

## www.mjssm.me





# Vol. 2

March 2013

# No. 1

#### **Index Coverage**

Montenegrin Journal of Sports Science and Medicine is indexed in: Genamics Journal Seek Index Copernicus SafetyLit EBSCO Publishing Inc. Ulrich's

#### **Editor-in-Chief**

Duško Bjelica, University of Montenegro (Montenegro)

#### Associate Editors

Selçuk Akpınar, Nevşehir University (Turkey) Mehmet Uygur, University of Delaware (USA)

#### **Honorary Editor**

Pavel Opavsky, University of Belgrade (Serbia)

#### **Managing Editor**

Stevo Popović, University of Montenegro (Montenegro)

#### **Advisory Board**

Boštjan Šimunič, University of Primorska (Slovenia) Goran Marković, University of Zagreb (Croatia) Humberto Moreira Carvalho, University of Coimbra (Portugal) John Hughson, University of Central Lancashire (UK) Matej Supej, University of Ljubljana (Slovenia) Miroslav Kezunović, University of Montenegro (Montenegro) Monem Jemni, University of Greenwich (UK) Raquel Escobar Molina, University of Granada (Spain) Slobodan Jarić, University of Delaware (USA)

#### **Editorial Board**

Ana Maria Botelho Teixeira, University of Coimbra (Portugal) Asterios Deligiannis, Aristotle University of Thessaloniki (Greece) Carlos Goncaves, University of Coimbra (Portugal) Daniela Dasheva, National sport academy "Vassil Levski" (Bulgaria) Feza Korkusuz, Middle East Technical University (Turkey) Georgi Georgiev, University "Sv. Kiril i Metodije" (Macedonia) Milan Čoh, University of Ljubljana (Slovenia) Morteza Jourkesh, Islamic Azad University (Iran) Nejc Šarabon, University of Primorska (Slovenia) Sandra Mandić, University of Otago (New Zealand) Praveen Kumar, Gulf Medical University (United Arab Emirates)

#### **Review Board**

Antonino Bianco, University of Palermo (Italy) Bojan Jošt, University of Ljubljana (Slovenia) Elena Taina Avramescu, University of Craiova (Romania) Ferman Konukman, The College at Brockport (USA) Gregor Jurak, University of Ljubljana (Slovenia) Jonatan Ruiz Ruiz, University of Granada (Spain) Manuel J. Coelho-e-Silva, University of Coimbra (Portugal) Mustafa Levent Ince, Middle East Technical University (Turkey) Raúl Arellano, University of Granada (Spain) Sergej Ostojić, University of Belgrade (Serbia)

#### Lektor Stevo Popović

**Prepress** Boris Šundić

Print "Art Grafika", Nikšić Tiraž 1500

#### MONTENEGRIN JOURNAL OF SPORTS SCIENCE AND MEDICINE International Scientific Journal

#### Vol. 2(2013), No.1 (1-53)

#### TABLE OF CONTENTS

Dear Readers
Duško Bjelica, Stevo Popović and Jovica Petković
(Original Scientific Paper)
Comparison of Instep Kicking Between Preferred and Non-Preferred Leg in Young Football Players
Damjan Jakšić, Radenko Matić and Milan Cvetković
(Original Scientific Paper)
Metric Characteristics of One Battery of Motoric Measuring Instruments
Praveen Kumar, Jaspal Singh Sandhu and Shweta Shenoy
(Original Scientific Paper)
Evaluation of Behaviour to Pain Measures in Athletes - A Correlative Analysis
Marcio Domingues
(Review Paper)
Osgood Schlatter's disease - A burst in young football players
Miroslav Kezunović
(Letter to the Editor)
Overuse Knee Injuries in Athletes
Guidelines for the Authors

Full-text available free of charge at http://www.mjssm.me/



Dear Readers,

I regard my appointment to the post of Editor-in-Chief of such an authoritative journal as the Montenegrin Journal of Sports Science and Medicine (MJSSM) as a great honor and serious responsibility.

For its more than year existence, the journal has become the undoubted leader among periodicals in the field of sports science and medicine in the region and wider. It is the fact that the journal has a constantly extending circle of readers in our country; being issued every half an year in English, it has long surpassed the boundaries of Montenegro and many foreign readers more often visit our official website as well as subscribe for the print version of the journal. In addition, it is also worth to mention that articles published in the journal arrive from leading scientists and specialists from all continents and it is currently indexed in five international bases, such as Genamics Journal Seek, Index Copernicus, SafetyLit, EBSCO Publishing Inc. and Ulrich's, while some further index bases are still pending.

From all mentioned above, I do believe that our journal will continue publishing high quality original scientific papers, notes, preliminary communications, reviews and conference papers in the fields of Sports Science and Medicine, as well as editorials, a "letter to the editor" section, abstracts from international and national congresses, panel meetings, conferences and symposia, and function as an open discussion forum on significant issues of current interest.

I hope that readers will find many interesting things about the progress of sports science and medicine and will encounter useful ideas that will assist in tackling new problems in these multidisciplinary scientific fields.

Sincerely Yours, Editor-in-Chief Prof. Duško Bjelica, PhD Dragi čitaoci,

prije svega bih istakao da svoju poziciju na mjesto glavnog urednika tako uglednog časopisa kao što je Montenegrin Journal of Sports Science and Medicine (MJSSM) doživljavam kao izuzetnu čast i obavljam je sa velikom odgovornošću.

Za svojih više od godinu dana postojanja, časopis je postao, nesumnjivo lider među časopisima iz oblasti sportskih nauka i medicine u regionu i šire. Činjenica je da naš časopis neprestano proširuje krug svojih čitalaca u našoj zemlji; međutim, njegovo polugodišnje publikovanje na engleskom jeziku, dovelo je do toga da široko prevaziđe granice Crne Gore pa veliki broj stranih čitalaca redovno posjećuje nađu zvaničnu internet prezentaciju i pretplaćuje se na štampano izdanje časopisa. Pored toga, takođe je vrijedno napomenuti da radovi objavljeni u časopisu stižu od vodećih naučnika i stručnjaka sa svih kontinenata, kao i da je trenutno je indeksiran u pet međunarodnih baza, kao što su Genamics Journal Seek, Index Copernicus, SafetyLit, EBSCO Publishing Inc. i Ulrich's, dok je kod nekih indeksnih baza evaluacija još uvijek u toku.

Iz svega navedenog, iskreno verujem da će naš časopis nastaviti da objavljuje visoko kvalitetne originalne naučne radove, bilješke, preliminarna saopštenja, preglede i konferencijske radove iz oblasti sportskih nauka i medicine, ali i "pisma uredniku", izvode sa međunarodnih i nacionalnih kongresa, panele sa sastanaka, konferencija i simpozijuma, kao i da funkcioniše kao otvorena tribina o bitnim pitanjima od savremenog značaja.

Takođe se nadam da će čitaoci pronaći mnogo zanimljivih stvari o napretku sportskih nauka i medicine i da će naići na korisne ideje koje će im pomoći u rješavanju novih problema u ovim multidisciplinarnim naučnim oblastima.

Iskreno Vaš, Glavni urednik Prof. dr Duško Bjelica

# **Comparison of Instep Kicking Between Preferred and Non-Preferred Leg in Young Football Players**

Duško Bjelica, Stevo Popović and Jovica Petković

University of Montenegro, Faculty for Sport and Physical Education, Nikšić, Montenegro

#### ABSTRACT

This research was aimed at gaining relevant knowledge about important differences with respect to compare accuracy of instep kicking between preferred and non-preferred leg depending on the different intensity (optimal and maximal) in a resting state, and in a state of fatigue. The sample included 20 respondents whose characteristics were age (yrs)  $16.7\pm0.47$ , height (cm)  $178.91\pm4.26$ , and body weight (kg)  $71.52\pm5.13$ . The sample of variables contained eight measures that defined accuracy of instep kicking by preferred and non-preferred leg in various occasions: with optimal and maximal intensities and in a resting state and a state of fatigue respectively. The results of the measuring were analyzed by means of a statistical procedure labeled a significance test of two arithmetic means conducted on independent samples or popularly known a t-test. In comparison of accuracy between preferred and non-preferred leg in a resting state with optimal and maximal intensity, as it was expected there were significant differences as well as in a state of fatigue with optimal intensity, all in favor of preferred leg. While the football instep kicking significant differences between preferred and non-preferred leg in a state of fatigue with maximal intensity. The current findings clearly demonstrated that the young football players have much more uniformed legs at the expense of accuracy when fatigue and kick the ball with the maximal intensity. It means a state of fatigue can affect the tested accuracy of instep kicking with the maximal intensity.

Key words: laterality, soccer, intensity, resting state, state of fatigue.

#### Introduction

Football players use the preferred leg to manipulate the ball and lead an action such as the kicking<sup>1</sup>. However, the frequent use of the preferred leg often gives rise to musculoskeletal asymmetry and footedness<sup>2</sup>. According to Grace and his collaborators, asymmetry exists in the cases if there is more than 10% difference for a specific quality between the legs, such as muscle girth, force or power<sup>3</sup>. Furthermore, Sadeghi and his collaborators have concluded that this fact has an impact on the overall laterality of the most athletes that use one side of their body much more than other one<sup>1</sup>. The same authors have underlined that football player usually displays laterality toward the preferred kicking leg, because of the dominance of one leg over the other one during the specific tasks in the game. The reason why this is happening reflects that the preferred leg displays decisive power capabilities for the execution of specific tasks. On the other hand, Maupas and his collaborators have indicated that just some research studies have demonstrated no training caused asymmetries in musculoskeletal measurement in athletes from preferred leg sports<sup>4</sup>. According to Capranica and his collaborators, some other research studies that treated laterality, have underlined that symmetry exists in young football players due to their lack of development<sup>5</sup>. However, this exists just in the period right before these young football players become more selective and specialized in their activities. Thereupon, they start developing increased muscle strength in relation to their natural foot preference. According to the same authors, the planned training may affect the equitable use of both legs and, consequently, mitigate the negative effects that occur regarding the symmetry.

Many coaches believe that it is desirable for players to be able to use either foot equally well and that excessive onesidedness would be a disadvantage, foot preference is always a relevant issue in football<sup>6</sup>. This means, it is essential for a good football player to kick the ball well with both legs. However, even top-level players show bilateral differences and fail to score when it is not possible to play the ball with their preferred leg. Therefore, the ability to kick with both legs is regarded as a desirable skill in top-level football players<sup>7</sup>. Given the apparent desirability of bilateral kicking skill in the football game, studies comparing preferred and non-preferred legs are not numerous, in spite of the many studies that have focused on the dynamics of football instep or similar maximal kicking. Some former studies comparing preferred and non-preferred legs have demonstrate many asymmetries between the preferred and nonpreferred legs, while some of them found no side-to-side difference in some characteristics <sup>2,5,7,8,9,10,11,12,13,14</sup>.

As the characteristics of the preferred leg are different from the non-preferred leg in most cases, the authors believed it would be reasonable to hypothesize that the accuracy of instep kicking between preferred and non-preferred leg is significantly different among the optimal and maximal intensity in a resting state, and in a state of fatigue all in favor of preferred leg. Due to the fact that the accuracy of instep kicking between preferred and non-preferred leg of football players in following occasions: with optimal and maximal intensities and in a resting state and a state of fatigue respectively, has not been investigated so far, the aim of the present study was to compare accuracy of instep kicking between preferred and non-preferred leg depending on the different intensity (optimal and maximal) in a resting state, and in a state of fatigue.

Received for publication January 28, 2013

#### **Materials and Metods**

Twenty football players from the junior premier league volunteered to be subjects. The players' characteristics were: age (yrs)  $16.7\pm0.47$ , height (cm)  $178.91\pm4.26$ , and body weight (kg)  $71.52\pm5.13$ . The criteria for selecting footballers for the sample were as follows: having a good health condition, then being a member of the team in the club for seven year at least and being under the supervision of qualified coaches all the time.

For the data collecting, it was used a valid and reliable method for measuring the accuracy of instep kicking<sup>15</sup>. It was conducted outdoors on a natural football pitch and all subjects wore their own shorts, t-shirt and football shoes. Following a warm up, stretching exercises and familiarization trials subjects were asked to shoot on target from the distance of 20 meters with both, preferred and non-preferred leg within four occasions: with optimal and maximal intensities and in a resting state (respondents had to shoot only if their heart rate is under 90 bpm) and a state of fatigue (respondents had to shoot as soon as they complete ten squats) respectively and we defined eight different variables, four variables regarding preferred leg: POR (shoot by preferred leg with optimal

intensity in a resting state), POF (shoot by preferred leg with optimal intensity in a state of fatigue), PMR (shoot by preferred leg with maximal intensity in a resting state), PMF (shoot by preferred leg with maximal intensity in a state of fatigue), as well as four variables regarding non-preferred leg: NOR (shoot by non-preferred leg with optimal intensity in a resting state), NOF (shoot by non-preferred leg with optimal intensity in a state of fatigue), NMR (shoot by non-preferred leg with maximal intensity in a resting state), NMF (shoot by non-preferred leg with maximal intensity in a state of fatigue). Subjects kicked a total of ten shoots, using a standard size ball, at an outlined target on a steady vertical surface in standard dimensions (7.32 x 2.44 m). The centre of the target (Picture 1) was marked with a cross lines which divided the target to four equal rectangles. From the central point it was drawn many concentric circles and the first one had the same diameter as a standard ball (22.1 cm). All other circles were outlined with their mutual space between of a size of a standard ball diameter. The central circle brought 17 points, which was a maximal number of points for one shoot, whereas peripheral circles on the left and right brought one point. It means that every shoot closer to center brought the larger number of points, while every failure was identified by zero points.



#### PICTURE 1 THE TARGET

The data obtained in the research were processed using the application statistics program SPSS for Windows 15.0. adjusted for the use on personal computers. Descriptive statistics were the first calculated, and then it was determined whether there was significance with respect to the difference between the mean in every variable recreationally, which was done testing the difference between the mean of independent samples, using the popularly known, t-test which was set at p<0.01. The analysis provided the answers to the question of whether there was and how prominent was the difference between instep kicking by preferred and non-preferred leg among various states and intensities in young football players.

#### Results

This section offers the results of the descriptive statistics, as well as the results of discriminative analysis classified into two tables and four graphs.

The first table, in the first three columns contains the means (M), the standard deviations (SD) and the standard errors (SE), as well as minimum (Min) and maximum (Max), range (R), Skewness (Sk.) and Kurtosis (Ku.).

	М	SD	SE	Min	Max	R	Sk.	Ku.
Age (yrs)	16.7	0.47	0.1	16	17	1	-0.94	-1.24
Height (cm)	178.91	4.26	0.95	171.5	188.6	17.1	0.31	0.42
Weight (kg)	71.52	5.13	1.15	64	84	20	0.59	0.24
POR	9.97	0.26	3.62	0	16	16	-0.72	-0.19
POF	9.5	0.3	4.31	0	17	17	-0.93	0.16
PMR	6.53	0.37	5.23	0	16	16	0.02	-1.45
PMF	6.47	0.35	4.96	0	15	15	-0.05	-1.50
NOR	8.09	0.33	4.60	0	17	17	-0.20	-0.88
NOF	8	0.37	5.28	0	17	17	-0.34	-1.29
NMR	4.94	0.38	5.30	0	16	16	0.59	-1.11
NMF	5.97	0.37	5.18	0	17	17	0.13	-1.44

TABLE 1DESCRIPTIVE STATISTICS

**Legend:** POR – shoot by preferred leg with optimal intensity in a resting state, POF – shoot by preferred leg with optimal intensity in a state of fatigue, PMR – shoot by preferred leg with maximal intensity in a resting state, PMF – shoot by preferred leg with maximal intensity in a state of fatigue, NOR – shoot by non-preferred leg with optimal intensity in a resting state, NOF – shoot by non-preferred leg with optimal intensity in a resting state, NOF – shoot by non-preferred leg with maximal intensity in a resting state, NOF – shoot by non-preferred leg with maximal intensity in a resting state, NOF – shoot by non-preferred leg with maximal intensity in a resting state, NMF – shoot by non-preferred leg with maximal intensity in a state of fatigue, NMR – shoot by non-preferred leg with maximal intensity in a resting state, NMF – shoot by non-preferred leg with maximal intensity in a state of fatigue.

The second table shows the result of independent t-test and it is presented through cross tabular scheme at a significance level of p=.01.

TABLE 2INDEPENDENT T-TEST

intensity	state	t-test		
ontimal	rest	2.95*		
optimai	fatigue	2.98*		
maximal	rest	2.77*		
maximai	fatigue	1.02		
*p<0.01				

The first graph shows the differences of instep kicking among preferred and non-preferred leg in a resting state with optimal intensity. The value of this comparison is 2.95 and it means that there is significant difference between these two variables at a significance level of p=.01.



#### FIGURE 1 COMPARISON OF INSTEP KICKING AMONG PREFERRED AND NON-PREFERRED LEG IN A RESTING STATE WITH OPTIMAL INTENSITY

The second graph shows the differences of instep kicking among preferred and non-preferred leg in a state of fatigue with optimal intensity. The value of this comparison is 2.98 and it means that there is significant difference between these two variables at a significance level of p=.01.



FIGURE 2 COMPARISON OF INSTEP KICKING AMONG PREFERRED AND NON-PREFERRED LEG IN A STATE OF FATIGUE WITH OPTIMAL INTENSITY

The third graph shows the differences of instep kicking among preferred and non-preferred leg in a resting state with maximal intensity. The value of this comparison is 2.77 and it means that there is significant difference between these two variables at a significance level of p=.01.



#### FIGURE 3

COMPARISON OF INSTEP KICKING AMONG PREFERRED AND NON-PREFERRED LEG IN A RESTING STATE WITH MAXIMAL INTENSITY

The fourth graph shows the differences of instep kicking among preferred and non-preferred leg in a state of fatigue with maximal intensity. The value of this comparison is 1.02 and it means that there is no significant difference between these two variables at a significance level of p=.01.



#### FIGURE 4

# COMPARISON OF INSTEP KICKING AMONG PREFERRED AND NON-PREFERRED LEG IN A STATE OF FATIGUE WITH MAXIMAL INTENSITY

Generally, in comparison of accuracy between preferred and non-preferred leg in a resting state with optimal and maximal intensity, as it was expected there were significant differences as well as in a state of fatigue with optimal intensity, all in favor of preferred leg. While the football instep kicking significant differences between preferred and nonpreferred leg in a state of fatigue with maximal intensity were not noticable (1.02).

#### Discusion

At the turn of the 21st century, it is the fact that football is one of the most popular sports, with more than 250 million

registered players in over 200 countries and over 1.4 billion people interested in it<sup>16</sup>. Most of footballers play this popular game and tend to use one leg as a preferred one because they need it for better receiving, controlling and kicking the ball<sup>17</sup> From the scientific point of view, numerous previous studies have been published on measuring differences between the preferred and non-preferred leg in football players. Detailed review of previous literature indicates that the preferred leg of football players, when compared with the non-preferred leg, the first produces significantly higher ball speed in maximal instep kicking<sup>10</sup> and three-steps drive kicking<sup>7</sup>. Furthermore, the preferred leg, when compared with the non-preferred leg has considerably greater angular velocities of the shank and thigh on impact with the ball<sup>7,12</sup>, as well as it has significantly greater peak and average torques measured by computerized dynamometer during knee extension at angular velocities of 0, 60, 180 and 240 degrees per second<sup>12,17</sup>. It is also very important to underline that the preferred leg, when compared with the non-preferred leg has considerably greater knee muscle moment<sup>12</sup> and strength of knee flexor muscles<sup>2</sup>, a notably larger muscle size<sup>9</sup> and considerably higher accuracy at kicking the ball<sup>7</sup>

As many characteristics of the preferred leg are very different from the non-preferred leg, it was reasonable to hypothesise that, the accuracy of instep kicking between preferred and non-preferred leg is significantly different among the optimal and maximal intensity in a resting state, and in a state of fatigue all in favor of preferred leg. However, this research study did not confirm the entire hypothesis and the discussion whether there are differences between the preferred and non-preferred leg still remains controversial. Generally, in comparison of accuracy between preferred and non-preferred leg in a resting state with optimal and maximal intensity, as it was expected there were significant differences as well as in a state of fatigue with optimal intensity, all in favor of preferred leg, while the football instep kicking significant differences between preferred and non-preferred leg in a state of fatigue with maximal intensity were not noticable. The discrepancy of results may even be caused by the uncertainty of which leg is defined as the preferred one as well as may be the result of the amateur level of the players.

The current finding clearly demonstrated that the young football players have much more uniformed legs at the expense of accuracy when fatigued and kick the ball with the maximal intensity. It means that a state of fatigue can affect the tested

#### REFERENCES

1. SADEGHI H, SADEGHI S, ALLARD P, LABELLE H, DUHAIME M, Lower limb muscle power relationships in bilateral able-bodied gait. American Journal of Physical Medicine and Rehabilitation, 80(11) (2001) 821. - 2. RAHNAMA N, LEES A, BAMBAECICHI E, Comparison of muscle strength and flexibility between the preferred and nonpreferred leg in English soccer players. Ergonomics, 48(11-14) (2005) 1568. - 3. GRACE TG, SWEETSER ER, NELSON MA, YDENS LR, SKIPPER BJ, Isokinetic muscle imbalance and knee-joint injuries. Journal of Bone and Joint Surgery, 66(5) (1984) 734. - 4. MAUPAS E, PAYSANT J, DATIE A, MARTINET N, ANDRE J, Functional asymmetries of the lower limbs. A comparison between clinical assessment of laterality, isokinetic evaluation and electrogoniometric monitoring of knees during walking. Gait and Posture, 16(3) (2002) 304. - 5. CAPRANICA L, CAMA G, TESSITORE A, accuracy of instep kicking with the maximal intensity in the positive manner. This fact should be taken into consideration by contemporary trainers as football is a highly intermittent sport, requiring from athletes to accelerate hundreds of times with repeated bouts of high-intensity running and players often have to fight with fatigue. This means that football players should be advised to use both legs in this situation as the ability to kick effectively with either leg is an essential attribute for a player. This ability provides a player with greater disposal options and makes it more difficult for the opposition to defend<sup>18</sup>. Furthermore, it is interesting to mention that 20% of kicks in Australian Football League games are performed with the nonpreferred foot, and this percentage can be as high as 45% for some individuals<sup>18</sup> and the findings from this research study would not be valid for mentioned population. This means that the consensus is required to define the term preferred leg, as well to standardize the tests that should be established to find out the preferred side.

#### Conclusion

Before this research study would be concluded, it is also very important to be underlined that some former studies that focused on accurate football kick indicated the possible influence of certain kinematic variables on the accuracy of target hit<sup>19</sup>, such as a decrease in the approach velocity of the football players, as well as linear and angular joint velocities and ball speed, compared with powerful kicks<sup>20,21,22</sup>. The mentioned variables that affect the accuracy are influenced, next to the preferred leg, also by various factors, such as muscle strength<sup>23,24</sup>, and training level<sup>25,26</sup>. This research study has identified some of the characteristics of asymmetry in football kicking performance. However, this issue is not completely explored and further studies are required to determine how all of these factors influence kicking accuracy in the same time.

#### Acknowledgements

This study was presented as Abstract Poster Presentation in the 1st International Conference in Science and Football, Scuola dello Sport CONI Sicilia: Palermo, Italy.

FIGURA F, Force and power of preferred and nonpreferred leg in young soccer players. Journal of Sports Medicine and Physical Fitness, 32(4) (1992) 358. 6. - BJELICA D, GEORGIEV G, POPOVIĆ S, Comparison of instep kicking beetwen preferred and non-preferred leg in young football players. In: Book of Abstract (1st International Conference in Science and Football, Scuola dello Sport CONI Sicilia, Palermo, 2011). - 7. MCLEAN BD, TUMILTY DM, Left-right asymmetry in two types of soccer kick. British Journal of Sports Medicine, 27(4) (1993) 260. - 8. CAREY DP, SMITH G, SMITH DT, SHEPHERD JW, SKRIVER J, ORD L, RUTLAND A, Footedness in world soccer: an analysis of France '98. Journal of Sports Sciences, 19 (2001) 855. - 9. KEARNS CF, ISOKAWA M, ABE T, Architectural characteristics of dominant leg muscles in junior soccer players. European Journal of Applied Physiology, 85(3-4) (2001) 240. -

DORGE HC, ANDERSEN TB, SORENSEN 10 H. SIMONSEN EB, Biomechanical differences in soccer kicking with the preferred and the non-preferred leg. Journal of Sports Sciences, 20 (2002) 293. - 11. ROSS S, GUSKIEWICZ KM, PRENTICE W, SCHNEIDER R, YU B, Comparison of biomechanical factors between the kicking and stance limbs. Journal of Sport Rehabilitation, 13(2) (2004) 135. - 12. NUNOME H, IKEGAMI Y, KOZAKAI R, APRIANTONO T, SANO S, Segmental dynamics of soccer instep kick with the preferred and non-preferred leg. Journal of Sports Sciences, 24, (2006) 529. - 13. SAMADI H, RAJABI R, MINOONEJAD H, AGHAIARI A, Asymmetries in flexibility, balance and power associated with preferred and non-preferred leg. World Journal of Sport Sciences, 2(1) (2009) 38. - 14. GSTÖTTNER M, NEHER A, SCHOLTZ A, MILLONIG M, LEMBERT S, RASCHNER C, Balance ability and muscle response of the preferred and nonpreferred leg in soccer players. Motor Control, 13(2) (2009) 218. - 15. BJELICA, D, The main components of football kicking accuracy. In Montenegrin. (Montenegrin Sports Academy, Podgorica, 2008). - 16. RITZER G, RYAN JM, The concise encyclopedia of sociology (Wiley-Blackwell, Malden, 2011). - 17. KRAMER JF, BALSOR BE, Lower extremity preference and knee extensor torques in intercollegiate soccer players. Canadian journal of sport sciences, 15(3) (1990) 180. - 18. SMITH J, BALL K, MACMAHON C, Foot to ball interaction in preferred and nonpreferred leg Australian rules kicking. In: Proceeding (XXVII International Conference on Biomechanics in Sports, Australian Catholic University, Fitzroy, 2009). – 19. BUBANJ S, STANKOVIĆ R, JOKSIMOVIĆ S, BUBANJ R, R, JOKSIMOVIĆ S, KOZOMARA G, EFTHIMIADIS P, Kinematics of accurate inside of foot kick. Kinesiologia Slovenica, 16(1-2) (2010) 75. - 20. GODIK M, FALES I, BLASHAK I, Changing the kicking accuracy of soccer players depending on the type, value and aims of training and competitive loads. In: Reilly T, Clarys J, Stibbe A (Eds) Science and Soccer (E&FN Spon, London, 1993). - 21. LEES A, NOLAN L, The biomechanics of soccer: A review. Journal of Sports Sciences, 16(3) (1998) 211. - 22. TEIXEIRA L, Kinematics of kicking as a function of different sources of constraint on accuracy. Perceptual and Motor Skills, 88(3Pt1) (1999) 785. - 23. OSTOJIĆ S, Characteristics of elite and nonelite Yugoslav soccer players: Correlates of success. Journal of Sports Science and Medicine, 2 (2003) 34. - 24. MASUDA K, KIKUHARA N, DEMURA S, KATSUTA S, YAMANAKA K, Relationship between muscle strength in various isokinetic movements and kick performance among soccer players. Journal of Sports Medicine and Physical Fitness, 45(1) (2005) 44. - 25. COMMETTI G, MAFFIULETTI NA, POUSSON M, CHATARD JC, MAFFULLI N, Isokinetic strength and anaerobic power of elite, subelite and amateur French soccer players. International Journal of Sports Medicine, 22(1) (2001) 45. - 26. DAVIDS K, LEES A, BURWITZ L, Understanding and measuring coordination and control in kicking skills in soccer: implications for talent identification and skill acquisition. Journal of Sports Sciences, 18(9) (2000) 703. -

#### D. Bjelica

University of Montenegro, Faculty for Sport and Physical Education, Nikšić, Montenegro e-mail: sportmont@t-com.me

#### POREĐENJE UDARACA UNUTRAŠNJOM STRANOM HRPTA STOPALA IZMEĐU PROTEŽIRANE I NEPROTEŽIRANE NOGE KOD MLADIH FUDBALERA

#### SAŽETAK

Cilj ovog istraživanja je dobijanje relevantnih znanja o značajnim razlikama kada je u pitanju poređenje udaraca unutrašnjom stranom hrpta stopala protežiranom i neprotežiranom nogom u zavisnosti od stanja zamora i intenziteta rada mladih fudbalera. Uzorak ispitanika je obuhvatio 20 ispitanika čije su karakteristike bile sljedeće: godine (god) 16.7±0.47, visina (cm) 178.91±4.26, i težina (kg) 71.52±5.13. Uzorak varijabli je sadržao osam varijabli koje su definisale tačnost udaraca unutrašnjom stranom hrpta stopala protežiranom nogom u različitim uslovima: optimalnim i maksimalnim intenzitetom, i u odmornom stanju i u stanju zamora, naizmjenično. Razlike u tačnosti udaraca unutrašnjom stranom hrpta stopala između protežiranje i neprotežirane. Dok značajne razlike nisu primijećene kod tačnosti udaraca unutrašnjom stranom hrpta stopala između protežiranje i neprotežirane noge u zamorenom stanju sa optimalnim intenzitetom. Navedena saznanja jasno ukazuju da mladi fudbaleri imaju mnogo jasnije uniformisana stopala na štetu tačnosti kada u zamorenom stanju udaraju po lopti sa maksimalnim intenzitetom. Dakle, trebalo bi zaključiti da stanje zamora utiče na testiranu tačnost udaraca unutrašnjom stranom hrpta stopala između protežiranje i neprotežiranje i neprotežirane.

Ključne riječi: lateralnost, fudbal, intenzitet, odmorno stanje, stanje zamora.

Monten. J. Sports Sci. Med. 2 (2013) 1: 11–16 Original scientific paper UDC 796.012

## Metric Characteristics of One Battery of Motoric Measuring Instruments

Damjan Jakšić, Radenko Matić and Milan Cvetković

University of Novi Sad, Faculty of Sport and Physical Education, Novi Sad, Serbia

#### ABSTRACT

The paper at hand presents the results of research, which is carried out on 161 male students of Faculty of Sport and Physical Education, University of Novi Sad, Serbia. System of 11 composite measuring instruments was applied on them and each of tests had three replications. Analysis of metric characteristics was done on two ways: in real and in Guttman's image space. Finally, it could be concluded that battery of motor measure instruments is absolutely appropriate for this sample of participants and also that it will be very useful to check all these outcomes with some of advanced statistical techniques in further investigations.

Key words: composite measure instruments, metric characteristics, 20-year-old students.

#### Introduction

During the motoric skills testing also very complex human characteristics are assessed. The mentioned testing is based on certain manifestations, because the motor skills by definition are of latent character and cannot be directly measured. All tests represent indirect estimates, and it is therefore necessary to check specific motor skill with the help of several motor tests which must meet certain metric properties<sup>1</sup>.

Although kinesiometric problems are unjustly neglected recently despite the importance they have in practice, testing of metric characteristics of measuring instruments became very rare. Their testing is very important, if not even necessary prior to entering the high-quality research process. Every sample of respondents bears its own specificities. If we only note that none of motor skills is clearly isolated, and that probably we will never find such measuring instrument which could separate (partialize) "other" characteristics and skills that are not necessary when testing the same, all of that leads us to the conclusion that metric properties of tests are specific, and it is necessary to constantly control them. In this way, the current state is observed during the research process; it is corrected and directs further research<sup>2</sup>.

Reliability is commonly cited as one of the two basic measurement properties of the test (the other is validity, of course)<sup>3</sup>. Although, when discussing this issue, it is much more correct to say that primarily it is about the reliability of the test score, and only indirectly about the reliability of the measuring instrument<sup>4,5</sup>. This terminological distinction is important, but meaningfully and practically does not significantly change the basic settings of the research work.

The validity of the measuring instruments by its significance represents more important metric characteristic than reliability. Very often, when observing the structure of motoric space, we can note that although the test hypothetically covers a certain motor skill, after operationalization, it actually better explains some other motor skill. In these cases it is possible that the test is invalid, and it is necessary to replace it with more valid test. However, it is not fair to prejudge the conclusions, because there is no invalidity always. There may be other reasons for it, such as imbalance of the system variables, and often there is a shortcoming of statistical procedure.

With this in mind, the aim of the research is to check the reliability of concrete motor measuring instruments, and to define the structure of the motor space over the applied battery of measuring instruments.

#### **Materials and Methods**

Motor tests were performed on male students of the Faculty of Sport and Physical Education (FSPE) from Novi Sad, with total of 161, mean age 20.15 ( $\pm$  0.83) decimal years, clinically healthy and without apparent psycho-somatic aberrations.

The system of 11 composite measuring instruments was applied on them. Each of the tests contained three particles, or replications.

These were the following motor measuring instruments: (1) Flexibility with the bat, (2) Forward bend on the bench, (3) Rope, (4) Standing broad jump, (5) Agility with the bat, (6) Lying medicine ball throw, (7) Standing high jump (vertical jump), (8) Drumming with hands and feet, (9) Seated medicine ball throw, (10) Non-rhythmic drumming and (11) Standing triple broad jump.

All the methods of measurement and testing were performed according to the recommendations of Metikoš et  $al.^{6}$ .

"There is a well-established view that for the reliability evaluation it is not sufficient to apply only one indicator. There is plenty of reliability coefficients (dozens) and behind each of them there is an elaborated measuring model and elaborated assumptions. The necessity of using several different coefficients is manifested by the fact that all of these coefficients, when calculated, give different estimates of reliability for the same data."<sup>3</sup>.

Reliability was tested using three different reliability coefficients as follows:

- Spearman-Brown-Kuder-Richardson-Guttman-Cronbach's α reliability coefficient (hereinafter referred to as α), which is commonly used to calculate the reliability of measuring instruments,
- 2. Lord-Kaiser-Caffrey's β coefficient and

#### 3. Guttman-Nicewander's coefficient ρ.

Cronbach's  $\alpha$  coefficient is based on the classical summation measurement model that takes into account all three particles, in quantitative terms. The next coefficient ( $\beta$ ) represents the reliability of the first principal component, which means the priority of the calculation is the principal component and the projection of a single particle on it, and the last coefficient  $\rho$  is a coefficient that is based on Guttman's measurement model, thus transforming the variables in Guttman's image space, eliminating unique variance and calculation of the reliability of so-called pure variable, or test particle.

For calculation of the reliability of motoric measuring instruments a RTT11G program was used<sup>7</sup>, which was written in Matrix pseudo-language so it could be performed in the standard SPSS environment. Definitions and formal mathematical presentation of these coefficients implemented in this program, can be found in Momirović's et al. study<sup>8</sup>.

In addition to calculating the reliability, a structure of applied battery of tests was also determined. Thus, the obtained structure has led to information about the factor validity of the applied test battery stemmed from the findings. Structure of applied battery of tests was obtained using factor analysis, where the number of significant principal components is determined based on the Kaiser-Guttman's criteria, then the initial intercorrelation matrix was rotated into more favorable parsimonic promax solution. It should also be noted how to select the most appropriate replication which is further factorized. At least four ways of taking adequate replication are methodologically different, so they as such, will be presented below by the quality. So, there is a possibility of one of the following four choices:

- 1. to take the best value out of three replications,
- 2. to take the arithmetic mean out of three replications,
- 3. to take a replication which saturates the first principal component the most,
- to take the factor score obtained from the all three replications.

In this particular case, for further analysis of the data the value obtained by factoring replications and calculating factor scores was taken, and also all other values are mentioned in informative purposes and will be discussed later.

In addition, the factor scores were transformed into Guttman's image metrics<sup>9</sup>. In that way partial images of variables are obtained in order to theoretically eliminate the error variance.

#### **Results and Discussion**

In Table 1 we extracted the most important information for each motor test and its single replication.

# TABLE 1 BASIC DESCRIPTIVE STATISTICS, CORRELATIONS AND CALCULATION OF THE FIRST PRINCIPAL COMPONENT OF EACH SEPARATE TEST

Variable	m	Descriptiv	ve	Pearson <sup>a(all)</sup>			Hotteling		
variable	Ite	Mean	SD	1	2	3	H1	h <sup>2</sup>	%
Elavibility with the bet	1	78.33	14.94	1.00			.97	.93	
(om)	2	75.13	15.95	.93	1.00		.99	.97	95.02
(cm)	3	73.24	16.90	.90	.95	1.00	.97	.95	
Forward hand on the	1	48.18	8.55	1.00			.99	.97	
Forward beind on the	2	50.40	8.43	.98	1.00		1.00	.99	98.18
bench (cm)	3	51.72	8.47	.96	.99	1.00	.99	.98	
	1	184.74	11.46	1.00			.98	.97	
Rope (cm)	2	186.14	11.21	.95	1.00		.99	.97	97.03
	3	186.51	11.30	.95	.96	1.00	.99	.97	
Standing hugad inner	1	235.08	19.84	1.00			.94	.88	
Standing broad jump	2	239.65	19.21	.85	1.00		.96	.93	91.06
(cm)	3	242.03	19.28	.84	.91	1.00	.96	.92	
	1	617.07	147.84	1.00			.86	.74	
Againty with the bat $(0,01,-)$	2	589.46	130.09	.58	1.00		.83	.68	70.36
(0.01 s)	3	575.37	137.19	.58	.51	1.00	.83	.68	
Tanina and dising hall	1	963.14	146.79	1.00			.93	.87	
Lying medicine ball	2	990.13	159.76	.83	1.00		.96	.92	90.23
throw (cm)	3	1001.19	151.88	.83	.90	1.00	.96	.92	
Standing high immu	1	287.36	11.79	1.00			.99	.97	
Standing nign jump	2	288.32	11.73	.99	1.00		.99	.98	95.37
(cm)	3	288.02	13.62	.90	.90	1.00	.96	.91	
D : :411 1	1	15.66	3.75	1.00			.93	.86	
Drumming with hands	2	16.58	3.72	.85	1.00		.97	.93	88.66
and feet (freq.)	3	16.99	3.79	.77	.87	1.00	.94	.87	
	1	648.22	83.97	1.00			.95	.90	
Seated medicine ball	2	661.72	78.96	.91	1.00		.96	.92	87.81
throw (cm)	3	667.41	95.23	.76	.79	1.00	.90	.81	
x	1	17.63	4.76	1.00			.92	.85	
Non-rhythmic	2	19.31	4.43	.76	1.00		.91	.83	83.59
drumming (freq.)	3	20.08	4.61	.77	.73	1.00	.91	.83	
	1	658.38	59.05	1.00			.95	.91	
Standing triple broad	2	669.99	56.60	.89	1.00		.97	.95	93.34
Jump (cm)	3	675 78	56.31	88	03	1.00	07	94	

Legend: Mean – arithmetic mean; SD – standard deviation; Pearson – Pearson coefficient of correlation; <sup>a</sup> – statistical significance at the level of p=.00; H1 – the first principal component;

 $h^2$  – communalities; % - percentage of common variance.



FIGURE 1 VARIABLES FACTOR MAP (PCA)

Table 1 helped to choose which of test replications gave the most information about particular variable which represents "something common". As we can see from above mentioned table, the biggest projections on belongs factor is just as follows: in test Flexibility with the bat – second replication; in test Forward bend on the bench – second replication; in test Rope – third replication; in test Standing broad jump – second replication; in test Lying medicine ball throw – second replication; in test Standing high jump – second replication; Drumming with hands and feet – second replication; Seated medicine ball throw –

tion; Non-rhythmic drumming – first replication and test Standing triple broad jump – second replication. All significant replications are bolded in Table 1 and also graphically presented in Figure 1.

Table 2 shows the values of the reliability coefficients of the motor measuring instruments, while Tables 3, 4 and 5 show the results obtained by factor analysis in real and image space. As a criterion for the formation of a matrix which is subsequently factorized, the best particles from each test are taken. In other words, the particle carrying the most information has been selected as the most suitable for further work.

TABLE 2					
RELIABILITY	OF MOTOR TESTS				

Variable	Measure of reliability under the classical summation model	Measure of reliability of the first principal component	Measure of reliability under Guttman's measuring model
	a	β	ρ
Flexibility with the bat	.973	.973	.997
Forward bend on the bench	.990	.990	.999
Rope	.984	.984	.998
Standing broad jump	.950	.950	.988
Agility with the bat	.789	.789	.832
Lying medicine ball throw	.945	.945	.987
Standing high jump	.975	.975	.999
Drumming with hands and feet	.935	.936	.984
Seated medicine ball throw	.930	.930	.986
Non-rhythmic drumming	.901	.901	.951
Standing triple broad jump	.964	.964	.994

Legend:  $\alpha$  – Spearman-Brown-Kuder-Richardson-Guttman-Cronbach's reliability coefficient;  $\beta$  – Lord-Kaiser-Caffrey's reliability coefficient;  $\rho$  – Guttman-Nicewander's reliability coefficient.

Variable	Real space				Image space		
variable	H1	H2	H3	H4	H1	H2	H3
Flexibility with the bat	26	.54	.48	17	49	.71	.40
Forward bend on the bench	.44	36	40	.37	.71	37	21
Rope	.63	10	10	.52	.83	.03	01
Standing broad jump	.80	.11	16	41	.88	.15	12
Agility with the bat	48	.31	.41	.41	74	.32	.36
Lying medicine ball throw	.64	.39	.31	.28	.75	.44	.20
Standing high jump	.81	.27	.00	.06	.90	.29	03
Drumming with hands and feet	.32	62	.58	02	.41	41	.70
Seated medicine ball throw	.69	.34	.20	.13	.82	.44	.17
Non-rhythmic drumming	.30	60	.59	10	.43	56	.56
Standing triple broad jump	.80	.12	01	37	.89	.17	08
Variance [%]	35.63	14.83	12.81	9.23	54.09	15.78	11.14

 TABLE 3

 PRINCIPAL COMPONENTS IN REAL AND IMAGE SPACE

Legend: H - principal components, Variance [%] - percent of common variability.

TABLE 4PATTERN MATRIX IN THE REAL AND IMAGE SPACE

Variable	Real space				In	Image space		
variable	A1	A2	A3	A4	A1	A2	A3	
Flexibility with the bat	.26	17	74	02	.30	-1.04	04	
Forward bend on the bench	.11	.01	.77	03	.19	.69	.09	
Rope	.58	18	.59	.03	.65	.25	.09	
Standing broad jump	.26	.80	04	03	.77	.25	08	
Agility with the bat	.29	79	26	01	23	78	.08	
Lying medicine ball throw	.90	12	07	.03	.98	27	.06	
Standing high jump	.69	.29	.07	07	.92	.07	05	
Drumming with hands and feet	.02	02	.03	.90	.08	08	.91	
Seated medicine ball throw	.78	.08	07	.00	1.02	23	.05	
Non-rhythmic drumming	02	.04	03	.90	06	.15	.86	
Standing triple broad jump	.34	.71	12	.06	.81	.21	04	

#### Legend: A - pattern.

Bearing in mind the obtained results one can observe that the largest number of measuring instruments gave the best projection on the first principal component in their second particle. Such was the case with the test: Flexibility with the bat, Forward bend on the bench, Standing broad jump, Lying medicine ball throw, Standing high jump, Drumming with hands and feet, Seated medicine ball throw and Standing triple broad jump. Tests Non-rhythmical drumming and Agility with the bat had the best values on the first attempt, while the test Rope saturated the best its own main component at the third attempt. It is easy to conclude that the majority of motor test requires a test attempt. Although the specificum of the sample of respondents is that they have above-average motoric capabilities<sup>10</sup>, that they probably had a lot of testing in their past, because they are generally more or less athletes, we can explicitly point to the necessity for a second attempt. Recalling of the movement structures necessary when performing test task can be seen as a necessity.

Tests Non-rhythmical drumming and Agility with the bat showed that the best value of the projection is on the first principal component during the first attempt. Hasty concluding could lead to the wrong track and say that it is enough to run these tests only once. However, the values of the percentage of common variance are clearly the lowest if we observe the full applied battery of tests. In other words, the differences are relatively high when repeating the tests, which later pointed to the unreliability of the test Agility with the bat. We could say, with a great degree of certainty, that in these tests processes of rapid acquisition of motor skills are very present, because by repetition in a short period of time we learn relatively complex movement structures that are always being performed in an identical manner. Also, the correlation values indicate that the highest value between the first and the third attempts. Therefore, it is recommended to perform the test three times, and if the examiner decides to use the real values (quantitative), he should use the third replication.

The test Rope, as it was expected, showed the best value for the third replication, since the level of engagement of muscle cells under the influence of elongation occurs after 10-12 seconds so the longer the retention the probability for a better result also increase.

Threshold value of the criteria for determining reliability is set at approximately 0.90<sup>3</sup>, although for some authors closely

related to our case study, this limit is somewhat more liberal for motor abilities assessment tests<sup>8</sup>.

From the presented table it can be seen that only the Agility with the bat test did not show satisfactory reliability values. It is also obvious that none of the three criteria ( $\alpha = 0.79$ ,  $\beta = 0.79$  and  $\rho = 0.83$ ) obtained by different measurement models did not reach an approximate theoretical value for the motor measuring instruments<sup>8</sup>, and the reason for that is a big difference between the initial first attempt which can almost be taken as a probationary and the other two where the process of learning already gained momentum and provided for better values. But, if test has other metric characteristics on satisfactory level (i.e. validity, if has good discrimination, if it is economical etc.) it could be used in further research.

Below, we can see that in the real space we isolated four factors that can be meaningfully interpreted as: 1) explosive strength (35.63% of common variability), 2) explosive leg strength and agility (14.83% of common variability), 3) flexibility (12.81% of common variability) and 4) coordination<sup>\*</sup> (9.23% of common variability). It is notable, too, that the measuring instrument Rope tends to equally saturate two latent dimensions. What the author could have concluded, on the basis of a previous research, is also confirmed here. In the paper by Cvetković et al.<sup>11</sup>, it is found that

the test Rope is not carefully selected. Although this work has confirmed that the test is reliable, the test didn't meet its basic purpose. Therefore, the validity of the measuring instrument is not at a satisfactory level. This problem was highlighted in the aforementioned study, where was, among other things, proved that this measuring instrument has very high correlation with variables of longitudinal dimensionality of the skeleton.

The importance of Guttman's image theory was observed by looking at the pattern matrix in image space. If we assume that the applied sample of the variables was drawn from a universe of variables, and this brought us to defining "pure" variables in which the measurement error was eliminated, we can observe that it is much more meaningful to define latent variables than in real space. Consequently, we can say that the first factor, explaining 54.10% of common variability, is interpreted as explosive strength factor, although another variable that constitutes this factor, Rope, was not interpreted because of the reasons mentioned in the preceding paragraph. Another factor has been interpreted as flexibility factor (explaining 15.78% of common variability), while the third factor – as a factor of coordination<sup>\*\*</sup> (11.15% common variability).

In tables 5 and 6 results of correlations in real and Guttman's space are shown.

TABLE 5
FACTOR CORRELATION MATRICES IN REAL SPACE

Factor	1.	2.	3.	4.
1. Explosive strength	1.00			
2. Explosive leg strength and agility	.41	1.00		
3. Flexibility	.16	.27	1.00	
4. Coordination	.15	.15	.16	1.00

 TABLE 6

 FACTOR CORRELATION MATRICES IN IMAGE SPACE

Factor	1.	2.	3.
1. Explosive strength	1.00		
2. Flexibility	.35	1.00	
3. Coordination	.16	.15	1.00

#### Conclusion

In the end, it is necessary to emphasize that the calculation of the metrical characteristics of motoric measuring instruments represents the necessity in any research, because they do not have a permanent character and because they change from one to another type and sample of respondents as well as numerous other factors. In this paper, the authors intended to illustrate the possibility of adequate implementation of already standard motor tests, using some kinesiometric concepts to define the internal characteristics of composite measuring instruments. It is not difficult to conclude that almost all coefficients have a very high value, much higher than those that are common in this type of analysis. This situation may also indicate the different nature of particles in motor tests. Accordingly, it is probably necessary to analyze composite motoric measuring instruments on some other ways, since it was shown that the classical methods are too "soft" for kinesiometric problems, or at least only in so far as it deals with the problem of motor tests.

The authors recommend further research based on Guttman's test theory, and methods that have been discussed in the works of Zhu and his collaborators<sup>12,13,14,15</sup>, dealing with similar problems, but using a relatively new so-called item response theory and Rasch's model, which are already used in kinesiometric research in the United States for some time now.

<sup>\*</sup> Conclusion was taken conditionally because third test, which is necessary for defining any motor ability, was missing in this particular case. \*\* Ibidem.

#### REFERENCES

1. BALA G, AMBROŽIČ F, Internal metric characteristics of motor tests in physical education students. Acta Universitatis Carolinae – Kinanthropologica, 39(1) (2003) 5. – 2. JAKŠIĆ D, CVETKOVIĆ M, Reliability of tests for assessing explosive strength in physical education students: how reliable are they and how can the proper one be chosen? Kinesiologia Slovenica, 15(1) (2009) 49. - 3. FAJGELJ S, Psychometrics. (Centre for Applied Psychology, Belgrade, 2005). - 4. BRAUMGART-NER TA, Reliability and error of measurement. In T. Wood & W. Zhu (Eds) Measurement Theory and Practice in Kinesiology (Human Kinetics. Champaign, 2006). - 5. HAASE V, Reliability generalization: exploring variance in measurement error affecting score. Educational and Psychological Measurement, 58 (1998) 6. - 6. METIKOŠ D, PROT F, HOFMAN E, PINTAR Ž, OREB G, Measurement of Basic Motor Dimensions of Sportsmen (Faculty of Physical Education, Zagreb, 1989). - 7. MOMIROVIĆ K, RTT11G: Program for analyzing metric characteristics of composite measurement instruments consisting of a small number of replications of a same task. Technical Note (Institute for Criminological and Sociological Researches, Belgrade, 2001). - 8. MOMIROVIĆ K, WOLF B, POPOVIC DA, Introduction to measurement theory I. Internal metric properties of composite measuring instruments (University of Pri-

ština, Priština, 1999). - 9. GUTTMAN L, Image theory for the structure of quantitative variates. Psychometrica, 18 (1953) 123. – 10. METIKOŠ D, PROT F, HORVAT V, KULEŠ B, HOFMAN E, Basic motor skills of respondents of above-average motoric status. Kinesiology, 14(5) (1982) 21. - 11. CVET-KOVIĆ M, JAKŠIĆ D, ORLIĆ D, Relations between anthropometric characteristics and flexibility in persons with above-average motor abilities. In M. Mikalački (Ed) Proceedings Book of 1<sup>st</sup> International Scientific Conference "Exercise and Quality of Life" (Faculty of Sport and Physical Education, Novi Sad, 2009). - 12. ZHU W, Constructing Test using Item Response Theory. In T. Wood & W. Zhu (Eds) Measurement theory and practice in kinesiology (Human Kinetics, Champaign, 2006a). -13. ZHU W, Scaling, equating, and linking to make measures interpretable. In T. Wood & W. Zhu (Eds) Measurement theory and practice in kinesiology (Human Kinetics, Champaign, 2006b). - 14. ZHU W, COLE LE, Many faceted Rasch calibration of a gross motor instrument. Research Quarterly for Exercise and Sport, 67(1) (1996) 24. - 15. ZHU W, TIMM G, AINSWORTH B, Rasch calibration and optimal categorization of an instrument measuring women's exercise perseverance and barriers. Research Quarterly for Exercise and Sport, 72(2) (2001) 104. –

#### D. Jakšić

University of Novi Sad, Faculty of Sport and Physical Education, Novi Sad, Serbia e-mail: jaksicd@uns.ac.rs

#### METRIJSKE KARAKTERISTIKE BATERIJE ZA MJERENJE MOTORIČKIH SPOSOBNOSTI

#### SAŽETAK

Ova studija ima za cilj da prikaže rezultate istraživanja koje je sprovedeno na uzorku 161 studenta muškog pola sa Fakulteta sporta i fizičkog vaspitanja na Univerzitetu u Novom Sadu. Sistem od 11 kompozitnih mjernih instrumenata je primenjen, a svaki od testova je imao tri ponavljanja. Analiza metrijskih karakteristika izvršena je na dva načina: u realnom i u Guttman-ovom prostoru. Na posletku je zaključeno da je baterija za mjerenje motoričkih sposobnosti apsolutno primjerena za upotrebu na ovom uzorku ispitanika, dok bi savjet za buduća istraživanja trebalo da skrenu pažnju da bi bilo veoma korisno da se ishodi ove studije provjere sa nekom od naprednijih statističkih procedura.

Ključne riječi: kompozitne mjere, mjerni instrumenti, metrijske karakteristike, 20-godišnji studenti.

## **Evaluation of Behaviour to Pain Measures** in Athletes - A Correlative Analysis

Praveen Kumar, Jaspal Singh Sandhu and Shweta Shenoy

Guru Nanak Dev University, Department of Sports Medicine & Physiotherapy, Amritsar, India

#### ABSTRACT

Research suggests that pain affects behaviour of the athletes, assessment of behaviour when in pain reveals that pain has influenced athletes' measurable response when they get injured in their course of play. The objectives of the study were to find and analyse correlation of pain behaviour measures in contact and non-contact sports. The study has been conducted using Vienna Testing System (VTS) Questionnaire for Evaluating Pain Behaviour- FSV on four hundred and eighty one (n=481) subjects that included both male and female athletes who had a history of injury in the past but not suffering from any acute injuries. Statistical analysis revealed a significant correlation between variables in both covariate and partial correlation analysis. We conclude that higher avoidance score predicts a lower activity score regardless of cognitive control and social support in FSV scale.

Key words: behaviour, social support, activity, avoidance, cognitive control, athletes.

#### Introduction

Pain is defined as 'an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage<sup>1</sup>. Pain is a personal and subjective experience, the fact that someone is experiencing pain is often apparent to others. People who have pain may vocalize their distress by moaning, crying or complaining, or may exhibit pain-related body postures or facial expressions. These verbal and nonverbal behaviours have been called pain behaviours because they serve to communicate the fact that pain is being experienced <sup>2</sup>. When an athlete experiences pain due to injury or ill health, it could change his or her behaviour in different aspects. Behaviour is broadly defined to include cognitions, psycho-physiological reactions, and feelings, which may not be directly observable but are defined in terms that can be measured by means of various assessment strategies<sup>3</sup>. The study compared a group of runners with a group of non-athletes and indicated that athletes were more withdrawn, thoughtful and presented lower anger levels than non athletes<sup>4</sup>.

Questionnaire for Evaluating Pain Behavior –FSV is a standard questionnaire found in literature to evaluate the behaviour of pain is based on the theory of effective learning processes in pain and the concept of cognitive pain control developed in laboratory studies can be used for assessing the behaviour to pain in athletes<sup>5</sup>. FSV is a multi-dimensional Questionnaire for Evaluating Pain Behaviour which was developed from an item collection with the rational scales avoidance/ pain expression, diversion and social reinforcement.

This study consists of variables of FSV -avoidance, cognitive control, activity & social support to find out the behaviour to pain between contact and non-contact athletes. Avoidance, cognitive control & activity are based on the theory of effective learning processes in pain, which holds that the experience of pain is intensified by negative reinforcement (putting an end to an averse condition by withdrawing) and is eased by positive reinforcement (turning to important persons

Received for publication February 20, 2013

who share a close relationship with the patient) and eventually can be reduced by confrontation<sup>6,7</sup>. Cognitive control refers to relaxation skills, ability to use the imagination and self-instruction as determined by experiments<sup>8</sup>.

The conceptual formulation, first advanced by Fordyce observes that consequences that immediately follow pain behaviors may exert a powerful influence on the probability of future occurrence of those pain behaviors<sup>7, 9, 10</sup>. As a consequence, pain behaviors originating because of body damage may, in the course of events, come to be controlled by consequences or conditioning effects operating in the patient's social environment.

It has been argued that the willingness of athletes to risk pain and injuries is affected by structural features of their sports networks (called "sportsnets"), by relations with individual sportsnet members, and by "the culture of risk" that is deeply embedded in serious athletic subcultures<sup>11</sup>. So it is necessary to conduct the study to examine the pain behaviours.

#### Avoidance

Avoidance is the behaviour when athletes feeling generally helpless as regards to their pain and withdraw from contact with others and social obligations. This can be described as "Reduction of contact with others due to pain<sup>38</sup>. Learning processes play a role in avoidance behaviour as a reaction to be perceived and expected pain (negative reinforcement). Exiting a situation is associated with a feeling of relief. This feeling of relief is stronger, the more a certain pain intensity criterion is made a prerequisite for withdrawal<sup>12</sup>. Avoidance behaviour is a prominent and extensive component of chronic pain behaviour. Its unadaptive consequences are delineated and the puzzling issue of its persistence is raised. An explanation is put forward emphasizing the functional relationship between cognitions and avoidance behaviour<sup>3</sup>. This study also proposed avoidance behaviour along with cognitive control, social support and activity.

#### Cognitive Control

Cognitive control is a term used to describe a subset of goal-directed, self regulatory operations involved in the selection, scheduling, and coordination of computational processes underlying perception, memory, and action. Core cognitive processes collectively termed 'cognitive control' or 'executive control' includes inhibition, working memory, and cognitive flexibility<sup>3</sup>. Coping refers to conscious cognitive and behavioral efforts to manage a situation that has been appraised as stressful<sup>15-16</sup>. In this study we considered coping skills (cognitive control) of athletes included positive self-communication, relaxation etc., and mental toughness represents the ability of a person to cope with the demands of training and competition, increased determination, focus, confidence, and maintaining control under pressure<sup>17</sup>.

#### Social Support

Social support is defined as "an exchange of resources between at least two individuals perceived by the provider or the recipient to be intended to enhance the well-being of the recipient" and "information from others that one is loved and cared for, esteemed and valued, and part of a network of communication and mutual obligations<sup>18</sup>. When athletes are injured they get support from either of the partner or team mates which would provide instrumental help or communicative support<sup>19</sup>. The study revealed that male athletes, whereas female athletes had greater satisfaction with the support they received<sup>20</sup>. Athletes' social support patterns changed after they became injured. In this subtest, the statements address the perceived support and attention the patient receives from his/her partner<sup>8</sup>.

#### Activity

This statement contained in this subtest (activity) attempt to understand pain as a challenge for coping behaviour and taking action. Activity is described as maintaining physical and social activities, as well as illness-related social skills<sup>8</sup>. However, when the patients maintain their usual activities, it is possible to verify the hypotheses in pain expectation, which can lead to a pain reduction experience in situations where pain increase is expected. As regards effectiveness, activity can be equated with confrontation in the context of fear treatment<sup>21</sup>.

Contact and non-contact specific classification may help to find athletes behaviour to pain which would adopt a strategy during rehabilitation to enhance the sports performance.

Aims of this study were: [1] to examine behaviour to pain responses of avoidance, cognitive control, social support & activity; [2] to find the difference in pain behaviour among contact and non-contact athletes, and [3] to find which variable is controlling pain behaviour among athletes.

#### **Materials and Metods**

This study proposal was approved by the Research Ethical Committee of Guru Nanak Dev University, Amritsar, India. Descriptive study design included 481 subjects (n=481) both male and female of contact (241 players) and non-contact (240 players) sports players. Subjects included in this study were aged between 17-45 years who played at college/ university/ state/ international level, who had a history of injury in the past and no history of any injury in past three months and had no psychological disorders. This study was conducted in Guru Nanak Dev University, Amritsar, India.

Questionnaire for Evaluating Pain Behaviour – FSV was used to evaluate the athletes' behaviour that consisted components of avoidance, cognitive control, social support and activity. All the sub-scales of FSV questionnaire has reliability with Cronbach's alpha co-effcient value of  $0.68 \le \alpha < 0.84^{22-27}$ . Each question is to be marked on a five point scale ranging from "does not apply" to "applies to a great extent". Prior consent was taken and instructions were given to athletes about the questionnaire to select the most appropriate answer against the questions regarding their behaviour when in pain experience and were given 5 minutes time to complete the questionnaire.

The athlete's responses were entered in to the VTS and the scores for the four variables were obtained and the total corrected raw score is calculated for avoidance, cognitive control, social support and activity.

All variables were statistically analysed using SPSS 16.0 version. The correlation among the included variables was calculated by Pearson's co-efficient correlation and partial correlation with control variables to find the influence of any variables on others.

#### Results

The statistical analysis revealed that significant correlation existed between avoidance and cognitive control (r=0.109, p<0.05), avoidance and social support (r=0.420, p<0.01), cognitive control and social support (r=0.211, p<0.01), cognitive control and activity (r=0.297, p<0.01), social support and activity (r=0.247, p<0.01) but avoidance and activity did not show significant correlation.

Variables	Avoidance	Cognitive Control	Social Support	Activity
Avoidance	1.000			
Cognitive Control	0.109*	1.000		
Social Support	0.420**	0.211**	1.000	
Activity	0.063	0.297**	0.274**	1.000

 TABLE 1

 CORRELATION OF PAIN TO BEHAVIOUR MEASURES IN ALL ATHLETES

\*. Correlation is significant at the 0.05 level (2-tailed); \*\*. Correlation is significant at the 0.01 level (2-tailed).

Also we have grouped athletes into two groups as contact sports athletes and non-contact sports athletes<sup>28</sup>. Contact sports athletes have statistically significant correlation between avoidance and social support (r=0.411, p<0.01), cognitive control and social support (r=0.202, p<0.01), cognitive control and

activity (r=0.245, p<0.01), social support and activity (r=0.230, p<0.01) whereas between avoidance and cognitive control, avoidance and activity have not showed any significant correlation.

Variables	Avoidance	Cognitive Control	Social Support	Activity
Avoidance	1.000			
Cognitive Control	0.024	1.000		
Social Support	0.411**	0.202**	1.000	
Activity	0.008	0.245**	0.230**	1.000

 TABLE 2

 CORRELATION OF BEHAVIOUR TO PAIN MEASURES IN CONTACT SPORTS ATHLETES

Non-contact sports athletes have statistically significant correlation between avoidance and cognitive control (r=0.254, p<0.01), avoidance and social support (r=0.446, p<0.01), avoidance and activity (r=155, p<0.01), cognitive control and

social support (r=0.229, p<0.01), cognitive control and activity (r=0.321, p<0.01), social support and activity (r=0.331, p<0.01).

TABLE 3
CORRELATION OF BEHAVIOUR TO PAIN MEASURES IN NON-CONTACT SPORTS ATHLETES

Variables	Avoidance	Cognitive Control	Social Support	Activity
Avoidance	1.000			
Cognitive Control	0.254**	1.000		
Social Support	0.446**	0.229**	1.000	
Activity	0.155**	0.321**	0.331**	1.000

As total correlation did not show statistically significant correlation between avoidance and activity (r=0.063, p>0.05), so these two variables kept each variable as control to find any influence to produce correlation among other variables. The bivariate correlation showed significant correlation between

variables but when avoidance is kept as control variable, resulted in reduced 'r' value between cognitive control and social support, cognitive control and activity, social support and activity. So the reduced 'r' values suggest that these variables are mediated by avoidance score.

TABLE 4	
PARTIAL CORRELATION RESULTS WITH CONTROL OF AVOIDANCE VAR	RIABLE

Variables	Cognitive Control	Social Support	Activity
Cognitive Control	1.000		
Social Support	0.183	1.000	
Activity	0.292	0.273	1.000

The variable cognitive control was kept control variable resulted in reduced 'r' value between social support and avoidance, activity and avoidance, social support and activity. Thus reduced 'r' values indicating that these variables are mediated by cognitive control score.

TABLE 5	
PARTIAL CORRELATION RESULTS WITH CONTROL	OF COGNITIVE CONTROL VARIABLE

Variables	Avoidance	Social Support	Activity
Avoidance	1.000		
Social Support	0.409	1.000	
Activity	0.033	0.227	1.000

When social support was kept as control variable resulted in reduced 'r' value between avoidance and cognitive control, cognitive control and activity. But avoidance and activity showed reduced 'r' value with negative correlation which indicates that social support less score would increase the avoidance and activity scores.

 TABLE 6

 PARTIAL CORRELATION RESULTS WITH CONTROL OF SOCIAL SUPPORT VARIABLE

Variables	Avoidance	Cognitive Control	Activity
Avoidance	1.000		
Cognitive Control	0.023	1.000	
Activity	-0.060	0.254	1.000

Also when activity variable was kept as control variable to partial out other variables it produced some difference between variables unlike other control variables. The results showed avoidance and control, cognitive control and social support reduced 'r' value. But avoidance and social support with same 'r' value (r=0.420) which indicates that activity did not mediate to produce any changes between avoidance and social support.

 TABLE 7

 PARTIAL CORRELATION RESULTS WITH CONTROL OF ACTIVITY VARIABLE

Variables	Avoidance	Cognitive Control	Social Support
Avoidance	1.000		
Cognitive Control	0.094	1.000	
Social Support	0.420	0.141	1.000

Instead of controlling one variable two variables have been used as controls where avoidance and activity did not show any significant correlation. The statistical results showed that reduced 'r' value indicates that these two are mediating other variables.

# TABLE 8 PARTIAL CORRELATION RESULTS WITH CONTROL OF AVOIDANCE & ACTIVITY VARIABLES

Variables	Cognitive Control	Social Support
Cognitive Control	1.000	
Social Support	0.112	1.000

Meanwhile controlling cognitive control & social support produced negative correlation have showed negative correlation

(r=-0.068) between avoidance and activity.

# TABLE 9 PARTIAL CORRELATION RESULTS WITH CONTROL OF COGNITIVE CONTROL & SOCIAL SUPPORT VARIABLES

Variables	Avoidance	Activity
Avoidance	1.000	
Activity	-0.068	1.000

#### Discusion

Overall findings showed that all variables are having correlation among each other in covariate analysis except between avoidance and activity however partial correlation revealed that some valuable predictive factors. When each of the variables have been kept as control to partial out other variables it was found that control variables were all mediated to influence each other. But cognitive control and social support of athletes in partialling out avoidance and activity resulted in negative correlation between them which indicates avoidance high score would reduce the activity score because avoidance is principal mediator.

The study has found that no significant difference in total pain behaviours between those high versus low in terms of level of availability of support. Individuals who are satisfied with the quality of their social support may be satisfied because they receive positive reinforcement from the social environment when they engage in pain behaviour. With previous evidence, our subjects having previous history of injury showed significant relation between pain behaviour measures with social support<sup>29</sup>.

Social influences can play a role in patient's engagement in activity with pain present and their willingness to have pain without trying to avoid or control  $it^{30}$ . Though present study showed social support is having influence significantly on avoidance and activity of athletes which expressed avoidance mediating regardless of social support.

Study on coping skill revealed results and indicate that social support and psychological coping skills are statistically independent psychosocial resources and that they operate in a conjunctive manner to influence the relation between life stress and subsequent athletic injury in adolescents. Only athletes low in both coping skills and social support exhibited a significant stress–injury relation, and in that vulnerable subgroup, negative major life events accounted for up to 30% of the injury variance. The results from present study revealed that coping skills (cognitive control) and social support are statistically significant correlation strongly which suggests that we can predict the value either of these variable<sup>31</sup>.

Individuals who are satisfied with the quality of their social support may be satisfied because they receive positive reinforcement from the social environment when they engage in pain behavior.

Reports from the general medical literature support the efficacy of cognitive behavioural intervention to reduce medical visits<sup>32</sup>. Likewise this study results would be useful to evaluate behaviour changes due to pain in injured athletes. In contrast, to find difference in gender we have done analysis between contact sports and non-contact sports athletes.

It is possible that interventions favorably altering cognitive–affective stress responses, behavior, and physiological processes underpinning adaptation to exercise training may impart a health benefit<sup>33</sup>. So we can use the results of all variables to intervene with some behavioural therapy top enhance the sports performance.

The pain behaviors may in some instances persist solely because of avoidance learning. On the basis of experiences prior to onset or during the early history of a pain problem, a patient may come to engage in protective behaviors and emit visible or audible indications of distress based on the anticipation of distress rather than distress<sup>34</sup>. Similarly, the findings of this study show that avoidance behaviour solely influencing activity pain behaviour. The statistical results found that regardless of cognitive control and social support, avoidance behaviour influencing physical and social activities (activity pain behavior).

Having measures that span a wide age range is important

given the protracted developmental progressions of many executive function and cognitive control skills<sup>35</sup>. Likewise we were able to examine measures as included subjects aged between 17-45 years. Further studies should consider the age group and gender for specific sports would reveal more information and predictive factors.

#### Conclusion

Chronic pain on social support and indicate that perceived social support and pain coping are independent predictors of chronic pain adjustment, providing support for a biopsychosocial model of pain. So, further study would consider the subjects with acute and chronic pain to derive a behavioral pain model<sup>36</sup>.

#### REFERENCES

1. MERSKEY H, BOGDUK N. Pain Terms, a current list with definitions and notes on usage. In: Classification of Chronic Pain (IASP Task Force on Taxonomy, IASP Press, Seattle, 1994). - 2. FORDYCE WE. Behavioural methods for chronic pain and illness. (MO: Mosby, 1976). - 3. KAZDIN AE. Treatment for oppositional, aggressive and antisocial behaviour in children and adolescent. (Oxford University Press, 2005). - 4. MARESH CM, SHECKLEY BG, ALLEN GJ, CA-MAIONE DN, SINATRA ST. Middle age male distances runners: physiological and psychological profiles. Journal of Sports Medicine & Physical Fitness, 31 (1991) 461. - 5. EYSE-NCK, HJ, NIAS DK, COX DN. Sport and personality. Advances in Behaviour Research and Therapy, 4 (1982) 1. - 6. FER-NANDEZ E. A classification system of cognitive coping with pain. Pain, 26 (1986) 141. - 7. FORDYCE WE. Behavioral methods for chronic pain an illness. (Mosby, 1976). - 8. KLAGES U, ANTONIUS K. Manual- Questionnaire on reaction to pain. (Test Label FSV 2011). - 9. FORDYCE WE, FOWLER RS, LEHMANN JF, DE LATEUR BJ. Some implications of learning in problems of chronic pain. Journal of Chronic Disease, 21 (1968) 179. - 10. FORDYCE WE, FOWLER RS, LEH-MANN JF, DE LATEUR BJ, SAND PL, TRIESCHMANN R. Operant conditioning in the treatment of chronic pain. Archives of Physical Medicine and Rehabilitation, 54 (1973) 399. - 11. NIXON II HL. A social network analysis of influences on athletes to play with pain and injuries. Journal of Sport & Social Issues, 16 (1992): 127. - 12. HAYTHORNTWAITE JA, SIEBER W, KERNS R. Depression and the chronic pain experience. Pain, 46 (1991) 177. - 13. PHILIPS HC. Avoidance behaviour and its sustaining chronic pain. Behaviour Research and Therapy, 25 (1987) 273. - 14. DIAMOND A. The early development of executive functions. In: Lifespan cognition- Mechanisms of change. (New York: Oxford University Press, 2006). - 15. LAZARUS RS. Stress and emotion: A new synthesis. (NY: Springer, 1999). - 16. LAZARUS RS, FOLKMAN S. Stress, appraisal and coping. (NY: Springer, 1984). - 17. JO-NES G, HANTON S, CONNAUGHTON D. What is this thing called mental toughness? An investigation of elite performers. Journal of Applied Sport Psychology, 14 (2002) 205. - 18. SHUMAKER SA, BROWNELL A. Toward a theory of social support: closing conceptual gaps. Journal of Social Issues, 40 (1984) 11. - 19. COBB S. Social support as a moderator of life stress. Psychosomatic Medicine, 38 (1976) 300. - 20. YANG J, PEEK-ASA C, LOWE JB, FOSTER E, FOSTER DT. Social support patterns of collegiate athletes before and after injury. The limitations of the study were that we did not consider acute injuries, specific sports and also subjects included in this study played at various levels. Avoidance behaviour influencing other pain behaviours in the FSV scale in non-contact sports players than in contact sports players (Table 2 & 3 as 'r' values are higher in non-contact than in contact players). Further studies have to find the rational for the mediating power of avoidance regardless of contact or non-contact sports.

Previous study has suggested that given the compelling evidence reached to date, however, fear-avoidance needs to be considered in clinical practice and given priority in research. This study results revealed that each measure of FSV scores are considered significant mediator to find the pain behaviour in athletes<sup>37</sup>. We conclude that avoidance behaviour highly influencing other pain behaviour scores to evaluate behaviour to pain in FSV scale.

Journal of Athletic Training, 45 (2010) 372. - 21. LETHEM J, SLADE PD, TROUP JDG, BENTLEY G. Outline of a fearavoidance model of exaggerated pain perception. Journal of Behavior Research and Therapy, 21 (1983) 401. - 22. CZISKE R. Faktoren des Schmerzerlebens und ihre Messung: Revidierte Mehrdimensionale Schmerzskala. Diagnostics, 28 (1983) 61. – 23. ERDMANN G, JANKE W. Der situative Reaktionsfragebogen. Ärztliche Praxis, 30 (1978) 1240. - 24. KLAGES U. Statistische Untersuchung zur Entwicklung eines multifaktoriellen Schmerzfragebogen. Schmerz Pain Douleur, 10 (1989) 134. -25. KLAGES U. Fragebogen zum Schmerzverhalten (FSV). Diagnostica, 35 (1989) 351. - 26. KLAGES U. Life change, irritational attitudes and disease impacts in patients with ankylosing spondylitis. International Journal of Psychomotorics, 40 (1993) 77. – 27. TÖNNIES S. Inventar zur Selbstkommunikation für Erwachsene. Weinheim: Beltz (1982). - 28. RICE SG. Medical Conditions Affecting Sports Participation. Pediatrics, 121 (2008) 841. - 29. GIL KM, KEEFE FJ, CRISSON JE, VAN DALFSEN PJ. Social support and pain behaviour. Pain, 29 (1987) 209. - 30. MCCRACKEN LM. Social context and acceptance of chronic pain: the role of solicitous and punishing responses. Pain, 113 (2005) 155. - 31. SMITH RE, SMOLL FL, PTACEK JT. Conjunctive moderator variables in vulnerability and resiliency research: Life stress, social support and coping skills, and adolescent sport injuries. Journal of Personality and Social Psychology, 58 (1990) 360. - 32. FRIEDMAN R, SO-BEL D, MYERS P, CAUDILL M, BENSON H. Behavioral medicine, clinical health psychology, and cost offset. Health Psychology, 14 (1995) 509. - 33. PERNA FM, ANTONI MH, KUMAR M, CRUESS DH, SCHNEIDERMAN N. Cognitivebehavioral intervention effects on mood and cortisol during athletic training. Annals of Behavioral Medicine, 20 (1998) 92. -34. FORDYCE WE, SHELTON JL, DUNDORE DE. The modification of avoidance behaviour learning pain behaviors. Journal of Behavioral Medicine, 5 (1981) 405. - 35. DAVIDSON MC, AMSO DIMA, ANDERSON LC, DIAMNOND A. Development of cognitive control and executive functions from 4 to 13 years: Evidence from manipulations of memory, inhibition, and task switching. Neuropsychologia, 44 (2006) 2037. - 36. MARTINEZ AEL, ZARAZAGA RE, MAESTRE CR. Pain coping and social support as predictors of long-term functional disability and pain in early rheumatoid arthritis. Journal of Pain, 41 (2008) 1295. - 37. VLAEYEN JWS, LINTON JS. Fearavoidance and its consequences in chronic musculoskeletal pain: a state of the art. Pain, 85 (2000), 317. -

#### J. Praveen Kumar

Guru Nanak Dev University, Department of Sports Medicine & Physiotherapy, Amritsar, India e-mail: jpk200513@gmail.com

#### PROCJENA PONAŠANJA KOD SPORTISTA PRILIKOM OSJEĆAJA MJERLJIVIH BOLOVA - KORELACIONA ANALIZA

#### S A Ž E T A K

Prethodna istraživanja ukazuju na to da bol utiče na ponašanje sportista, a procjena ponašanja je otkrivana dok je bol uticao na mjerljivi odgovor sportiste kada se povreda desila u toku igre. Glavni cilj ovog istraživanja je bio da se prepozna i analizira korelacija mjerljivih parametra koji određuju ponašanje sportista prilikom osjećaja bola u sportovima kod kojih dolazi do fizičkog kontakta i onih bez kontakata. Studija je sprovedena pomoću "Vienna Testing System (VTS) Questionnaire for Evaluating Pain Behaviourm – FSV", dok je uzorak ispitanika sačinjavalo četiri stotine i osamdeset jedan sportista (n = 481) muškog i ženskog pola. Ispitanici su imali određenu istoriju povreda u prošlosti, ali u trenutku ispitivanja nisu patili od akutnih pojava određenih povreda. Statistička analiza je pokazala značajnu korelaciju između promjenljivih u obije kovarijate i parcijalne korelacione analize. Stoga je zaključeno da viši skor izbjegavanja povreda predviđa niži skor aktivnosti, bez obzira na kognitivnu kontrolu i socijalnu podršku u FSV skali.

Ključne riječi: bolno ponašanje, socijalna podrška, aktivnost, izbjegavanje, kognitivna kontrola, sportisti.

# Osgood Schlatter's disease - A burst in young football players

#### **Marcio Domingues**

University of Coimbra, Faculty of Sport Sciences, Department of Youth Studies, Coimbra, Portugal

#### ABSTRACT

Football is the most popular sport in the world. Like any contact sport it is susceptible to various kinds of injuries. It is referred the link between methodology of training and the prevention of overuse injuries in youth as it relates to maladaptive sport programs. There is an increasing awareness to growth related conditions and the relation of musculoskeletal development and the onset of youth related conditions. This article examines one specific injury sustained by children and adolescents who play football, Osgood Schlatter disease, and the main mechanisms whereby such injury occur. The aethology is complex and the risk factors underpinning injury occurrence are considered, along with injury avoidance tactics.

Key words: Injuries, Youth Sport, Football, Osgood Schlatter Syndrome.

#### Introduction

Data from several countries indicate generally similar trends in youth sport participation<sup>1,2</sup>. Over the past decades youth sport programs in Portugal have been modified accordingly to changes in societal movements, alongside to political and demographic changes. Two general ideas emerge, one is that elite programs and consequently sport participation must assure their proficiency leading youth athletes to their real potential; a second wave is that competitive sports are decreasing in youth participation when compared to new organizations, more attractive leisure activities<sup>3</sup>.

Training and competition are the two main subsystems of sport and by definition they are related. Therefore, it is imperative to address quality in youth sport programs through the development of the competitive system <sup>4-7</sup>.

In effect, it must be considered growth and maturation with an overview and implications for teaching and coaching <sup>8,9,10</sup>. When we consider training as a systematic, specialized practice for a specific sport along the year with rigorous schedule and short term or continuous program, we acknowledge the fact that regular training produces changes in height of young athletes <sup>11,</sup> <sup>8, 12, 9</sup> as in specific tissues<sup>10</sup> affecting overall performance and the responsiveness of the individual to a specific training regimen <sup>10,13.</sup>

Football is a well-studied sport and, therefore, there is a need to try to reassess the impact of biological maturity status upon the socialization process in youth football<sup>14</sup>. Observations of the physiological demands of competitive young football should always be viewed in close consideration on the process of growing; also, priorities should be placed on skills acquisition, technical aspects and enjoyment of play<sup>15, 16</sup>.

This approach should also be focused on injury prevention, acute and specially overuse injuries often associated with repetitive micro trauma, excessive repetitions of a specific sport activity<sup>17</sup> that recently have been associated with psychological factors, that is, potential stressors that youth sport presents<sup>18</sup>. This article focus on the comprehension of micro traumatology in youth sports in its relation to maturation and biological

references and consequently describes Osgood Schlatter Disease in sporting context.

#### Injury and the young football athlete: Epidemiological findings

There is a strong need to evaluate the circumstances of injuries over time in youth sport, so possible preventive mechanisms can be in equation. Although youth sports participation is beneficial on many levels, it is also associated with an increased risk of injury. Risk factors for injury in children and adolescents include the presence of growth cartilage, existence of muscle imbalance, and pressure to compete despite pain and fatigue<sup>19, 20, 21</sup>.

One disease particularly important in young athletes' life is Osgood Schlatter. It is characterized by painful lumps just below the knee and is most often seen in young adolescents, risk factors, often associate include excess weight and overzealous conditioning (running and jumping). While Osgood Schlatter disease is more common in boys, the gender gap is narrowing as more girls become involved with sports. Osgood Schlatter disease affects as many as 1 in 5 adolescent athletes.

Researchers in a retrospective study, dealing with intensity and duration found that during the period of 1976 to 1981, a total of 412 young athletes contacted the Turku Sports Medical Research Unit's (TSMRU) Outpatient Sports Clinic with 586 complaints<sup>22</sup>. These records included 68 athletes with Osgood Schlatter's disease in evaluating the cessation of training in which ages and for how long. Furthermore, the descriptive epidemiology reviews like the 16 years of National Collegiate Athletic Association (NCAA) injury surveillance data for men's basketball identified potential areas for injury prevention initiatives<sup>23</sup> or the ISS data provide information on the general risk and specific types of injuries associated with women's college basketball players over a 16-year period<sup>24</sup> reveal great insight in long term management of youth sport in injury prevention programs. Another study, a prospective cohort study aimed to assess the overall incidence of acute and overuse basketball injuries and identified risk factors associated with ankle sprains and knee overuse injuries<sup>25</sup>.

Long-term planning is a characteristic and requirement of modern training as it can greatly increase training efficiency for future competitions<sup>26</sup>. The more difficult the task the bigger the need for repetition, aiming for qualitative improvement of execution. Modern training programs focus on exhaustive repetition of stereotyped gestures<sup>27</sup>. On the other side, congenital or acquired organic modifications have fundamental importance in the predisposition to some sport injuries<sup>28</sup>. Variations in definitions and methodologies have created differences in the results and conclusions obtained from studies of European football injuries, this fact made comparisons difficult<sup>29</sup>.

It is a fact that while more and more children participate in sports and recreational activities, there has been an increase in acute and overuse injuries; there is an inherent risk of injury<sup>30</sup>. One of the most common sites is at the knee<sup>2,31,32</sup>. In this regard adults differ from children in many aspects. The latter have a larger surface area to mass ratio, children have larger heads proportionately, children may be too small for protective equipment, growing cartilage may be more vulnerable to stresses and children may not have the complex motor skills needed for certain sports until after puberty<sup>2</sup>.

A descriptive epidemiology study in high school sports injury data for the 2005 through 2008 academic years were collected and showed recurrent injury rates and patterns differed by sport<sup>33</sup>. Despite the fact that football is a contact sport, it is perceived to be relatively safe to play<sup>34</sup>. Injuries rates in youth football are higher than in many other contact/collision sports and have greater relative numbers in younger, preadolescent players<sup>35</sup>.

The injury rate in football is high, and studies have shown that the injury rate among players aged 16 years or older approaches that of adult players<sup>36</sup>. However, little is known about the injury risk among the youngest players, that is, players between 6 and 12 years. Other research reports that injury risk among young players of the same age playing organized 5- or 7-a-side football is low, lower than that of adolescents and much lower than at the elite level<sup>36</sup>.

Acute and minor injuries predominate in the statistics, with contusions and abrasions being the most commonly recorded<sup>34</sup>. As one would expect, the majority of football injuries are to the lower limbs, with serious trunk and spinal trauma being rare. With regard to musculoskeletal injuries, young females tend to suffer more knee injuries, and young males suffer more ankle injuries. Concussions are fairly prevalent in football as a result of contact/collision rather than purposeful attempts at heading the ball<sup>35</sup>.

The condition where training takes place is considered a major concern for the prevention of such injuries; investigate the incidence of acute injuries and football-related chronic pain from long-term training. Some studies concerning this issue point out that artificial and natural grass turfs<sup>37</sup>, equipment <sup>28</sup>, atmosphere conditions<sup>38</sup> and of course training program interfere with the exposure of young athletes to the risk of injury.

Because recurrent injuries can have severe consequences on an athlete's health and future sports participation, injury prevention must be a priority. Appropriate rule enforcement and emphasis on safe play can reduce the risk of football-related injuries<sup>39, 33, 35</sup>.

#### Specific lesions in adolescence: Osgood Schlatter case

Overuse injuries are not uncommon in children and adolescent<sup>40</sup> as it is one of most common causes of knee pain in young patients  $^{41,42}$ . In fact, teenage girls and young women are

more likely to have patellar tracking problems<sup>43</sup>. This disease has its common apophyseal injuries in tibial tuberosity site<sup>26,44</sup>, <sup>45</sup> a painful ossicle in the distal patellar tendon<sup>46</sup>.

Micro traumatic lesions are more difficult to assess and general clinics have less experience in dealing with them, both diagnosis and therapy<sup>38</sup>. There is some clinical and biomechanical evidence that growth cartilage in youth and especially articular cartilage are less resistant to micro traumatism of repetition when compared to the adult <sup>1</sup>. In fact, the rising of competition demands carries out a process of debilities in tissue structures due to the bigger magnitude of aggressive mechanisms<sup>47</sup>.

There is an increasing awareness to growth related conditions and the relation of musculoskeletal development and the onset of youth related conditions, therefore this disease vary upon sport participation<sup>48</sup>. Researchers tried to determine skeletal age in children with Osgood Schlatter disease by using radiographs of the knee<sup>48</sup>. They studied 26 children (12 girls, 14 boys). All but one of the skeletal ages fell within the normal range. With normal skeletal maturation and normal physes histologically (previously shown), it is unlikely that an abnormality of physeal development or structure is the etiology of Osgood Schlatter disease. Rather, it is most likely a result of tensile stresses on the tibial tuberosity. This is in contrast to slipped capital femoral epiphysis, another common disorder affecting children of the same ages as those with Osgood Schlatter disease, in which physeal abnormalities and skeletal maturation anomalies do occur.

Another study found that in male skaters accounted for more than 50% of injuries were due to overuse diseases in elite junior figure skaters<sup>49</sup>. Other investigation made an audit of the severity and nature of injuries in academy youth football<sup>50</sup>. As another investigation point out, this disease is one of the possible etiologic diagnosis which may cause knee pain in adolescent athletes during growth (boys, 12-15 years; girls, 8-12 years), especially when practicing sports activities such as basketball, football, volleyball or running<sup>51</sup>. US yields complete information on the involvement of the tibial tuberosity and of the surrounding soft tissues with the findings of tenderness and focal swelling of the tibial tuberosity, typical of this condition as it can damage bone, cartilage, tendon and serous bursa<sup>26</sup>.

Meanwhile, a retrospective study reviewed all the pediatric patients diagnosed with overuses injuries during a 5 years and 7 months period including Osgood Schlatter disease (*apophysitis tibialis adolescentium*). A total of 506 cases of the overuse injuries were seen during the study period. Seventy-three per cent were male patients. The knee joint was the commonest affected joint while the hip was the least affected joint<sup>40</sup>.

The aethology is complex, one study tries to determine if Osgood Schlatter lesion is produced by avulsion fracture or injury to the patellar tendon<sup>52</sup>. This condition affects human adolescents in which there is partial separation of bone fragments from the tibial tuberosity at the site of insertion of the patellar ligament to the tibial tuberosity.

Following this reasoning another study aimed at evaluating a possible relationship between limited dorsiflexion of the ankle and the occurrence of Morbus Osgood Schlatter in sports-active children brought biomechanical aspects into consideration<sup>53</sup>. In fact, quadriceps femoris muscle contracts eccentrically during the stance phase of running till the beginning of propulsion when the knee reaches the highest level of flexion. Limited dorsiflexion in the ankle joint is associated with a compensatory increased knee flexion, tibial inversion, and foot pronation during the stance phase of running. Theoretically, these compensatory mechanisms might cause increased stress on the quadriceps femoris muscle attachment to the tuberositas tibia.

Another study evaluating thirty-five patients, twenty of them had Osgood Schlatter disease (study group) and the remaining 15 adolescents constituted the control group<sup>54</sup>. The ratio of the distance between the proximal margin of the patellar tendon attachment point to the tibia and the tibial tubercle epiphysis to the distance between the knee joint level and the tibial tubercle epiphysis was higher in the control group. They concluded that if the patellar tendon attaches more proximally and in a broader area to the tibia, it might probably cause Osgood Schlatter disease.

If ossicles occur within the disease pattern of the duration of the complaints is usually extended to twice the normally expected period. Their shape and location influences the clinical course of the disease and surgical removal of these ossifications is the therapy of choice if the complaints persist for a relatively long time<sup>55</sup>.

It is well established that knee pain stops at the end of the growth and that long-term outcome is good for the majority of the patients<sup>56</sup>, with a focus on muscular tightness as a possible causative factor<sup>7</sup>. There are contradictory reports regarding patellar position in the Osgood Schlatter disease. Some studies suggest a *patella alta* at the end of the growth, with the strong pull of the well-developed quadriceps muscle as an etiological factor<sup>11,57</sup>.

#### Treatment and recovery

Osgood Schlatter disease runs a self-limiting course, and usually complete recovery is expected with closure of the tibial growth plate<sup>58</sup>. With regard to conservative treatment it has been shown on the basis of the duration of healing that functional therapy with an expansion of the ischiocrural musculature is preferable to immobilization of the joint. So that functional treatment is justified even if there is an increased formation of ossicles on non-immobilization of the joint, since such ossification occurs with only 20-25% of all cases of Osgood Schlatter disease and the duration of the complaints is markedly less enhanced than with immobilization measures<sup>55</sup>.

As far as the sportsman is concerned, this entails only brief loss of training and the possibility to avoid muscular atrophy of the affected leg by means of physiotherapeutic exercise<sup>55</sup>. Although there may be some discomfort in kneeling and activity restriction in a few cases<sup>42, 58</sup>. When patients fail extensive nonoperative management, surgery to remove the symptomatic ossicle must be endured<sup>59, 60</sup> in unresolved cases

#### **REFERENCES**

1. MASSADA L, Lesões típicas do desportista (2nd Ed). (Lisboa, Editorial Caminho, 2000). – 2. ADIRIM TA, CHENG TL, Overview of injuries in the young athlete. Sports Medicine, 33(1) (2003) 75. – 3. GONÇALVES CE, COELHO E SILVA MJ. Contemporary trends and issues in youth sports in Portugal. In Gonçalves CE, Coelho e Silva MJ (Eds) Children and youth in organized sports (Coimbra, University Press, 2004). – 4. MARQUES A, Crianças e adolescents atletas: entre a escolar e os centros de treino...entre os centros de treino e a escolar. In: Adelino J, Vieira J, Coelho O (Orgs) Treino de Jovens (Lisboa, CEFD, Secretaria de Estado do Desporto, 1999). – 5. MARTIN D, Capacidade de performance e desenvolvimento no desporto de jovens. In: Adelino J, Vieira J, Coelho O (Orgs) Treino de jovens (Lisboa, CEFD, Secretaria de Estado do Desporto, 1999). – 6. LIMA T, Competições para arthroscopic technique is an option<sup>61</sup>. The young athlete must be assured that while residual deformity may remain, disappearance of symptoms coinciding with closure of the apophyseal plate is often the end result<sup>62</sup>.

#### **Osgood Schlatter disease prevention**

The long term outcome may not be favorable as they remain equivocal<sup>63</sup>. The small injuries that may cause this disorder are usually unnoticed, so prevention may not be possible. Literature is consensual about regular stretching, both before and after exercise and athletics, can help prevent injury<sup>64,65,66</sup>, that is warm-up exercises before playing sports, especially exercises that stretch your thigh (quadriceps), hamstring and calf muscles as well as knee strengthening exercises. Other more general guidelines suggest that overweight children should be encouraged to lose weight and susceptible children to exercise regularly but moderately, and to avoid weight-bearing activities that put excessive stress on the patellar tendon. Osgood Schlatter disease usually strikes active adolescents around the beginning of their growth spurts, the approximately 2-year period during which they grow most rapidly. Growth spurts can begin any time between the ages of 8 and 13 for girls, or 10 and 15 for boys<sup>67</sup>.

#### Conclusion

As final regards it is suitable to remember that during a growth spurt, it is thought that the tendon attaching the quadriceps muscle to the knee joint fails to keep up with the lengthening bone and pulls tight, creating a strain on the growing bone (tibial tuberosity). As one of the most common causes of knee pain in adolescents, surgical treatment is rarely indicated and is generally reserved for patients with recurrent disabling pain unresponsive to conservative therapy. While Osgood Schlatter disease is more common in boys, the gender gap is narrowing as more girls become involved with sports. This disease usually resolves by itself once growth has finished. This may take up to two to three years. Prevention is most associated with good stretching to balance muscle size and function as well as ligaments. Future studies should address longitudinal particularities of young athletes who suffered of this disease.

jovens. In: CEFD (Ed) O melhor da revista treino desportivo (Lisboa, CEFD,2000). – 7. MARQUES A, OLIVEIRA J, Promoting quality in youth sports. In: Gonçalves CE, Coelho e Silva MJ (Eds) Children and youth in organized sports (Coimbra, University Press, 2004b). – 8. MALINA RM, BOUCHARD C, Growth, maturation and physical activity (2<sup>nd</sup> Ed.) (Champaign, IL, Human Kinetics, 1991). – 9. MALINA RM, Physical growth and biological maturation of young athletes. Exercise and Sport Sciences Reviews, 24 (1994) 389. – 10. MALINA RM, Growth and maturation: Basic principles and effects of training. In: Gonçalves CE, Coelho e Silva MJ (Eds) Children and youth in organized sports (Coimbra, University Press, 2004a). – 11. BEUNEN G, MALINA RM, Growth and physical performance relative to the timing of the adolescent spurt. Exercise and Sports Science Reviews 16

(1988) 503. - 12. PENA-REYES ME, CARDENAS-BARAHONA E, MALINA RM, Growth, physique, ans skeletal maturation of soccer players 7-17 years of age. Humabiologica Budapestinesis, 25 (1994) 453. - 13. MALINA RM, EISENMANN JC, Responses of children and adolescents to systematic training. In: Gonçalves CE, Coelho e Silva MJ (Eds) Children and youth in organized sports (Coimbra, University Press, 2004). - 14. MALINA RM, PENA REYES ME, EISENMANN JC, HORTA L, RODRIGUES J, MILLER R, Height, mass and skeletal maturity of elite Portuguese soccer players 11-16 years of age. Journal of Sport Sciences, 18 (2000) 685. - 15. MALINA RM, Youth football players: Perspectives from growth and maturation. Insight-The F.A. Coaches Association Journal, I(5) (2001) 27. - 16. REILLY T, The physiological demands of soccer: Implications for youth training. In: Gonçalves CE, Coelho e Silva MJ.(Eds) Children and youth in organized sports (Coimbra, University Press, 2004). - 17. MALINA RM, Injuries in Youth Sports. In Gonçalves CE, Coelho e Silva MJ (Eds) Children and youth in organized sports (Coimbra, University Press, 2004b). - 18. KONTOS AP, Risk of injury in youth sport: The role of physiological factors. In: Gonçalves CE, Coelho e Silva MJ (Eds) Children and youth in organized sports (Coimbra: University Press, 2004). - 19. HERGENROEDER A, Prevention of sport injuries. Pediatrics, 101 (1998) 1057. - 20. AMERICAN ACADEMY OF PEDIATRICS, Injuries in youth soccer-a subject review. Pediatrics, 105 (2000) 659. - 21. STEIN CJ, MICHELI LJ, Overuse injuries in youth sports. Physician and Sportsmedicine, 38(2) (2010) 102. - 22. KUJALA UM, KVIST M, HEINONEN O, Osgood-Schlatter's disease in adolescent athletes. Retrospective study of incidence and duration. American Journal of Sports Medicine, 13(4) (1985) 236. - 23. DICK R, HERTEL J, AGEL J, GROSSMAN J, MARSHALL SW, Descriptive Epidemiology of Collegiate Men's Basketball Injuries: National Collegiate Athletic Association Injury Surveillance System, 1988-1989 Through 2003-2004. Journal of Athletic Training, 42(2) (2007) 194. - 24. AGER J, OLSON DE, DICK R, ARENDT EA, Descriptive Epidemiology of collegiate women's basketball injuries: National collegiate athletic association injury surveillance system, 1988-1989 through 2003-2004. Journal of athletic training, 42(2) (2007) 202. - 25. CUMPS E, VERHAGEN E, MEEUSEN R, Prospective epidemiological study of basketball injuries during one competitive season: ankle sprains and overuse knee injuries. Journal of Sports Science Medicine, 6 (2007) 204. - 26. BOMPA T, Periodization. Theory and methodology of training (5<sup>th</sup> Ed). (Champaign, IL, Human Kinetics, 1999). - 27. AIRES L, HORTA L, Biomecânica segmentar na traumatologia do Futebol. In: Horta L (Org.) Prevenção de lesões no desporto (Lisboa, Editorial Caminho, 1995). - 28. HORTA L, CUSTÓDIO J, Elaboração de um programa de prevenção de lesões-os factores de risco e os cuidados preventivos. In Horta L (Org) Prevenção de lesões no desporto (Lisboa, Editorial Caminho, 1995). - 29. FULLER CW, EKSTRAND J, JUNGE A, ANDERSEN TE, BAHR R, DVORAK J, HAGGLND M, MCCRORY P, MEEUWISSE WH, Consensus statement on injury definitions and data collection procedures in studies of football (soccer) injuries. Clinical Journal of Sport Medicine, 16 (2006) 97. - 30. CASSAS KJ, CASSETTARI-WAYHS A, Childhood and adolescent sports-related overuse injuries. American Family Physician, 73(6) (2006) 1014. - 31. KAEDING CC, WHITE-HEAD R, Musculoskeletal injuries in adolescents. Primary Care, 25(1) (1998) 211. - 32. PEĆINA M, BOJANIĆ I, HASPL M, Overuse injury syndromes of the knee. Archives of Industrial Hygiene and Toxicology, 52(4) (2001) 429. - 33.

SWENSON DM, YARD EE, FIELDS SK, COMSTOCK RD, Patterns of recurrent injuries among US high school athletes, 2005-2008. American Journal Sports Medicine, 37(8) (2009) 1586. - 34. PATERSON A, Soccer injuries in children. Pediatric Radiology, 39(12) (2009), 1286. - 35. KOUTURES CG, GREGORY AJ, Injuries in youth soccer. Pediatrics, 125(2) (2010) 410. - 36. FROHOLDT A, OLSEN OE, BAHR R, Low risk of injuries among children playing organized soccer: a prospective cohort study. American Journal Sports Medicine, 37(6) (2009) 1155. - 37. AOKI H, KOHNO T, KATO H, YATABE K, MORIKAWA T, SEKI J, Incidence of injury among adolescent soccer players: a comparative study of artificial and natural grass turfs. Clinical Journal Sport Medicine, 21(1) (2010) 1. - 38. HORTA L, As lesões músculoesqueléticas. In Barata T (Org) Actividade física e medicina moderna (Odivelas, Europress, 1998). - 39. HORTA L, Prevenção das lesões no desporto. (Lisboa, Editorial Caminho, 2007). - 40. LAU LL, MAHADE A, HUI JH, Common lower limb sport-related overuse injuries in young athletes. Annals Academy of Medicine Singapore, 37(4) (2008) 315. - 41. ROSS MD, VILLARD D, Disability levels of college-aged men with a history of Osgood-Schlatter disease. Journal of Strength & Conditioning Research, 17(4) (2003) 659-663. - 42. GERULIS V, KALESINSKAS R, PRANCKEVICIUS S, BIRGERIS P, Importance of conservative treatment and physical load restriction to the course of Osgood-Schlatter's disease. Medicina (Kaunas), 40(4) (2004) 363. - 43. CALM-BACH WL, HUTCHENS M, Evaluation of patients presenting with knee pain: Part II. Differential diagnosis. American Family Physician, 68(5) (2003) 917. - 44. DUNN JF, Osgood-Schlatter disease. American Family Physician, 41(1) (1990) 173. - 45. PECK DM, Apophyseal injuries in the young athlete. American Family Physician, 51(8) (1995) 1897. - 46. MAFFULLI N, LONGO UG, SPIEZIA F, DENARO V, Sports injuries in young athletes: long-term outcome and prevention strategies. Physician and Sportsmedicine, 38(2) (2010) 29. - 47. AIRES L, Prevenção de lesões no futebol. In: Horta L (Org.). Prevenção de lesões no desporto (Lisboa, Editorial Caminho, 1995). - 48. YASHAR A, LODER RT, HENSINGER RN, Determination of skeletal age in children with Osgood-Schlatter disease by using radiographs of the knee. Journal of Pediatric Orthopaedics, 15(3) (1995) 298. - 49. DUBRAVCIC-SIMUNJAK S, PECI-NA M, KUIPERS H, MORAN J, HASPL M, The incidence of injuries in elite junior figure skaters. American Journal of Sports Medicine, 31(4) (2003) 511. - 50. PRICE RJ, HAWKINS RD, HULSE MA, HODSON A, The Football Association medical research programme: an audit of injuries in academy youth football. British Journal of Sports Medicine, 38(4) (2004) 466. - 51. ORGAZ-GALLEGO MP. TRICIO-ARMERO MJ, Enfermedad de Osgood Schlatter: a propósito de dos casos. SEMERGEN - Medicina de Familia, 35(8) (2009) 418. - 52. ROSENBERG ZS, KAWELBLUM M, CHEUNG YY, BELTRAN J, LEHMAN WB, GRANT AD, Osgood-Schlatter lesion: fracture or tendinitis? Scintigraphic, CT, and MR imaging features. Radiology, 185(3) (1992) 853. - 53. SARCEVIĆ Z, Limited ankle dorsiflexion: a predisposing factor to Morbus Osgood Schlatter? Knee Surg Sports Traumatol Arthrosc, 16(8) (2008) 726. - 54. DEMIRAG B, OZTURK C, YAZICI Z, SARISOZEN B, The pathophysiology of Osgood-Schlatter disease: a magnetic resonance investigation. Journal of Pediatric Orthopaedics B, 13(6) (2004) 379. - 55. ENGEL A, WINDHAGER R. Importance of the ossicle and therapy of Osgood-Schlatter disease. Sportverletz Sportschaden, 1(2) (1987) 100. - 56. VARGAS B, LUTZ N, DUTOIT M, ZAMBELLI PY, Osgood-Schlatter disease. Revue Médicale

Suisse, 4(172) (2008) 2060. - 57. JAKOB RP, VON GUM-PPENBERG S, ENGELHARDT P, Does Osgood- Schlatter disease influence the position of the patella? Journal of Bone and Joint Surgery, 63B(4) (1981) 579. - 58. GHOLVE PA, SCHER DM, KHAKHARIA S, WIDMANN RF, GREEN DW, Osgood Schlatter syndrome. Current Opinion in Pediatrics, 19(1) (2007) 44. - 59. ORAVA S, MALINEN L, KARPA-KKAM J, KVISTM M, LEPPILAHTI J, RANTANEN J, KUJALA UM, Results of surgical treatment of unresolved Osgood-Schlatter lesion. Annales Chirurgie et Gynaecologiae, 89(4) (2000) 298. - 60. WEISS JM, JORDAN SS, ANDER-SEN JS, LEE BM, KOCHER M, Surgical treatment of unresolved Osgood-Schlatter disease: ossicle resection with tibial tubercleplasty. Journal of Pediatric Orthopaedics, 27(7) (2007) 844. - 61. DEBERARDINO TM, BRANSTETTER JG, OWENS BD. Arthroscopic treatment of unresolved Osgood-Schlatter lesions. Arthroscopy, 23(10) (2007) 1127.e1. - 62.

ANTICH TJ, BREWSTER CE, Osgood-schlatter disease: review of literature and physical therapy management. Journal of Orthopaedic and Sports Physical Therapy, 7(1) (1985) 5. -63. CAKMAK S, TEKIN L, AKARSU S, Long-term outcome of Osgood-Schlatter disease: not always favorable. Rheumatology International, in press. - 64. CASSAS KJ, Childhood and adolescent sports-related overuse injuries. American Family Physician, 73(6) (2006) 1014. - 65. MERCIER LR, Osgood-Schlatter disease. Ferri's Clinical Advisor: Instant Diagnosis and Treatment (Mosby, Saint Louis, 2009). - 66. AMERICAN ACADEMY OF ORTHOPAEDIC SURGEONS, Osgood-Schlatter disease (knee pain), accessed January 26, 2012. Available from: URL: orthoinfo.aaos.org/fact/thr report.cfm? Thread ID=145&topcategory=Knee. - 67. CALMBACH WL, HUTCHENS M, History, Physical Examination, Radiographs and Laboratory Tests. Am Fam Physician, 68(5) (2003) 917. -

#### M. Domingues

University of Coimbra, Faculty of Sport Sciences, Department of Youth Studies, Coimbra, Portugal e-mail: marcio.domingues@live.com.pt

#### EKSPLOZIJA "OSGOOD SCHLATTER" BOLIJESTI KOD MLADIH FUDBALERA

#### SAŽETAK

Fudbal je najpopularniji sport na svijetu. Kao i svaki drugi sport u kojem dolazi do kontakta među igračima, i fudbal je veoma podložan različitim vrstama povreda. Prije svega, ovaj problem se odnosi na vezu između metodike obučavanja i prevencije od pretjeranog povređivanja kod mladih tj. rješenje u osnovi leži u predviđenim sportskim programima koji se izvode. Na sreću, evidentan je porast svijesti kod različitih struktura kada se govori o razvoju predviđenih uslova koji su neophodni za razvoj lokomotornog aparata mladih ljudi. Ova studija ispituje, isključivo jednu specifičnu povredu koja se zove "Osgood Schlatter" a koja se javlja kod djece i adolescenata koji se bave fudbalom, kao i glavne mehanizme zbog kojih se ove povrede pojavljuju. U studiji su razmotreni rizični faktori koji izazivaju javljanje ove bolijesti, kao i strategija za izbjegavanje iste.

Ključne riječi: povrede, mladi sportisti, fudbal, "Osgood Schlatter" sindrom.

## **Overuse Knee Injuries in Athletes**

#### Miroslav Kezunović

University of Montenegro, Faculty for Sport and Physical Education, Nikšić, Montenegro Clinical Center of Montenegro, Orthopedics and Traumatology Clinic, Podgorica, Montenegro

#### ABSTRACT

According to many statistics over 55% of all sports-related injuries are incurred in the knee joint (active sportsmen and recreationists). The statistics definitely differ, depending on type of sport and specific movements habitually performed in a particular sport. Therefore, in addition to acute knee injuries overuse syndromes are common in the knee area also due to specificities of patellofemoral joint just because specific diseases like "jumper's knee" and "runner's knee" are related to certain sport activities. Generally speaking, these syndromes occur due to poor orientation of the knee extensor mechanism, i.e. friction of iliotibial band and patellofemoral chondromalacia. It is believed that about 45% of all overuse syndromes in the knee area occur as a result of running.

Key words: Knee, Overuse, Sport.

#### **Dear Editor-in-Chief:**

Given the anatomical structure of the knee, where the upper surface of femor is of relatively curved shape like skis and "slides" against the flat lower tibial surface, it is the most frequently injured region not only in acute injuries, but also as a result of overuse<sup>1</sup>. Major role in maintaining knee joint stability is played not only by its bone congruence but also by numerous tendons and ligaments insertions, joint capsules and bursa mucosa. All these knee stabilizers are divided into so-called active and passive stabilizers. It is therefore not surprising that in the knee joint and around it microtraumatic cumulative disorders manifested by occurrence of so-called painful syndromes do not occur so rarely. Depending on their anatomical localization, these syndromes are divided into four groups: anterior, posterior, medial and lateral<sup>2</sup>.

Anterior knee pain is related to the main sport activity with lot of jumping and landing components, which significantly increases mechanical overload of knee extensor mechanism. Anterior knee pain presupposes so-called jumper's knee, Morbus Hoffa and pathological changes in patellar cartilage (chondromalatio)<sup>2,3</sup>.

Jumper's knee as an overuse syndrome is certainly one of the most common injuries that happen in sports, which have a large number of jumps. Some authors state that even 45% of elite male volleyball players have experienced difficulties of this type during their careers. Strength of front thigh muscles (quadriceps) is significantly higher of the posterior muscle group (biceps femorisa) which consequently leads to enthesopathy of proximal and distal insertion of the patella. Feretti reports that jumper's knee represents 28% of all sport injuries in volleyball. In addition, he concludes that the type of training plays minor role in contrast to the quantity and length of practice, as well as physical characteristics and biomechanics of lower extremity in a particular athlete<sup>4</sup>.

During five-year research, Kujala et al reported that 26.4% of athletes among 2762 with knee disorder who were treated in outpatient unit have had jumper's knee. That is why he believes

that this injury has greater incidence than any other knee injury like meniscus tear or anterior cruciate ligament (ACL) tear<sup>5</sup>. Pećina et al. found that in 21.3% pathological changes affected quadriceps tendon insertion to patella, 72.1% involved inferior patellar pole and 6.6% involved tibial tuberosity<sup>2.6</sup>.

The main symptom is pain in the inferior or proximal pole of the patella. The pain is sharp, of varying intensity and usually develops gradually without any association with a direct trauma. In the beginning of the disease, pain occurs after training or a match, and disappears after a short period of rest. If training process continues without adequate treatment procedures, pain becomes stronger and lasts throughout sporting activity and after it. In addition to spontaneous pain when the knee is bent (receiver volleyball position), a slight pressure occurs in the distal pole of the patella, as a characteristic diagnostic sign. In advanced cases, the functional ability of the knee is reduced and accompanied by feeling of weakness and kneeling and sports activity becomes practically impossible. Therefore, the characteristics of overuse syndrome of jumper's knee would be pathological changes in tendon insertions of extensor mechanism (leg extensor) of the leg. Since they generally occur in athletes who heavily load their quadriceps during sports activity (volleyball and basketball players, skiers, jumping disciplines, weightlifters .... rarely others), the reasons for occurrence of these injuries should be primarily sought in the characteristics of a particular sport, constitution type of the participants in these sports activities, and then in the planning of training and training errors that occur during its performance<sup>7</sup>.

Constitutional type would in principle fit to Sheldon's classification of ectomorph type, whose characteristics are: tall stature, slim figure, high forehead, thin face, pointed nose, long and thin neck, narrow chest and abdomen, rather long, thin arms and legs with long and narrow muscles<sup>8</sup>. If elements of an eventual deformity of valgus or varus of knees or lower legs are added to this constitution type, it is clear that there is an unbalanced load transfer to elements of the knee extensor mechanism.

It is certain that biomechanics disorders of the foot and its static and dynamic functions are not rare and insignificant

Received for publication February 2, 2013

reason for the occurrence of overuse syndrome of the whole extremity. Length of lower - extremity lever is significantly higher in tall people than in short, so therefore the range of motion of the knee is much higher. The existence of a database of anthropometric values and the anatomical and physiological characteristics of athletes would facilitate decision making for possible causes of frequency of their injuries.

After long-term overuse in inadequate and uneven load during the training process it comes to sensitivity, illness of the weakest part of the extensor mechanism, which is often distal or proximal pole of the patella. One of the causes of jumper's knee occurrence may be the sudden beginning of normal activities after a long break, without previous adequate preparation of musculature and insertion sites of the extensor mechanism<sup>9</sup>.

At top-level players, who are in a continuous process of training, overuse syndrome may mean the introduction of some new exercises with higher loads or number of repetitions that they had not done before. Combination of large number of repeation of certain movements that is associated with jumps is also possible (strengthening exercises - quadriceps strengthening exercise), for example smash exercise targeting specific areas in a deep squat position during landing, with previous or later exercises in the gym on the same day which contain ejection with loads greater than 10 kilos and compulsory jump at the end of the exercise. Continuous repetition of new half-squat exercises, with repeation of technical errors during performance of the element itself and a greater load of one side can also be the reason for the occurrence of overload in the knee area<sup>10</sup>.

Fitness training has an important role in any professional and recreational sport. Many sports should involve skillfulness, agility, good coordination, jumping ability and explosiveness, extremely well developed general and specific strength, and therefore the reason for the high quality fitness training is great. Knowledge of the elements and characteristics of a particular sport requires serious and studious approach to planning and programming of fitness training. That is why every physical conditioning coach must take account of several important factors, including: the anthropological characteristics of players, their individual current motor skills, requirements for conducting fitness training, calendar of championship and important matches and, at the end, the basic elements and the essence of sport.

According to some authors, the foundations of fitness training are:

- Explosive strength training 50% (jumps, sprints etc.);
- Strength training 25-30% (specific and general strengthening exercises);
- Aerobic training 20% (high-intensity interval training).

It is certainly indispensable the training of coordination, as well as training of skillfulness and agility, as the basis of motor abilities of each athlete in general.

Morbus Hoffa syndrome is the name for symptoms incurred by traumatizing the intrapatellar fat pad during repeated knee extension movement. The characteristic pain occurs during sudden passive hyperextension of the knee, with occasional blockages that are similar to meniscus injuries (Smiley's sign). Treatment of this syndrome is rarely surgical and requires rest, therapy with non-steroidal antirheumatic drugs (NSAIDs), isometric exercises, cooling, wearing orthotic insoles support heels pads and reduced knee hyperextension<sup>11</sup>.

Chondromalacia patella results from degeneration of cartilage of a various degree, while there has been no change in subhondral bone. Initially, these changes are reversible and later irreversible due to severe degenerative changes. There are a lot of divisions of joint cartilage destruction, but the Outerbridge classification is the most commonly used where chondromalacia of the first grade is manifested as softening or swelling of cartilage, while the fourth grade is cartilage destruction with exposed subhondral bone<sup>12</sup>.

The syndrome of lateral hiperpressure of the patella is the anterior knee pain with no patellar instability. Pain or discomfort occurs during forced flexion of the knee, when going down the stairs and downhill, but also during forced and prolonged sitting or running. Pain occurs during these activities, but more often after the activities, at rest. During examination lateral facets of the patella is painful when palpated. Upon patellar flexion of the knee, a shortened lateral retinaculum can be seen, followed by inability to move medially<sup>12,13</sup>. X-rays axial images of the knee held in 30 ° of flexion show a different degree of knee flexion, the so called patellar tilt as well as subhondral sclerosis of the lateral facet.

Patellar Subluxation Syndrome is the most common syndrome within the framework of Patellofemoral dysplasia (PFD). Patients experience blockage of movements and an unstable kneecap (a feeling of the knee "giving way"). The pain occurs in lateral facet of the patella, and if occurs parapatellary medially, it is due to inflammation of the medial parapatellar plica as a result of lateral patellar dislocation<sup>14</sup>.

Medial Knee Pain is associated with the synovial fold syndrome and the three most important are: plica suprapatellaris, plica infrapatellaris and plica synovialis medialis. Fibrotic changes of a medial synovial fold cause impacts with medial facet of the patella, resulting in a sound phenomenon of "clicking" in the ankle with occasional blockages. In indicated cases (of particularly hypertrophic type), this so-called "third meniscus" must be removed with arthroscopic knee surgery<sup>15,16</sup>.

M.semimembranosus syndrome is characterized by pain in the posterolateral corner of the knee just below the joint cavity and is often replaced by symptomatology of meniscus injury. Treatment is generally conservative, and only rarely does a surgical intervention become necessary.

Pes anserinus syndrome occurs frequently in long-distance runners and those athletes who have abnormal biomechanics of the lower extremity (valgus and external rotation of the tibia). Bursitis is more common and is easily diagnosed clinically and by ultrasound, but the problem of tendon enthesitis pes anserinus represents much bigger problem. Treatment of pes anserinus syndrome is typically nonsurgical and includes administration of local anesthetic with corticosteroids.

Swimmer's knee mostly occurs in breaststroke swimmers, but also in other swimming disciplines, and is considered to be the cause of the symptoms of enthesitis of the medial collateral ligament insertions on the medial femoral epicondyle. It frequently affects both knees, and the most important prevention of symptoms is proper swimming technique.

Lateral knee pain is usually manifested by iliotibial band friction syndrome (ITBFS) that results from activity comprising many repetitive flexion and extension movements of the knee, during which rubbing of the band against the lateral femoral epicondyle occurs. This produces irritation and subsequent inflammatory reactions within the iliotibial band or formation of underlying bursa and secondary inflammation. This syndrome is the most common in runners, especially in recreational joggers, but also in all other sports, whose activities entail a lot of running<sup>17</sup>. Causes for occurrence of iliotibial band friction syndrome are multiple, but the most frequent are abnormal biomechanics of the lower extremities (for example, knee

varus) or errors made during training. This syndrome is characterized by pain on the outer side of the knee (lateral knee pain), in the lateral condoyle of the femur 2 cm. above the joint cavity Lidenberg has proposed four-grade classification of injury grade according to symptoms in ITBFS. At grade 1, pain comes on after the run, but does not restrict distance or sped. At grade 2, pain comes on during the run but does not restrict distance or speed. At grade 3, pain comes on during the run and restricts distance or speed. At grade 4, pain is so severe that it prevents running.

Treatment of iliotibial band friction syndrome is frequently non-surgical. It is necessary to perform stretching exercise for iliotibial band, which is usually shortened in these athletes and proven by Ober's test. For the success of treatment, it is very important to correct biomechanical imbalances of the lower extremity, which is achieved by a suitable sport shoes with orthotic shoe insoles according to the computer model derived. Injection of local anesthetic with corticosteroid injected between the band and lateral epicondyle of the femur can be a very successful treatment, especially if inflammation of bursa occurred. In some cases resistant to conservative therapy, the surgical treatment is necessary, which consists of a limited resection of a small triangular piece at the posterior part of the iliotibial band covering the lateral femoral epicondyle<sup>17,18,19</sup>.

#### **REFERENCES**

1. POST WR, FULKERSON JP. Anterior knee pain - a symptom, not a diagnosis. Bulletin on the Rheumatic Diseases, 42 (1993) 5. - 2. PEĆINA M, BOJANIĆ I. Overuse injuries of the musculoskeletal system (CRC Press, Boca Raton, 1993). -3. PARKER R, CALABRESE J. Anterior knee pain. In: FU FH, HARNER CD, VINCE KG (Eds.) Knee surgery (Williams &Wilkins, Baltimore. 1994). - 4. FERRETTI A, PUDDU G, MARIANI PP, NERI M. Jumper's knee: an epidemiological study of volleyball players. Physican and Sportsmedicine, 12 (1984) 97. - 5. KUJALA UM, OSTERMAN K, KVIST M, AALTO T, FRIBERG O. Factor predisposing to patellar chondropathy and patellar apicitis in athletes. International Orthopaedics, 10 (2986) 195. - 6. STANITSKI CL. Adolescent anterior knee pain. In: BABLOS J,] (Ed.) The immature knee (Biblios, Barcelona, 1998). - 7. JACKSON AM. Anterior knee pain. Journal of Bone & Joint Surgery, 83 (2001) 937. - 8. OXFORD DICTIONARY OF SPORTS SCIENCE & MEDICINE, Sheldon somatotype classification, accessed on 1.11.2012. Available from URL: www.answers.com/topic/ sheldon-somatotype-classification. - 9. BAHR R, REESER JC. Injuries among world-class professional beach volleyball players: the Federation Internationale de Volleyball beach volleyball injury study. American Journal of Sports Medicine, 31 (2003) 119. - 10. COOK JL, KISS ZS, KHAN KM, PURDAM CR, WEBSTER KE. Anthropome - try, physical performance, and ultrasound patellar tendon abnormal- ity in elite junior basketball players: a cross-sectional study. British Journal of Sports Medicine, 38 (2004) 206. - 11. BREDELLA MA, TIRMAN PF, WISCHER TK, BELZER J, TAYLOR A, Popliteus Tendon Syndrome is the pain in the area above the origin of the popliteal muscle on the lateral part of the lateral femoral condyle. Excessive and/or extended pronation of the foot during running is considered to be a predisposing factor in developing this syndrome. For clinical examination, the knee is placed in the so-called "figure four position" when the pain is palpated in the front and distally from the origin of the lateral collateral ligament<sup>20</sup>.

Posterior knee pain is manifested in so-called fabellitis or fabella syndrome, which is present in 10 to 18% of the population, i.e. in those ones who have sesamoid bone fabella located on the posterior side of the lateral femoral condyle in the lateral head of the gastrocnemius muscle. Symptoms occur as a result of overuse of cartilage of the fabella whether it is a direct trauma to the fabella or arthritic changes in the fabella. The pain occurs gradually and is associated with knee movements, either due to extension of the muscles during hyperextension of the knee or due to direct pressure on the fabella, e.g., when sitting with legs crossed. Pain is provoked by applying pressure to the fabella, in the area posterior to the lateral femoral condyle and above the joint line. If the usual non-operative treatment does not produce improvement, the fabella is extirpationed surgically<sup>20,21</sup>.

GENANT HK. Skeletal Radiology, 29 (2000) 577. - 12. MORI Y, KUROKI Y, YAMAMOTO R, FUJIMOTO A, OKUMO H, KUBO M. Clinical and histological study of patellar chondropathy in adolescents. Arthroscopy, 2 (1991) 182. - 13. HASHEMI J, CHANDRASHEKAR N, GILL B, BEYNNON BD, SLAUTERBECK JR, SCHUTT RC, MANSOURI H, DABEZIES E. The geometry of the tibial plateau and its influence on the biomechanics of the tibiofemoral joint. Journal of Bone & Joint Surgery, 90 (2008) 2724. - 14. TAUNTON JE, MC KENZIE DC, CLEMENT DB. The role of biomechanic in the epidemiology of injuries. Sports Medicine, 6 (1988) 107. -15. KHAN D, WILSON MA. Bone scintigraphic findings in patellar tendonitis. Journal of Nuclear Medicine, 28 (1987) 1768. - 16. JOHNSON DP, EASTWOOD DM, WITHEROW PJ. Symptomatic synovial plicae of the knee. Journal of Bone & Joint Surgery, 75 (1993) 1485. - 17. LINDENBERG G, PIN-SHAW R, NOAKES TD. Iliotibial band friction syndrome in runners. Physician and Sportsmedicine, 12 (1984) 118. - 18. INSALL J, SALVATI E. Patella position in the normal knee joint. Radiology, 101 (1971) 101. - 19. MCWALTER EJ, CI-BERE J, MACINTYRE NJ, NICOLAOU S, SCHULZER M, WILSON DR. Relationship between varus-valgus alignment and Patellar Kinematics in Individuals with Knee Osteoarthritis. Journal of Bone & Joint Surgery, 89 (2007) 2723. - 20. PECI-NA M, BOJANIC I, HASPL M. Overuse injuries of the knee joint. Archives of Industrial Hygiene and Toxicology, 52 (2001) 429. - 21. SINDING-LARSEN MF. A hitherto unknown affection of the patella in children. Acta Radiologica, 1 (1921) 171.

M. Kezunović

University of Montenegro, Faculty for Sport and Physical Education, Nikšić, Montenegro e-mail: miroslavkezunovic@hotmail.com

#### PRENAPREZANJA U PODRUČJU KOLJENA KOD SPORTISTA

#### SAŽETAK

Više od polovine svih sportskih povreda (preko 55%), kako kod aktivnih sportista, tako i kod rekreativaca, dešava se na koljenom zglobu. Taj broj svakako varira obzirom na vrstu sporta i specifičnost pokreta koji se u određenom sportu izvode. Pored akutnih povreda koljena, česti su i sindromi prenaprezanja. To se objašnjava specifičnostima patelofemoralnog zgloba. U vezi sa nekim specifičnim sportskim aktivnostima dešavaju se specifična oboljenja kao što su "skakačko koljeno" i "trkačko koljeno". Uopšte gledajući ovi sindromi nastaju zbog lošeg usmjerenja ekstenzornog aparata koljena, odnosno trenja iliotibijalnog traktusa i patelofemoralne hondromalacije. Smatra se da oko 45% svih sindroma prenaprezanja u području koljena nastaje kao posljedica trčanja.

Ključne riječi: koljeno, prenaprezanje, sport.

# **Guidelines for authors**\*

When preparing the final version of the manuscript, either NEW or REVISED authors should strictly follow these guidelines. Manuscripts departing substantially from the guidelines will be returned to the authors for revision.

For more detailed information on the uniform requirements of the manuscript elements please visit the web site of the International Committee of the Medical Journal Editors.

#### **1. Manuscript layout**

#### **1.1. General remarks**

Authors should submit their manuscript as one Microsoft Word (.doc) file strictly following specified layout of manuscript structural elements. Main manuscript file should be carefully checked to contain all needed structural elements. Do not add any additional elements or data in your main manuscript file except the ones specified in guidelines! Do not break your main manuscript file in more files!

In text, avoid "one sentence – one paragraph" writing. Integrate your sentences in continuous text and sensible paragraphs.

Type the whole manuscript double-spaced!

Apart from chapter titles and subtitles avoid any kind of formatting (bold, underline) in the main text of the manuscript or table contents.

#### **<u>1.1.1. Length of the manuscript</u>**

The manuscript should not exceed the maximum length of 8 pages as printed in Montenegrin Journal of Sports Science and Medicine, which are roughly 30 A4 pages of double-spaced text. Additional pages are extra charged (See **Costs and payments**)

#### 1.1.2. Printing in color

If your manuscript contains pictures in color note that printing in color is extra charged. For prices see **Costs and Payments**.

#### **1.2.** Overview and position of structural elements of the main manuscript file

First or title page contains: 1. title, 2. type of publication, 3. running head, 4. authors, and 5. affiliations.

Second page contains: 6. abstract, and 7. key words.

**Starting on a third page** follow: 8. chapters of the manuscript, 9. references 10. corresponding author's address, and 11. corresponding author's e-mail.

A separate page, following corresponding author's address, contains: 12. naslov na crnogorskom jeziku (title in Montenegrin, only for Montenegrin authors), and 13. sažetak na crnogorskom jeziku (abstract in Montenegrin, only for Montenegrin authors).

Tables (14. Tables) with headings and footnotes should be put each on a separate page.

As for 15. Figures, **ONLY** graphs and other Microsoft Office graphics should be included in the main manuscript file, each on a separate page with appropriate heading below. All other graphic material should be submitted separately, in

<sup>\*</sup> Modified from guidelines for authors of the Collegium Antropologicum

properly named files to avoid any confusion. The last, separate page of the manuscript should contain 16. Figure headings of figures submitted **separately**.

You can download a Short overview of the main manuscript file structure (MS Word .doc file).

Following are two examples of the first (or title) page:

#### Example 1:

Transfer of learning on a spatial memory task between the blind and sighted people

Spatial Memory among Blind and Sighted

Selcuk Akpinar<sup>1</sup>, Stevo Popović<sup>1,2</sup> and Sadettin Kirazci<sup>1</sup>

<sup>1</sup>Physical Education and Sports Department, Middle East Technical University, Ankara, Turkey

<sup>2</sup>Faculty for Sport and Physical Education, University of Montenegro, Niksic, Montenegro

#### Example 2:

Comparison of instep kicking between preferred and non-preferred leg in young football players

Instep kicking between preferred and non-preferred leg

Dusko Bjelica, Stevo Popovic

Faculty for Sport and Physical Education, University of Montenegro, Niksic, Montenegro

#### 1.3. Title

Authors should include all information in the title that will make electronic retrieval of the article both sensitive and specific.

Check spelling and language of your title. The title should be in Titlecase, written in uppercase and lowercase letters (initial uppercase for all words except articles, conjunctions, short prepositions no longer than four letters etc.) so that first letters of the words in the title are in caps. Exceptions are words like: articles, and, or, between etc. The word following a colon (:) or a hyphen (-) in the title is always capitalized.

#### Example:

Effects of Socio-Economic and Behavioral Characteristics in Explaining Central Obesity – A Study of Adult Asian Americans in San Diego, USA

#### **1.4.** Type of publication

Authors should suggest the type of their submission. Montenegrin Journal of Sports Science and Medicine publishes original scientific papers, notes, preliminary communications, reviews and conference papers.

**Original scientific papers** – report hitherto unpublished results of original research. The acceptance of the paper obliges the author not to publish the same material elsewhere without the permission of the Editorial Board.

Notes (short communications) - reports on shorter but completed research.

Preliminary communications - include preliminary results of greater importance requiring rapid publication.

**Reviews** – original, concise and critical surveys of a current research area in which the author himself (authors themselves are) is active. In the review the role of the author's contribution in this field in relation to other published reports, as well as original views should be given.

**Conference papers** – previously reported at congress, symposium or summer school, etc., should be submitted by the Organizing Committee in the form of a complete manuscript of the Proceedings

#### 1.5. Running head

Short running title should not exceed 50 characters including spaces.

#### **Example:**

Attitudes toward advertising through sport

(Title: Attitudes toward advertising through sport among the frequency of watching sports events)

#### 1.6. Authors

In one line list all authors with full names separated by a comma (and space). Last author should be separated with the word "and". Only the first name, initial of a middle and family name of authors should be given. Avoid any abbreviations of academic or professional titles. If authors belong to different institutions, following a family name of the author there should be a number in superscript designating affiliation (see the next section 1.7. Affiliations).

#### **Example:**

Selcuk Akpinar<sup>1</sup>, Stevo Popović<sup>1,2</sup> and Sadettin Kirazci<sup>1</sup>

#### 1.7. Affiliations

Affiliation consists of the name of a department(s) and institution(s), city and country to which the author(s) belong and to which the presented / submitted work should be attributed.

List all affiliations (each in a separate line) in the order corresponding to the list of authors. Affiliations must be written in English, so carefully check the official English translation of the names of institutions and departments. Do not translate yourself – check the information since Editorial Board does not have any way of checking these.

Affiliations should be written as follows:

#### name of institution(s), name of department(s), town, state

Only if there is more then one affiliation, should a number be given to each affiliation in order of appearance. This number should be written **in superscript at the beginning** of the line, separated from corresponding affiliation with a space. This number should also be put **after** corresponding name of the author, in superscript with **no space** in between (see example).

If an author belongs to more than one institution, all corresponding superscript digits, separated with a comma with **no space** in between, should be present behind the family name of this author.

In case all authors belong to the same institution affiliation numbering is not needed.

Whenever possible expand your authors' affiliations with departments, or some other, specific and lower levels of organization.

#### **Example:**

Selcuk Akpinar<sup>1</sup>, Stevo Popovic<sup>1,2</sup> and Sadettin Kirazci<sup>1</sup>

<sup>1</sup>Middle East Technical University, Physical Education and Sports Department, Ankara, Turkey

<sup>2</sup>University of Montenegro, Faculty for Sport and Physical Education, Niksic, Montenegro

#### 1.8. Abstract

The abstract should provide the context or background for the study and should state the study's purposes, basic procedures (selection of study subjects or laboratory animals, observational and analytical methods), main findings (giving specific effect sizes and their statistical significance, if possible), and principal conclusions. It should emphasize new and important aspects of the study or observations.

It is recommended that abstract should not exceed one typed double-spaced page, written in English. It should be placed, **in italics**, on second page of your document after the standard title written in caps (**abstract**).

Since abstract is independent part of your paper, all **abbreviations** used in the abstract should also be **explained** in it. If an abbreviation is used, the term should always be first written in full with the abbreviation in parentheses immediately after it.

Abstract **should not** have any special headings (Aim, Results...). Abstract should be written as a continuous text and consists of **one paragraph only**!

Citing literature in abstract is done in the same way as in the rest of the text.

#### 1.9. Key words

Authors should provide 3 to 10 key words or short phrases that capture the main topics of the article. These will assist indexers in cross-indexing the article and may be published with the abstract. Terms from the **Medical Subject Headings (MeSH)** list of **Index Medicus** should be used. There are other subject headings lists available on the Internet like **Sociology and Anthropology Subject Headings**.

Key words should be placed on the second page of the manuscript right below the abstract in English, written in italic as shown in the following example.

#### **Example:**

ABSTRACT

Results of the analysis of.....

Key words: spatial memory, blind, transfer of learning, feedback

#### **<u>1.10. Chapters of the manuscript</u>**

Style of the journal prescribes only 2 types of titles:

**Main chapter titles** – written **in bold** and **in titlecase** (initial uppercase for all word except articles, conjunctions, short prepositions etc.). The word following a colon (:) or a hyphen (-) in the title is always capitalized.

#### **Example:**

#### Methods of Analysis - An Overview

Subtitles – all other titles within one chapter. They are written in italic and in normal sentence case (only the starting word of a title begins with first letter in caps).

#### **Example:**

*Table position of the research football team* Note that titles but NOT the subtitles are written in titlecase.

Do not put a full stop or any other sign at the end of the title.

Depending on the type of publication main manuscript chapters may vary. The general outline is: Introduction, Materials, Methods, Results, Discussion, Conclusion, Acknowledgements. If not needed, acknowledgements may be omitted. Conclusion can be part of Discussion. Materials and Methods can be (if authors want to) united in one chapter and titled "Materials and Methods". Results and Discussion can be united in one chapter and titled accordingly. Subjects and Methods or Patients and Methods can also be used as a chapter title. For example, a case report might have the following titles: Introduction – Case Report – Discussion – Conclusion – Acknowledgements.

However, this scheme may not be suitable for reviews or publications from some areas and authors should then adjust their chapters accordingly but use the general outline as much as possible.

#### 1.10.1. Introduction

Introduction provides a context or background for the study (i.e. the nature of the problem and its significance). It states the specific purpose or research objective of, or hypothesis tested by the study or observation; e.g. keep in mind that the research objective is often more sharply focused when stated as a question. Both the main and secondary objectives should be made clear, and any pre-specified subgroup analyses should be described. Only strictly pertinent references should be given without data or conclusions from the work being reported.

#### 1.10.2. Materials (subjects, patients etc.) and Methods

The Materials and Methods section should include only information that was available at the time the plan or protocol for the study was written. All information obtained during the conduct of the study belongs to the Results section.

#### Statistics

Describe statistical methods with enough detail to enable a knowledgeable reader with access to the original data to verify the reported results. When possible, quantify findings and present them with appropriate indicators of measurement error or uncertainty (such as confidence intervals). Avoid relying solely on statistical hypothesis testing, such as the use of p-values, which fails to convey important information about effective size. References for the design of the study and statistical methods should comply with standard works when possible (with pages stated). Define statistical terms, abbreviations, and most particularly symbols. Specify the computer software used.

#### 1.10.3. Results

Present your results in logical sequence in the text, tables, and illustrations, giving the main or most important findings first. Do not repeat in the text all the data in the tables or illustrations; emphasize or summarize only important observations. Restrict tables and figures to those needed to explain the argument of the paper and to assess its support. Use graphs as an alternative to tables with many entries; do not duplicate data in graphs and tables. Avoid non-technical uses of technical terms in statistics, such as "random" (which implies a randomizing device), "normal", "significant", "correlations", and "sample".

#### 1.10.4. Discussion and Conclusion

Emphasize the new and important aspects of the study and the conclusions that follow from them. Do not repeat in detail data or other material given in the Introduction or the Results section. For experimental studies it is useful to begin the discussion by summarizing briefly the main findings, then explore possible mechanisms or explanations for these findings, compare and contrast the results with other relevant studies, state the limitations of the study, and explore the implications of the findings for future research and for clinical practice.

Link the conclusions with the goals of the study but avoid unqualified statements and conclusions not adequately supported by the data. In particular, authors should avoid making statements on economic costs and benefits unless their manuscript includes appropriate economic data and analyses. Avoid claiming priority and alluding to work that has not been completed. State new hypotheses when warranted, but clearly label them as such.

Authors can also separate Conclusion chapter from Discussion.

#### 1.10.5. Acknowledgements

Authors should acknowledge help and support (financial, advisory etc.) from an institution, organization, group or an individual who have contributed to the production of the article.

#### 1.11. References

References should be numbered consecutively in the order in which they are first mentioned in the text.

All information needed for each type of reference (journal article, book, book chapter, internet source etc.) **MUST** be present as specified in guidelines. If you omit any of the specified data you will surely be contacted to rectify it.

Authors are responsible for accuracy of each reference. Use authoritative source for information such as databases Current contents, Web of Science, Medline or PubMed (see Links) to check the validity of journal article citation.

#### 1.11.1. Reference list

Reference list is a highly structured part of the text where each comma, space, colon, etc. counts. Authors are kindly asked to be very careful and strict when editing this part of the text. Following are some general rules and examples that should help authors.

In the reference list, references should be listed one after another (without line break) separated with a dash (see an example of a reference list).

All authors of the cited source should be quoted (*et. al.* cannot be used in the reference list). Accuracy and content of the references are **author's responsibility**, so make sure you provide correct references.

The following conventions are used for references:

#### Journal article

2. BARAK O, JAKOVLJEVIC DJ, POPADIC-GACESA J, OVCIN Z, BRODIE D, GRUJIC N, J. Heart rate variability before and after cycle exercise in relation to different body positions. Journal of Sports Science and Medicine, 9 (2010) 176. –

#### Book

5. FRANCE RC, Introduction to sports medicine and athletic training (Thomson Delmar Learning, Clifton Park, 2004). -

#### **Book chapter**

11. Stotlar DK, Facility management. In: Parks JB, Zanger BK (Eds) Sport and fitness management: career strategies and professional content (Human Kinetics Books, Champaign, 1990). –

#### **Congress report**

13. POPOVIC S, RADOVANOVIC R, Primary school pupils' views on extra-curricular Sport and recreational activities. In: Proceedings (Theoretical, methodology and methodical aspects of physical education, Faculty of Sport and Physical Education, Belgrade, 2008). -

#### M.S., PhD Thesis, etc.

16. Pyun DY, The proposed model of attitude toward advertising through sport. PhD Thesis. In Engl. (The Florida State University, Tallahassee, 2006). -

#### **Reference to an internet source**

17. HABIBZADEH N, The effect of short-term weight-bearing exercise on bone mass density in obese and thin young girls, Sport scientific and practical aspects, accessed 2.1.2011. Available from: URL: www.sportspa.com.ba/html/ dec2010/rad2.html. -

**Personal communication** - avoid citing a "personal communication" unless it provides essential information not available from a public source, in which **case the name of the person and date of communication** should be cited in parentheses in the text. For scientific articles, authors should obtain written permission and confirmation of accuracy from the source of a personal communication.

#### **Example for the reference list:**

(please note how references are separated with a dash and NOT a line break)

#### REFERENCES

1. Pyun DY, The proposed model of attitude toward advertising through sport. PhD Thesis. In Engl. (The Florida State University, Tallahassee, 2006). – 2. HABIBZADEH N, The effect of short-term weight-bearing exercise on bone mass density in obese and thin young girls, Sport scientific and practical aspects, accessed 2.1.2011. Available from: URL: www.sportspa.com.ba/html/dec2010/rad2.html. – 3. POPOVIC S, RADOVANOVIC R, Primary school pupils' views on extra-curricular Sport and recreational activities. In: Proceedings (Theoretical, methodology and methodical aspects of physical education, Faculty of Sport and Physical Education, Belgrade, 2008). – 4. Stotlar DK, Facility management. In: Parks JB, Zanger BK (Eds) Sport and fitness management: career strategies and professional content (Human Kinetics Books, Champaign, 1990). – 5. FRANCE RC, Introduction to sports medicine and athletic training (Thomson Delmar Learning, Clifton Park, 2004). 6. BARAK O, JAKOVLJEVIC DJ, POPADIC-GACESA J, OVCIN Z, BRODIE D, GRUJIC N, J. Heart rate variability before and after cycle exercise in relation to different body positions. *Journal of Sports Science and Medicine*, 9 (2010) 176. –

#### Additional comments and examples:

#### Initials of authors' names should NOT be followed by a full stop:

BARAK O, JAKOVLJEVIC DJ, POPADIC-GACESA J, OVCIN Z, BRODIE D, GRUJIC N, J. Heart rate variability before and after cycle exercise in relation to different body positions. *Journal of Sports Science and Medicine*, 9 (2010) 176.

#### but not:

BARAK, O., JAKOVLJEVIC, DJ., POPADIC-GACESA, J., OVCIN, Z., BRODIE, D., GRUJIC, N. Heart rate variability before and after cycle exercise in relation to different body positions. *Journal of Sports Science and Medicine*, 9 (2010), 176.

#### Initials of authors' first and middle names should NOT be separated with a space:

Pyun DY, The proposed model of attitude toward advertising through sport. PhD Thesis. In Engl. (The Florida State University, Tallahassee, 2006).

#### but not:

Pyun D Y, The proposed model of attitude toward advertising through sport. PhD Thesis. In Engl. (The Florida State University, Tallahassee, 2006).

#### There should be a comma after a journal name:

BARAK O, JAKOVLJEVIC DJ, POPADIC-GACESA J, OVCIN Z, BRODIE D, GRUJIC N, J. Heart rate variability before and after cycle exercise in relation to different body positions. *Journal of Sports Science and Medicine*, 9 (2010) 176.

#### but not:

BARAK O, JAKOVLJEVIC DJ, POPADIC-GACESA J, OVCIN Z, BRODIE D, GRUJIC N, J. Heart rate variability before and after cycle exercise in relation to different body positions. *Journal of Sports Science and Medicine* 9 (2010) 176.

#### All parts of authors' names should be written in uppercase:

BARAK O, JAKOVLJEVIC DJ, POPADIC-GACESA J, OVCIN Z, BRODIE D, GRUJIC N, J. Heart rate variability before and after cycle exercise in relation to different body positions. *Journal of Sports Science and Medicine*, 9 (2010) 176.

#### but not:

Barak O, Jakovljevic DJ, Popadic-Gacesa J, Ovcin Z, Brodie D, Grujic N, J. Heart rate variability before and after cycle exercise in relation to different body positions. *Journal of Sports Science and Medicine*, 9 (2010) 176.

There should be a space after a reference number and before the first author's surname.

When citing journal articles, ONLY the first page of the article in the journal should be given.

#### 1.11.2. Reference citation

References should be numbered in the order in which they appear in the text. **Number** of the reference should be written in **superscript** after the text **without spacing and without brackets**. If the reference number is at the end of a line/sentence, put full stop **after** the reference. More than two references are not to be spaced. If more than two consecutive references are encountered, please separate them with a **dash**.

#### **Examples for references in the text:**

....learn places of body parts are among the topics that spatial memory covers<sup>4,9</sup>....

....bandwidth KR feedback on movement performance in retention<sup>18-21</sup>. Therefore.....

...among young football player in Montenegro<sup>2,8-11</sup>.

There should be no space between numbers in superscript: SHOULD BE: .....of each person<sup>11</sup>. They have...... NOT: ......of each person.<sup>11</sup> They have......

#### **1.12.** Corresponding author's address

Corresponding author's name with **full postal address in English** and, if possible, **e-mail** address should be placed, *in italics*, at the end of the manuscript between reference list and abstract in Montenegrin. It is preferred that submitted **address is institutional** and not private.

Author's name should include only initials of the first and middle names separated by a full stop (and a space) and the full surname. Postal address should be written in the following line in sentence case. Parts of the address should be separated by a comma instead of a line break.

#### **Example:**

J. Petkovic

University of Montenegro, Faculty for Sport and Physical Education, Narodne omladine bb, 84000 Niksic, Podgorica

#### e-mail: jpetkovic@ac.me

#### 1.13. Corresponding author's e-mail

E-mail (if possible) should be placed in the line following the postal address.

Author should clearly state weather or not his e-mail should be published.

#### **1.14. Title in Montenegrin (only for Montenegrin authors)**

Title in Montenegrin, together with an abstract in Montenegrin should be placed on a separate page following the author's address and e-mail.

Title in Montenegrin should be written in bold capital letters.

#### **1.15. Abstract in Montenegrin (only for Montenegrin authors)**

Only Montenegrin authors should provide the **title of the paper** and **abstract** in the Montenegrin language, which must correspond to the title and abstract in English. They should be placed at the end of the manuscript, after the author's corresponding address.

There should be no subtitles in Montenegrin abstract (Aim, Results etc.). Abstract in Montenegrin just as in English should be written as in one paragraph.

Montenegrin authors should check the language and do the spell-check for Montenegrin.

Key words in Montenegrin are not needed.

#### Example:

#### RAZLIKE U MORFOLOSKOM STATUS MLADIH FUDBALERA I NESPORTISTA

#### SAŽETAK

Prikazani su rezultati.....

#### 1.16. Tables

All tables should be included in the main manuscript file, each on a separate page right after the abstract in Montenegrin. Number tables consecutively in the order of their first citation in the text and supply a brief title for each.

Tables and table headings should be completely intelligible without reference to the text. Give each column a short or abbreviated heading. Authors should place explanatory matter in footnotes, not in the heading. All abbreviations appearing in a table and not considered standard MUST be explained in a footnote of that table (see **Abbreviations**).

Tables should be presented as standard MS Word tables, NOT as pictures or other graphic material. Do not use simple text editing to create a table, but the table option instead. If you are not familiar with using MS Word please find a colleague to help you.

All text appearing in tables should be written beginning only with first letter of the first word in caps (only the initial word of all text should be capitalized), i.e. all words for variable names, column headings etc. in tables should start with the first letter in caps.

Avoid any formatting (bold, italic, underline) in your tables and their headings. Avoid any shading or coloring in your tables. Avoid any border formatting in your tables. Put plain borders, no additional graphic editing is necessary.

Be sure that each table is cited in the text.

If you use data from another published or unpublished source, obtain permission and acknowledge them fully.

The format of tables should not exceed A4. Only exceptionally the format A3 will be accepted.

#### **Example:**

TABLE 5PRESENTATION OF INSTEP FOOTBALL KICKBETWEEN PREFERRED AND NON-PREFERREDLEG IN YOUNG FOOTBALL PLAYER

INTENSITY	STATE	t	р
ΟΡΤ	SR	21	.04
011	SF	22	.03
ΜΑΥ	SR	44	.55
MAA	SF	55	1.22

OPT – optimal intensity, MAX – maximal intensity, SR – resting state, SF – state of fatigue

#### **Example for table citation:**

....exhibit greater variance than three years before (Table 6). Therefore....

#### 1.16.1. Table heading

Table heading should be written above the table, in caps and without a full stop at the end of the heading.

#### **Example:**

TABLE 5PRESENTATION OF INSTEP FOOTBALL KICKBETWEEN PREFERRED AND NON-PREFERREDLEG IN YOUNG FOOTBALL PLAYER

#### 1.16.2. Table footnote

Footnotes should be written below the table.

#### **Examples:**

\*p>0.01, \*\*p>0.05, OPT – optimal intensity, MAX – maximal intensity, SR – resting state, SF – state of fatigue

**SHOULD BE:** OPT – optimal intensity, MAX – maximal intensity **NOT:** OPT = optimal intensity, MAX = maximal intensity

#### 1.16.3. Table citation

In the text, tables should be cited as full words. Some examples are given below:

#### **Examples:**

**SHOULD BE:** Table 1 **NOT:** table 1 (first letter in caps)

SHOULD BE: Table 1 NOT: Table 1. (no full stop) **SHOULD BE:** ...(p<0.05, Table 1). **NOT:** ...(p<0.05). (Table 1)

SHOULD BE: ...as shown in Tables 1 and 3. (citing more tables at once)

SHOULD BE: ...result has shown (Tables 1-3) that... (citing more tables at once)

SHOULD BE: ....in our results (Tables 1, 2 and 5)... (citing more tables at once)

#### 1.16.4. Subtables

Use this only if there is no other solution. It is preferred that you brake subtables in two independent tables or merge them into one.

#### **Examples:**

heading for a subtable: TABLE 1a

citation of a subtable: ....(Table 1a)

#### 1.17. Figures

The only figures allowed in the main manuscript file are graphs and other Microsoft Office graphics. All other graphic material (pictures, photographs, drawings etc.) should be submitted separately in digitalized form. When submitting separate figure file s make sure that they are named properly to avoid any loss or confusion (See **Naming files**). On the last separate page of the main manuscript file, authors should place the headings of all the figures submitted separately.

All graphic material should be digitalized first. Avoid sending photographs or similar. All graphic materials should be of sufficient quality for print (300 dpi, or more if necessary).

#### **Important!**

When submitting manuscript for the first time it is not necessary to send very high quality pictures. We are contacting all our reviewers via e-mail so if it is not extremely necessary, please resize your pictures. Complete submission package with all other files should not exceed 2 MB.

Figures should be numbered consecutively according to the order in which they appear in the text. If a figure has been published previously, acknowledge the original source and submit a written permission from the copyright holder to reproduce the material. Permission is required irrespective of authorship or publisher except for documents in the public domain. If photographs of people are used, either the subjects must not be identifiable or their pictures must be accompanied by written permission to use the photograph whenever possible permission for publication should be obtained.

Figures and figure headings should be completely intelligible without reference to the text. All abbreviations appearing in a figure or its heading not considered standard **MUST** be explained in a figure heading (see **Abbreviations**).

The format of figures should not exceed A4. Only exceptionally the format A3 will be accepted.

Avoid using any formatting (bold, underline) in figures or figure headings.

Be sure that each figure is cited in the text.

#### 1.17.1. Graphs

All graphs and other Microsoft Office material should be placed in the main manuscript file each on a separate page and are accompanied by a corresponding figure heading.

All words for variable names should be capitalized.

All abbreviation s are to be explained in the footing of the figure. If you have "Number of...." then put the whole word NOT "No. of.....".

Axis titles in your figures should have no formatting (bold, italic etc.). After the title of the axis there should be a unit of measure in parentheses for example Age (years). While the first letter of the axis title is capitalized, unit of measure is not. Whenever possible, all axis titles should be put below the middle of the axis.

Take care about the **colors** on your graphs. The graphs shall be printed in gray unless otherwise specified in the new submission form and paid for accordingly.

Decimal numbers on your axis should have a decimal full stop, NOT a comma.

#### 1.17.2. Figure heading

Figures should not contain footnotes. All information, including explanations of abbreviations must be present in figure heading. Headings of the figures like graphs and other MS Office material submitted in the main manuscript file should be presented together with their corresponding figures. Headings of the figures submitted separately should be presented on the last separate page of the main manuscript file.

Figure heading should be written bellow the figure, in caps and without a full stop at the end of the heading.

#### **Examples for figure heading:**

FIGURE 1

CHANGES IN ACCURACY OF INSTEP FOOTBALL KICK MEASURED BEFORE AND AFTER FATIGUED. SR – resting state, SF – state of fatigue, \*p>0.01, \*\*p>0.05.

FIGURE 7 *ATTITUDES TOWARD ADVERTISING THROUGH SPORT. X – mean, SD – standard deviation.* 

#### 1.17.3. Figure citation

All graphic material (graphs, pictures, drawings etc.) should be referred to as Figures in the text. Figures are cited in the text as full words.

#### **Examples for figure citation:**

....exhibit greater variance than the year before (Figure 2). Therefore...

**SHOULD BE:** Figure 1 **NOT:** figure 1 (first letter in caps)

**SHOULD BE:** Figure 1 **NOT:** Figure 1. (no full stop)

**SHOULD BE:** ....(p<0.05, Figure 1). **NOT:** ...(p<0.05). (Figure 1)

SHOULD BE: ....as shown in Figures 1 and 3. (citing more figures at once)

SHOULD BE: ...result has shown (Figures 1-3) that... (citing more figures at once)

**SHOULD BE:** ....in our results (Figures 1, 2 and 5)... (citing more figures at once)

#### 1.17.4. Subfigures

If there is a figure divided in several subfigures, each subfigure should be marked with a small letter followed by parenthesis, starting with a), b), c) etc. The letter and parenthesis should be marked for each subfigure in a logical and consistent way.

If a figure consists of several subfigures, all of them should be referred to in the main figure heading (see example).

#### **Example:**

Fig. 1. a) Morphologic characteristics of the..... b) Sources of the.... c) The last segment...

Subfigures should be cited in the text as follows:

#### **Examples:**

**SHOULD BE:** Figure 1c **NOT:** Fig. 1 C

SHOULD BE: ... in Figures 1a and b we can...

SHOULD BE: ...data represent (Figures 1a-d)...

#### 2. Additional requirements

#### 2.1. Language

Language quality is author's responsibility. Therefore authors should let a native speaker or fluent English speaker check their manuscript. There are professional lectors who can help with that. Please make spell and language check before sending back your manuscript or find a competent person to do that. Montenegrin authors should also do spell check for additional summary in the Montenegrin language.

#### 2.2. Numbers, units of measurement, variables and values

In Montenegrin Journal of Sports Science and Medicine all units of measures should conform to the International System of Units (SI).

Decimal places in English language are separated with a full stop and NOT with a comma. Thousands are separated with a comma

Temperatures should be expressed in degrees Celsius. Blood pressures should be expressed in millimeters of mercury, unless other units are specifically required by the journal.

#### **Examples:**

Percentages and degrees: SHOULD BE: 10% NOT: 10 % (NO space in between)

**SHOULD BE:** 10° **NOT:** 10 ° (NO space in between)

All other units of measure: SHOULD BE: 10 kg NOT: 10kg (a space in between)

Ratios: SHOULD BE: 12:2 NOT: 12 : 2 (NO space in between) Decimal numbers: SHOULD BE: 0.056 NOT: .056 (there should be a zero in front of decimal full stop)

SHOULD BE: SD=3.5 NOT: SD = 3.5 (NO space in between)

SHOULD BE: X=45±3.4 NOT: X=45 ± 3.4 (NO space in between)

SHOULD BE:  $45\pm3.4$ NOT:  $45\pm3.4$  (NO space in between)

SHOULD BE: X±SD (use standard abbreviation) NOT: Mean±SD

**SHOULD BE:** p<0.005 **NOT:** p < 0.005 (NO space in between)

**SHOULD BE:** 0.001<P **NOT:** 0.001 < p < 0.005 (NO space in between)

**SHOULD BE:**  $\chi^2$ **NOT:** chi square or X2 or X<sup>2</sup> (use the Greek letter) **SHOULD BE:**  $\chi^2=2345$ **NOT:**  $\chi^2 = 2345$  (no space between)

**SHOULD BE:** p **NOT:** P (not capitalized)

#### 2.3. Abbreviations

Use only standard abbreviations; the use of non-standard abbreviations can be extremely confusing to readers. Avoid abbreviations in the title. The full term for which an abbreviation stands should precede its first use in the text unless it is a standard unit of measurement.

All abbreviations should be explained ONLY the first time they appear in text in the following way:

#### **Example:**

.... following the main sample (MS). Therefore.....

Note that **abstract**, **each figure and table** is considered a separate and independent part of the text and all abbreviations should be also explained there despite the fact that you may have already explained it text. If you have abbreviations that are repeated through tables and figures they should be explained in each figure and in each table (in heading or in footnote).

#### 2.4. Latin names

Latin names of species, families etc. should be written in italics (even in titles). If you mention Latin names in your abstract they should be written in non italic since the rest of the text in abstract is in italic. The first time the name of a species appears in the text both genus and species must be present; later on in the text it is possible to use genus abbreviations.

#### **Example:**

First time appearing: musculus biceps brachii

Abbreviated: *m. biceps brachii* 

#### 3. Naming and submitting files

Name your files according to the family name of the first author (see example). Authors submitting revised versions of the manuscript can use the identification number of their manuscript as provided by the Journal Office.

#### **Example:**

Jordan-form.doc – (submission form) Jordan-manuscript.doc – (main manuscript file) Jordan-fig3.jpg – (Figure 3) Jordan-fig4.tiff – (Figure 4) Authors should submit the files to the e-mail of the Journal Office: **office@mjssm.me** 

If you want to send your main manuscript file in formats other than Microsoft Word, please contact the Journal Office first.

**DO NOT SEND** us hard (paper) copy of your manuscript through regular mail. Those submissions **WILL NOT BE** considered at all. **DO NOT USE FLOPPY DISKS!** 

#### 3.1. NEW manuscript submission

Authors who want to submit a new manuscript to Montenegrin Journal of Sports Science and Medicine should send an e-mail to **office@mjssm.me** with the following files attached:

#### a) Submission form file – filled IMPORTANT!

b) Main manuscript file - with all structural elements, according to guidelines

#### c) Figure file(s) – if needed

It is extremely important that new submission form is provided with all necessary information and that the main manuscript file is organized as specified in the guidelines for authors.

d) Authorship statement form should be filled and signed by ALL coauthors and then send in regular mail to our office.

#### Office will not consider new submissions that do not comply with those requests!

When submitting manuscript for the first time it is not necessary to send very high quality pictures. We are contacting all our reviewers through e-mail so if it is not extremely necessary, please resize your pictures. Complete submission package with all other files should not exceed 2 MB.

For help in preparing the documents for new submission see Checklist NEW.

#### 3.2. REVISED manuscript submission

Authors returning their manuscript after revision or additional corrections should do so by sending an e-mail to **office@mjssm.me** with the following files attached:

a) Response to reviewers' comments – it is extremely important that authors write an letter explaining how each of the revivers' comments was included in the new version of the manuscript
b) Main manuscript file - with all structural elements, according to guidelines
c) Figure file(s) – if needed

#### Incomplete submission will be returned to author for additional correction!

If all your files exceed 2 MB please send us all your files on a CD-ROM. Do not forget to send a short accompanying letter and to properly mark CD.

For help in preparing the documents for revised manuscript submission see Checklist REVISED.

#### 4. Authorization of the final version of the manuscript

After the manuscript has been accepted, authors will receive a PDF version of their manuscript for authorization, as it should look in printed version of the journal. Authors should carefully check for omissions. Reporting errors after this point will not be possible and the Editorial board will not be eligible for them.

Should there be any errors; authors should report them to the Office e-mail address **office@mjssm.me**. If there are not any errors authors should also write a short e-mail stating that they agree with the received version.

#### 5. Costs and payments

Do not make any payments prior to contact with Journal Office.

All payments should be made to:

#### Crnogorska komercijalna banka, Podgorica, Montenegro

If you pay outside Montenegro, the account is IBAN ME2551000000002219012

If you pay inside Montenegro, the account is 510-22190-12

#### 5.1. Fees and Reprints

Authors of the article (altogether not each) are expected to pay the fee of 100 EUR for the publication of the article. The notification for the payment will be sent to the author when the paper is accepted. 10 reprints of the paper as well as one copy of the journal issue will be sent to the specified corresponding address.

#### 5.2. Printing additional pages

The manuscript should not exceed the maximum length of 8 pages as printed in Montenegrin Journal of Sports Science and Medicine, which are roughly 30 A4 pages of double-spaced text. Additional pages are extra charged.

Printing of an additional page in Montenegrin Journal of Sports Science and Medicine is 50 EUR per page as printed in an issue of the journal.

#### 5.3. Printing in color

If your manuscript contains pictures in color note that printing in color is extra charged. The price of printing in color is 50 EUR per page as printed in an issue of the journal.

#### **AUTHORSHIP STATEMENT**

(Fill out the blank fields, in print)

Manuscript title:				
Authors (last name, initials):				
Number of authors				

**ALL AUTHORS MUST SIGN THIS FORM.** The signature will evidence the mutual understanding between the Montenegrin Journal of Sports Science and Medicine and the undersigned authors on the rights and responsibilities of both parties in the process of the manuscript evaluation and its possible publication in the Montenegrin Journal of Sports Science and Medicine.

#### 1. Copyright transfer

The listed authors warrant that they are the authors and sole owners of the submitted manuscript. The authors also warrant that the work is original; that it has not been previously published in print or electronic format and is not under consideration by another publisher or electronic medium; that it has not been previously transferred, assigned, or otherwise encumbered; and that the authors have full power to grant such rights. With respect to the results of this work, the manuscript of this or substantially similar content will not be submitted to any other Montenegrin Journal until the review process in the Montenegrin Journal of Sports Science and Medicine has been officially completed (acceptance or rejection of the manuscript).

The paper will not be withdrawn from the review process by the Montenegrin Journal of Sports Science and Medicine Editorial Board until the review process is completed. The authors will comply with the requests of the Montenegrin Journal of Sports Science and Medicine Editors and reviewers to improve the paper for publication. The eventual disagreements will be submitted in a written form; the authors are aware that the disagreement(s) with the Montenegrin Journal of Sports Science and Medicine's requests may result in the rejection of the manuscript. The authors hereby grant to the Montenegrin Journal of Sports Science and Medicine the right to edit, revise, abridge, and condense the manuscript.

If the manuscript is accepted for publication in the Montenegrin Journal of Sports Science and Medicine, the authors hereby transfer the copyright of the paper to the Montenegrin Journal of Sports Science and Medicine. The authors permit the Montenegrin Journal of Sports Science and Medicine to allow third parties to copy any part of the Montenegrin Journal without asking for permission, provided that the reference to the source is given.

For papers with more than one author: All other co-authors agree to allow the corresponding author to make decisions regarding prepublication release of the information in the paper to the media, government agencies, or both.

#### 2. Financial disclosure

(Please check **ONLY ONE** appropriate box below.)

- U We have no relevant financial interests in this manuscript
- U We certify that all financial and material support for this research and work are clearly identified in the manuscript
- We certify that all our affiliations with or financial involvement (e.g. employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, royalties) with any organization or entity with a financial interest in or financial conflict with the subject or materials discussed in the manuscript are **disclosed completely here**:

(Use a separate sheet of paper if necessary)

#### 3. Ethical standards

(Check **ONLY** if the submitted manuscript reports the experiments on human subjects and animals.)

- □ Authors confirm that the procedures followed in the manuscript were in accordance with the ethical standards of the responsible institution in the community or organization that scientists work in.
- □ (If not, specify why in the following box)

#### 4. Permissions

(Please check **ONLY ONE** appropriate box below.)

- **D** Publishing the contents of the submitted manuscript does not require any special permission.
- Authors certify that copies of all permissions to reproduce published material, to use illustrations or report information about identifiable people, or to name people for their contributions are submitted along with the manuscript.
   (Please list them on a separate sheet of paper)

#### AUTHORS

By signing, all authors confirm the agreement with the contents of the previous (first) page of the Authorship statement (of the Montenegrin Journal of Sports Science and Medicine) and that the information they provided on these pages is true.

(Authors should be listed in the exact order as appearing on the title page of the manuscript. Feel free to copy and add more tables for additional authors if needed, likewise delete the excess if not used. ALL AUTHORS MUST SIGN THIS FORM).

When signed please return to: Crnogorska sportska akademija, Montenegrin Journal of Sports Science and Medicine, Dzordza Vasingtona 445, 81000 Podgorica, Montenegro.

No.	Name	Date and signature:
1	Institutional address	
	Email	
	Corresponding author (YES/NO)	

No.	Name	Date and signature:
	Institutional address	
2	Email	
	Corresponding author (YES/NO)	

No.	Name	Date and signature:
	Institutional address	
3	Email	
	Corresponding author (YES/NO)	

No.	Name	Date and signature:
	Institutional address	
4	Email	
	Corresponding author (YES/NO)	

No.	Name	Date and signature:
	Institutional address	
5	Email	
	Corresponding author (YES/NO)	

## **NEW SUBMISSION FORM**

(Fill out the blank fields, in print and send on email: office@mjssm.me together with other files of submitting manuscript)

#### 1. Manuscript title:

#### 2. List all authors in order of appearance on the title page:

(Family name, initials)

#### 3. Publication type:

(*Please suggest the type of your publication:* original scientific paper, review, short communication, professional paper, case report, *etc.*)

#### 4. Printing in color:

Do you want your figures to be printed in color? (yes/no)

(Only if your manuscript contains figures in color. Note that printing in color is extra charged. Check guidelines or contact Journal Office.)

#### 5. Numbers:

Number of <b>authors</b> :	
Number of <b>tables</b> :	
Number of <b>figures</b> :	
Number of <b>figures</b> submitted	
separately:	
Total number of <b>FILES</b> submitted	
(including submission form):	

#### 6. Re-submission:

Are you submitting an improved version of manuscript that was previously submitted to Montenegrin Journal of Sports Science and Medicine and for which you obtained negative (reject) answer? (yes/no)			
If yes, please provide us the Identification Number of the			
manuscript while under peer-review procedure or the date of your			
last communication with Montenegrin Journal of Sports Science			
and Medicine office			

#### 7. Potential reviewers:

To facilitate the whole process of peer review but to still keep it anonymous and unbiased we would like to ask to suggest a minimum of 5 possible reviewers for your paper that we could contact. Out of this five we will then choose a few to whom we will send your manuscript. **DO NOT CONTACT POTENTIAL REVIEWRS YOURSELF, JUST PROVIDE US THEIR** CONTACTS (EMAILS) AND WE WILL CONTACT THEM. When suggesting a reviewer please keep in mind that they should be **recognized** scientists in the field of study that your paper is dealing with as well as the fact that they should be scientist primarily working on renowned institutions **outside** of Montenegro. Possible reviewers should not be colleagues or collaborators form author's institution. Suggestions for possible reviewers should include scientists from **different countries** and institutions of the world, therefore please avoid sending us suggestions where all suggested reviewers are from one, usually author's country. Our intention is to shorten the peer review process but also to retain objectivity and quality of anonymous peer review. Beside name and affiliation please provide us also with reviewer's address and <u>EMAIL</u>. Email of a reviewer will greatly reduce the time of the peer review and therefore speed up the whole process toward publishing your paper.

#	TITLE	FAMILY NAME	FIRST AND MIDDLE NAME(S) (only initials)	AFFILIATION / ADDRESS	EMAIL(s)
1.					
2.					
3.					
4.					
5.					

#### 8. Corresponding author:

NAME			ADRESS			
Family	First	Initial of middle	(as it should appear on the envelope)	PHONE/ FAX	EMAIL	

#### 9. Billing address

Please provide us with a private or institutional address to which an invoice shall be sent when paper is accepted for publication (*see costs and fees in the Guidelines*). Please provide all necessary data that need to be present on the invoice.

# For Montenegrin authors: U slučaju da želite da se račun pošalje na instituciju <u>OBAVEZNO</u> navedite i <u>MATIČNI BROJ</u> institucije. Ime institucije obavezno navesti na <u>CRNOGORSKOM JEZIKU</u>.

NAME	ADDRESS	VAT No.	ADDITIONAL REMARKS
(private or		(MATIČNI BROJ)	(additional information if needed
institutional)		(if needed)	to be present on the invoice)

#### **10. Other authors:**

		NAME			ADRESS	PHONE /	,	
#	TITLE	Family	First	Initial of middle	(as should appear on the envelope)	FAX	EMAIL	
1								
2								
3								
4								



### Friday, 5. 04. 2013 <u>From 16,00 to 16,45 h</u> <u>OPENING CEREMONY</u> <u>From 16,45 to 17,00 h Coffee break</u>

#### PLENARY LECTURES

Friday, 5. 04. 2013 Congress Hall - 1 on the ground floor <u>From 17,00 to 18,45 h</u> Moderator: Stevo POPOVIĆ, PhD

- 1. Pavel Opavsky (Montenegrin Sports Academy, Podgorica): "Executive Managenent Team in Sport".
- 2. Monèm Jemni (School of Science, University of Greenwich, London Great Britain): "The Science behind the Champions... Pushing the human boundaries".
- 3. Mustafa Levent Ince (Middle East Technical University, Ankara Turkey): "Professional development of coaches and teachers: trends and challenges".
- 4. Dragan Milanović, Dinko Vuleta, Sanja Tomašević (Faculty of Kinesiology, University of Zagreb): "Differences of physical fitness among female handball players in cadet and senior level of competition".
- 5. Milan Čoh, Milan Žvan, Stojan Burnik (Faculty of Sport, University of Ljubljana Slovenija): "Biomonitoring of elastic strength in elite triple jumpers".

#### **CURRENT TOPICS - A**

Friday, 5. 04. 2013 Congress Hall - 1 on the ground floor <u>From 9,00 to 12,30 h</u> Moderator: Prof. Pavel OPAVSKY, PhD

- 1. Dejan Gojković (Faculty of Physical Education and Sport, Pale, Republic of Srpska Bosnia and Herzegovina, Zoran Milinković (Elementary school: "Petar Petrović Njegoš", Teslić, Republic of Srpska Bosnia and Herzegovina): "Incidence of scoliosis deformities and flat feet among the third, fifth and seventh grade students of the elementary school".
- 2. Grujo Bjeković, Nenad Lalić, Đorđe Arnaut (University in the eastern Sarajevo); "Comparative analysis of physical activity and sedentary spending of time of the female classroom teaching students at the Faculty of Philosophy in relation to the present physical and psychological problems and knowlege of using the valuable contents of personal physical education".
- 3. Omer Špirtović, Danilo Aćimović (State University of Novi Pazar, Department of Biomedical Science; the study program of Sport and Physical Education): "Analysis of the motor abilities of football players with different ranges of competitions".
- 4. Veselin Jovović (Faculty of Sport and Physical Education, Nikšić University of Montenegro): "Kinematic analysis and schematic representation of the curve of the extended sprint speed of older juniors".
- 5. Enver Tahiraj (PhD student at the Faculty of Kinesiology in Zagreb), Nenad Borković, Besim Aliti (Student of integrated undergraduate and graduate studies at the Faculty of Kinesiology in Zagreb), Hazir Salihu (Student at the Faculty of Sport Science, Pristina), Fitim Arifi (Department of Sport, Pristina), Bahri Gjinovci (Faculty of Sport Science, Priština): "Sport recreation and professional sport".
- 6. Emilija Petković (Faculty of Sport and Physical Education, University of Nis): "The differences in the biomechanical properties of the knee extensor at the moment of the bouncing from substrate of different elasticity".
- 7. Zoran Đokić, Bojan Međedović (Faculty of Sport and Tourism, Novi Sad): "Application of EMS in the development of explosive strength".
- 8. Jovan Gardašević, Duško Bjelica (Faculty of Sport and Physical Education, Nikšić University of Montenegro): "The effects of the six-week training programmed work on the transformation of the flexibility of football players who are at the cadet level".
- 9. Yuriy Briskin, Marjan Pityn, Olha Zadorozhna (Lviv State University of Physical Culture): "Game model of formation of theoretical preparedness in fencing".
- **10. Stevo Popović, Duško Bjelica**, (Faculty of Sport and Physical Education, Nikšić-University of Montenegro): *"The relationship of sport and national identity in Montenegro".*
- 11. Elvira Beganović, Milica Bešović (Faculty of Pedagogy, Sarajevo): "The incidence of flat foot among younger students in the city of Sarajevo".
- 12. Constantin Pehoiu (Valahia University of Targoviste Romania): "Stretching type exercises and their role in the training of junior athletes".
- 13. Peko Vujović, Vukan Vujović, Vasilije Vujović (Novi Sad): "Comparative analysis of quantitative and qualitative indicators of the stage attacks on the FIFA World Cup in Germany in 2006 and South Africa in 2010".
- 14. Danijela Kuna, (High school "Kupres"), Boris Maleš (Faculty of Kinesiology Split), Ivica Franjko (Croatian Skiing Association, Croatian choir teachers and coachs skiing): "*Methodical model for teaching basic ski turn*".

Saturday, 6. 04. 2013 Congress Hall - 1 on the ground floor <u>From 9,30 to 13,30 h</u> Moderator: Prof. Pavel OPAVSKY, PhD

 Georgi Georgiev, Vujica Živković (Faculty of Physical Education, "Ss Cyril and Methodius" University, Skopje, Macedonia), Viktor Mitrevski (Business Academy Smilevski, Bitola, Macedonia): "Frequency of movement of pupils through longitudinal observation".

- Branimir Mikić (Faculty of Physical Education and Sports, Tuzla), Sakib Kurtović (independent researcher), Natalija Kurtović (Faculty of Education Bihac) Vahid Dedić (Elementary School "Šerići" Živinice): "Effects of partial quantitative changes in the dynamic power and static power of athletes aged 15-16".
- 3. Goran Dimitrić, Nebojša Čokorilo, Miroslav Petrović, Milica Bogdanovski (Faculty of Sport and Physical Education, Novi Sad), Igor Glavičić (University Department of Marine Studies, University of Split): "The reaction rate of swimmers at the start in the 50 m freestyle discipline".
- 4. Dragan Koković, Jelica Petrović; Dušan Ristić (Faculty of Philosophy, University of Novi Sad): "Social capital as a factor in sporting achievements".
- 5. Bogdan Tomić (Sports Academy, Belgrade), Miroslav Smajić, Dejan Madić, Borislav Obradović, Slavko Molnar (Faculty of Sport and Physical Education, Novi Sad), Miroslav Radoman (Faculty of Sport and Tourism, Novi Sad): "The differences between the 'ideal teams' of two generations of players in motor skills".
- 6. Krassimir Petkov (Bulgarian National Sports Academy, Head of department "Weightlifting, boxing, fencing and sport for all"), Valentine Panayotov (Bulgarian National Sports Academy, Department "Weightlifting, boxing, fencing and sport for all"): "Evaluating the representation of the different world states on International foil men contests, based on objective criterions".
- 7. Selim Alili (Tetovo, Macedonia): "Techniques and methodology of training in crawl swimming".
- 8. Slobodan Andrašić (University of Novi Sad, Faculty of Economics), Milan Cvetković, Damjan Jakšić, Dejan Orlić, Radenko Matić (University of Novi Sad, Faculty of Sport and Physical Education): "The structure of load of young soccer players during the game, determined on the basis of heart rate".
- 9. Petya Kutincheva (National Sports Academy Sofia): "Algorithmic training program for swimming I-IV class in the Bulgarian school".
- Bujar Turjaka, Aziz Dujaka (Prishtina University, Faculty of Physical Education and Sport), Žarko Kostovski (Faculty of Physical Education, "Ss Cyril and Methodius" University, Skopje, Macedonia), Visar Ganiu, Shpresa Memishi (State University in Tetovo, Faculty for Physical culture, Tetovo, Macedonia): "Situastional biomechanical parameters at slalom carving skis in top level skipers".
- 11. Goran Vučković, Raša Dimitrijević (Criminal Police Academy, Belgrade, Serbia): "Discriminative model of certain motor parameters of soccer players as selection criteria for position in the team".
- 12. Lulzim Ibri (Department of Sport at the Municipality of Prizren), Sulejman Šalja (Faculty of Physical Education and Sport in Pristina): "Predictive values of anthropometric characteristics on running short distances in young sportsmen".
- **13. Orlin Groshev**, **Pavel Yordanov**, **Aleksandar Tazov**, **Vihren Bachev**, (National Sports Academy "Vasil Levski"): "Methodology, metrology assurance and standards for measuring static strenght of human".
- 14. Francesco Perrotta, Angelo Pannelli (University of Macerata, Italy-Faculty of Education): "The educator, sports past and present".
- 15. Dobrislav Vujović, Rašid Hadžić (Faculty of Sport and Physical Education, Nikšić-University of Montenegro), Aleksandar Vujović (Faculty of Philosophy, Nikšić): "The effects of High-low aerobics program on the morphological features of female secondary school students".
- **16.** Abdulla Elezi, Hasim Rushiti (Faculty of Sport Sciences Priština), Arben Osmani (AAB University Priština): "*Relationship lean and fat body composition in women with deformities leg x*".
- 17. Gëzim Hazrolli (Shooting Sports Federation of Kosovo Pristina), Abdulla Elezi (Faculty of Sport Priština): *"The influence of certain motor and conative parameters in shooting ".*

#### **CURRENT TOPICS - B**

Friday, 5. 04. 2013 Small room no. 2 - First floor <u>From 9,30 to 12,30 h</u> Moderator: Prof. Georgi GEORGIEV, PhD

- 1. Veroljub Stanković, Dragan Popović (Faculty of Sport and Physical Education in Leposavic, University of Pristina, Serbia): "Canonical discriminative analysis and its effects in determining differences in motor skills of adolescents".
- 2. Iconomou Charalabos (Technological Educational Institution of Serres, Department of Physical Activity, Greece), Ioanidis Theodoros, Lazaridis Savvas, Kokkinakis Michail, Papadopoulos Konstantinos (Laboratory of Coaching and Sport Performance, Department of Physical Education and Sports Sciences, Aristotle University of Thessaloniki, Greece): "Handgrip dynamometry of Greek healthy university students".

- **3.** Mirsad Ademović (Gymnasium "May 25" Tuzi Faculty of teacher education in the Albanian language Podgorica University of Montenegro): "The transformation of the morphological characteristics under the influence of programmed work of the students of the age of sixteen".
- 4. Lulzim Ibri (Department of Sport, Prizren Municipality): "Canonical correlation of morphological characteristics and motor abilities of young judo athletes".
- 5. Dragan Toskić, Ljubiša Lilić (Faculty of Sport and Physical Education in Leposavić, University of Priština, Serbia), Lazar Toskić (Student of Master studies at the Faculty of Sport and Physical Education, University of Belgrade, Serbia): "The interconnections between morphological characteristics and motor abilities of young water polo players".
- 6. Bećir Šabotić (Montenegrin Sports Academy): "Canonical relations between the basic-motor and situationalmotor abilities in sports games".
- 7. Zulfo Aruković, Salko Huskic, Midhat Mekić (Faultet of Sport and Physical Education, Sarajevo): "Canonical relations morphologic features, motor abilities and tests with sitacioni basketball players aged 12-14 years".
- 8. Milan Matić (Faculty of Sport and Physical Education, Belgrade Serbia), Srđan Jovović (Paraolympic Committee of Serbia): "The development and speed power impact on the progression of the results of visually impaired javelin throwers".
- 9. Katarina Herodek, Emilija Petković (Faculty of Sport and Physical Education, University of Nis), Miljana Jovanović (Faculty of Sport and Physical Education, University of Nis, student of Master studies): "Relations between conative characteristics and success in gymnastics".
- 10. Ćamil Elmazi (Tetovo Macedonia): "Influence of anthropometric measures on specific motor test for football players".
- Artan R. Kryeziu (Lower Secondary School "Pjeter Bogdani" Priština, Kosovo & Association of teachers of physical education and school sport, Priština), Zenel Metaj (AAB University Faculty of Kinesiology Priština), Jeton Rexhepi (The Elementary School "Abdulla Krashnica", Miratoc Presheva): "The influence of basic skills in some tests of the precision of young bascetball players".
- 12. Indira Jašarević, Dževad Džibrić (Faculty of Physical Education and Sports, University in Tuzla): "The significance level of the difference in the acquisition of the subject matter among students aged 11 to 14 years".
- **13. Dževad Džibrić, Indira Jašarević** (Faculty of Physical Education and Sports of the University of Tuzla): "Quantitative differences in certain anthropological dimensions of students that are caused by extra-curricular activities".
- 14. Branislav Radulović (Faculty of Sport and Physical Education, Nikšić): "Physical development and physical abilities of the fourteen years old students in Montenegro in relation to their peers from European countries".
- **15. Branislav Radulović** (Faculty of Sport and Physical Education, Nikšić): "Monitoring the effect of the dance program as a chosen sport activity in physical education curriculum on the transformation of motor abilities of students".
- 16. Zoran Grgantov (Kinesiology Faculty Split): "The importance of longitudinal dimensionality of the skeleton, explosive power and agility in distinguishing young female volleyball players of different situational efficiency".

Saturday, 6. 04. 2013 Small room no. 2 - First floor <u>From 9,30 to 13,30 h</u> Moderator: Assistant professor Rašid HADŽIĆ

- 1. Viktor Mitrevski (Business Academy Smilevski, Bitola, Macedonia), Georgi Georgiev, Vujica Živković (Faculty of Physical Education, "Ss Cyril and Methodius" University, Skopje, Macedonia): "Relation of body mass index (BMI) with the achievements and performance of motor skills of students".
- 2. Zlatko Zlatev (Technical University of Varna): "A longitudinal study of some anthropometrical and physiometric indicators of students at marine engineering specialities".
- 3. Dragan Martinović, Vladan Pelemiš, Dragan Branković, Vladimir Živanović (Belgrade Faculty of Teacher Education): "Relation of morphological characteristics with factor for the duration of excitation of motor units of preschool children".
- 4. Valter Vuleta (Handball club Metalurg Skopje), Dinko Vuleta (Faculty of Kinesiology, University of Zagreb), Lidija Bojić – Ćaćić (Croatian Handball Association): "The differences in the indicators of situational efficiency of gollkeepers of the victorious and the defeated teams at the World Handball Championships of Juniors in Korea".

- 5. Katarina Ohnjec (Faculty of Kinesiology, University of Zagreb): "Structure of the outcome and ending of the attacks on women's European Handball Championship in 2010".
- 6. Vladimir Milošević, Adam Petrović (Faculty of Sport and Physical Education, Belgrade, Serbia): "Testing the motor abilities of children aged 4-5 years in the sport Hopscotch "Sportomanija" (Belgrade)".
- 7. Vladimir Milošević (Faculty of Sport and Physical Education, Belgrade, Serbia): "Relativized assessment of motor abilities of students of the 7th grade in physical education lesson".
- 8. Mila Vukadinović, Jelena Obradović, Milan Pantović, Maja Batez, (Faculty of Sport and Physical Education, Novi Sad): "Differences in the mobility status of children of different sex in the school of volleyball".
- Jadranka Kocić, Slađana Milošević (Faculty of Sport and Physical Education Leposavic, University of Prishtina

   Kosovska Mitrovica): "Differences in the level of basic and specific motor abilities of girls 9 years of age treated with elements of rhythmic gymnastics".
- 10. Milomir Trivun, Jovica Tošić (Faculty of Physical Education and Sport at the University of East Sarajevo), Goran Grahovac (Faculty of Physical Education and Sport at the University of Banja Luka): "The result of the success of trudgen finalists at 100 feet, at an international meeting in 2011".
- 11. Sladana Milošević, Jadranka Kocić (Faculty of Sport and Physical Education Leposavic, University of Prishtina Kosovska Mitrovica): "Differences in the level of basic and specific motor abilities of boys aged 9 years treated with elements of rhythmic gymnastics".
- 12. Momčilo Pelemiš, Nebojša Mitrović (Faculty of Pedagogy, Bijeljina, Bosnia and Herzegovina), Vladan Pelemiš (Faculty of Teacher Education, Belgrade, Serbia), Jovo Rankić (Faculty of Physical Education and Sports, East Sarajevo, Bosnia and Herzegovina): "The differences between motoric space of children in urban and rural areas caused by fragmentation of the morphological characteristics".
- **13.** Vidran Kljajević (Secondary vocational school, Bijelo Polje): "The influence of election programs of volleyball and basketball on the transformation of students' bio-motor abilies".
- 14. Kenan Asani (HSCS "8th September", Skopje, Macedonia): "Intergroup multivariate and univariate differences in the study of anthropometry space between the respondents of junior and senior members of the Macedonian karate team".
- **15. Kenan Asani** (HSCS "8th September", Skopje, Macedonia), **Vujica Živković** (Faculty of Physical Education, "Ss Cyril and Methodius" University, Skopje, Macedonia): "Intergroup multivariate and univariate differences in the investigated specific motor behavior between the respondents of junior and senior members of the Macedonian karate team".
- 16. Dragana Aleksić (Faculty of Sport and Physical Education Leposavic, University of Pristina, Serbia Kosovo & Metohia), Slađana Stanković (Pedagogical Faculty in Jagodina, University of Kragujevac, Serbia), Vesko Milenković, Ljubiša Lilić (Faculty of Sport and Physical Education Leposavic, University of Pristina, Serbia Kosovo & Metohia): "The effect of applying rhythmic gymnastics elements on the speed development among girls aged 9 and 10 years".
- 17. Dragana Aleksić (Faculty of Sport and Physical Education Leposavic, University of Pristina, Serbia Kosovo & Metohia), Slađana Stanković (Pedagogical Faculty in Jagodina, University of Kragujevac, Serbia), Vesko Milenković (Faculty of Sport and Physical Education Leposavic, University of Pristina, Serbia Kosovo & Metohia): "The effects of applying rhythmic gymnastics elements in teaching physical education on the development of the balance of female pupils".
- 18. Ratko Pavlović (Faculty of Physical Education and Sport at the University of East Sarajevo), Aleksandar Raković (Faculty of Sport and Physical Education, University of Nis): "Morphological status of female athletes finalists in jumping disciplines at the Olympic Games in Beijing".
- **19. Danilo Bojanić** (Faculty of Sport and Physical Education, Nikšić, University of Montenegro): "Motivation as a factor in the realisation of complex movement structures among 9-11 years old schoolgirs".

#### **GENERAL ISSUES**

Friday, 5. 04. 2013 Ceremonial hall no. 3 – First floor <u>From 9,30 to 12,30 h</u> Moderator: Prof. Spasoje BJELICA, PhD

1. Milica Bešović, Elvira Beganović (Faculty of Pedagogy, University of Sarajevo), Helena Bešović (The University of Missouri): "Comparison of the outcomes of the effects of unequal residential status on psychomotor skills of female adolescents".

- 2. Danilo Aćimović, Omer Špirtović (State University of Novi Pazar, Department of Biomedical Science; the study program of Sport and Physical Education), Aleksandar Joksimović (Faculty of Sport and Physical Education, University of Nis): "Sport marketing as a business function in contemporary sport".
- **3.** Milan Matić (Faculty of Sport and Physical Education, Belgrade Serbia), Srđan Jovović (Paraolympic Committee of Serbia): "The methodology of the technical preparations of visually impaired javelin throwers".
- 4. Jelena Ilić (The Republic Institute for Sport, Belgrade), Dragoljub Višnjić (Faculty of Sport and Physical Education, Belgrade): "Preferences of parents of the elementary school students for the introduction of electoral sports in physical education classes".
- 5. Danilo Radanović, Valdemar Štajer, Boris Popović, Dejan Madić (Faculty of Sport and Physical Education, Novi Sad): "Differences between boys and girls aged 11-12 years in the success of the adoption of gymnastic exercises".
- 6. Petar Kojić (Elementary School: "Svetozar Miletić", Titel), Radovan Čokorilo (Faculty of Sport and Physical Education, Novi Sad): "The opinion of sportsmen about the necessity for the realisation of the psychological preparation of the sportsmen in football clubs of Vojvodina".
- 7. Radovan Čokorilo, prof. Zoran Milošević (Faculty of Sport and Physical Education, Novi Sad): "The ethics of leadership in sports management".
- Besim Aliti, Nenad Borković (Students of integrated undergraduate and graduate studies at the Faculty of Kinesiology in Zagreb – DRITE – Association of physical education students in scientific and professional work), Enver Tahiraj (PhD student at the Faculty of Kinesiology in Zagreb), Abedin Bahtiri (Faculty of Sport Science, Priština), Admira Koničanin (University of Novi Pazar), Fadil Luta (Koleg Univers, Priština): "Strategic documents in sport in the EU".
- 9. Zoran Đokić (Faculty of Sport and Tourism, Novi Sad): "Sportsmen rehabilitation program after ACL injury ".
- 10. Constantin Pehoiu ("Valahia" University of Târgoviște, Dâmbovița County, Romania), Dumitru-Niculae Cristea (Valahia University of Targoviste Romania): "Case study on initiation in athletic throws".
- 11. Gica Pehoiu (Department of Geography, Valahia University of Targoviste Romania, Târgoviște, jud. Dâmbovița, România), Constantin Pehoiu (Valahia University of Targoviste – Romania), Ciprian Prisăcaru (manager, Sportive Club Târgoviște – Romania): "Leisure Activities and Outdoor Training Programs on the Formation of a Healthy Lifestyle and on the Socialization of the Population from the Romanian Rural Area".
- 12. Vukan Vujović, Peko Vujović, Marijana Tišma (Faculty of Sport and Tourism, University of Educons, Novi Sad): "Modern sport and tourism as two mutually stimulating and complementary areas".
- 13. Nebojša Čokorilo, Milena Mikalački, Darinka Korovljev, Goran Dimitrić, (University of Novi Sad, Faculty of Sport and Physical Education, Novi Sad): "The differences in the effects of Nordic walking and walking on the morphological characteristics of women".
- 14. Goran Dimitrić, Maja Batez, Milica Bogdanovski, Miroslav Petrović (Faculty of Sport and Physical Education, Novi Sad), Igor Glavičić (University Department of Marine Studies, University of Split): "Influence of swimming techniques on the result in the 200 meters mixed".
- 15. Marta Bon, Mojca Doupona Topič (University of Ljubljana, Faculty of Sport): "Attitude of handball coaches towards conflict situations".
- **16. Dragan Martinović, Dragan Branković, Vladan Pelemiš, Vladimir Živanović** (Belgrade Faculty of Teacher Education): "*Parents' attitudes toward outdoor activițies*".
- 17. Dragan Martinović, Dragan Branković, Vladimir Živanović (Belgrade Faculty of Teacher Education): "A general view of the historical development of physical culture and physical education".
- 18. Tomaž Pavlin, Milan Žvan (University of Ljubljana, Faculty of Sport): "Formation of PE study and profesional school in Slovenia, nowaday Faculty of Sport".
- Osman Lačić (Faculty of Physical Education and Sports, University of Tuzla), Danilo Bojanić (Faculty of Sport and Physical Educaton, Niksic), Miloš Ilić (Independent researcher, Niksic, Montenegro): "Classification of schoolgirls grade of V and VI on the basis of morphologic features".
- **20. Dragan Milanović, Dinko Vuleta** (Faculty of Kinesiology, University of Zagreb), **Dean Kontić** (Water polo Club "South", Dubrovnik): "Correlation between morphological dimensions of waterpolo players with the indicators of success in the game".
- 21. Krassimir Petkov, Valentine Panayotov (National Sports Academy of Bulgaria): "Analysis of the 2012 European Fencing Championship for men and women, held in Legnano, Italy".
- 22. Bistra Dimitrova (NSA "V. Levski" Sofia, Chair of Water and Aquatic sports): "Synchronized swimming theoretical cencept of the critical training zone".
- 23. Dimitar Trendafilov, Bistra Dimitrova, Stefan Kapralov (Nationals Sports Academy of Bulgaria): "Aquaspining as anti – stress health prevention".

- 24. Petya Kutincheva, Bistra Dimitrova (NSA "V. Levski" Sofia, Chair of Water and Aquatic sports): "Implementation of EU directives for certification of the staff in the spa business in Bulgaria".
- 25. Jovica Petković, Aldijana Muratovic, Gabrijela Doina Tanase (Faculty of Sports and Physical Education Niksic, University of Montenegro): "Correlations of motor dimensions of students of the Faculty of Sport and Physical Education with teaching contents of sport gymnastics".
- 26. Abedin Ibrahimi (PhD student at the Faculty of Physical Education and Sports in Skopje), Vildane Jashari (PhD student Management Resource in Mostar), Ismajl Jashari (postgraduate student DUT Tetovo): "Factors success off pupils of secondary school in Kosovo with special reference to of phisical activity and sports activities".

Saturday, 6. 04. 2013 Ceremonial hall no. 3 – First floor <u>From 9,30 to 12,30 h</u> Moderators: Prof. Spasoje BJELICA, PhD Assistant professor Jovica PETKOVIĆ

- 1. Miroslav Smajić, Dejan Madić, Borislav Obradović, Zoran Milošević, Slavko Molnar (Faculty of Sport and Physical Education, Novi Sad), Bogdan Tomić (Sports Academy, Belgrade): "Attitudes of the players of different sports experience toward the permissible stimulating means for recovery ".
- 2. Duško Bjelica, Dragan Krivokapić (University of Montenegro, Faculty of Sport and Physical Educaton, Niksic): "Pedagogical aspects of teacher attitudes regarding the organization of games in preschool institutions".
- **3.** Francesco Perrotta, Angelo Pannelli (University of Macerata, Italy-Faculty of Education, Physical activity taught to children in particular): "Motor training and benefits for children, the future of mankind"
- 4. Francesco Perrotta, Angelo Pannelli (University of Macerata, Italy-Faculty of Education): "Scenery pedagogical-educational of movement playful".
- 5. Vladimir Obradović, Marko Kimi Milić, (High School of Professional Studies, the Academy of Football, Belgrade): "The domination of the basketball club Partizan in the last decade".
- 6. Marko Kimi Milić, Vladimir Obradović (lecturers of professional studies, High School Professional Studies Academy, Belgrade, Serbia): "Marketing of sports events".
- 7. Josip Lepeš, Sabolč Halaši (University of Novi Sad, Faculty of Teacher Education in Hungarian, Subotica): *"Key competences in primary and secondary education from the aspect of physical education".*
- 8. Jadranka Kocić, Sonja Antonijević (Faculty of Sport and Physical Education Leposavic, University of Prishtina Kosovska Mitrovica): "The structure of motor abilities in basketball".
- 9. Selim Alili, Ćamil Elmazi (Tetovo, Macedonia): "Attitudes of students on dealing with swimming".
- Vladimir Milošević, Adam Petrović (Faculty of Sport and Physical Education, Belgrade, Serbia), Nikola Stevanović (Department of Psychology, Faculty of Philosophy, Belgrade, Serbia): "The position of the interest in sports and recreation of the 7<sup>th</sup> grade students in the factor analysis of the various interests".
- 11. Miodrag Koprivica, Ana Jovičić (Faculty of Legal and Business Studies, Novi Sad, Serbia): "Risk Management in the organization of sports events".
- 12. Abdulla Elezi, Hasim Rushiti, Afrim Koca (Faculty of Sport Science Pristina): "The influence of functional ability in running at 400 and 800 meters".
- **13. Rade Stefanović** (Faculty of Sport and Physical Education Pristina-Leposavic): "Some of anthropological characteristics with the technique of running on middle distances".
- 14. Ana Jovičić, Miodrag Koprivica (High School: "Legal and business studies Lazar Vrkatić, PhD", Novi Sad, Serbia), Marko D. Petrović (Faculty of Science, University of Novi Sad, Serbia): "Analysis of customer satisfaction with the offer of sports and recreational hotel facilities in Novi Sad".
- 15. Enver Tahiraj (PhD student at the Faculty of Kinesiology in Zagreb), Besim Aliti (Student of integrated undergraduate and graduate studies at the Faculty of Kinesiology in Zagreb), Fikret Shatri (Department of Sport, Priština), Arsim Thaqi (F.C. "2 Korriku", Priština), Afrim Shabani (Koleg Univers, Priština), Malesor Gjonbalaj (Faculty of Sport Science, Priština): "Sport recreation and tourism".
- 16. Biljana Vitošević (Faculty of Sport and Physical Education Leposavic), Nebojša R. Mitić (Institute of Pathophysiology, Faculty of Medicine in Kosovska Mitrovica), Iva Nikolić (PhD student of medicine in Kosovska Mitrovica): "Ethical aspects of the application of genomic medicine in sport".
- **17.** Assistant Professor Jovica Petković, Aldijana Muratović (Faculty of sport and Physical Education– Nikšić): *"Dangers and safety measures in a mountain".*

- 18. Danilo Aćimović, Assistant Professor Omer Špirtović, (State University in Novi Pazar): "Sports marketing as a business function in contemporary sport".
- 19. Lulzim Ibri (Department of Sport, Prizren Municipality), Sylejman Shala (Faculty of Phyisical Education and Sport in Priština): "The discriminative analysis of morphological and motor parameters between judo and karate sportsmen".
- 20. Rašid Hadžić (Faculty of Sport and Physical Education Niksic), Georgi Georgijev (Faculty of Physical Education, "Ss Cyril and Methodius" University, Skopje, Macedonia), Dobrislav Vujović (Faculty of Sport and Physical Education Niksic): "Attitudes of students of the Faculty of Sport and Physical Education toward practical lessons of skiing".
- 21. Ivica Šćepanović (The Elemetary School: "Milorad Musa Burzan", Podgorica): "Predictive value of motor skills in relation to karate technique".
- 22. Radojica Dačević (Public Company: "Sports and Recreation Center", Nikšić), Veselin Jovović (Faculty of Sport and Physical Education, Nikšić): "Comparative analysis of postural status of non sportsmen and young adolescent judo athletes".
- 23. Milovan Ljubojević (Gymnasium: "Petar I Petrović Njegoš", Danilovgrad), Ivan Terzić (Secondary vocational school Pljevlja): "*Rescue in water knowledge, courage, humanity*".
- Nela Tatar (Ministry of Culture and Sports of the Capital City Podgorica), Mirza Mulešković (Centre for Development of Sport), Rajko Ćupić (Ministry of Culture and Sports of the Capital City Podgorica): "Physical activity in free time of young people in Montenegro".
- 25. Milovan Ljubojević (Gymnasium :"Petar I Petrović Njegoš" Danilovgrad), Jelena Ilić (The Republic Institute for Sport, Belgrade): "Testing the attitudes of primary school students towards the elective course sport for sportsmen".
- 26. Ivica Šćepanović (The Elemetary School: "Milorad Musa Burzan" Podgorica), Aleksandar Vlahović (Public Institution Secondary Vocational School: "Spasoje Raspopović", Podgorica): "The influence of motor abilities on foot karate technique".

President of the Organising Board, Prof. Duško Bjelica, PhD





"Vijesti", 31. oktobar 2012.

# SPORT I NAUKA: Prvi broj "Montenegrin Journal of sports science and medicine", izašao na engleskom jeziku Istraživanje i razmjena ideja

- Časopis "Montenegrin Journal of sports science and medicine" je forum za istraživanje i dijalog o vrijednostima i formama sportskih nauka i sportske medicine. Posvećen je vrijednostima kritičkog razmišljanaja i naučnog istraživanja - stoji, između ostalog, u uvodniku urednika ovog časopisa na engleskom jeziku, prof. dr Duška Bjelice.

A prvi broj na 53 štrane, upotpunosti je sadržajem pogodio želju osnivača da časopis doprinose razvoju sporta. I već pri pogledu na spisak saradnika, ovaj časopis će nuditi raznovrsne teme i istraživanja, pošto uređivačkoj politici



doprinose stručnjaci ne samo sa univerziteta u okruženju,

već cijele Evrope i Amerike. Časopis će izlaziti dva puta godišnje i objavljivaće originalna istraživanja iz cjelokupnog spektra naučnog doprinosa razvoju sporta. Časopis se već nalazi pod okriljem četiri međunarodne baze, a u toku je prijem u još tri. To će garantovati dostupnost publikovanih istraživanja širom svijeta.

Casopis otvara istraživanje Zagrebačkog univerziteta "Razlike između fudbalskih i rukometnih golmana u morfološkim karakteristikama", a posebno interesantna su i zapažanja i radovi sa Univerziteta u Nišu, Ankari, Istan-

. bulu...

Osim publikovanja naučnih istraživanja, ovaj časopis će objavljivati i zaključke sa naučnih konferencija iz oblasti sportske nauke i sportske medicine. U prvom broju dati su zaključci sa 9. međunarodne naučne konferencije "Sports performance", koji je organizovao Fakultet za sport i fizičko vaspitanje iz Nikšića.

Duško Bjelica je dekan Fakulteta za sport i fizičko vaspitanje u Nikšiću i urednik časopisa za sport, fizičko vaspitanje i zdravlje "Sport mont", koji izdaje Cmogorska sportska akademija.

S. Ž.

#### "Dan", 12. novembar 2012.

ИЗАШАО ПРВИ БРОЈ МЕЂУНАРОДНОГ ЧАСОПИСА "MONTENEGRIN JOURNAL OF SPORTS SCIENCE AND MEDICINE"

# Сви аспекти спортских наука

Недавно је из штампе изашао први број међународног научног "Montenegrin Journal of Sports Science and Medicine", који објављује рукописе, искључиво на енгле-



ском језику.

- Часопис покрива све аспекте спортских наука и медицине, као и све кли-

ничке аспекте вјежбања, здравља и спорта, истраживања у области физиологије и биофизике у спорту, спортске биомеханике, спортске исхране, спортске психологије, спортског менацмента, а представља научну подршку спортским тренерима и свим запосленим у мултидисциплинарној области спортске индустрије. Такође би требало истаћи да је планирано "Montenegrin Journal of Sports Science and Medicine", излази два пута годишње, у септембру и марту, те да објављује оригиналне научне радове, биљешке, прелиминарна саопштења, прегледе и конференцијске радове, али и "писма уреднику", изводе са међународних и националних конгреса, панеле са састанака, конференција и симпозијума, као и да функционише као отворена трибина о битним питањима од савременог значаја, рекао је главни уредник, проф. др Душко Бјелица. T.F.

# **Subscription**

How you subscribe for print copy varies as to whether you are interested in a personal or institutional subscription, and whether you are outside or inside the Montenegro.

Yearly subscription rates:

	Montenegro	Abroad
Private	25.00 EURO	75.00 EURO
Institutions	50.00 EURO	150.00 EURO

The amount should be forwarded to the following accounts:

Foreign subscribers: Montenegrin Sport Academy Account Number: 510-22190-12, Crnogorska komercijalna banka IBAN: ME2551000000002219012 SWIFT: CKBCMEPG

Montenegrin subscribers: Crnogorska sportska akademija PIB: 02386216 Broj računa: 510-22190-12, Crnogorska komercijalna banka

For further information, please contact the Journal Office at office@mjssm.me.

CIP – Каталогизација у публикацији Централна народна библиотека Црне Горе, Цетиње

796:61 (497.16)

MONTENEGRIN journal of sport science and medicine / urednik Duško Bjelica. – Vol. 1, no. 1 (2011) - . – Podgorica (Džordža Vašingtona 445) : Crnogorska sportska akademija, 2013 (Nikšić : Art grafika). – 30 cm

Polugodišnje. ISSN 1800-8755 = Montenegrin journal of sports science and medicine (Podgorica) COBISS.CG-ID 17824272

Changing jobs is easier when you have a pan-European network to back you up. Our website offers numerous opportunities for work, international collaboration and funding opportunities for researchers in Europe. Discover a world of opportunities at

10 FS

http://ec.europa.eu/euraxess



ARCHERS