes mostly come from tennis, basketball and swimming, but there is also significant difference according to gender (χ^2=45.965; *df*=26; *p*<.009). Both gender chose their idol from tennis and basketball, but men more chose idols from basketball, swimming and soccer and women more chose idols from water polo. Women do not choose their idol in boxing and kick boxing and male don't choose their idol in handball and shooting, while they have similar attitude toward athletics and volleyball.

TABLE 2
Sports from which sports idol coming from.

TABELA 2
Sportovi kojima se bave izabrani idoli.

Rank	Total		Male		Female	
	Sport of Idol	%	Sport of Idol	%	Sport of Idol	%
1	tennis	21.5	tennis	34.0	tennis	31.0
2	basketball	17.9	basketball	31.0	basketball	23.0
3	swiming	11.3	swiming	21.0	swiming	13.0
4	soccer	9.6	soccer	18.0	water polo	13.0
5	athletics	8.9	athletics	14.0	athletics	13.0
6	water polo	7.0	water polo	8.0	soccer	11.0
7	volleyball	4.0	volleyball	6.0	handball	7.0
8	handball	2.3	boxing	6.0	volleyball	6.0
9	boxing	2.0	kick boxing	5.0	shooting	5.0

Legend/Legenda: Rank - Rang; Total - Ukupno; Male - Muškarci; Female - Žene; Sport of Idol - Sport idola: Tennis - Tenis; Basketball - Košarka; Swiming - Plivanje; Soccer - Fudbal; Athletics - Atletika; Water polo - Vaterpolo; Volleyball - Odbojka; Handball - Rukomet; Boxing - Boks; Kick boxing - Kikj boks; Shooting - Streljaštvo.

It turns out that senior athletes for their idol choose more often foreign athletes – 61.6 % and in 38.4 % domestic athletes. There was statistically significant difference between male and female respondents according to origin of chosen idol (χ^2=10.668; *df*=1; *p*<.001) and also between respondents from different branches of sports according to origin of chosen idol (χ^2=46.979; df=27; *p*<.010). The highest percent of domestic athletes as their idols chose water polo and handball players, bocca, kick boxing and jiu jitsu fighters.

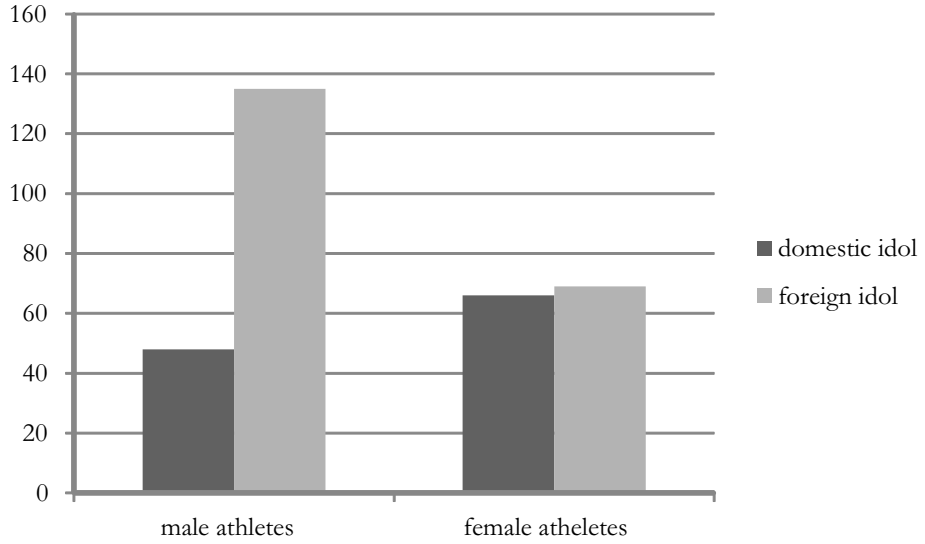
It turns out that senior athletes for their idol choose more often active athletes – 73.8 % and in 26.2 percents of case retrieved athletes. There is no statistically significant difference between male and female respondents according to actuality of chosen idol. But, water polo, volleyball and basketball players and kyokushinkai fighters in larger percent then others choose their idol among retrieved athletes (χ^2=58.803; *df*=27; *p*<.000).

Pokazalo se da sportisti seniori za svog idola više biraju strane sportiste – 61,6 % a u 38,4 % domaće. Postoji i statistički značajna razlika između sportista i sportistkinja kada je u pitanju porijeklo odabranog idola (χ^2 =10,668; *df*=1; *p*<0,001) kao i između sportista koji se bave različitim sportovima (χ^2=46,979; *df*=27; *p* <0,010). Najveći broj vaterpolista, rukometaša, boćara, kik boksera i džiu džicu boraca za svog idola bira domaće sportiste.

Ispostavilo se da sportisti seniori za svog idola više biraju aktivne sportiste – 73,8 % a samo u 26,2 % bivše. Nije dobijena značajna razlika između sportista i sportistkinja u odnosu na aktuelnost bavljenja sportom njihovog idola. Međutim, vaterpolisti, odbojkaši, košarkaši i kjokušin borci su u značajnijem procentu u odnosu na ostale birali idola među sportistima koji su okončali karijeru (χ^2=58,803; *df*=27;

FIGURE 2
Rang lista of sportskih idola sportista seniora.

SLIKA 2
Porijeklo idola u odnosu na pol ispitanika.



Legend/Legenda: Domestic idol - Domaći idoli; Foreign idol - Strani idoli; Male athletes - Sportisti; Female athletes - Sportistkinje.

Also, when it come to names, idol for water polo players was Vladimir Vujasinović, for handball players Andrea Lekić, for volleyball and basketball players Michael Jordan, for wrestlers Aleksandr Karelin and for jiu jitsu fighters the idol was Milorad Čavić (χ^2=3761.762; *df*=2727; *p*<.000).

DISCUSSION

Senior athletes for their sports idols, in most cases elect Roger Federer, followed by Michael Jordan, Milorad Čavić, Usein Bolt and Novak Đoković. However, there was no statically significant difference according to gender. But, it is very significant data that there are three female athletes present on the list: Andrea Lekić, Jasna Šekarić and Jelena Janković and they were chosen only by female. So, including gender of athlete show some important data which would be lost if this distinction wasn't make. Also, very characteristic data is absence of Aleksandr Karelin and Vladimir Vujasinović at girl's sample. Reason for this might be a strong masculine message in water polo and wrestling, which symbolize high presence of physical strength and power and emphasize masculine body shape. Also, these sports are not very popular and numerous among girls in Serbia and there are no important results of domestic female athletes in these sports. In a study of young people in Germany by Biskup and Pfister (1999), girls and boys very rarely identified with sports women despite the high

Takođe, kada su u pitanju konkretna imena, idol vaterpolista je Vladimir Vujasinović, rukometaša Andrea Lekić, odbojkaša i košarkaša Majkl Džordan, rvača Aleksandar Karelin a džiu džicu boraca Milorad Čavić (χ^2 =3761,762; *df*=2727; *p*<0,000).

DISKUSIJA

Sportisti seniori za svog sportskog idola većinom birali Rodžera Federera, Majkla Džordana, Useina Bolta i Novaka Đokovića. Međutim, nije dobijena statistkički značajna razlika između polova. Ali, veoma značajan podatak je da su samo tri sportistkinje prisutne na listi idola: Andrea Lekić, Jasna Šekarić i Jelena Janković, kao i da ih biraju samo sportistkinje. Stoga se pokazalo da se uključivanjem pola ispitanika kao varijable dobijaju važni podaci koji bi inače bili zanemareni. Takođe, simptomatično je i nenavođenje Aleksandra Karelina i Vladimira Vujasinovića od strane sportistkinja. Razlog za ovo može biti snažna maskulina poruka koja se šalje u vaterpolu i rvanju jer ovi sportovi simboliziraju visoko prisustvo fizičke snage i moći i potenciraju maskulinu tjelesnu kompoziciju. Takođe, ovi sportovi nisu naročito popularni niti omasovljeni među ženskom populacijom u Srbiji i stoga i ne postoje značajni rezultati domaćih sportistkinja u ovim sportovima. U studiji koju su na mladima u Njemačkoj sprovele Biskup i Pfister (1999),

profile of Steffi Graf in the German sporting culture. Results of this research are consistent with theirs, but it is important to say that Andrea Lekić, Jasna Šekarić and Jelena Janković are domestic athletes and still active and they are among best ever in Serbia in their sports.

Both male and female athletes dominantly choose male athlete as their idol, but female athletes have larger percent of female idols. Senior athletes select for their idols 87.4% male athletes and 12.6% female athletes. Balswick and Ingoldsby (1982) surveyed American adolescents and found that seven male heroes were selected for every one female heroine. Melnick and Jackson (2002) found that 78.4% of chosen idols were males and 21.6% females. Cross-tabulations revealed that 89.8% of the males chose a same-sex idol while just 10.2% 'crossed over' and chose a female. For females, six times as many (66.8%) 'crossed-over' and chose a male public figure for their hero; just 33.2% chose a female. On the contrary, Teigen, Normann, Bjorkheim, and Helland (2000) found that the same sex idols were chosen by practically all the boys and by 83% of the girls. In sport area, while boys almost exclusively mentioned same sex models, about 30% of the girls selected a person of the opposite sex, with the hero from the Lillehammer Olympics, Koss, mentioned almost equally often by girls as by boys. There is also significant difference between athletes of different branches of sport according to gender of their idol. Only handball players choose more female than male idols. Reason for this is the fact that Serbian male handball players are not as the top level as they used to be for many years, until Andrea Lekić is one of the best female handball players in the world in this moment. Senior savate and jiu jitsu fighters choose none of female idols, so as athletics.

It turns out that the majority of athletes selected for their idol person that comes out of their sport. This was the case among soccer, water polo, basketball and handball players and also among athletics (track and field), gymnastics and wrestling. Fleming, Hardman, Jones, and Sheridan (2005) also found that elite young British rugby league players dominantly choose idol from their sport. Exceptions were volleyball players who dominantly chose their idol among basketball players and tennis players. The same case was with dance, fencing and karate who chose their idol from tennis and jiu jitsu fighters chose their idol from swimming. The reason for this might be enormous success of domestic athletes in these sports and their media coverage in our country, which is much more then dance, fencing, karate and jiu jitsu.

dječaci i djevojčice su se veoma rijetko poistovjećivali sa sportistkinjama uprkos visoko pozicioniranoj Štefi Graf u njemačkoj sportskoj kulturi. Rezultati dobijeni u ovom istraživanju su konzistetni sa njihovim nalazima, ali je važno napomenuti da su Andrea Lekić, Jasna Šekarić i Jelena Janković domaće sportiskinje, koje su još uvijek aktivne u svom sportu, ali i da su među najboljima u svom sportu u Srbiji ikada.

I sportisti i sportistkinje u velikoj većini biraju muškarce za svoje sportske idole, iako sportistkinje u daleko većem broju navode i ženske idole. Sportisti seniori za svog idola u 87,4% slučajeva navode muškarce a u 12,6% žene. Balswick i Ingoldsby (1982) su u istraživaju dobijenom na američkim adolescentima dobili da na 7 odabranih idola muškaraca dolazi jedan ženski idol. Melnick i Jackson (2002) su dobili da su 78,4% odabranih idola muškarci a of 21,6% žene. Pokazalo se i da 89,8% muškaraca bira idola istog pola dok je samo 10,2% navelo ženu. Žene su šest puta više (66,8%) za svoje idole navodile muškarce nego žene a samo 33,2% je izabralo ženu. Suprotno tome, Teigen, Normann, Bjorkheim i Helland (2000) su dobili da su idoli istog pola odabrani od strane 83% i dječaka i djevojčica. Na polju sporta, dok dječaci gotovo isključivo navode idole istog pola, oko 30% djevojčica su birale osobu suprotnog pola dok se heroj iz Lilehamera, Kos, spominje gotovo jednako i kod djevojčica i kod dječaka. Također, postoji i značajna razlika među sportistima koji se bave različitim sportovima kada je u pitanju pol njihovog idola. Samo rukometaši češće navode ženske nego muške idole. Objašnjenje za to može biti činjenica da muški rukomet u Srbiji više nije na onom nivou na kom je bio prije mnogo godina, dok je Andrea Lekić jedna od najboljih rukometašica na svijetu u ovom trenutku. Savate i džiu džicu borci, kao ni atletičari ne navode žene za svoje idole.

Pokazalo se da većina sportista bira za svog idola osobu koja se bavi njihovim sportom. To je naročito bilo izraženo u fudbalu, vaterpolu, košarci, rukometu, atletici, gimnastici i rvanju. Fleming, Hardman, Jones i Sheridan (2005) su također ustanovili da vrhunski mladi ragbisti u Britaniji uglavnom biraju idola koji dolazi iz svijeta ragbija. Izuzetak su odbojkaši koji svog idola uglavnom traže među košarkašima i teniserima. Isti slučaj je bio i sa plesačima, mačevaocima i karatistima koji svog idola traže među teniserima kao i kod džiu džicu boraca, čiji su idoli plivači. Objašnjenje za tu pojavu može biti veliki uspjeh domaćih sportista u ovim sportovima kao i medijska propraćenost u našoj zemlji, a koja je svakako mnogostruko veća nego kada su u pitanju ples, mačevanje, karate i džiu džicu. Kada su u pitanju konkretna imena, idol vaterpolista je Vladimir Vujasinović,

Also, when it come to names, idol for water polo players was Vladimir Vujasinović, for handball players Andrea Lekić, for volleyball and basketball players Michael Jordan, for wrestlers Aleksandr Karelin and for jiu jitsu fighters the idol was Milorad Čavić. Idols of senior athletes mostly come from tennis, basketball and swimming, but there is also significant difference according to gender. Both genders chose their idol from tennis and basketball, but men more chose idols from basketball, swimming and soccer and women more chose idols from water polo. Women do not choose their idol in boxing and kick boxing and male don't choose their idol in handball and shooting, while they have similar attitude toward athletics and volleyball.

It turns out that senior athletes for their idol choose more often foreign athletes – 61.6% and in 38.4% domestic athletes. Equal results found Melnick and Jackson (2002): domestic idol choose 36% of American and 34.2% of New Zealand sample. But, there was statistically significant difference between male and female respondents according to origin of chosen idol and also between respondents from different branches of sports according to origin of chosen idol. The highest percent of domestic athletes as their idols chose water polo and handball players, bocca, kick boxing and jiu jitsu fighters. Explanation for this is large amount of very successful athletes in Serbia in these sports for a very long time.

It turns out that senior athletes for their idol choose more often active athletes – 73.8 % and in 26.2 % retrieved athletes. These findings are not consisted with Teigen et al. (2000) who found that almost all idols were active. There is no statistically significant difference between male and female respondents according to actuallity of chosen idol. But, water polo, volleyball and basketball players and kyokushinkai fighters in larger percent then others choose their idol among retrieved athletes. So it seems that sports results have only contemporary value even among senior athletes, with large sport experience.

CONCLUSION

It seems that actuality of results and sports branch have the most significant role in process of choice of Serbian proffesional senior athletes sports idols, so as media coverage and international career and longer international sports experience in top level in process of adoption of behavior model and its contained intrinsic values. Senior athletes are more open toward values which promote foreign male athletes who are still active and coming from their sport, which emphasize their concentration on top results at inter-

rukometaša Andrea Lekić, odbojkaša i košarkaša Majkl Džordan, rvača Aleksandar Karelin i džiu džicu boraca Milorad Čavić. Idoli sportista seniorskog uzrasta uglavnom se bave tenisom, košarkom i plivanjem, ali postoji i značajna razlika u odnosu na pol ispitanika. Oba pola navode za idole sportiste koji se bave tenisom i košarkom, ali muškarci više navode idole iz košarke, plivanja i fudbala, a žene iz vaterpola. Žene svoje idole ne vide u bokserima i kik bokserima, a muškarci u rukometu i streljaštvu, dok slično mišljenje oba pola imaju prema atletičarima i odbojkašima.

Pokazalo se da sportisti seniori za svog idola češće biraju strane sportiste 61,6% a u 38,4% domaće. Identičan rezultat su dobili Melnick i Jackson (2002): domaće idole je biralo 36% amerikanaca i 34,2% novozelanđana. Ali, dobijena je i statistički značajna razlika između muškaraca i žena u odnosu na porijeklo odabranog idola kao i između ispitanika koji se bave različitim sportovima. Domaće sportiste su najviše birali vaterpolisti, rukometaši, boćari, kik bokseri i džiu džicu borci. Objašnjenje za ovo može biti dugogodišnji veliki broj veoma uspješnih srpskih sportista koji su se ovim sportovima bavili.

Sportisti seniori za svoje idole češće biraju aktivne sportiste – 73,8 %, a u 26,2 % bivše. Ovi rezultati nisu u saglasnosti sa onim što su dobili Teigen i saradnici (2000), a to je da su skoro svi idoli bili aktivni sportisti. Takođe, nije dobijena ni statistički značajna razlika između sportista i sportistkinja u odnosu na aktuelnost bavljenja sportom idola. Ali, vaterpolisti, odbojkaši, košarkaši i kjokušin borci su u daleko većem broju u odnosu na ostale za svoje idole proglašavali sportiste koji su se povukli iz aktivnog takmičenja. Stoga se čini da sportski rezultati imaju samo trenutačnu i privremenu vrijednost čak i među sportistima seniorima sa velikim sportskim iskustvom.

ZAKLJUČAK

Čini se da aktuelnost postignutih rezultata i vrsta sporta imaju najznačajniju ulogu u procesu izbora sportskog idola srpskih profesionalnih sportista seniorskog uzrasta, kao i medijska pokrivenost i međunarodna karijera i duže sportsko iskustvo u vrhunskom sportu, ali i za proces usvajanja modela ponašanja i unutrašnjih vrijednosti koje ti modeli sadrže. Sportisti seniori su otvoreniji za vrijednosti koje promovišu strani sportisti muškarci koji se još uvijek aktivno bave sportom i koji dolaze iz istog sporta kojim se i oni bave, što zapravo odslikava njihovo stavljanje akcenta na vrhunske rezultate na međunarodnom nivou kao i njihovu težnju za napredovanjem u sopstvenoj karijeri. Žene i domaći sportisti, kao i oni čija je karijera okončana kao i sportisti

national level as striving toward enhancing in their career. Female and domestic athletes, those whose career is ended and athletes who are competing in other sports are not in focus of senior athletes and their attention is not directed toward past time and legends, nor gender equality or promotion of national identity and values, but only toward reaching international competition and being the top on the world in their sport here and now.

koji se takmiče u drugim sportovima, nisu u fokusu pažnje sportista seniora i njihova pažnja nije usmjerena ka prošlosti i legendama sporta i sportskim veličinama, niti rodnoj ravnopravnosti, niti promociji nacionalnog identiteta i vrijednosti, već je usmjerena samo ka postizanju rezultata na međunarodnim takmičenjima i tome kako da se bude u samom svjetskom vrhu sporta kojim se bave, i to isključivo u odrednicama "ovdje i sad".

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Received: March 11, 2013
Revision received: Jun 10, 2013
Accepted: Jun 29, 2013

Primljeno: 11. mart 2013. godine
Izmjene primljene: 10. jun 2013. godine
Odobreno: 29. jun 2013. godine

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LOS ÍDOLOS DEPORTIVOS DE LOS DEPORTISTAS DE EDAD MAYOR

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El deporte es el producto social e un fenómeno cultural que revela mucho de los valores y normas que aparecen, dominan y quedan como herencia en las culturas y/ o las subculturas de la sociedad determinada. El estado del héroe deportivo es algo que se debe merecer y, lo difícil que es a alcanzar al título de estrella, lo más valorada es la persona – estrella. Héroes deportivos son vistos como personas que presentan un valor bueno y tienen un papel central en la construcción de la conciencia nacional y la formación de la imagen de la nación, pero también la creación y la promoción de la imagen de corporaciones globales. Estos ídolos pueden presentar los modelos sanos en tiempos difíciles y/ o en los periodos de los crisis nacionales, y también pueden tener el papel del símbolo de un tiempo.

El objetivo de la investigación es la identificación de los ídolos de atletas de la edad mayor, porque de tal manera se puede llegar a las conclusiones relacionadas con sus sistemas de valor. La muestra incluyo a 318 deportistas mayores serbios de nivel profesional alto (183 hombres y 135 mujeres), de la edad desde 18 hasta 40 años. Los encuestados procedían de 28 deportes diferentes. Las variables independientes fueron el sexo, el ídolo seleccionado, y los variables dependientes fueron el deporte, el sexo, la actualidad e orígenes del ídolo seleccionado. La encuesta se realizó por esta investigación y consistió de las preguntas de los datos demográficos de encuestados y preguntas del tipo abierto del ídolo deportivo. Los resultados se procesaron a través de χ^2 e a través de las frecuencias.

Para el ídolo deportivo más frecuentemente son elegidos Roger Federer, Michael Jordán, Milorad Cavic. Los atletas mayores en 87,4 casos eligen los hombres, los atletas que practican los mismos deportes que ellos, deportistas de fuera e activos. Por eso parece que los deportistas mayores profesionales serbios se ven más abiertos para los valores que promueven los atletas hombres, exteriores, que todavía activamente practican el deporte y que vienen del mismo deporte, lo que en realidad demuestra que ellos ponen el acento a los resultados excelentes en el nivel internacional, así como su aspiración a alcanzar en su misma carrera.

Las palabras claves: hacer, ídolos, serbia, valores.

SportLogia
2013, 9(1), 27–47
ISSN 1986-6089
e-ISSN 1986-6119
CD-ROM ISSN 1986-6097

STRUKTURA RAZLIČITIH INDIKATORA IZOMETRIJSKE EKSPLOZIVNE SILE OPRUŽAČA NOGU KOD VRHUNSKIH SPORTISTA

STRUCTURE OF DIFFERENT INDICATORS FOR EVALUATING ISOMETRIC LEG EXTENSORS EXPLOSIVE FORCE IN TOP LEVEL ATHLETES

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ORIGINAL SCIENTIFIC PAPER
doi: 10.5550/sgia.130901.en.003I
doi: 10.5550/sgia.130901.se.003I
UDK: 796.015.26:796.012.1

ORGINALNI NUČNI ČLANAK
COBISS.BH-ID: 3814168
COBISS.BH-ID: 3813912

SUMMARY

The aim of this work was to establish factore structure of different indicators force-time curve for evaluating the leg extensors explosiveness regarding different sports and both genders. The research included 378 examinees divided into 8 groups based on gender and training process distinctiveness they have been subjected to. To evaluate contractile characteristics of leg extensors, standardized equipment was used and standardized "seating leg press" test. The isometric force-time characteristics of the leg extensors were evaluated using the 15 variables during unilateral (dominant and non-dominant leg) and bilateral exertions measured at 100 and 50% of the maximal force and at 100, 180 and 250 ms from the beginning of the muscle contraction. The results obtained in this study show that the measured characteristics of the leg extensors explosive force obtained in the bi and unilateral exertions, in regard to the various sports groups, have different structures as a function separate sets of factors influenced by different mechanisms than on training in various sports disciplines.

Key words: factor structure, different trained athletes, force-time curve.

SAŽETAK

Cilj ovog rada bio je utvrditi faktorsku strukturu posmatranih karakteristike tj. indikatora krive sila-vrijeme za procjenu eksplozivnosti opružača nogu u odnosu na različite grupe sportova. U istraživanju je učestvovalo 378 ispitanika raspoređenih u 8 grupa prema polu i specifičnosti trenažnog procesa kojem su bili izloženi. Za procjenu kontraktilnih karakteristika opružača nogu korišćena je standardizovana oprema i standardizovan test u sjedećoj poziciji. Mjerni opseg definisan je na osnovu 15 varijabli koje se odnose na kontraktilne karakteristike izometrijske eksplozivne sile ekstenzora nogu mjerene u unilateralnom (dominanta i nedominanta noga) i bilateralnom režimu mišićne kontrakcije mjerenih na 100 i 50% od maksimalne sile i na 100, 180 i 250 ms od početka mišićne kontrakcije. Rezultati dobijeni u ovom istraživanju pokazuju da mjerene karakteristike eksplozivne sile opružača nogu dobijene u bi i unilateralnom režimu naprezanja u odnosu na različite grupe sportova imaju različitu strukturu u funkciji izdvojenog sklopa faktora pod uticajem drugačijih mehanizama u odnosu na trenažne procese u različitim sportskim disciplinama.

Ključne riječi: faktorska struktura, različito trenirani sportisti, kriva sila-vrijeme.

INTRODUCTION

In metrology procedures in sport (testing procedures) among the already established standards on

UVOD

U metrološkim procedurama u sportu (procedure testiranja) pored utemeljenih standarda o mjerenju

measuring the maximal values of *F-t* curve, recognized in values of maximal isometric force (F_{max}), general indicator of explosiveness ($RFDF_{max}$) and general index of sinergy ($I_{ndx}SNG_{BASIC}$), it is necessary to addopt the specific and special characteristics of *F-t* curve, i.e. special and specific indicators of explosiveness. It is the matter of fact that while performing maximal quick movements of the extremities it is impossible to achieve absolute values of maximal force at the level of full contractile potential of the engaged muscle. Top level athletes in the competitive conditions most commonly perform movements in the time interval of maximal 300 ms (Andersen & Aagaard, 2006). Therefore, any mean of targeted and specific physical fitness should be based on increasing the certain characteristics of explosiveness (RFD_{max}), with the tendency to increase the given characteristics precisely in specific time interval of movement performance, i.e. in the early phase of muscle contraction (Andersen, Andersen, Zebis, & Aagaard, 2010; Hakkinen, Komi, & Kauhanen, 1987; Ivanović, Dopsaj, Ćopić, & Nešić, 2011; Mero, 1988).

Purposefulness of the results on the athletes fitness level and the level of the tested physical property development are directly dependable on applied test and its specificity and sensitivity of the measuring. The specificity of the test in regard to the sports branch, directly affects the evaluation of the fitness level, since the information obtained during specific testing is more valid (Müller, Benko, Raschner, & Schwameder, 2000; Зациорски, 1982; Wilson & Murphy, 1996). One of the aims of this research was to find and verify better, i.e. more valid measures in order to evaluate contractile characteristics of the leg extensors isometric force in different trained top level athletes. Detecting the structure of the space defined as contractile characteristics of the leg extensors isometric force could enable us to detect regularities that rule between the elements of the system in regard to different trained population which consequently should get to the generally precised training process menagement from the aspect of different sports disciplines and in the function of gender. Besides, since all three types of load during movement have been used in sports, it is well known that locomotion – running, jumping, rebound, change of directions, makes the system of bilateral and unilateral exertion, this paper will observe the three regime of muscle contraction.

The suggested approach of the data analisis, which were gathered using the measuring instrument for measuring leg extensors force in the seating position in the conditions of bilateral and unilateral isometric exertion, will enable us to detect the regularities, that can apply among the tested properties of the differ-

maksimalnih vrednosti *F-t* krive, prepoznatih u vrijednostima maksimalne izometrijske sile (F_{max}), opštem pokazatelju eksplozivnosti ($RFDF_{max}$) i opštem indeksu sinergije ($I_{ndx}SNG_{BASIC}$) neophodno je usvojiti i specifične i specijalne karakteristike *F-t* krive, odnosno specijalne i specifične pokazatelje eksplozivnosti. Činjenica je da za vrijeme izvođenja maksimalno brzih pokreta ekstremiteta nije moguće ostvarivanje apsolutnih vrijednosti maksimalnih sila na nivou punog kontraktilnog potencijala angažovanog mišića. Vrhunski sportisti u takmičarskim uslovima najčešće realizuju pokrete u vremenskom intervalu do 300 ms (Andersen i Aagaard, 2006). Zbog toga se svaki vid usmjerene i specifične fizičke pripremljenosti treba bazirati na povećanju određene karakteristike eksplozivnosti (RFD_{max}), sa tendencijom povećanja iste upravo u specifičnom vremenskom intervalu izvođenja datih pokreta, odnosno u ranoj fazi mišićne kontrakcije (Andersen, Andersen, Zebis i Aagaard, 2010; Hakkinen, Komi i Kauhanen, 1987; Ivanović, Dopsaj, Ćopić i Nešić, 2011; Mero, 1988).

Svrsishodnost samih rezultata o utreniranosti sportiste i nivou razvijenosti testiranih fizičkih svojstava direktno zavisi od primjenjenog testa i njegove specifičnosti i osetljivosti mjerenja. Što je test više specifičan u odnosu na sportsku granu u kojoj se sportista takmiči, informacije prikupljene tokom testiranja validnije su za procjenu realnog stanja pripremljenosti (Müller, Benko, Raschner, & Schwameder, 2000; Зациорски, 1982; Wilson & Murphy, 1996). Jedan od zadataka ovog istraživanja je upravo i pronalaženje i verifikacija boljih, tj. validnijih i reprezentativnijih mjera za procjenu konraktilnih karakteristika izometrijske sile opružača nogu kod različito treniranih vrhunskih sportista. Otkrivanjem stukture prostora definisanog kao kontraktilne karakteristike izometrijske sile opružača nogu omogućilo bi se otkrivanje zakonitosti koje vladaju između elemenata sistema u odnosu na različito trenirane populacije što bi trebalo posledično dovesti i do generalno preciznijeg upravljanja trenažnim procesom sa aspekta različitih sportskih disciplina i u funkciji pola. Pored toga, s obzirom da se u sportu koriste sva tri oblika opterećenja tokom kretanja, poznato je da lokomocija tipa trčanja, odskoka, doskoka, promjene pravaca čini sistem bi i unilateralnog naprezanja, u ovom radu će se kontraktilne karakteristike opružača nogu posmatrati u sva tri režima mišićne kontrakcije.

Predloženim pristupom analize podataka dobijenih mjernim instrumentom za mjerenje sile ekstenzora nogu u sjedećoj poziciji u uslovima bilateralnog i unilateralnog izometrijskog naprezanja utvrdiće se zakonitosti koje važe među ispitivanim svojstvima

ent trained athletes system – force contractile characteristics, the acknowledgement on improving the technological training process in diferent disciplines will be complemented.

The aim of this paper was to establish factoral structure of the observed characteristics, i.e. *F-t* curve indicators for evaluation of the leg extensors explosiveness in regard to different trained sports.

METHODS

The research included 378 examinees divided into 8 groups based on gender (male *n*=236 and female *n*=142) and training process distinctiveness they have been subjected to: top level athletes from the speed-strength sports (different track, up to 400 m and field, jumps and throws, disciplines of athletics, weightlifters, gymnasts, skiers and sprint disciplines, up to 200 m, in swimming; male *n*=40 and female *n*=34), top level athletes from the sports with complex exertion of all motoric properties (volleyball, handball, basketball, football, water polo and martial arts – judo, wrestling, boks, taekvondo, fencing; male *n*=99 and female *n*=43), top level athletes from the endurance sports (middle and long distance disciplines of athletics, rowers, swimming disciplins, under 400 m, cyclists, triathletes; male *n*=64 and female *n*=33) and controls consisting of healthy untrained adults, both genders (male *n*=33 and female *n*=32).

Variables

Measurement range was defined by 15 variables regarding the contractile characteristics of leg extensors isometric force measured both unilateral (dominant – RFD_{DO} and nondominant – RFD_{ND} leg) and bilateral (RFD) regime of muscle contraction:

- Indicator of the basic (general) isometric leg extensors explosive force bilateral and unilateral (dominant and nondominant leg), was done by applying the following procedure (Ivanović, Dopsaj, & Nešić, 2011; Zatsiorsky & Kreamer, 2006):

$$\text{Bilateral} - RFD_{Fmax} = F_{max}/tF_{max}$$
$$\text{Dominant leg} - RFD_{FmaxDO} = F_{maxDO}/tF_{maxDO}$$
$$\text{Nondominant leg} - RFD_{FmaxND} = F_{maxND}/tF_{maxND}$$

Where: F_{max}, F_{maxDO}, F_{maxND} represents the maximal value of isometric leg extensors force achieved, bilateral and unilateral (dominant and nondominant leg), and tF_{max}, tF_{maxDO}, tF_{maxND} represents the time in s necessary to reach it bilateral and unilateral (dominant and nondominant leg), expressed in $N \bullet s^{-1}$.

sistema različito treniranih sportista – kontraktilne karakteristike sile, upotpuniće se saznanja potrebna za usavršavanje tehnološkog procesa treninga u različitim sportskim disciplinama.

Cilj ovog rada je utvrđivanje faktorske strukture posmatranih karakteristika, tj. indikatora *F-t* krive za procjenu eksplozivnosti opružača nogu u odnosu na različite grupe sportova.

METODE

U ovom istraživanju je učestvovalo 378 ispitanika raspoređenih u 8 grupa prema polu i specifičnosti trenažnog procesa kojem su podvrgnuti: vrhunski sportisti iz grupe brzinsko-snažnih sportova (različite bacačke, skakačke i sprinterske, do 400 m, discipline atletike, dizači tegova, gimnastičari, skijaši i sprinterske discipline, do 200 m, u plivanju; muškarci *n*=40 i žene *n*=34), vrhunski sportisti iz grupe sportova s kompleksnim ispoljavanjem svih motoričkih svojstava (odbojka, rukomet, košarka, fudbal, vaterpolo i borilačkim sportovima – džudo, rvanje, boks, tekvondo, mačevanje; muškarci *n*=99 i žene *n*=43), vrhunski sportisti iz grupe sportova izdržljivosti (atletske discipline, srednje i dugoprugaši, veslači, određene plivačke discipline, preko 400 m, biciklisti i triatlonci; muškarci *n*=64 i žene *n*=33) i kontrolna grupa sačinjena od netreniranih osoba muškog i ženskog pola (muškarci *n*=33 i žene *n*=32). U odnosu na pol, uzorak ispitanika ženskog pola činilo je ukupno 142 ispitanica a uzorak ispitanika muškog pola 236.

Varijable

Mjerni opseg definisan je na osnovu 15 varijabli koje se odnose na kontraktilne karakteristike izometrijske sile ekstenzora nogu merene u unilateralnom (dominantna – RFD_{DO} i nedominantna – RFD_{ND} noga) i bilateralnom (RFD) režimu mišićne kontrakcije:

- Pokazatelj opšteg ili bazičnog nivoa razvijenosti eksplozivne sile tj. eksplozivnosti opružača nogu bilateralno i unilateralno (dominantne i nedominantne noge), dobijen je na osnovu sljedeće procedure (Ivanović, Dopsaj i Nešić, 2011; Zatsiorsky i Kreamer, 2006):

$$\text{Bilateralno} - RFD_{Fmax} = F_{max}/tF_{max}$$
$$\text{Dominantna noga} - RFD_{FmaxDO} = F_{maxDO}/tF_{maxDO}$$
$$\text{Nedominantna noga} - RFD_{FmaxND} = F_{maxND}/tF_{maxND}$$

Gde: F_{max}, F_{maxDO}, F_{maxND} predstavljaju maksimalnu vrednost dostignute izometrijske sile opružača nogu bilateralno i unilateralno (dominantne i nedominantne noge), dok tF_{max}, tF_{maxDO}, tF_{maxND} predstavljaju vreme u s potrebno da se dostigne maksimalna sila bilateralno i unilateralno (dominantne i nedominantne noge), izraženo u $N \bullet s^{-1}$.

TABLE 1

Descriptive statistics for both genders regarding different groups of sports.

TABELA 1

Osnovni deskriptivni pokazatelji oba pola u odnosu na različite grupe sportova.

	Male					Female				
	BM (kg)	BH (cm)	BMI (kg/m^2)	A (yeras)	TP (years)	BM (kg)	BH (cm)	BMI (kg/m^2)	A (yeras)	TP (years)
Speed-strength sports (male *n*=40; female *n*=34)										
M	80.61	182.10	24.23	21.48	10.95	66.44	169.29	23.16	21.65	11.06
SD	13.81	7.72	3.33	3.43	3.34	19.52	7.41	6.92	3.32	3.19
cV%	17.13	4.24	13.73	15.99	30.46	29.37	4.38	29.86	15.34	28.85
Min	59.00	169.00	18.01	18.00	8.00	50.00	154.00	17.41	18.00	8.00
Max	130.00	203.00	37.18	31.00	20.00	163.20	184.00	60.38	29.00	22.00
Sports with complex exertion of all motoric properties (male *n*=99; female *n*=43)										
M	83.35	183.97	24.57	22.24	11.87	67.49	175.45	21.89	21.16	11.27
SD	11.60	6.97	2.66	4.31	3.72	8.92	10.42	1.92	2.79	2.83
cV%	13.92	3.79	10.84	19.37	31.38	13.22	5.94	8.87	13.16	25.11
Min	51.00	162.00	18.87	17.00	8.00	53.00	158.00	18.59	17.00	7.00
Max	115.00	201.00	33.60	35.00	27.00	87.40	196.00	26.99	27.00	18.00
Endurance sports (male *n*=64; female *n*=33)										
M	82.36	186.67	23.57	23.88	11.27	60.91	171.70	20.57	22.45	8.97
SD	10.18	8.02	1.80	5.04	3.58	8.61	7.31	1.69	5.48	1.76
cV%	12.36	4.30	7.62	21.11	31.76	14.13	4.26	8.19	24.42	19.61
Min	65.00	171.00	18.52	17.00	8.00	48.00	160.00	17.99	17.00	7.00
Max	105.00	204.00	29.71	37.00	25.00	82.00	186.00	24.39	37.00	14.00
Control group (male *n*=33; female *n*=32										
M	80.93	181.24	24.57	24.77		60.36	167.63	21.47	23.16	
SD	10.91	5.59	2.51	5.09		6.29	6.18	1.91	4.69	
cV%	13.48	3.08	10.20	20.55		10.42	3.68	8.91	20.26	
Min	56.00	171.00	19.15	18.00		47.00	155.00	18.42	18.00	
Max	109.00	197.00	30.51	34.00		75.00	180.00	28.04	34.00	

Legend/Legenda: **BM** - Body mass (Tjelesna masa); **BH** - Body hight (Tjelesna visina); **BMI** - Bod mass index (Indeks tjelesne mase); **A** - Ages (Uzrast); **TP** - Training period (Sportski staž); ***M*** - Mean (Aritmetička sredina); ***SD*** - Standard deviation (Standardna devijacija); ***cV%*** - Coefficient of variation (Koeficijent varijacije); ***Min*** - Minimum (Minimum); ***Max*** - Maximum (Maksimum); ***n*** - Number of respondents (Broj ispitanika); Male - Muškarci; Female - Žene; Speed-strength sports - Brzinsko-snažni sportovi; Sports with complex exertion of all motoric properties - Sportovi sa kompleksnim ispoljavanjem svih motoričkih svojstava; Endurance sports - Sportovi izdržljivosti; Conrol group - Kontrolna grupa.

- The indicator of specific isometric leg extensors explosive force or the S gradient of the leg extensors force, as a rate of force development measured at 50% of F_{max}, bilateral and unilateral (dominant and nondominant leg), was measured by applying the following procedure (Ibid):

- Pokazatelj razvijenosti specifičnog nivoa eksplozivne sile tj. eksplozivnosti opružača nogu bilateralno i unilateralno (dominantne i nedominantne noge), ili S gradijent, izmjeren na 50% od F_{max} je dobijen na osnovu slijedeće procedure (Ibid):

$$\text{Bilateral} - RFD_{50\%} = F_{50\%}/tF_{50\%}$$
$$\text{Dominant leg} - RFD_{50\%DO} = F_{50\%DO}/tF_{50\%DO}$$
$$\text{Nondominant leg} - RFD_{50\%ND} = F_{50\%ND}/tF_{50\%ND}$$

Where: $RFD_{50\%}$, $RFD5_{0\%DO}$, $RFD_{50\%ND}$ represents the value of isometric force achieved at 50% of F_{max}, bilateral and unilateral (dominant and nondominant leg), and $tF_{50\%}$, $tF_{50\%DO}$, $tF_{50\%ND}$ represents the time in s necessary to reach it bilateral and unilateral (dominant and nondominant leg), expressed in $N \bullet s^{-1}$.

- The indicator of special level of leg extensors explosive force development RFD_{250ms}, measured at time zone of SSC, i.e. at 250 ms of tF_{max}, bilateral and unilateral (dominant and nondominant leg), was done by applying the following procedure (Ibid):

$$\text{Bilateral} - RFD_{250ms} = F_{250ms}/tF_{250ms}$$
$$\text{Dominant leg} - RFD_{250msDO} = F_{250msDO}/tF_{250msDO}$$
$$\text{Nondominant leg} - RFD_{250msND} = F_{250msND}/tF_{250msND}$$

Where: F_{250ms}, $F_{250msDO}$ and $F_{250msND}$ represents the value of isometric force achieved at 250 ms of F_{max}, bilateral and unilateral (dominant and nondominant leg), and tF_{250ms}, $tF_{250msDO}$, $tF_{250msND}$ represents the time in s necessary to reach it bilateral and unilateral (dominant and nondominant leg), expressed in $N \bullet s^{-1}$.

- The indicator of special level of explosive force development RFD_{180ms}, measured at 180 ms of tFmax, bilateral and unilateral (dominant and nondominant leg), was done by applying the following procedure (Ibid):

$$\text{Bilateral} - RFD_{180ms} = (F_{180ms}/tF_{180ms})$$
$$\text{Dominant leg} - RFD_{180msDO} = F_{180msDO}/tF_{180msDO}$$
$$\text{Nondominant leg} - RFD_{180msND} = F_{180msND}/tF_{180msND}$$

Where: F_{180ms}, $F_{180msDO}$ and $F_{180msND}$ represents the value of isometric force achieved at 180 ms of F_{max},bilateral and unilateral (dominant and nondominant leg), and tF_{180ms}, $tF_{180msDO}$ and $tF_{180msND}$ represents the time in s necessary to reach it bilateral and unilateral (dominant and nondominant leg), expressed in $N \bullet s^{-1}$.

- The indicator of special level of explosive force development RFD_{180ms}, measured at 100 ms of tFmax, bilateral and unilateral (dominant and nondominant leg), was done by applying the following procedure (Ibid):

$$\text{Bilateral} - RFD_{100ms} = F_{100ms}/tF_{100ms}$$
$$\text{Dominant leg} - RFD_{100msDO} = F_{100msDO}/tF_{100msDO}$$
$$\text{Nondominant leg} - RFD_{100msND} = F_{100msND}/tF_{100msND}$$

Where: F_{100ms}, $F_{100msDO}$ and $F_{100msND}$ represents the value of isometric force achieved at 100 ms

$$\text{Bilateralno} - RFD_{50\%} = F_{50\%}/tF_{50\%}$$
$$\text{Dominantna noga} - RFD_{50\%DO} = F_{50\%DO}/tF_{50\%DO}$$
$$\text{Nedominantna noga} - RFD_{50\%ND} = F_{50\%ND}/tF_{50\%ND}$$

Gde: $F_{50\%}$, $F_{50\%DO}$ i $F_{50\%ND}$ predstavljaju vrijednosti izometrijske sile opružača nogu bilateralno i unilateralno (dominantne i nedominantne noge) dostignute na 50% od F_{max}, dok $tF_{50\%}$, $tF_{50\%DO}$ i $tF_{50\%ND}$ predstavljaju vremena u s potrebna za dostizanje $F_{50\%}$, $F_{50\%DO}$ i $F_{50\%ND}$, izraženo u $N \bullet s^{-1}$.

- Pokazatelj specijalnog nivoa razvijenosti eksplozivne sile tj. eksplozivnosti opružača nogu bilateralno i unilateralno (dominantne i nedominantne noge), izmjeren na 250 ms od tF_{max} je dobijen na osnovu slijedeće procedure (Ibid):

$$\text{Bilateralno} - RFD_{250ms} = F_{250ms}/tF_{250ms}$$
$$\text{Dominantna noga} - RFD_{250msDO} = F_{250msDO}/tF_{250msDO}$$
$$\text{Nedominantna noga} - RFD_{250msND} = F_{250msND}/tF_{250msND}$$

Gde: F_{250ms}, $F_{250msDO}$ i $F_{250msND}$ predstavljaju vrijednosti izometrijske sile opružača nogu bilateralno i unilateralno (dominantne i nedominantne noge), dostignute na 250 ms od tF_{max}, dok tF_{250ms}, $tF_{250msDO}$ i $tF_{250msND}$ predstavljaju vremena u s potrebno za dostizanje izometrijske sile opružača nogu bilateralno i unilateralno (dominantne i nedominantne noge) izmjerene na 250 ms, izraženo u $N \bullet s^{-1}$.

- Pokazatelj specijalnog nivoa razvijenosti eksplozivne sile tj. eksplozivnosti opružača nogu bilateralno i unilateralno (dominantne i nedominantne noge), izmjeren na 180 ms od tF_{max} je dobijen na osnovu slijedeće procedure (Ibid):

$$\text{Bilateralno} - RFD_{180ms} = (F_{180ms}/tF_{180ms})$$
$$\text{Dominantna noga} - RFD_{180msDO} = F_{180msDO}/tF_{180msDO}$$
$$\text{Nedominantna noga} - RFD_{180msND} = F_{180msND}/tF_{180msND}$$

Gde: F_{180ms}, $F_{180msDO}$ i $F_{180msND}$ predstavljaju vrijednosti izometrijske sile opružača nogu bilateralno i unilateralno (dominantne i nedominantne noge) dostignute na 180 ms od tF_{max}, dok tF_{180ms}, $tF_{180msDO}$ i $tF_{180msND}$ predstavljaju vrijeme u s potrebno za dostizanje izometrijske sile opružača nogu bilateralno i unilateralno (dominantne i nedominantne noge) izmerene na 180 ms, izraženo u $N \bullet s^{-1}$.

- Pokazatelj specijalnog nivoa razvijenosti eksplozivne sile tj. eksplozivnosti opružača nogu bilateralno i unilateralno (dominantne i nedominantne noge), izmjeren na 100 ms od tF_{max} je dobijen na osnovu slijedeće procedure (Ibid):

$$\text{Bilateralno} - RFD_{100ms} = F_{100ms}/tF_{100ms}$$
$$\text{Dominantna noga} - RFD_{100msDO} = F_{100msDO}/tF_{100msDO}$$
$$\text{Nedominantna noga} - RFD_{100msND} = F_{100msND}/tF_{100msND}$$

Gde: F_{100ms}, $F_{100msDO}$ i $F100_{msND}$ predstavljaju vrijednosti izometrijske sile opružača nogu bi-

of F_{max} bilateral and unilateral (dominant and nondominant leg), and tF_{100ms}, $tF_{100msDO}$, $tF_{100msND}$ represents the time in s necessary to reach it bilateral and unilateral (dominant and nondominant leg), expressed in $N \bullet s^{-1}$.

Measuring procedure

To evaluate contractile characteristics of isometric leg extensors force (unilateral and bilateral), standardized equipment was used, i.e. metal device for measuring leg extensors isometric force, a tensiometric probe and standardized "seating leg extension" test. All data was recorded and analyzed using a specially designed software system (M_S_NI, Nikola Tesla Institute, Serbia, Belgrade) for purpose of control and monitoring athletes training at the Serbian Institute for Sport and Sport Medicine in Belgrade (Dopsaj & Ivanović, 2011) (Figure 1).

lateralno i unilateralno (dominantne i nedominantne noge), dostignute na 100 ms od tF_{max}, dok tF_{100ms}, $tF_{100msDO}$ i $tF_{100msND}$ predstavljaju vrijeme u s potrebno za dostizanje izometrijske sile opružača nogu bilateralno i unilateralno (dominantne i nedominantne noge) izmjerene na 100 ms, izraženo u $N \bullet s^{-1}$.

Postupak merenja

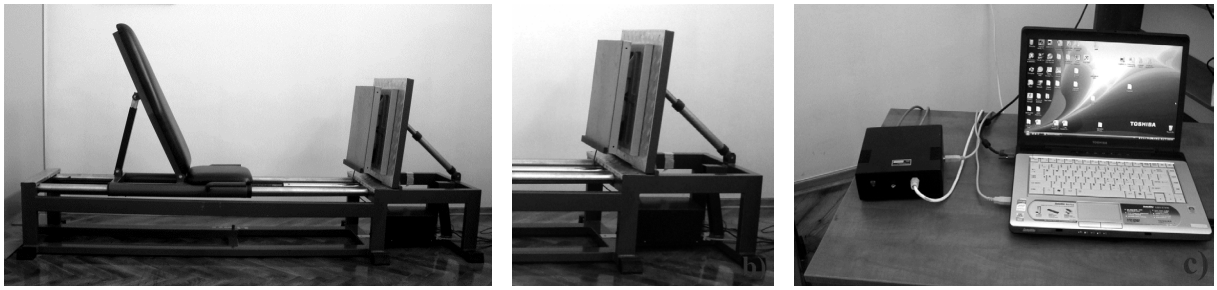
Za procenu kontraktilnih karakteristika izometrijske mišićne sile opružača nogu (bilateralno i unilateralno) korišćena je standardizovana oprema, sprava metalne konstrukcije gde je sila merena u sedećem položaju. Testiranje i akvizicija sirovih podataka je realizovano korišćenjem posebno izrađenog hardversko-softverskog sistema, M_S_NI CW UI 8.0, od strane Instituta „Nikola Tesla", Beograd za potrebe kontrole i praćenja treniranosti sportista u Zavodu za sport i medicinu sporta RS (Dopsaj i Ivanović, 2011) (Slika 1).

FIGURE 1

The measuring device for assesing maximal leg extensors isometric force with the hardware-software system (a), tensiometric device within foot platform (b), force reader conected with the PC (c).

SLIKA 1

Aparatura za merenje maksimalne izometrijske sile opružača nogu (a), tenziometrijska sonda unutar platforme za stopala (b), čitač sile s računarom (c).



A foot-platform fixed to the frame by strain-gauge transducers and data was collected at 2000 Hz using interface box with an analog to digital card (National Instruments, Austin, TX, USA). During later off-line analysis the trials were selected and the force signal was filtered by a digital fourth order recursive low-pass filter, using a cutoff frequency of 50 Hz. Thereafter, data was processed using a PC.

After individuals had warmed up for five minutes and received an introduction to the measuring procedure, each subject made two attempts in bilateral and four attempts in unilateral (dominant – nondominant – dominant – nondominant leg), with one minute of rest between trials. The subjects were instructed to exert their maximal force as quickly as

Tenziometrijska sonda, frekvencije odabira, uzorkovanja podataka od 2000 Hz, nalazi se unutar platforme za stopala koja je fiksirana za konstrukciju (National Instruments, Austin, TX, USA). Tenziometrijska sonda, granične frekvencije NF filtra kroz koji se propušta izmjereni signal od 50 Hz, bila je povezana s čitačem sile (indikatorom sile) povezanim s računarom.

Na osnovu upotrebljenog protokola testiranja, ispitanici su tokom testa mjerenja karakteristika F-t krive opružača nogu bilateralno i unilateralno realizovali po dva pojedinačna testovna pokušaja, prema slijedećoj proceduri: svi ispitanici su testirani posle 5 minuta individualnog zagrevanja. Zadatak ispitanika bio je da ostvare maksimalnu mišićnu silu primjenom maksimalno intenzivnog naprezanja u što kraćem vremenskom periodu u sjedećem položaju (pozicija guranja nogama). Testiranje je realizovano u izometrijskim uslovima naprezanja i pri uglu natkolenice i

FIGURE 2
Exeminees position during measuring procedure.

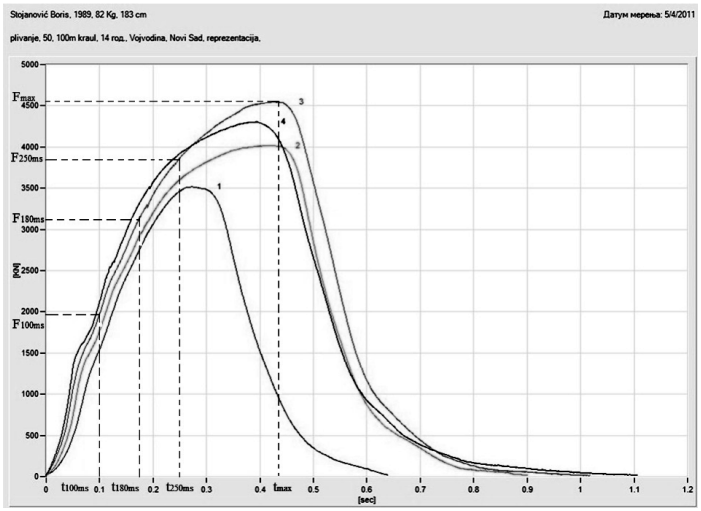
SLIKA 2
Položaj ispitanika tokom merenja.

possible in seating position (pushing with legs position). Hence, subjects were seated on a bench, so that their thigh and lower leg angle was at 120°, i.e. lower leg and foot angle 90° (Figure 2). The subject performs the test trial based on a test leader instruction. The result was automatic, measured by the strain-gauge transducers and hardware-software system, recorded in a special database with the possibility of *F-t* curve inscription control (Figure 3). Best trial according to basic (general) isometric leg extensors explosive force was chosen for further statistical analysis.

potkolenice od 120°, odnosno pri uglu potkoljenice i stopala od 90° (Slika 2). Ispitanik je izvodio testovni pokušaj na zvučni signal mjerioca. Svaki ispitanik imao je pravo na dva pokušaja bilateralnog naprezanja i po dva pokušaja unilateralnog naprezanja (desna-lijeva-desna-lijeva noga) između kojih je bila pauza od jednog minuta. Rezultati testa su automatski, pomoću korišćenja tenziometrijske sonde i pripadajućeg hardversko-softverskog sistema beleženi u posebnu bazu podataka uz mogućnost pregleda zapisa *F-t* krive (Slika 3). Za potrebe ovog rada analiziran je pokušaj sa izmjerenim najvećim pokazateljem opšteg ili bazičnog nivoa razvijenosti eksplozivne sile tj. eksplozivnosti opružača nogu.

FIGURE 3
F-t curve.

SLIKA 3
Zapis F-t krive.



Statistical analysis

For statistical analysis, in addition to the descriptive statistical model, for defining the structure, i.e. real qualitative relationships between variables, the multivariate analysis in the group of mutual dependence was used. The methods of interdependence is the method used confirmative factor analysis using the optimal rotation dependence (Oblimin).

Multivariate assessment of the adequacy of the raw data was carried out using measures KMO (Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett test of sphericity - Bartlett's Tests of sphericity), whose statistical significance was wxpressed in terms of a chi-square (χ^2) (Hair, Rolph, Ronald, & William, 1998).

Statistička analiza

Od statističkih metoda, pored deskriptivnog statističkog modela, za definisanje strukture, tj. stvarne kvalitativne relacije između varijabli korišćena je multivarijaciona analiza iz grupe metoda međusobne zavisnosti. Od metoda međusobne zavisnosti upotrebljen je metod konfirmativne faktorske analize korišćenjem rotacija optimalne zavisnosti (Oblimin).

Procjena multivarijatne adekvatnosti sirovih podataka vršen je primenom mjere KMO (Kaiser-Meyer-Olkin measure of sampling adequacy i Bartletovim testom sferičnosti - Bartlett's Tests of Sphericity) čija je statistička značajnost izražena preko hi kvadrata (χ^2) (Hair, Rolph, Ronald i William, 1998).

RESULTS

Table 2 shows the adequacy results in the given sample of the analized variables for subsample male examinees.

REZULTATI

Na Tabeli 2 su prikazani rezultati adekvatnosti datog uzorka analiziranih varijabli subuzoraka ispitanika muškog pola.

TABLE 2
Values of The Kaiser-Meyer-Olkin Measure of Sampling Adequacy in male subsample.

TABELA 2
Mjera adekvatnosti faktorizovanog uzorka ispitanika muškog pola.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		1	2	3	4
		.806	.802	.737	.680
Bartlett's Test of Sphericity	χ^2	1229.941	2804.331	1760.349	913.941
	df	105	105	105	105
	p	**.000**	**.000**	**.000**	**.000**

Legend/Legenda: **1** - Speed-strength sports - Brzinsko-snažni sportovi; **2** - Sports with complex exertion of all motoric properties - Sportovi sa kompleksnim ispoljavanjem svih motoričkih svojstava; **3** - Endurance sports - Sportovi izdržljivosti; **4** - Conrol group - Kontrolna grupa; χ^2 - Chi-Square test (Hi-kvadrat test); ***df*** - Degrees of freedom (Stepeni slobode); ***p*** - Probability (Vjerovatnoća); Kaiser-Meyer-Olkin Measure of Sampling Adequacy - Kaiser-Meyer-Olkin mjera adekvatnosti; Bartlett's Test of Sphericity - Bartlett test sferičnosti.

Table 3 shows abstracted factors with the structure indicators of the explained variance for the sample all observed variables.

Measure KMO showed high statistical significance of multivariate adequacy of the given variables for the examinees in group speed-strength sports at the level of .806, i.e. 80.6%, while χ^2 test value was 1229.941. at the level of p=.000; for the examinees in group endurance sports at the level .737, i.e. 73.7%,

Na Tabeli 3 su prikazani izdvojeni faktori sa strukturnim pokazateljima objašnjene varijanse uzorka svih posmatranih varijabli.

Mera KMO pokazuje visoku statistički značajnu vrednost multivarijatne adekvatnosti datih varijabli za ispitanike grupe brzinsko-snažnih sportova na nivou od 0,806, tj. 80,6%, dok vrednost χ^2 testa iznosi 1229,941, na nivou p=0,000; za ispitanike grupe sportova sa kompleksnim ispoljavanjem svih motoričkih svojstava na nivou od 0,802, tj. 80,2%, dok vrednost χ^2 testa iznosi 2804,331, na nivou p=0,000; za ispi-

while χ^2 test value was 1760.349, at the level of p =.000; for the examinees in the control group at the level .680, i.e. 68.0%, while χ^2 test value was 913.941. at the level of p=.000.

tanike grupe sportova izdržljivosti na nivou od 0,737, tj. 73,7%, dok vrednost χ^2 testa iznosi 1760,349, na nivou p=0,000; za ispitanike kontrolne grupe na nivou od 0,680, tj. 68,0%, dok vrednost χ^2 testa iznosi 913,941, na nivou p=0,000.

TABLE 3

Abstracted factors with the structure indicators of the explained variance.

TABELA 3

Izdvojeni faktori sa strukturnim pokazateljima objašnjene varijanse.

Component	Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
Speed-strength sports			
1	10.413	69.418	69.418
2	1.699	11.329	80.748
3	1.073	7.152	87.899
Sports with complex exertion of all motoric properties			
1	9.193	61.285	61.285
2	1.979	13.191	74.476
3	1.256	8.376	82.852
4	1.210	8.067	90.919
Endurance sports			
1	9.066	60.438	60.438
2	2.148	14.317	74.755
3	1.517	10.112	84.866
4	1.022	6.815	91.682
Control group			
1	8.934	59.560	59.560
2	2.718	18.120	77.679
3	1.423	9.487	87.166

Legend/Legenda: Speed-strength sports - Brzinsko-snažni sportovi; Sports with complex exertion of all motoric properties - Sportovi sa kompleksnim ispoljavanjem svih motoričkih svojstava; Endurance sports - Sportovi izdržljivosti; Conrol group - Kontrolna grupa; Extraction Sums of Squared Loadings - Suma kvadrata opterećenja.

What this means is that measured data are valid to be used at the level of 68.0% (control group) to 80.6% (speed-strenght sports), which indicates that the rest of the variability in the amount of 32.0% (control group) to 19.4% (speed-strenght sports) has no valid adequacy and presents source of noise, respectivelly belongs to variability which can generally be assigned to the space that doesn't belong to the given measurement (for example different methodic or accidental mistakes that arose during the measurement, the space of different examinee motivation when it comes to testing, the space of different examinee fitness level, etc...).

To praktično znači da se izmereni podaci sami po sebi validno mogu iskoristiti na nivou od 68,0% (kontrolna grupa) do 80,6% (brzinsko-snažni sportovi), što ukazuje na činjenicu da ostatak varijabiliteta u iznosu od 32,0% (kontrolna grupa) do 19,4% (brzinsko-snažni sportovi) nema validnu adekvatnost i predstavlja izvor šuma, odnosno pripada varijabilitetu koji se generalno može pripisati prostoru koji ne pripada datom merenju (npr. različite sistemske ili slučajne greške nastale tokom merenja, prostor različite motivacije ispitanika za testiranje, prostor različitog nivoa utreniranosti ispitanika, itd...).

Table 4 shows the matrix of structure with the variables saturation in the function of the abstracted factors.

Na Tabeli 4 je data matrica strukture sa saturacijom varijabli u funkciji izdvojenih faktora.

TABLE 4
Structure Matrix in male subsample.

TABELA 4
Matrica strukture kod ispitanika muškog pola.

I factor	Speed-strength		Complex		Endurance		Control	
	$RFD_{180msND}$	.957	$RFD_{180msND}$	.988	$RFD_{180msND}$	.984	$RFD_{100msND}$	.968
	$RFD_{50\%ND}$	.957	$RFD_{50\%ND}$	.986	$RFD_{50\%ND}$	.966	$RFD_{50\%DO}$	.961
	$RFD_{250msND}$	.923	$RFD_{100msND}$	.926	$RFD_{250msND}$	.937	$RFD_{50\%ND}$	.958
	$RFD_{100msND}$	.872	$RFD_{250msND}$	.918	$RFD_{100msND}$	.878	$RFD_{180msDO}$	.946
	RFD_{180ms}	.847					$RFD_{180msND}$	.946
	$RFD_{50\%}$	.847					$RFD_{100msDO}$	.944
	RFD_{250}	.831					$RFD_{250msDO}$	.942
	RFD_{100}	.782					$RFD_{250msND}$	.885
II factor	Speed-strength		Complex		Endurance		Control	
	RFD_{Fmax}	.903	RFD_{FmaxDO}	.897	RFD_{180ms}	.991	RFD_{180ms}	.991
	RFD_{FmaxND}	.866	RFD_{FmaxND}	.874	$RFD_{50\%}$	.982	$RFD_{50\%}$	.984
	RFD_{FmaxDO}	.782	RFD_{Fmax}	.821	RFD_{250ms}	.938	RFD_{250ms}	.947
					RFD_{100ms}	.924	RFD_{100ms}	.887
III factor	Speed-strength		Complex		Endurance		Control	
	$RFD_{180msDO}$	.989	$RFD_{180msDO}$	.981	RFD_{FmaxDO}	.943	RFD_{Fmax}	.923
	$RFD_{50\%DO}$	.980	$RFD_{50\%DO}$	.980	RFD_{FmaxND}	.926	RFD_{FmaxND}	.879
	$RFD_{100msDO}$	.956	$RFD_{100msDO}$	.943	RFD_{Fmax}	.853	RFD_{FmaxDO}	.636
	$RFD_{250msDO}$	.946	$RFD_{250msDO}$	.888				
IV factor	Speed-strength		Complex		Endurance		Control	
			RFD_{180ms}	-.988	$RFD_{180msDO}$	-.980		
			$RFD_{50\%}$	-.983	$RFD_{50\%DO}$	-.973		
			RFD_{100ms}	-.946	$RFD_{100msDO}$	-.962		
			RFD_{250ms}	-.936	$RFD_{250msDO}$	-.888		

Legend/Legenda: **RFD_{DO}** - Dominant leg (Dominantana noga); **RFD_{ND}** - Nondominant leg (Nedominantna noga); **Speed-strength** - Speed-strength sports (Brzinsko-snažni sportovi); **Complex** - Sports with complex exertion of all motoric properties (Sportovi sa kompleksnim ispoljavanjem svih motoričkih svojstava); **Endurance** - Endurance sports (Sportovi izdržljivosti); **Control** - Conrol group (Kontrolna grupa).

Factor analysis abstracted among the given variables three factors for the examinees in the group speed-strength sports and control group, and four factors for the examinees in the sports with the complex demonstration of motoric properties and in endurance sports (Table 2, 3), which cumulatively explained 87.899% of good varians for the examinees in the group speed-strenght sports; 91.682% for the examinees of endurance sports; 87.166% for the examin-

Faktorska analiza je nad datim varijablama izdvojila tri faktora za ispitanike grupe brzinsko-snažnih sportova i kontrolne grupe, a četiri faktora za ispitanike grupe sportova sa kompleksnim ispoljavanjem svih motoričkih svojstava i sportova izdržljivosti (Tabele 2, 3), koji su ukupno kumulativno objasnili 87,899% valjane varijanse za ispitanike grupe brzinsko-snažnih sportova; 89,380% za ispitanike grupe sportova sa kompleksnim ispoljavanjem svih motoričkih svojstava; 91,682% za ispitanike sportova izdržljivosti;

ees in control group.

In speed-strength sports 80.6% of measured space which made the set of 15 variables was defined by 3 factors, with the high level of explained specificity at the level of 87.899% of the explained common variance.

In sports with the complex demonstration of motoric properties 80.2% of measured space which made the set of 15 variables was defined by 4 factorts, with the high level of explained specificity at the level of 90.919% of the explained common variance.

In endurance sports 73,7% of measured space which made the set of 15 variables was defined by 4 factorts, with the high level of explained specificity at the level of 91.682% of the explained common variance.

In control group 68.0% of measured space which made the set of 15 variables was defined by 3 factorts, with the high level of explained specificity at the level of 87.166% of the explained common variance.

Table 5 shows the results of adequacy regarding the given sample of the analized variables in the subsample female examinees.

87.166% za ispitanike kontrolne grupe.

Kod brzinsko-snažne grupe sportova 80,6% izmerenog prostora, koji je činio set sastavljen od 15 varijabli je definisalo 3 faktora, sa veoma visoko objašnjenim specificitetom i to na nivou od 87,899% objašnjene zajedničke varijanse.

Kod sportova sa kompleksnim ispoljavanjem svih motoričkih svojstava 80,2% izmjerenog prostora, koji je činio set sastavljen od 15 varijabli je definisalo 4 faktora, sa veoma visoko objašnjenim specificitetom, i to na nivou od 90,919% objašnjene zajedničke varijanse.

Kod sportova izdržljivosti 73,7% izmjerenog prostora, koji je činio set sastavljen od 15 varijabli je definisao 4 faktora, sa veoma visoko objašnjenim specificitetom, i to na nivou od 91,682% objašnjene zajedničke varijanse.

Kod kontrolne grupe 68,0% izmjerenog prostora, koji je činio set sastavljen od 15 varijabli je definisalo 3 faktora, sa veoma visoko objašnjenim specificitetom, i to na nivou od 87,166% objašnjene zajedničke varijanse.

Na Tabeli 5 su prikazani rezultati adekvatnosti datog uzorka analiziranih varijabli subuzoraka ispitanika ženskog pola.

TABLE 5

Values of The Kaiser-Meyer-Olkin Measure of Sampling Adequacy in female subsample.

TABELA 5

Mera adekvatnosti faktorizovanog uzorka ispitanika ženskog pola.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		1	2	3	4
		.715	.788	.809	.718
Bartlett's Test of Sphericity	χ^2	831.927	1300.777	1042.572	827.770
	df	105	105	105	105
	p	**.000**	**.000**	**.000**	**.000**

Legend/Legenda: **1** - Speed-strength sports - Brzinsko-snažni sportovi; **2** - Sports with complex exertion of all motoric properties - Sportovi sa kompleksnim ispoljavanjem svih motoričkih svojstava; **3** - Endurance sports - Sportovi izdržljivosti; **4** - Conrol group - Kontrolna grupa; χ^2 - Chi-Square test (Hi-kvadrat test); ***df*** - Degrees of freedom (Stepeni slobode); ***p*** - Probability (Vjerovatnoća); Kaiser-Meyer-Olkin Measure of Sampling Adequacy - Kaiser-Meyer-Olkin mjera adekvatnosti; Bartlett's Test of Sphericity - Bartlett test sferičnosti.

Table 6 shows abstracted factors with the structure indicators of the explained variance for the sample – all of the observed variables.

Measure KMO shows high statistical significance of multivariate adequacy of the given variables for the examinees in group speed-strength sports at the level of .715, i.e. 71.5%, while χ^2 test value is 831.927. at the level of p=.000; for the examinees in group of

Na Tabeli 6 su prikazani izdvojeni faktori sa strukturnim pokazateljima objašnjene varijanse uzorka svih posmatranih varijabli.

Mera KMO pokazuje visoku statistički značajnu vrijednost multivarijatne adekvatnosti datih varijabli za ispitanike grupe brzinsko-snažnih sportova na nivou od 0,715, tj. 71,5%, dok vrednost χ^2 testa iznosi 831,927, nivou p=0,000; za ispitanike grupe

TABLE 6

Abstracted factors with the structure indicators of the explained variance.

TABELA 6

Izdvojeni faktori sa strukturnim pokazateljima objašnjene varijanse.

Component	Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
Speed-strength sports			
1	8.141	54.276	54.276
2	2.644	17.628	71.904
3	1.908	12.723	84.627
4	1.059	7.062	91.689
Sports with complex exertion of all motoric properties			
1	10.161	67.742	67.742
2	1.655	11.034	78.776
3	1.174	7.828	86.604
Endurance sports			
1	10.210	68.067	68.067
2	1.728	11.518	79.584
3	1.243	8.286	87.871
Control group			
1	8.046	53.640	53.640
2	2.667	17.777	71.417
3	1.550	10.336	81.753
4	1.422	9.483	91.235

Legend/Legenda: Speed-strength sports - Brzinsko-snažni sportovi; Sports with complex exertion of all motoric properties - Sportovi sa kompleksnim ispoljavanjem svih motoričkih svojstava; Endurance sports - Sportovi izdržljivosti; Conrol group - Kontrolna grupa; Extraction Sums of Squared Loadings - Suma kvadrata opterećenja.

sports with complex demontration of motoric properties at the level of .788, i.e. 78.8%, while χ^2 testa value was 1300.777, at the level of p=.000; for the examinees in group of endurance sports at the level .809, i.e. 80.9%, while χ^2 test value was 1042.572, at the level of p=.000; for the examinees in the control group at the level .718, i.e. 71.8%, while χ^2 test value was 827.770. at the level of p=.000.

What this means is that measured data are valid to be used at the level of 71.5% (speed-strength sports) to 80.9% (endurance sports), which indicates that the rest of the variability in the amount of 28.5% (speed-straingth sports) to 19.1% (endurance sports) there is no valid adequacy and presents source of noise, respectivelly belongs to variability which can generally be assigned to the space that doesn't belong to the given measure (for example different methodic or accidental mistakes that arise during the measures, the space of different examinees motivation when it

sportova sa kompleksnim ispoljavanjem svih motoričkih svojstava na nivou od 0,788, tj. 78,8%, dok vrijednost χ^2 testa iznosi 1300,777, na nivou p=0,000; za ispitanike grupe sportova izdržljivosti na nivou od 0,809, tj. 80,9%, dok vrijednost χ^2 testa iznosi 1042,572, na nivou p=0,000; za ispitanike kontrolne grupe na nivou od 0,718, tj. 71,8%, dok vrijednost χ^2 testa iznosi 827,770, na nivou p=0,000.

To praktično znači da se izmereni podaci sami po sebi validno mogu iskoristiti na nivou od 71,5% (brzinsko-snažna grupa sportova) do 80,9% (sportovi izdržljivosti), što ukazuje na činjenicu da ostatak varijabiliteta u iznosu od 28,5% (brzinsko-snažna grupa sportova) do 19,1% (sportovi izdržljivosti) nema validnu adekvatnost i predstavlja izvor šuma, odnosno pripada varijabilitetu koji se generalno može pripisati prostoru koji ne pripada datom mjerenju (npr. različite sistemske ili slučajne greške nastale tokom mjerenja, prostor različite motivacije ispitanika za

comes to testing, the space of different examinees fitness level, etc...).

Factor analysis abstracted four factors among the given variables for the examinees in the group speed-strength sports and control group, and three factors for the examinees in sports with the complex demonstration of motoric properties and endurance sports (Table 5, 6), which cumulatively explained 91.689% of good varians for the examinees in group speed-strenght sports; 86.604% for the examinees in sports with complex demonstration of motoric properties; 87.871% for the examinees of endurance sports; 91.235% for the examinees of control group.

testiranje, prostor različitog nivoa utreniranosti ispitanika, itd...).

Faktorska analiza je nad datim varijablama izdvojila četiri faktora za ispitanike grupe brzinsko-snažnih sportova i kontrolne grupe, a po tri faktora za ispitanike grupe sportova sa kompleksnim ispoljavanjem svih motoričkih svojstava i sportova izdržljivosti (Tabele 5, 6), koji su ukupno kumulativno objasnili 91,689% valjane varijanse za ispitanike grupe brzinsko-snažnih sportova; 86,604% za ispitanike grupe sportova sa kompleksnim ispoljavanjem svih motoričkih svojstava; 87,871% za ispitanike sportova izdržljivosti; 91,235% za ispitanike kontrolne grupe.

TABLE 7
Structure Matrix in female subsample.

TABELA 7
Matrica strukture kod ispitanika ženskog pola.

	Speed-strength		Complex		Endurance		Control	
I factor	$RFD_{180msND}$	.993	$RFD_{180msND}$	.959	$RFD_{180msND}$	.959	$RFD_{180msND}$	.961
	$RFD_{50\%ND}$	.966	$RFD_{50\%ND}$	.948	$RFD_{250msND}$	.932	$RFD_{50\%ND}$	.947
	$RFD_{100msND}$	.915	$RFD_{250msND}$	.940	$RFD_{180msDO}$	.928	$RFD_{250msND}$	.929
	$RFD_{250msND}$	.893	$RFD_{100msND}$	.882	$RFD_{50\%ND}$	.926	$RFD_{100msND}$	.920
			RFD_{FmaxND}	.816	$RFD_{50\%DO}$	.916	$RFD_{250msDO}$	.917
			RFD_{FmaxDO}	.707	$RFD_{100msND}$	.908	$RFD_{180msDO}$	.888
			RFD_{Fmax}	.672	$RFD_{250msDO}$	.899	$RFD_{50\%DO}$	.869
					$RFD_{100msDO}$	.886	$RFD_{100msDO}$	.783
	Speed-strength		Complex		Endurance		Control	
II factor	RFD_{180ms}	-.978	$RFD_{50\%}$	.969	RFD_{180ms}	-.990	RFD_{180ms}	.992
	$RFD_{50\%}$	-.948	RFD_{180ms}	.954	$RFD_{50\%}$	-.989	$RFD_{50\%}$	.977
	RFD_{100ms}	-.945	RFD_{100ms}	.936	RFD_{250ms}	-.971	RFD_{250ms}	.965
	RFD_{250ms}	-.876	RFD_{250ms}	.869	RFD_{100ms}	-.069	RFD_{100ms}	.945
	Speed-strength		Complex		Endurance		Control	
III factor	RFD_{FmaxDO}	.938	$RFD_{180msDO}$	-.995	RFD_{FmaxDO}	.916	RFD_{FmaxDO}	.919
	RFD_{FmaxND}	.866	$RFD_{50\%DO}$	-.994	RFD_{FmaxND}	.807	RFD_{FmaxND}	.885
	RFD_{Fmax}	.857	$RFD_{250msDO}$	-.978	RFD_{Fmax}	.774		
			$RFD_{100msDO}$	-.965				
	Speed-strength		Complex		Endurance		Control	
IV factor	$RFD_{180msDO}$	-.980					RFD_{Fmax}	-.781
	$RFD_{250msDO}$	-.962						
	$RFD_{50\%DO}$	-.894						
	$RFD_{100msDO}$	-.777						

Legend/Legenda: **RFD_{DO}** - Dominant leg (Dominantna noga); **RFD_{ND}** - Nondominant leg (Nedominantna noga); **Speed-strength** - Speed-strength sports (Brzinsko-snažni sportovi); **Complex** - Sports with complex exertion of all motoric properties (Sportovi sa kompleksnim ispoljavanjem svih motoričkih svojstava); **Endurance** - Endurance sports (Sportovi izdržljivosti); **Control** - Conrol group (Kontrolna grupa).

Table 7 shows structure matrix with the saturation of the variables in the function of the abstracted factors.

In speed-strength sports 71.5% of measured space which made the set of 15 variables was defined by 4 factorts, with the high level of explained specificity at the level of 91.689% of the explained common variance.

In sports with the complex demonstration of motoric properties 78.8% of measured space which made the set of 15 variables was defined by 3 factorts, with the high level of explained specificity at the level of 86.604% of the explained common variance (Tabela 6, 7).

In endurance sports 80.9% of measured space which made the set of 15 variables was defined by 3 factorts, with the high level of explained specificity at the level of 87.871% of the explained common variance.

In control group 71.8% of measured space which made the set of 15 variables was defined by 4 factorts, with the high level of explained specificity at the level of 91.235% of the explained common variance.

Na Tabeli 7 data je matrica strukture sa saturacijom varijabli u funkciji izdvojenih faktora.

Kod brzinsko-snažne grupe sportova 71,5% izmjerenog prostora, koji je činio set sastavljen od 15 varijabli je definisalo 4 faktora, sa veoma visoko objašnjenim specificitetom, i to na nivou od 91,689% objašnjene zajedničke varijanse.

Kod sportova sa kompleksnim ispoljavanjem svih motoričkih svojstava 78,8% izmjerenog prostora, koji je činio set sastavljen od 15 varijabli je definisalo 3 faktora, sa veoma visoko objašnjenim specificitetom, i to na nivou od 86,604% objašnjene zajedničke varijanse (Tabela 6, 7).

Kod sportova izdržljivosti 80,9% izmjerenog prostora, koji je činio set sastavljen od 15 varijabli je definisalo 3 faktora, sa veoma visoko objašnjenim specificitetom, i to na nivou od 87,871% objašnjene zajedničke varijanse.

Kod kontrolne grupe 71,8% izmjerenog prostora, koji je činio set sastavljen od 15 varijabli je definisalo 4 faktora, sa veoma visoko objašnjenim specificitetom, i to na nivou od 91,235% objašnjene zajedničke varijanse.

DISCUSSION

It seems that the significance of the dominant leg has influenced the defining of structure characteristics of explosive force in regard with different sports groups (Table 4 and 7). The results obtained in this research show that measured characteristics of the leg extensors explosive force, obtained in bilateral and unilateral exertion regime in regard with different sports groups, have different structure in the function of abstracted factors under the impact/influence of different mechanisms in regard to training processes in different sports disciplines. Tables 4 and 7 and Figures 4 a 5 show abstracted factors in the function of different sports groups in respect to gender and from the aspect of absolute values of the explosive force development.

Based on the obtained results and analized variables of the First factor on the sample trained male examinees, it can be concluded that the differencies between altletes from these groups are most recognisable, i.e. the explosiveness of the non-dominant leg measured at the level of 180 ms is the most discriminating indicator. The reasons, especially when it comes to speed-strength group and group with complex demonstration of motoric properties, should be looked for in the simple fact that large number of athletes from the disciplines in which dominant leg plays an important role took part in this research (role of

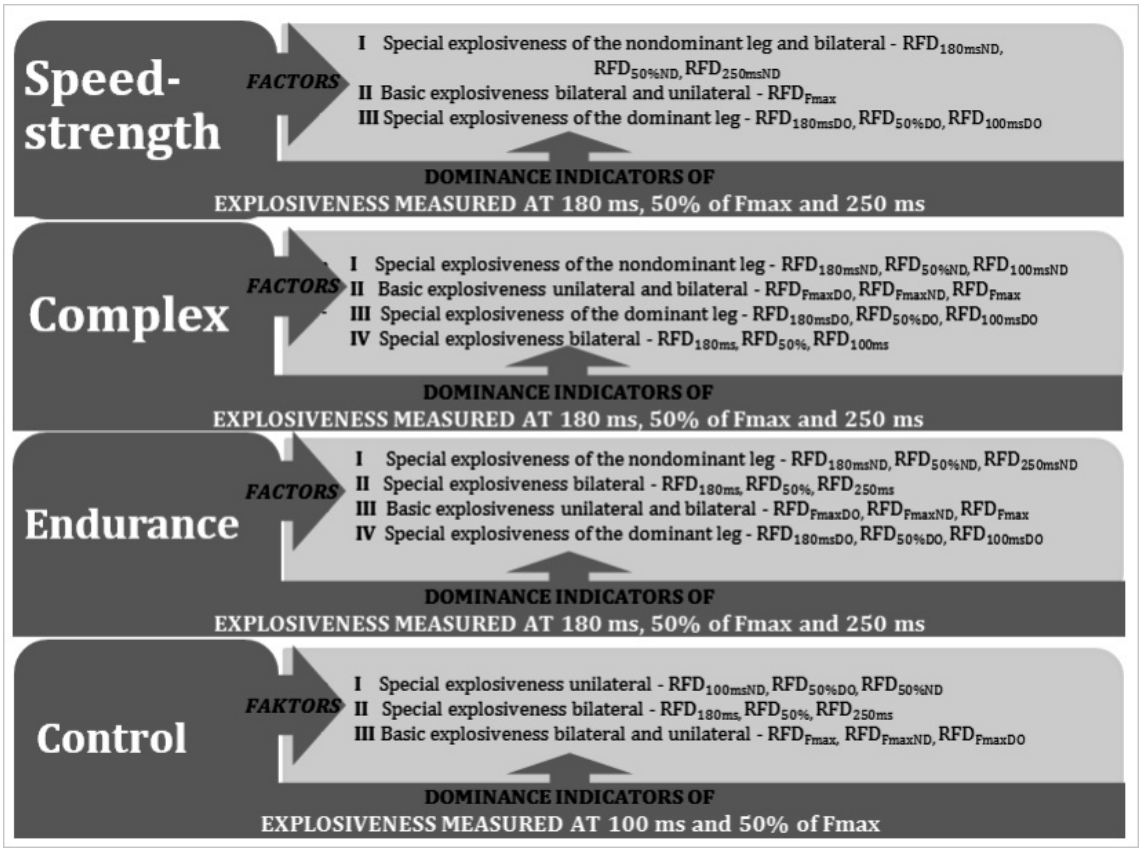
DISKUSIJA

Čini se da je značaj dominantne noge imao uticaj na definisanje strukture karakteristika eksplozivne sile u odnosu na različite grupe sportova (Tabele 4 i 7). Rezultati dobijeni u ovom istraživanju pokazuju da mjerene karakteristike eksplozivne sile opružača nogu dobijene u bi i unilateralnom režimu naprezanja u odnosu na različite grupe sportova imaju različitu strukturu u funkciji izdvojenog sklopa faktora pod uticajem drugačijih mehanizama u odnosu na trenažne procese u različitim sportskim disciplinama. Na Tabelama 4 i 7 i Slikama 4 i 5 su prikazani izdvojeni faktori u funkciji različitih grupa sportova u odnosu na pol sa aspekta apsolutnih vrijednosti pokazatelja nivoa razvijenosti eksplozivne sile.

Na osnovu dobijenih rezultata i analiziranih varijabli Prvog faktora na uzorku treniranih ispitanika muškog pola možemo zaključiti da se sportisti iz ovih grupa najviše razlikuju, tj. diskriminiše ih najviše eksplozivnost nedominantne noge mjerene na nivou od 180 ms. Razloge, posebno kada je riječ o brzinsko-snažnoj i grupi sportova sa kompleksnim ispoljavanjem svih motoričkih svojstava, vjerovatno treba tražiti u činjenici da je u istraživanju učestvovao veliki broj sportista iz sportskih disciplina gdje dominantna noga igra značajnu ulogu (uloga dominantne noge u skakačkim disciplinama atletike, različitim vrstama skokova sa jedne noge u odbojci, košarci, rukometu, različite

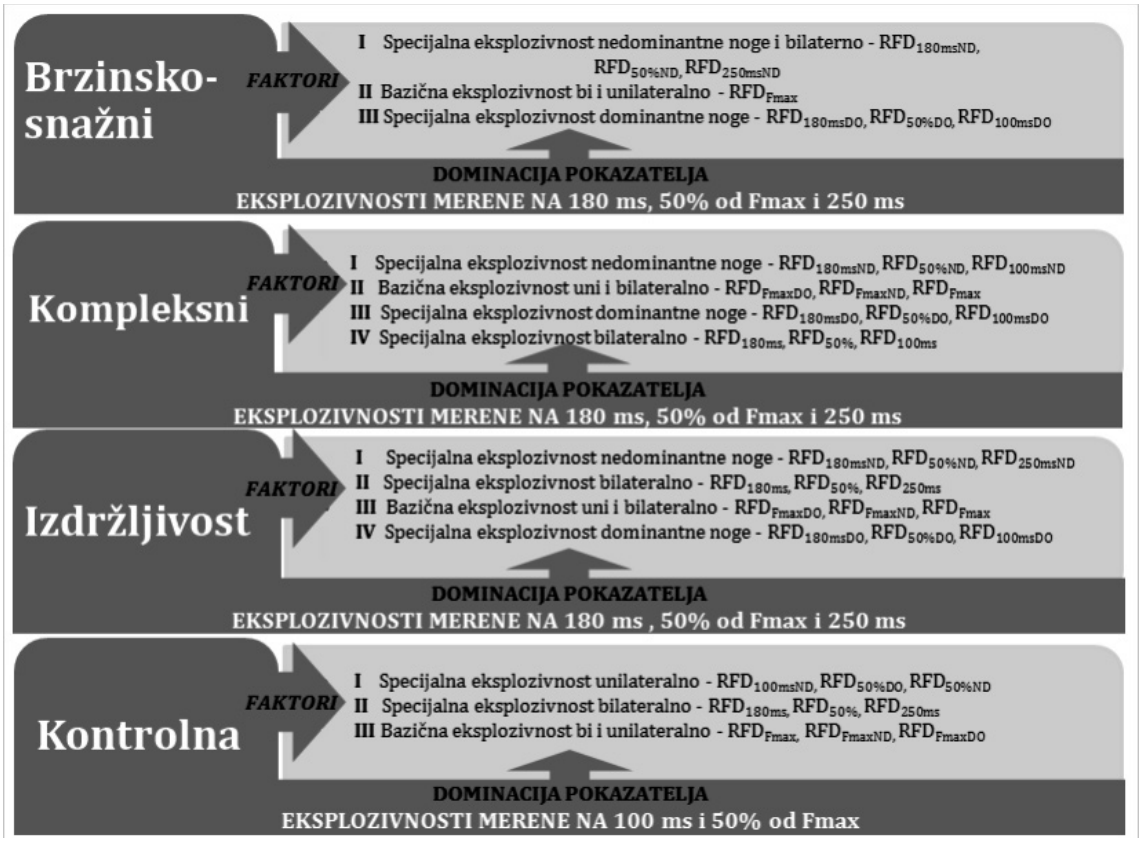
FIGURE 4

Abstracted factors regarding male subsample.



SLIKA 4

Izdvojeni faktori u odnosu na ispitanike muškog pola.



dominant leg in jump disciplines in field and track, different types of jumps with one leg in valleybal, basketball, handball, shoots, passings and dribbling ind football, specific postures and movements in fancing...).

In this case, non-dominant leg usually is not important for the successful conduction of certain motoric tasks, therefore contractile abilities of the leg extensors aren't similary/adequate developed in all persons. Basic explosiveness is an indicator, i.e. analogy of general fitness level from the aspect of explosiveness. Given that the speed-strenght group was composed from the top level athletes, the fact that the second factor is saturated with the indicators of the general fitness level, which from the aspect of the priority in training process is in the background, isn't surprising. In fact, it is the base for the specific "functional fundament" in further tendency to increase productivity in sport. In case of top level athletes of speed-strenght sports, special fitness level and training process which should influence the high level of explosive force demonstration during the initial (early) phase of muscal contraction, that is extremlly important for successful movements, should dominate. The third factor is saturated with the indicators of specific, i.e. specialized fitness level from the aspect of explosiveness. Special explosiveness of the dominant leg measured at 180 ms is the least discriminating indicator for the athletes from this group. The reasons for the obtained results, as it has already been explained, should be looked for in the significant role of the dominant leg in the disciplines which made speed-strangth group.

Unlike speed-straingth athletes, the differencies between altletes from sports with complex demonstration of motoric abilities were the smallest, i.e. they were least discriminated by the special explosiveness measured in time interval of 180 ms and specific explosiveness bilateral. Time interval measured at 50% of maximal force presents the time for S gradient, i.e. starting/initial acceleration implementation/ralization, while at the level of 180 ms it presents the most characteristic duration of contact with the ground during running in submaximal regime of exertion, abrupt changes in direction and vertical jumps (Čoh, 2010; Čoh & Bošnjak, 2010; Gruber & Gollhofer, 2004; Haff et al., 2005; Hakkinen, 1991; Ikemoto et al., 2007; Kraska et al., 2009; Zatsiorsky & Kraemer, 2006). These time intervals are typical for sports with complex demonstration of motoric properties, so it is not strange that these indicators of explosiveness in the mentioned time intervals were abstracted as the last, IV factor.

Since group of endurance sports and control group

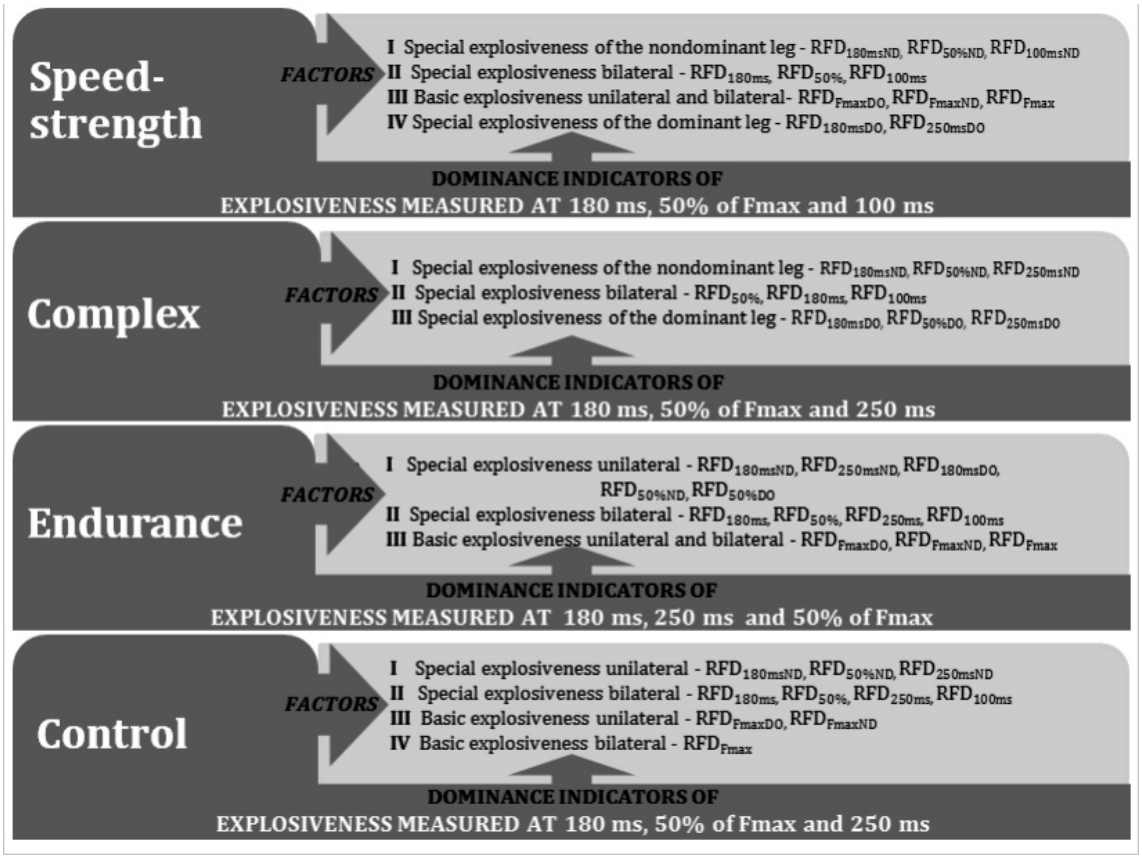
vrste šuteva, dodavanja i driblinga u fudbalu, specifičnim stavovima i kretnjama u mačevanju...).

U tim slučajevima često nedominantna noga ne igra značajnu ulogu u uspješnosti izvođenja određenih motoričkih zadataka, pa samim tim ni kontraktilne sposobnosti opružača nogu nisu razvijene na istom/adekvatnom nivou kod svih pojedinaca. Bazična eksplozivnost je indikator, tj. analogija opšte fizičke pripreme sa aspekta eksplozivnosti. Kako brzinsko-snažnu grupu sportova čine vrhunski sportisti ne čudi činjenica da je drugi faktor saturiran indikatorima opšte fizičke pripreme koji je sa aspekta prioriteta u trenažnom procesu date grupe sportista u drugom planu. On zapravo čini bazu za specifični „funkcionalni fundament" za dalji rad na povećanju efikasnosti u sportu. U slučaju vrhunskih sportista brzinsko-snažne grupe sportova treba da dominira specijalna fizička priprema i trenažni procesi koji će uticati na visok nivo ispoljavanja eksplozivne sile tokom inicijalne (rane) faze mišićne kontrakcije koja je veoma značajna za uspješno izvođenje eksplozivnih pokreta u grupi brzinsko-snažnih sportova. Upravo je treći faktor saturiran indikatorima usko specifične, tj. specijalizovane fizičke pripreme sa aspekta eksplozivnosti. Specijalna eksplozivnost dominantne noge mjerena na 180 ms je indikator po kome se sportisti iz ove grupe najmanje razlikuju, tj. diskriminišu. Razlozi dobijenih rezultata kao što je u prethodnom dijelu teksta već spomenuto kod objašnjenja izdvojenih varijabli prvog faktora, treba tražiti u značajnoj ulozi dominantne noge u sportskim disciplinama koje su činile brzinsko-snažnu grupu sportova.

Za razliku od brzinsko-snažne grupe sportista, sportiste iz grupe sportova sa kompleksnim ispoljavanjem svih motoričkih sposobnosti se najmanje razlikuju, tj. najmanje ih diskriminišu specijalna eksplozivnost mjerena u vremenskom intervalu od 180 ms i specifična eksplozivnost bilateralno. Vremenski interval mjeren na 50% od maksimalne sile predstavlja vreme realizacije S gradienta tj. startnog ubrzanja, dok na 180 ms predstavlja najkarakterističnije vrijeme kontakta sa tlom tokom trčanja u submaksimalnom režimu naprezanja, naglih promjena pravaca kretanja i vertikalnih odskoka (Čoh, 2010; Čoh i Bošnjak, 2010; Gruber i Gollhofer, 2004; Haff i saradnici, 2005; Hakkinen, 1991; Ikemoto i saradnici, 2007; Kraska i saradnici, 2009; Zatsiorsky & Kraemer, 2006). Ovi vremenski intervali su tipični za sportove koji čine grupu sportova sa kompleksnim ispoljavanjem svih motoričkih svojstava pa samim tim ne čudi ni činjenica da su baš indikatori eksplozivnosti u tim vremenskim intervalima izdvojeni kao IV i poslednji faktor ove grupe sportova.

FIGURE 5

Abstracted factors regarding female subsample.



SLIKA 5

Izdvojeni faktori u odnosu na ispitanike ženskog pola.

were composed by top level athletes and physically active and health examinees who don't have dominant explosive movements, then it's not strange that the third and fourth factors, which have been saturated with the indicators of basic physical fitness level, the indicators that the examinees of the control group and group of endurance sports were least discriminated by, and that are dominant from the aspect of priority when it comes to physical activities.

Based on the obtained results and analized variables of the First factor on the sample trained female examinees, it can be concluded that the differences between athletes from these groups were the largest, just like in male examinees, i.e. these examinees were most discriminated by the explosiveness of the non-dominant leg measured at the level of 180 ms. We can presume that the reasons of the obtained results are the same, taking into account that the same disciplines made both male and female groups of sports.

Unlike the male group of sports with complex demonstration of motoric abilities, the differences between female athletes from this group were the smallest, i.e. they were least discriminated by special explosiveness measured in time interval of 180 ms and specific explosiveness of dominant leg.

The obtained results indirectly confirm the results of our previous research where in regard to three groups of different trained female athletes, at the sample of absolute and relative parametres of leg extensors explosiveness, results showed differences in number, structure and composition of the abstracted factors under the influence of different mechanism in respect to training processes in different sports disciplines (Ivanović & Dopsaj, 2011).

CONCLUSIONS

Based on the obtained results it could be concluded that different factor structure of the observed explosiveness indicators was determined in athletes, both male and female, from the different sports.

The results from this research show that measured characteristics of leg extensors explosive force, obtained in bilateral and unilateral exertion regime, and in respect to different sports groups, have different structure in the function of abstracted composition of factors under the influence of different mechanisms in regard to different training processes in different disciplines. From the aspect of determined differences in factor structure of the indicators for evaluatin the leg extensors explosiveness in regard with different sports, even more emphasise the influence of adoptation on muscle force characteristics demonstration, but on correlation between sports branch and the production of muscle force contractile characteristics.

Kako grupu sportova izdržljivosti i kontrolnu grupu čine vrhunski sportisti i fizički aktivni i zdravi ispitanici kod kojih ne dominiraju eksplozivni pokreti, onda ne čudi činjenica da je treći i četvrti faktor, koji je saturiran indikatorima opšte fizičke pripreme po kojima se ispitanici kontrolne grupe i grupe sportova izdržljivosti najmanje razlikuju, tj. najmanje ih diskriminišu i koji su sa aspekta prioriteta u fizičkim aktivnostima datih grupa dominantni.

Na osnovu dobijenih rezultata i analiziranih varijabli Prvog faktora na uzorku treniranih ispitanika ženskog pola možemo zaključiti da isto kao i kod muškaraca sportisti iz ovih grupa se najviše razlikuju, tj. diskriminiše ih najviše eksplozivnost nedominantne noge merene na nivou od 180 ms. Evidentno je da možemo da pretpostavimo da su razlozi dobijenih rezultata isti, s obzirom da su iste sportske discipline činile i muške i ženske grupe sportova.

Za razliku od muške grupe sportova sa kompleksnim ispoljavanjem svih motoričkih sposobnosti, sportistkinje iz ove grupe se najmanje razlikuju, tj. najmanje ih diskriminišu specijalna eksplozivnost mjerena u vremenskom intervalu od 180 ms i specifična eksplozivnost dominantne noge.

Dobijeni rezultati indirektno potvrđuju i rezultate našeg ranijeg istraživanja gde su u odnosu na tri grupe različito treniranih sportistkinja, na uzorku apsolutnih i relativnih parametara eksplozivnosti opružača nogu rezultati pokazali razlike u broju, strukturi i sklopu izdvojenih faktora pod uticajem drugačijih mehanizama u odnosu na trenažne procese u različitim sportskim disciplinama (Ivanović i Dopsaj, 2011).

ZAKLJUČCI

Na osnovu rezultata istraživanja može se zaključiti da je kod sportista iz različitih grupa sportova oba pola utvrđena i različita faktorska struktura posmatranih indikatora eksplozivnosti.

Rezultati dobijeni u ovom istraživanju pokazuju da mjerene karakteristike eksplozivne sile opružača nogu dobijene u bi i unilateralnom režimu naprezanja u odnosu na različite grupe sportova imaju različitu strukturu u funkciji izdvojenog sklopa faktora pod uticajem drugačijih mehanizama u odnosu na trenažne procese u različitim sportskim disciplinama. Sa aspekta utvrđenih razlika u faktorskoj strukturi indikatora za procenu eksplozivnosti opružača nogu u odnosu na različite grupe sportova oba pola još više naglašavaju uticaj adaptacije sa različitim ispoljavanjem karakteristika mišićne sile ali i povezanosti sportske grane i produkcije kontraktilnih karakteristika mišićne sile.

Generally, it was determined, in both male and female examinees, that the most dominant isometric explosive force indicator of leg extensors was the indicator for the development level of force demostration in non-dominant leg in time interval of 180 ms ($RFD_{180msND}$), therefore the main recommendation of this research would be to join it to the batery of already existing standard indicators (F_{max} and RFD_{Fmax}), as a most informative special indicators of explosive force.

Generalno, i kod muškaraca i kod žena je utvrđeno da je najdominantniji indikator izometrijske eksplozivne sile opružača nogu indikator nivoa razvijenosti ispoljavanja sile nedominantne noge u vremenskom intervalu od 180 ms ($RFD_{180msND}$), pa je osnovna preporuka ovog istraživanja da se on priključi bateriji već postojećih standardnih indikatora (F_{max} i RFD_{Fmax}) kao najinformativniji specijalni indikator esplozivne sile.

ACKNOWLEDGMENT

The paper was realized as part of project III47015 sponsored by Ministry of science and technological development in the Republic of Serbia.

IZJAVA ZAHVALNOSTI

Rad je realizovan u okviru projekta br. III47015 finansiranog od strane Ministarstva za nauku i tehnološki razvoj Republike Srbije.

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Received: Decemeber 22, 2012
Revision received: Jun 5, 2013
Accepted: Jun 17, 2013

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Primljeno: 22. decembra 2012. godine
Izmjene primljene: 5. juna 2013. godine
Odobreno: 17. juna, 2013. godine

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STRUKTURA RŮZNÝCH INDIKATORŮ ISOMETRICKÉ SÍLY EXTENSORŮ NOH U VRCHOLOVÝCH SPORTOVCŮ

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Cílem této práce bylo stanovit faktorskou strukturu sledovaných charakteristik, resp. indikatorů křívky síla-čas k ohodnocení explosivností extensorů noh s ohledem na různé sportovní skupiny.

Výzkumu se celkem zúčastnilo 378 zkoušených osob rozdělených do 8 skupin dle pohlaví a specificity tréninkového procesu, kterému byli podrobeni, resp. vrholoví sportovci ze skupin: silově-rychlostní sporty (muže *n*=40 a ženy *n*=34), sporty s komplexním projevem veškerých motorických vlastností (muže *n*=99 a ženy *n*=43), sporty odolností (muže *n*=64 a ženy *n*=33) a kontrolní skupina netrénovaných osob mužského a ženského pohlaví (muže *n*=33 a ženy *n*=32).

K ohodnocení kontraktilních charakteristik extensorů noh bylo používané standardizované vybavení, resp. kovový přístroj pro meření izometrické síly extensorů noh, tenzometrická sonda a standardizovaný test v sedací pozice.

Rozsah měření byl definován na základě 15 variablí, vztahujících se ke kontraktilním charakteristikám isometrické síly extensorů noh, měřené v unilaterálním a bilaterálním režimu svalové kontrakce, jako časových parametrů pro realizace nejtypičtějších motorických úkolů techniky pohybu v sportu.

Získané důsledky ukazuju, že měřené charakteristiky explosivní síly extensorů noh získaných v bila-

terálním a unilaterálním režimu napětí, pokud jde o různých sportech, mají odlišnou strukturu s významem odděleného složení faktorů pod vlivem odlišných mechanismů pokud jde o tréninkové procesy v různých sportech. Z aspektu určených odlišností, vliv specifické adaptace k projevení svalové síly byl ještě více zdůrazněn a dále spojitost mezi sportovní disciplínou a produkcí kontaktilních charakteristik svalové síly. Obecně, u mužů a u žen bylo určeno, že je nejdominantnějším indikátorem isometrické explosivní síly extensorů noh indikátor vývoje projevu síly nedominantní nohy v časovém interválu 180 ms ($RFD_{180msND}$), tudíž by hlavním doporučením bylo připojit tento průzkum již existujícím indikátorům (F_{max} a RFD_{Fmax}), jakožto nejinformativnějším speciálním indikátorem explosivní síly.

Klíčová slova: faktorová struktura, odlišné trénované sportovci, křívka síla-čas

SportLogia
2013, 9(1), 48–58
ISSN 1986-6089
e-ISSN 1986-6119
CD-ROM ISSN 1986-6097

SPORT U METAFORI I METAFORA U SPORTU

SPORTS IN METAPHOR AND METAPHOR IN SPORTS

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ORIGINAL SCIENTIFIC PAPER
doi: 10.5550/sgia.130901.en.004K
doi: 10.5550/sgia.130901.se.004K
UDK: 796/799:81'243

ORGINALNI NUČNI ČLANAK
COBISS.BH-ID: 3814680
COBISS.BH-ID: 3814424

SUMMARY

This paper looks at the metaphors and idioms in the English language that have sports as their motivation and attempts to draw certain parallels with their corresponding semantic equivalents in Serbian. To establish the origin of an idiom is not an easy task, it is even more difficult to segregate them in groups relating to the metaphorical motivation. One of the groups that is worth exploring relates to those that seem to be sport generated. They are probably so prevalent among metaphoric constructions on account of their convenience as an interplay between different meanings which at the same is indeed a real play between people. What distinguishes them from other types of expressions is that they include sport terminology while referring to something totally different, sometimes involving ordinary folk, sometimes even state dignitaries. What they all have in common though is the transfer of meaning, from one sematic field into a different arena, this time it being a sport arena. This would imply that phraseology encompasses proverbs, sayings, idiolect and every other form of collocated wording used to denote an object, advice, idea or anything else with a meaning that, to some extent, deviates from the exact meaning of the words used in them. In the methodology chapter, the paper looks at more than 20 different metaphorical sport expressions, while the introduction, results, discussion and conclusion explore the theoretical bases that underpin any twist in meaning once a group of several words are joined together, thereby changing the sum of their individual meanings.

Key Worlds: metaphor, sports, language, meaning, motivation, English, Serbian.

SAŽETAK

Tema ovog rada su metafore i idiomi u engleskom jeziku koji kao motivacionu osnovu imaju sport, te težnja da se povuku određene paralele sa njihovim korespondentnim semantičkim ekvivalentima u srpskom jeziku. Spoznati porijeklo bilo kojeg idioma nije jednostavan zadatak. Još je teže razvrstati ih u grupe na osnovu njihove metaforičke motivacije. Jedna od grupa koju vrijedi istražiti odnosi se na za koje se čini da su motivisane sportom. Moguće je da njihovo značajno prisustvo među metaforičkim konstrukcijama zasnovano na njihovoj pogodnosti jer predstavljaju igrokaz između različitih značenja od kojih neka zaista prava igra među ljudima. Ono što ih razlikuje od ostalih vrsta izražavanja je činjenica dao uključuju terminologiju iz sporta a odnose se na nešto potpuno drugo, ponekad uključujući običan narod a ponekad visoke zvaničnike. No, ono što im je svima zajedničko je transfer značenja, iz jednog semantičkog polja u sasvim drugu arenu, u ovom slučaju u sportsku arenu. Ovim se implicira da frazeologija uključuje izreke, poslovice, idiolekt i svaki drugi oblik kolociranog iskaza kojim se denotira određeni objekat, savjet, ideja ili bilo šta drugo čije značenje u određenoj mjeri odudara od doslovnog značenja riječi koje su u njima sadržane. U dijelu o metodologiji, rad detaljnije razmatra više od 20 različitih metaforičkih izraza koji uključuju sportsku terminologiju, dok uvod, rezultati, diskusija i zaključak preispituju teoretske osnove koje leže u osnovi bilo kojeg obrta u značenju kada se grupa od nekoliko riječi udruži na takav način da im se promijeni zbir individualnog značenja.

Ključne riječi: metafora, sport, jezik, značenje, motivacija, engleski, srpski.

INTRODUCTION

In each cultural context and in each language, there are typical modes of expression that assemble words in order to signify something that is not limited to the sum of the meanings of the single words that compose them; an extra meaning, usually metaphorical, becomes part and parcel of this particular assembly. A particular type of metaphorical expression is seen in phraseology and idioms. Idioms and phraselogisms are not generated accidentally; they are junctions of collective thought and wisdom reached through a concise and metaphorical expression. To establish the origin of an idiom is not an easy task. However, if we decide to take such an endeavour upon ourselves we shall soon discover that their genesis is motivated by different aspects of human existence, sports playing an important role in it. As the knowledge on phraseology increases, and as new historical facts emerge, there seem to be even more questions to be answered as to why there are particular words and notions included in idioms and when they were first used.

Answers to the abovementioned questions appear to be even more important in the situations when particular idioms and metaphors need to be translated in another language. Lexical composition of an idiom in one language need not necessarily correspond to that in another language. Metaphors that have sports as the driver and generator of their lexical composition may be expressed via a different aspect of human or natural interaction in another. This paper looks at the metaphors and idioms in the English language that have sports as their motivation, and attempts to draw certain parallels with the corresponding semantic equivalents in Serbian. This may be of particular relevancy in the translation practice since, just as Anuradha Dingwaney (1995) defined it to translate a metaphor from one language to another involves a certain amount of violence in meaning, particularly when the translated culture is seen as somewhat alien.

METHODS

Definition of samples

For decades now, idioms have been a part of linguistics that has never been decidedly defined. Definitions of phraseology are everything but consistent. There are a few reasons for that. A phraseologism is seen by some as anything that has a solidly moulded form with no variations in lexical composition regardless of the usage, argot, expressiveness, poetical note or frequency as long as it has

UVOD

U svakom kulturološkom kontekstu i u svakom jeziku postoje tipični modusi izražavanja koji udružuju riječi u svrhu označavanja nečega što nije ograničeno na zbir njihovog individualnog značenja u smislu riječi koje ih čine; dodatno značenje, uglavnom metaforičko postaje sastavni dio tog udruživanja. Poseban vid metaforičkog izražavanja može se vidjeti u frazeologizmima i idiomima. Idiomi i frazeologizmi se ne stvaraju slučajno; oni su raskršća kolektivne misli i mudrosti do koje se dolazi na sažet način uz prenošenje značenja. Spoznati im porijeklo nije lak zadatak. No, ukoliko se opredijelimo da se prihvatimo takvog poduhvata ubrzo ćemo shvatiti da je njihova geneza motivisana različitim aspektima ljudske egzistencije, pri čemu sport igra bitnu ulogu. I kako raste znanje o frazeologiji, i kako se javljaju nove istorijske informacije, čini se da se javlja i sve više pitanja o tome zašto se određene riječi i koncepti uključuju u idiome i kada su se kao takvi prvi put počeli koristiti.

Čini se da su odgovori na gorenavedena pitanja još više bitni u situacijama u kojima određeni idiomi i metafore trebaju biti prevedeni na neki drugi jezik. Leksički sastav idioma u jednom jeziku ne mora pod obavezno da odgovora leksičkom sastavu idioma u drugom jeziku. Metafore u kojima je sport generator i pokretač leksičkog sastava mogu biti iskazane putem potpuno drugog aspekta ljudske ili prirodne interakcije u drugom jeziku. Ovaj rad razmatra metafore i idiome u engleskom jeziku koji su motivisani sportom, te pokušava da povuče određene paralele sa korespondentnim semantičkim ekvivalentima u srpskom jeziku. Ovo može biti od većeg značaja u prevodilačkoj praksi jer, baš kao što Anuradha Dingwaney (1995) reče – prevesti metaforu iz jednog jezika u drugi uključuje određenu količinu nasilja u značenju, pogotovo kada se kultura koja se prevodi čini odveć stranom.

METODE

Definisanje uzorka

Idiomi su već više decenija dio lingvistike koji nikada nije decidno definisan. Definicije frazeologije su sve samo ne doslijedne. Za to postoji više razloga. Određeni autori na frazeologizme gledaju kao na nešto što ima ustaljenu formu, bez varijacija u leksičkom sastavu, bez obzira na upotrebu, žanr, ekspresivnost, poetsku notu ili učestalost u upotrebi dok god u njima postoji nevarijabilan leksički sastav koji je kao

an invariable lexical composition known as such to speakers of the language. This would imply that phraseology encompasses proverbs, sayings, idiolect and every other form of collocated wording used to denote an object, advice, idea or anything else with a meaning that, to some extent, deviates from the exact meaning of the words used in them. Others are far stricter in their understanding of phraseology and believe that only those language constructions whose meaning is clearly different from the sum of meanings of the secluded words, can be called metaphorical phraseologisms.

Popular sayings can generally be subdivided into five categories:

Historical – popular sayings attributed to famous people of the past (for example, Marie Antoinette's *After us the deluge*), scientific – popular sayings attributed to great scientists and philosophers of the past (Archimedes's *Eureka!*); literary – popular sayings associated with famous writers (Shakespeare's *All the world's a stage*) patriotic – popular sayings coined by British or American political and military leaders (Thomas Jefferson' *All men are created equal*) or sports – popular sayings attributed to sports figures and journalists (Joe Louis, Knute Rockne, Vince Lombardi): *You can run, but you can't hide; Win this one for the Gipper; Winning isn't everything, it's the only thing* etc (Titelman, 2000).

Since this paper focuses on metaphors in sports, and sports in metaphor the sample that it ponders are 24 sayings that include sports as their motivational basis, with certain explanations as to what they mean, how they came into circulation and when they were first used:

The ball is in your court. It is your turn to make the next move. Originated in the United States in the mid-twentieth century and refers to the game of tennis. Another word may be substituted for *court*.

Don't change the rules in the middle of the game. When people have become involved in something on the assumption that certain rules are binding, they will be angered when they are changed arbitrarily. Often shortened to *don't change the rules*.

Don't hit a man when he's down. Don't attack someone who is already hurt. Originally a boxing phrase. According to the boxing rules, you cannot hit another boxer when he is down; you can strike him only when he gets up after the fall. The proverb has been traced back to Answer to Gairdner by Thomas Cranmer in the sixteenth century. The proverb is found in varying forms: *Never hit a man when he's down; Never kick a guy except when he is down; There can be no harm in kicking a man when he's down; Why hit a man when he's down? You* takav poznat govornicima datog jezika. Ovo bi podrazumijevalo da frazeologija obuhvata izreke, poslovice, idiolekt i svaki drugi oblik kolociranog iskaza kojim se denotira određeni objekat, savjet, ideja ili bilo šta drugo sa značenjem koje, u određenoj mjeri, odudara od doslovnog značenja riječi koje su korištene u njima. Drugi su mnogi strožiji u razumijevanju frazeologije i smatraju da samo one jezičke konstrukcije koje imaju značenje koje je jasno različito od zbira značenja odvojenih riječi mogu biti nazvani metaforičkim frazeologizmima.

Popularne izreke se mogu generalno podijeliti u pet kateogirja:

Istorijske – popularne izreke koje se pripisuju čuvenim ljudima iz prošlosti (kao na primjer *Poslije nas potop* od Marije Antoanete), naučne – popularne izreke koje se pripisuju velikim naučnicima ili filozofima (kao što je recimo Arhimedova *Eureka!*); književne – popularne izreke koje se pripisuju čuvenim piscima (kao što je recimo Šekspirovo – *Čitav svijet je pozornica*); patriotske – popularne izreke koje su skovali britanske ili američke vojskovođe (kao što je recimo Tomas Džeferson i njegovo *Svi ljudi su stvoreni jednaki*); ili sportski – popularne izreke koje se pripisuju bitnim ljudima iz svijeta sporta ili novinarima (kao što su Joe Louis, Knute Rockne, Vince Lombardi): *You can run, but you can't hide (Možeš da bježiš, ali ne možeš da se sakriješ); Win this one for the Gipper (Pobijedite ovaj put za Gippera); Winning isn't everything, it's the only thing (Pobjeda nije sve, ali jeste jedina stvar)* itd (Titelman, 2000).

S obzirom da se ovaj rad fokusirana na metafore u sportu i sport u metaforama, uzorak koji razmatra jesu 24 izreke koje uključuju sport kao motivacionu osnovu, sa određenim objašnjenjima u pogledu njihovog značenja, kako su ušle u opticaj i kada su prvi put upotrebljene:

The ball is in your court. (Lopta je u vašem terenu/dvorištu) – sa značenjem – Sada je red na vas da napravite naredni potez. Potiče iz Sjedinjenih Američkih Država sa polovine dvadesetog vijeka i odnosi se na igru tenisa. Umjesto riječi *court/teren* mogu se koristiti i druge riječi.

Don't change the rules in the middle of the game. (Ne mijenjaj pravila u sredini utakmice) – sa značenjem – Kada se ljudi upuste u nešto pod pretpostavku da su obavezani na određena pravila, imaju pravo da se ljute ako se ta pravila promijene jednostrano. Često se skraćuje u *don't change the rules/ ne mijenjaj pravila*.

Don't hit a man when he's down. (Ne udaraj čovjeka dok je na podu) – sa značenjem – Ne napadaj na onoga koji je već povrijeđen. Fraza izvorno potiče iz boksa. Prema pravilima boksa, drugog boksera se ne smije udariti dok je na podu; udariti ga možeš jedino kada ustane nakon pada. Ova se izreka može pratiti sve do

can't kick a man when he's down, etc. The metaphorical phrase *to hit a man when he's down* is also used.

Don't play with fire. Don't take unnecessary risks. First attested in the United States in Eugene O'Neill's (1928) *Strange Interlude*. The proverb is found in varying forms: *If you play with fire, you're apt to get burned; Those who play with fire must expect to get burned; If you play with fire you will burn your finger sooner or later*, etc.

Don't put the cart before the horse. Don't get things in the wrong order. The proverb is found in varying forms: *Don't get the cart before the horse; Never put the cart before the horse; It's like putting the cart before the horse; The cart is in front of the horse, etc. To put the cart in front of the horse* means to do things in the wrong order and is commonly used as a figure of speech. Similar phrases were used by the Greeks and the Romans.

Don't swap horses in midstream. Don't change leaders when they are in the midst of important projects. Probably originated in the United States. Used by Abraham Lincoln in his 1864 presidential campaign. The proverb is found in varying forms: *Don't change horses in the middle of the stream; Don't change horses in the midstream; Don't swap horses while crossing a stream; Don't change horses in the middle of the river; It never pays to change horses in midstream; It's no use changing horses in midstream; Never change horses in the middle of the stream*, etc. The proverb is often shortened to *swap (change) horses in midstream*.

The game is not worth the candle. The gain is not worth the effort. The saying dates from the pre-electric era, when candles were used for lighting; thus, continuing a game at night was not worth even the cost of the candles. The proverb is of French origin. Michel de Montaigne (1533-1592) is quoted as saying, *Le jeu ne vaut pas la chandelle*. In 1678, it was included in John Ray's collection of proverbs. Although it is usually used in negative, the affirmative version, *The game is worth the candle*, is also sometimes heard.

It takes two to tango. Certain activities require mutual cooperation to achieve a common goal. Originated in the United States in the 1920s. Popularized by Pearl Bailey's recording of the 1952 song "Takes Two to Tango" (Hoffman & Maning, 1952).

It's a different (new) ball game (ballpark). Things have changed radically; the new situation is nothing at all like what we're used to. Originally, the saying meant literally a ball game different from baseball, such as basketball, football, etc. It has been common since the 1930s and is now used figuratively. Often used with the word *whole* before *different* or *new*.

It's not over till it's over. Never give up hope until the outcome is final: in life, as in baseball, miracles can and often do, happen. Attributed to Yogi Berra in

Odgovora Gardineru od strane Tomasa Krenmera u šenaestom vijeku. Ovu izreku možemo čuti u različitim oblicima: *Never hit a man when he's down; Never kick a guy except when he is down; You can't kick a man when he's down*, etc. Takođe se koristi i metaforička fraza *to hit a man when he's down/ udariti čovjeka dok je na podu*.

Don't play with fire (Ne igraj se vatrom) – sa značenjem – Ne prihvataj se nepotrebnih rizika. Ovu frazu nalazimo zabilježenu prvi put u Americi kod Judžina O'Nila (1928), u Strange Interlude, a takođe je možemo čuti u različitim oblicima: *If you play with fire, you're apt to get burned*; itd.

Don't put the cart before the horse (Ne stavljaj zapregu prije konja; Ne trči pred rudu) – sa značenjem – Ne remeti ispravan redoslijed aktivnosti. Ova se izreka može naći u raznim oblicima: *Don't get the cart before the horse; itd. To put the cart in front of the horse (Staviti zapregu prije konja)* znači raditi stvari pogrešnim redoslijedom, i često se koristi kao stilska figura sa prenesenim značenjem. Slične fraze korištene su još u doba grčkih olimpijskim igara.

Don't swap horses in midstream (Ne mijenjaj konje na sredini vodotoka; Ne mijenjaj konje na uzbrdici) – sa značenjem – ne mijenjaj vođe u toku važnih poduhvata. Vjerovatno potiče iz Sjedinjenih Američkih Država. Koristio ju je čak i Abraham Linkoln tokom svoje predsjedničke kampanje 1864. godine. Izreka se često skraćuje i u to s*wap (change) horses in midstream. (Mijenjati konje na sredini vodotoka)*.

The game is not worth the candle (Igra nije vrijedna svijeća; Skuplja pita od tepsije) – sa značenjem da uloženi trud ne donosi adekvante rezultate. Potiče još iz doba prije elektrifikacije kada su se za osvjetljivanje koristile svijeće, pa otuda i aluzija na utrošak svijeća tokom igre. Fraza je inače francuskog porijekla. Zabilježeno je da ju je Michel de Montaigne (1533-1592) izrekao *Le jeu ne vaut pas la chandelle*. 1678. godine je uključena u zbirku poslovica Johna Raya. Iako se često koristi u negativnoj konotaciji, ima i svoju afirmativnu verziju, *The game is worth the candle, (Igra vrijedi svijeća)*.

It takes two to tango (Za tango je potrebno dvoje) – sa značenjem da je za ostvarivanje određenih aktivnosti neophodno učestvovanje obije strane. Potiče iz Sjedinjenih Američkih Država iz 1920ih godina. Popularizovao ju je Pearl Bailey u pjesmi "Takes Two to Tango" iz 1952. godine (Hoffman i Maning, 1952).

It's a different (new) ball game (ballpark) (To je drugačija /nova/ igra) – sa značenjem da su se stvari radikalno promijenile; nova situacija uopšte ne liči na prethodnu. Fraza je prvobitno imala doslovno značenje da je u pitanju igra koja se razlikuje od bejzbola, kao što je košarka, nogomet i slično. Uobičajena je od 1930ih godina, i danas se više koristi u prenesenom značenju. Često se prije riječi *different* ili *new* koristi riječ *whole*.

1973, when he was managing the ragtag New York Mets. Probably the most famous of all Yogiisms. *It ain't over till it's over and It's never over till it's over* are variations. George Bush is usually given credit for saying, "Politics is like baseball. It isn't over till the last batter swings".

It's survival of the fittest. Only the strongest ones survive or succeed. The saying originated in the latter half of the nineteenth century with Darwin's theory of natural selection as "survival of the fittest." Later, this biological principle of evolutionary progress was applied to any form of struggle for survival or success.

It's the only game in town. It's the only available option. The catch phrase dates from 1900 or earlier. The full version is: *I know it's crooked, but it's the only game in town*. In *Hollywood Husbands*, Jackie Collins (1986) revamped the old saying, adding to it something very familiar and likeable: "It's the only ballgame in the park." Often shortened to the only game in town.

Monday morning quarterbacking. Second-guessing. Criticism after the fact. Football games are traditionally played on Sunday, so Monday was often devoted to analyzing the errors made by the quarterbacks and postulating what they should have done. *Monday morning quarterback* is also a common form.

Slow and steady wins the race. Keep on doing something steadily and you'll succeed. Lexicographers usually refer this saying to Aesop's fable "The Hare and the Tortoise." The Hare, confident that it could beat the slower Tortoise, fell asleep after having run very fast at the beginning of the race, while the Tortoise slowly and steadily continued, reached the finish line, and won the race. Also found in the variant: *Slow and easy wins the race*. "You rest all you want," Stu said. "Slow and easy wins the race." – Stephen King (1978), *The Stand*.

Step up to the plate. Face a task or responsibility with courage. This American phrase is of recent origin and comes from baseball. It alludes to home plate, where a batter stands to face the pitcher.

That's the name of the game. That's the most essential point of something, what it's all about. This saying originated in the United States in the early 1960s, and has been in common use since about 1965. It was popularized through the movie, *Fame is the Name of the Game* (MacDougall, 1966) and the TV series, *The Name of the Game* (1968-1971).

1979. "How are we doing?"

"We're making money."

"That's the name of the game, isn't it?" – Howard Fast (1979), The *Establishment*.

There's no joy in Mudville. After all the hopes and

It's not over till it's over (Nije gotovo dok se ne završi) – sa značenjem da nikada ne treba gubiti nadu dok god se stvari u potpunosti ne završe: u životu, kao i u bejzbolu, čuda se ponekad dese. Pripisuje se Yogi Berri, da ju je izrekao misleći na New York Metse. *It ain't over till it's over and It's never over till it's over* su varijacije istog frazeologizma. Za Džordža Buša važi da je često znao reći "Politics is like baseball. It isn't over till the last batter swings" (Politika je poput bejzbola. Ništa nije gotovo do posljednjeg udarca policom).

It's survival of the fittest (Opstaju samo najspremniji) – sa značenjem da samo najsnažniji mogu da opstanu. Izreka datira iz druge polovine devetnaestog vijeka uz Darvinovu teoriju o prirodnoj selekciji kao "preživljavanju naprilagođenijih". Kasnije je ovaj princip evolucijskog napretka primijenjen na bilo koji oblik borbe za opstanak ili napredak.

It's the only game in town (To je jedina igra u gradu) – sa značenjem da je u pitanju jedina opcija koja stoji na raspolaganju. Datira iz 1900. godine ili možda i ranije. Potpuna verzija glasi: *I know it's crooked, but it's the only game in town*. U *Hollywood Husbands*, Jackie Collins (1986) je modifikovala staru izreku dodavši joj nešto veoma blisko i dopadljivo: "It's the only ballgame in the park." Često se skraćuje u the only game in town.

Monday morning quarterbacking (Kvoterbeking ponedjeljkom ujutro; Poslije bitke svi su generali) – sa značenjem naknadnog pametovanja. Kritikovanje nakon su se stvari već desile. Američki fudbal se tradicionalno igra nedjeljom, tako da je ponedjeljak obično doba kada se analiziraju greške iz mečeve koje su napravili kvoterbekovi, i postuliranje onoga što su inače trebali da urade. *Monday morning quarterback* je takođe uobičajen oblik.

Slow and steady wins the race (Sporo i polako donosi pobjedu u trci; Što je brzo to je kuso; Prijeko preče, a okolo bliže) – sa značenjem da istrajnost dovodi do uspjeha. Leksikografi na ovo uglavnom gledaju iz ugla Ezopove basne o zecu i kornjači. Zec, ubijeđen da će pobijediti sporu kornjaču, zaspi nakon brzog trčanja dok kornjača sporo ali sigurno nastavlja do cilja prva. Takođe se može naći u obliku: Slow and easy wins the race.

Step up to the plate (Zakorači na ploču) sa značenjem hrabrog preuzimanja odgovornosti. Ova američka fraza je skorašnjeg porijekla i dolazi iz bejzbola. Aluzija je na 'plate' gdje stoji udarač okrenut prema bacaču.

That's the name of the game (To je naziv igre) – sa značenjem da je pitanju najkrucijalniji dio nečega. Ova izreka potiče iz Amerike, iz ranih šezdesetih godina prošlog vijeka, a postala je uobičajena od 1965. Godine. Pupularizovana je kroz film: *Fame is the Name of the Game* (MacDougall, 1966) and i TV seriju, *The Name*

expectations, defeat is hard to bear. The proverb was coined by American balladeer Ernest Lawrence Thayer (1863-1940), whose poem and song, "Casey at the Bat," published on June 3, 1888, in the *San Francisco Examiner*, became an overnight hit. The Mudville fans expected their baseball team to win, but they were badly disappointed when their beloved Casey lost the game. The saying is often used in variants with other place names.

Trust everyone, but cut the cards. It's OK to trust everyone, but always take precautions to protect yourself just in case. The proverb comes from the game of cards where players cut the cards to prevent cheating. It was used by Finley Peter Dunne (1867-1936) in *Mr. Dooley's Opinions* (1900). The proverb is an American variant of the Russian Доверяй, но проверяй ("Trust, but verify") and was popularized by President Regan.

Always trust your fellow man. And always cut the cards. – Robert Fulghum (1986), *All I Really Need to Know I Learned in Kindergarten.*

Turnabout is fair play. Reversing a situation or relations is only fair. The proverb has been traced back to 1755 in *the Life of Captain Dudley Bradstreet*, and was given literary use by the Scottish novelist Robert Luis Stevenson (1868-94) and American writer Lloyd Osborne (1868-1947) in their novel, *The Wrecker* (1892).

You had your chance then; seems to me it's mine now. Turn about's fair play. – Robert Louis Stevenson & Lloyd Osborne, *The Wrecker* (Titelman 2000)

Who's counting? No one cares, so go ahead and do as you please. *But* often precedes the saying.

"The target will be reached in six minutes, thirty-four seconds unless we encounter unexpected head winds over the mountains which will extend our time to six minutes, fourty-eight seconds or perhaps fifty-five seconds, but then who's counting?" – Robert Ludlum (1988), *The Icarus Agenda.*

Win this one for the Gipper. If you need a reason to win, do it for someone who inspires you. The proverb originated in the United States in the 1920s and is attributed to Knute Rockne, then-coach of the Notre Dame football team. One of his best players, George Gipp (the Gipper), died at the age of twenty-five. Before he died, he told Knute Rockne: "Rock, someday when things look real tough for Notre Dame, ask the boys to go out and win for me." The coach honored his deathbed request and Notre Dame defeated Army by an unprecedented score of 12-6. In 1940, *Knute Rockne – All-American* (Robert Buckner, 1940), a motion picture based on the life of George Gipp, was released, and Ronald Reagan played the Gipper. "Win this one for the Gipper" became one of the major political slogans of Ronald Reagan.

of the Game (1968-1971).

There's no joy in Mudville (Nema radosti u Madvilu) – sa značenjem – izgubljena je sva nada u pobjedu a poraz nije lako podnijeti. Frazu je skovao američki tekstopisac Ernest Lawrence Thayer (1863-1940), čija je pjesma, "Casey at the Bat," objavljena 3. Juna, 1888. godine u *San Francisco Examineru*, postala hit preko noći. Fanovi Madvila su očekivali da pobijedi njihov bejzbol tim, ali uslijedilo je veliko razočarenje kada je njihov omiljeni Casey izgubio. Fraza se često koristi u varijantama sa drugim toponima.

Trust everyone, but cut the cards (Vjeruj svima, ali ipak presijeci špil) – sa značenjem – U redu je vjerovati svima, ali ipak treba preduzeti mjere predostrožnosti kako bismo se zaštitili u svakom slučaju. Fraza potiče iz igre kartama gdje igrači presijecaju špil da bi izbjegli varanje. Koristio ju je Finley Peter Dunne (1867-1936) u *Mr. Dooley's Opinions* (1901). Fraza je američka varijanta ruske: Доверяй, но проверяй ("Vjeruj ali provjeri") a popularizovao ju je predsjednik Regan.

Always trust your fellow man. And always cut the cards. – Robert Fulghum (1986), *All I Really Need to Know I Learned in Kindergarten.*

Turnabout is fair play (Preokret je ferplej) - sa značenjem da nema ničega spornog u preokretima. Izreka datira još iz 1755. godine u *the Life of Captain Dudley Bradstreet*, a književnu upotrebu stekla je uz pomoć škotskog romanopisca Roberta Luisa Stevensona (1868-1894) i američkog pisca Lloyda Osborna (1868-1947) u romanu *The Wrecker* (1892).

You had your chance then; seems to me it's mine now. Turn about's fair play. – Robert Louis Stevenson & Lloyd Osborne, *The Wrecker* (Titelman 2000).

Who's counting? (Ko broji) – sa značenjem – Nikoga nije briga, tako da – samo naprijed, radite kako vam milo. Riječ *But* često prethodi izreci.

"The target will be reached in six minutes, thirty-four seconds unless we encounter unexpected head winds over the mountains which will extend our time to six minutes, fourty-eight seconds or perhaps fifty-five seconds, but then who's counting?" – Robert Ludlum (1988), *The Icarus Agenda.*

Win this one for the Gipper (Pobijedite ovaj put za Gippera) – sa značenjem – Ako je potreban razlog za pobjedu, uradite to za nekoga ko vas inspiriše. Izreka potiče iz Amerike iz 20ih godina prošlog vijeka a pripisuje se Knutu Rockneu, tadašnjem treneru tima Notre Dame. Jedan od njegovih najboljih igrača, George Gipp (Gipper), umro je u dvadeset i četvrtoj godini. Prije nego što je umro, rekao je Knutu Rockneu: "Rock, jednoga dana kada stvari ne budu izgledale dobro za Notre Dame, pitaj momke da izađu i pobijede za mene." Trener mu je ispunio posljednju želju i Notre Dame je pobijedio Army do tada neviđenim

Some day, when things are tough, maybe you can ask the boys to go in there and win just one for the Gipper! – Robert Buckner, *Knute Rockne – All-American*, spoken by Ronald Reagan

A winner never quits, and a quitter never wins. If you want to win, you can't quit. *A quitter never wins, and a winner never quits* is a variant of the proverb.

1990. "I keep telling him a quitter never wins, and a winner never quits, but I'm not sure he's going to quit smoking." – Overheard during diner

You can't beat a man at his own game. You can't surpass people in their own environment or if they're more qualified. The proverb has been traced back to the 1756 *Papers of Henry Laurens*. The proverb is found in varying forms: *Anyone can be fooled at the other man's game; You can beat the bastards at their own game; You can't beat the rich at their own game; You can beat the IRS at their own game*, etc. (Titelman, 2000).

"No, no, I'll come back, you'll see… I'll beat the bastards at their own game!" he [Konig] added, with a ferocity that startled Queenie. – Michael Korda (1985), *Queenie.*

"You said you were going to beat Jadwin at his own game. How?" – Philip Friedman (1992), *Inadmissible Evidence.*

You have to learn to walk before you can run. Learning the basics prepares you for more advanced tasks. The proverb has been traced back to *Douce* (c.1350), and in 1670, it was included in John Ray's book of English proverbs. It is first attested in the United States in a letter of George Washington's dated July 20, 1794. The saying occurs in varying forms: You must learn to walk before you can run; *You got to learn to walk before you can run; One mustn't be expected to fly before he is able to walk*, etc.

1794 - We must walk as other countries have done before we can run. – George Washington, *Writings of George Washington* (Titelman, 2000).

1985 - "Do you want me to take my clothes off in any special way?"

"Just take them off the way you normally do," Goldner said, puffing his cigar. "Nothing fancy. We must learn to walk before we can run." – Michael Korda (1985), *Queenie.*

RESULTS

Comparing and contrasting phraseologisms existing in American English and Serbian shows that almost half of them are mutually translatable. Of course, there will always be those locally generated ones, such as "kruži kao kiša oko Kragujevca" or "no joy in Mudville" that will have to be left to translators' own devices. Once the expression is identified, the next

rezultatom od 12-6. 1940. godine, snimljen je film *Knute Rockne – All-American* (Robert Buckner, 1940), zasnovan na životu Georgea Gippa, a Gippa je glumio Ronald Reagan. "Win this one for the Gipper" je postao jedan od glavnih političkih slogana Ronalda Reagana.

A winner never quits, and a quitter never wins – Pobjednik nikad ne odustaje a onaj ko odustaje nikada ne pobijedi *A quitter never wins, and a winner never quits* je takođe varijanta ove izreke.

You can't beat a man at his own game (Ne možeš ga pobijediti u njegovoj igri) – sa značenjem – ne možeš prevazići ljude u njihovom sopstvenom okruženju ili ako su više kvalifikovani. Izreka datira još iz 1756. godine iz *Papers of Henry Laurens.* Može se čuti u različitim oblicima: *Anyone can be fooled at the other man's game; You can't beat the rich at their own game; You can beat the IRS at their own game*, itd. (Titelman, 2000).

"No, no, I'll come back, you'll see… I'll beat the bastards at their own game!" he [Konig] added, with a ferocity that startled Queenie. – Michael Korda (1985), *Queenie.*

"You said you were going to beat Jadwin at his own game. How?" – Philip Friedman (1992), *Inadmissible Evidence.*

You have to learn to walk before you can run (Moraš da naučiš da hodaš, prije nego što počneš da trčiš) – sa značenjem da se prvo moraju savladati osnove prije nego što se pređe na komplikovanije aktivnosti. Fraza potiče još iz *Douce* (c.1350), a 1670. godine je uvrštena u knjigu engleskih poslovica Johna Raya. Prvi put je upotrijebljena u Americi u pismu Georgea Washingtona, 1794. godine. Javlja se u raznim oblicima: *You must learn to walk before you can run; You got to learn to walk before you can run; One mustn't be expected to fly before he is able to walk*, itd.

1794 - We must walk as other countries have done before we can run. – George Washington, *Writings of George Washington* (Titelman, 2000).

1985 - "Do you want me to take my clothes off in any special way?"

"Just take them off the way you normally do," Goldner said, puffing his cigar. "Nothing fancy. We must learn to walk before we can run." – Michael Korda (1985), *Queenie.*

REZULTATI

Upoređivanje frazeologizama koji postoje u američkom engleskom i srpskom jeziku pokazuje da je gotovo polovina njih međusobno prevodiva. Naravno, uvijek će postojati i oni koji su stvoreni na lokalnom nivou, kao što je recimo as "kruži kao kiša oko Kragujevca" ili "no joy in Mudville" za koje će pre-

problem consists in decoding it. All authors agree that dictionaries are not always reliable tools in this sense. First, they do not contain all phraseologisms, partly because every day new ones are formed and partly because they add considerably to the dictionary's physical volume and it is often not practical to include them all. There are phraseologisms that are arguably universal. Some of them are taken over from other languages in a form that is conspicuously foreign, but have nevertheless become popular. Such are "all roads lead to Rome", "carpe diem/seize the day", "veni, vidi, vici", "Pyrrhic victory". If experiences of the human kind were all different, the meanings of their symbols would also be different, but they are not (Sanders Peirce, 1935). It is therefore reasonable to assume that there are relatively identical and invariable elements in the experiences of each member of a group of people.

This paper is part of a larger research which took into consideration metaphorical expressions from many other source domains. What transpires from the larger and more comprehensive analysis is that American phraseologisms are very present in everyday speech, covering all kinds of topics and referring to different spheres of life. They have a very pragmatic function and are useful tools in all kinds of situations. They convey orders, feelings of dismay or jubilance. Serbian phraseologisms, on the other hand, lack the pragmatic facility so abundantly present in American English. What they have to offset that shortcoming is their evident poetical note. Rhyme is far more present in Serbian phraseology. In fact, 2.5 more Serbian phraseologisms rhyme than is the case in American English, even though English morphology is more convenient for rhyming. This can be explained by centuries of oral tradition is Serbian, which prefers rhyme and preserves it better.

DISCUSSION

It is difficult to hypothesize about the existence of objective experiential meaning without having a clear, sound and axiomatic position. "Because so many of the concepts that are important to us are either abstract or not clearly delineated in our experience (the emotions, ideas, time, etc.), we need to get a grasp on them by means of other concepts that we understand in clearer terms (spatial orientations, objects, etc.)" (Lakoff & Johnsen, 2003, p. 116). The relations between thoughts, reactions and metaphors have long merited thorough and productive linguistic explorations (Whorf, 1975).

Many if not most of these proverbs and sayings, while used in America, are of British origin. Chaucer,

vodioci morati da se oslone na sopstvenu kreativnost. Kada se određen metaforički izraz identifikuje, naredni problem sastoji se od njegovog dekodiranja. Svi autori se slažu da rječnici nisu uvijek pouzdane alatke za rješavanje te vrste problema. Oni prije svega ne sadrže sve frazeologizme, dijelom zato što se svakoga dana stvaraju novi, a dijelom zato što značajno povećavaju fizički volumen rječnika te je stoga često nepraktično da se sve uključi. Postoje frazeologizmi za koje se sa velikom dozom sigurnosti može reći da su univerzalni. Neki od njih su preuzeti iz drugih jezika u obliku koji je upadljivo stran, ali su ipak postali popularni. Takvi su, recimo, „svi putevi vode u Rim", "carpe diem/seize the day", "veni, vidi, vici", "Pirova pobjeda" itd.. Da su iskustva različitih ljudi različita, značenja njihovih simbola bi također bila različita, ali nisu (Sanders Peirce, 1935). Stoga se da zaključiti da postoje relativno identični i nevarijabilni elementi u iskustvima svakog člana grupe ljudi.

Ovaj rad je dio šireg istraživanja koje je u razmatranje uzelo metaforičke izraze iz mnogih izvornih domena. Ono što proizilazi iz šire i sveobuhvatnije analize je da su američki frazeologizmi veoma prisutni u svakodnevnom govoru i da pokrivaju razne teme i odnose se na različite sfere života. Imaju veoma pragmatičnu funkciju i korisni su kao instrumenti za izražavanje u raznim situacijama. Mogu da prenose naredbe, osjećanja nezadovoljstva ili sreće. Sa druge strane, srpskim frazeologizmima nedostaje ta vrsta pragmatičnosti koja je sveprisutna u američkom engleskom. Ono što oni imaju da nadomijeste taj nedostatak je njihova evidentna poetičnost. Rima je mnogo prisutnija u srpskoj frazeologiji. Štaviše, 2,5 više srpskih frazeologizama se rimuje od frazeologizama u engleskom jeziku, iako je engleska morfologija pogodnija za rimovanje. Ovo se može objasniti vijekovima usmene tradicije u srpskom jeziku koja preferira rimu i bolje je čuva.

DISKUSIJA

Teško je nuditi bilo kakve hipoteze o postojanju objektivnog iskustvenog značenja bez da se ima jasna, provjerena i aksiomatska polazna osnova. „Uzimajući u obzir da je toliko mnogo koncepata koji su bitni za nas ili apstraktno ili nije jasno navedeno u našem iskustvu (emocije, ideje, vrijeme, itd.) moramo da ih pojmimo uz pomoć drugih koncepata koje razumijemo na jasniji način (prostorna orijentacija, predmeti itd.)" (Lakoff i Johnsen, 2003, str. 116). Odnosi između misli, reakcija i metafora su već dugo predmet produktivnih lingvističkih istraživanja (Whorf, 1975).

Mnoge, ako ne i sve, od navedenih izreka i poslovica, iako se upotrebljavaju u Americi su ustvari

Shakespeare, and other British writers originated and contributed a great deal to the preservation and popularization of some English proverbs used by Americans. Proverbs no longer come mostly from Britain. Born in America, many of them travel to British shores and enrich British English. Those two nations at least seem to share similar views on the world - "What can be represented in clauses includes aspects of the physical world (its processes, objects, relations, spatial and temporal parameters), aspects of the 'mental world' of thoughts, feelings, sensations and so forth, and aspects of the social world" (Fairclough, 2003, p. 134). And yet, these words are related to experience too, albeit via a more distant and more mediated linkage. The role of the mediator is played by the symbol, or a whole plethora of symbols which we can array in a series conforming to the degree of their abstraction. That conforms to Korzybski's (1948) general semantics which implies that abstractions always seek to be exemplified. According to Mckee (2003), just because people say when you ask them that this is what they think about a particular text, it does not mean that this is what it means to them in their everyday lives.

They exist independent from the conscience of each individual subject, even though they are not independent from the general and mutual subject, in this case: the community awareness. In such a situation, it no longer matters whether the conception includes more or fewer elements of images or abstractions, or, in other words, whether it is closer to sensation or notion. It does matter though, whether it results from a sport-related or some other experience, emotions (Ogden & Richards, 1923, p. 124), or through the process of detachment, separation and isolation of certain elements and underestimation of others, even though one could reasonably claim that every conception of sport, manifested in metaphor contains, or at least indirectly assumes a certain element of experience detached from the rest of the experiential whole in which it commonly appears, generalized, extrapolated or transformed by another action of the thinking apparatus.

This again reinforces the notion of dualism between the empiric and actual participation in sport and the contemplative process that uses them as motivation. In his seminal work, Ernest Cassirer (1923) expanded the notion of meaning onto numerous symbolic forms which include human competition. Lakoff and Johnsen (2003, p. 159) say that people do not believe that there is such a thing as objective (absolute and unconditional) truth or individual sport-related experience, though it has been a long-standing theme in Western culture that there is.

britanskog porijekla. Chaucer, Shakespeare, i mnogi drugi britanski pisci stvarali su, ili su u mnogome doprinijeli stvaranju, očuvanju i popularizaciji određenih engleskih frazeologizama koje koriste Amerikanci. Frazeologizmi više ne dolaze samo sa britanskih obala. Mnogi od njih se stvaraju u Americi, a potom putuju do Britanije gdje obogaćuju britanski engleski. Čini se da te dvije nacije dijele slične poglede na svijet - "Ono što se može prikazati u rečenicama uključuje aspekte fizičkog svijeta (njegove procese, objekte, odnose, prostorne i vremenske parametre), aspekte 'mentalnog svijeta' misli, osjećanja, osjećaja i tako dalje, kao i aspekte društvenog svijeta" (Fairclough, 2003, str. 134). A ipak, sve te riječi su vezane i za iskustvo, mada putem malo udaljenije i posrednije veze. Ulogu posrednika igra simbol, ili čitav niz simbola koje možemo poslożiti u serije u skladu sa nivoom njihove apstraktnosti. To je u skladu sa generalnom semantikom Koržobskog (1948) koja implicira da apstraktnosti uvijek teže ka tome da budu potkrijepljene primjerima. Prema Mckee-u (2003), sama činjenica da ljudi kažu, kada ih upitate, da je to ono što oni misle o određenom tekstu ne znači da je to ono što oni o tome inače misle u svakodnevnom životu.

Oni postoje nezavisno od svijesti bilo kojeg zasebnog pojedinca, mada nisu nezavisni od opštih i zajedničkih subjekata, u ovom slučaju: od svijesti zajednice. U takvoj situaciji, više nije bitno da li koncept uključuje manje ili više elemenata slika ili apstrakcija, ili, drugim riječima rečeno, da li je bliže osjećaju ili misli. Ono što jeste bitno je da li potiče iz određenog iskustva vezanog za sport ili nekog drugog iskustva ili osjećaja (Ogden i Richards, 1923, str. 124), ili je možda putem procesa odvajanja, separacije i izolacije određenih elemenata i razumijevanja ostalih, mada bi se moglo s razlogom tvrditi da svaka konceptualizacija sporta, manifestovana u metaforama sadrži, ili bar indirektno podrazumijeva određene elemente iskustva odvojenog od ostatka sveukupnog iskustva u kojem se inače javlja, generalizovano, ekstrapolirano ili transformirano usljed djelovanja misaonog aparata.

Ovo opet potkrijepljuje misao o dualizmu empirijskog i stvarnog učestvovanja u sportu i kontemplativnog procesa koji ga koristi kao motivaciju. U svom kapitalnom djelu, Ernest Cassirer (1923) je proširio koncept značenja na brojne simboličke forme koje uključuju ljudsko nadmetanje. Lakoff i Johnsen (2003, str. 159) kažu da ljudi ne vjeruju da uopšte postoji objektivna (apsolutna i neuslovljena) istina ili individualno iskustvo vezano za sport, mada je suprotno stanovište na zapadu već dugo prisutno.

CONCLUSION

We always understand each other – if the apparatus that analyses our sensations is the same. It is no longer about the quality of the sensation. The attempts to introduce a coherent classification of elements involved in meaningful sensations are not new (Morris, 1946, p. 22). Sport metaphors are junctions of collective thought and wisdom reached through a concise and metaphorical expression. To establish the origin of an idiom is not an easy task. However, if we decide to undertake such an endeavour upon ourselves we shall soon discover that their genesis is motivated by different aspects of human existence, sports playing an important role in it. They are not equally present in different languages, but it seems that sport-related metaphorical expressions are particularly productive in the English Language.

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ZAKLJUČAK

Ljudi se međusobno razumiju – ukoliko je aparatura koja analizira naše osjećaje ista. Tu više nije u pitanju kvalitet osjećaja. Pokušaji da se uvede koherentan sistem klasifikacije elemenata uključen u smislene osjećaje nisu novi (Morris, 1946, str. 22). Sportske metafore su raskršća kolektivne svijesti i mudrosti do koje se došlo putem sažetog i metaforičkog iskaza. Zadatak ustanovljavanja porijekla idioma nije nimalo lak. No, ukoliko se ipak upustimo u takav poduhvat ubrzo ćemo shvatiti da njihovu genezu motivišu različiti aspekti ljudskog bivstvovanja, pri čemu sport igra jednu od bitnijih uloga. Oni nisu u jednakoj mjeri prisutni u svim jezicima, ali čini se da su oni koji su vezani za sport veoma produktivni u engleskom jeziku.

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Received: Marta 18, 2013
Revision received: Jun 5, 2013
Accepted: Jun 28, 2013

Primljeno: 18. mart 2013. godine
Izmjene primljene: 5. jun 2013. godine
Odobreno: 28. jun 2013. godine

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LO SPORT NELLA METAFORA, LA METAFORA NELLO SPORT

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Le metafore e le espressioni idiomatiche nella lingua inglese che hanno lo sport come base motivazionale sono tema del presente studio, così come una tendenza a tracciare certe parallele tra i loro equivalenti semantici corrispondenti nella lingua serba. Conoscere l'origine di un'espressione idiomatica non è un compito semplice. È ancora più difficile classificarle in gruppi in base alla loro motivazione metaforica. Uno dei gruppi che vale la pena esplorare riguarda quelle espressioni che sembrano essere motivate dallo sport. È possibile che la loro presenza significativa tra le costruzioni metaforiche sia basata sulla loro idoneità a rappresentare il gioco tra i diversi significati di cui alcuni sono un vero gioco tra le persone. Quello che le differenzia dagli altri tipi di espressioni è il fatto che comprendono la terminologia proveniente dallo sport e riguardano qualcosa completamente diverso, a volte includendo le persone comuni e a volte i funzionari di alto livello. Però, quello che tutti hanno in comune è il trasferimento del significato, da un campo semantico ad un'arena completamente diversa, in questo caso in arena sportiva. Ciò implica che la fraseologia include: detti, proverbi, idioletti e ogni altra forma di espressione collocata che denota un oggetto particolare, un consiglio, un'idea o qualsiasi altra cosa il cui significato è in parte diverso dal significato letterale delle parole che contiene. Nella sezione sulla metodologia, lo studio esamina più dettagliatamente oltre 20 diverse espressioni metaforiche che coinvolgono la terminologia sportiva, mentre l'introduzione, gli esiti, la discussione e la conclusione rivedono i fondamenti teorici che stanno alla base di qualsiasi ribaltamento di significato, quando un gruppo di alcune parole si uniscono insieme cambiando così il significato della somma dei singoli.

Parole chiave: metafora, lo sport, linguaggio, significato, motivazione, inglese, serbo.

SportLogia
2013, 9(1), 59–77
ISSN 1986-6089
e-ISSN 1986-6119
CD-ROM ISSN 1986-6097

MOTORIČKE KARAKTERISTIKE, DERMATOGLIFIKA I EEG PERIODI DJEVOJAKA PRIJE I POSLIJE MENARHE

MOTOR FEATURES, DERMATOGLYPHIC AND EEG PERIODS OF GIRLS IN PRE AND POST MENARCHE

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ORIGINAL SCIENTIFIC PAPER
doi: 10.5550/sgia.130901.en.005R
doi: 10.5550/sgia.130901.se.005R
UDK: 796.012.1:159.928.23-057.874

ORGINALNI NUČNI ČLANAK
COBISS.BH-ID: 3815192
COBISS.BH-ID: 3814936

SUMMARY

The identification of menarche at puberty is important to evaluate the physical qualities, since the organism is developing a result of maturation. The dermatoglyphic characteristics are presented as possible indicators of genetic predispositions for basic physical qualities such as strength, speed, endurance, power and coordination. The aim of this study is relation of motor characteristics, dermatoglyphic and brain electro in girls in the periods before and after menarche. For this purpose the sample consisted of 45 girls aged between 10 and 14 years and 11 months divided into two groups, 21 in pre-menarche group (G1) and 24 in post menarche (G2). The variables analyzed were: motor characteristics, dermatoglyphic and EEG (absolute power in alpha and beta) electrodes in the frontal regions (F), central (C) and parietal (P), using the protocol KTK, protocol and capture fingerprints spectral activity through EEG. The results show a significant difference in QM4 for a $p \leq .05$ between groups G1 and G2, and the G2 achieved better performance. Compared the results of the motor characteristics, dermatoglyphic and electroencephalographic they indicate significant differences in spectral activity of the alpha rhythm in girls belonging to the group after menarche. It was observed that, with respect to motor characteristics, dermatoglyphic and EEG, the groups are not presented separately.

SAŽETAK

Identifikacija prve menstruacije u pubertetu važna je za procjenu motornih kvalitete organizma pošto je razvoj organizma rezultat njegovog sazrijevanja. Dermatoglifske karakteristike predstavljaju moguće pokazatelje genetskih predispizicija za osnovne fizičke osobine kao što su snaga, brzina, izdržljiovost, moć i koordinacija. Cilj ovog rada je poređenje motornih i dermatoglifskih karateristika i elektro snimanja mozga kod djevojčica u periodu prije i poslije prve menstruacije. U tu svrhu uzorak se sastojao od 45 djevojčica uzrasta od 10 do 14 godina i 11 mjeseci podjeljenih u dvije grupe, 21 u predmenarhnoj grupi (G1) i 24 u postmenarhnoj (G2). Analizirane varijable su: motorne karakteristike, dermatoglife i EEG (apsolutni alfa i beta talasi), elektrode u frontalnim regijama (F), centralnim (C) i parijetalnim, korištenje KTK protokola, protokol i snimanje spektralne aktivnosti otisaka prstiju kroz EEG. Rezultati pokazuju značajnu razliku u QM4 za $p \leq 0{,}05$ između G1 i G2 grupe, a G2 postiže bolje rezultate. Porećenje rezultata motornih karakteristika, dermatoglifa i elektroencefalografije ukazuju na značajne razlike u spektralnim aktivnostima alfa ritma u djevojčica koje pripadaju grupi nakon menarhe. Treba imati u vidu da u odnosu na motorne karakteristike, dermatoglife i EEG grupe nisu posebno predstavljene. Ipak kade se

However, to join the motor characteristics, dermatoglyphic and EEG groups before and after menarche, there was a significant difference with respect to brain activity only in the alpha rhythm and at frontal (F3, FZ, F4) and central (C3 and CZ) and in the post menarche.

Key words: menarche, coordination, dermatoglyphics, electroencephalography.

INTRODUCTION

Puberty is a stage of human life characterized by various transformations both physical and psychosocial. At this stage, the assessment of sexual maturation becomes an important parameter to assess whether the influences that it exerts on the growth and development, whereby a maturational diversity can be found among individuals with the same chronological age (Fonseca Júnior, Dantas, & Fernandes Filho, 2009). The stage of growth and maturation is regulated by the anterior pituitary gland located at the base of the brain, into the cell turcica of the sphenoid bone. Some hormones from the anterior pituitary, including somatropin, corticotropin, thyrotropin, gonadotropin and prolactin have an important role during the growth and maturation of human being (Malina, Bouchard, & Bar-Or, 2009).

Being the body, motility wise, the place of the sense and possible (Sérgio, 2001) the presence of menarche is a significant event in a woman's life and involves transformations in her own body of order somatic, metabolic and neuromotor transformations. Related to neuromotor transformations, Collet, Folle, Pelozin, Botti, and Nascimento (2008) corroborates these ideas saying that in recent years the motor coordination has been investigated because of the growing importance of the psychomotor domain related to the autonomy of the human being, especially during periods of growth and maturation. Motor coordination is essential to perform some basic skills and can be enhanced during motor learning throughout life (Schimidt & Wrisberg, 2006).

According to Eckert (1993) one of the changes that occur in females in the beginning of menarche is related to changes in anthropometric, going on an increase in body weight and height and consequently the increase of body mass index (BMI) of adolescents. This increase in body mass, as well as being linked to sexual maturation, may also be associated with sedentary behavior that affects teenagers (Mendonça & Anjos, 2004). Studies have been developed in order to investigate the influence of high body mass indexes on aspects that concern the manifestation of chronic diseases in adulthood (Oliveira, Cerqueira, Souza, & Oliveira, 2003).

spoje motorne karakteristike, dermatoglife i EEG grupa prije i poslije menarhe, postoji značajna razlika u odnosu na moždanu aktivnost samo u alfa ritmu i frontalno (F3, FZ, F4) i centralno (C3 i CZ) i u periodu poslije menarhe.

Ključne riječi: menarha, koordinacija, dermatoglife, elektroencefalografija.

UVOD

Pubertet je faza u životu ljudi koju karakterišu brojne i fizičke i psihičke promjene. U toj fazi procjena seksualnog sazrijevanja postaje važan parametar za procjenu njihovog uticaja na rast i razvoj, pri čemu se različitosti sazrijevanja mogu naći među pojedincima istog hronološkog uzrasta (Fonseca Júnior, Dantas i Fernandes Filho, 2009). Fazu rasta i sazrijevanja reguliše prednji režanj žljezde hipofize smještene u bazi mozga, u sella turcica na klinastoj kosti. Pojedini hormoni prednjeg režnja hipofize uključujući somatotropin, kortikotropin, tirotropin, gonadotropin i prolaktinimaju važnu ulogu i rastu i sazrijevanju ljudskog bića (Malina, Bouchard i Bar-Or, 2009).

Za buduće tijelo, um i osjećaje i mogućnosti (Sérgio, 2001) prsustvo menarhe je zanačajan događaj u životu žene i podrazumjeva, u njenom vlastitom tijelu, somatske, metboličke i neuromotorne promjene. U vezi sa neuromotornim promjenama Collet, Folle, Pelozin, Botti i Nascimento (2008) potvrđuju prethodno ističući da se poslednjih godina istražuje motorna koordinacija zbog njenog sve većeg značaja u psihomotornom prostoru a koji se odnosi na autonomiju ljudskog bića, a posebno tokom perioda rasta i sazrijevanja. Motorna koordinacija je bitna za obavljanje nekih osnovnih sposobnosti i može se povećati motornim učenjem tokom života (Schimidt i Wrisberg, 2006).

Prema Eckertu (1993) jedna od promjena koja se javlja kod žena na početku menarhe se odnosi na antropometrijske promjene, dolazi do povećanja tjelesne težine i visine a samim tim se povećava i indeks tjelesne mase (BMI) adolescentkinja. Ovo povećanje tjelesne mase povezano je sa seksulanim sazrijevanjem ali, takođe, može da bude povezano sa sedentarnim načinom života koje utiče na tinejdžere (Mendonça i Anjos, 2004). Provedena su istraživanja kako bi se istražio uticaj visokog indeksa tjelesne mase na pojavljivanje hroničnih bolesti u zrelom dobu (Oliveira, Cerqueira, Souza i Oliveira, 2003).

The lack of motor coordination relates to a general motor instability, involving problems in conducting the movement triggered by an incorrect action of the functional structures, sensory nerve and muscle, which consequently leads to changes in the quality of movement and reduction of motor efficiency (Silva, 2007). In order to achieve better performance and minimize such shortcomings, it is necessary to study the genetic potential of each athlete, thus obtaining an improvement of sports preparation and guidance about its features pre-disposition to certain tasks, since studies show the existence of a relationship between dermatoglyphic patterns, the physical qualities and also the types of muscle fibers. Fernandes Filho (1997) reports that, based on the model of fingerprints, facilitates the choice of the appropriate sport or even the function of players on the field, court or appropriate expertise to existing genetic characteristics, and thus contributes to the reduction of dropouts and same frustrations coming from the choice of sport or activity poorly suited to the capabilities of each individual.

In terms of maturity, capturing brain activity is also important in this age group, since it is characterized by changes in brain electrical activity (Gasser, Verleger, Bãcher, & Sroka, 1988). With increasing age, the background activity of the EEG undergoes modifications, particularly for infants, pre-school age, but still variations to the end of adolescence (Eckert, 1993).

Grounded in such arguments and in the face of a greater contribution of work in the area of Physical Education that will focus the menarche and its relationship to motor coordination, dermatoglyphic and electroencephalography, the present study aimed to verify and relate, the motor, dermatoglyphic and electroencephalographic characteristics of girls in the pre-and post-menarche.

METHODS

The study was methodologically developed along the lines of an investigative research, descriptive, comparative and associative (Thomas, Nelson, & Silverman, 2007). Participants were, intentionally, 48 (forty eight) girls, 24 in the pre-menarche, with the loss of 3 of these girls during the collection process, then getting the pre menarche group consisted of 21 girls, and 24 post-menarche, students of the Integrated Center for Public Education (CIEP) 275 - city of Itaocara/RJ, whose ages ranged from 10 to 15 years old. To be part of the study involved should be within the age group between 10 and 15 years old, have answered the questionnaire of sexual maturation to identify the presence or absence of menarche and

Nedostatak motorne koordinacije odnosi se na opštu motornu nestabilnost, uključujući probleme u sprovođenju kretanja izazvanih pogrešnim djelovanjem funkcionalnih struktura senzornih nerava i mišića, što za posljedicu ima promjene u kvalitetu kretanja i smanjenje motorne efikasnosti (Silva, 2007). Kako bi se postigla bolja efikasnost i ublažili takvi nedostatci, neophodno je proučiti genestki potencijal svakog sportiste tako da se poboljša sportska priprema i dobiju upustva o njegovim predispizicijama za određene poslove, jer istraživanja pokazuju da postoji veza između dermatoglifskog obrazca, fizičkih kvaliteta i tipova mišićnih vlakana. Fernandes Filho (1997) saopšto je da model otisaka prstiju, olakšava izbor odgovarajućeg sporta pa čak i ulogu igrača na terenu, donosi sud ili odgovarajuća znanja o postojanju genetskih karakteristika, te na taj način doprinosi smanjenu odustajanja ili nastajanju izvjesnih frustracija do kojih dolazi usljed izbora sporta ili aktivnosti koje slabo odgovaraju sposobnostima pojedine osobe.

U pogledu zrelosti, snimanje moždane aktivnosti je takođe važno u ovoj starosnoj dobi, pošto je karakterišu promjene u električnoj aktivnosti mozga (Gasser, Verleger, Bãcher i Sroka, 1988). Starenjem, pozadinska aktivnost EEG prolazi kroz promjene, posebno za bebe, predškolski uzrast ali i dalje varira do kraja adolescencije (Eckert, 1993).

Temljeći se na tim argumentima i u svjetlu većeg doprinosa radu na području fizičkog vaspitanja a koji će se fokusirati na menarhu i njen odnos sa motornom koordinacijom, dermatoglifikom i elektroencefalografijom, ovo istraživanje ima za cilj da provjeri relacije između motornih, dermatoglifskih i elektroenecfalografskih karakteristika djevojaka prije i poslije menarhe.

METODE

Istraživanje je sprovedeno u skladu sa istraživačkim procedurama, deskriptivnoj, komparativnoj i asocijativnoj (Thomas, Nelson i Silverman, 2007). Učesnice su hotimično birane, 48 (četrdeset osam) djevojaka, 24 u prije-menarhnom periodu, od čega su 3 djevojke odustale tokom procesa istraživanja, tako da se ta grupa sastojala od 21 djevojke i 24 djevojke u postmenarhnom periodu. Svi učesnici su bile učenice Integrted Center for Public Education (CIEP) 275 u gradu Itoacara/RJ uzrasta od 10 do 15 godina starosti. Kako bi bile uključene u istraživanje trebale su biti u starosnoj grupi između 10 i 15 godina i da odgovore na uputnik o seksualnoj zrelosti kako bi se

authorized by their parents and/or guardians through informed consent for participation and free consent. Were excluded from the sample girls who refused to participate as volunteers, to submit any physical deficiencies that could possibly impede the execution of motor tests and who did not attend on the appointed days for test execution.

The study was conducted in accordance with the rules for conducting research on human beings, Resolution 196/96 of the National Health Council, October 10, 1996. (CNS, 1996) being subjected to analysis by the Ethics Committee of the Universidad Autónoma de Asunción - UAA and approved under number 09/10 dated 20 August 2010.

Experimental procedure

After application of questionnaire (Oliveira Junior, 1996) for identifying the presence and/or absence of menarche, the evaluated were divided into two groups: pre-menarche (G1) and after menarche (G2). For the tests of motor coordination, collection of fingerprints (dermatoglyphic) and capture the EEG signal was used, respectively, the KTK test (Kiphard & Schilling, 1974) battery consisting of four motor tasks, having components as balance, rhythm, laterality, speed, agility and has an individual reliability between 65-87% and a total of 90% reliability which demonstrates credibility to the application of this test; a fingerprint collector, following the protocol and Roquetti Fernandes and Fernandes Filho (2010) and appliance pickup EEG and international 10-20 system (Jasper, 1958).

Protocols

Motor characteristics (Gorla, Duarte, & Montagner, 2009):

- Task 01 - Motor Quotient 1 (QM1) - Balanced backpedal (ER) - sed three balance beams of three meters in length and 3 cm in height, with widths of 6 cm, 4.5 cm and 3 cm. At the bottom of these balance beams are rafters measuring 15 x 1.5 x 5 cm, and spaced 50 cm each one, making the balance beams reach a total height of 5 cm. The task consisted in backpedaling on the three balanced beams, with different thicknesses, which were placed parallel 1 meter away from each other. Three valid attempts are recorded, making a total of nine attempts. The number of steps until one of the feet touch the ground or be achieved 8 points (steps) should be counted. For exercise and balance beam, the maximum that can be achieved are 8 points. The maximum possible score is 72 points. After nine attempts, adds to the value of the numbers of

ustanovilo prisustvo ili odsustvo menarhe. Učesnice su se saglasile da dobrovljno pristaju na istraživanje što su potvrdili i njihovi roditelji, odnosno staratelji koji su bili takođe informisani. Iz istraživanja su isključene djevojke koje su odbile da dobrovoljno učestvuju u istraživanju, koje nisu prijavile fizičke nedostatke koji bi eventualno mogli da ometaju izvođenje motoričkih testova i koje nisu, u naznačene dane, prisustvovale testiranju.

Istraživanje je sprovedeno u skladu sa propisima za provođenje istraživanja na ljudima, Rezolucija 196/96 Nacionalnog zdravstvenog savjeta od 10. oktobra 1996. godine (CNS, 1996) koji je razmatran od strane Etičkog komiteta Univerziteta Autónoma de Asunción - UAA i odobren pod brojem 09/10, 20. avgusta 2010. godine

Procedura istraživanja

Po sprovođenju upitnika (Oliveira Junior, 1996), kako bi se utvrdilo prisustvo ili odsustvo menarhe, ispitanice su podijeljenje u dvije grupe: prije-menarhnu (G1) i post-menarhnu (G2). Za testove motorne koordinacije, skupljanje otisaka prstiju (dermatoglifika) i snimanje EEG aktivnosti korišten je KTK test baterija (Kiphard i Schilling, 1974) koja se sastoji od: četiri motorička zadatka koji testiraju ravnotežu, ritam, bočno kretanje, brzinu i agilnost, a svaki od njih pojedinačno ima pouzdanost 65-87% i ukupnu pouzdanost 90% što govori u prilog pouzdanosti primjene ovog testa, otisci prstiju prikupljani su po pravilima protokola i Roquetti Fernandes i Fernandes Filho (2010) i EEG aparata i međunarodnog 10-20 sistema (Jasper, 1958).

Protokoli

Motorne karakteristike (Gorla, Duarte i Montagner, 2009):

- Zadatak 01 - Motorni koeficijent 1 (QM1) - Uravnoteženo hodanje unazad (ER) - koriste se tri ravnotežne grede dužine tri metra i 3 cm visine, sa širinom od 6 cm, 4.5 cm i 3 cm. Na donjoj strani ravnotežne grede su rogovi dimenzija 15 x 1,5 x 5 cm, sa 50 cm razmaka, što ukupnu visinu greda podiže na 5 cm. Zadatak se sastoji u hodanju unazad na tri ravnotežne grede različite širine, koje su paralelno postavljene sa razmakom 1 m između njih. Registruju se tri uspješna pokušaja, što ukupno iznosi 9 pokušaja. Broji se broj koraka sve dok jedna stopalo ne dodirne tlo ili se ne neparvi 8 poena (koraka) u kontinuitetu. Maksimalni broj poena je 72. Nakon devet pokušaja, sabirane su vrijednosti napravljenih koraka unazad i na taj način se

backpedals and get the result.

- Task 02 - Motor Quotient 2 (QM2) – Single Leg Vertical Jump (SM): was used 12 foam blocks each having 50 x 20 x 5 cm, the task was to jump three times with his right leg and three times in the left leg with increasing altitude. To skip the blocks of foam, the individual needed a distance of 1.50 m to drive, which should also be exceeded in jumps with the same leg. After skipping the foam block, the individual needed to take at least two more jumps with the same leg, so that the task was completed. For each height, the performances were analyzed as follows: 1st = 3 points valid attempt, 2nd = 2 points and 3rd = 1 point. The heights recommended for initiating the test in years, are: 5 to 6 = no foam pad; 6-7 years = 5cm (one block of foam); 7-8 years = 15cm (three foam blocks); 9 to 10 years = 25cm (five blocks of foam) and from 11 to 14 years and 11 months = 35cm (seven foam blocks).
- Task 03 - Motor Quotient 3 (QM3) - lateral jumps (SL): with the use of an adhesive tape was marked on the ground a rectangle measuring 60 x 50cm. With a 60 x 4 x 2cm wooden slats was made to divide this rectangle so that the task of jumping with legs together from side to side after a whistle was held in 15s. Was recorded, in the number of Hops, two passes and the result obtained with the sum of them.
- Task 04 - Motor Quotient 4 (QM4) - Transposition Lateral (TL): were deposited on the ground, away from each other to 5cm, two wooden platforms containing bases and measuring 25 x 25cm. Was asked to evaluate whether a position itself on one of them, and at the sound of a whistle, should move to another. Then it should take the platform from which it emerged and allocate it sideways. These movements should be performed two times or repeated as many times as possible in 20s. Have been computed the both of the number of transference platforms = 1 point, as the body = 2 points. After the execution of two attempts, the result was obtained with the sum of points both attempts.

Dermatoglyphic features:

Regarding collection of prints of ten fingers we used a digital collector's mark Cross Match®, Verifier 320 LC® and acquisition software BioUnistation Biology®. It was treated of a collection whose procedure was: after the hands are clean, the appraised supported the first finger to be collected starting from the position ulnar and rotating in her longitudinal axis in the radial sense. Had to be careful not to overlap the finger on the scanner again. The procedure was repeated with each of the fingers, beginning and end-

dolazilo do rezultata testa.

- Zadatak 02 - Motorni koeficjent 2 (QM2) – Skok uvis jednom nogom (SM): korišteno je 12 blokova od elastične pjene dimenzija 50 x 20 x 5 cm, a zadatak se sastojao da se skoči tri puta desnom i tri puta lijevom nogom sa povećanjem visine. Da bi preskočili blokove, potreban je zalet od 1,50 m koji bi takođe trebalo da se pređe skokovima na jednoj nozi. Nakon što preskoči blok pojedinac mora da izvede bar još dva skoka na istoj nozi kako bi završio zadatak. Za svaku visinu, prilikom izvođenja primjenjuje se sljedeće bodovanje: prelazak u prvom pokušaju 3, u drugom 2 i u trećem 1 poen. Preporučena visina za početak testa u odnosu na godine strosti je: 5-6 godina = nema blokova; 6-7 godina = 5 cm (jedan blok); 7-8 godina = 15 cm (tri bloka); 9-10 godina = 25 cm (pet blokva) i od 11 do 14 godina i 11 mjeseci = 35 cm (sedam blokova)
- Zadatak 03 - Motorni koeficijent 3 (QM3) - lbočni skokovi (SL): na terenu je označen, korišćenjem ljepljive trake, pravougaonik dimenzija 60 x 50 cm. drvenom letvicom dimenzija 60 x 4 x 2 cm prvouganik je podijeljen tako da se zadatak sastojao od sunožnog skakanja sa jedne na drugu stranu poslije signala pištaljkom u vremenu od 15 s. Registrovan je broj skokova, dva prolaza i rezultat dobijen njihovim sabiranjem.
- Zadatak 04 - Motorni koeficijent 4 (QM4) - bočno premještanje (TL): na terenu su položene dvije drvene platforme dimanzija 25 x 25 cm i na udaljenosti jedna od druge 5 cm. Od ispitanica je zahtijevano da se pozicioniraju u jednu od njih i da se, na znak pištaljkom, premjeste u drugu. Potom su trebali da uzmu platformu i da je postave na drugu stranu. Test se sastoji od dva pokušaja a broji se koliko će ovaj pokret ponoviti u 20 s. Izračunava se i broij prenesenih platformi = 1 bod, i premještanja tijela = 2 boda. Nakon završena dva pokušaja registruje se rezultat koji se dobija zbrajanjem oba pokušaja.

Dermatoglifske karakteristike:

Za prikupljanje otisaka deset prstiju korišten je digitalni sakupljač marke Cross Match®, Verifier 320 LC® i softver BioUnistation Biology®. Prikupljanje se sastojalo: ruke se očiste i potom se prinosi prvi prst , sa rukom savijenom u laktu, i prst se rotira oko svoje uzdužne ose u radijalnom smjeru. Mora se voditi računa da se otsci prstiju ne prave jedan preko drugoga na skeneru. Postupak se ponavlja sa svakim

ing at a minimum by the thumb of both hands (Roquetti Fernandes, 2004).

After obtaining the fingerprints, there was the reading of the same following the pattern below:

- Arc "A" - with no deltas drawing - is characterized by the absence of trirrádios or deltas and is composed of ridges crossing transversely the digital pad.
- Catch "L" - has a delta. This is a drawing enclosed in which the ridges of the skin begin to curl up from one end of the finger distally relative to each other, but without approaching that where they start.
- Whorl "W" - designs of two-deltas. A closed figure, in which the center lines are concentrated around one or more core in the drawing. Below are shown the types of drawings of fingerprints (Figure 1).

Features electroencephalographic (EEG):

For the EEG signal capture device was used Braintech 3000 (EMSA - Medical Instruments, Brazil) system that uses a digital-analog converter board (A/D) of 32 channels with 12 bit resolution. EEG signals were filtered analog between 16 Hz (high-pass) and 35 Hz (low-pass) with a sampling rate of 200 Hz was used EEG acquisition software called Capture (Emsa-DELPHI 5.0). The international system 10-20 (Jasper, 1958) was used for placement of 19 unipolar electrodes over the scalp (areas: frontal, temporal, parietal and occipital) and an electrode in each ear (lobe), and used as references (bi-atrial). We checked a priori impedance levels for each electrode, whose values were maintained between 5-10 KΩ (Kilo-ohms). For the acquired signals have full amplitude (peak to peak) less than 100 μV, it was amplified with a gain of approximately 20.000 times.

Involved them in the study were submitted to the reception of the sign EEG uptake at rest. The data

prstom, a počinje malim prstom i završava se palcom svake ruke (Roquetti Fernandes, 2004).

Nakon što se dobiju otisci prstiju, prstupa se njihovom očitavanju na način kako to slijedi:

- Luk "A" - bez delta šara - karakteriše ga odsustvo delti i sastoji se od nabora koji poprečno prelaze na jagodice prstiju.
- Kuka "L" - imaju delte. Ovo su zatvorene šare gdje nabori počinju da se boraju sa jednog kraja prsta distalno u odnosu na svaki drugi ali bez da se približavaju tamo gdje su započeli.
- Spirala "W" - sastoje se od dvije delte. Zatvorena figura, u kome su središnje linije koncentrisane oko jednog ili više jezgra u šari. U daljem tekstu su prikazane vrste šara na psrtima (Slika 1).

Elektroencefalografske karakteristike (EEG):

Za snimanje EEG signala korišćen je Braintech 3000 (EMSA - Medical Instruments, Brazil) sistem koji koristi digitalno-analognu konvertor ploču(A/D) sa 32 kanala i 12-bitnom rezolucijom. EEG signal nalogno se filtrira između 16 Hz (visoka frekvencija) i 35 Hz (niska frekvencija) uzimanjem uzorka od 200 Hz koji koristi EEG nabavljeni siftver nazvan Capture (Emsa-DELPHI 5.0). Međunarodni sistem 10-20 (Jasper, 1958) se koristi da se postavi 19 unipolranih elektroda na lobanji (oblasti: frontalna, temporalna, parijetalna i zatiljačna) i po jedna ekletroda u svakom uhu (ušna školjka) a koriste se kao referentne (dvo-

FIGURE 1

The types of drawings of fingerprints: Arch (A), Hook (L), Whorl (W) (Source: Roquetti Fernandes, 2004).

SLIKA 1

Vrste linija otisaka prstiju: Luk (A), Kuka (L), Spirala (W) (Izvor: Roquetti Fernandes, 2004).

Arch (A) Hook (L) Whorl (W)

fibrilacijske). Apriori smo provjerili nivoe impendance za svaku elektrodu čije su vrijednosti održavane između 5-10 KΩ (Kilo-oma). Pošto dobijeni signali imaju punu amplitudu (od vrha do vrha) manju od 100 μV bili su pojačani približno 20.000 puta.

Tokom istraživanja dobijeni EEG signal uziman je u mirovanju. Prikupljeni podaci se odnose samo na apsolutnu jačinu (PA) i beta (13-35 Hz) i alfa (8-12

collected relate only to absolute power (PA) of beta rhythms (13-35 Hz) and alpha (8-12 Hz), since alpha is the individual lying down and relaxed wakefulness with eyes closed, and beta be associated with processes of sensory-motor integration. Only electrodes located in frontal areas (F3-F4), central (C3-C4) and parietal (P3-P4) were selected. Frontal areas were analyzed because of their association with mechanisms of attention, motivation and planning. Central and parietal electrodes were analyzed as representative areas of pre motor and primary motor, and primary sensory (Goda & Stevens, 1996) somatosensory areas.

The room used for the test was prepared with a sound isolation and during the examination, the lights were kept to a maximum. The subjects sat comfortably in a chair with a slight slope, with their arms supported, with the aim of reducing muscular artifacts.

After collection of data and its associated archive was used to calculate the dependent variable extracted from quantitative electroencephalography (qEEG). A routine in Matlab 5.3® (Mathworks Inc., Naticj, Ma, USA) was implemented to perform spectral analysis and estimate the specific parameter of interest: absolute power in the alpha and beta rhythms.

Statistical treatment

Descriptive statistics: The descriptive analysis presented consisted of a set of measures aimed to define the profile of each group studied, obtaining representative values of the data obtained through the measures of central tendency (mean), and characterizing the variation of these data, by means of measures of dispersion (standard deviation) and for percentiles.

Inferential statistics: Tests were used Komolgorov-Smirnov and Shapiro-Wilk test and QQ Plot order to obtain a distribution curve of the data. From these results, it was found that the data is not normally distributed. So, to compare the data we used bivariate nonparametric Mann-Whitney test, and $p \leq .05$.

In the case of an experiment with several variables, we chose to examine, in the light of the multivariate analysis of Cluster, if there was a single association or set of associations between variables. For this purpose, we used the age factor for the creation of cases: the case 1 = 10 years; case 2 = 15 years and case 3 = 12 years; choosing the number of three (3) cases is intended to reduce clusters. The significance level of 5% was considered, which defines as a rule of decision when the results present $p<.05$ can be stated that for the variable being tested, there is a significant difference.

RESULTS AND DISCUSSION

Results are presented and then, with basement

Hz) ritmove, pošto pri alfi pojedinac leži budan i opušten sa zatvorenim očima, a beta je povezana sa procesom senzorno-motorne integracije. Odabrane su samo elektrode koje leže u frontalnoj oblasti (F3-F4), centralne (C3-C4) i parijetalne (P3-P4). Frontalne oblasti analizirane su zbog njive povezanosti sa mehanizmima pažnje, motivacije i planiranja. Centralne i parijetalne elektrode anlizirale su reprezentativne pre motorne i primarno motorne i primarno senzorne (Goda i Stevens, 1996) somatosenzorne oblasti.

Prostor koji se koristio za testiranje bio je zvučno izolovan a svjetla su tokom ispitivanja održavana na maksimumu. Ispitanice su sjedile u udobnoj stolici sa blagim nagibom, sa rukama na naslonima kako bi se izbjegli mišićni pokreti.

Nakon prikupljanja podataka i prateće arhive oni su korišćeni za izračunavanje zavisno promjenljivih izvedenih iz kvantitativne elektroencefalografije (qEEG). Izračunavanje je sprovedeno u Matlab 5.3® (Mathworks Inc., Naticj, Ma, USA) kako bi se sprovela spektralna analiza i procjenili specifični parametri koji nas interesuju: apsolutna jačina u alfa i beta ritmovima.

Statistička procedura

Deskriptivna statistika: Deskriptivna analiza sastojala se od niza mjera koje su imale za cilj da definišu profil svake grupe učenica, da se dobiju reprezentativne vrijednosti podataka kroz mjere centralne tenedencije (aritmetička sredina) a koje opisuju varijacije tih podataka pomoću mjera disperzije (standardna devijacija) te za percentile.

Inferentialna statistika: Korišćeni su Kolmogorv-Smirnov i Shapiro-Wilk test i QQ Plot da bi se dobila kriva distribucije podataka. Iz ovih rezultata utvrđeno je da podaci nisu normalno distribuirani. Stoga je, da bi se uporedili rezultati, korišten neparametrijski Mann-Whitney test i vjerovatnoća $p \leq 0{,}05$.

U slučaju eksperimenta sa više promjenljivih izabrali smo da se ispita, u svjetlu multivariacione analize klastera, da li postoji jedan skup ili set skupova među varijablama. U tu svrhu koristili smo faktor uzrasta za stvaranje slučaja: slučaj 1 = 10 godina; slučaj 2 = 15 godina; slučaj 3 = 12 godina; izbor tri (3) slučaja imao je za namjeru smanjenje klastera. U obzir je uzeta nivo značajanosti od 5% koji je predstavljen kao pravilo da kada rezultat iznosi $p<0{,}05$ može se reći da postoji značajna razlika za testirane varijable.

REZULTATI I DISKUSIJA

Rezultati su predstavljeni a onda su temeljito obrazloženi uz pomoć odgovarajuće literature, kako

discussed in the literature searches in order to provide a better understanding of relevant data.

Results comparing motor characteristics, dermatoglyphic and EEG between G1 and G2

Comparing the performance of pre-menarche girls (G1) and post-menarche (G2) (Table 1), it was observed that there was no significant difference to a value of $p \leq .05$ in the performance of tasks related to (QM1) (QM2) and (QM3). However, in the last task that makes up the protocol used, and refers to (QM4), it was found a significant difference to a value of $p \leq .05$ between groups G1 and G2, with the best performance achieved G2.

Knowing that the motor performance during childhood and adolescence has a strong association with the processes of growth and maturation, Malina, Bouchard, and Bar-Or (2009) discuss several factors that influence the performance, such as maturation and cultural factors, body size and other. Thus, the growth and maturation are considered interrelated processes influenced by media interdependent and interrelated. Thus Mirwald, Baxter-Jones, Bailey, and Beunen (2002) discuss that the evaluation of maturity when related to adolescents is of great importance for effective motor program. The physical exercise during the stages of childhood and adolescence can aid in the overall development of individuals in maintaining body weight and improved levels of coordination (Collet, Folle, Pelozin, Botti, & Nascimento, 2008).

Linhares et al. (2009) emphasize that, as a phase of constant and large changes, puberty and its variables ask the professionals who work directly with the people who are in this stage, detailed knowledge in relation to growth and development in order facilitate

bi bezbjedili bolje razumjevanje relevantnih podataka.

Rezultati poređenja motornih karakteristika, dermatoglifike i EEG između G1 i G2

Upoređujući sposobnosti djevojaka prije menarhe (G1) i poslije menarhe (G2) (Tabela 1) uočava se da ne postoji razlika u vrijednostima od $p \leq 0{,}05$ u obavljanju zadataka vezanih za (QM1) (QM2) i (QM3). Međutim, u zadnjem zadatku iz protkola koji se koristio a odnosi se na (QM4), utvrđena je značajna razlika u vrijednostima od $p \leq 0{,}05$ između grupa G1 i G2 sa najboljim sposobnostima postignutim u G2.

Imajući u vidu da motorne sposobnosti u djetinjstvu i adolscenciji su jako povezane sa procesima rasta i sazrijevanja Malina, Bouchard i Bar-Or (2009) su istakli nekoliko faktora koji utiču na sposobnosti kao što su sazrijevanje i kulturni faktor, veličina tijela i drugo. Dakle, rast i sazrijevanje se smatraju međusobno povezani i nezavisni procesi pod uticajem osobe. Mirwald, Baxter-Jones, Bailey i Beunen (2002) su došli do zaključka da je procjena zrelosti, kada su u pitanju adolescenti, od velikog zančaja za efikasan motorni program. Fizičko vježbanje tokom perioda djetinjstva i adolescencije može pomoći ukupnom razvoju pojedinaca u održavanju tjelesne težine i poboljšanju nivola koordinacije (Collet, Folle, Pelozin, Botti i Nascimento, 2008)

Linhares i saradnici (2009) ističu da, kao period stalnih i velikih promjena, pubertet i njegove varijable traže od profesionalca koji rade direkto sa ljudima koji su u ovoj fazi života, detaljnija znanja o rastu i razvoju da bi se olakšalo i obezbjediolo osnovno motorno funkcionisanje, izbjegavajući pretjerivanja u odnosu na fazu u kojoj se tinejdžer nalazi. Vidal i

TABLE 1

Comparison of the results of motor characteristics between groups G1 and G2.

TABELA 1

Poređenje rezultata motoričkih karakteristika između grupa G1 i G2.

	M			
	QM1	QM2	QM3	QM4
G1	26.64	25.72	20.24	27.67
G2	19.81	20.79	25.42	18.92
p	.267	.118	.090	**.050**

Legend/Legenda: **QM1** - Balanced backpedal (Pedaliranje unazad); **QM2** - Single Leg Vertical Jump (Skok uvis jednom nogom); **QM3** - Lateral jumps (Bočni skokovi); **QM4** - Transposition Lateral (Bočna transpozicija); ***M*** - Mean (Aritmetička sredina); **G1** - Group 1 (Grupa 1); **G2** - Group 2 (Grupa 2); ***p*** - Probability (Vjerovatnoća).

and provide a crucial motor work, avoiding excesses in relation to the stage where your teen is. Thus Vidal et al. (2009) indicate the battery of tests KTK as a user-friendly tool to assess the coordination of the participants. However, Gorla, Duarte, and Montagner (2008) describe that the KTK test battery should not be seen as just one mean of assessment and coordination, but rather as part of a set of methods and procedures that can assess each individual in different ways.

Gorla et al. (2008) mentioning that individuals who have difficulty in movement, show a coordination disorder, often have problems associated with learning. Thus, the practice of physical activity from childhood and a daily exercise program, improve the expression level of coordination, contributing to the development of the individual and their quality of life (Barbosa et al., 2007; Lopes & Maia, 1997). The present study found that compared to tests Battery KTK, comparing G1 and G2, there was no significant difference in the ratios (QM1), (QM2) and (QM3), which differs from Malina et al. (2009) studies showing that individuals who are more advanced in maturational stages have mature movement patterns in a way that would influence the motor aspect. Though, the results of that study converge with Souza, Gorla, Araújo, Lifante & Campana (2008) which notices that different factors can influence in those results, could mention the concentration difficulty, lack of attention in the moment of the task, impatience when they don't get to accomplish with success the movement and existence lack and experience in the proposed activities. Regarding the (QM4) - lateral transposition (TL), being possibly the most complex task and, for this reason, demanding a larger effort on the part of the performers during his/her realization. The task of transposing side is characterized by being a type of activity where the performer needs to combine speed and complexity, it must make use of all body segments and have under control action coordination to move from one platform to another. Comparing the results between the groups G1 and G2, there was significant difference between the groups with the G2 demonstrated a better performance on the task. This result corroborates with the writings of Eckert (1993) when he says that the change in engine performance tends to correspond to changes in body size, strength and physiological functioning at puberty, which is observed in the group of girls after menarche.

Studies involving maturation have been considered, but few are those who find differences with respect to maturational stages. Thus, Lopes, Maia, Silva, Seabra, and Morais (2003) explain that most often occur dif-

saradnici (2009) ukazuju na bateriju testova KTK kao korisno a sigurno sredstvo da se procijeni koordinacija ispitanika. Međutim, Gorla, Duarte i Montagner (2008) smatraju da KTK bateriju testova ne treba sagledavati samo kao jedan od načina procjene i koordinacije nego radije kao dio skupa metoda i postupaka koji mogu procijeniti svakog pojedinca na različite načine.

Gorla i saradnici (2008) navode da osobe koje imaju poteškoća u kretanju i pokazuju poremećaje u koordinaciji često imaju i problema sa učenjem. Dakle upražnjavanje fizičke aktivnosti od djetinstva i dnevni program vježbanja poboljšavaju ispoljavanje nivoa koordinacije, doprinose razvoju pojedinca i njegovom kvalitetu života (Barbosa i saradnici, 2007; Lopes i Maia, 1997). Ovo istraživanje pokazalo je da, u odnosu na bateriju testova KTK, a poredeći G1 i G2, nije bilo značajnije razlike u pokazateljima (QM1), (QM2) i (QM3), a što se razlikuje od istraživanja Malina i saradnika (2009) koja je pokazalo da pojedinci koji su u poodmaklijim fazama sazrijevanja imaju zrelije obrazce kretanja tako da to utiče na motorni aspekt. Rezultati ovog istraživanja, pak, podudaraju se sa istraživanjem Souza, Gorla, Araújo, Lifante i Campana (2008) koje upućuje da različiti faktori mogu da utiču na te rezultate. Mogu se navesti neki od njih: poteškoće u koncentraciji, nedostatk usredsređenosti na zadatak, nestrpljenje kada se ne mogu uspješno obavljati pokreti i nedostatak iskustva i stručnosti u aktivnostima koje se izvode. Što se tiče (QM4) - bočno premještanje (TL), to je vjerovatno najkopleksniji zadatak i, prema tome, zahtijeva veći napor izvođača tokom njegove realizacije. Zadatak bočno premještanje karakteriše vrsta aktivnosti u kojoj izvođač kombinuje brzinu i složenost, mora da koristi sve dijelove tijela i mora imati pod kontrolom koordinaciju prilikom premještanje iz jedne u drugu platformu. Poređenje rezultate između grupa G1 i G2 ukazalo je da postiji značajna između grupa. G2 je pokazala bolje sposobnosti prilikom izvođenja zadatka. Ovaj rezultat je potvrđen u Eckert (1993) člancima u kojima ističe da promjene u motornim vještinama ima tendeciju promjena u veličini tijela, snazi i fiziološkim funkcijama u pubertetu, koji karakteriše grupu djevojaka nakon menarhe.

Istraživanja koja govore o sazrijevanju su uzeta u obzir, ali su rijetke ona istraživanja koja su našla razliku u odnsou na periode sazrijevanja. Tako Lopes, Maia, Silva, Seabra i Morais (2003) kažu da se najčešće javljaju razlike u djevojčica u određenoj dobi u odnosu na rezultate koji se očekuju za njihov uzrast. Pojedinci istog uzrasta imaju različitu motornu koordinaciju, pa čak i ispod standarda koji se očekuju.

ferences in girls of a given age compared to results expected for their age group, individuals of the same age have diversified motor coordination or even below the standards expected. This is due to lack of physical activity and insufficient work, because when it is established and monitored carefully it contributes significantly to learning, and it is satisfying and beneficial (Deus et al., 2008). Analyzing the maturational process and motor development, Ulbrich et al. (2007) clarify that further studies in this area should be developed to promote a better understanding.

Motor coordination is an important physical quality and dermatoglifia presents itself as one of the possible indicators of genetic predispositions coordinative and basic physical qualities. The association of those two variables can contribute in a profitable way to notice if there is a dichotomy between the development of the capacity coordinative and the genetic predisposition and, like this being, to subsidize an intervention so that this basic physical quality is added.

The motor tests that make up the protocol used in this study are related to the physical qualities of balance, agility, speed and coordination. Comparing the results of this protocol with the dermatoglyphic patterns presented, we can conclude that, when it comes to speed and strength qualities that are valued in the physical test battery KTK, both groups showed satisfactory results. This result may have been influenced by the presence of larger D10 values of the two groups, as they are, according to Dantas & Fernandes Filho (2002) in category III qualification sport.

Razlog tome je nedostatak fizičke aktivnosti i nedovoljno treninga, jer kada se to uspostavi i pažljvo prati značajno doprinosi zadovoljvajućem učenju i korisno je (Deus i saradnici, 2008). Analizirajući proces sazrijevanja i motorički razvoj Ulbrich i saradnici (2007) istakli su da treba poduzeti dalja istraživanja na ovom području kako bi se postiglo bolje razumijevanje ovog problema.

Motorna koordinacija je važna fizička kvaliteta, a dermatoglifika se predstavlja kao jedan od mogućih pokazatelja genetskih predispozicija koordinacije i bazičnih fizičkih kvaliteta. Udružene, ove dvije karakteristike mogu da korisno doprinesu otkrivanju postojanja razlika između razvojnog kapaciteta koordinacijskih genetskih predispozicija i podstaknu djelovanje u smislu razvoja osnovne motorike koje ovaj kvalitet povećavaju.

Motorni testovi koji čine protokol korišćen u istraživanju povezani su sa fizičkim kvalitetima ravnoteže, agilnosti, brzine i koordinacije. Upoređujući rezultate tog protokola sa uzetim dermatoglifskim šarama možemo zaključiti da su, kada su u pitanju osobine brzine i snage, koje se vrednuju u motoričkim testovima baterije KTK, obe grupe pokazale zadovoljavajuće rezultate. Ovaj rezultat može da bude pod uticajem većih prisutnih D10 vrijednosti dviju grupa, kao što su oni, prema Dantas i Fernandes Filho (2002), koji se nalaze u III grupi sportova.

TABLE 2

Comparison results of dermatoglyphic characteristics between groups G1 and G2.

TABELA 2

Poređenje rezultata dermatoglifskih karakteristika između grupa G1 i G2.

	M			
	A	L	W	D(10)
G1	22.90	25.17	20.76	21.29
G2	23.08	21.10	24.96	24.50
p	.367	.565	.176	.168

Legend/Legenda: **A** - Arch (Luk); **L** - Hook (Kuka); **W** - Whorl (Spirala); **D(10)** - Distal phalanges of 10 fingers (Distalne falange 10 prstiju); ***M*** - Mean (Aritmetička sredina); **G1** - Group 1 (Grupa 1); **G2** - Group 2 (Grupa 2); ***p*** - Probability (Vjerovatnoća).

The data obtained (Table 2), with respect to dermatoglyphic patterns, corroborate the studies of Klein (2003) that when comparing the relationship between dermatoglyphic, the physical qualities and maturity level of students of both sexes, also found no difference between dermatoglyphic patterns presented by women's groups prepubescent and pubescent. Over-

Dobijeni podaci (Tabela 2), s obzirom na dermatoglifske šare, potvrđuju istraživanja Kleina (2003) koji je, kada se uporedi odnos između dermatoglifike, motornih kvaliteta i zrelosti učenika oba pola, našao iste takve razlike u dermatoglifskim šarama u ženskim grupama prepubescenata i pubescenata. Generalno, u ovom istraživanju provjera genetskog potencijala na osnovu dermatoglifskih karakteristika nije poka-

all, in this study, verification of genetic potential based on dermatoglyphic variables, showed no significant difference between the groups before and after menarche.

The age range of 7 to 11 years is characterized by major changes, both of a biological and psychological and social, which covers, among other things, the maturation of brain electrical activity (Gasser, Verleger, Bãcher, & Sroka, 1988). With increasing age, the background activity of the EEG undergoes modifications, particularly for infants, pre-school age, but still variations to the end of adolescence (Ibid). According to these authors, there is a provision of maturation occurs subsequent to the above regions. Such fact is possible to observe in adolescents that present difficulties for the development of the executive functions, once the same ones possess the frontal lobe function such as manager (Gomes & Bello, 2004).

The use of quantitative analysis of brain activity enables the quantification of data which, in a way, facilitates the understanding of the composition of the frequency of brain activity. This quantitative contribution is important, since the conventional EEG examination is based on visual reading the traces and is thus a subjective component (American Academy Neurology, 1997). Some measures can be used to obtain the EEG activity of brain rhythms. In this study we opted for the analysis of the absolute potency in order to if it compares, among the groups G1 and G2, the alterations of the rhythms alpha and beta, because to the if it accompanies the process of cerebral maturation in normal children it is known that, until the adult phase, it exists decrease of the activities theta and delta (slow) and increase of the activity alpha. This maturation process seems similar to studies conducted in different populations such as United States, Barbados and Cuba (Alvares, Valdes, & Pascual, 1987).

Comparing the groups G1 and G2 regarding electric activity of alpha and beta (Table 3), it was not found significant difference. It understands each other that the age group among the groups is very close, which maybe, it can be a factor to explain such result. These results corroborate studies Fonseca et al. (2003) in analyzing "normal" individuals between 7 and 11 years, hwo also found no significant difference in the absolute power of alpha and beta. The alpha activity is common in individuals who are at rest, which also converges with the aforementioned study, because in both studies the spectral activity was also captured with the subjects awake and with eyes closed. In what it refers to the wave beta, EEG studies eletroencefalográficos have been presenting out of sync (ERD) processes and synchronization (ERS) in the rhyme of beta, a decrease and a ghastly increase of this rhythm, in function of motor events, could be observed in primary motive areas during the voluntary movement (Feige, Aertsen & Feige-Kristeva, 2000) the mental planning of the movement (McFarzala značajne razlike između grupa prije i poslije menarhe.

Uzrast od 7 do 11 godina karakterišu velike promjene, biološke, psihološeke i sociološke, koje obuhvataju, između ostalog i sazrijvanje električne aktivnosti mozga (Gasser, Verleger, Bãcher i Sroka, 1988). Starenjem, aktivnost EEG prolazi kroz promjene, posebno za bebe, predškolski uzrast, ali su prisutna i odstupanja sve do kraja adolescencije (Ibid). Prema ovim autorima, sazrijevanja nastaje u tačno određenim regionima. Ova činjenica se može vidjeti kod adolescenata koji imaju poteškoća u razvoju izvršnih funkcija, pošto imaju fukcije u fronlanom režnju kao što je upravljanje (Gomes i Bello, 2004).

Korišćenje kvantitativne analize aktivnosti mozga omogućava kvantifikaciju podataka na način da olakšava razumijevanje strukture učestalosti moždane aktivnosti. Ovaj kvantitativni doprinos je važan, jer konevncionalna EEG istraživanja se zasnivaju na vizuelnom čitanju tragova i na taj način su subjektivna (American Academy Neurology, 1997). Neke mjere mogu da se koriste za dobijanje EEG ritmova moždane aktivnosti. U ovom istraživanju opredjelili smo se da analiziramo apsolutnu moć da bi uporedili promjene u alfa i beta ritmovima grupe G1 i G2, jer ako pratimo procese sazrijevanja mozga kod normalne djece poznato je, da do zrelosti, postoji smanjenje teta i delta (spori) i povećanje alfa aktivnosti. Ovaj proces sazrijevanja potvrdile su slične studije provedene na različitim populacijama kao što su istraživanja u SAD, Barbadosu i Kubi (Alvares, Valdes i Pascual, 1987).

Poredeći grupe G1 i G2 u pogledu alfa i beta električne aktivnosti (Tabela 3), nisu pronađene značajne razlike. Treba imati u vidu da su ove dvije grupe veoma blizu po godinama, što može da bude jedan od faktora koji obajšnjava ovaj rezultat. Ovi rezultati potvrđuju istraživanja Fonseca i saradnika (2003) koji su analzirajući "normalne" osobe starosti između 11 i 17 godina, smatraju da ne postoji zančajna razlika u alfa i beta apsolutnoj moći. Alafa aktivnost je uobičajena kod osoba koje su u stanju mirovanja, što je takođe u skladu sa prethodno pomenutim istraživanjem, jer je u obe studije spektralna aktivnost snimana na budnim osobama koje su imale zatvorene oči. Što se tiče beta EEG valova istraživanje je pokazalo da su procesi desinhronizacije (ERD) i sinhronizacije (ERS) beta ritmova, odnosno smanjenje i povećanje spektralnog nivoa u funkciji motornih događanja i može se posmatrati u primarnim motornim oblastima tokom voljnog pokreta (Feige, Aertsen i Feige-Kristeva, 2000), mentalnog planiranja pokreta (McFarland, 2003) i tokom pasivnih pokreta (Alegre i saradnici, 2002).

land, 2003) and also during passive movements. (Alegre et al., 2002).

In this context, the results of this study support previous data from other studies, since there was no planning or mental and motor actions at the time of capture spectral activity, what has probably contributed so that oscillations in beta were not produced.

Results of the association between the groups before and after menarche

Studies involving maturation and motor coordination and dermatoglyphic patterns have been developed throughout the ages. However, when dealing with correlations between these variables and EEG, few studies have been developed. Then, with respect to maturation and motor coordination, according to the literature, performance should improve with age, and the best results, on average, found in older subjects

U tom smislu rezultati ovog istraživanja su potvrda ostalih istraživanja pošto nije ni bila planirana mentalna ili motorna aktivnost tokom snimanja spektralne aktivnosti što je vjerovatno i pridonijelo da ne dođe do beta oscilacija.

Ukupni rezultati između grupa prije i poslije menarhe

Istraživanja koja uključuju sazrijevanje i motornu koordinaciju i uzorke dermatoglifskih šara provode se godinama. Međutom kada se radi o povezanosti između tih varijabli i EEG, postoji nekoliko istraživanja. U odnosu na sazrijvanje i motornu koordinaciju, prema literaturi, ona se poboljšava s godinama, a najbolje rezultate, u prosjeku, postižu stariji ispitanici (Malina & Brown, 1998). Ali ovaj zaključak nije u skladu sa

TABLE 3

Comparison of the results of absolute power in the á and β (electroencephalographic features) between groups G1 and G2.

TABELA 3

Poređenje rezultata á i β apsolutne moći (elektroencefalografskih karakteristika) između grupa G1 i G2.

Electrodes	*M*		*p*
	G1	G2	
F3A	22.90	23.08	.946
FZA	21.86	24.00	.585
F4A	22.29	23.63	.733
C3A	25.48	20.83	.237
CZA	22.33	23.58	.750
C4A	25.33	20.96	.265
P3A	23.14	22.88	.946
PZA	23.67	22.42	.750
P4A	23.38	22.67	.856
F3B	25.67	20.75	.219
FZB	22.43	23.50	.785
F4B	24.00	22.13	.633
C3B	23.81	22.29	.699
CZB	22.48	23.46	.802
C4B	25.52	20.79	.228
P3B	23.14	22.88	.946
PZB	22.95	23.04	.982
P4B	24.14	22.00	.585

Legend/Legenda: ***M*** - Mean (Aritmetička sredina); **G1** - Group 1 (Grupa 1); **G2** - Group 2 (Grupa 2); ***p*** - Probability (Vjerovatnoća).

(Malina & Brown, 1998). However the data for this statement diverge from this study (Table 4), since we did not find a correlation between these profiles.

With respect to dermatoglyphic profile and motor coordination, this can make a correlation in the case of coordinative abilities, because studies like Assef, Oliveira, Teixeira, and Alonso (2009) to analyze the profile of the athletes of the Brazilian women's soccer under 17, found among the 45 athletes participating in the study, 23 women with high predisposition dermatoglyphic, ie, low incidence of the number of arcs, to obtain the best results on the test of motor coordination.

Also related to the use of dermatoglyphic profile, the concomitant use of EEG, can quote the study Bogdanov, Gorbachevskaya, Solonichenko, Yakupova, and Iznak (1998) performed with 80 healthy girls, aged 6 to 8 years and with different dermatoglyphic patterns. Results found that the group with 10 loops (L) at the fingertips (n=18) correlates with a decrease in alpha spectral density, especially in the fronto-temporal compared to those without this pattern. In contrast, the group (n=22) with the predominance of 8-10 whorls (W), the spectral density banda alpha was higher than in the other groups. With regard to the data of the present study, we can also observe an association between increased activity of alpha spectral (Table 4), but only the pair of front and center electrodes.

The alpha frequency band, in some studies, has been correlated with cognitive processes, with changes in light exposure of the subject to cognitive tasks with different levels of complexity (Angelakisa et al., 2004). However, in this study the subjects were not exposed to any task, just getting awake and with eyes closed, which is also a characteristic of increased spectral activity in alpha.

With the division of cases into groups, based on multivariate statistical Cluster, the case number 2, composed of girls aged 15 years, showed the significant difference, but only in electroencephalographic profile, especially in the rhythm alpha and frontal regions (electrodes F3, FZ, F4) and central (electrodes C3 and CZ) and Wilk's Lambda $F_{(2;\ 5629;\ 461)}$=14.000, p=.001.

Studies indicate that girls in older age have a different pace of spectral activity and these changes may be related to genetics, however, suffering from environmental influences. The EEG can be applied for optimization studies in neurophysiology, neurology and clinical psychiatry because this examination revealed peculiarities in children with different patterns dermatoglyphic corroborating the suggestion of Bogdanov et al. (1998) when it says that "the patterns dermatoglyphic can be correlated with individual characteristics of EEG and, possibly to serve as a marker of certain aspects of SNC".

The results related to the pace and beta corroborate the research that points like a beta rhythm related to planning and also the mental sensory-motor integration (Kandel, Schwartz, & Jessel, 2003). The

ovim istraživanjem (Tabela 4) pošto nije ustanovljena korelacija između ovih karakteristika.

Što se tiče dermatoglifskih šara i motorne koordinacije, moguće je napraviti korelaciju kada su u pitanju koordinativne sposobnosti, pošto su istraživanja poput Assef, Oliveira, Teixeira i Alonso (2009) koja su analizirala karakteristike sportista kod Brazilskih fudablerki U17, pronašla da među 45 sportistkinja koje su sudjelovale u istraživanju njih 23 su imale visoke dermatoglifske predispozicije, tj. one sa niskom pojavom broja lukova postizale su bolje rezultate na testu motorne koordinacije.

Isto tako kada su u pitanju dermatoglifske šare sa istovremenim korišćenjem EEG treba navesti istraživanje Bogdanov, Gorbachevskaya, Solonichenko, Yakupova i Iznak (1998) koje je obuhvatilo 80 zdravih dejvojčica uzrasta od 6 do 8 godina i sa različitim dermatoglifskim šarama. Rezultati ukazuju da grupa sa 10 kuka (L) na jagodicama prstiju (n=18) korelira sa smanjenjem gustoće alfa spektra, posebno u frontalno-temporalnoj oblasti u poređenju sa onima bez tih šara. Nasuprot tome, grupa (n=22) sa dominacijom 8-10 spirala (W), spektralna alfa gustina bila je viša nego u ostalim grupama. U svjetlu podataka iz ovog istraživanja moemo uočiti vezu između povećanja alfa spektralnih aktivnosti (Tabela 4) ali samo para fronatlnih i centralnih elektroda.

Pojas alfa frekvencija, u nekom istraživanjima, povezan je sa kognitivnim procesima i promjenama u izloženosti svjetlu ispitanika koji je rješavao kognitivne zadatke različitog nivoa složenosti (Angelakisa i saradnici, 2004). Međutim, u ovom istraživanju, ispitanici nisu bili izloženi bilo kakvom zadatku, samo su trebali biti budni i zatvorenih očiju, što je karakteristično za povećanje alfa spektralne aktivnosti.

Podjelom ispitanica u grupe, shodno multivarijantnoj statistic klastera, ispitanice iz grupe 2, koja se sastojala od djevojaka uzrasta 15 godina pokazale su značajne razlike, ali samo u elektroencefalografskom profilu, posebno u alfa ritmovima u frontalnoj (elektrode F3, FZ, F4) i centralnoj (elektrode C3 i CZ) oblasti i Wilkis Lambda $F_{(2;\ 5629;\ 461)}$=14,000, p=0,001.

Istraživanja ukazuju da djevojke u starijem uzrastu imaju različit ritam spektralne aktivnosti i da ove promjene mogu biti u vezi sa genetikom ali i pod uticajem spoljašnje sredine. EEG se može primjeniti za optimizaciju studija u neurofiziologiji, neurologiji i kliničkoj pshijatriji zato što je ovaj eksperiment ukazao na posebnosti djece sa različitim dermatografskim šarama što ide u prilog istraživanjima Bogdanova i saradnika (1998) koji kaže da dermatografske šare mogu da budu u korelaciji sa individualnim karakteristikama EEG i da vjerovatno mogu poslužiti kao pokazatelj određenih aspekata CNS-a.

Rezultati koji se odnose na beta ritam potvrđuju istraživanja koja ukazuju da se beta ritam odnosi na planiranje kao i senzo-motorne integracije (Kandel,

activity of the beta rhythm exhibits increased spectral amplitude as a function of engine events and also because the afferent when different stimuli are presented. Then, for there not being visual incentives and much less motors in the moment of the reception of the ghastly activity of both groups, generating synchronization in the rhythm beta, it justifies the found results (Table 5).

Schwartz i Jessel, 2003). Povećanje beta ritma dovodi do povećanja spektralnih amplituda kao funkcije motornog mehanizma a, takođe, i zbog aferentnosti kada se izazivaju različiti nadražaji. Pošto ima jako malo vizuelnih i motornih aktivnosti tokom snimanja aktivnosti spektra kod obe grupe, generišuća sinhronizacija beta ritma opravdava ovaj rezultat (Tabela 5).

TABLE 4
Results of the association among motor characteristics, dermatoglyphic and EEG absolute power - Alfa (A).

TABELA 4
Rezultati udruživanja motoričkih karakteristika, dermatoglifskih i apsolutne moći EEG - Alfa (A).

Variables	Case	*p*
QM1 (motor profile)	2	.340
QM2 (motor profile)	2	.213
QM3 (motor profile)	2	.216
QM4 (motor profile)	2	.077
A (dermatoglyphic profile)	2	.689
L (dermatoglyphic profile)	2	.770
W (dermatoglyphic profile)	2	.592
D10 (dermatoglyphic profile)	2	.445
F3A (electroencephalographic profile - Alfa)	2	**.001**
FZA (electroencephalographic profile - Alfa)	2	**.000**
F4A (electroencephalographic profile - Alfa)	2	**.001**
C3A (electroencephalographic profile - Alfa)	2	**.004**
CZA (electroencephalographic profile - Alfa)	2	**.003**
C4A (electroencephalographic profile - Alfa)	2	.160
P3A (electroencephalographic profile - Alfa)	2	.100
PZA (electroencephalographic profile - Alfa)	2	.100
P4A (electroencephalographic profile - Alfa)	2	.190

Legend/Legenda: ***M*** - Mean (Aritmetička sredina); **G1** - Group 1 (Grupa 1); **G2** - Group 2 (Grupa 2); ***p*** - Probability (Vjerovatnoća).

CONCLUSION AND RECOMMENDATIONS

From the results it was observed that, with respect to motor characteristics, dermatoglyphic and EEG, the groups are not presented separately. However, to join the motor characteristics, dermatoglyphic and EEG groups before and after menarche, there was a significant difference with respect to brain activity only in the alpha rhythm and at frontal (F3, FZ, F4) and central (C3 and CZ) and in the post menarche (G2). Then, from these results, we can conclude that, with advancing age, the activity spectrum of the alpha rhythm tends to undergo changes both with respect

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Iz dobijenih rezultata se može primjetiti da s obzirom na motorne karateristike, dermatglife i EEG, grupe nisu predstavljene odvojeno. Međutim ako se spoje motorne karakteristike, dermatoglifske karakteristike i EEG grupa prije i poslije menarhe, uočava se značajna razlika u odnosu na moždanu aktivnost i to samo u alfa ritmovima na frontalnoj (F3, FZ, F4) i centralnoj (C3 i CZ) oblasti kod post menarhe (G2). Isto tako, iz ovih rezultata, da se zaključiti da u starijem uzrastu spektralna aktivnost alfa ritma ima tendeciju da se

TABLE 5
Results of the association among motor characteristics, dermatoglyphic and EEG absolute power - Beta (B).

TABELA 5
Ukupni rezultati motornih karakteristika, dermatogliskih karateristika i aspolute moći EEG - beta (B).

Variables	Case	*p*
QM1 (motor profile)	2	.340
QM2 (motor profile)	2	.213
QM3 (motor profile)	2	.216
QM4 (motor profile)	2	.077
A (dermatoglyphic profile)	2	.689
L (dermatoglyphic profile)	2	.770
W (dermatoglyphic profile)	2	.592
D10 (dermatoglyphic profile)	2	.445
F3A (electroencephalographic profile - Beta)	2	.843
FZA (electroencephalographic profile - Beta)	2	.616
F4A (electroencephalographic profile - Beta)	2	.831
C3A (electroencephalographic profile - Beta)	2	.867
CZA (electroencephalographic profile - Beta)	2	.986
C4A (electroencephalographic profile - Beta)	2	.683
P3A (electroencephalographic profile - Beta)	2	.395
PZA (electroencephalographic profile - Beta)	2	.905
P4A (electroencephalographic profile - Beta)	2	.293

Legend/Legenda: ***M*** - Mean (Aritmetička sredina); **G1** - Group 1 (Grupa 1); **G2** - Group 2 (Grupa 2); ***p*** - Probability (Vjerovatnoća).

to amplitude and also its distribution in the brain regions, since the predominance of its initial location is in the posterior region, more precisely in the occipital lobe, showing that age is a determining factor in brain activity in girls before and after menarche.

Then, we are suggested other studies with larger samples and that present chronological age different from the biological age. Such characteristics, possibly, would point larger differences among the researched variables.

podvrgne promjenama kako u pogledu amplitude tako i njene distribucije u moždanim oblastima pošto je dominacija njene početne lokacije u zadnjoj oblasti, tačnije u potiljačnom režnju, što ukazuje na to da je uzrast odlučujući faktor moždane aktivnosti kod djevojčica prije i poslije menarhe.

Zato, preporučujemo dalja istraživanja na većem uzorku kod ispitanica različitog hronološkog i biološkog uzrasta. Ta istraživanja mogla bi da pokažu veće razlike između ispitivanih varijabli.

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Received: February 4, 2013
Revision received: Jun 11, 2013
Accepted: Jun 27, 2013

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Primljeno: 4. februara 2013. godine
Izmjene primljene: 11. juna 2013. godine
Odobreno: 27. juna 2013. godine

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CARACTERÍSTICAS MOTORAS, DERMATOGLÍFICAS E ELETROENCEFALOGRÁFICAS DE MENINAS NOS PERÍODOS PRÉ E PÓS MENARCA

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A identificação da menarca, quando na puberdade, é importante para avaliar as qualidades físicas, uma vez que o organismo está a desenvolver um resultado da maturação. As características dermatoglíficas são apresentadas como possíveis indicadores de predisposições genéticas para as qualidades físicas básicas, tais como força, velocidade, resistência, força e coordenação. O objetivo deste estudo é relacionar as características motoras, dermatoglíficas e eletroencefálicas das meninas nos períodos pré e pós a menarca. Para este efeito, a amostra foi composta de 45 meninas com idades entre 10 e 14 anos e 11 meses, divididas em dois grupos, 21 no grupo pré-menarca (G1) e 24 de pós menarca (G2). As variáveis analisadas foram: características motoras, dermatoglíficas e eletroencefalográficas (potência absoluta em alfa e beta) nas regiões frontais (F), central (C) e parietal (P), utilizando o protocolo KTK, protocolo de impressões digitais e captura da atividade espectral através do Eletroencefalograma (EEG). Os resultados indicam uma diferença significativa no QM4 para um valor de $p \leq 0{,}05$ entre os grupos G1 e G2, onde o G2 apre-

sentou melhor desempenho. Em comparação, os resultados das características motoras, dermatoglíficas e eletroencefalográficas indicam diferenças significativas na atividade espectral do ritmo alfa nos eletrodos frontais (F3, FZ, F4) e centrais (C3 e CZ) naquelas pertencentes ao grupo pós menarca.

Palavras-chave: Menarca, coordenação, dermatoglifia, eletroencefalografia.

SportLogia
2013, 9(1), 78–89
ISSN 1986-6089
e-ISSN 1986-6119
CD-ROM ISSN 1986-6097

UČESTALOST ANAEROBNE MOĆI KOD BRAZILACA NA OSNOVU DERMATOGLIFIKE I R577X POLIMORFIZMA ACTN3 PROTEINA

FREQUENCY OF ANAEROBIC POWER AMONG BRAZILIANS BASED ON DERMATOGLYPHICS AND R577X POLYMORPHISM OF THE ACTN3 PROTEIN

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OWERVIEV PAPER
doi:: 10.5550/sgia.130901.en.006P
doi: 10.5550/sgia.130091.se.006P

PREGLEDNI ČLANAK
COBISS.BH-ID: 3815704
UDK: 796.012.1:159.928.23-05(=436)
COBISS.BH-ID: 3815448

SUMMARY

Dermatoglyphics and analysis of the Alpha-Actinin-3 gene are evaluative instruments frequently used to identify the sportive and general population profile associated with physical performance. This research aimed to determine, based on dermatoglyphic characteristics and the R577X polymorphism of Alpha-Actinin-3, the percentage of people in the State of Paraíba/Brazil, with unfavorable characteristics to excelling in sports that require anaerobic power. A descriptive study of profiles, with ex post facto typology, was performed. The dermatoglyphic fingerprint characteristics of 309 people (149 males and 160 females) were identified, and ACTN3 genotype was analyzed in 96 people (40 males and 56 females). The dermatoglyphic data indicated that 5.8% of the study population fit the classification of anaerobic muscle power predisposition, while 94.2% did not fit on it. The genetic frequency analysis indicated that 19.8% of subjects in the sample had the XX mutant genotype.

SAŽETAK

Dermatoglifika i analize Alfa-aktin gena su evluativni instrumenti koji se često koriste za selekciju sportista i uopšte populacije u odnosu na motoričke vještine. Ovo istraživanje imalo je za cilj da utvrdi, na osnovu dermatoglifskih karakteristika i R577X polimorfizma Alfa-aktina, procenat ljudi u saveznoj brazilskoj državi Paraiba sa nepovoljnim sposobnostima za sportove koje karakterišu anaerobne sposobnosti. Izvršena je deskriptivna studija profila sa eks post fakto tipologijom. Identifikovani su dermatoglifski otisci prstiju 309 osoba (149 muškaraca i 160 žena), a ACTN3 genotip je analiziran na njih 96 (40 muškaraca i 56 žena). Dermatoglifski podaci pokazuju da 5,8% populacije obuhvaćene istraživanjem odgovara anaerobnim predispozicijima mišićne moći, dok 94,2% nema te sposobnosti. Genetička analiza frekvencija ukazala je na činjenicu da su 19,8% ispi-

These results represent a substantial error reduction in the search for and selection of athletes with the potential for high performance, especially in those sports that require AMP.

Key Worlds: Alpha-actinin, Fingerprint, Genetic Polymorphism, Skeletal Muscle, Genotype frequency.

INTRODUCTION

The search for sports talent is a phenomenon that have been constant growing and brings with it precious investments in potential elite athletes. Therefore, the use of adequate and specific evaluative instruments is fundamental to identifying promising athletes. These instruments help to reduce the chances of mistakes and excessive financial expenses by increasing the likelihood of identifying athletes that are capable of achieving a high level of performance in particular sport modalities (Kansal, 2010).

One evaluative method being used to characterize high-performance athletes is dermatoglyphics, an approach that involves the analysis of the patterns made by dermal papillae originating from the neurovascular region. These patterns are formed since the womb period and remain unchanged throughout life. This form of analysis establishes strong correlations between dermatoglyphic features and particular physical qualities, offer an inexpensive evaluation, and is highly reproductible (Abramova, Nikitina, & Ozolin, 1996; Junior, Cunha, Scheneider, & Dantas, 2006; Kücken & Newell, 2005; Zary & Fernandes-Filho, 2007; Zary et al., 2010).

The immutability of fingerprints allows their configurations analysis from childhood, making this method a valuable tool for identifying and training potential individuals at all levels of human development, from beginning level to elite level sports (Bogle, Reed, & Norton, 1994; Cummins & Midlo, 1961; Linhares et al., 2009).

Successful performance in certain sport modalities requires good Anaerobic Muscle Power (AMP). This physical property is related to the gene that encodes α-actinin isoform 3 (ACTN3), which is specific to type II rapid contraction fibers. ACTN3 is an actin-binding protein which is part of the Z line of the sarcomere; it assists in the organization and maintenance of the contractile apparatus, and in the arrangement of myofibrils (Macêdo & Fernandes-Filho, 2003; Mills et al., 2001; North et al., 1999; Holdys, Kryściak, Stanisławski, & Gronek, 2011; Papadimitriou, Papadopoulos, Kouvatsi, & Triantaphyllidis, 2008).

tanika imali XX mutan genotip. Ovi rezultati predstavljaju značajano smanjenje greške u izboru sportista za potencijalno vrhunske rezultate pogotovu u onim sportovima koji zahtijevaju AMP.

Ključne riječi: Alfa-aktin, otisci prstiju, genetski polimorfizam, skeletni mišić, frekvencija genotipa.

UVOD

Potraga za sportskim talentim je fenomen koji neprestano raste i sa sobom donosi i dragocjena potencijalna ulaganja u vrhunski sport. Shodno tome, korišćenje adekvatnih specifičnih instrumenata je osnova za identifikovanje perspektivnih sportista. Ti instrumenti pomažu da se smanji mogućnost greške i preveliki finansijski rashodi tako što se povećava broj sportista koji mogu da dosegnu visoke sposobnosti u različitim sportovima (Kansal, 2010).

Jedna od metoda koja se koristi za procjenu sportista koji posjeduju visoke sposobnosti je dermatoglifika, pristup koji obuhvata analizu uzoraka kožnih papila koji vode porijeklo iz neurovaskularnih regija. Ti regioni se formiraju još u materici i ostaju nepromjenjeni tokom cijelog života. Ova vrsta analize potvrdila je jake veze između dermatglifskih karakteristika i pojedinih motoričkih sposobnosti, a uz to je i vrlo jeftina i visoko efikasna (Abramova, Nikitina i Ozolin, 1996; Junior, Cunha, Scheneider i Dantas, 2006; Kücken i Newell, 2005; Zary i Fernandes-Filho, 2007; Zary i saradnici, 2010).

Nepromjenljivost otisaka prstiju omogućava analizu njihove konfiguracije od djetinjstva, tako da je to korisno sredstvo za identifikovanje i obuku talentovanih pojedinaca na svim nivoima ljudskog razvoja, od početničkog do vrhunskog sportskog nivoa (Bogle, Reed i Norton, 1994; Cummins i Midlo, 1961; Linhares i saradnici, 2009).

Uspješan nastup u pojedinim sportovima zahtijeva dobru anaerobni mišićnu moć (AMP). Ova motorička sposobnost je u vezi sa ά-aktin izomorfom (ACTN3), koji je karakterističan za II tip brzo kontraktilnih mišićnih vlakana.ACTN3 je aktin-vezujući protein koji je dio Z linije sarkoma; on pomaže u organizovanju i održavanju kontraktilnog aparata i uređenju miofibrila (Macêdo i Fernandes-Filho, 2003; Mills i saradnici, 2001; North i saradnici, 1999; Holdys, Kryściak, Stanisławski, & Gronek, 2011; Papadimitriou, Papadopoulos, Kouvatsi, & Triantaphyllidis, 2008).

577R alela ACTN3 gena proizvodi aktivni ACTN3 protein u RR homozigotu i RX heterozigotu. Ti

The 577R allele of the ACTN3 gene produces active ACTN3 protein in RR homozygotes and RX heterozygotes. These genotypes are favorable for anaerobic activity and are associated with elite and Olympic sprinter athletes. The ACTN3 R577X polymorphism can also be identified in childhood and determining the genotype for this locus can provide information about an individual's genetic predisposition for AMP (Druzhevskaya, Ahmetov, Astratenkova, & Rogozkin, 2008; Eynon et al., 2009; Moran et al., 2007; Yang et al., 2003).

The presence of active ACTN3 is not vital to the human body since α-actinin isoform 2 (ACTN2) can satisfactorily make up for its absence in normal daily functioning. However, the absence of ACTN3 appears to hinder athletic muscular performance in terms of anaerobic muscle power, and XX genotype individuals are generally not found among elite athletes participating in events that require this physical quality to excel (Bustamante-Ara et al., 2010; Norman et al., 2009; Roth et al., 2008; Scott et al., 2009).

By determining the dermatoglyphic profile and the polymorphism R577X of the ACTN3, the goal of this study was to assess the percentage of people living in the State of Paraíba/Brazil that would not be good candidates for sports that require AMP.

METHODS

Study Design and Subjects

The sample of this study was randomly selected among 7-17 years old students living in the State of Paraíba/Brazil. Descriptive profiles were compiled with an ex post facto typology which identified the fingerprint characteristics of 309 subjects (149 boys and 160 girls); among these, 96 subjects (40 boys and 56 girls) were genotyped for ACTN3.

Digital impressions (DIs) and cells from the oral mucosa were collected at the UNIPÊ/SANNY Laboratory of the Physical Education Course of the University of João Pessoa - UNIPÊ, by one researcher (C.R.P.). The biological material collected were then passed on to the laboratory complex of the Scientific Policing Institute of the State of Paraíba (SPI/PB).

The research was approved by the Human Research Ethics Committee of the Lauro Wanderley University Hospital (EC/LWUH) under protocol no 677-10. Written free and informed consent forms were obtained from all the parents and guardians in compliance with the 1975 Helsinki Declaration.

genotipovi su pogodni za anaerobne aktivnosti i nalaze se kod vrhunskih sportista i olimpijaca sprintera. ACTN3 R577X polimorfizam takođe može da se identifikuje u djetinjstvu i određivanje genotipa za ovaj lokus može dati informacije o genetskim predispozicijama pojedinca za AMP (Druzhevskaya, Ahmetov, Astratenkova i Rogozkin, 2008; Eynon i saradnici, 2009; Moran i saradnici, 2007; Yang i saradnici, 2003).

Priustvo aktivnog ACTN3 nije od vitalnog značaja za organizam pošto ά-aktin izoform 2 (ACTN2) na zadovoljavajući način može da nadoknadi njegov nedostatak u normalnom svakodnvenom funkcionisanju. Međutim, odsustvo ACTN3 čini se da spriječava sportske mišićne sposobnosti tipa anaerobne mišićne moći, a pojedinci sa XX genotipom se u suštini i ne nalaze među onim vrhunskim sportistima koji se takmiče u onim aktivnostima koje zahtijevaju visok nivo ovih fizičkih predispozicija (Bustamante-Ara i saradnici, 2010; Norman i saradnici, 2009; Roth i saradnici, 2008; Scott i saradnici, 2009).

Pošto je utvrđen dermatoglifski profil i polimorfizam ACNT3-ov R577X, cilj ovog istraživanja bio je da se ustanovi procenat ljudi koji žive u saveznoj brazilskoj državi Paraiba a koji koji ne bi bili dobri kandidati za sportove koji zahtijevaju AMP.

METODE

Provođenje istraživanja i ispitanici

Uzorak ovog istraživanja nasumično je odobaran među učenicima starosti 7-17 godina koji žive u saveznoj brazilskoj državi Paraiba. Deskriptivni profil urađen je pomoću eks post fakto tipologije koja je prepoznala karakteristike otisaka prstiju 309 ispitanika (149 dječaka i 160 djevojčica), a među nima 96 ispitanika (40 dječaka i 56 djevojčica) su genetipizirani na ACTN3.

Digitalni otisci (DIs) i ćelije iz sluzokože usne šupljine su prikupljeni u UNIPÊ/SANNY laboratoriji Univerziteta João Pessoa - UNIPÊ od strane jednog istraživača (C.R.P.). Prikupljani biološki materijal potom je prenjet u laboratrorijski kompleks Policijskog instituta države Paraiba (SPI/PB).

Istraživanje je odobreno od strane Etičkog komiteta za istraživanja na ljudima Lauro Wanderley univerzitetske klinike (EC/LWUH) na osnovu prtokola broj 677-10. Potpsani obrazci da se dobrovoljnom voljom pristaje na istraživanje dobijeni su od svih roditelja ili staratelja u skladu sa Helsinškom deklaracijom iz 1975. godine

Protocol for dermatoglyphic data collection and analysis

DIs were collected and analyzed following as described by Cummins and Midlo (1961). Forensic-grade flat and rolled DIs were captured using a Cross Match® Verifier 320 LC scanner linked to a computer. The DIs were classified as having no delta Arch (A) patterns, single delta Loop (L) patterns, and two deltas Whorl (W) patterns.

Next, the number of deltas on the ten digits (D10) of the hands was identified from their sum. The summation total quantity of lines (STQL) was obtained by counting the lines present between the deltas and the DI nuclei on all the fingers, discounting the first and final line.

Individuals were designated as not having a predisposition for AMP if they did not have the dermatoglyphic characteristics for AMP described by Abramova, Nikitina, and Ozolin (1996): A=1 or 2; L=7 or 8; W=1 or 2; STQL≤134, and D10≤13.

Protocol for ACTN3 genotype data collection and analysis

The biological material used to analyze the ACTN3 R577X polymorphism came from oral mucosa cells that were collected using a sterile cotton bud that was swabbed in the internal cavity of the mouth until the cotton absorbed the saliva. The collected material were subjected to DNA extraction as described by Walsh, Metzger, and Higuchi (1991). Genotypes were determined by employing real-time polymerase chain reactions (PCRs) using an IQ5 Thermal Cycler (Biorad) PCR machine with a kit designed to reveal the R577X polymorphism (Assay Id C5900931-Applied Biosystems).

Statistical Analysis

Descriptive statistics were used to represent the dermatoglyphic frequencies of A, L, W, D10, and STQL, as well as the frequencies of the ACTN3 R577X polymorphism as determined by gene counting. The frequencies were represented as percentage values. All analyses were performed using the Statistical Package for the Social Sciences (SPSS), Version 14.0.

RESULTS

Dermatoglyphic Profiles

Of the 309 subjects examined, 291 (94.2%) were classified as not predisposed to AMP according to

Protokol za prikupljanje dermatoglifska podataka i analiza

DIs su prikupljeni i analizirani kako su opisali Cummins i Midlo (1961). Forenzički razredi i valjani DIs su uzeti pomoću Cross Match® Verifier 320 LC skenera koji je bio povezan sa računarom. DIs su bili klasifikovani: bez delta Luk (A), jedna delta Kuka (L) i dve delete Spirala (W).

Potom je broj delti na deset prstiju (D10) na rukama identifikovan iz njihovog zbira. Ukupan zbir linija (STQL) dobijen je prebrojavanjem pronađenih delta šara i DI nukleusa na svim prstima, odbijajući od toga broja prvu i zadnju šaru.

Osobe koje se oznavačaju kao one koje nemaju predispozicije za AMP su one koje nemaju dermatoglifske karakteristike opisane od strane Abramova, Nikitina i Ozolin (1996): A=1 ili 2; L=7 ili 8; W=1 ili 2; STQL≤134; i D10≤ 13.

Protokol za prikupljanje ACTN3 genotipa i analiza podataka

Biloški materijal, ACTN3 R577X polimorfizan za analizu uziman je od oralnih ćelija sluzokože koja se prikupljala uz pomoć sterilne vate pomoću koje je pravljen bris unutrašnje šupljine usta sve dok pamuk ne pokupi pljuvačku. Sakupljani materijal je podvrgnut očitavanju DNA kao što je to opisano od strane Walsh, Metzger i Higuchi (1991). Genotipovi su određivani uz pomoć reakcije lanca pliomeraze (PSTs) u realnom vremenu uz pomoć IQ5 Thermal Cycler (Biorad) PCR aparata kako bi se ustanovio R577X polimorfizam (analiza Id C5900931-Applied Biosystems).

Statistička analiza

Da bi se predstavili rezultati dermatoglifskih frekvencija A, L, W, D10 i STQL kao i frekvencija ACTN3 R577X polimorfizma gena utvrđenih prebrojavanjem korištena je deskriptivna statistika. Frekvencije su predstavljene kroz procentulane vrijednosti. Sve analize su provedene uz pomoć statističkog paketa za društvene nauke (SPSS), verzija 14.0.

REZULTATI

Dermatoglifski profili

Od 309 ispitanih osoba, na osnovu njihovog dermatoglifskog profila, njih 291 (94,2%) su klasifikovane

their dermatoglyphic profiles. Within this group it was found individuals with physical characteristics associated with a high resistance to speed (14.0%), pure force (4.1%), endurance (46.9%) and motor coordination (29.2%). Only 18 (5.8%) of the sample presented a dermatoglyphic profile suggestive of a propensity for sports that require high-power muscle contraction.

ACTN3 Genotyping

Of the 96 subjects investigated for which ACTN3 genotype information was determined, 19.8% were XX homozygotes, 47.9% were RX heterozygotes, and 32.3% were RR homozygotes. Thus, as both RR homozygotes and RX heterozygotes express the active form ACTN3, 80.2% of the sample were not excluded from potentially having an AMP predisposition. The 19.8% that were found to have the XX genotype were considered to be likely incapable of realizing contractions with high performance AMP.

DISCUSSION

This was a pioneering type of research in which was identified the relative frequency of individuals who do not have a predisposition to perform high-powered muscle contractions in a cohort of subjects in the State of Paraíba/Brazil, based on dermatoglyphics and ACTN3 polymorphism genotyping.

The dermatoglyphic classification approach was better able to identify people who are not predisposed to AMP (94.2%) than ACTN3 analysis (19.8%). However, it should be noted that the dermatoglyphic approach involved an associative analysis (Abramova, Nikitina, & Ozolin, 1996), whereas subjects identified as having the XX genotype were identified as not being able to perform high strength performance contractions due to their lack of active ACTN3 protein, which affects in a functional way the contractile apparatus needed for rapid contraction (Roth et al., 2008; Scott et al., 2009).

Dermatoglyphics

The dermatoglyphic classification of individuals who are not predisposed to AMP stemmed from an analysis of qualitative and quantitative indexes obtained from the subjects' DIs. In a study of the dermatoglyphic characteristics of 122 adolescents, of both sexes, who were not athletes and who lived in the city of Resende - Rio de Janeiro/Brazil, (Klein & Fernandes-Filho, 2003) found that approximately 59.0% of the subjects had dermatoglyphic patterns that did not

kao pojedinci koji nemaju AMP predispozicije. Unutar ove grupe otkriveni su pojedinci sa visokom rezistentnošću na: brzinu (14,0%), maksimalnu snagu (4,1%), izdržljivost (46,9%) i motornu koordinaciju (29,2%). Samo 18 (5,8%) ispitanika imalo je dermatoglifski profil koji je ukazivao na sklonosti za sportove koji traže veliku moć mišićne kontrakcije.

ACTN3 genotipovanje

Od 96 ispitanika za koje je ustanovljen ACTN3 genotip, 19,8% su bile XX homozigotne, 47,9% RX heterozigotne i 32,3% RX homozigotne. Kako RR homozigotne kao i RX heterzigotne sadrže aktivnu formu ACTN3, 80,2% ispitanika nije isključeno iz moogućnosti da potencijalno ima AMP predispozicije. 19,8% ispitanika kod kojih je ustanovljen XX gentip klasikovani su kao oni koji vjerovatno nisu u stanju da izvedu kontrakcije sa visokim sposobnostima AMP.

DISKUSIJA

Ovo je pionirska vrsta istraživanja u kojoj je identifikovana relativna frekvencija pojedinaca koji nemaju predispozicije za izvođenje visoko moćnih mišićnih kontrakcija u populaciji osoba koja živi u saveznoj državi Paraiba (Brazil), a baziralo se na dermatoglifici i ACTN3 polimorfizmu genotipova.

Pristup dermatoglifskom klasifikacijom bio je u stranju da bolje identifikuje ljude koji nemaju predispozicije za APM (94,2%) nego ACTN3 analiza (19,8%). Ipak, treba napomenuti da je dermatoglifski pristup uključen u asocijativnu analizu (Abramova, Nikitina i Ozolin, 1996), dok su ispitanici sa postojanjem XX genotip identifikovani kao oni koji nisu u stranju da izvrše visoko snažne kontrakcije zbog nedostatka aktivnog ACTN3 proteina koji ima uticaj na funkcionalan način kontraktilnog aparata neophodnog za brzu kontrakciju (Roth i saradnici, 2008; Scott i saradnici, 2009).

Dermatoglifika

Dermatoglifska klasifikacija pojedinaca koji imaju predispozicije za AMP proizilazi iz kvalitativne i kvantitativne analize pokazatelja dobijenih iz DIs subjekata. U istraživanju dermatoglifskih karakteristika na 122 adolescenta oba pola, koji nisu bili sportisti i koji žive u gradu Resende - Rio de Žaneiro u Brazilu (Klein i Fernandes-Filho, 2003), utvrđeno je da oko 59,0% subjekata ima dermatoglifske šare koje

favor AMP. In a similar 2003 study of 96 people living in the city of Niterói - Rio de Janeiro/Brazil, who had a similar profile as the subjects in Klein and Fernandes-Filho's (2003) study; Macêdo and Fernandes-Filho (2003) found that 76.0% of the subjects did not presented a predisposition for AMP. The percentage of subjects without a predisposition for AMP found in these prior Brazilian studies (Klein & Fernandes-Filho, 2003; Macêdo & Fernandes-Filho, 2003) was lower than that observed in this research.

Hence, the results obtained by the samples analyzed in the prior two Brazilian studies in Rio de Janeiro State (Klein & Fernandes-Filho, 2003; Macêdo & Fernandes-Filho, 2003) are not similar to the current findings from Paraíba in terms of the relationship of the relative frequency of those subjects with the dermatoglyphic characterisics for AMP. The findings of this research reinforce the results of previous studies in terms of the effectiveness of the dermatoglyphic method as an instrument for evaluating and determining population profiles of a predisposition for a physical activity, given the strong association between papillary patterns and physical qualities, both in adolescents and in high-performance athletes (Junior et al., 2006; Linhares et al., 2009; Zary & Fernandes-Filho, 2007; Zary et al., 2010).

ACTN3 genotyping

Discussion of the ACTN3 polymorphism has centered mostly around the mutant XX homozygous genotype since it is this configuration that differentiates potential athletes in terms of their ability to produce active ACTN3 (Roth et al., 2008; Ruiz et al., 2010; Scott et al., 2009).

To place the current genotype findings in nowadays context, the percentage of XX genotype individuals revealed in the current study of a Brazilian cohort is compared to percentages obtained in studies performed in other geographical regions (Table 1).

Note that the finding of this study (of 19/96 subjects having the XX genotype at the 577 locus of the ACTN3 protein gene) is similar to the proportions reported by Ruiz et al. (2011) among physical education students, Norman et al. (2009) for white men and women, Eynon et al. (2009) white subjects, Papadimitriou et al. (2008) for his control group, and Yang et al. (2003) for healthy white children and adults. Studies with moderately lower ratios of XX genotype individuals have also been reported by McCauley, Mastana, and Folland (2010) for men between 60–70 years of age, Druzhevskaya et al. (2008) for white men and women, and Niemi and Majamaa (2005) for

ne idu u prilog AMP-u. U sličnom istraživanju 96 ljudi koji žive u gradu Niterói - Rio de Žaneiro u Brazilu 2003. godine, koje je imalo sličan profil kao i kod subjekata u istraživanju Kleina i Fernandes-Filho's (2003), Macêdo i Fernandes-Filho (2003) su ustanovili da 76,0% ispitanika nije posjedovalo predispozicije za AMP. Procenat ispitanika bez predispozicija za AMP, koji je ustanovljen u ovim prethodnim brazilskim istraživanjima (Klein i Fernandes-Filho, 2003; Macêdo i Fernandes-Filho, 2003), bio je niži nego što je pronađen u ovom istraživanju.

Dakle, rezultati dobijeni na uzorcima analiziranim u prethodne dvije brazilske studije u saveznoj državi Rio de Žaneiro (Klein i Fernandes-Filho, 2003; Macêdo i Fernandes-Filho, 2003) nisu jednaki ovim koji su ustanovljeni u Paraibu, a kada je u pitanju relativna učestalost pojave pojedinaca sa dermatoglifskim karakteristikama za AMP. Nalazi ovog istraživanja potvrđuju rezultate prethodnih istraživanja u smislu efikasnosti dermatoglifske metode kao instrumenta za procjenu i utvrđivanje populacionog profila sa predispozcijama za motoričke aktivnosti, s obzirom da postoji visoka povezanost između papilarnih šara i motoričkih kvaliteta i kod adolescenata i kod vrhunskih sportista (Junior i saradnici, 2006; Linhares i saradnici, 2009; Zary i Fernandes-Filho, 2007; Zary i saradnici, 2010).

ACTN3 genotipovanje

Diskusija o ACTN3 polimorfizmu je uglavnom usmjerena oko mutacije XX homozigotnih genotipova pošto ona diferencira potencijalne sportiste u smislu njihove sposobnosti da stvaraju aktivni ACTN3 (Roth i saradnici, 2008; Ruiz i saradnici, 2010; Scott i saradnici, 2009).

Kako bi se izveli tekući zaključci iz dobijenih rezultata genotipa, procenat XX genotipa pojedinaca koji se odnosi na istraživanje provedeno na brazilskoj populaciji upoređeno je sa procentima dobijenim u ispitivanjima u drugim geografskim područjima (Tabela 1). Traba zapaziti da rezultati iz ovog istraživanja (19 od 96 osoba imalo je XX genotip na 577 lokusu ACTN3 protein gena) je po proporciji slično zaključcima do kojih su došli Ruiz i saradnici (2011) sa učenicima na časovima fizičkog vaspitanja, Norman i saradnici (2009) na ženama i muškarcima bjelcima, Eynon i saradnici (2009) na ispitanicima bjelcima, Papadimitriou i saradnici (2008) u svojoj kontrolnoj grupi i Yang i saradnici (2003) kod zdravih bijelaca djece i odraslih. Istraživanja koja su ustanovile blago niži odnos XX genotipova pojedinaca takođe su prijavljenaod McCauleya, Mastana i Follanda (2010) kod muškaraca između 60 i 70 godina starosti, Druzhevs-

his control group. And markedly lower ratios of XX genotype individuals were reported by Scott et al. (2009) for Jamaican and US African American groups. Only a sample of post-menopausal women in Japan studied by Zempo et al. (2010) showed a frequency of the mutant XX genotype (24.8%) that was higher than that found in the present study.

Hence, with respect to the relative frequency of mutant XX homozygote polymorphism, this research obtained a frequency similar to that found in studies performed in various parts of the world (including studies in Sweden, Greece, Australia, Spain, and Israel) (Eynon et al., 2009; Norman et al., 2009; Papadimitriou et al., 2008; Ruiz et al., 2011; Yang et al., 2003), suggesting that the frequency of the XX genetic configuration does not vary greatly in the world's population.

kaya i saradnika kod muškaraca i žena bijelaca i Niemia i Majamaa (2005) kod njihove kontrolne grupe. Znatno niži odnos XX genotipa pojedinaca ustnovili su Scott i saradnici (2009) za grupe jamaičana i stanovnika SAD afričkog porijekla. Samo uzorak žena u postmenopauzi u Japanu u istraživanju Zempoa i saradnika (2010) pokazao je učestalost XX genotipova (24,8%) koji je bilo veći nego što je nađen u ovom istraživanju.

Dakle, u vezi sa relativnom frekvencijom mutiranog XX homozigotnog polimorfizma, ovim istraživanjem dobili smo frkevenciju sličnu onoj koju su dobile stidije provedene u različitim dijelovima svijeta (uključujući Švedsku, Grčku, Australiju, Španiju i Izrael) (Eynon i saradnici, 2009; Norman i saradnici, 2009; Papadimitriou i saradnici, 2008; Ruiz i saradnici, 2011; Yang i saradnici, 2003) što ukazuje da se učestalost XX genetske konfiguracije ne razlikuje u velikoj mjeri u svjetskoj populaciji.

TABLE 1

Comparison of frequencies of XX homozygote genotype of the R577X polymorphism of ACTN3 protein by country.

TABELA 1

Poređenje frekvencija XX homozigotnog genotipa R577X polimorfizma ACTN3 proteima po zemljama.

Study	Country	XX frequency (%)
Paz et al., 2012	Brazil	19.8
Zempo et al., 2010	Japan	24.8
Norman et al., 2009	Sweden	19.0
Papadimitriou et al., 2008	Greece	18.2
Ruiz et al., 2011	Spain	18.3
Yang et al., 2003	Australia	18.0
Eynon et al., 2009	Israel	18.0
McCauley, Mastana, and Folland, 2010	United Kingdom	16.0
Druzhevskaya et al., 2008	Russia	14.2
Niemi, 2005	Finland	9.2
Scott et al., 2009	Jamaica	2.0
Scott et al., 2009	United States	4.0

Legend/Legenda: Study - Istraživanje; Country - Zemlja; XX frequency - XX frekvecija; Brazil - Brazi; Japan - Japan; Sweden - Švedska; Greece - Grčka; Spain - Španija; Australia - Australija; Israel - Izrael; United Kingdom - Velika Britanija; Russia - Rusija; Finland - Finska; Jamaica - Jamajka; United States - Sjedinjene Američke Države.

In terms of the allele encoding the active form of ACTN3, the frequencies of RR and RX genotypes observed here were similar to those of several other studies, especially those in studies with more RX heterozygotes than RR homozygotes, including the findings of Ruiz et al. (2011) RR 31.1% and RX 50.6%, Zempo et al. (2010) RR 17.4% and RX 57.8%, Nor-

U pogledu alela kodiranja aktivne forme ACTN3, frekvencija RR i RX genotipova i u ovoj studiji su slične onima iz nekoliko drugih, posebno u istraživanjima sa više RX heterozigotnih nego RR homozigotnih, uključujući Ruiza i saradnike (2011) RR 31,1% i RX 50,6%, Zempa i saradnike (2010) RR 17,4% i RX 57,8%, Normana i saradnike RR 31,0% i RX 50,0%,

man et al. (2009) RR 31.0% and RX 50.0%, Eynon et al. (2009) RR 20.0% and RX 62.0%, Niemi and Majamaa (2005) RR 45.0% and RX 45.8%, Yang et al. (2003) RR 30.0% and RX 52.0%, Druzhevskaya et al. (2008) RR 36.8% and RX 49.0%, and Papadimitriou et al. (2008) RR 25.97% and RX 55.8%. On the other hand, McCauley, Mastana, and Folland (2010) RR 43.0% and RX 41.0% and Scott et al. (2009), with control groups from Jamaica RR 75.0% and RX 23.0% and US African Americans RR 66.0% and RX 30.0%, observed a higher proportion of the RR homozygote genotype.

The ACTN3 gene has become an important molecular genetic marker for predicting maximum athletic performance because of the association of the R577 allele with elite sprinters (Druzhevskaya et al., 2008; Eynon et al., 2009; Moran et al., 2007; Papadimitriou et al., 2008; Yang et al., 2003). Meanwhile, various studies have shown that the mutant XX homozygotes genotype is less frequently found in these athletes and that it can impact muscle performance in contractions requiring AMP (Berman & North, 2010; Roth et al., 2008; Scott et al., 2009).

These presuppositions show the clear importance of identifying and excluding individuals who are homozygotes for the ACTN3 577X allele as a way of selecting subjects for sports that require AMP, once this genetic configuration, (which is present in around 18% of the world's population), is not typically found in high-performance sprinters. However, Scott et al. (2009) observed that 2/46 athletes, who won medals in important international speed competitions or who broke world records, have the XX genotype. This phenomenon could be explained by a high level of ACTN2 compensation. Despite these exceptional cases, the XX genotype can be considered a genetic obstacle impeding success in sports that require AMPs.

The 577X allele might, however, boost the suitability of athletes for endurance intensive sports (Berman & North, 2010; Eynon et al., 2009; Papadimitriou et al., 2008; Scott et al., 2009), although Moran et al. (2007) didn't find any evidence that this allele was associated with endurance.

The study made by Ruiz et al. (2010) analyzed the ACTN3 R577X polymorphism and five other polymorphisms related to good performance in endurance sports (ACE I/D, AGT Met235Thr, GDF-8 K153R, IL6_174 G/C, and NOS3_786T_C) in a sample of power and endurance athletes and in a control group, all of whom were Caucasian. They found that the polygenic profile only partially differentiated power athletes from endurance athletes and controls. Their

Eynona i saradnike (2009) RR 20,0%, Neimuena i Majamaa (2005) RR 45,0% i RX 45,8%, Yanga i saradnike (2003) RR 30,0% i RX 52,0%, Druzhevckaya i saradnici (2008) RR 36,8% i RX 49,0% i Papadimitriou i saradnici (2008) RR 25,9% i RX 55,8%. Na drugoj strani kod McCauleya, Mastana i Follanda (2010) RR 43,0% i RX 41,0% i Scotta i saradnika (2009) u kontrolnoj grupi jamaičana RR 75,0% i RX 23,0% i stanovništva SAD afričkog porijekla RR 66,0% i RX 30,0% primjetno je veći procenat RR homozigotnog genotipa.

ACTN3 gen postao je važan molekularni marker za predviđanje vrhunskog sportskog postignuća zbog povezanosti R577 alele sa eltinim sprinterima (Druzhevskaya i saradnici, 2008; Eynon i saradnici, 2009; Moran i saradnici, 2007; Papadimitriou i saradnici, 2008; Yang i saradnici, 2003). Istovremeno, različita istraživanja pokazala su da se mutirani XX homozigotni genotip rjeđe nalazi kod sportista i da to može uticati na izvođenje mišićne kontrakcije koja se traži kod AMP (Berman i North, 2010; Roth i saradnici, 2008; Scott i saradnici, 2009).

Ove pretpostavke pokazuju jasnu važnost identifikacije i odbacivanja pojedinaca koji su homozigotni za ACTN3 577X alele kao način selekcije pojedinaca za sportove koji zahtijevaju AMP, pošto se ova genetska konfiguracija (koja je prisutna kod 18% svjetske populacije) obično nalazi kod vrhunskih sprintera. Ipak, Scott i saradnici su primjetili da 2 od 46 sportista koji su osvojili medalje na značajnim međunarodnim takmičenjima u brzini ili koji su obarali svjetske rekorde je imala XX genotip. Ovaj fenomen se može objasniti visokim nivoom ACTN2 nadoknade. Uprkos ovim izuzetcima XX genotip se može smatrati kao genetsko ograničenje koje ometa postizanje uspjeha u sportovima koji traže AMP.

Alela 577X može, pak, uvećati šanse sportista u sportovima tipa izdržljivosti (Berman i North, 2010; Eynon i saradnici, 2009; Papadimitriou i saradnici, 2008; Scott i saradnici, 2009), iako Moran i saradnici nisu našli nikakve dokaze da je ova alela povezana sa izdržljivošću.

Istraživanje provedeno od strane Ruiza i saradnika (2010) analiziralo je ACTN3 R577X polkimorfizam i pet drugih polimorfizama (ACE I/D, AGT Met235Thr, GDF-8 K153R, IL6_174 G/C i NOS3_786T_C) u vezi sa dobrim rezultatima u izdržljivosti na uzorku sportista snage i brzine i kontrolne grupe u kojoj su svi bili sa Kavkaza. Oni su ustanovili da višegenetski profil samo djelomično razlikuje sportise snage od sportista izdržljivosti i

findings suggest that, even in a partial way, there is genetic variation, that can distinguish between and guide for better choices about in which sports some particular athletes would be predisposed to perform well in.

CONCLUSION

Both the dermatoglyphic and ACTN3 genotyping methods tested in this study demonstrated effectiveness in identifying individuals likely not ideally suited for AMP intensive sports. Dermatoglyphics revealed a much larger group of individuals as not innately predisposed to perform well in sports that require AMP than ACTN3 polymorphism genotyping. These results represent a substantial error reduction in the search for and selection of athletes with the potential for high performance, especially in those sports that require AMP. Ideally a combination of genetic markers related to physical performance should be employed to develop athletic potential profiles.

ACKNOWLEDGMENTS

We would like to offer our sincere thanks to Dr. Antônio Albuquerque Toscano the and Forensic DNA Laboratory of the Scientific Policing Institute SPI/PB for making available for DNA analyses.

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kontrolne grupe. Njihovi rezultati pokazuju da, čak i djelimično, postoji genetska varijacija koja može napraviti razliku i voditi boljem odabiru koji sport odgovara kojem sportisti koji ima predispozicije da bude dobar u njemu.

ZAKLJUČAK

I dermatoglifska i metoda ACTN3 genotipiranja korišćene u ovom istraživanju pokazale su se kao efikasne za identifikaciju osoba koje nisu idelane za bavljenje AMP sportovima. Dermatoglifika je identifikovala mnogo veću grupu osoba koje ne posjeduju predispozicije za sportove koji traže AMP koji je u vezi od ACTN3 polimorfizmom genotipa. Ovi rezultati predstavljaju značajno smanjenje greške u traženju i izboru sportista sa potecijalom za vrhunska sportska dostignuća, posebno u sportovima koji zahtijevaju AMP. Bilo bi idealno kada bi kombinacija genetskih markera, koji su vezani za motoričke vještine, bila uključena u razvoj potencijalnih sportskih profila.

IZJAVA ZAHVALNOSTI

Želimo izraziti našu iskrenu zahvalnost dr Antônio Albuquerque Toscano i Forenzičkom DNA laboratoriju Naučno policijskog instituta SPI/PB za obavljenu DNA analizu.

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Received: February 26, 2013
Revision received: Jun 11, 2013
Accepted: Jun 29, 2013

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Primljeno: 26. februar 2013. godine
Izmjene primljene: 11. jun 2013. godine
Odobreno: 29. jun 2013. godine

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FREQUÊNCIA DA POTÊNCIA ANAERÓBICA EM BRASILEIROS BASEADA NA DERMATOGLIFIA E NO POLIMORFISMO R577X DA ACTN3

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Introdução – O fenômeno da busca pelo talento esportivo vem crescendo constantemente e traz consigo o elevado investimento cada vez mais precoce no possível atleta. Desse modo, a utilização de ferramentas de avaliação adequadas e específicas se torna fundamental no garimpo dos promissores atletas ao reduzir as chances de equívocos e dispêndio financeiro. Um método de avaliação que vem sendo utilizado na caracterização de atletas de alto rendimento é a Dermatoglifia, que estuda os desenhos formados pelas papilas dérmicas originadas da região neurovascular. Esta técnica estabelece uma forte correlação com as qualidades físicas individuais, apresentam um baixo custo financeiro e alta reprodutibilidade. O sucesso em algumas modalidades esportivas no alto rendimento depende da potência muscular anaeróbica, esta qualidade física está relacionada ao gene que codifica a isoforma 3 da α-actinina (ACTN3),

específica das fibras de contração rápida do tipo II. A ACTN3 é uma proteína de ligação a actina que faz parte da linha Z do sarcômero e auxilia na organização, manutenção do aparato contrátil e no arranjo das miofibrilas. Os indivíduos que apresentam o alelo 577R produzem a ACTN3 ativa e expressam os genótipos homozigoto RR e heterozigoto RX, essas configurações propiciam um efeito favorável à atividade anaeróbica e estão associados a atletas velocistas de elite e olímpicos. Já a presença do genótipo XX prejudica o desempenho muscular em relação à potência anaeróbica e está ausente em atletas de elite participantes de provas que necessitam dessa qualidade física. Objetivo – Por meio da determinação do perfil dermatoglífico e do polimorfismo R577X da ACTN3, esta pesquisa teve como objetivo identificar os percentuais de indivíduos com características desfavoráveis à prática esportiva em modalidades que exigem potência muscular anaeróbica em habitantes do Estado da Paraíba – Brasil. Métodos – A pesquisa foi aprovada pelo Comitê de Ética e Pesquisa do Hospital Universitário Lauro Wanderley (CEP/HULW) com protocolo - 677-10 e seguiu todos os padrões e regras do Estatuto da Criança e do Adolescente, bem como da Resolução do Conselho Nacional de Saúde (CNS) 196/96 de 10/10/1996 e teve a assinatura do Termo de Consentimento Livre e Esclarecido (TCLE) obtido de todos os pais ou responsáveis em conformidade com a Declaração de Helsinki em 1975. Foi realizada uma pesquisa descritiva de perfil, com tipologia ex post facto, que identificou as características dermatoglíficas de n = 309 indivíduos (149 masculinos e 160 femininos) e dentre estes, a frequência gênica do polimorfismo da proteína α-actinina do tipo 3 de n = 96 indivíduos (40 masculinos e 56 femininos). Foram utilizados os protocolos de dermatoglifia (Cummins & Midlo, 1961) sendo os indivíduos classificados de acordo com (Abramova, 1996); a genotipagem foi realizada através do PCR em tempo real IQ5 Termal Cycler (Biorad) com uso do kit para determinação do polimorfismo R577X (Assay Id C____590093_1_ - Applied Biosystems). Resultados – Ao observar o perfil dermatoglífico da amostra pesquisada constatou-se que a frequência relativa dos indivíduos que não foram classificados como predispostos à potência muscular anaeróbica correspondeu a 94,2% dos avaliados, os quais apresentaram características físicas associadas a uma elevada resistência de velocidade, força pura e coordenação motora. Em consonância aos resultados, apenas 5,8% da amostra apresentaram o perfil dermatoglífico adequado a modalidades esportivas que exigem contrações musculares com alta potência; quanto aos resultados das frequências genotípicas observaram-se os seguintes percentuais para cada genótipo: homozigoto RR 32,3% e heterozigoto RX 47,9%, ambos com valores superiores ao da ACTN3 não ativa. Desta forma, 80,2% dos doadores, não foram excluídos para predisposição à potência muscular anaeróbica. O genótipo homozigoto mutante XX foi identificado em 19,8% dos doadores da amostra, caracterizando os indivíduos que não são capazes de realizar contrações com Potência muscular anaeróbica no alto rendimento. Conclusão – Concluí – se que os dois métodos empregados (dermatoglifia e análise da ACTN3) demonstraram ser eficazes para determinar a frequência de indivíduos não predispostos geneticamente para a prática de modalidades esportivas que exigem potência muscular anaeróbica. Identificando-se respectivamente, 94,2% e 19,8% dos indivíduos avaliados. Esses resultados representaram o percentual de diminuição de erro em uma busca e seleção de atletas com potencial para o alto rendimento, especialmente, nas modalidades que utilizam a potência muscular anaeróbica. Recomendações – Recomenda-se a utilização de outros marcadores genéticos voltados ao desempenho físico na caracterização de perfis populacionais para o esporte.

Palavras Chave: Dermatoglifia, Actn3, Musculo esquelético, Genes, Genótipo, Polimorfismo, Frequência genotípica.

SportLogia
2013, 9(1), 90–99
ISSN 1986-6089
e-ISSN 1986-6119
CD-ROM ISSN 1986-6097

ANALIZA ODBIJANJA LOPTI U RUKOMETNOJ UTAKMICI

ANALYSIS OF REBOUNDED BALLS IN A TEAM HANDBALL MATCH

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SHORT SCIENTIFIC PAPER
doi: 10.5550/sgia.130901.en.007B
doi: 10.5550/sgia.130901.se.007B
UDK: 796.332.01:796.322.4

KRATKI NUČNI ČLANAK
COBISS.BH-ID: 3816216
COBISS.BH-ID: 3815960

SUMMARY

We have analysed fifteen matches played by the male Croatian national handball team at the World Championship in Tunisia in 2005 and those played at the European Championship in Austria in 2010. The research has been conducted with the purpose of establishing the frequency of shooting from certain zones, i.e. from the attacking positions, the frequency of rebounded balls off the goal keeper or off the goal frame, as well as establishing where or who to the performed shots rebound. The field for the position game was divided into five zones: the left wing player, the left back player, the middle back player, the right back player and the right wing player. The mentioned zones also represent the rebounding zones. The results have shown that most shots were performed from the central zone, while the frequency of shooting from other zones was mostly equally disposed. The average number of the balls rebounded off the goal keeper or the goal frame is 17.6 balls. In 71% of the cases, the rebounded balls end in the possession of defence players which is the consequence of their close position in relation to the ball. The biggest number of rebounded balls (40%) returns to the central zone. By the χ^2 test we established that the largest number of shots performed from a certain zone rebounds in the same zone, or, in rare cases, in the nearby zone. This greatly depends on the shooting angle, which is mostly in a straight line in relation to the goal, and on the goal keeper's position in relation to the ball. The research implies the need for practising this game segment during handball training by the means of specific and situation training exercises.

Key words: rebounded ball, handball game, shot on goal, goal keeper.

SAŽETAK

Analizirano je 15 utakmica Hrvatske muške rukometne reprezentacije na Svjetskom prvenstvu u Tunisu 2005. godine i Europskom prvenstvu u Austriji 2010. godine. Istraživanje je provedeno sa ciljem utvrđivanja učestalosti šutiranja iz pojedinih zona odnosno napadačkih pozicija, učestalosti odbijanja lopti od strane golmana ili okvira gola, te utvrđivanja gdje i kome se upućene lopte odbijaju. Polje za pozicijsku igru podijeljeno je u 5 zona: lijevi krilni napadač, lijevi vanjski napadač, srednji vanjski napadač, desni vanjski napadač i desni krilni napadač. Navedene zone ujedno predstavljaju i zone odbijanja lopte. Rezultati su pokazali da se najviše udaraca upućuje iz središnje zone, dok je frekventnost šutiranja iz ostalih zona uglavnom podjednaka. Prosječan broj odbijenih lopti od golmana ili okvira gola iznosi 17,6 lopti. U 71% slučajeva odbijena lopta završi u posjedu obrambenih igrača što je posljedica blizine odbranbenog igrača u odnosu na loptu. Najveći broj odbijenih lopti (40%) vraća se u središnju zonu. χ^2 testom je utvrđeno da se najveći broj upućenih lopti iz pojedine zone odbija u tu istu zonu ili nešto rjeđe u susjednu zonu. Tome najviše pridonosi ugao šutiranja, koji je uglavnom direktan u odnosu na gol, te postavljanje golmana u odnosu na loptu. Istraživanje implicira potrebu za uvježbavanjem ovog segmenta igre u okviru rukometnog treninga pomoću specifični i situacionih trenažnih vježbi.

Ključne riječi: odbijena lopta, rukometna utakmica, udarac na gol, golman.

INTRODUCTION

Handball game consists of four phases: position defence, position attack, transition defence and transition attack. A faster transition from one phase to another enables a faster and more attractive game with more opportunities to score. Most handball experts support this type of approach to the game (Pokrajac, 2008; Rogulj, 2000a). The quality of transferring from the position defence into transition attack depends on the speed of returning the ball back in the game by the goal keeper. The transition attack starts when the opposing team makes a technical mistake or does not score when shooting on goal. The shot on goal can be directed to the goal frame or outside it. If the shot was directed towards the goal frame, the ball rebounds from the goal keeper and most frequently, due to the shooting speed of the ball (Gorostiaga, Granados, Ibáñez, & Izquierdo, 2005; Hermassi, Chelly, Fathloun, & Shephard, 2010), does not remain in his possession, but rebounds behind the base line of the court or returns from the goal keeper's area into the playing field. The result of taking into possession the rebounded ball depends to a great extent on the performance of the defence players. It is essential that defence players control their part of the space to take the ball into possession before the opposing team's players since, by positioning and reacting properly in defence, players create an opportunity for a fast counter attack, and at the same time an opportunity to score as well. If the defence players do not catch the ball, transition attack is not possible, but the opposing team has a repeated attack. This is the reason why the trainers insist on players to be concentrated in defence when the ball rebounds after the goal keeper's defence.

Rebounded balls depend to a large extent on the goal keeper's position and setting. The goal keeper is the player most essentially contributing to the result efficiency of the game (Rogulj, 2000a). Unlike other players, the goal keeper has the most immediate influence on the result of every opponents'attempt to score (Rogulj, 2009). Nowadays, shots on goal are very fast, precise, and frequently unpredictable which prevents the goal keeper from keeping the ball in the possession after a defence (Debanne, 2003). The balls rebounded from the goal keeper or from the goal frame actually present the attack peak which may turn into a counter attack if the defence players take the ball in their possession, or it may end as a counter attack if the defence players take the ball into their possession or as a repeated attack if the attack players take the ball into their possession. With regard to the situation efficiency, taking into possession the rebounded ball may bring some advantage to one or the other team, i.e. defence players or attack players,

UVOD

Rukometna igra sastoji se od 4 faze: pozicione obrane, pzicionog napada, tranzicije obrane i tranzicije napada. Brži prelazak iz jedne u drugu fazu omogućava bržu i atraktivniju igru sa više prilika za postizanje pogodaka. Ovakvom pristupu igri teži većina rukometnih eksperata (Pokrajac 2008, Rogulj 2000a). Kvaliteta prelaska iz pozicione obrane u tranziciju napada zavisi o brzini ubacivanja lopte u igru od strane golmana. Tranzicija napada započinje kada protivnička ekipa napravi tehničku pogrešku ili ne realizuje ostvareni udarac na gol. Udarac na gol može biti upućen u okvir gola ili izvan njega. Ukoliko je udarac upućen u okvir gola lopta se odbija od golmana i najčešće, zbog brzine leta lopte (Gorostiaga, Granados, Ibáñez i Izquierdo, 2005; Hermassi, Chelly, Fathloun i Shephard, 2010), ne ostaje u njegovom posjedu već se odbija iza osnovne linije igrališta ili se kroz golmanov prostor vraća u igračko polje. Ishod dolaska u posjed odbijene lopte u velikoj mjeri zavisi o djelovanju obrane. Vrlo je važno da obrambeni igrači kontrološu svoj dio prostora kako bi došli u posjed lopte prije igrača protivničke ekipe jer se pravilnim postavljanjem i reagovanjem u obrani stvara šansa za brzi protunapad, a s time i šansa za pogodak. Ako obrambeni igrači ne uhvate loptu nije moguća tranzicija napada već protivnička ekipa ima ponovljeni napad. Ovo je razlog zašto treneri insistiraju na koncentraciji igrača u obrani prilikom odbijanja lopti nakon obrane golmana.

Odbijanje lopte u velikoj mjeri zavisi o poziciji i postavljanju golmana. Golman je igrač koji najznačajnije doprinosi rezultatskoj uspješnosti ekipe (Rogulj, 2000a). Za razliku od ostalih igrača, golman je u prilici da najdirektnije utiče na rezultat svakog pokušaja protivničke realizacije (Rogulj, 2009). Udarci na gol danas su veoma brzi, precizni i često nepredvidivi što golmanu nakon obrane ne omogućava zadržavanje lopte u posjedu (Debanne, 2003). Odbijene lopte od strane golmana ili okvira gola zapravo predstavljaju vrhunac jednog napada koji može završiti kontranapadom ako lopta završi u rukama obrane, ili ponovnim napadom ako lopta završi u posjedu napada. Sa gledišta situzacione efikasnosti dolazak u posjed obijene lopte, može dovesti jednu ili drugu ekipu, odnosno obranu ili napad u prednost, na kraju možda i do same pobjede.

Dosadašnja istraživanja situacione efikasnosti u rukometu obrađivala su efikasnost u odnosu na igračke pozicije (Gajić, 1970; Gruić, Vuleta i Milanović, 2006;

and may even lead to winning the match.

Previous researches on the situation efficiency in handball have studied efficiency in relation to playing positions (Gajić, 1970; Gruić, Vuleta, & Milanović, 2006; Ohnjec, Vuleta, Milanović, & Gruić, 2008), the efficiency in relation to the shooting zones (Gajić, 1970; Pokrajac, 2008; Rogulj, 2000b), and efficiency in relation to the different ways of shooting (Delija & Šimenc, 1994; Vuleta, Milanović, & Sertić, 2003). Further on, there were some studies on the differences between the shooting frequency and efficiency in relation to the team's efficiency (Apitzs & Liu, 1997; Taborsky 2008), in addition to the influence of tactics elements on the efficiency and the influence of the finalisation attack variables on the final score of the match (Rogulj, Srhoj, & Srhoj, 2004; Rogulj & Srhoj, 2009; Srhoj, Rogulj, & Katić 2001). The previous researches lack in scientifically based researches studying the rebounded balls in a handball match. According to the authors' opinion, the lack of this type of research, an extremely important segment of the handball game, was the main motif for this study and for setting its main goal.

The purpose of this research was to establish the frequency of shooting from certain zones i.e. from a certain attack position, the frequency of the balls rebounded off the goal keeper or the goal frame and to determine where and who to do the performed shots rebound.

METHODS

Sample of entities

The sample of entities represents the performed shots which ended with the ball being rebounded into the playing field during the fifteen matches played by the male Croatian national handball team, eight out of which were played at the World Championship in Tunisia in 2005, and seven were played at the European championship in Austria in 2010. We analysed the attacks, i.e. the defences of the both teams in the game.

Sample of varibales

The sample of variables is presented by: shots performed from the shooting zones, the shots rebounding into the same zones, the defence players, i.e. the attack players as the possessors of the rebounded balls (Figure 1). C zone is the widest and forms a 60° angle, while the other zones A, B, D and E form a 30° angle.

Statistical analysis

Within descriptive statistics we calculated entity frequencies and the percentage proportion of entities

Ohnjec, Vuleta, Milanović i Gruić, 2008), efikasnost u odnosu na zone šutiranja (Gajić, 1970, Pokrajac, 2008; Rogulj, 2000b), te učinkovitost u odnosu na različite načine šutiranja (Delija i Šimenc, 1994; Vuleta, Milanović i Sertić, 2003). Nadalje, istraživane su razlike između učestalosti i uspješnosti šuta u odnosu na uspješnost momčadi (Apitzs & Liu 1997, Taborsky 2008), utjecaj elemenata taktike na uspješnost te utjecaj varijabli završnice napada na završni rezultat utakmice (Srhoj i sur 2001, Rogulj i sur 2004, Rogulj i sur 2009). Pored toga, postoji nekoliko radova o razlici između frekvencije šutiranja i efikasnosti u odnsou na efikasnost ekipe (Apitzs i Liu, 1997; Taborsky 2008) i uticaju elemenata taktike na efikanost i uticaja završnice napada na konačni rezultat utakmice (Rogulj, Srhoj i Srhoj, 2004; Rogulj i Srhoj, 2009; Srhoj, Rogulj i Katić 2001). U pregledu dosadašnjih istraživanja nedostaje naučno zasnovanih studija koje su obrađivale odbijanje lopte u rukometnoj utakmici. Upravo je nedostatak istraživanja ovog, prema mišljenju autora, izuzetno važnog segmenta rukometne igre, bio glavni motiv ovog istraživanja i postavljanja njegovog cilja.

Cilj istraživanja je utvrditi frekvanciju šutiranja iz pojedinih zona odnosno sa pojedine napadačke pozicije, frekvanciju odbijanja lopti od strane golmana ili okvira gola, te utvrditi gdje i kome se upućene lopte odbijaju.

METODE

Uzorak entiteta

Uzorak entiteta predstavljaju upućeni udarci koji su završili odbijanjem lopte u polje za igru tokom odigravanja 15 utakmica hrvatske muške rukometne reprezentacije, od čega je 8 utakmica odigrano na Svjetskom prvenstvu u Tunisu 2005. godine, a 7 na Europskom prvenstvu u Austriji 2010. godine. Analizirani su napadi odnosno odbrane obje ekipe na utakmici.

Uzorak varijabli

Uzorak varijabli predstavljaju: upućene lopte iz zona šutiranja, odbijene lopte u iste zone, te obrana odnosno napad kao posjednici odbijene lopte (Slika 1). Zona C je najšira i čini ugao od 60°, dok ostale zone A, B, D i E čine ugao od 30°.

Statistička analiza

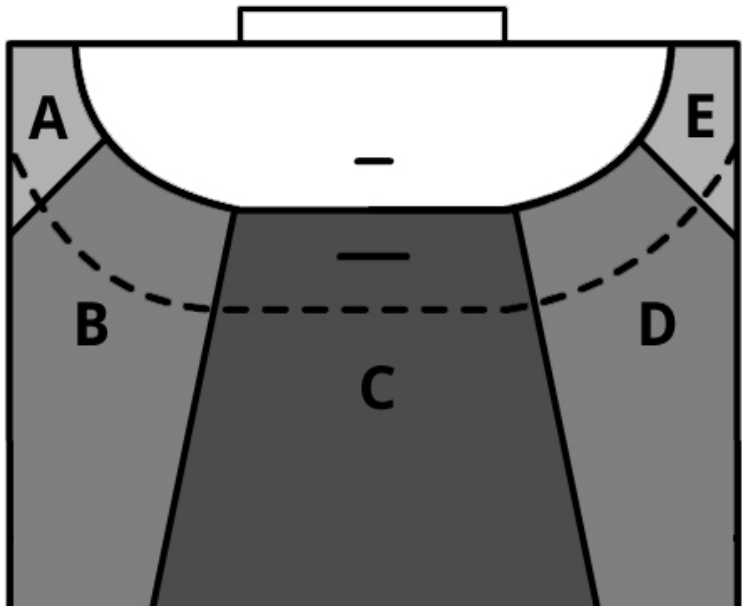
U okviru deskriptivne statistike izračunate su frekvencije entiteta i procentualna proporcija zatu-

presence in relation to a certain variable. The connection between the shooting zones and the zones where the balls rebounded to was established by a non-parametrical χ^2 test.

pljenosti entiteta u odnosu na pojedinu varijablu. Povezanost između zona iz kojih su upućeni udarci i zona u koju se udarci odbijaju utvrđena je neparametrijskim χ^2 testom.

FIGURE 1
Shooting and rebounding zones.

SLIKA 1
Zone udaraca na gol i odbijanja lopte.



Legend/Legenda: **A** – Left wing player's zone (Zona lijevog krilnog napadača); **B** – Left back player's zone (Zona lijevog vanjskog napadača); **C** – Middle back player's zone (Zona srednjeg vanjskog napadača); **D** – Right back player's zone (Zona desnog vanjskog napadača); **E** – Right wing player's zone (Zona desnog krilnog napadača).

RESULTS

In the fifteen studied matches included in this research, the ball rebounded off the goal keeper or the goal post 264 times, which is, on average, the total of 17.6 rebounded balls in a match. The ball was taken into possession by the defence players 187 times (71%) and the attack players took the ball into possession 77 times (29%).

Figure 2 displays the shooting frequency from a certain zone as well as the frequency of balls rebounding into a certain zone. The greatest number of shots on goal was performed from the C zone (40%) i.e. from the position of the middle back player and pivot. The shooting frequency from other positions is mostly equal, except for the left side of the attack (A+B=35%) which prevails in relation to the right side (D+E=25%).

The balls rebounded off the goal keeper or the goal frame, likewise in the performed shots, ended

REZULTATI

U 15 praćenih utakmica koje su obuhvaćene ovim istraživanjem lopta se odbila od strane golmana ili okvira gola 264 puta, što u prosjeku iznosi 17,6 odbijenih lopti po utakmici. Od toga 187 puta lopta je završila u posjedu odbrane (71%), a 77 puta u posjedu napada (29%).

Slika 2 prikazuje učestalost šutiranja iz pojedine zone kao i učestalost odbijanja lopti u pojedinu zonu. Najveći broj udaraca na gol upućen je iz zone C (40%) odnosno sa pozicije srednjeg vanjskog i kružnog napadača. Frekventnost šutiranja iz ostalih zona uglavnom je jednaka, iako je primjetno da lijeva strana napada (A+B=35%) prevladava u odnosu na desnu (D+E=25%).

Lopte koje su odbijene od strane golmana ili okvira gola, slično kao kod upućenih lopti, najviše su

for the greatest number of times in the C zone (41%) and in the B zone (20%), while other zones had nearly equally disposed frequency.

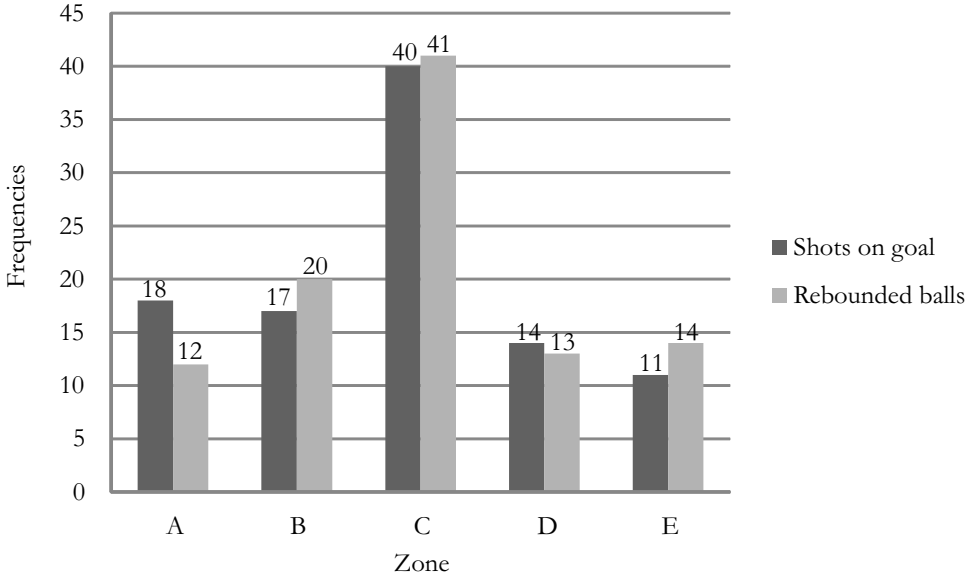
puta završavale u zoni C (41%) i B (20%) dok su se u ostalim zonama rasporedile približno jednakom učestalošću.

FIGURE 2

Shooting and rebounding frequencies with regard to certain zones.

SLIKA 2

Frekvencije udaraca na gol i odbijanja lopti obzirom na određene zone.



Legend/Legenda: Shots on goal - Udarci na gol; Rebounded balls - Odbijene loptre; Frequencies - Frekvenicje; Zone - Zone; **A** – Left wing player's zone (Zona lijevog krilnog napadača); **B** – Left back player's zone (Zona lijevog vanjskog napadača); **C** – Middle back player's zone (Zona srednjeg vanjskog napadača); **D** – Right back player's zone (Zona desnog vanjskog napadača); **E** – Right wing player's zone (Zona desnog krilnog napadača).

Figure 3 displays the frequencies of the teams' ball possession in attack and defence after the balls rebounded in certain zones. The largest number of the rebounded balls is in the C zone (108) and the smallest in zones A (36), D (35) and E (36). The graph displays that defence players take the ball into possession more times than the attack players.

The χ^2 test did not determine any statistically significant differences between the frequencies of shooting and the frequency of rebounded balls with relation to the shooting zones, i.e. to the rebounding zones (table 1). This means the largest number of performed shots from a certain shooting zone returns, i.e. rebounds into the same zone.

Slika 3 prikazuje frekvencije posjeda lopte ekipa u napadu i odbrani nakon odbijanja lopti u pojedinim zonama. Najveći broj odbijenih lopti je u zoni C (108) a najmanji u zonama A (36), D (35) i E (36). Iz grafičkog prikaza je vidljivo da obrambeni igrači više puta dolaze u posjed lopte od napadača.

χ^2 testom nije utvrđena je statistički značajna razlika između frekventnosti upućivanja i odbijanja lopti u odnosu na zone iz kojih se upućuju udarci, odnosno na zone u koje se lopte odbijaju (Tabela 1). Ovo znači da se najveći broj lopti upućenih iz neke zone šuta vraća tj. odbija u tu istu zonu.

DISCUSSION

The reason for a significantly large number of rebounded balls in the possession of defence players could be found in the distance in relation to the rebounded ball of the defence and attack players. The

DISKUSIJA

Razlog značajno većem broju odbijenih lopti u rukama obrambenih igrača valja tražiti u udaljenosti u odnosu na odbijenu loptu igrača obrane i napada. Odbrambeni igrači su u povoljnijoj poziciji a imaju i

defence players are in a more favourable position, and also, by proper blocking, have a better opportunity to ensure a more favourable position to receive the ball rebounded from an attack player.

The largest number of shots performed from the C zone may be explained by the width of the zone

bolju mogućnost da pravilnim građenjem osiguraju povoljniju poziciju za primanje odbijene lopte od napadača.

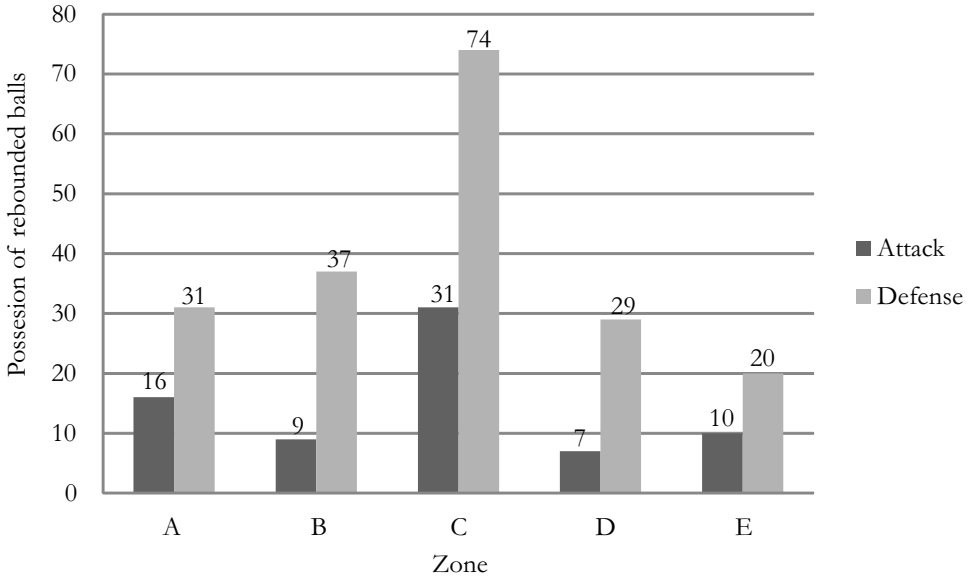
Najveći broj upućenih udaraca iz zone C može se tumačiti širinom zone koja je najveće površine. To je zona u kojoj se kreću dva igrača, srednji vanjski i

FIGURE 3

Frequencies of the ball possession after shooting from a certain zone.

SLIKA 3

Frekvencije posjeda nakon udarca iz pojedine zone.



Legend/Legenda: Attack - Napad; Defnece - Odbrana; Possesion of rebounded balls - Posjed odbijenih lopti; Zone - Zone; **A** – Left wing player's zone (Zona lijevog krilnog napadača); **B** – Left back player's zone (Zona lijevog vanjskog napadača); **C** – Middle back player's zone (Zona srednjeg vanjskog napadača); **D** – Right back player's zone (Zona desnog vanjskog napadača); **E** – Right wing player's zone (Zona desnog krilnog napadača).

TABLE 1

Connection of frequencies of performed shots and rebounded balls in certain zones.

TABELA 1

Povezanost frekvencija upućenih i odbijenih lopti u određenim zonama.

Zones	A	B	C	D	E
Directed balls	47	46	105	36	30
Rebounded balls	31	54	108	35	36

χ^2=4.52; *df*=4; *p*>.05

Legend/Legenda: Directed balls - Upućene lopte; Rebounded balls - Odbijene lopte; Zones - Zone; **A** – Left wing player's zone (Zona lijevog krilnog napadača); **B** – Left back player's zone (Zona lijevog vanjskog napadača); **C** – Middle back player's zone (Zona srednjeg vanjskog napadača); **D** – Right back player's zone (Zona desnog vanjskog napadača); **E** – Right wing player's zone (Zona desnog krilnog napadača); χ^2 - Chi-sequer test (Hi-kvadrat test); ***df*** - Degrees of freedom (Stepeni slobode); ***p*** - Probability (Vjerovatnoća).

which has the largest surface. This is the zone where two players move, the middle back player and the pivot and where most of the actions end since, to the players, from a geometrical point of view, the goal here is the widest (Gajić 1970). Seven-metre penalty shot is also performed from the centre of this zone. Due to tactics reasons, the ball is most frequently here, in this zone. Most of the attacks start with the middle back player as the game organiser and the distribution of the ball from one wing player to another is always performed over the centre of the attack. All this explains for the largest shooting frequency (40%) from the centre zone of the position attack.

Figure 3 evidently shows that after shooting most balls return to the central zone and, with a slightly smaller frequency, to the zone of the back player on the left side of the attack. The player performing the shot always attempts to shoot through an angle as wide as possible in relation to the goal, in a straight line if the situation is allowing it. In theory, the greatest efficiency is achieved from the central position. Due to this straight or approximately straight shooting, in most cases, the ball rebounds back into the C zone, and we have previously established that most shots were performed from this zone. The results are logical and based on the basic laws of physics, i.e. on the mechanics of collision between the elastic and solid substances (Robertson, Caldwell, Hamill, Kamen, & Whittlesey, 2004 2004).

Although the defence players dominate in the possession of balls in all the zones, a certain number of the rebounded balls are still taken in the possession by the attack players. The pivot has a major role here since he can take the rebounded ball into the possession by the means of his blocking and positioning on the line. There is a similar situation in wing positions where the last defenders by prematurely starting the counter attack, enable the wing players to take the ball into their possession.

In the largest number of cases the ball returns to the same zone from which the shot was performed. This fact can be easily explained by the basic laws of physics (Ivančević, Jovanović, Đukić, Marković, & Đukić, 2008) and creates the basis to understand the rebounding of the ball in the handball game, based on which we can and precisely and with quality organise the training programme depending on the characteristic situations.

CONCLUSION

Based on the conducted analyses and obtained results, we may form several conclusions. The largest frequency of shooting on goal comes from the central zone which is the consequence of the space width, more players playing in the same zone, the greatest circulation of ball, performance of the penalty shots and the position of the zone in relation to the goal frame.

kružni napadač i u kojoj se završava većina akcija napada jer je igračima, geometrijski posmatrano, gol najširi (Gajić 1970). U sredini ove zone izvodi se i udarac sa 7 metara. Iz taktičkih razloga, lopta se najčešće nalazi upravo u ovoj zoni. Većina napada polazi od srednjeg vanjskog napadača kao organizatora igre te distribucija lopte od krila do krila uvijek prelazi preko sredine napada. Sve ovo objašnjava najveću frekventnost udaraca (40%) iz središnje zone pozicijskog napada.

Iz Slike 3 vidljivo je da se najviše lopti nakon udarca vraća u središnju zonu i nešto manjom frekvencijom u zonu vanjskog igrača na lijevoj strani napada. Igrač koji izvodi udarac uvijek nastoji šutirati pod što većim uglom u odnosu na gol, pravolinijski ako mu to situacija dozvoljava. Teoretski, najveća efikasnost postiže se sa srednje pozicije. Sam ugao šutiranja određuje gdje će se lopta odbiti. Zbog tog direktnog ili približno direktnog šutiranja, lopta se u većini slučajeva odbija nazad u zonu C, a već je prethodno utvrđeno da je najviše udaraca uopšte iz te zone. Rezultati su logični i temeljeni na osnovnim fizičkih zakona, odnosno mehanici sudara elastičnih i krutih tijela (Robertson, Caldwell, Hamill, Kamen i Whittlesey, 2004).

Iako odbrana dominira kada se posmatra posjed lopte u svim zonama, određen broj odbijenih lopti ipak završi u posjedu napadača. Pri tome, veliku ulogu ima kružni napadač koji svojim građenjem i postavljenjem na liniji golmanskog prostora može doći u posjed odbijene lopte. Slična je situacija i na krilnim pozicijama na kojima krajnji odbrambeni igrači preuranjenim odlascima u kontranapad omogućavaju krilnim napadačima da dođu u posjed lopte.

U najvećem broju slučajeva lopta se vraća u zonu iz koje je udarac izveden. Ova se pojava jednostavno da objasniti osnovnim zakonima fizike (Ivančević, Jovanović, Đukić, Marković i Đukić, 2008) i stvara temelj razumijevanja odbijanja lopte u rukometnoj igri na osnovu kojeg je moguće kvalitetno i egzaktno konstruirati trenažne sadržaje ovisno o karakterističnim situacijama.

ZAKLJUČAK

Na osnovu izvršenih analiza i dobijenih rezultata, moguće je donijeti nekoliko zaključaka. Najveća frekventnost šutiranja na gol dolazi sa središnje zone što je posljedica širine prostora, igre je više igrača u istoj zoni, najveće cirkulacije lopte, izvođenja sedmeraca, te položaja zone u odnosu na okvir gola.

The rebounding of the ball off the goal keeper or the goal frame depends on a large number of factors, but mostly on the starting point of the ball (the angle of shooting) and the positioning of the goal keeper in relation to the goal. The results have shown that in the 40% of the cases the ball rebounded into the centre part of the court. Nowadays, shots on goal are very fast and precise, so the goal keeper rarely remains in the possession of the ball after having defended the shot. Defence players prevail in the possession of the rebounded balls which is not surprising considering the vicinity of defence players, i.e. the distance of the attack players in relation to the rebounded ball.

In the largest number of cases, the ball returns to the zone from where the shot was performed, thus during the training procedure, more time should be given to practising this segment of the game, which is most frequently not the case in practice, according to the authors' opinion and experience. The results of the research may be used in the tactical preparation of the match by giving certain defence players concrete tasks to start the counter attack with relation to the positions from which the attack players performs the shot on goal.

The research also revealed that rebounded balls are quite frequent in matches and more time should be spent on practising the phase of taking the rebounded ball into possession.

Handball is a complex game where all the segments of the game can hardly be controlled with the same quality. However, the proper players' reaction in characteristic situations may bring an advantage or a victory to a certain team. Thus, it is important in further analysis and training procedures in top quality handball to give more attention to the details such as rebounded balls and taking it into possession.

Odbijanje lopte od strane golmana ili okvira gola zavisi o većem broju faktora, no najviše o početnom polazištu lopte (uglu šutiranja) te postavljanju golmana u odnosu na loptu. Rezultati su pokazali da se lopta u 40% slučajeva odbija u središnji dio igrališta. Udarci na vrata danas su veoma brzi i precizni pa golman rijetko ostaje u posjedu lopte nakon odbranjenog udarca. Odbrana je ta koja prevladava u posjedu odbijenih lopti što nije iznenađujuće obzirom na blizinu odbrane, odnosno udaljenost napada u odnosu na odbijenu loptu.

Lopta se u najvećem broju slučajeva vraća u zonu iz koje je udarac izveden pa bi u okviru trenažnog postupka više vremena trebalo posvetiti uvježbavanju ovog segmenta igre što, prema mišljenju i iskustvu autora, najčešće u praksi nije slučaj. Rezultati istraživanja mogu se koristiti u taktičkoj pripremi utakmice tako da se pojedinim odbranbenim igračima daju konkretna zaduženja za odlazak u kontranapad u odnosu na pozicije s koje napadač upućuje udarac na gol.

Istraživanjem je također utvrđeno da je odbijanje lopte česta situacija na utakmicama i da bi trebalo više vremena posvetiti vježbanju same faze dolaska u posjed odbijene lopte.

Rukomet je kompleksna sportska igra u kojoj je izuzetno teško kontrolisati sve segmente igre istim kvalitetom. No upravo pravovaljana reakcija igrača u karakterističnim situacijama, može dovesti ekipu u prednost, ili čak do pobjede. Stoga je važno da se prilikom analize igre i trenažnog postupka u vrhunskom rukometu posveti pažnja detaljima kao što je odbijanje lopte i dolazak u njen posjed.

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Received: November 14, 2012
Revision received: Jun 1, 2013
Accepted: Jun 19, 2013

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Primljeno: 14. novembra 2012. godine
Izmjene primljene: 1. juna 2013. godine
Odobreno: 19. juna, 2013. godine

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L'ANALISI DEL RIMBALZAMENTO DELLA PALLA NEL GIOCO DI PALLAMANO

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Il gioco di pallamano consiste di 4 fasi: la difesa posizionata, l'attacco posizionato, la transizione della difesa e la transizione dell'attacco. Quanto più veloce è il passo da una fase all'altra, tanto più attraente è il gioco e ci sono più possibilità di segnare. La transizione dell'attacco inizia quando la squadra avversaria fa un errore tecnico oppure non realizza il tiro segnando il gol. Il tiro in porta può essere diretto all'interno della porta oppure fuori si essa. Nel primo caso, la palla colpisce il portiere rimbalzando dal suo corpo, e a causa della sua velocità (Gorostiaga e sur 2005, Hermassi e sur 2010) non rimane in suo pos-

sesso ma rimbalza fuori dal campo linea o ritorna dall'area di porta nel campo di gioco. È molto importante che i difensori controllino la loro parte dello spazio per entrare in possesso della palla prima della squadra avversaria. Il rimbalzamento della palla dipende maggiormente dalla posizione e dall'impostazione del portiere. Le palle rimbalzate dal corpo del portiere o dai pali della porta sono il picco dell'attacco che può terminare con un contrattacco se la palla finisce nelle mani della difesa della squadra avversaria, oppure con un nuovo attacco se la palla finisce nel possesso degli attaccanti.

Le ricerche sull'efficenza situazionale in pallamano compiute finora hanno elaborato diversi segmenti del gioco, però manca uno studio scientifico che elabori il rimbalzamento della palla nel gioco di pallamano. Proprio la mancanza della ricerca su questo segmento del gioco, che l'autore ritiene molto importante, è stato il motivo principale di questo studio a della definizione dei suoi obiettivi. L'obiettivo principale è quello di determinre la frequenza dei tiri dalle varie zone cioè dalle varie posizioni di attacco, la frequenza del rimbalzamento della palla dal portiere o dai pali della porta, e anche di determinare dove queste palle rimbalzano e nelle mani di chi.

Per il campione sono stati presi i tiri che sono finiti con il rimbalzamento della palla nel campo durante quindici partite giocate da parte della squadra nazionale maschile croata, di cui otto sono state giocate al Campionato mondiale in Tunisia nel 2005, e sette al Campionato europeo in Austria nel 2010. Le variabili del modello costituiscono: le palle lanciate dalle zone di tiro, le palle rimbalzate nelle stesse zone, e le rispettive defese e attachi che sono venuti in possesso di queste palle. La zona C è la più larga e fa un angolo di 60º, mentre l'altre zone A, B, D e E fanno un angolo di 30º. Il rapporto tra le zone dalle quali i tiri sono stati lanciati e le zone nelle quali questi tiri sono rimbalzati è stata definita con un test non parametrico χ^2.

Nelle 15 partite analizzate la palla è rimbalzata dal corpo del portiere o dal palo 264 volte, che in media vuol dire 17,6 palle rimbalzate per partita. Di questo totale di 264 rimbalzi, 187 volte la palla è finita nelle mani della difesa (71%) e 77 volte in possesso del attacco (29%). La ragione di questa supremazia della difesa in relazione all'attacco per quanto riguarda il possesso delle palle rimbalzate stà nella distanza dei giocatori della difesa e quelli dell'attacco rispetto alla palla rimbalzata. La maggioranza dei tiri verso la porta sono stati lanciati dalla zona centrale, mentre la frequenza dei tiri dall'altre zone era più o meno uguale. Nella zona centrale si spostano due giocatori, il mediano esterno e il perno, e proprio qui termina la maggioranza degli attacchi perché in questa posizione, guardando in maniera geometrica, la porta è la più ampia in relazione ai giocatori.

Le palle rimbalzate dal corpo del portiere oppure dai pali della porta sono finite in maggioranza dei casi nelle zona C (41%), e B (20%) mentre nelle altre zone le palle si sono distribuite con approssimativamente uguale frequenza. Il giocatore che lancia la palla verso la porta cerca sempre di tirare ad un angolo più grande rispetto alla porta, in rettilinea se la situazione gli permette. Teoricamente, l'efficenza più grande è dalla posizione centrale. Il posto dove la palla rimbalza dipende dall'angolo dal quale è stata lanciata. Proprio perché il tiro è in maggioranza dei casi rettilineo o quasi rettilineo, la palla rimbalza quasi sempre indietro nella zona C dalla quale, come abbiamo già determinato, parte la maggioranza dei tiri.

La maggior parte delle palle rimbalzate finiscono nella zona C (108) e solo una piccola parte finisce nelle zone A (36), D (35) e E (36). Nonostante l'evidente predominio della difesa per quanto riguarda il possesso di palla in tutte le zone, un certo numero di palle rimbalzate finisce in possesso dell'attacco.

Pallamano è uno sport complesso nel quale è molto difficile controllare tutti i segmenti del gioco con la stessa qualità. La giusta reazione dei giocatori nelle situazioni caratteristiche può portare la squadra in vantaggio, o addiritura alla vittoria. Proprio per questo è molto importante che le squadre di pallamano di alto livello dedichino durante l'allenamento la massima attenzione ai detagli come lo è il rimbalzamento della palla e l'arrivo in possesso di essa.

I risultati di questa ricerca possono essere usati nella preparazione tattica della partita, in modo che ai singoli difensori vengono dati i compiti specifici per andare al contrattacco rispetto alla posizione dalla quale l'attaccante lancia il tiro verso la porta.

Parole chiave: infilato la palla, partita di pallamano, tiro in porta, custode

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- *Professional article* is a review of something that is already known, with an emphasis on the usability of the results of the original research and the spread of knowledge. The complexity of the text is adjusted to the needs of the professional and scientific aspects of the journal.

After reviews have been done, the editorial board will analyze them. If needed, the paper is sent back to the author who must comply with the suggestions and objections made by the reviewers. Once they have redone the paper, the authors need to specifically describe, on a *separate sheet of paper*, how they have resolved the reviewer's suggestions.

Only those papers that have been placed in one of the categories and which have *two positive reviews will be published*.

Text style and organization

Scientific articles must adhere to the IMRAD scheme (Introduction, Methods, Results and Discussion).

Title

The title page of the manuscript should contain the following information: (1) a concise, but informative title. Use of abbreviations is not encouraged; (2) the author's names (do not include degrees); the last one is introduced by "&"; (3) the affiliation of the authors, town and state; (4) the name and address of the corresponding author (must include title, degree and position of the corresponding author, phone and fax numbers – zip code for the country and city, and email address).

Summary, large summary and key words

The summary should be brief and Self-explanatory. It should cover a general presentation of the topic (the

ili na deskriptivan način za deskriptivna naučna područja.

- *Pregledni naučni članak* predstavlja pregled najnovijih radova o određenom predmetnom području, radova pojedinog istraživača ili grupe istraživača sa ciljem da se već publikovane informacije sažmu, analiziraju, evaluiraju ili sintetizuju. Donose nove sinteze koje, takođe, uključuju i rezultate sopstvenog istraživanja autora.
- *Kratki naučni članak* predstavlja izvorni naučni članak kod kojih neki elementi šeme IMRAD mogu da budu ispušteni. Ukratko sažima rezultate završenog izvornog istraživačkog rada ili rada koje je još u toku.
- *Izlaganje sa naučnog skupa* predstavlja cjelovit članak koji je prethodno referisan na načnom skupu, ali u obliku cjelovitog članka nije objavljen u zborniku naučnog skupa.
- *Stručni članak* predstavlja prikaz već poznatog, s naglaskom na upotrebljivost rezultata izvornih istraživanja i širenja znanja, a zahtijevnost teksta prilagođena je potrebama stručnosti i naučnosti časopisa.

Nakon primljenih recenzija uredništvo ih analizira. Ukoliko je to potrebno, rad se vraća autoru koji je dužan uvažiti sugestije i primjedbe recenzenata. Kada preradi svoj rad autor-i treba da, na *posebnom listu papira*, konkretno navedete kako su razriješili sugestije vezane za recenziju.

Objavljuju se samo radovi koji su svrstani u jednu od kategorija i koji *imaju dvije pozitivne recenzije*.

Stil i organizacija teksta

Naučni članci se organizuju po šemi IMRAD (Introduction, Methods, Results, i Discussion).

Naslov rada

Naslov rada treba da sadrži sledeće informacije: (1) kratak ali informativan naslov u kome se ne preporučuje korištenje skraćenica; (2) ime autora bez titule gdje se ispred posledenjeg autora stavlja "i"; (3) institucija u kojoj autor-i radi, grad i država; (4) ime i adresa autora predviđenog za korespodenciju (naučno zvanje, položaj, broj telefona i faksa, poštanski broj grada, državu i e-mail adresu).

Sažetak, veliki sažetak i ključne riječi

Sažetak treba da bude kratak i razumljiv sam po sebi. U sažetku se ne traba pozivati na tekst članka.

purpose and the objective of the paper), results and conclusions. Authors should not use abbreviations. The abstract should include 150-250 words. Authors from abroad write the large summary in their native languge (the summary has to be reviewed), and the authors whose native language is BCS write the mentioned summary in one of the official languages of the IOC Assembly (article 27 of Olympic Charter), except English. The translation should be made by relevant person.

Large summary should not exceed 1800 characters (up to tree pages of double spaced text), and should include title, keywords and summary text.

Three to six words, which are not part of the title, need to be singled out. The Key words need to reflect the contents of the paper.

Introduction

This part of the paper ought to inform the reader of the issues dealt with in the research and the results of previous analyses. The purpose of the research should also be clearly stated in this part.

Methods

This part should consist of the following subtitles: entity sample, variables, procedures, tastings, statistical analysis.

Units of measurement, symbols and abbreviations must conform to international standards. Measurements of length, height, weight and volume should be given in metric units (meter, kilogram, liter).

Results

The results should be presented as tables, graphs and pictures, possibly processed statistically and be concisely presented in the text.

Tables, graphs and pictures showing the results of individual analyses need to be indicated in the text for easier reader navigation.

Discussion

The authors are expected here to comment on the results and compare them with literature data. The discussion must be professional and correspond to experimental data. Practical implications are welcome.

Conclusion

Contains clearly stated scientific assertions, open issues and recommendations for further research.

Tables, graphs and pictures

Each table and any illustration (black and white only) must be submitted on a separate sheet of paper. Tables should be numbered in the order in which they

Treba da obuhvati opšti prikaz teme (predmet i cilj rada), rezultate i zaključak. Autori ne bi trebali da tom prilikom koriste skraćenice. Sažetak treba da sadrži 150-250 riječi.

Velik sažetak ne smije da pređe 1800 karaktera (do tri stranice u duplom proredu), i treba da sadrži naslov rada, ključne riječi i tekst sažetka. Autori iz inostranstva veliki sažetak pišu na maternjem jeziku (sažetak mora da bude lektorisan), a autori kojima je maternji jezik BHS ovaj sažetak pišu na jednom od jezika Međunarodnog olimpijskog komiteta, naravno osim engleskog, na koje se simultano prevodi na svim Skupštinama MOK-a (član 27 Olimijske povelje). Prevođenje mora da uradi stručna osoba.

Potrebno je izdvojiti i dati tri do šest ključnih riječi koje se ne nalaze u naslovu. Ključne riječi moraju da odražavaju suštinu sadržaja rada.

Uvod

Ovaj dio rada treba da informiše čitaoca o problemima datog istraživanjai rezultatima prethodnih analiza. Cilj istraživanja takođe treba jasno navesti u ovom dijelu.

Metode

Ovaj dio treba da se sastoji od sledećih podnaslova: uzorak entiteta, varijable, procedure testiranja, statistička analiza.

Mjerne jedinice, simboli i skraćenice moraju da poštuju međunarodne standarde. Mjere dužine, visine, težine i zapremine moraju da budu u metričkim jedinicama (metar, kilogram, litar).

Rezultati

Rezultati bi trebalo da budu predstavljeni kroz, tabele, grafikone i slike, statistički obrađene i koncizno interpretirane.

Tabele, grafikoni i slike koje pokazuju rezultate pojedinih analiza trebaju da budu naznačene u tekstu kako bi se pažnja čitaoca skrenula na njih.

Diskusija

Od autora se očekuje da iznesu dokaze istraživanja i da ih uporede sa dosada objavljenim istraživanjima u toj oblasti. Diskusija mora da bude stručna i u skladu sa podacima eksperimenta. Poželjno je da diskusija obuhvati i praktične implikacije rada.

Zaključak

Sadrži jasno izrečene naučne tvrdnje, otvorena pitanja i preporuke za daljnja istraživanja.

Tabele, grafikoni i slike

Svaka tabela, grafikon i slika (samo u crno bijeloj tehnici) treba da bude dostavljena na posebnom listu papira. Tabele treba da budu numerisane po redosli-

occur in the text and referred to as, for example, "Table 1". Each table should be accompanied by a short title. Tables should be accompanied with interpretations (legends). It will also be deemed informative if the tables include indications of important correlations and relevant variables. Tables should be submitted separately

Illustrations, graphs and pictures shall be marked as "Figure 1". Photographs are sent in electronic form in a resolution not smaller than 300 dpi and in a .tif (figures) and .eps (graphics) format. Each figure needs to have a short title. In case that the figures are taken over from another paper, the title should not include the original name. In such a case, the source where the picture was taken from should be indicated under the picture.

If tables, graphs and pictures contain special symbols, or are prepared in a special program, they must be submitted in a separate file, with clearly indicated order of their inclusion in the text.

Article technical form

Articles are written and published in Latin alphabet, and, when needed, in other alphabets, in the Serbian language (ijekavica dialect) and the English language. Any deviation from this, needs to be agreed with the editorial board in advance. If author's native language is not Serbian, Croatian or Bosnian their papers will bi translated by editorial board. When translating the paper authors are suggested to engage someone whose native language is English.

Texts are to be written in Microsoft Word Windows program, on A4 paper format. Text is to be written in the Times New Roman font, size 12 pt in 1.5 spacing, aligned on both sides, with a 1 tub denting of the first row of a paragraph, with 2.5 cm paper margins. If it is necessary to indicate a word or a sentence in the text, use the italic. Text size should conform to 15 pages. The editorial board may accept a bit longer papers, but it will seldom do so.

Articles and abstracts should be written in the third person, neutrally, adhering to a good style and defined linguistic norms.

Refereneces

The journal uses the Harvard reference system - APA standards for referencing literature.

Sending papers

The manuscripts are received directly through logging on our web page http://www.sportlogia.com. In case you need any additional information please be kind to contact us on e-mail address kri.pan@hotmail.com.

jedu kojim se pojavljuju u tekstu i označena kao npr. "Tabela 1". Svaka tabela treba da ima kratak naslov. Potrebno je dodati legende za tabele. Takođe bilo bi informativno ako bi se u tabelama naznačile značajnije korelacije i značajnije varijable. Tabele treba posebno priložiti.

Ilustracije, grafikoni i slike obilježavaju se sa "Slika 1". Fotografije se šalju u elektronskoj formi u rezuliciji najmanje 300 dpi i formatu .tif (slike) i .eps (grafike). Svaka slika treba da ima kratak naslov. U slučaju da su slike preuzete iz nekog drugog rada, u naslovu ne bi trebalo da se nalazi orginalini naziv. U takvom slučaju potrebno je da se ispod slike nalazi Izvor odakle je slika preuzeta.

Ukoliko tabele, grafikoni i slike sadrže posebne znakove, te su rađeni u posebnom programu, dostavljaju se na posebnom fajlu, sa tačno navedenim rasporedom po kojem se uključuju u tekst.

Tehničko oblikovanje članka

Članci se pišu i štampaju latiničnim pismom, po potrebi i drugim pismima, na srpskom (ijekavica) i engleskom jeziku. Svako odstupanje od navedenog, treba posebno unaprijed dogovoriti s Uredništvom. Ako se radi o autorima kojima maternji jezik nije srpski, hrvatski ili bošnjački njihove radove na srpski prevodi uredništvo. Autori su dužni da prilikom prevođenja rada na engleski jezik angažuju stručne osobe, najbolje one kojima je maternji jezik engleski.

Tekstovi se pišu u Microsoft Word Windows programu, na papiru A4 formata. Tekst se piše u Times New Roman fontu, veličine 12 pt u proredu 1,5, poravnat sa obje strane, sa uvlačenjem prvog reda pasusa od 1 tab, sa marginama papira 2,5 cm. Ukoliko je u tekstu potrebno posebno označiti neku riječ ili rečenicu, koriste se kosa slova (italik). Obim teksta treba da sadrži do 15 strana. Uredništvo može prihvatiti i malo duže radove ali će to činiti rijetko.

Članke i sažetke treba pisati u trećem licu, neutralno, pridržavajući se dobrog stila i utvrđenih jezičkih normi.

Literatura

Časopis koristi Harvard reference system APA standard kod navođenja literture.

Slanje radova

Radovi se šalju putem direktnog logovanja na veb stranici časopisa http://www.sportlogia.com. U slučaju da trebate dodatne informacije molimo vas da se obratite na e-mail adresu kri.pan@hotmail.com.