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Sport-Specific Morphology Profile: Differences in Anthropometric Characteristics among Elite Soccer and Handball Players

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A B S T R A C T

The aim of this study was to obtain the relevant knowledge about significant differences in some anthropometric characteristics of top soccer and handball players. The sample included 41 male subjects divided into two subsamples. The first subsample included 25 subjects, who train in the senior selection in the Football club "Vojvodina" from Novi Sad, while the other subsample included 16 subjects who train in the senior selection in the Handball club "Vrbas" from Vrbas. The variables sample included 20 anthropometric measures that defined longitudinal and transversal dimensionality of skeleton, volume and mass of the body, and subcutaneous adipose tissue. The results were analysed in a statistical procedure marked as a significance testing of two arithmetic means of the independent samples, a t-test at the level of significance of $p<0.05$. It was concluded, based on these results, that significant differences occur in all variables for evaluation of subcutaneous adipose tissue, except for the skinfold of the upper arm and forearm, and in variables for evaluation of body height, body mass, the minimum circumference of the upper arm and lower leg, and the maximum circumference of the upper arm, forearm, upper leg and lower leg.

Key words: *anthropometric characteristics, soccer players, handball players, professional sport*

Introduction

Top athletes, engaged in different sports branches, each differ in physical and physiological characteristics. It is expected for a top athlete to represent an expression of potential through heritage, training, nutrition, and sociocultural factors (Bourgois et al., 2000).

Anthropometry is the method of measuring the human body or the individual body parts, which involves the quantitative definition of the morphological traits, and insight into an objective image of the state of growth of the person tested. Morphological characteristics appear to be great importance for orientation and selection in the most of sport disciplines, given that they are present in the specification equation of almost every sport, morphological dimensions occupy one of the major positions. For a large number of sports disciplines, the morphological structure that affects the sports efficiency the most is already known, although the coefficients of participation of individual morphological dimensions in the specification equation indubitably change due to the development of technique and tactics, and modern achievements in a particular sport. Soccer is a sports game played in the open field, and the training is usually based on the movement, expressed through endurance, which consists of a series of moderate activities, followed by alternating periods of high intensity, which leads to significant metabolic heat production (Masanovic, 2015).

Role of morphological characteristics or body constitution in sport activities, on one side for specific kinesilogical activity type, specific morphology type is necessary for above-average and top result achievement, and on the other side long-term training procces, with regards of previous selection, genetical basis and social surroundings (Bala, 2000).

In regards of sport-specific or postion-specific morphological profiling of athletes, study conducted by Sporis, Jukic, Ostojic and Milanovic (2009) which results can be used by coaches for improving process of designing training program to maximize the fitness development. According to the study of Matkovic et al. (2003), who investigated a sample of 57 first league players of Croatian soccer league, the players were not significantly different in height and body weight, but showed significant differences in the amount of adipose tissue as well as in the circumference of certain body parts, in relation to normal population.

The aim of this research was a desire to determine whether there is a difference, and the scope of it, in anthropometric characteristics between the top soccer and handball players, and to characterize, as acurately as possible, the morphological characteristics of subjects by measuring the individual body parts.

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Methods

The sample included 41 male subjects divided into two subsamples. The first subsample included 25 subjects, who trained in the senior selection in the Football club "Vojvodina" from Novi Sad, which competed in Serbian Super League, while the other subsample included 16 subjects who trained in the senior selection in the Handball club "Vrbas", which competed in Serbian Super League. Criteria for selection of subjects for the sample were as follows: that they have been a part of the first team at the club for at least one year and that they are in good health.

Anthropometric research technique was used for data collection. A total of 20 anthropometric measures were evaluated, that defined the longitudinal and transversal dimensionality of skeleton, volume and body mass, and subcutaneous adipose tissue: body height, body weight, elbow diameter, wrist diameter, knee diameter, ankle joint diameter, minimum circumference of the upper arm, maximum circumference of the upper arm, minimum circumference of the forearm, maximum circumference of the forearm, minimum circumference of the upper leg, maximum circumference of the upper leg, minimum circumference of the lower leg, maximum circumference of the lower leg, skinfold thickness of the upper arm, skinfold thickness of the forearm, skinfold thickness of the thigh, skinfold thickness of the calf, skinfold thickness of the chest and skinfold thickness of the abdomen.

Anthropometric research was conducted according to IBP standards, while respecting the basic rules and principles related to the selection of parameters, standard conditions and measuring techniques, as well as the standard measuring instruments calibrated before measuring.

The measuring was carried out in the middle of the competitive season. The data obtained in the research were analyzed with the statistical program SPSS 10.0, adapted for use on personal computers. The arithmetic means, standard deviation and standard errors of arithmetic means of the anthropometric characteristics were calculated in respondents who are professional soccer players and professional handball players, by testing the differences of arithmetic means of independent samples at a significance level of $p<0.05$. This analysis was able to answer the question whether there is a difference, and the scope of it, between the anthropometric characteristics of the soccer and handball players, regulars who compete in union divisions.

Results

This section presents the results of centrality and dispersion parameters, as well as the results of t-test for independent samples, classified into tables.

Observing the results, the differences of the centrality and dispersion parameters can be immediately noticed between the top soccer and top handball players when it comes to accumulation of subcutaneous adipose tissue, except the skinfolds of the upper extremities, while for the parameters of longitudinal and transversal skeletal dimensionality, volume and body mass, those differences are not as visible and emphasized as in the parameters for the evaluation of subcutaneous adipose tissue. Soccer players have higher values when it comes to knee diameter, minimum circumference of the upper leg and minimum circumference of the lower leg, while handball players have higher values in all the other variables (Table 1).

Table 1. Descriptive Statistics

	Soccer N=26		Handball N=16	
	AM	S	AM	S
Body height (cm)	182.11	± 6.73	188.16	± 6.14
Body weight (kg)	80.10	± 7.13	86.63	± 7.50
Elbow diameter (mm)	72.71	± 3.38	74.50	± 4.30
Wrist diameter (mm)	58.10	± 3.43	59.09	± 4.42
Knee diameter (mm)	99.33	± 3.77	99.01	± 5.53
Ankle joint diameter (mm)	75.72	± 3.22	76.13	± 2.91
Upper arm circumference (min) (cm)	30.31	± 2.46	33.30	± 2.64
Upper arm circumference (max) (cm)	32.15	± 1.97	35.60	± 2.59
Lower arm circumference (min) (cm)	16.92	± 0.89	19.57	± 7.76
Lower arm circumference (max) (cm)	16.42	± 2.55	28.73	± 1.57
Upper leg circumference (min) (cm)	42.27	± 2.63	40.57	± 2.29
Upper leg circumference (max) (cm)	56.42	± 2.66	58.83	± 3.22
Lower leg circumference (min) (cm)	24.35	± 1.20	23.43	± 1.16
Lower leg circumference (max) (cm)	37.85	± 1.93	39.30	± 2.12
Upper arm skinfold (mm)	4.21	± 1.16	4.75	± 1.00
Lower arm skinfold (mm)	4.84	± .62	5.67	± 1.52
Thigh skinfold (mm)	7.33	± 2.07	10.02	± 3.34
Calf skinfold (mm)	6.14	± 1.53	8.27	± 2.94
Chest skinfold (mm)	6.47	± 1.35	9.15	± 3.45
Abdomen skinfold (mm)	6.34	± 1.38	8.55	± 2.80

Legend: N – number of subjects, AM – arithmetic mean, S – standard deviation

On the basis of the results presented it was determined that the subsamples are significantly different in 12 of 20 anthropometric characteristics (level of significance $p<0.05$) and in 11 variables (body height, body weight, minimum and maximum circumference of the lower arm, maximum circumference of the forearm, maximum circumference of the upper leg, maximum circumference of the lower leg, thigh skinfold, calf skinfold, chest skinfold and abdominal skinfold), handball players show significantly higher values while the soccer players show higher values only in one anthropometric characteristic (minimum circumference of the lower leg, Table 2).

Table 2. Independent Samples t-test

	F	t	df	p	MD	SED	Min	Max
Body height	0.66	-2.86	39	0.01	-6.05	2.12	-10.32	-1.77
Body weight	0.01	-2.78	39	0.01	-6.53	2.36	-11.30	-1.77
Elbow diameter	1.45	-1.48	39	0.15	-1.79	1.21	-4.24	0.66
Wrist diameter	0.88	-0.81	39	0.43	-0.99	1.24	-3.50	1.51
Knee diameter	5.62	0.20	21.64	0.85	0.32	1.61	-3.02	3.66
Ankle joint diameter	0.85	-0.41	39	0.68	-0.41	1.01	-2.46	1.63
Upper arm circumference (min)	0.25	-3.65	39	0.00	-2.99	0.82	-4.65	-1.34
Upper arm circumference (max)	1.06	-4.80	39	0.00	-3.45	0.72	-4.90	-1.99
Lower arm circumference (min)	5.23	-1.31	14.21	0.21	-2.64	2.01	-6.95	1.67
Lower arm circumference (max)	0.19	-3.17	39	0.00	-2.31	0.73	-3.78	-0.83
Upper leg circumference (min)	0.68	0.86	39	0.39	0.70	0.82	-0.95	2.35
Upper leg circumference (max)	1.10	-2.70	39	0.01	-2.51	0.93	-4.39	-0.63
Lower leg circumference (min)	0.00	2.38	39	0.02	0.91	0.38	0.14	1.69
Lower leg circumference (max)	0.27	-2.24	39	0.03	-1.45	0.65	-2.77	-0.14
Upper arm skinfold	0.57	-1.53	39	0.14	-0.55	0.36	-1.27	0.18
Lower arm skinfold	12.23	-2.02	16.75	0.06	-0.83	0.41	-1.70	0.04
Thigh skinfold	3.66	-3.19	39	0.00	-2.69	0.84	-4.39	-0.97
Calf skinfold	3.28	-3.06	39	0.00	-2.13	0.70	-3.54	-0.72
Chest skinfold	9.48	-2.90	16.53	0.01	-2.68	0.93	-4.64	-0.72
Abdomen skinfold	9.63	-2.90	18.00	0.01	-2.21	0.77	-3.83	-0.59

Legend: F – value of Levene's test of equality of variances, t – value of t-test, df – number of degreese of freedom, p – significance of two-tailed testing of arithmetic mean difference, MD – arithmetic mean difference, SED – standard error of difference, Min – the level of lower difference interval, Max – level of upper difference interval

Discussion

On the basis of the data obtained in this study was found that there are significant differences in certain anthropometric characteristics between soccer players and handball players in the highest rank of competition. Results relating to measures of the skeleton longitudinality and subcutaneous adipose tissue showed significantly higher values for handball players. Also, the measuring results of the volume and body mass showed higher values for handball players, while only one variable (min. lower leg circumference) shows significant difference, where the soccer players had higher values.

Being a professional athlete requires a high level of preparation which, in addition to motor and functional abilities, must be supported by morphological characteristics that should correspond, through the perfect harmony, based on sport structure, rank of the competition and the specifics of the player position, which differ within almost every sport branch.

The aim of this research was a desire to determine whether there is a difference, and the scope of it, in anthropometric characteristics between the top soccer and handball players, and to characterize, as acurately as possible, the morphological characteristics of subjects by measuring the individual body parts.

Given the structure of the movement in soccer and handball, higher values of lower extremities circumferences, and lower level of skin folds were expected for soccer players, as a result of specific strength training and higher training load on the lower extremities compared to handball players, for which the largest training load involves upper extremities and shoulder area. Still, fsoccer players had higher values only for minimal circumference of lower leg, as confirmed by the study of Smajić, Ujsasi, Djukic and Kapidzic (2015). They had similar results in their research, for the same sports, but for female subjects where in all measured variables handball player had significantly higher values, and soccer players had significantly higher value only in 1 variable (circumference of lower leg). It appear that differences in muscular activity of different regions of body, could influence these changes in morphological domain, but not concluded in what amount and proportion between endogenous and exogenous factors.

Regarding the anthropometric characteristics of handball players, similar values were acquired by Srhoj, Marinovic and Rogulj (2002). They determined the characteristic morphological profile of top rank handball players, presenting clearer picture for coaches in possible morphological selection demands where cluster analysis revealed homogenecity between certain positions (more at wings and pivots, less at backs and goalkeepers). The research results of Stanković, Malacko and Doder (2009) partially coincide with the results of this research in terms of longitudinal and transversal dimensionality of skeleton and voluminosity and body mass. It was concluded, by comparing handball, basketball and soccer players, that similar differences were present in height and subcutaneous adipose tissue, in where handball players had higher values in comparison to soccer players. Results relating to the circumferences of the upper extremities also coincide, however, lower leg circumference in the aforementioned study was lower for soccer players, which can be marked as partial non-matching of these two studies.

Higher values observed in body height of handball players can be related to the selection of athletes for the forementioned sport, which is dominated by athletes who are taller and more massive and corpulent, because of the need of the sport itself for technical and tactical elements (jump shot, block, etc.) to be performed with maximum efficiency. These requirements can be recognized in sports like basketball and volleyball (Prahovic & Protic, 2007; Stanković, Malacko, & Doder, 2009; Rexhepi & Brestovci, 2010). Nevertheless, female subjects had also being studied by Bayios, Bergele, Apostolidis, Noutsos and Kaskolou (2006) with significant differences found between sports, level of competition and specific player position. On the other hand, soccer is characterized as aerobic-anaerobic type of sport, with high load sprints, turns, and jumps but with much lesser amount of contact between players so force impact in contact duels are more often and intence in handball which may also in-

fluence team tactic in favor of particular player morphology type (wings are shortest, pivots tallest and haviest, goalkeeper oldest with most fat but no difference between lactate and max hart rate) concluded by Sporis, Vuleta, Vuleta and Milanovic (2010). It is known that soccer players do not differ significantly from the general population in body height and body weight, but have significantly lower levels of fat components and significantly higher values for muscle circumference (Matkovic et al., 2003).

Sport-specific morphological characteristics of top class soccer players appears to have great interest for some authors (Di Salvo et al., 2007; I. Joksimovic, A. Joksimovic, & S. Joksimovic, 2008; Gorostiaga et al., 2009; Jovanovic, Sporis, & Milanovic, 2011) with interest of finding best morphology type for particular sport, competition level or player position. Quantification and comparison of anthropometrics should support coaches with better understanding specific demands of certain sport where particular morphology type of athlete, combined with motor and functional abilities, should express it's full potential.

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The Improvement of Equilibrium through Yoga Exercises

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A B S T R A C T

Yoga, one of the most ancient cultures of physical education, is a physical, mental and spiritual discipline and it has been made part of curricular program in Sports University of Tirana (SUT). We took the responsibility to study the equilibrium quality as a discipline which has never been studied before in Albania. The aim of this study is to assess how postural sway is affected in two different conditions, Eyes Open and Tandem Eyes Closed tests in balance training through yoga exercises. One of the most important yoga exercises is balance training. This training helps in improving coordination system in static and dynamic activities. Before, yoga exercises had been used to build and to maintain the physical conditions, later on this concept has been extended in the balance training and used to improve physical parameters. The reason for describing such exercises is to explain the benefits of yoga exercises to the equilibrium system.

Key words: *balance training, yoga exercises, 1L_EO, TanEC, Sway Area, equilibrium, Sway Index*

Introduction

Yoga, one of the most ancient cultures of physical education has been made part of curricular program in Sports University of Tirana (SUT). We took the responsibility to study the equilibrium quality as a discipline which has never been studied before in Albania.

Yoga is a physical, mental and spiritual practice or discipline, which originated in India and includes a variety of schools, practices and goals. Yoga as a disciplined method for attaining a goal (Jacobsen & Lama, 1998), incorporate systematic exercises and self-development techniques of controlling the body, mind and spirit (Bryant, 2011; Samuel & Geoffrey, 2008). One of the most important yoga exercises is balance training. This training helps in improving coordination system in static and dynamic activities. Before, yoga exercises had been used to build and to maintain the physical conditions, later on this concept has been extended in the balance training and used to improve physical parameters.

Many studies have tried to determine the effectiveness of yoga in different pathologies, such as cancer, schizophrenia, asthma, chronic low back pain (Tilbrook et al., 2011), and heart disease. The results of these studies have been mixed with cancer studies (Smith & Pukall, 2009), suggesting none to unclear effectiveness, and others suggesting yoga may reduce risk factors and aid in a patient's psychological healing process (Vancampfort et al., 2012). The studies for yoga as exercise or alternative medicine have been reported the potential benefits for adults and physical injuries from yoga practitioners too (Penman, Cohen, Stevens, & Jackson, 2012; Summers & Kathleen, 2012). Many long-term users have reported musculoskeletal and mental health improvements, as well as reduced symptoms of asthma in asthmatics (Birdee et al., 2008). Regular yoga has been shown to improve mood and anxiety more than some other metabolically-matched exercises, such as walking (Streeter et al., 2010). Three main focuses of yoga: exercise, breathing and meditation, make it beneficial to those suffering from heart disease. Overall studies of the effect of yoga on heart disease, suggest that yoga may reduce high blood-pressure, improve symptoms of heart failure, enhance cardiac rehabilitation and lower cardiovascular risk factors (Harvard Heart Letter, 2010). Yoga is used for treatment of cancer patients to decrease depression, insomnia, fatigue and to increase anxiety control (De Stasio, 2008). Another study had showed positive effects on sleep, anxiety, quality of life and spiritual growth in cancer patients (Smith & Pukall, 2009). Yoga has also been studied as a treatment for schizophrenia (Yoga Health Benefits), it is observed as a complementary treatment which help to improve health related quality of life (Vancampfort et al., 2012) and quality of recovery index too (S.B.S. Khalsa, G.S. Khalsa, H.K. Khalsa, & M.K. Khalsa, 2008).

Even though the positive effect of yoga exercises are very evident, it has been criticized for being potentially dangerous and being a cause for a range of serious medical conditions, including thoracic outlet syndrome, degenerative arthritis of the cervical spine, spinal stenosis, retinal tears, damage to the common fibular nerve, etc. (Chusid, 1971). Some yoga practitioners do not recommend certain yoga exercises for women during menstruation, for pregnant women, or nursing mothers. However, breathing exercises and certain postures which are safe and beneficial for women in these categories are encourages (Christensen, 2012).

The aim of this study is to assess how postural sway is affected in two different conditions, Eyes Open and Tandem Eyes Closed tests in balance training, through yoga exercises.

Methods

Fifty healthy male and female subjects, aged 20-25 years old from Sports University of Tirana (SUT) and Albanian University (AU), participated in this study. The mean age was 21.14 years old for SUT subjects and 22.07 for AU

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subjects. The measurements were recorded in force plate Biomechanics Laboratory of SUT (Leonardo Mechanography GRFP, 2010) and the study was approved and provided by the Sports University of Tirana. The balance testing Romberg protocol was used to collect the data, in two different conditions: Romberg One Leg Open Eyes (1L_EO) and Tandem Eyes Closed (TanEC). Center of Pressure (COP) is simply the point location of the vertical ground reaction resultant force vector, which is easily measured using a force platform (Tallon et al., 2012). The COP is the response of the body to COG displacement. The Center of Gravity (COG) signal represents a real movement, the sway of the body inverted pendulum (Bendo, Skënderi, & Veveçka, 2014; Luigi, Morasso, Cristina & Spada, 2002).) The sway parameters were taken during the COP trajectory shifts, along the time interval of 10 second: relative Pathlength (velocity in mm/s); absolute Pathlength (in mm); standard ellipse Sway Area SA (in cm^2); Equilibrium Anterior-posterior Score EQ (in percentage); and Sway Index SI (in cm). Sway area is calculated by integrating the area of COP with regard to reference point, while the sway index was calculated by determining the distance from the COP shifts for each data points, as given in formula:

$$SI = \sqrt{SD(x^2 \times y^2)}/N$$

This study included a three months period, followed by a re-valuation (balance training in yoga exercises effect). The repeated measure analyses paired t-test was used to compare the mean differences in two conditions, 1L_EO and Tan EC balance tests, to see the effect of yoga exercises in equilibrium system. Statistical analyses were performed using SPSS version 17. A value of $p < 0.05$ was considered statistically significant.

Results

Table 1 shows the descriptive statistics in terms of means and standard deviations (SD) of all anthropometric parameters (age, height, weight and body mass index BMI) for SUT and AU subjects.

Table 1. Descriptive statistics of anthropometric for SUT & AU subjects.

Parameter	Mean ± SD (SUT)	Minimum (SUT)	Maximum (SUT)	Mean ± SD (AU)	Minimum (AU)	Maximum (AU)
Age	21.14±1.48	20.00	25.14	22.07±1.87	20.00	25.02
Height	1.76±0.08	1.58	1.91	1.69±0.08	1.54	1.86
Weight	69.95±10.49	47.70	86.80	67.68±10.19	50.30	88.10
BMI	22.62±2.38	17.71	27.40	23.69±2.28	19.90	26.26

In Table 2 are presented the descriptive statistics of postural sway parameters in both SUT and AU subjects, as well as the absolute change and the percentage of this change after balance training.

Table 2. Descriptive statistics and the difference of postural sway parameters for SUT & AU subjects

Parameter	Mean ± SD (SUT)	Mean ± SD (AU)	Subjects	Absolute change	Percentage of change
V1(EO)	96.18±26.69	110.94±49.71	SUT	23.94	24.90
V2(EO)	72.24±19.31	81.51±28.82	AU	29.43	26.53
V1(TanEC)	113.99±43.85	114.01±54.04	SUT	35.14	30.83
V2(TanEC)	78.85±32.66	81.23±33.56	AU	32.78	28.75
L1(EO)	961.42±266.92	1110.85±497.54	SUT	238.99	24.85
L2(EO)	722.43±193.17	815.13±288.21	AU	295.72	26.62
L1(TanEC)	1140.09±438.57	1140.24±540.40	SUT	351.48	30.83
L2(TanEC)	788.61±326.60	812.37±335.59	AU	327.87	28.75
SA1(EO)	13.67±11.70	11.15±5.62	SUT	6.7	49.01
SA2(EO)	6.97±2.93	7.20±2.36	AU	3.95	35.42
SA1(TanEC)	17.84±12.46	18.49±11.49	SUT	8.49	47.59
SA2(TanEC)	9.35±6.09	8.67±3.78	AU	9.82	53.10
Eq1(EO)	0.80±0.07	0.78±0.05	SUT	0.06	7.5
Eq2(EO)	0.86±0.03	0.82±0.05	AU	0.04	5.13
Eq1(TanEC)	0.71±0.08	0.73±0.04	SUT	0.07	9.85
Eq2(TanEC)	0.78±0.08	0.78±0.05	AU	0.05	6.85
IL1(EO)	2.43±0.81	2.59±0.60	SUT	0.8	31.62
IL2(EO)	1.63±0.42	2.19±0.63	AU	0.4	15.44
IL1(TanEC)	3.4±0.96	3.26±0.53	SUT	0.86	25.29
IL2(TanEC)	2.54±0.93	2.58±0.58	AU	0.68	20.85

Table 3 reports pair of variables compared in two different conditions during 1L_EO and TanEC balance tests, before and after yoga exercises training.

Figure 1 shows the graphs of variation for: a) relative Pathlength (mm/s); b) SA (cm^2); c) EQ (%); and d) SI (cm) for SUT subjects in EO condition test before and after yoga exercise training.

In Figure 2 are presented the graphs of sway parameters for SUT subjects in TanEC balance test before and after yoga exercise training.

While in Figure 3 are given these graphs for AU subjects in EO condition before and after yoga exercise training.

Finally, Figure 4 presents the graphs of sway parameters during TanEC balance test before and after training.

Table 3. Pair of variables comparison of SUT & AU subjects in 1L_EO and TanEC tests

Condition	Pair of variables	t-value (SUT)	t-value (AU)	p-value (SUT)	p-value (AU)
	V1(EO)-V2(EO)	7.742	4.436	0.000	0.001
1 Leg	L1(EO)-L2(EO)	7.702	4.455	0.000	0.001
Eyes	SA1(EO)-SA2(EO)	3.940	3.682	0.000	0.002
Open	Eq1(EO)-Eq2(EO)	-7.262	-2.774	0.000	0.015
	IL1(EO)-IL2(EO)	7.262	2.774	0.000	0.015
	V1(TanEC)-V2(TanEC)	7.995	4.702	0.000	0.000
Tandem	L1(TanEC)-L2(TanEC)	7.997	4.703	0.000	0.000
Eyes	SA1(TanEC)-SA2(TanEC)	5.398	4.228	0.000	0.001
Closed	Eq1(TanEC)-Eq2(TanEC)	-8.267	-4.369	0.000	0.001
	IL1(TanEC)-IL2(TanEC)	8.267	4.369	0.000	0.001

Discussion

In Table 2 is observed that in EO condition, the absolute change and its percentage are respectively: for velocity and pathlength smaller for SUT subjects compared to AU subjects; for SA; EQ and SI higher for SUT than AU subjects. While in TanEC condition, these parameters results: velocity, pathlength, EQ, and SI higher for SUT than AU subjects, meanwhile EQ Score is lower for SUT subjects compared to AU. In Figures 3/c, d and 4/c, d seems that after training the EQ score is clearly higher than before training, due to the effect of balance training through yoga exercises. The results show that EQ (AP) has increased (Fig. 3/c and 4/c) when SA has decreased, because of the sway index has increased. From these results, it is clear that yoga exercises in balance training had been more efficient for SUT subject compared to AU subjects, due to the better physical parameters and preparation of these subjects.

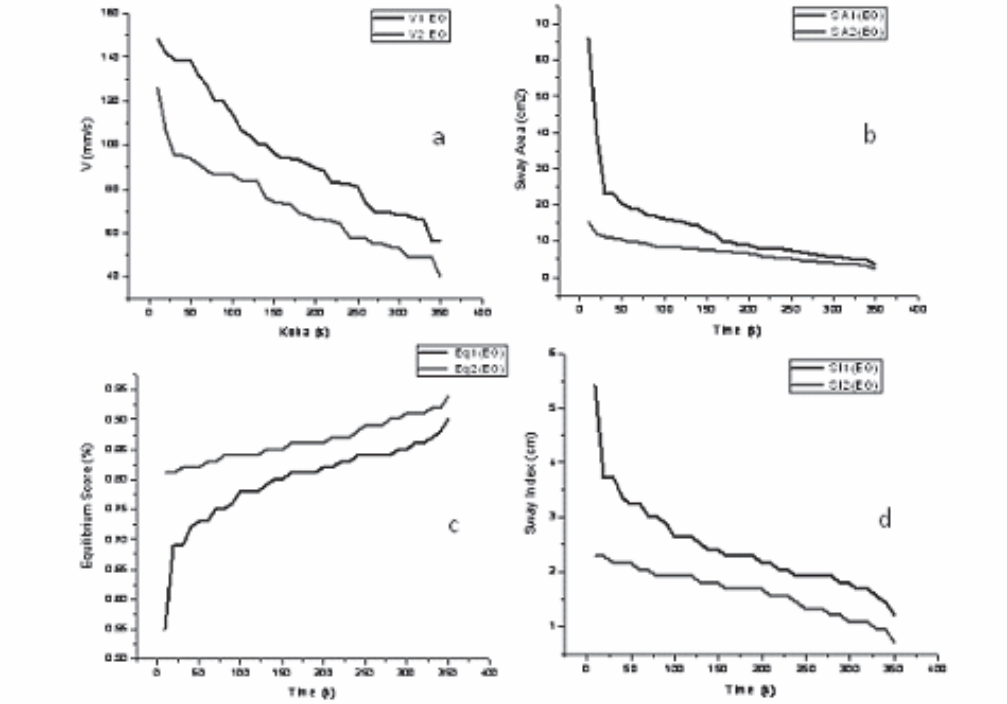

Figure 1. The graphs of sway parameters during time period in 1L_EO test for SUT subjects

The control analysis (paired t-test) shows that no essential difference between both SUT and AU subjects, despite the fact that the test is carried in EO or EC conditions, as it is reported by the respective values (t-values) and (p-values) in Table 3. The values reported in this table, gives the p-value ($p<0.05$) for both conditions of balance tests. At AU subjects, it is observed that p-values are a little bit lower in EC condition, compared to EO condition. This result is observed more clearly in Table 2, comparing the absolute change and its percentage in EO and TanEC condition for AU subjects. Hence the improvements have been more obvious in TanEC balance test, due to the effect of meditation. From comparison of the sway parameters of SUT and AU subjects, results that this improvement has been higher at SUT subjects, because of their prior physical preparation, improving health related quality of life (Vancampfort et al., 2012).

Eventually, three main sway parameters: SA and SI are statistically decreased due to the balance training in yoga exercises, while EQ scores are statistically increased. Therefore, the postural sway parameters are significantly changed compared to EO and TanEC balance tests before and after training, resulting in overall improvement of the body equilibrium system, because of yoga exercises.

Yoga has become a universal language of spiritual exercise in the world, crossing many lines of religion and cultures. Beside the spiritual goals, the physical postures of yoga are

used to alleviate health problems and to reduce the stress. Yoga is also used as a complete exercise program and physical therapy routine. Millions of people practice yoga to improve their health and overall well-being.

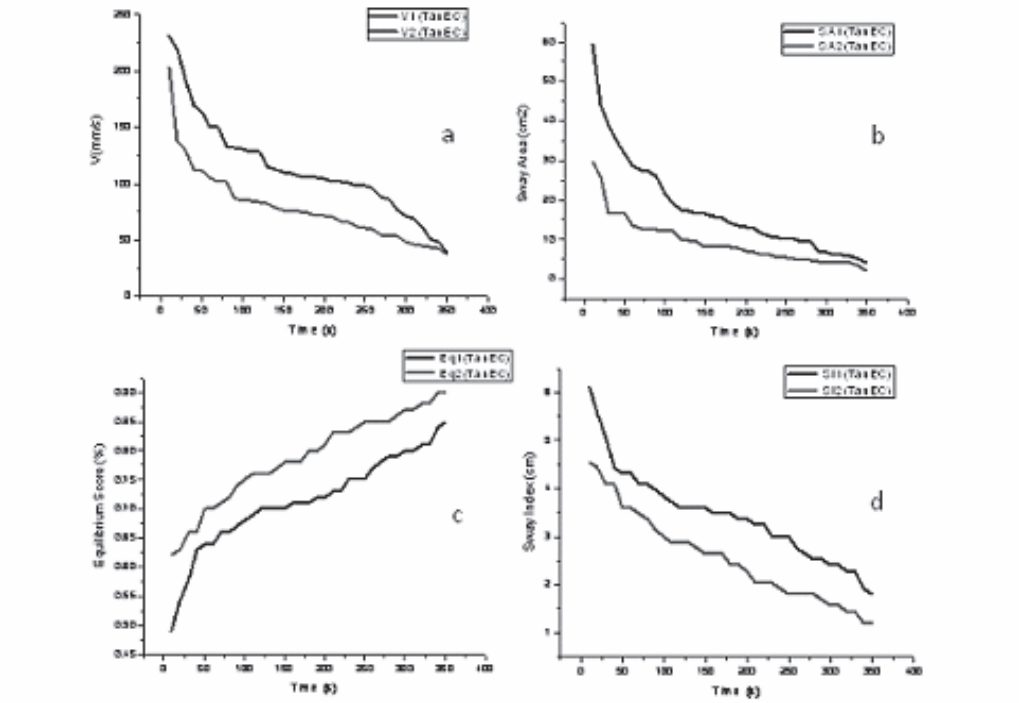

Figure 2. The graphs of sway parameters during time period in TanEC test for SUT subjects

The biomechanical parameters analysis pointed out significant statistical changes in one of the more important disciplines of movement expression, such as equilibrium. The results have verified the benefits of yoga exercises to the equilibrium system, as well as the necessity of these yoga exercises training development, to improve the life quality, even in other psychological and emotional dimensions.

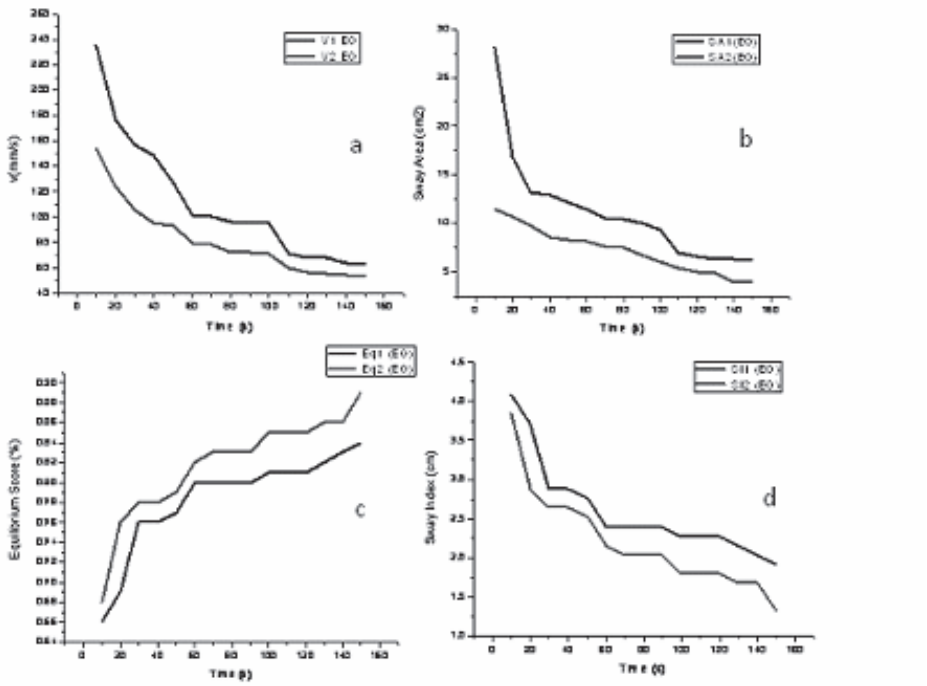

Figure 3. The graphs of sway parameters during time period in 1L_EO test for AU subjects

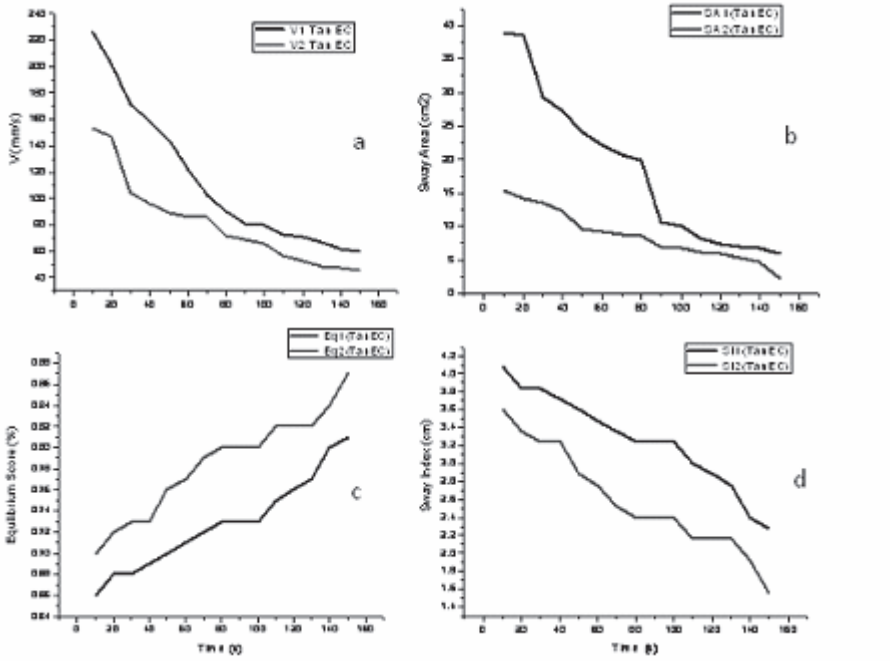

Figure 4. The graphs of sway parameters during time period in TanEC test for AU subjects

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The Effects of Sodium Bicarbonate and Sodium Citrate on Blood pH, HCO3-, Lactate Metabolism and Time to Exhaustion

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A B S T R A C T

The purpose of this study was to compare the effects of sodium bicarbonate and sodium citrate in increasing lactate concentration, blood pH, $HCO3^-$, and time to exhaustion. Increased time to exhaustion is an advantage since the athletes can do more anaerobic work. Exhaustion could be delayed by increasing $HCO3^-$ to catch H^+ produced by lactate metabolism to form H_2O and CO_2. The design of this research was randomized pretest posttest control group design. Thirty badminton student players were randomly selected and randomly assigned to three groups. The first group (the control group) was given placebo, NaCl .9 g/dl, the second group was given sodium bicarbonate 300 mg/kg in 500 ml aqua, and the third group was given sodium citrate 300 mg/kg in 500 ml aqua. Blood pH and bicarbonate ion ($HCO3^-$) were measured through Opti Medical Blood gas Analyzer. Lactate was measured by Cobas Roche lactate Analyzer. Data was analyzed using Manova with .05 significant level. Blood pH of the groups taking sodium bicarbonate and sodium citrate were higher significantly against control group (p<.05), and sodium bicarbonate group was significantly higher than the sodium citrate group (p<.05). Blood lactate tests showed that sodium bicarbonate group and sodium citrate group gave significant difference vs control group (p<.05), whereas sodium bicarbonate did not differ significantly against sodium citrate (p>.05). Sodium bicarbonate is better than sodium citrate, although both were better than control (p<.05). Sodium bicarbonate is better than sodium citrate in increasing blood pH and time to exhaustion. The disadvantage of using sodium bicarbonate is that it can cause gastrointestinal problem and headache, so it is not advisable to be used by athletes who have the symptoms.

Key words: *blood pH, blood lactate, [HCO3-], time to exhaustion*

Introduction

Physical training not only has a good impact on health status but also on sport performance. Badminton is very popular in Indonesia. It needs kind of anaerobic performance. As a favorite game that can get gold medals in international events, badminton players are expected to have a good anaerobic performance. Effective and efficient training is sometimes not good enough to get maximal performance so that trainers finally turn to ergogenic aids that are not prohibited by Olympic Regulations.

In sport performance, fatique is a prominent factor that needs attention since it limits the ability of muscles to perform well. The causes of fatique is quite complex; namely central and peripheral fatique, lack of oxygen in muscle, homeostatic imbalance, changes in body as well as room temperature, substrate depletion or metabolite accumulation (Brooks & Fahey, 1984). Lactic acid, a byproduct of energy producing metabolism, could act as fatique indicator, although it is not the only cause of muscular fatique, accumulation of H+ ion from ATP hydrolysis would also cause muscular fatigue .

In general, fatique is caused by two factors, intracellular acidosis and changes in excitation-contraction coupling process. Recovery of excitation coupling proces is heavily influenced by external pH, since the decrease in pH as a consequence of increase in lactic acid production in muscle disturbs excitation-contraction coupling process (Allen, Westerblad & Lannergren, 1995). This situation happens in short duration sport activity with high intensity. Accumulation of H+ ion from lactic acid is then evacuated through plasma in adjacent surrounding.

Among many attempts to reduce muscular fatique, the use of sodium bicarbonate as buffer system enforcer could be applied, known as bicarbonate loading. Sodium bicarbonate or NaHCO3 has the ability to inhibit pH increase. Bicarbonate ions react with H+ to produce bicarbonate acid or H2CO3, soon being decomposed into H2O and CO2. Sodium bicarbonate consumed results in acute increase of bicarbonate level [HCO3–] and blood pH, therefore increasing buffering capasity of the blood against pH decrease. Increased buffering capasity would change intracellular environment and increase blood efflux of lactic acid and H+ out of the cells. Sodium bicarbonate or sodium citrate would decrease H+ ion level and lactate in muscle and postpone the decrease of intracellular pH that has negative impact on glycolysis in muscle. Since sodium bicarbonate is found in the body in limited amount, consumption of sodium bicarbonate 90 minutes before high intensity activity is expected to increase the availability of buffer and increase time of exhaustion.

Besides sodium bicarbonate, sodium citrate proved to be

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effective in increasing blood pH and carbonic acid level (Oopik, Saaremets, Timpmann, Medijainen & Karelson, 2004). Costill, Verstappen, Kuipers, Janssen and Fink (1984) stated that by consuming sodium bicarbonate, acidity in muscle was reduced so that fatigue could also be reduced. Consumption of sodium citrate was able to increase plasma volume by increasing sodium ion level in serum, therefore suppresing aldosteron activity (Oopik et al., 2004).

Badminton is an anaerobic activity. It is done with high intensity, high speed and power. So, the energy (Adenosine Tri Phosphate) is supplied through anaerobic glycolisis with a lot of lactic acid as a byproduct (Bahri, Joseph, Sigit & Yusanti, 2009). Once the anaerobic threshold is achieved when blood lactic acid was 4 mMol/L, fatique began to show up. Athletes should be trained in accordance with predominant energy so that fatique could be postponed until later (Purba, 2002).

Methods

The design of this study was pretest posttest control group design. Thirty badminton student players were randomly selected and randomly assigned to three groups consisted of 10 people. Subject characteristics; all sample were male with the age mean=21 years old. During pretest, blood lactate, blood pH, [$HCO3^-$], and time to exhaustion were measured. Time to exhaustion was measured from anaerobic threshold to the time they stopped running because of exhaustion. During posttest, the first group which acted as the control group was given 500 ml aqua, the second group was given sodium bicarbonate 300 mg/kg in 500 ml aqua, 90 minutes before treadmill testing, the third group was given sodium citrate 300 mg/kg in 500 ml aqua, 90 minutes before treadmill testing. Posttest was conducted at least 3 days after pretest to ensure complete recovery of the sample. Blood pH and bicarbonate ion were measured through Opti Medical Blood gas Analyzer. Lactate was measured by Cobas Roche lactate Analyzer. Time to Exhaustion was measured from anaerobic threshold (respiratory exchange ratio=1) to termination of the test because of exhaustion. Appropriate statistics was applied.

This study was approved in advance by Institutional Review Board of Surabaya State University. Each participant voluntarily provided written informed consent before participating.

Results

Kolmogorof-Smirnov test of Normality; .112 for blood pH, .102 for [HCO3-], .144 for [blood lactate], and .200 for Time to Exhaustion, so the data was normal. Homogeinity test using Box's test of equality of Covariance Matrices showed p=.805 (p>.05). It meant that the sample was normal and homogenous, so that parametric statistics could be applied.

Table 1. Blood lactate cocentration following of ingestion of placebo, sodium bicarbonate, and sodium citrate

group	group	Sig.	Mean
K1	K2	0.000*	K1=6.640 mEq/L
	K3	0.000*	
K2	K1	0.000*	K2=10.630 mEq/L
	K3	0.568	
K3	K1	0.000*	K3=10.140 mEq/L
	K2	0.568	

Legend: *: signifikant at p<.05; K1: control group; K2: sodium bicarbonate group; K3: sodium citrate group

Sodium bicarbonate and sodium citrate gave significant difference vs control group in blood lactate concentration, but sodium bicarbonate did not differ significantly against sodium citrate on increasing blood lactate.

Table 2. Time to Exhaustion following ingestion of placebo, Sodium bicarbonate, and Sodium Citrate

Group	Group	Sig.	Mean
K1	K2	0.029*	K1=3.400 minutes
	K3	0.017*	
K2	K1	0.029*	K2=6.890 minutes
	K3	0.020*	
K3	K1	0.017*	K3=6.120 minutes
	K2	0.020*	

Legend: *: significant at p<0.05

Sodium bicarbonate showed significant difference against sodium citrate (p=.020) and control (p=.029), with the best Time to Exhaustion in sodium bicarbonate (6.890 min), although sodium citrate also showed significant difference against control (p=.017).

Table 3. Blood pH following ingestion of plscebo, Sodium Bicarbonate, and Sodium Citrate

Group	Group	Sig.	Mean
K1	K2	0.000*	K1=7.428
	K3	0.048*	
K2	K1	0.000*	K2=7.635
	K3	0.000*	
K3	K1	0.048*	K3=7.355
	K2	0.000*	

Legend: *: significant at p<0.05

Sodium bicarbonate gave the highest blood pH compared with sodium citrate (p=.000) and control (p=.000), eventhough sodium citrate also increased pH significantly against control group (p=.048).

Table 4. Blood bicarbonate concentration [$HCO3^-$] following ingestion of placebo, Sodium Bicarbonate, and Sodium Citrate

Group	Group	Sig.	Mean
K1	K2	0.045*	K1 = 24.310 mEq/L
	K3	0.009*	
K2	K1	0.045*	K2 = 27.980 mEq/L
	K3	0.008*	
K3	K1	0.009*	K3 = 22.870 mEq/L
	K2	0.008*	

Legend: *: significant at p<0.05

Sodium bicarbonate gave the highest buffering ability compared to sodium citrate (p=.008) and control (p=.045). Buffering ability of sodium citrate was also greater than control (p=.009)

Discussion

Requena, Zabala, Padial and Feriche (2005) stated that sodium bicarbonate and sodium citrate had ergogenic function because those supplements increased pH level, bicarbonate ion, and lactate concentration. Sodium bicarbonate and Na-citrate seem to be effective in activities with a sufficient duration to generate a difference in the hydrogen ion gradient, characterized by a very high intensity and involving large muscular groups. However, in activities of equally high intensity, but with longer duration, the results obtained have been conflicting and inconclusive.

McNaughton and Cedaro (1986) indicated that a dose of 0.5 g/kg body mass sodium citrate had no ergogenic benefit for exercise of either 10-s or 30-s duration, but exercise periods of 120 s and 240 s were significantly increased (p<.05) above the control and placebo conditions following sodium citrate ingestion. They suggested that a dose of 0.5 g.kg-1 body mass of sodium citrate could improve anaerobic exercise performance of 120-s and 240-s duration. Parry-Billing and MacLaren (2005) found in their study that pH increased significantly with sodium citrate supplement. Increased pH was possible with the role of sodium bicarbonate and sodium citrate as buffering agents that absorbed hydrogen ions and diverted into H2O and CO2 (McNaughton, Dalto, Tarr & Buck, 1997), so that pH did not fluctuate a lot.

Other benefit of using sodium bicarbonate and sodium citrate is that sodium could maintain body fluid, so it is favorable to the work of the heart (Zajac, Cholewa, Poprzecki, Waśkiewicz & Langfort, 2009). Graydon, Marsh, Kowalchuk and Thompson (2004) stated that metabolic effect caused by alkalosis related to the ability of NaHCO3 to maintain optimal pH would delay the onset of intracellular acidification during exercise with high intensity. Graydon et al. (2004) stated further that the induced alkalosis triggers an increase in glycolysis that eventually increase training capacity, proven by increased lactate level.

Billat, Bernard, Pinoteau, Petit and Koralsztein (1993) found that one factor related to time to exhaustion was increased blood lactate. In this study, sodium bicarbonate loading also significantly increased time to exhaustion by 3.49 minutes which meant that bicarbonate loading could increase anaerobic endurance, although the effect of sodium bicarbonate loading was not significantly different from sodium citrate loading. In other study, Hartono, Wiriawan and Ashadi (2014) found that supplement sodium bicarbonate and sodium citrate 21 g/500 ml aqua given 60 minutes before treadmill testing in badminton student players did not give any significant difference in time to exhaustion between sodium bicarbonate loading and sodium citrate loading, and control (p>.05), but blood lactate level was significantly higher in sodium bicarbonate and sodium citrate loading compared with control (p<.05). It could be concluded from this study that time for sodium bicarbonate or sodium citrate to go to extracellular level optimally is 90 minutes, and increased blood lactate was not linked with sport performance. Other possible cause was that the physical condition of the sample during treadmill test was not optimal. Zabala et al. (2011) studied the effects of sodium bicarbonate on performance of elite BMX cyclist and concluded that the induced alkalosis did not improve the Wingate test performance, Ratings of Perceived Exertion (RPE) and performance across three consecutive Wingate tests in elite BMX cyclists although the sodium bicarbonate modified acid-base balance significantly.

McNaughton, Curtin, Goodman, Perry, Turner and Showell (1991) studied the effects of sodium bicarbonate on 60 second of an anaerobic work and power output of cyclists on cycle ergometer. The results of this study suggest that sodium bicarbonate is an effective ergogenic aid when used for typically anaerobic exercise as used in this experiment, and this ergogenic property is probably due to the accelerated efflux of H+ ions from the muscle tissue due to increased extracellular bicarbonate buffering. McNaughton et al. (1997), and Parry-Billing and Maclaren (1986) stated that the use of sodium citrate is a better choice than sodium bicarbonate in that sodium citrate did not give any bad effects to gastrointestinal system as sodium bicarbonate loading. The side effects to gastrointestinal system could be headache, stomachache, and diarrhea

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Sick Leaves during the Low Back Pain and Influence of Obesity on its Prolonging

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A B S T R A C T

Lumbar syndrome (LS) is common problem from which the patients remain bedridden, unable, therefore working productivity is lost. Stiffness (blockage) in the lumbar-sacral part of the spinal cord limits locomotors movement, flexion, extensions and other normal daily activities. Purpose of this work is to determine the duration of the sick leaves during one year period at patients with low back pain comparing with obesity. The research was carried out in the Physiatrist Service of the Institute of Occupational Medicine (IOM) during the one year period. The total number of patients included in the research was 101, who were adult employed in the Energy Corporation of Kosovo (ECK). The subjective and objective data were collected from the medical record and the duration of the sick leaves was registered. Only 11 or 10.9% of the diseased, during the period of research, didn't use their sick leaves because of the low back pain. While the greater number of them 30 or 29.7% have used one or two weeks sick leave. By the distribution of the cases according to the groups we have got similar structure, and it can be seen from the t-test, where we didn't get important statistical significance between the groups comparing to the duration of sick leaves per week (t=0.602; p>0.05). While the average number of the sick leaves of the diseased from non-obese group was 3.94 per week (SD±3.74 week), rank 0-19 week, while the result in obese group was 4.42 week (SD±3.58 week), rank 0-13 week. Sick leaves are longer at physical employees in comparison with other occupations. Psycho-social facts affect the duration of the healing.

Key words: *low back pain, obesity, sick leaves*

Introduction

The lumbar syndrome (LS) is the common problem from which the diseased remain bedridden, disabled, in which occasion the productivity of the employees is lost (Szpalski, Gunzburg & Rydevik 2010). The spinal cord forms a stable cord, but movable in the human body. The lumbar-sacral part of the spinal cord (LSPSC) is strong, elastic and movable; it has characteristics which are needed for the straight (proper) position and completion of all normal life activities of the human. This straight and proper position affects the whole spinal cord. Stiffness (blockage) in the LSPCS limits the locomotor skills (movement), flexion, extension and many other normal daily activities (Twomey & Taylor, 1987; Pengel, Herbert, Maher & Refshauge, 2003). Position, balance muscles, weakness of muscles, spondylosis, arthritic changes, mechanical movements disorders could be the source or the cause of the symptoms at diseased with the low back pain (Maitland's, Hengeveld, Banks & English, 2005).

To determine the duration of the sick leaves during one year period at diseased with the low back pain comparing to obesity.

Methods

The research was conducted in the Physiatrist Service at the Institute of the Occupational Medicine (IOM) during one year period during the year of 2013. The total number of the diseased included in this research was 101 who were of adult age, employed at Energy Corporation of Kosovo (ECK). The research was long-term and retrospective. The material was obtained in protocolled manner. The subjective data were collected; age, gender, working experience, clinical signs and occupation.

The objective data, as well as specific tests and diagnostics were carried out in the Physiatrist service, while the radiography was examined by the radiologist. From the records of the systematic visits,the information about the weight and height were taken. Also, the duration of the sick leaves was copied from the medical records. The application of the physical therapy was taken from the protocol register. The patients were treated with physical therapy at IMP. Out of total 101 patients, they have applied physical therapy. Physiotherapy is applied according to the protocol of McKenzie in a standardized protocol and tailor made for each case. The main goals of the McKenzie Protocol are: reduction of pain and deformity, conservation and education for a good posture, full function recovery, and prevention of dissability[4]. In general, Physiotherapy has focused on static and dynamic exercises to strengthen the muscles of the lumbar region, abdominal, pelvic muscles, spine, and in general extremities, especially legs.

Results

The presentation of data was carried out through the tables and pictures. The following statistical parameters were in-

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cluded: index of the structure, arithmetic average, standard deviation as well as minimal and maximal value. For testing of non-parametric data was used X 2 and Fisher's test, while T-test was used for the parametric data. Verification of the tests for the level of reliability 95%, is ($p<0.05$).

Out of all examinees, in the greater number of them (44.6%) the duration of the disease was up to 4 years. In regards to the distribution according to the groups, in obese ones with a higher frequency they had duration up to <1 year, while the duration of disease in non-obese ones was longer (1-4; Table 1).

Table 1. Duration of pain according to the groups

	group I Non obese		group II Obese		Totally	
Duration of pain (years)	N	%	N	%	N	%
<1	28	40	17	54.8	45	44.6
1-4	30	42.9	12	38.7	42	41.6
>4	12	17.1	2	6.5	14	13.9
Totally	70	100	31	100	101	100

As seen in the Table 2, only 11 or 10.9% of the diseased, during the period of the research, didn't use their sick leaves because of the low back pain. While the greater number of them 30 or 29.7% have used the sick leave in duration of one up to two weeks.

Table 2. Sick leaves according to the groups

	Group 1 non obese		Group 2 Obese		Totally	
Sick leaves (week)	N	%	N	%	N	%
0	8	11.4	3	9.7	11	10.9
1-2	23	32.9	7	22.6	30	29.7
3-4	15	21.4	7	22.6	22	21.8
5-6	9	12.9	6	19.4	15	14.9
7-8	8	11.4	4	12.9	12	11.9
9+	7	10.0	4	12.9	11	10.9
Totally	70	100.0	31	100.0	101	100.0

By the distribution of the cases according to the groups we have obtained similar structure, and this can be seen from the T-test, in which occasion we didn't obtain important statistical significance between the groups in relation to the duration of the sick leaves per week ($t=0.602$; $p>0.05$; Table 3).

Table 3. Average sick leaves (week) according to the groups

Sickleaves (week)	Group 1 (non obez)	Goup 2 (Obez)	Totally
N	70	31	101
Average	3.94	4.42	4.09
Dev. Stand.	3.74	3.58	3.68
Min	0	0	0
Max	19	13	19
T-test, P-value	t=0.602, P=0.548		

While the average sick leave at diseased from non-obese group was 3.94 per week (SD±3.74 week), rank 0-19 week, the ones from obese group it was 4.42 per week (SD±3.58 week), rank 0-13 week (Table 2). The examinees who perform physical work have used longer sick leaves in comparison with the other groups (41.3%; 37.5%; 27.3%; Table 4).

Table 4. Sick leaves according to the mandatory position at work

	Siting position		Hard work		Often sitting		Totally	
Sick leaves (week)	N	%	N	%	N	%	N	%
0	4	18.2	7	11.1	-	-	11	10.9
1	2	9.1	13	20.6	4	25.0	19	18.8
2	5	22.7	5	7.9	1	6.3	11	10.9
3	3	13.6	9	14.3	3	18.8	15	14.9
4	2	9.1	3	4.8	2	12.5	7	6.9
5+	6	27.3	26	41.3	6	37.5	38	37.6
Totally	22	100.0	63	100.0	16	100.0	101	100.0

Discussion

During our work we found that 89% of the diseased have used their sick leaves. Approximate data are presented also by Wittink and Michel (2002). We got contradictory data regarding the bedridden sick leaves or application of the physical therapy in the acute phase. Barclay (2007) came to a conclusion that in regards to the acute low back pain, the diseased who are active

during this phase have more benefits in relation to decreasing of pain and preservation of the function in comparison to the ones who stay bedridden (lying) at this phase. At the diseased who suffered the pain along N. Ishiadicus there wasn't found significant difference whether they stayed active or bedridden.

Sick leaves are longer at physical employees comparing to other occupations. Physical workload at work affects appearing of pain along N. Ishiadicus while the psycho-social factors affect the duration of the healing.

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Waist Circumference as an Indicator Abdominal Obesity in Middle Age

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A B S T R A C T

Metabolic syndrome was defined in order to identify people with an increased risk. One of five criteria of metabolic syndrome is also an abdominal (central) obesity. The study included 297 subjects, middle aged from Montenegro, 137 (46.12%) male and 160 (53.88%) of the respondents were female. According to the World Health Organization (WHO) about 2.1 billion people suffer from overweight. Analyzing the results of our research, more than worrying fact is that two-thirds of the studied population in middle age are having problems with over-nutrition and obesity. It is estimated that in the world today, about one billion people are overweight, and about 300 million obese.

Key words: *obesity, waist circumference, nutritional*

Introduction

It is believed that the modern lifestyle, which includes eating unhealthy, industrial processed food rich in sugar and saturated fats, as well as a sedentary lifestyle, are main culprit for the appearance of abdominal obesity and obesity in general. Obesity is a disorder characterized by enlargement of the body fat mass to an extent that leads to poor health and a series of complications. Excessive intake above the needs of the basal metabolic rate and physical inactivity are the main causes of obesity. In the 21st century we face with the global epidemics of obesity, diabetes and heart disease, including hypertension. In order to identify people with an increased risk, metabolic syndrome was defined. One of five criteria of the metabolic syndrome is and abdominal (central) obesity. Highly specific anthropometric indicator of central obesity in adults is waist circumference (WC). Waist circumference is an adequate indicator of intra-abdominal fat and health risk. The trigger for the buildup of fatty deposits can also be hereditary factors, metabolic or endocrine disorders, physical inactivity, various psychological trauma, tumors, and even drugs, usually steroids and antidepressants. Recent research in the UK suggests us that in the previous two decades waist circumference increased faster than Body mass index. According to the World Health Organization (WHO, 2000) waist circumference over 102 cm for men and 88 cm for women is a boundary that requires immediate weight reduction.

The aim of the research is to determine the waist circumference as an indicator of obesity in people of middle age.

Methods

The study included 297 subjects, middle aged from Montenegro, 137 (46.12%) male and 160 (53.88%) of the respondents were female. Waist circumference was used as anthropometric indicator of abdominal obesity. Waist circumference is precisely measured centimeter tape, midway between the last rib and the top of the iliac bone (top of the hip bone to hip) as recommended by the World Health Organization. The data were analyzed by statistical methods, using the statistical software STATISTICA for WINDOWS.

Results

Based on the results of research that included 297 subjects middle aged, 95 (32%) patients had normal nutritional status. 101 (34%) of the respondents have excessive nutritional status, and the same number of respondents 101 (34%) are obese (Table 1).

Table 1. Waist circumference as an indicator abdominal obesity in middle age

	N	%
normal nutritional status	95	32
excessive nutritional status	101	34
obesity	101	34
total	297	100

Table 2. Waist circumference as an indicator abdominal obesity in male of middle age

	N	%
normal nutritional status	44	32.1
excessive nutritional status	52	37.9
obesity	41	30
total	137	100

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In a sample of 137 male subjects, normal nutrition has got 44 (32.1%) of the respondents, excessive nutritional status, 52 (37.9%) and obesity was found on 41 (30%) patients (Table 2).

Table 3. Waist circumference as an indicator abdominal obesity in female of middle age

	N	%
normal nutritional status	51	31.9
excessive nutritional status	49	30.6
obesity	60	37.5
total	160	100

From 160 female subjects, normal nutrition had got 51 (31.9%) of respondents, excessive nutritional status had 49 (30.6%) and 60 (37.5%) of the respondents were overweight (Table 3).

Discussion

According to the World Health Organization (WHO, 2000), about 2.1 billion people suffer from overweight. Analyzing the results of our research, more than worrying fact is that two-thirds of middle aged population are having a problem with over-nutrition and obesity, especially if we know that level of female sex hormones in the stated period, comes with less "production" of estrogen. It is estimated that in the world today, about one billion people are overweight, and about 300 million are obese (WHO, 2000). Preventive measures in fight against obesity should involve increasing physical activity, reducing energy intake, changes in the factors that affect the excessive body weight and obesity. Recent studies conducted on adults in Sri Lanka (Katulanda, Jayawardena, Sheriff, Constantine & Matthews, 2010) have found a high prevalence of overweight and obesity, especially abdominal obesity. The obesity is often accompanied by gallbladder disease (chronic inflammation and calculus), and fatty infiltration of the liver (Stokić, 2004). The research results indicate that good physical fitness reduces the risk of excessive weight gain and that men who have excessive body weight, or who are in good shape, have a lower mortality rate than people of normal weight (Lee, Jakcon & Blair, 1998). Research conducted before 1989 showed that in developing countries, obesity is associated with higher socioeconomic status and represents a disease of the richer classes, while in developed countries the trend is reversed (Monteiro, Moura, Conde & Popkin, 2004). It is believed that the body weight gain of 20%, leads to an increase in the risk of diabetes by 150% (Johann, 1994). Disorders of lipid metabolism and lipoprotein are present in approximately 30% of the obese person (Stokić, 2004). The goals of treatment of obesity are much broader than strict weight loss and they include the reduction of risk factors and improve health (Stern, 2009).

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Relations between Biomechanical Parameters and Static Power of Arms in Children with Disturbed Posture

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A B S T R A C T

This study is aimed at determining the parameters and biomechanical analysis of their impact on the static arm strength in children with impaired posture as poor kyphotic posture, lordotic poor posture and children with flat feet. A transversal study included a sample of 67 children on the territory of the municipality of Subotica. The structure of the sample is as follows: 22 subjects with impaired kyphotic posture, 18 patients with impaired lordotic posture, and 27 subjects with flat feet. Measuring the level of static arm strength was done by the standardized "folding endurance" test. Observing the morphological development of children with kyphotic, lordotic poor posture and flat feet determined statistically significant differences in biomechanical variables.

Key words: *biomechanical parameters, static power, children, disturbed posture*

Introduction

Any deviation from the standard dimensionality in terms of biomechanics and anthropometry parameters can clearly lead to impaired body posture, and thus lead to muscle inefficiency regarding motor functioning. Functional posture disorders commonly occur in preschool and early school age, while the adolescent age is characterized by the appearance of structural spinal deformities (Adar, 2004; Demeshi, 2007). During the schooling period, the child's posture is opposed to many external influences, leading to inadequate postural habits. Posture changes the most between 7 and 12 years of age under the influence of body changes and psychosocial factors, in order to achieve balance in accordance with the new proportions of the body (McEvoy & Grimmer, 2005; Penha, Joao, Casarotto, Amino, & Penteado, 2005). As stated by McEvoy and Grimmer (2005), postural control develops in segments in cephalo-caudal direction, starting from establishing the control of the head, then the torso and finally achieving postural stability while standing. The motor and sensory system that is responsible for postural stability goes through a transition at the age of 4-6 years, and achieves adult maturity between the ages of 7-10 years. Posture evolution in the sagittal plane between 4th and 12th year of age is considered a normal consequence of musculoskeletal maturation or the result of the process of adaptation in terms of maintaining balance in the sagittal plane (Lafond, Descarreaux, Normand, & Harrison, 2007). The posture of primary school boys and girls is characterized by the head protrusion, bent shoulders, winged shoulder blades, front pelvis inclination, which is often accompanied by a pronounced lumbar lordosis and abdominal protrusion. These changes in the shoulder-blade region are connected (Penha et al., 2005). Motor performance can be significantly hampered if there is biomechanical disproportion. Biomechanical imbalance in children with postural disorders *de facto* influences the movement, i.e. the manifestation of motor abilities in whatever form. All motor abilities have equal opportunity to be in insufficient state, of course according to the postural disorder. Changes in bone-articular apparatus may arise not only from biological physiological reasons, but also from social and cultural aspects. Numerous studies determined the more common poor posture in the early school age than in the adolescent age followed by more structural changes (Adar, 2004; Demeshi, 2007; Kratenova, Žejlicova, Maly, & Filipova, 2007). A high percentage of poor posture in lower grades of primary school is the result of the relative instability of the musculoskeletal system which becomes more stable with the development of musculature over the years (Adar, 2004). Adolescence includes more structural deformity of the spine, which can be a result of accelerated growth and disproportion in the growth of bone and muscle structures (Gandreault, Ansenault, & Laviere, 2005; Wong, Hui, Rajan, & Chia, 2005; Yilkoski, 2005).

The aim of the study is to determine the parameters and biomechanical analysis of their impact on the static arm strength in children with impaired posture as poor kyphotic posture, lordotic poor posture and children with flat feet.

Methods

Methodic approach has included an assessment of the static strength of arms and shoulders, and a measurement of biomechanical parameters on a sample of 67 children with an existing diagnosis by a physician. Data processing was done using statistical procedures: descriptive statistics for calculating basic descriptive statistics of all the analyzed variables: arithmetic

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mean (AM), standard deviation (S), minimum (MIN) and maximum (MAX) value of the measurement results. Regression analysis was used to determine the influence of a set of biomechanical variables, which represented the predictor variables, on the motor variable, which was the criterion variable.

The sample of variables and measurement instruments

The sample consisted of 67 children with a diagnosis already given by a physician (22 subjects with kyphotic, 18 subjects with lordotic poor posture, and 27 subjects with flat feet from Subotica, of 10-11 years of age. The assessment of motor abilities in patients with kyphotic, lordotic poor posture and flat feet, of younger school age was administered using a standardized folding endurance motor test. From the biomechanical parameters that may have an impact on the manifestation of static strength in children with impaired posture represented supredictor variables in the study. For the assessment of longitudinal dimensionality of the skeleton: body height (mm), sitting height (mm), upper arm and forearm length (mm). For the assessment of the volume and body mass, body weight (kg). Measurements were conducted using anthropometer (height, sitting height, upper arm length, forearm length were measured) and decimal digital scales (body weight was measured), following the *IBP* standard for each dimension.

Results

Table 1 presents the results of descriptive statistics of biomechanical parameters in three pre-formed sub-samples: patients with kyphotic impaired posture (labeled as K group), patients with lordotic impaired posture (marked as L group), and patients with flat feet (labeled as FF group).

Table 1. Descriptive Statistics of Biomechanical Variables for Different Groups of Subjects

Variable	Group	AM	S	MIN	MAX	Sk	Kurt
Body height (mm)	K	1543.86	63.28	1390	1630	-0.66	0.07
	L	1556.11	84.32	1375	1705	-0.39	-0.12
	FF	1511.67	77.78	1370	1660	0.30	-0.87
Sitting height (mm)	K	702.23	41.71	625	790	0.20	0.21
	L	708.33	70.79	560	815	-0.36	-0.57
	FF	695.15	66.74	565	820	0.14	-0.96
Upper-arm length (mm)	K	221.55	10.23	200	241	0.27	-0.07
	L	221.67	10.91	204	250	1.03	1.51
	FF	217.41	7.92	202	232	-0.06	-0.60
Forearm length (mm)	K	206.05	12.94	184	236	0.39	-0.22
	L	210.00	13.81	190	240	0.17	-0.27
	FF	203.96	8.60	190	219	-0.07	-0.87
Arm length (mm)	K	595.05	21.31	535	636	-0.84	2.31
	L	598.00	28.15	551	666	0.70	0.77
	FF	577.41	28.96	521	629	-0.22	-0.64
Body weight (0.1 kg)	K	49.57	8.86	36.40	67.00	0.33	-0.96
	L	47.77	9.36	34.00	67.00	0.19	-0.57
	FF	44.18	10.48	32.00	74.00	1.33	1.62

Based on the value of descriptive statistics of biomechanical variables, balanced growth of the longitudinal skeleton can be determined in all three subsamples considered through variables: *body height, sitting height, upper-arm length, forearm length and arm length*. Such data are the result of pre-puberty and is present in a given sample of children. Subjects are of similar body height, i.e. the length of tubular bones which provide body growth in height. There were remarkable differences between the lowest and highest recorded results primarily in the height variable, which points to the fact that individuals already show the intensive growth of bone tissue, which is the result of pubertal period of individuals (human).

Table 2. Results of Descriptive Statistics of Motor Variables

Variable	Group	AM	S	MIN	MAX	Sk	Kurt
Folding endurance (s)	K	14.70	10.20	0	32.10	0.40	-1.16
	L	12.58	7.20	0	23.30	-0.56	-0.37
	FF	23.81	21.41	0	78.85	0.90	0.13

Slightly larger variability was recorded in the variables for the assessment of body volume and mass, *Body weight*, in all three subsamples.

Table 2 shows the descriptive statistics of motor variables. The results are shown in particular for all three pre-formed samples.

Table 3. Regression Analysis of the *Folding Endurance* in Subjects with Impaired Kyphotic Posture

Variable	R	p	r_{part}	p_{part}	Beta	Pbete
Body height	-0.13	0.28	0.05	0.86	0.04	0.86
Sitting height	-0.17	0.23	-0.08	0.76	-0.06	0.76
Upper-arm length	0.24	0.14	0.09	0.72	0.13	0.72
Forearm length	0.16	0.24	.016	0.53	0.21	0.53
Arm length	0.16	0.24	-0.17	0.52	-.015	0.51
Body weight	-0.78	0.00	-0.80	0.00	-0.81	0.00

Based on descriptive statistics shown in the table, it can be concluded that the subjects were of different levels of static strength of arms and shoulders. The extraordinary result variability is the consequence of the unevenness of strength development in a given sample of subjects and weaknesses of individual muscle regions in the uneven ratio in all subjects.

Table 4. Regression Analysis of the *Folding Endurance* in Subjects with Impaired Lordotic Posture

Variable	r	p	r_{part}	p_{part}	Beta	pbete
Body height	-0.59	0.01	0.21	0.50	0.46	0.50
Sitting height	-0.32	0.09	-0.17	0.58	-0.23	0.58
Upper-arm length	-0.49	0.02	0.08	0.81	0.16	0.81
Forearm length	0.51	0.02	-0.21	0.49	-0.43	0.49
Arm length	-0.39	0.06	0.01	0.98	0.01	0.98
Body weight	-0.71	0.00	-0.51	0.08	-0.87	0.08

Reviewing the results of regression analysis of the *Folding endurance* criteria (Table 3) suggests that there is a statistically significant effect of the predictor variables system on the criterion variable in subjects with impaired kyphotic posture (p=0.00). The obtained high values of the multiple correlation coefficient R=0.83 explain the exceptional 68% of common variability.

Table 5. Regression Analysis of the *Folding Endurance* in Subjects with Flat Feet

Variable	r	p	r_{part}	p_{part}	Beta	pbete
Body height	-0.40	0.02	-0.05	0.81	-0.07	0.81
Sitting height	-0.25	0.10	0.18	0.43	0.29	0.43
Upper-arm length	-0.33	0.05	-0.10	0.65	-0.20	0.65
Forearm length	-0.30	0.06	-0.02	0.92	-0.06	0.92
Arm length	0.06	0.39	0.05	0.83	0.04	0.83
Body weight	-0.58	0.00	-0.47	0.03	-0.60	0.03

Regression analysis of *Folding endurance* criterion variable in the sub-sample of subjects with lordotic poor posture (Table 4) revealed the absence of statistically significant correlation of the predictor variables system on the assessed criterion, because the significance of the multiple correlation coefficient p=0.11, i.e. the multiple correlation coefficient value R=0.75, which was explained with 56% of common variability.

Based on the results of the regression analysis of the *Folding endurance* criterion in Table 5, it can be concluded that there is no statistically significant correlation of the predictor system in the subsample with flat feet (p=0.10).

Discussion

Observing the morphological development of children with kyphotic, lordotic poor posture and flat feet determined statistically significant differences in biomechanical variables. The obtained data indicate the fact that the subjects with impaired poor posture of the spine possessed longer tubular bones of the upper limbs, which suggests a greater longitude of the skeleton of these subjects. It was concluded that the subsamples of subjects with kyphotic and lordotic poor posture were higher than of those with flat feet, although there were no statistically significant differences. The longitude of the skeleton may probably be associated with the formation of body deformities as poor (impaired) posture and changes in the spinal cord in children of primary school age. Brevity of chest muscles and elongation of muscles on the back side of the body (muscles of the upper third of the back) contributed to the poor results of the *Folding endurance* variable in kyphotic subjects compared to those with flat feet, as well as between the subjects with lordotic poor posture and subjects with flat feet in benefit of the subjects with flat feet. Weak and elongated musculature of back muscles, especially the upper third of the back muscles (surface and deep muscles), is responsible for the poor results of this group of subjects in the variable for the assessment of static strength of arms and shoulders. The surface back muscles that are affected by the changes are arranged in three layers. Due to the longitude of the skeleton and body weight, the condition of muscles, especially the muscles of arms and shoulders, chest muscles, abdominal muscles along with paravertebral muscles that stabilize the lumbar segment of the spinal cord in kyphotic patients with poor posture, contributed to the poorer results compared to those with the flat feet, which were primarily the lightest, thus their muscles in these areas were not as weak as in the above groups of subjects. The fact that the musculature is more insufficient in the subjects with lordotic poor posture compared to those with flat feet, which is due to the protrusion of the abdominal wall, is confirmed by the research of Ishida and Kuwajima (2001) and Penha et al. (2005). Obviously, in addition to weak abdominal muscles, these subjects possess poor, weak and underdeveloped back musculature, which can contribute to the occurrence of kypho-scoliosis, which are very common result of compensation on the spinal cord in children with lumbar lordosis.

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Structure of Cognitive Abilities and Skills of Lifeguards

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A B S T R A C T

The presence of lifeguard service on beaches greatly contributes to reducing the number of accidents in and around the water. The lifeguard can be a person with good motor, but also cognitive skills and abilities. In addition to good swimming skills, lifeguard must be able to quickly detect and recognize the accident, and also to be able to timely and correctly act in case of accident in water, but also at the beach. The goal of this study is to determine the structure of cognitive abilities and skills with the sample of lifeguards that work on Montenegrin beaches. Battery KOG-3 was applied on the sample of 40 lifeguards. The collected and achieved results lead to following conclusion: the subjects have good ability to determine relation between elements of a structure and lower characteristics of that structure; subjects have good ability to assess the efficiency of serial processor; and subjects have good ability to assess efficiency of perceptive processor.

Key words: *cognitive abilities, tests, lifeguards*

Introduction

There is acute problem how to reduce the number of accidents in around the water in all countries (Ljubojević & Terzić, 2013). In addition to swimming training (Milošević, 2003), lifeguard training and organization of lifeguard service is efficient model that countries use in order to increase the level of safety on beaches and other swimming places. In Montenegro, the number of drowning significantly decreased since the lifeguard service has been present at all beaches (Ljubojević & Terzić, 2013). Given the fact that Montenegrin coast is recognized as attractive tourist organization, the need for more well-trained lifeguards increased. It is important to emphasize that the length of Adriatic coast that belongs to Montenegro is 300 km, but all beaches are, by its configuration, very different, from very long, wide, and sand beaches, to small, narrow, rocky, inaccessible beaches. This should be kept in mind when we discuss the profile of a lifeguard, his/her morphological and connotative characteristics, and motor and cognitive skills and capabilities.

According to some previous research (Guilford & Zimmerman, 1956; Cattell, 1963, 1971; Momirović, 1975; Momirović, Šipka, Wolf, & Džamonja, 1978; Momirović, Gredelj, & Hošek, 1980; Wolf, Momirović & Džamonja, 1992) that treated the problem of structure of cognitive skills, the problem subject and goal of study is defined. The goal of this study is to determine the structure of cognitive abilities and skills with the sample of lifeguards.

Methods

Battery KOG-3 was applied on the sample of 40 lifeguards who professionally work as beach lifeguards in various locations. It was taken into account that lifeguards encompassed with this study work on beaches along the Montenegrin coast, from the border with Albania to the border with Croatia, due to abovementioned differences in beach conditions they cover. Testing was conducted with lifeguards who already work on Montenegrin beaches, and it was performed in framework of their annual medical control, and regular check of lifeguard skills and knowledge.

"KOG-3" Battery (Wolf, Momirović & Džamonja, 1992) is used for achieving the basic goal, i.e. to determine level of general cognitive capability. Battery KOG-3 consists of three tests, as follows: pictures comparison test – IT1,synonyms and antonyms test– AL4, and visual specialization test S1. IT -1 test is pictures comparison test. It is designed as the test of general perceptive factor, which is, actually, synthesis of primary factors of perceptive identification, perceptive analysis, and perceptive functioning. Test contains 39 multiple choice tasks in which the subject needs to identify which, out of 4 suggested pictures, is identical to the given picture. Time is limited to four minutes. Synonyms and antonyms test (AL4) is designed as test of verbal comprehension. It consists of 40 pairs of words, and task for subject is to identify whether the words in pair have the same or opposite meaning. Time is limited to two minutes. Visual specialization test (S1) is designed as classic multiple choices test. It consists of 30 tasks in which the subject needs to find, in 4 transverse projections of one set of bricks, a projection that is adequate for that group. Collected data are analyzed via basic descriptive statistical methods, and after that the Pearsons's correlation analysis was used. Furthermore, data are processed through factor analysis. Factor analysis represents correlation technique as it seeks group of variables that are related or similar in terms of "joint moving", and therefore they are highly correlated.

Results

Table 1 shows basic descriptive parameters of cognitive capability variables.

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Table 1. Basic descriptive parameters of cognitive capability variables

Variable	$\bar{X}$	SD	Min	Max	V%	Sx	Vš
IT1	35.28	5.67	28.00	39.00	17.05	0.40	11.00
AL4	38.13	3.37	32.00	40.00	9.07	0.24	8.00
S1	25.80	5.70	19.00	29.00	23.94	0.40	10.00

If you analyze the Table 1, it is evident that results achieved through this research are similar to the results of some previous researches (Milošević, 1987; Popović, 1990; Momirović et al., 1975, 1978, 1980).

Table 2. shows inter-correlation matrix.

Table 2. Inter-correlation matrix of cognitive capability variables

Variable	IT1	AL4	S1
IT1	1.00		
AL4	0.52	1.00	
S1	0.35	0.48	1.00

Intercorrelation matrix shows relatively high correlation coefficients. The highest correlation coefficient is achieved between variables AL-4 and IT-1, i.e. test for assessing efficiency of serial processor with the test for assessing efficiency of input processors highly significantly correlate.

Table 3 shows matrix of factors of cognitive capabilities.

Table 3. Matrix of factors of cognitive capabilities

Variable	FAC_1	h^2
IT1	0.78	0.61
AL4	0.85	0.72
S1	0.75	0.57
LAMBDA	1.91	
%	63.80	
KUM%	63.80	

Discussion

By applying the principal components method with Guttman-Kaiser (GK) criteria, there is only one characteristic root and its corresponding vector are found as significant (Table 3).Variable system is reduced on one principle component. Communalities of variable are significantly high are their range is 0.75-0.72.

The lowest is recorded with test S-1, which assessed the efficiency of parallel processor, i.e. ability to identify relations and correlations. This test belongs to the processor for parallel, simultaneous processing of information, which is capable to simultaneously process a number of information flows, and to search the memory simultaneously, both short-term and long-term.

Test AL-4belongs to processor for successive, serial processing of information, which performs sequential cognitive processes and analysis of information transformed into the symbolic code. Test IT-1 belongs to processor for decoding, structuring, and search of input information that, in interaction with other processors of cognitive system, creates basis for perceptive ability.

The main component with 63.8% of variance behaves as general cognitive factor. All tests have high level of correlation with this factor, which is also main subject of measurement of all elements of cognitive abilities in this sample of subjects. Results achieved in this way can be interpreted, with high level of reliability, in framework of Cattella cognitive theory (1963, 1971).Dimension interpreted as efficiency of perceptive processor is very close to general perceptive factor (Gp); dimension interpreted as efficiency of parallel processor is very close to factor of fluid intelligence (Gf); while dimension interpreted as efficiency ofserial processor can be accepted as measure of factor of crystalized intelligence (Gc), (Cattell, 1963, 1971; Horn & Cattell, 1966).

Based on the results achieved, following can be concluded: Subjects have good ability to determine relation between elements of some structure and lower characteristics of such structures (Test S-1); Subjects have good ability to assess efficiency of serial processor (Test Al-4); and Subjects have good ability to assess efficiency of perceptive processor.

Results of this study and research can be helpful in profiling staff for such responsible job as the beach lifeguard is.

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The Association of Sprint Performance with Anthropometric Parameters in Youth Soccer Players

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A B S T R A C T

Several studies have investigated the association between strength and speed, showing that stronger athletes perform better during sprint performances (Baker & Nance, 1999). Moreover, the aim of this study was to evaluate the correlation between sprint performance and anthropometric parameters. Subjects were 32 youth soccer players. The age of participants was 15.1±0.3 years. Speed time (50 m sprint) was evaluated during sprint test, and anthropometric parameters were measured (weight, height, percent body fat). Correlation analysis (Pearson test) was performed to evaluate the correlation between speed and anthropometrics. Results showed correlation between body weight and speed (r=-0.041 Sig=0.834); BMI values and speed (r=0.231; Sig=0.236), body height and speed (r=-0.384; Sig=0.044); percent body fat and speed (r=0.440; Sig=0.019).In conclusion, the results of this study show no significance association between body weight and BMI with sprint performance and significance correlation between body height (negative correlation) and percent body fat (positive correlation) with speed.

Key words: *speed, correlation, sprint performance, soccer, player*

Introduction

In soccer players there are a lot of characteristic about physical preparation that affect the result of the match. So an athlete need a lot of physical preparation in order to achieve better result. Helsen, Hodges, Van Winckel and Starkes (2000) in their study showed that it takes 10 years of a soccer player to grow as a player in elite.

Studies by S.M. Gil, J. Gil, Ruiz, Irazusta and Irazusta (2007) and Gravina, S.M. Gil, Ruiz, Zubero, J. Gil and Irazusta (2008) revealed that for different playing positions there are specific physiological demands and anthropometrical prerequisites. This results showed in conclusion that this affect the selection of young players based on superior physiological performances and anthropometrical advantage. Results from different studies show that match intensity decreases with age (Capranica, Tessitore, Guidetti & Figura, 2001) and match level is indicated by distance coverage. Two studies by Di Salvo et al. (2007), Rampinini, Coutts, Castagna, Sassi and Impellizzeri (2007) revealed that the coverage is 11 km in professional senior while in youth U18 about 9 km (Helgerud, Engen, Wisloff & Hoff, 2001). Castagna et al., 2003 for athletes at U12 showed that distance coverage is 6.2 km (60-minute 11-a-side match).

Regarding heart rate response in professional senior a study by Stolen, Chamari, Castagna and Wisloff (2005) revelead that 93% of maximal heart rate—HRmax and U18: 82% of HRmax, and blood lactate concentration (professional senior: 10 mmol L21and U12: 5 mmol L 21 (Capranica et al 2001; Stolen et al., 2005). There are a few studies and a few literature review reporting the relationship between anthropometric and physiological performances among young soccer players. Several studies have investigated the association between strength and sprint performances, showing that stronger athletes perform better during sprint performances (Baker & Nance, 1999; Comform et al., 2012).

Moreover, the aim of this study was to evaluate the correlation between sprint performance and anthropometric parameters.

Methods

Subjects were 32 youth soccer players. The age of participants was 15.1±0.3 years. Speed time (50 m sprint) was evaluated during sprint test, and anthropometric parameters were measured (weight, height, percent body fat). Correlation analysis (Pearson test) was performed to evaluate the correlation between sprint and anthropometrics. Body height and body mass were measured using a Health O Meter 402 KL professional physician beam scale. Values were recorded to the nearest 0.1 cm and 100 g, respectively. Body Mass Index was calculated using the usual formula; BMI=body mass (kg)/body height (m^2). Skin fold thickness measurement were used for the estimation of children body fat percent. Triceps and sub scapular thickness were measured to the nearest 0.1 mm using a calliper on the right side of the body (Harpenden Skinfold Caliper; Baty International RH15 9LR. England). All skin folds were taken three times by the same examiner to ensure consistency in the results with the average of the three values used as a final value. To predict percent body fat the equation described by Slaughter et al. (1988) were used.

Descriptive statistics (mean and standard deviation) were calculated for the variables assessed in this study. It was creating a specific data base in excel file (pre and post intervention

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test results) and then converted in SPSS database. All variables assessed in this study were tested for normality. P-values of≤0.05 were considered statistically significant. Pearson product moment correlation coefficient was used to assess the relationship between selected parameters (anthopometric parameters and sprint performance). All analysis was performed using the statistics system SPSS 17.0.

Results

Data on table 1 show the results for anthropometric parameters of youth soccer players. The mean values for weight mass are 48.2 kg (sd 8.8 kg), for body height 160.4 cm (sd 9.0 cm), for BMI 18.6 kg/m^2 (sd 2.5 kg/m^2) while for percent body fat 10.6% (sd 6.0%). Also the table shows the results for speed using 50 m sprint test (mean 7.85 seconds; sd 0.6).

Table 1. Descriptive statistics for anthropometric parameters and speed

	Minimum	Maximum	Mean	Std. Deviation
Weight	32.5	71.3	48.2	8.8
Height	138.0	175.0	160.4	9.0
BMI	15.3	26.4	18.6	2.5
Percent Body fat	5.0	31.7	10.6	6.0
Speed (50m sprint)	6.85	9.36	7.85	0.56

Results on table 2 show correlation between speed and body weight (r=-0.041; Sig=0.834); speed and BMI values (r=0.231; Sig=0.236), speed and body height (r=-0.384; Sig=0.044); speed and percent body fat (r=0.440; Sig= 0.019).

Table 2. Correlation coefficient between speed and anthropometric parameters

		Weight	Height	BMI	Percent Body fat
Speed (50m sprint)	Pearson Correlation	-0.041	-0.384*	0.231	0.440*
	Sig. (2-tailed)	0.834	0.044	0.236	0.019

Legend: ** Correlation is significant at the 0.01 level (2-tailed) ; * Correlation is significant at the 0.05 level (2-tailed)

Results on table 3 show correlation between speed with body height and percent body fat splited by speed category. In the first category (lowest speed score) data show that speed and body height are negatively correlated (r=-0.471; Sig=0.425); speed and percent body fat values are positively correlated (r=0.208; Sig=0.736) while in the second category data show that speed and body height are negatively correlated (r=-0.348; Sig=0.359); speed and percent body fat values are positively correlated (r=0.597; Sig=0.09) while in the third category data show that speed and body height are negatively correlated (r=-0.467; Sig=0.174); speed and percent body fat values are positively correlated (r=0.427; Sig=0.218) and fourth category (highest score) data show that speed and body height are negatively correlated (r=-0.986; Sig=0.014); speed and percent body fat values are positively correlated (r=0.944; Sig=0.051).

Table 3. Correlation coefficient between speed with body height and percent body fat splited by speed category

Speed category			Height	Percent Body fat
1	Speed (50m sprint)	Pearson Correlation	-0.471	0.208
		Sig. (2-tailed)	0.425	0.736
2	Speed (50m sprint)	Pearson Correlation	-0.348	0.597
		Sig. (2-tailed)	0.359	0.09
3	Speed (50m sprint)	Pearson Correlation	-0.467	0.427
		Sig. (2-tailed)	0.174	0.218
4	Speed (50m sprint)	Pearson Correlation	-0.986*	0.944*
		Sig. (2-tailed)	0.014	0.051

Legend: * Correlation is significant at the 0.05 level (2-tailed); Speed category- increases with 0.5 seconds per category (1 lowest score- 4 highest score)

Discussion

In conclusion, the results of this study show no significance association between weight and BMI with sprint performance and significance correlation between height (negative correlation) and percent body fat (positive correlation) with sprint. This data show that in youth soccer players the height and percent body fat plays a crucial role in the performance of sprint during the game or the training course. The significance between height and sprint performance is negative, meaning that increasing the height the performance of sprint decreases meaning better results. In contrary with decreasing height. This mean having higher values in sprint test so not having better results.

Results also showed that the association between percent body fat and sprint performance is positive. This mean that with the increase in body fat percentage, the soccer player will have higher values in sprint performance and in contrary. In conclusion in this study the author suggest for the trainers or coaches to pay attention in the anthropometric parameter like percent body fat. Body height plays a crucial role but this parameter defer in the position at the field court. This data are in line this the results from a study by Wong, Chamari, Dellal and Wisløff (2009).

Wong et al. (2009) in their study showed that body mass was significantly correlated with ball shooting speed (r=0.58; p=0.001) and 30 m sprint time (r=-0.54; p=0.001) while body height was significantly correlated with vertical jump height (r=0.36; p=0.01), 10m (r=-0.32; p=0.01) and 30m (r=-0.64; p=0.001) sprint times and BMI was significantly correlated with ball shooting speed (r=0.31; p=0.01), 30 m sprint time (r=-0.24; p=0.05).

To conclude we must emphasize the role of anthropometric parameters in the selection of youth soccer players as suggested by Reilly, Williams, Nevill and Franks (2000), other than absolute anthropometry advantage, psychological and soccer-specific skills should be also considered in the selection of young soccer players for developing future high-class players.

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Theories of Tiredness in Sport

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A B S T R A C T

Classic theories interpret the phenomena of tiredness as a consequence of biochemical changes appearing in the whole organism or in active organs. From operational point of view we can define tiredness as a reversible psychophysical condition appearing under the influence of expanded time of activities, which is manifested a series of negative changes on physiological, psychological and behavioral plan. Physiological nature was primarily related by the scientists to lack of oxygen and other nutritional material in blood or blood plasma andloading of different waste material and metabolism products On those bases, three classical theories were founded, such as: theory of suffocation, theory of exhaustion, and theory of saturation, united in one general name as hormonal theories of tiredness. Lately, with extending of findings on the role of reticular formation, there are activation theories of tiredness being developed. Supporters of these theories have discovered a series of complex connections and relations existing through tiredness and different forms of brain work such as: exhaustion of neural cells during their activity, neural influences determining arrival of nutritious material into work active organs, disruption of harmony in neurophysiological processes, role of inhibition process etc. For explanation of mental tiredness, central brain theory of tiredness is dominantly used. Due to new findings of neurophysiology, a neurophysiological theory known as theory of changed hronaxy, starting from time constant of skeletal nerve irritability, is nowadays commonly used for explanation of physical tiredness at skeletal muscles.

Key words: *intensity, reduction, metabolism, material*

Introduction

In the research sense, tiredness is nowadays commonly taken as an interdisciplinary phenomenon going into several scientific disciplines, so that it is defined in accordance to their basic theoretical postulates, because of which there is no unambiguously and commonly accepted interpretation of this term. Globally viewed, in the literature we find three basic approaches in defining and researching tiredness appeared as a consequence of physical activity.

The first approach defines tiredness from the aspect of *decrease of physical efficacy*, where the accent is put on decrease of physical activity.

The second group of definitions talks about tiredness as *balance disorder* of physiological functional systems in the body that is the fall of physiological and organic equilibrium under the influence of physcho-physical effort. In the scope of this approach, tiredness is usually seen as inhibitory functional state of cortex, subcortical structures and other activating systems, appearing as a result of functional exhaustion of neural structures. It is obvious that this approach and definitions given in the scope of it represent the physiological point of view, where tiredness is interpreted as a biological protective function of organism.

The third group of definition puts *psychological aspects* of tiredness in the first plan. They talk about losing motivation and interest in proceeding sport activities and the feeling of psychophysical exhaustion (Blakemore, 1997). Very important for this aspect is primarily the subjective experience related to expanded duration of activity and exhaustion of psychophysical reserves of organism. As characteristic for this approach we can mention Pageaux`s definition in which it is said: "Tiredness is self-recognizable state in which a person feels to be inadequate to fulfill the given task, which reflects on feeling body comfort, weakness, slowness, and in cognitive plan as a feeling of futility" (Pageaux, Marcora & Lepers, 2013).

Taking into account complexity of phenomenon and different definitions regarding some aspects of tiredness, we can conclude that it is difficult to give a unique and overwhelming definition of tiredness, but from the operational aspect we can define tiredness as a reversible psychophysical condition appearing under the influence of expanded time of activities, which is manifested a series of negative changes on physiological, psychological and behavioral plan and with expressed tendency in intensity reduction or interruption of physical activity which affects reduction of sports effects and efficacy.

Theories of tiredness

Classic theories interpret the phenomena of tiredness as a consequence of biochemical changes appearing in the whole organism or in active organs. Physiological nature was primarily related by the scientists to lack of oxygen and other nutritional material in blood or blood plasma that `feeds` muscles (Kayser, Narici & Cibella, 1993). Also, in the scope of those interpretations, tiredness is related to loading of different waste material and metabolism products, such as lactic acid and other material. On those bases, three classical theories were founded, such as: *theory of suffocation*, *theory of exhaustion*, and *theory of saturationor intoxication*, united in one general name as *hormonal theories of tiredness*.

Theory of suffocation-starts for the fact that every cell needs oxygen to work, which in the process of metabolism provides tissue breathing. Muscular cells use oxygen during their work to perform contractions though which the major part (95%) of

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physical work is done. Depending on the state, an organism can provide maximally ten times more oxygen in relation to basal level, so when the work lasts longer, or when there is more tiring work is done, the aerobic capacity of a man becomes insufficient and there is a lack of oxygen for ending metabolically cycle which causes sense of tiredness.

Muscular cells for the lack of necessary amount of oxygen reduce contractile ability and that results in tiredness. After work stop and making up oxygen lack-during the rest amount od oxygen is brought into to enable muscle cells to get ready for work again.

Theory of exhaustion-starts from the fact that the tiredness appears as a consequence of spending and exhausting all disposable reserves of energetic material. Muscle cell for its work, that is muscle contractions, uses the energy given by degradation of adenosine thiphosphate (ATP) to diphosphate and monophosphate. During the work that spent energy is compensated by degradation of glucoses from blood and glycogen from liver. When these reserves are out, the organism is getting tired and the working activity is reduced or stopped.

Intoxication theories-starts from the fact that the work that lasts longer, or it is harder than it can be regulated by the aerobic capacity of the person, and it includes anaerobic capacity that are also present during metabolic cycle. On one hand, metabolism of nutritional material is at that time stopped on the level of pyruvic and lactic acid loaded in the muscle cell, as on the other hand, energetic reserves of glucoses, glycogen, adenosine thiphosphate, creatin phosphate) which enables metabolism to be finalized. Both of these lacks have a consequence in disorder in cell metabolism, so it comes to loading of waste products-lactic acid, phosphor acid, carbon-dioxide and other waste material, because bloodstream is unable to remove them on time and the consequence is tiredness and work activity which is reduced or stopped.

The proofs for the above mentioned hormonal theories are found in laboratory conditions on isolated muscles of animals, as well as monitoring changes appeared in organism of a man during activities of skeletal muscles at physical work, it was soon proved that generalization of such findings on the whole organism was unjustifiable, especially in the cases where connections of muscle tissues with brain structures are not disrupted, or where not only dominates physical work based on contraction and decontraction of skeletal muscles.

It has been established that continued stimulation of neural centers and static work bring to earlier tiredness, which on the base of classical hormonal theories cannot be explained, especially when taking into account the complexity of the processes in the human body during work. For that reason, focus of tiredness phenomenon research is redirected to study of brain functions in the conditions of increased and long-term efforts, so in that sense new theories of tiredness are set:

Activating theories of tiredness- started to develop in the middle of 20th century, when besides physical there was an emphasis on mental tiredness and when there is a sudden expanding of findings on the role of reticular formation and other brain structures responsible for sleeping and wakefulness, which enables seeing the consequences of work in that light, even the phenomenon of tiredness.

Centrally-brain theory is dominantly used for explaining mental tiredness and its beginnings can be found in the works of Russian scientists Secenov and Palov, as well as their students and heirs (Luria, 1976). Supporters of this theory, in different phases of its development, have given a series of convincible evidence that tiredness in the human body is a complex phenomenon that can only be explained by hormonal changes in blood and muscles. They consider that tiredness and its characteristics can be explained on the base of findings on neurophysiological changes appearing in CNS (Brownsberger, Edwards, Crowther & Cottrell, 2013). External demands and conditions of work in the form of stimulation effect on membrane of big brain, wherefrom the impulses leave to reticular formation that had an activating and inhibiting role, through two basic and reciprocal processes-excitation and inhibition. These two processes induce each other, at which there are two forms. The first one is alternating induction - when excitation of one center at the same time causes inhibition of the other center and vice versa. The other form of induction is self-induction-when in the same center there is alternating induction of excitation and induction processes (Pageaux, Lepers, Dietz & Marcora, 2014). As there complex and reciprocal processes between brain membrane and reticular formation, then in dependence on working activation characteristics the level of activation can be changed from maximal wakefulness and attention concentration, to the state of relaxation and sleepiness. As a result of inadequate activation or predomination of inhibitory processes in certain neural cells, the state of tiredness appears (Marcora, Bosio, & De Morree, 2008).

Scientists discovered a series of complex connections and relations between tiredness and different forms of work brain such as: exhaustion of neural cells during their activity, neural influences determining coming of nutritious material into the working active organs, disrupting coordination of neurophysiological processes, special role of breaking or inhibition processes etc.

Due to new findings in neurophysiology, a neurophysiological theory known as theory of changed hronaxy is more and more used with skeletal muscles to explain physical tiredness, and it starts from the timely constant of irritation of skeletal nerve (McGillis, Semmler, Jakobi, & Enoka, 2003). It is well known that thick myelinated neuralfibers have limited time interval during which they can transmit impulses onto the active muscle. Their hronaxy is from 0.00025 to 0.001 s. After every done stimulant comes the time when the nerve membrane is depolarized. That is the time of its refractivity, when stimulants cannot be transmitted through the nerve or affect the muscle fibers. Which high-demanding works when it comes to speed, repetitiveness and preciseness, the stimulus spreads more frequently, the hronaxy time is shorter than physiological and happens at the time of refractivity, when reflects on speed and work quality, and there is nuisance which indicates to tiredness and reduction or stop of physical activity.

Conclusion

So far, there hasn`t been a way found for direct and objective measuring of amount of tiredness, nor it can be expressed in such a simple way in certain measuring units, as for example energy consumption is expressed. All the measuring can be divided into three groups, according to basic indicators of tiredness expression: 1) Physiological measuring; 2) Psychological measuring; 3)Medical measuring.

It means that different indicators can be used for tiredness measuring and the signs often registered through different methods and techniques which commonly include: 1) Indicators of quality and quantity of sports activity; 2) Scales for measuring subjective experience of tiredness; 3) Electroencephalography (through EEG); 4) Critical frequency of fusion of visible stimulus; 5) Physchomotor and psychosensory tests; 6) Mental tests.

Tiredness measuring through the above mentioned indicators and methods is usually done before, during and after work. Therefore the given value has relative significance, because it is compared to values in the state of inaction, or to the values of some control person. So far, there hasn`t been a way found for measuring tiredness in some absolute units. In order to get as reliable indicator of the kind and degree of tiredness as possible, nowadays several objective indicators are used in combination or correlation with subjective estimation of tiredness.

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Historical Development of Skiing: Case Study in Durmitor Area

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A B S T R A C T

The objective of this study is the history of skiing, while the main goal will be the historical development of skiing in the mountain Durmitor area in Montenegro. The study consists two goals. The first goal is the emergence of the first ski in the Montenegro and benefits that are brought. The second and the main goal is the occurrence and development of skiing and ski sports in the territory of mountain Durmitor. During the making of this study, the authors used descriptive method with consulting of competent literature. The previous authors' experience in this field was also so useful. Moreover, the author used the analytic method and parallel method that is the most productive if you make some inferences about some appearance. The main outcome of this study was showing of historical progress of ski sports in the territory of mountain Durmitor from early beginnings to the modern Olympic skiing. Skis and ski sport were early appeared in the region of Mount Durmitor. The mountain and the region around it, are very rich with slopes with Olympic diameter, with plenty of snowfall and long winters. However, lack of financial investment, channeling money to other centers, led to the fact that the skiing in this area is at a low level.

Key words: *ski sport, development, competition, Durmitor area*

Introduction

Durmitor area is located on north-east of Montenegro Crne Gore and its size is 1852 m². It is hill- rocky area dominate by mountain Durmitor (the highest peak is 2522 m), and it is rugged by very deep canyons of rivers Tara, Piva i Komarnica. Over this area, 18 glacial lakes and one big artificial lake hick resulted from building of hydroelectric power plant Piva. The area is split into 3 municipalities with centers in Žabljak, Šavnik i Plužine, in which there are 13800 residents.

National park Durmitor which is famous by magnificent natural beauty, geomorphological and hydrographical characteristics and very rich wildlife. The biggest international award for natural and anthropological values of national parka "Durmitor" represents its entry in register of world cultural and national heritage at UNESCO. Canyon of river Tara which is long 68 km i sporadically deep over 1000 m, was registered in 1977. This review work is consisted of 4 parts. In the first part the sole appearing of first snow shoes is mentioned, as well as developing of skiing in the world. In the second and third part the short retrospect on development of skiing on the territory of the former Yugoslavia and Montenegro has been done. In the forth part of work the coming of first snow shoes and later development of recreational and competitive skiing in the area of mountain Durmitor is mentioned.

Development of Skiing in the World

Ski sport vuoriginates from the need for easier sroosing over snovvy areas. That affected the appearing of first skiis especially in areas with plenty of snovv precipation. Contemporary man noticed that he was moving more easily through the snow if he tied to his feet something bigger made from various materials such as animal leather, wood, brushwood etc. That is ho snowshoe were made. The next step in thinking was that it wold be easier to glide on snow than to walk in snow shoes to which the snow is being glued. That is how primitive skiis appeared.

On oldness of skiis testify cave drawings in Salavrug near Oneško lake and in bay of North Norvvay, Rodo. That drawings vvith characters of skiers are old from 4000 to 5000 years. Near the place called Musom in marsh areas of south Norvvay the skiis old around 2500 years have been found (Lund, 1996).

The biggest role in development of sports skiing had Norvvay. The first skii competition in running and and dive was held in 1770. In Kristijanija (today`s Oslo), and in 1875 the first skii club vvas established. In 1883 the first competition vvas held in place Holmenkolen near Oslo, which is today the most famous skii center. Skiing was especially developed in the district of Telemark, where in the middle of XIX century broyhers Hamestvajt i Sondre Nordhajm gave the skii ne shape and tie and thus contributed a lot to development of skii sport. The name skiing comes from Norwegian word ski which means shiver, the name telemark comes from Norvvegian district Telemark, a kristijanija from Norvvegian town Kristijanija, today`s Oslo. In 1910 in Norwegian town Kristijanija International skii committee has been established. This comittee used to prepare the first rules for the international skii competition (Taylor, 2015).

Skiing was introduced even on the first Winter Olympic games in 1924 in Chamonix in France, where the first World championship in skiing as held in 1937 (Lutz, 2015).

Development of Skiing in Former Yugoslavia

The first snow shoes of former Yugoslavia appeared in republic of Slovenija. As well as with the neighbouring countries

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those came from Nordic countries. Edmond Čibej i Rudolf Cvetko are considered to be the pioneers of skiing in Yugoslavia. In 1888, Čibij brought the first original Norwegian skiis in Slovenija, and Cvetko vvas one of the first educated skii teachers in school of Matijaš Zdarski (Denda, 2009). In republic of Croatia the development of skii sport is entitled to dr. Franje Bučar, who brought the first skiis in homeland in 1895. In 1909 skii section as a art of a club from Zagreb HAŠK was organized. In 1918 ski club Zagreb was established. In republic of Bosnia and Hercegovina, more precisley in tovvn Sarajevo the first skii section was established in 1920. Ater World War II Sarajevo expands development of skii sport. In 1984 XIV Winter Olympic games were held and Sarajevo becomes an olympic city. In republic of Srbija the first skii competition was held in 1939 the first skii club Beograd was establishe in 1934.

Yugoslavian winter-sport federation was established in 1922 with centre in Ljubljana. It was consisted of 6 sub-federations. In 1923 Yugoslavian take part in an International competition in Krkonoše in Czesch republic for the first time, when Yugoslavian winter- sport federation becomes a part of Federation of international skiers–FIS. In 1924 the first Olympic Winter games were held in Chamonix in France, where Yugoslavian group also took part. In 1964 in Yugoslavia there were 354 ski organzations and around 62000 organized skiers. That number was grovving in the followving years until the falling apart of Yugoslavia.

Develoment of Skiing in Montenegro

In 1893 ski shoes came to Montenegro and they were brought to Cetinje from Kotor via Njegusi, or even better used by captain of Norwegian military Henrik Augusto Angel. About his coming and staying in Montenegro in "Voice of a Montenegrian" was written: "There have been a few days that in our area mister Henrik Angel, a military captain from Norway has been going or, even better flying through snow. Those are a meter and half long woden poplats, by which you can go through the heaviest snow and even alongside hill". Angel`s staying on Cetinje and his excursion across Montenegro contributed a lot to popularisation of skiing.

The first skii assosiaciatin was established, vvhich is considered to be the oldest in Yugoslavia. Anent establishment of this association, jubilar ceremonial general meeting of Skiing association was held in september in 1973 in Durmitor (Paunić, 1991). Remembering Henrik Angel and his staying in Montenegro, Montenegrian people, respectively, sporstsmenpaid their debt to this extraordinairy man, a big skii enthusiast , by building a memorial in Mountain hut in Ivanova korita, on 29 September 1984. This memorial makes the future generation remember Henrik Angel, who inspired the development of this sport in our area and forming of the first skii club in Cetinje by his coming to Montenegro in skii shoes. Besides, he represented Montenegrian customs in his books "Through Montenegro in skii shoes", "Sons of black hills" and others published at the end of XIX century in Norway, and later, through their translations represented life and customs in Montenegro to world public.

During his staying in Nikšić he met a young doctor Novak Ognjenović, who was educating in Moscov, but was on duty in Nikšić. Novak was very olite tovvards Angel, as well as a big fan of skii shoes, so Angel endowed him one pair, realizing how useful they are for his job. During those days in Nikšić, a local carpenter started making skii shoes. The intense interest for skiing in Kolasin was shoved in 1932 when lieutenant Evgenije Džamonja, who was on duty in Kolasin`s garrison made the young from Kolasin interested in skiing. There were skiing activities in other places, such as Berane, Herceg Novi, Pljevlja and Žabljak.

Development of Skiing in the Region of Durmitor

Massif Durmitor, which is rising in height (2522 m) from lake area (1400 m), is a determinant of this ski area. The area is sprawled from Gornja Bukovica through Ranisava, Pošćenski region, Šljemen, Savin kuk, Karlica, Lokvice, Razvršje, Žabljak, Zmijinje jezero, Štuoc to the sole coastal of Tara, respectively, to village Tepca. Village Gornja Bukovica and urban center Žabljak are macroidentifications of zones Gornja Bukovica i Žabljak, where building of bigger commodity parts are predicted for ski activities. Alpine ski tracks and cable car parallel to their function for this area, are set on relation Gornja Bukovica–Žabljak. This area makes two ski zones-Gornja Bukovica and Žabljak.

The first skiers went to Žabljak in 1924. That was a group of tourists from Zagreb. Their coming to Durmitor which is later published in Zagreb newspapers, aroused big amazement in Durmitor area. People was fascinated by their fluency while moving through very deep snow. In Žabljak in 1925 carpenter Uroš Vojinović was the first one to make ski shoes, who was educated on Cetinje. Then Đuro Janković started doing the same. Later Gojko Samardžić improved his work to that extent that they were the same as those from factory, say villagers (R. Šamšal, personal communications, November 10, 2002).

The forming of the first ski club on Žabljak dates from 1933, and is connected with three members of ski club Zagreb and those are Vrbaški, Levačić i Crndak who, in the second half on February after exhausting journey in ski shoes from Pljevlja to Žabljak, tried winter climbing on Bobotov kuk (2522 m). Newly formed ski association was very big at the beginning. As first skiers from this area are mentioned dr. Cibilić and teachers Jovan Vuković and Veljko Durković. The most prominent skier from that period was Đorđije Milić, who surmounted Durmitor slopes with ease. Radoman Šamšal was one of the pioneers of Durmitor skiing. He started competing in 1939 until 1972. When he said goodbye to his competition career at the age of fifty. He was the winner of many competitions. He was competing in Alpine and Nordic disciplines, but downhill was his specialty where he was a big rival with Milo Rakočević Pif teacher from Kolašin.

The World War II had an impact, on other human and sports activities, as well as on skiing. After it, or more precisely until 1949 in Montenegro there were Ski association and Mountain association as two different associations. From Ilija Ćućilović`s archive we can conclude that by the end of 1950 Mountain association and Ski association joined into one common association called Mountain-ski association of Montenegro. Analogically, with an aim of forming new associations, during the same year the majority of mountain- ski associations were established (shorten for MSA) which had canton and covered the areas of majority of cantons. Majority of these associations were officially registered in 1951. During that and the following years the following associations were established: MSA Durmitor-Žabljak, MSA Vojnik-Šavnik, MSA Javorak-Nikšić, MSA Ljubišnja-Pljevlja, MSA Vojo Maslovarić-Ivangrad (Berane), MSA Komovi-Andrijevica, MSA Visitor-Plav, MSA Zelenit-Gusinje, MSA Gorštak, kasnije Bjelasica-Kolašin, MSA Subra-Herceg Novi, MSA Orjen–Kotor.

As Ilija Ćućilović says, the first president of MSA Durmitor

was Tanasije Gašić originally from Godijelje, contemporary member of the closest management of canton committee of Communistic party. The first secretary of this association was Ilija Ćućilović originally from Gornja Bukovica, contemporary member of canton committee of the young and clerk of national committee canton. Very soon after the establishing of MSA Durmitor people acceded to becoming members and gathering of all of these who wanted or had interest or who used to ski. In that sense, more organized work was set, so in 1951 first republic championship in u downhill, slalom and Nordic running was organized (I. Ćućilović, personal communications, November 12, 2002).

As Vuk Šibalić and Radoman Šamšal say, the most prominent Alpine skiers from Durmitor after World War II are: Radoman Šamšal, Tomaš Popović, Branko Nikitović, Radoman Zarubica, Vajo Karadžić, Dušan Zorić and others. In 1950 a new generation lead by Vuk Šibalić comes on the scene. There are Mima Baranin, Mišo Karadžić, Drago Šamšal, Vuk Jauković, Savo Delić, Milika Baranin, Vojo Šibalić, Nikola Kovačević, Milosav Stijepović, Momir Grbović and others. Among postwar "Norsemen" the most prominent ones are: MSA Durmitor Radisav Jauković, Radoman Zarubica, Branko Nikitović, Radoman Šamšal in patrol running (running of 3 km plus shooting from rifle) and others. In pioneer category, the most prominent were: Vuk Šibalić, Ratko Baranin, Milosav Ćetković, Mirko Stevović, Luka i Nikola Šamšal, Kale Delić and others (R. Šamšal, V. Šibalić, personal communications, November 15, 2002).

People from Durmitor came to an idea that Žabljak, as the center of ski canton should have a ski jump, as other ski center in Yugoslavia had. That idea was realized in 1961 and Žabljak got 2 ski jumps. The small one was 25 m long and the maximum result achieved on it was 23 m and the big one was 50 m long and the result of 52 m was achieved on it. Both records were set by rivals from Slovenia.

As Mihailo Milašinović, a rival from Gornja Bukovica says, ski in Gornja Bukovica had the best organization, the biggest density and the biggest success during the period from 1970 to 1980. In that period in the school Bukovica, Mitar Ostojić worked as a teacher of skiing. The school had numerous generations of students and talented skiers. In that period, the president of Mountain-ski association of Montenegro was Danilo Jauković, originally from Gornja Bukovica, national hero, general on YPA, commander of Second army area. In Bukovica in that period there were many high school students and those waiting for job and "earning for existence "after finished schools. Big migration after 80s had big influence on ski (M. Milašinović, personal communications, November 26, 2002).

The special place, as well as "cherry on top" of Durmitor ski is reserved for Zorica Popović, who as the best ant the most prospective Montenegrian rival with the best achieved results in Montenegro until this century. She started competing in 1995 in category of juniors. Since 1996 she started competing on the level of former Yugoslavia where she was an absolute champion in all categories so far. She was the first competitor from region with scored FIS points. Also, she was our first competitor who won some international competition. She was proclaimed for the best young sportsman for 2000.

Conclusion

Huge ski potentials are not even near to be used, and to be used we need big financial means for development of mountain tourism on Durmitor. We should prepare tracks for registration. For now, there is only one speedway on Žabljak which is registered for organization of biggest ski competitions, as well as those international. Durmitor area has perfect conditions for development of Alpine and Nordic ski so because of that we should do everything that is socially possible currently so that we can use those natural advantages. I consider that in that sense touristic organizations of municipality of Žabljak should show more caring about making the staying in ski centers possible for young skiers with convenient usage of cable cars and other objects. This, together with organization of certain competitions, would represent a certain guarantee that in the next period trend of development of ski sport on Durmitor will continue even more than until now.

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Short reports of experimental work, new methods, or a preliminary report can be accepted as two page papers. Your manuscript should include the following sections: Introduction, Methods, Results, and Discussion.

☑Open Submissions ☑Indexed ☑Peer Reviewed

Short reports should be:

- Up to 1500 words (excluding title, abstract, tables/figures, figure legends, Acknowledgements, Conflict of Interest, and References);
- A structured abstract of less than 250 words;
- Maximum number of references is 15.

Peer review - fair review provides authors who feel their paper has been unfairly rejected (at any journal) the opportunity to share reviewer comments, explain their concerns, and have their paper reviewed for possible publication in SMJ.

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Peer review - fair review should be:

- Up to 1500 words (excluding title, abstract, tables/figures, figure legends, Acknowledgements, Conflict of Interest, and References);
- A structured abstract of less than 250 words;
- Maximum number of references is 15.

Invited papers and award papers include invited papers from authors with outstanding scientific credentials. Nomination of invited authors is at the discretion of the SMJ editorial board. SMJ also publishes award papers selected by the scientific committee of the International Scientific Conference on Transformation Processes in Sport.

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Invited papers and award papers should be:

- Up to 3000 words (excluding title, abstract, tables/figures, figure legends, Acknowledgements, Conflict of Interest, and References);
- A structured abstract of less than 250 words;
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- Maximum combined total of 6 Tables/Figures.

1.3. Submission

SMJ only accepts electronic submission to the e-mail of the Journal Office: **sportmont@ac.me**.

Submitted material includes:

- A manuscript prepared according to the Guidelines for the Authors;
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- A signed form that there is no conflict of interest.

Name the files according to the family name of the first author. Authors submitting revised versions of the manuscript can use the identification number of their manuscript as provided by the Journal Office. *See* example:

- ✓ FAMILY NAME-manuscript.doc – (main manuscript file)
- ✓ FAMILY NAME-statement.PDF – (authorship statement)
- ✓ FAMILY NAME-declaration.PDF – (declaration of potential conflict of interest)
- ✓ FAMILY NAME-fig1.tiff – (Figure 1)

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A manuscript submitted for publication will be submitted to the review process as long as it fits the following criteria:

- The study was not previously published, nor has been submitted simultaneously for consideration of publication elsewhere;
- All persons listed as authors approved its submission to SMJ;
- Any person cited as a source of personal communication has approved the quote;
- The opinions expressed by the authors are their exclusive responsibility;
- The author signs a formal statement that the submitted manuscript complies with the directions and guidelines of SMJ.

The editors-in-chief and associate editors will make a preliminary analysis regarding the appropriateness, quality, originality and written style/grammar of the submitted manuscript. The editors reserve the right to request additional information, corrections, and guideline compliance before they submit the manuscript to the ad-hoc review process.

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2. MANUSCRIPT STRUCTURE

2.1. Title Page

The first page of the manuscripts should be the title page, containing: title, type of publication, running head, authors, affiliations, corresponding author, and manuscript information. *See* example:

Transfer of Learning on a Spatial Memory Task between the Blind and Sighted People Spatial Memory among Blind and Sighted

Original Scientific Paper

Transfer of learning on a spatial memory task

Selcuk Akpinar[1], Stevo Popović[1,2], Sadettin Kirazci[1]

[1]Middle East Technical University, Physical Education and Sports Department, Ankara, Turkey
[2]University of Montenegro, Faculty for Sport and Physical Education, Niksic, Montenegro

Corresponding author:
S. Popovic
University of Montenegro
Faculty for Sport and Physical Education
Narodne omladine bb, 84000 Niksic, Montenegro
E-mail: ***stevop@ac.me***

Word count: 2,980

Abstract word count: 236

Number of Tables: 3

Number of Figures: 3

2.1.1. Title

Title should be short and informative and the recommended length is no more than 20 words. The title should be in Title Case, 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 capitalized. Exceptions are words like: “and”, “or”, “between” etc. The word following a colon (:) or a hyphen (-) in the title is always capitalized.

2.1.2. Type of publication

Authors should suggest the type of their submission.

2.1.3. Running head

Short running title should not exceed 50 characters including spaces.

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The form of an author's name is first name, middle initial(s), and last name. In one line list all authors with full names separated by a comma (and space). 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.

2.1.5. Affiliations

Affiliation consists of the name of an institution, department, city, country/territory (in this order) 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.

Only if there is more than 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.

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.

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Corresponding author's name with full postal address in English and e-mail address should appear, after the affiliations. It is preferred that submitted address is institutional and not private. Corresponding author's name should include only initials of the first and middle names separated by a full stop (and a space) and the last name. 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. E-mail (if possible) should be placed in the line following the postal address. Author should clearly state whether or not the e-mail should be published.

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All authors are required to provide word count (excluding title page, abstract, tables/figures, figure legends, Acknowledgements, Conflict of Interest, and References), the Abstract word count, the number of Tables, and the number of Figures.

2.2. Abstract

The second page of the manuscripts should be the abstract and key words. It should be placed on second page of the manuscripts after the standard title written in upper and lower case letters, bold.

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 (e.g., Aim, Results…).

Authors should provide up to six key words that capture the main topics of the article. Terms from the Medical Subject Headings (MeSH) list of Index Medicus are recommended to be used.

Key words should be placed on the second page of the manuscript right below the abstract, written in italic. Separate each key word by a comma (and a space). Do not put a full stop after the last key word. *See* example:

Abstract

Results of the analysis of

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

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Starting from the third page of the manuscripts, it should be the main chapters. Depending on the type of publication main manuscript chapters may vary. The general outline is: Introduction, Methods, Results, Discussion, Acknowledgements (optional), Conflict of Interest (optional). 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.

2.3.1. Headings

Main chapter headings: written in bold and in Title Case. *See* example:

- ✓ **Methods**

Sub-headings: written in italic and in normal sentence case. Do not put a full stop or any other sign at the end of the title. Do not create more than one level of sub-heading. *See* example:

- ✓ *Table position of the research football team*

2.3.2 Ethics

When reporting experiments on human subjects, there must be a declaration of Ethics compliance. Inclusion of a statement such as follow in Methods section will be understood by the Editor as authors' affirmation of compliance: "This study was approved in advance by [name of committee and/or its institutional sponsor]. Each participant voluntarily provided written informed consent before participating." Authors that fail to submit an Ethics statement will be asked to resubmit the manuscripts, which may delay publication.

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SMJ encourages authors to report precise p-values. When possible, quantify findings and present them with appropriate indicators of measurement error or uncertainty (such as confidence intervals). Use normal text (i.e., non-capitalized, non-italic) for statistical term "p".

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All contributors who do not meet the criteria for authorship should be listed in the 'Acknowledgements' section. If applicable, in 'Conflict of Interest' section, authors must clearly disclose any grants, financial or material supports, or any sort of technical assistances from an institution, organization, group or an individual that might be perceived as leading to a conflict of interest.

2.4. References

References should be placed on a new page after the standard title written in upper and lower case letters, bold.

All information needed for each type of must be present as specified in guidelines. Authors are solely responsible for accuracy of each reference. Use authoritative source for information such as Web of Science, Medline, or PubMed to check the validity of citations.

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SMJ adheres to the American Psychological Association 6th Edition reference style. Check "American Psychological Association. (2009). Concise rules of APA style. American Psychological Association." to ensure the manuscripts conform to this reference style. Authors using EndNote® to organize the references must convert the citations and bibliography to plain text before submission.

2.4.2. Examples for Reference citations

One work by one author
- ✓ In one study (Reilly, 1997), soccer players
- ✓ In the study by Reilly (1997), soccer players
- ✓ In 1997, Reilly's study of soccer players

Works by two authors
- ✓ Duffield and Marino (2007) studied
- ✓ In one study (Duffield & Marino, 2007), soccer players
- ✓ In 2007, Duffield and Marino's study of soccer players

Works by three to five authors: cite all the author names the first time the reference occurs and then subsequently include only the first author followed by et al.
- ✓ First citation: Bangsbo, Iaia, and Krustrup (2008) stated that
- ✓ Subséquent citation: Bangsbo et al. (2008) stated that

Works by six or more authors: cite only the name of the first author followed by et al. and the year
- ✓ Krustrup et al. (2003) studied
- ✓ In one study (Krustrup et al., 2003), soccer players

Two or more works in the same parenthetical citation: Citation of two or more works in the same parentheses should be listed in the order they appear in the reference list (i.e., alphabetically, then chronologically)
- ✓ Several studies (Bangsbo et al., 2008; Duffield & Marino, 2007; Reilly, 1997) suggest that

2.4.3. Examples for Reference list

Journal article (print):

Bangsbo, J., Iaia, F. M., & Krustrup, P. (2008). The Yo-Yo intermittent recovery test: a useful tool for evaluation of physical performance in intermittent sports. *Sports Medicine, 38*(1), 37-51.

Duffield, R., & Marino, F. E. (2007). Effects of pre-cooling procedures on intermittent-sprint exercise performance in warm conditions. *European Journal of Applied Physiology, 100*(6), 727-735.

Krustrup, P., Mohr, M., Amstrup, T., Rysgaard, T., Johansen, J., Steensberg, A., Bangsbo, J. (2003). The yo-yo intermittent recovery test: physiological response, reliability, and validity. *Medicine and Science in Sports and Exercise, 35*(4), 697-705.

Journal article (online; electronic version of print source):

Shaw, A. (1999). The planning and development of New Bombay [Electronic version]. *Modern Asian Studies, 33*(4), 951-988.

Journal article (online; electronic only):

Chantavanich, S. (2003, October). Recent research on human trafficking. *Kyoto Review of Southeast Asia, 4*. Retrieved November 15, 2005, from http://kyotoreview.cseas.kyoto-u.ac.jp/issue/issue3/index.html

Conference paper:

Pasadilla, G. O., & Milo, M. (2005, June 27). *Effect of liberalization on banking competition*. Paper presented at the conference on Policies to Strengthen Productivity in the Philippines, Manila, Philippines. Retrieved August 23, 2006, from http://siteresources.worldbank.org/INTPHILIPPINES/Resources/Pasadilla.pdf

Encyclopedia entry (print, with author):

Pittau, J. (1983). Meiji constitution. In *Kodansha encyclopedia of Japan* (Vol. 2, pp. 1-3). Tokyo: Kodansha.

Encyclopedia entry (online, no author):

Ethnology. (2005, July). In *The Columbia encyclopedia* (6th ed.). New York: Columbia University Press. Retrieved November 21, 2005, from http://www.bartleby.com/65/et/ethnolog.html

Thesis and dissertation:

Pyun, D. Y. (2006). *The proposed model of attitude toward advertising through sport.* Unpublished Doctoral Dissertation. Tallahassee, FL: The Florida State University.

Book:
Borg, G. (1998). *Borg's perceived exertion and pain scales*: Human kinetics.

Chapter of a book:
Kellmann, M. (2012). Chapter 31-Overtraining and recovery: Chapter taken from Routledge Handbook of Applied Sport Psychology ISBN: 978-0-203-85104-3 *Routledge Online Studies on the Olympic and Paralympic Games* (Vol. 1, pp. 292-302).

Reference to an internet source:
Agency. (2007). Water for Health: Hydration Best Practice Toolkit for Hospitals and Healthcare. Retrieved 10/29, 2013, from www.rcn.org.uk/newsevents/hydration

2.5. Tables

All tables should be included in the main manuscript file, each on a separate page right after the Reference section.

Tables should be presented as standard MS Word tables.

Number (Arabic) tables consecutively in the order of their first citation in the text.

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. Avoid any shading or coloring in your tables and be sure that each table is cited in the text.

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2.5.1. Table heading

Table heading should be written above the table, in Title Case, and without a full stop at the end of the heading. Do not use suffix letters (e.g., Table 1a, 1b, 1c); instead, combine the related tables. *See* example:

- ✓ **Table 1.** Repeated Sprint Time Following Ingestion of Carbohydrate-Electrolyte Beverage

2.5.2. Table sub-heading

All text appearing in tables should be written beginning only with first letter of the first word in all capitals, i.e., all words for variable names, column headings etc. in tables should start with the first letter in all capitals. Avoid any formatting (e.g., bold, italic, underline) in tables.

2.5.3. Table footnotes

Table footnotes should be written below the table.

General notes explain, qualify or provide information about the table as a whole. Put explanations of abbreviations, symbols, etc. here. General notes are designated by the word *Note* (italicized) followed by a period.

- ✓ *Note.* CI: confidence interval; Con: control group; CE: carbohydrate-electrolyte group.

Specific notes explain, qualify or provide information about a particular column, row, or individual entry. To indicate specific notes, use superscript lowercase letters (e.g. $^{a, b, c}$), and order the superscripts from left to right, top to bottom. Each table's first footnote must be the superscript ^{a}.

- ✓ ^{a}One participant was diagnosed with heat illness and n = 19.^{b}n =20.

Probability notes provide the reader with the results of the texts for statistical significance. Probability notes must be indicated with consecutive use of the following symbols: * † ‡ § ¶ || etc.

- ✓ *P<0.05,†p<0.01.

2.5.4. Table citation

In the text, tables should be cited as full words. *See* example:

- ✓ Table 1 (first letter in all capitals and no full stop)
- ✓ ...as shown in Tables 1 and 3. (citing more tables at once)
- ✓ ...result has shown (Tables 1-3) that... (citing more tables at once)
- ✓ ....in our results (Tables 1, 2 and 5)... (citing more tables at once)

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On the last separate page of the main manuscript file, authors should place the legends of all the figures submitted separately.

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Figures should not contain footnotes. All information, including explanations of abbreviations must be present in figure legends. Figure legends should be written bellow the figure, in sentence case. *See* example:

- ✓ **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.

2.6.2. Figure citation

All graphic materials should be referred to as Figures in the text. Figures are cited in the text as full words. *See* example:

- ✓ Figure 1
- × figure 1
- × Figure 1.
- ✓ ….exhibit greater variance than the year before (Figure 2). Therefore…
- ✓ ….as shown in Figures 1 and 3. (citing more figures at once)
- ✓ ….result has shown (Figures 1-3) that... (citing more figures at once)
- ✓ ….in our results (Figures 1, 2 and 5)... (citing more figures at once)

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If there is a figure divided in several sub-figures, each sub-figure should be marked with a small letter, starting with a, b, c etc. The letter should be marked for each subfigure in a logical and consistent way. *See* example:

- ✓ Figure 1a
- ✓ …in Figures 1a and b we can…
- ✓ …data represent (Figures 1a-d)…

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All units of measures should conform to the International System of Units (SI).

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

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Signs should be placed immediately preceding the relevant number.		
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- ✓ First time appearing: *musculus biceps brachii*

Abbreviated: *m. biceps brachii*

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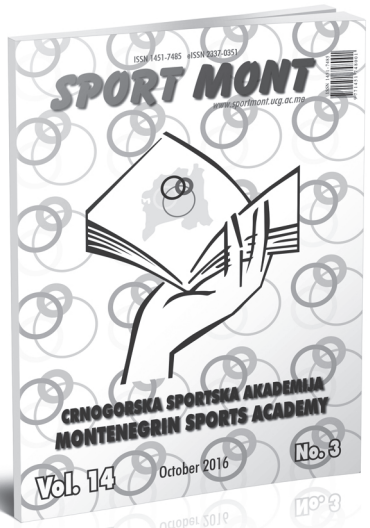

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Autumn issue – October 2017

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MARITIME FACULTY - KOTOR

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OSC offshore simulator at Maritime Faculty Kotor, Montenegro

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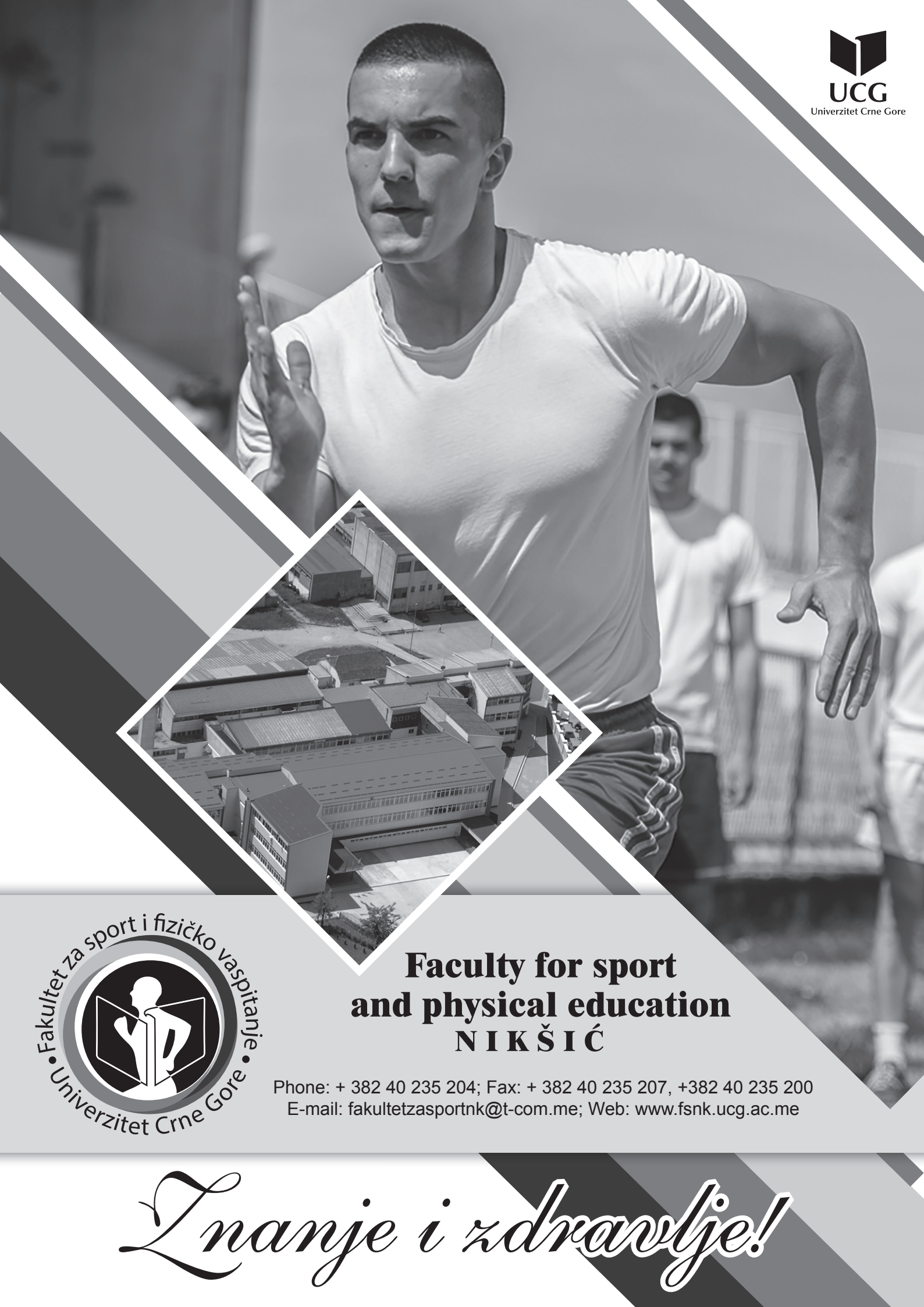

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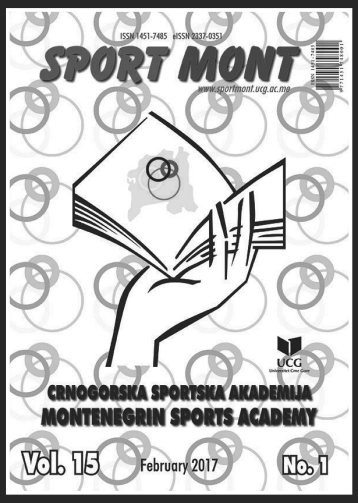

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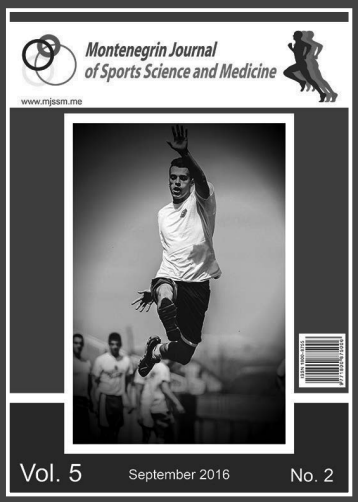

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