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SportMont

ORIGINAL SCIENTIFIC PAPER

Perceptual and Motor Performances between Fencers and Non-Fencers

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Abstract

Sports participation can improve many cognitive and physical performances. It is important to test different sports in different perceptual and motor tests in order to expose the demands of sports. Thus, in this study, we investigated if there are some perceptual and motor performance differences between fencers and aged match sedentary group. Nineteen fencers and nineteen non-fencers performed choice reaction time in an aiming task. Reaction time (RT), accuracy, and velocity of the movements were measured. Results displayed that fencers had significantly faster RT, better accuracy with faster movements compared to non-fencers. These findings suggest that participating a sport requiring fast and accurate pointing movements can modify perceptual and motor performance parameters. Thus, it could be better to select participants who have better perceptual and motor performances. Moreover, speed-accuracy trade off proposed by Fitts (1954) can be altered through long-term sport participation.

Key words: *accuracy, speed, trade-off, motor performance, reaction time*

Introduction

Participating physical activities and exercise can improve the physical, perceptual, and cognitive well-being (Chan, Wong, Liu, Yu, & Yan, 2011; Hassmén, Koivula, & Uutela, 2000; Lee, Hsieh, & Paffenbarger, 1995). Overall, it has been generally accepted that athletes have better performance in some motor tasks, like balance (Davlin, 2004), strength (Sleivert, Backus, & Wenger, 1995), and speed than non-athletes. Moreover, superior performance of athletes with the result of the long-term practice has also been observed in some perceptual motor skills, like reaction time (Chan et. al., 2011; Di Russo, Taddei, Apnile, & Spinelli, 2006). Superior performance of any athletes can be linked to some neurophysiological characteristics. Neurophysiological characteristics help determine superior athletes' level of performance in that athletes' brains must adapt their behaviors to perform skilled movements under different and changing environment (Nakata, Yoshie, Miura, & Kudo, 2010). Such neural activities in the brain include perception, decision-making, motor preparation, and execution of the movement. Several studies reported changes and shifts in brain activity due to long-term practice among both musicians (Ridding, Brouwer, & Nordstrom, 2000) and athletes (Pearce, Thickbroom, Byrnes, & Mastaglia, 2000). Thus, the brain shows great plasticity in its ability to acquire skills over the long-term, and in turn to improve performance when executing skilled movement.

Besides the perceptual motor skills, athletes also displayed better sensorimotor performance in comparison to non-athletes both their dominant and non-dominant arms in many sports (Akpinar & Bicer, 2014; Akpinar, 2015: Akpinar; 2016: Akpinar, Sainburg, Kirazci, & Przybyla, 2015; Ramsay & Riddoch, 2001). The effect of long-term practice on sensorimotor performance has also been observed in musicians (Rodrigues, Loureiro, & Caramelli, 2013). The observed improvements in physical and perceptual functioning are somehow associated with the length of sport participation (Brisswalter, Collardeau, & René, 2002). Therefore, the improvements can be seen with the long-term participation.

One of the sports that requires a high level of perceptual and motor performance is fencing. Fencing is a combat sport

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in which two athletes fight indirectly, through their weapons (the foil, the sabre, or the epee), and mainly includes fast movements directed toward the opponent. Those movements need to be fast and accurate so that the fencer can get a point. Regarding the speed and accuracy, Fitts (1954) stated that when the speed of the movement increased then this reduces the accuracy of movement. In opposite, decreasing the speed of the movement increase the accuracy of the movement. This phenomenon, speed accuracy trade-off, can be often seen in many movements. It is still crucial to state that nature of the task can determine how this phenomenon affects the performance. When the task is mainly a fine motor skill or when it is a gross motor skill, then the effect of speed accuracy trade-off may be different in those skills. Some skills require both to be accurate and fast to accomplish the task (i.e. batting in baseball). In these cases, studies suggest that moving with an optimal speed will yield an accurate movement performance (Belkin & Eliot, 1997; Freeston & Rooney, 2014).

Years of training improve coordination of both arms of right-handed fencers, making them less lateralized than are non-athletes (Akpinar et al., 2015). Fencing was chosen in this study because it challenges upper limb coordination. As it was stated above, sports participation can increase the well being of physical, perceptual, and cognitive parameters, we tried to investigate if the fencers have better perceptual and motor performance in an aiming task compared to non-fencers. Moreover, we wanted to figure out if fencers will display different pattern in speed accuracy trade-off compared to non-fencers. The reason to ask this question is basically fencers make fast pointing movements and those movements also need to be accurate. Thus, they may show different pattern in terms of speed accuracy compared to non-fencers.

Method

Nineteen fencers (10 female) between 19 and 24 years old (M_{age}=22.8±2.45) and nineteen healthy young non-fencers (10 female) between 18 and 25 years old (21.3±2.12) signed voluntarily informed consent form approved by Nevsehir Haci Bektas Veli University which was conducted in accordance with the Declaration of Helsinki as amended by the World Medical Association Declaration of Helsinki (World Medical Association, 2013). Fencers' experiences changed between 4 and 9 years and non-fencers self reported no training experience in any sports. All the participants reported right handedness and scored above 60% on the extended 35-item handedness questionnaire (Hull, 1936), which is similar to widely known Edinburgh Inventory (Oldfield, 1971).

Experimental Setup

The detail of the experimental setup was previously explained (Akpinar, 2016). The participants seated an adjustable chair with a sensor of the electromagnetic movement tracker (TrackSTAR, Ascension Technology, USA) put to their right forearm. 2D view for reaching was provided to the participants. There was a mirror above the participants' arms and this mirror displayed one cursor, one start circle for each hand, and 3 different targets that were projected from 55" flat TV. This configuration was designed from a custom virtual reality interface. This cursor was associated with the index finger of each arm and its position on the mirror was updated in real time that was limited to TV screen update of 100 Hz.

There were three targets in different directions (80^0, 90^0, and 100^0, please see Figure 1) and the task was to reach these targets with maintaining accuracy. One target was shown for each trial randomly. The start circle was 2 cm in diameter and was 20 cm away from the body midline to the right side. Each target was shown as 3.5 cm in diameter. There was a cursor representing the tip of the index finger. The cursor was 1 cm in diameter with cross hair. The distance between the start circle and target was set to 30 cm so that each participant could reach the target easily. We gave an imperative audio-visual "go" signal, upon which participants were required to move to the target. The imperative signals were delayed until the participants positioned their right hand in start location for 300 milliseconds. The task was to move the cursor to the target, which was displayed when the cursor placed in the start circle. Thus it was restricted pace, that is, the participants did not know which target would pop-up in the screen.

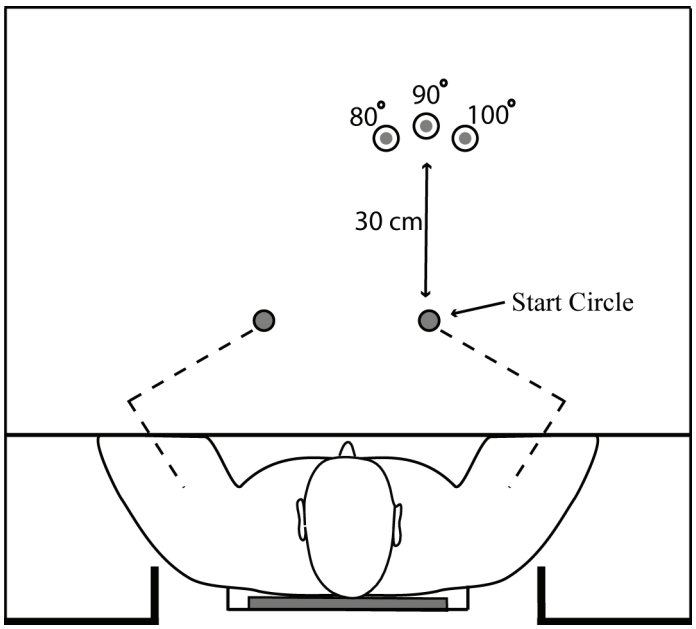

Figure 1. The distribution of the targets

Experimental Task

As it was stated above, there were three different targets and participants performed the total of 30 trials (10 trials to each target). Participants were asked to make fast reaches to the targets (trials were 1 sec) while maintaining accuracy with possibly no additional corrections. In order to motivate the participants, accuracy of the trials were rewarded with 10, 3 and 1 point for landing within 3.5 cm, 4.5 cm and 5.5 cm diameter from the center of the target respectively. After each trial, feedback about the score and performed cursor path were displayed for 1 sec. The task condition can be considered as choice reaction time condition because there was more than one stimulus. Experimental task only performed with the right dominant arm by the participants.

Data and Statistical Analysis

In order to determine perceptual and movement performance, we quantified three measures: 1) The reaction time (RT) was defined as the elapsed time between the presentation of a target on the workplace and the initiation of the movement to that target; 2) Movement accuracy (Final Position Error=FPE); 3) Movement speed was defined as the peak amplitude of the velocity profile. The collected data were analyzed using Matlab software and, dependent variables were calculated.

For the statistical comparison, the mean score of each dependent measures was calculated and subjected to the statistical analysis. For the statistical comparison, t-test was used and statistical significance level was set as .05.

Results

Both groups, fencers and non-fencers, made reaches to the three different targets located across horizontal space in front of the body with the dominant arm. Figure 2 shows the average magnitude of the reaction time (RT).The statistical analysis displayed a significant result for RT, $t_{(36)}$=3.35, p=.001.Fencers' RT was (M=273±42 ms) faster compared to non-fencers (M=327±56 ms).

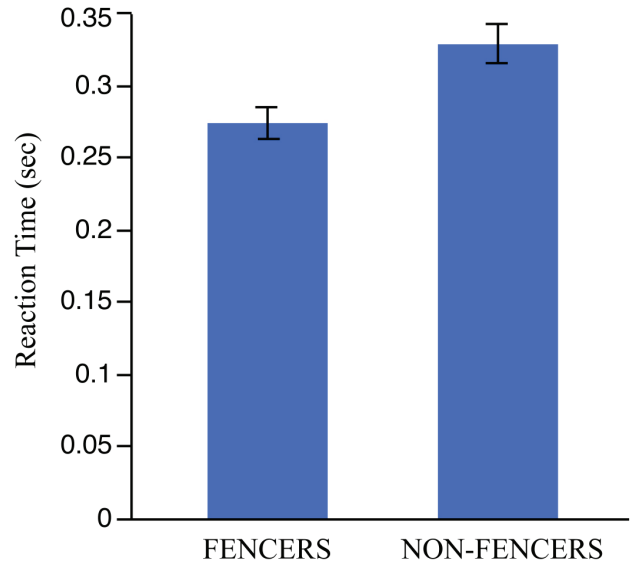

Figure 2. The average magnitude of the reaction time (RT) between fencers and non-fencers

The other dependent variable was final position error (FPE). The mean value for FPE for both groups was displayed in Figure 3. The statistical analysis showed a significant result for FPE, $t_{(36)}$=14.93, p=.0001. Fencers had significantly less errors (M=3.79±1.74 cm) compared to non-fencers (M=23.04±5.33 cm).

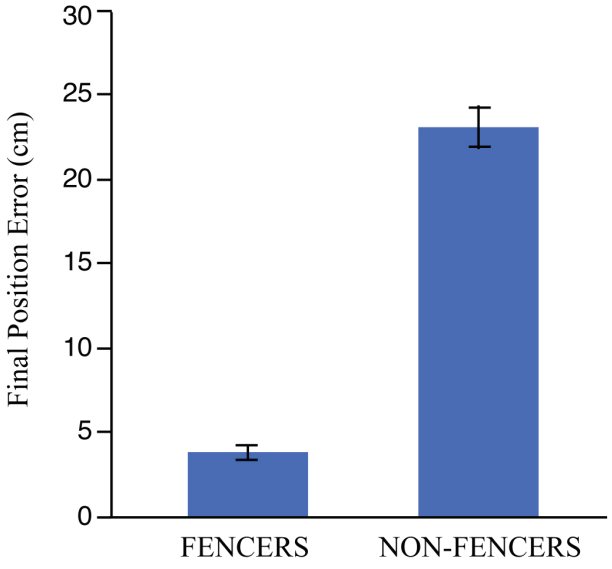

Figure 3. The average magnitude of final position error (FPE) between fencers and non-fencers

We have lastly measured movement speed during the reaches. The mean value for movement speed for both groups was given in Figure 4. The statistical analysis showed a significant result for movement speed, $t_{(36)}$=-7.49, p=.0001. Fencers' reaches were significantly faster (M=183.6±22.3cm) compared to non-fencers (M=124.5±26.1 cm/s).

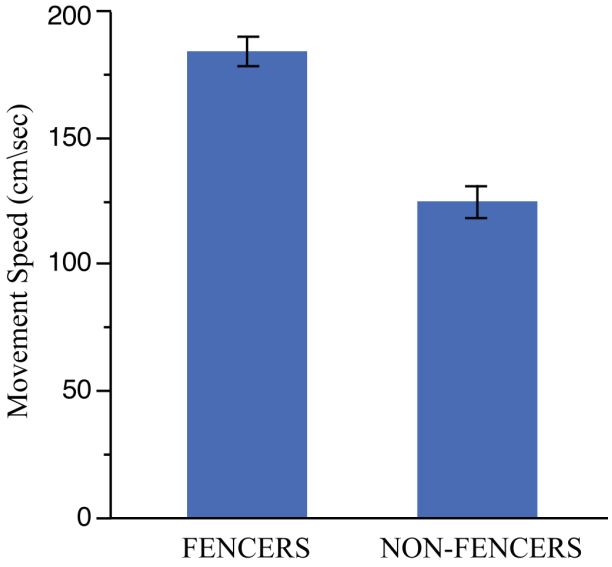

Figure 4. The average magnitude of movement speed between fencers and non-fencers

Discussion

In study, we examined perceptual and motor performances between fencers and non-fencers during a reaching task with a choice reaction time (RT) condition. The variables depicting the perceptual (RT) and motor performances (accuracy and movement speed) were analyzed. In all those variables, fencers displayed better performances compared to non-fencers. That is, fencers performed the reaching task with better RT, less final position error, and faster movements compared to non-fencers.

Superior performance of fencers compared to non-fencers was observed in many tasks. For instance, greater performance of the right arm in fencers over non-fencers has been reported for discriminative reaction time tasks (Chan et al., 2011; Di Russoet al., 2006). In their study, Chan et al. (2011) concluded that the combination of physical fitness and level of expertise get more benefit for cognitive control mechanism compared to when each of them applied singly. In the current study, we also found that fencers have better perceptual performance compared to non-fencers. Both cognitive and perceptual skills are acquired through training, and the long-term participation of training required to attain high level of skill makes the component processes mainly automatic (Logan, 1988). Thus, expert skills are often flexible, so they can be utilized in various task contexts (MacKay, 1982), like what was observed in the current study. In another study, Williams and Walmsley (2000) introduced recordings of EMG activity during measurement of response times between elite fencers and novice subjects. They have found that elite fencers displayed more coherent muscle synergies and more consistent pattern of muscle coordination than novice subjects. Thus, more coherent muscle synergies for fencers may lead to have fewer errors than non-fencers, which was observed in the current study. We have also found that fencers' reaches were significantly faster than non-fencers. It has been previously found that fencers were faster than non-fencers in movements of the upper limbs (Roi & Bianchedi, 2008); thus, our finding on reaching movement speed is in agreement with that previous study result. Participation of long-term practice may lead the fencers to develop this skill over the time. In addition, as they mainly practice fast pointing movements in their exercise settings, this can lead them to have faster movements than non-fencers. In fact these results are not in agreement with speed accuracy trade-off proposed by Fitts (1954). As we stated earlier, Fitts stated that when the movement velocity increased, the errors in the aiming movements increased as well. This trend was not observed for the fencer. The speed accuracy trade-off has been an interesting topic for researchers especially focusing on choice RT tasks (Bogac, Wagenmakers, Forstmann, & Nieuwenhuis, 2010). This phenomenon is also very important for the sports performance. For instance, Freeston and Rooney (2014) conducted a study with baseball and cricket players to determine the speed that optimizes accuracy in a throwing task. They found that speed accuracy trade-off was worse for the cricket players compared to baseball players. Thus, even though these two sports seem to be similar in many ways, they do not show the similar pattern in motor performance. In our study, fencers showed faster reaches with significantly less errors compared to non-fencers. Thus, speed accuracy trade-off is not predetermined entity and can be modified by long-term sport participation. It has been also previously stated that the classical Fitts' law can be violated in tasks that involve a ballistic component (Juras, Slomka, & Latash, 2009). In this study, we compared fencers and non-fencers in the same task that can include a ballistic component, and fencers showed a different pattern compared to non-fencers and violated the speed accuracy trade-off. In conclusion, although we do not know if the fencers had already superior perceptual and motor skill capabilities before they started fencing, we can point that this sport requires high perceptual and motor skill requirement. Moreover, fencers can control better the speed accuracy trade-off, and thus the phenomenon cannot be valid for some groups.

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Conflict of Interest
The authors declare that there are no conflicts of interest.

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ORIGINAL SCIENTIFIC PAPER

Metric Characteristics of Tests Assessing Speed and Agility in Youth Soccer Players

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Abstract

The main aim of this study was to validate the measuring instruments for assessing sprinting speed and specific agility in youth soccer players. The study was conducted on a sample of 32 soccer players in younger age categories. The sample of variables included three tests assessing sprinting speed (5-meter sprint from a standing start, 20-meter sprint from a standing start, and flying 15-meter sprint), and three tests assessing specific agility (slalom run with a ball, zig-zag run with a ball, and 20-meter sprint with a ball). Metric characteristics of tests were determined by calculating indicators of reliability, homogeneity, sensitivity, and factor and pragmatic validity. The values of indicators of metric characteristic showed that the applied motor tests had high level of reliability, good homogeneity, normal distribution of data, and acceptable values of factor and pragmatic validity. As a recommendation for future scientific and/or expert activities which would include assessment of speed and specific agility in young soccer players, investigations should definitely include 20-meter sprint from a standing start and slalom run with a ball.

Key words: *metric characteristics, soccer players, agility, speed*

Introduction

One of the main reasons for widespread popularity of soccer today is in its full „exploitation" of athlete's conditional and technical-tactical performances. One can be successful in soccer, in either offense or defense, only if the fundamental, i.e., basic functional and motor abilities are at high level. Whether it be a top professional or recreational athlete, the overall volume of activity during a soccer match or training requires from an athlete the maximum activation of power, balance, flexibility, coordination, precision, endurance, and speed and specific agility.

Soccer is dominated by frequent and rapid changes of movement direction, sprints, jumps, sudden stops (Váczi, Tollár, Meszler, Juhász, & Karsai, 2013), so it can be assumed that motor dimensions responsible for performance of these movements greatly differentiate elite soccer players from average players or amateurs. Ball possession, total shots on goal and assists contribute most to the final team placement in a competition (Lago-Peñas, Lago-Ballesteros, Dellal, & Gómez, 2010) There have been some studies (Buchheit, Mendez-Villanueva, Delhomel, Brughelli, & Ahmaidi, 2010; Mujika, Santisteban, Impellizzeri, & Castagna, 2009) that suggest that abilities such as speed, agility, and explosive power are more determinant of success than others. By reaching puberty, which is marked by significant release of hormones, increase of height and body mass, and most importantly, increase of muscle mass, biologically more mature individuals are enabled to demonstrate greater force per unit of time and therefore achieve better results in sprint tests (De Matos et al., 2013; Le Gall, Carling, Williams, & Reilly, 2010; Malina, Eisenmann, Cumming, Ribeiro, & Aroso, 2004), repeated sprint (Mendez-Villanueva et al., 2011), explosive power (Chuman, Hoshikawa, & Lida, 2009; Figueiredo, Gonçalves, Coelho E Silva, & Malina, 2009), and agility (De Matos et al., 2013; Figueiredo et al., 2009).

Speed and specific agility are mutually correlated and, as such, represent one of the main factors of success in soccer. Speed as a movement ability is manifested as an activity in which a person attempts to cover a given distance from start to finish in the shortest time possible. Speed as a motor ability is very im-

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portant in all sports, thus in soccer as well. Even though speed is greatly „innate", its performance may be somewhat influenced primarily by a process of motor learning of those performance factors which directly determine the quality of technique of the starting position, start, starting acceleration, gaining maximum speed, as well as running when reaching the finish line (stride length and frequency,knowledge of the starting skill, etc.).

Agility is coordination in reaction to what is happening on the field and performance without delay (Gatz, 2009). As in any other sport, differences in agility between individuals in soccer are noticeable in activities which are manifested during performance of the first stride, as well as in the ability and efficiency of stopping and starting to moveagain and changing movement direction. Generally, both abilities include movement in the sense of rapid forward motion, only that agility also includes the change of movement direction. Measurement/testing of speed and agility can help and identify athlete's weaknesses within the sport or the quality of performance of a certain task (Harman & Garhammer, 2008). Assessment of speed and agility (specific coordination) in controlled conditions with tests which are similar to the demands of play in the sport itself, is very efficient in helping the programming of training, with the aim of higher performance quality of athletes in competitive conditions (Miller, 2012).

Therefore, the main aim of this study is to validate the measuring instruments for assessing speed and specific agility of youth soccer players.

Methods

The study was conducted on a sample of 32 young soccer players in two age categories. The first group of soccer players (N=20) included children whose chronological age was 10±1.0 years (height: 142.4±5.4 cm; weight: 37.1±5.8 kg; body mass index: 18.2±1.8; body fat%: 15.9±6.1), whereas the second group of young soccer players (N=12) included children aged 11±0.6 years (height: 145.6±5.1 cm; weight: 37.7±4.0; body mass index: 17.9±2.0; body fat%: 14.6±3.4).

To identify subjects with a medical contraindication to performing applied tests, subjects completed medical history questionnaires.Inclusion criteria to participate in this study were: i) at least one year of training experience, ii) having a valid sport medical certification, and iii) being healthy (i.e. absence of musculoskeletal or joint injuries, cardiovascular disease, and illness,). Subjects did not eat for 2 hours before testing to reduce any possible interference on the experiment. Written consent for participation in this study was obtained from the subject's parents/guardians after being thoroughly informed about the purpose, benefits, and potential risks of this study.The Ethical Committee of the Faculty of Kinesiology, University of Split verified that this investigation complied with all ethical standards for scientific investigations involving human subjects.

Testing procedures

To eliminate any influence of circadian variation, each participant completed all trials in the same time period of the testing day and under the same climate conditions (8-10 p.m., 24.6±0.1°C temperature and 30.3±1.9% relative humidity). Twenty-four hours before the testing protocol subjects weren't under heavy training routines. In this way, no interference of fatigue on the results was possible.

Prior to testing, anthropometric characteristics (standing height, body weight, body mass index, and body fat%) were carried out. Standing height was measured with Harpenden Portable Stadiometer 603 VR (Holtain LTD, Crosswell, UK). Body mass index and body fat% were calculated using Tanita diagnostic scale BC 418 (Tokyo, Japan). After anthropometric measurements, subjects performed tests assessing speed and specific agility. Witty Timing System's (Microgate, Bolzano, Italy) time gate was used to record time. All tests were performed on a flat surface, i.e., artificial grass. All subjects had soccer boots and the ball used in all tests was Adidas Jabulani 69.0±0.2 cm in circumference and 440±0.3 g in mass. Testing protocol included quality warm-up of 25 minutes because this investigation required maximal muscle activation during a short period of time. Warm-up included sequences of 15 minutes for jogging with and without the ball followed by 10 minutes of dynamic stretching especially of leg and abdominal muscles.

Speed was assessed by the following tests: MT5M–5-meter sprint from a standing start, MT20M–20-meter sprint from a standing start, MT15ML–15-meter sprint from a flying start. In tests assessing sprinting speed, subject stood in a standing start position 1m behind the start line where the first pair of photocells was placed.Depending on the test, the second pair of photocells was placed at 5, 15 or 20 meters. A subject started to move arbitrarily, and his task was to run the distance between the photocells at maximum speed.

To assess specific agility following tests were applied:M20 L–20-meter sprint from a standing start with a ball, MSLA L–slalom run with a ball, MZI-ZA L–zig-zag run with a ball.20-m run with a ball (M20 L) - the subject stands in a medium start with a ball 1m behind the start line, where the first pair of photocells is placed. The second pair of photocells is placed at 20m. The subject starts to run arbitrarily, and his task is to cover the distance between the photocells with maximum speed by dribbling the ball and he must touch it at least 4 times – at least once in the first 3m.Slalom test (MSLAL)–the test is performed on a flat surface, i.e., artificial grass. The subject stands in a medium start position with a ball at the start line, straight in front of him at 1m there are 6 slalom poles 2m apart, and the subject must dribble the ball between those poles at maximum speed forward and back. The subject starts arbitrarily, and time is measured from the moment he starts moving until he crosses the start/finish line with the ball.Zig – zag test (MZI-ZA L)–the test is performed on a flat surface, i.e., artificial grass.The subject stands in a medium start position with a ball at the start line. The zig-zag test is constructed as a 16 x 10-yard (4.85m x 3m) rectangle, with a cone right in the centre. The subject's task is to dribble the ball with maximum speed around the cones – after the start he goes around the central cone, then around the two side cones, again around the central cone, and around the final cone towards the start/finish line. Each test is repeated 3 times with pause adequate for recovery.

Statistical analysis

In line with the main aim of the study–validation of measuring instruments for assessing sprinting speed and specific agility the following methods of data analysis were used: for sensitivity of applied tests, descriptive statistical parameters–arithmetic mean (AM), standard deviation (SD), minimum (MIN) and maximum (MAX) result, measures of asymmetry (SKE) and peakedness (KURT) of the probability distribution, Kolmogorov-Smirnov test of normality of distribution (K-S) were calculated. For reliability of applied tests Inter-item correlation (IIr) and Cronbach's alpha (α) were calculated. Univari-

ate analysis of variance (F, p)–differences between results of each repetition for each variable was used to calculate homogeneity. To determine factor validity of tests assessing sprinting speed and specific agility, the intercorrelation matrix was transformed into a principal component matrix. By doing so, projections of variables on the first principal component (Guttman-Kaiser criterion) were obtained for, tests assessing sprinting speed and specific agility. By applying an independent samples t-test to assess differences between two groups of subjects, pragmatic validity was determined. Statistical significance was designated at $p<0.05$. Statistical analyses were carried out using Statistica software version 13.2 (Dell Inc., Round Rock, TX, USA).

Results

In line with the main aim of the study, the results of metric characteristics of tests assessing sprinting speed and specific agility in youth soccer players are presented below.

Metric characteristics of tests assessing speed

Indicators of reliability of tests assessing speed showed relatively high correlation between the measured items in all the analysed motor tests (Table 1). The values of reliability coefficient of „inter-item correlation" (IIr) ranged from moderately high correlation in the 5-meter sprint from a standing start (MT5M; IIr=0.68) to high correlation in the 20-meter sprint from a standing start (MT20M; IIr=0.97). The results of the Cronbach's alpha coefficient of reliability (α) also indicated a relatively high correlation between the measured items (V1-V3) in all the analysed tests assessing sprinting speed. The values of coefficient of reliability (α) ranged from high correlation value in the MT5M test (α=0.84) to very high correlation value in the MT20M test (α=0.97). Examination of indicators of the metric characteristic (Table 1) which generally indicates to what extent the subjects' result in the analysed items (V1-V3) depends on the same object of measurement, showed that unambiguous inference (homogenous test) is possible in all the applied tests assessing sprinting speed. Thus, as end result in all the tests: 5-meter sprint from a standing start (MT5M; p=0.331), 20-meter sprint from a standing start (MT20M; p=0.001) and flying 15-meter sprint (M15ML; p=0.41), mean value was used.

Table 1. Results of reliability and homogeneity of variables assessing sprinting speed

Variables	V 1	V 2	V 3	II r	α	AM±SD	F-test	p
MT5M (sec)	1.00	0.58	0.79	0.68	0.84	1.21±0.73	1.10	0.331
	0.58	1.00	0.66			1.19±0.49		
	0.79	0.66	1.00			1.21±0.80		
MT20M (sec)	1.00	0.92	0.92	0.94	0.97	3.74±1.54	4.29	0.170
	0.92	1.00	0.97			3.74±1.64		
	0.92	0.97	1.00			3.77±1.84		
M15ML (sec)	1.00	0.79	0.90	0.88	0.94	2.53±0.10	2.31	0.106
	0.79	1.00	0.92			2.54±0.13		
	0.90	0.92	1.00			2.55±0.12		

Legend: V1-V3–intercorrelation of items; IIr-inter-item correlation; α–Cronbach's alpha coefficient; AM-arithmetic mean; SD-standarddeviation; F test-analysis of variance; p–significance, MT5M–5-meter sprint from a standing start, MT20M–20-meter sprint from a standing start, M15ML–flying 15-meter sprint.

By examining the values of sensitivity indicators in the analysed variables (Table 2), it can be said that all the tests (MT5M: =0.16; MT20M: D max=0.15; M15ML: D max=0.16) had distribution of results which does not deviate significantly from normal Gaussian distribution. Thus, as the analysed tests are successful in differentiating subjects regarding the object of measurement, all the tests are suitable for further statistical analyses planned in this study. The coefficient of asymmetry (SKE) shows if the majority of results of some test skew to the zone of maximum or minimum values. However, before analysing this indicator, it should be noted that the variable 5-meter sprint from a standing start (MT5M) is inversely scaled (a higher value of the test means a weaker result and vice versa), so this should be taken into consideration during interpretation. By examining the obtained values of coefficient of asymmetry, it can be said that there was minimum asymmetry towards higher results of the test in the variable 5-meter sprint from a standing start (MT5M). Moreover, by examining the measure of peakedness (KURT), it can be seen that it was somewhat more pronounced in the variable 5-meter sprint from a standing start (MT5M). The obtained results indicate somewhat higher clustering of results around the mean.

Table 2. Results of sensitivity of variables for assessing sprinting speed

Variables	AM	SD	MIN	MAX	SKE	KUR	D max
MT5M (sec)	1.21	0.06	1.10	1.44	1.70	6.22	0.16
MT20M (sec)	3.75	0.17	3.43	4.22	0.75	0.63	0.15
M15ML (sec)	2.55	0.11	2.33	2.78	0.55	-0.57	0.16

Legend: AM–arithmetic mean, SD–standard deviation, MIN–minimum result, MAX–maximum result, SKE–measure of asymmetry, KURT–measure of peakedness, K-S–Kolmogorov Smirnov test of normality of distribution, d=0.246 for N=32 ($p<0.05$), MT5M–5- meter sprint from a standing start, MT20M–20-meter sprint from a standing start, M15ML–flying 15-meter sprint.

In the overall sample, factor analysis in the space of three manifest motor variables analysed a single dimension, i.e., factor, which accounts for 88% of the variance in the system (Table 3). The highest correlation with the object of measurement, i.e., the highest validity was found in the 20-meter sprint from a standing start (MT20M: 0.98) test. Tests assessing sprinting speed which are ranked in such a way should not be treated as the best, weak and the weakest tests, but rather as very good tests for assessing sprinting speed, and among these very good tests, the MT20M is the best.

Table 3. Factor analysis of variables assessing sprinting speed

Variables	F1
MT5M	0.90
MT20M	0.98
M15ML	0.93
Lambda	2.64
Variance %	88.23

Legend: Lambda-eigenvalue; Variance %-percentage of variance explained by latent dimension, MT5M–5- meter sprint from a standing start, MT20M–20-meter sprint from a standing start, M15ML–flying 15-meter sprint.

The results of differences determined by an independent samples t-test are presented in Table 4. The results of the independent samples t-test indicate there was a statistically significant difference between two groups of soccer players only in the variable 5-meter sprint (t–value=-2.56; p=0.02). By examining arithmetic means of the two groups of subjects, it can be concluded that soccer players in the first group (players aged 11 years) had better results.

Table 4. Differences between two groups of soccer players in tests assessing sprinting speed

Variable	Group 1 (N=20) AM±SD	Group 2 (N=12) AM±SD	t-test	
			t-value	p
MT5M	1.15±0.04	1.19±0.04	-2.56	0.02
MT20M	3.66±0.11	3.75±0.14	-1.63	0.12
M15ML	2.49±0.24	2.53±0.10	-1.21	0.24

Legend: t-test–independent samples t-test, p–level of significance, MT5M–5-meter sprint from a standing start, MT20M–20-meter sprint from a standing start, M15ML–fl ying 15-meter sprint.

Metric characteristics of tests assessing specific agility in youth soccer players

By examining coefficients of reliability of tests assessing specific agility (Table 5), it can be said that the values of inter-item correlation were relatively satisfactory. The most reliable tests for assessing the analysed ability were the zig-zag run with a ball (MZI-ZA L: IIr=0.65; α=0.83) and the 20-meter sprint with a ball (M20 L: IIr=0.6; α=0.85) test. On the other hand, somewhat lower accuracy of measurement was noted in the slalom run with a ball test (MSLA L: IIr=0.52; α=0.75). Results of homogeneity (F-test and the associated level of significance–p) indicate there were certain differences in values of indicators of this metric characteristic in tests assessing specific agility. Unambiguous inference (homogenous test) is possible in slalom run with a ball (MSLA: p=0.324) and zig-zag run with a ball test (MZI-ZA L: p=0.149), whereas unambiguous inference (heterogenous tests) is not possible in the third test 20-meter sprint from a standing start with a ball (M20 L: p=0.007). Therefore, as end result in the slalom run with a ball and zig-zag run with a ball test, mean value of the three measured items was used, whereas in the 20-meter sprint with a ball the best result was used.

Table 5. Results of reliability and homogeneity of variables assessing specific agility

Variables	V 1	V 2	V 3	II r	α	AM±SD	F-test	p
M20 L (sec)	1.00	0.62	0.59	0.66	0.85	4.33±0.23	5.33	0.007
	0.62	1.00	0.76			4.24±0.23		
	0.59	0.76	1.00			4.22±0.23		
MSLA L (sec)	1.00	0.55	0.46	0.52	0.75	12.58±1.57	1.14	0.324
	0.55	1.00	0.55			12.39±1.50		
	0.46	0.55	1.00			12.20±1.09		
MZI-ZA L (sec)	1.00	0.82	0.49	0.65	0.83	9.53±0.66	4.17	0.149
	0.82	1.00	0.59			9.70±0.75		
	0.49	0.59	1.00			9.84±0.75		

Legend: V1-V3–inter-refereecorrelation; IIr-inter-item correlation; α–Cronbach's alpha coefficient; AM–arithmetic mean; SD-standard deviation; F test-analysis of variance; p–level of significance, M20 L–20-meter sprint from a standing start with a ball, MSLA L–slalom run with a ball, MZI-ZA L–zig-zag run with a ball.

The results of sensitivity of tests (Table 6) showed that normal distribution of data existed in all the tests assessing specific agility. This was confirmed by the values of normality of distribution (D max), which did not deviate from relative cumulative Gaussian distribution (M20 L: D max=0.08; MSLA L: D max=0.13; MZI-ZA L: D max=0.12).

Table 6. Results of sensitivity of variables assessing specific agility

Variables	AM	SD	MIN	MAX	SKE	KUR	D max
M20 L (sec)	4.16	0.19	3.86	4.63	0.38	-0.28	0.08
MSLA L (sec)	12.39	1.15	10.30	15.37	0.73	0.83	0.13
MZI-ZA L (sec)	9.70	0.63	8.59	10.68	-0.05	-1.26	0.12

Legend: AM–arithmetic mean, SD–standard deviation, MIN–minimum result, MAX–maximum result, SKE–measure of asymmetry, KURT–measure of peakedness, K-S–Kolmogorov Smirnov test of normality of distribution, d=0.246 for N=32 (p<0.05), M20 L–20-meter sprint from a standing start with a ball, MSLA L–slalom run with a ball, MZI-ZA L–zig-zag run with a ball.

Results of factor analysis of variables assessing specific agility are presented in Table 7. By factor analysis applied on a sample of youth soccer players, out of the 3 manifest variables assessing specific agility, a single latent dimension was isolated, accounting for 75.08% of total variability of the system. The obtained dimension was defined by high projection of the slalom run with a ball (MSLA L: 0.91) test, which is followed positively by good projection of the zig-zag run with a ball (MZI-ZA L: 0.89) and 20-meter sprint from a standing start with a ball (M20 L: 0.78) test.

Table 7. Factor analysis of variables assessing specific agility

Variables	F1
M20 L	0.78
MSLA L	0.91
MZI-ZA L	0.89
Lambda	2.25
Variance %	75.08

Legend: Lambda - eigenvalue; Variance % - percentage of variance explained by latent dimension, M20 L–20-meter sprint from a standing start with a ball, MSLA L–slalom run with a ball, MZI-ZA L–zig-zag run with a ball.

The results of differences determined by an independent samples t-test are presented in Table 8. The results of the independent samples t-test indicate there was a statistically significant difference between two groups of soccer players in variables slalom run with a ball (t–value=-3.41; p =0.01) and zig-zag run with a ball (t–value=-3.48; p=0.01).By examining arithmetic means of the two groups of subjects, it can be concluded that soccer players in the first group (players aged 11 years) achieved better results.

Table 8. Differences between two groups of soccer players in tests assessing specific agility

Variable	Group 1 (N=12) AM±SD	Group 2 (N=20) AM±SD	t-test	
			t-value	p
M20 L	4.08±0.16	4.21±0.20	-1.94	0.06
MSLA L	11.10±0.56	11.99±0.79	-3.41	0.01
MZI-ZA L	8.95±0.39	9.63±0.60	-3.48	0.01

Legend: t-test–independent samples t-test; p–level of significance, M20 L–20-meter sprint from a standing start with a ball, MSLA L–slalom run with a ball, MZI-ZA L–zig-zag run with a ball.

Discussion

The primary aim of this study was to validate the measuring instruments for assessing certain motor abilities in youth soccer players. In line with this goal, values of reliability, homogeneity, sensitivity, and factor and pragmatic validity were calculated. Analyses were performed based on which the results on metric characteristics of tests assessing selected motor dimensions were obtained. Numerous previous studies (Folio & Fewell, 2000; Ulrich, 2000) claim that values of coefficients of reliability are the most important indicator of metric characteristics. Desirable values of coefficients of reliability cannot be explicitly determined. Namely, some authors claim that coefficients of correlation must be at least 0.90 (Malacko & Popoviæ, 2001; Salvia & Ysseldyke, 1988) for a test to be reliable, whereas others argue that the level of correlation of 0.70 is the lower reliability limit (Folio & Fewell, 2000; Ulrich, 2000).

Considering that analysis of homogeneity by using average inter-item correlation or factor analysis greatly depends on objectivity, i.e., variance of error, and is hard to differentiate from coefficient of objectivity, in this study homogeneity was analysed by applying analysis of variance. This type of analysis is also used by Žuvela, Maleš and Ěerkez (2009) in their study of biotic motor skills, in which the author uses lower homogeneity as indication to take the best result as the final result in a test, instead of using the mean result (heterogenous result).

In accordance with these findings and the results presented in this study, some general findings of this study may be presented. Indicators of metric characteristics for assessing sprinting speed indicate that the 20-meter sprint from a standing start (M20M) test is the best in assessing sprinting speed. Indicators of accuracy of measurement in the analysed test are very high. According to the obtained arithmetic means it can be said that

in the M20M test a process of motor learning has not occurred, so the same number of items in assessment of the analysed ability (homogenous test) can be recommended for future studies. The test is good in differentiating subjects regarding the object of measurement. The subjects' results do not deviate significantly from normal Gaussian distribution. Results of factor structure of motor space on a sample of youth soccer players indicate that the analysed test has the highest correlation with the object of measurement. By observing the findings of this study through parameters of pragmatic validity, the obtained results indicate there is a certain difference in the sprinting speed only in the 5-meter sprint test. The obtained differences can probably be ascribed to the difference in chronological age, but also to the knowledge on performance of standing start, which, by the authors' opinion, certainly represents an important factor for running the 5-meter distance from a standing start successfully. It can be assumed that during systematically directed kinesiological exercise boys in the older age category managed to acquire the starting skill on a higher and more quality level, which in the end has certainly led to certain differences in the 5-meter sprint.

Values of metric characteristics of tests assessing specific agility indicate that the slalom run with a ball (MSLA L) test is best in assessing the analysed ability. Correlation of results of measurement on the same object of measurement is satisfactory. Unambiguous inference in the MSLA L test is possible (homogenous test). Distribution of data in the test does not deviate significantly from normal Gaussian distribution. Out of the 3 manifest variables assessing specific agility, the slalom run with a ball test has the highest partial projection on the obtained motor factor. Also, it should be noted that in the M20L test there was a certain tendency of decrease of arithmetic mean values, which could indicate a certain motor learning process during performance of this motor task. Therefore, it would be advisable to increase the number of repetition items in future studies. On the other hand, there was a certain tendency of increase of arithmetic mean values in the zig-zag run with a ball test. This trend has probably occurred due to insufficient pause between each repetition in the test, so it would be advisable in future studies to increase the rest period between repetitions.

In line with the obtained results (pragmatic validity), it can be seen that there are certain differences between the two age categories in specific agility. As in the previously analysed difference in sprinting speed at 5-meter distance from a standing start, it is obvious that the quality of systematically selected kinesiological operators (primarily of soccer contents), has led to significant differences in specific agility. The obtained differences can be seen in almost all the applied tests.

To summarize, the values of metric characteristics indicators showed that motor tests assessing speed and specific agility had high level of reliability, good homogeneity, normal distribution of data, and acceptable factor and pragmatic validity. Results obtained in indicate that during a properly selected training process (soccer), target transformations may occur in abilities of specific agility, which are considered by most authors as being one of the most important for further development of youth soccer players. One of the most important and most frequently tested segments of anthropological status are motor abilities of athletes. Processes of selection, orientation and monitoring in the area of elite sport are inconceivable without information on athletes' motor dimensions. Without a doubt, sports can be classified into a pattern of motor activities in which these characteristics come to the fore. All motor abilities undeniably affect the results of sports achievements, but individual contributions of different motor dimensions are diverse and varying in each individual sports activity. Therefore, it is very important have a valid tool to assess motor abilities such as speed and specific agility in youth soccer. We hope that this study will provide useful information's for coaches and athletes for creating a successful training program.

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Conflict of Interest
The authors declare that there are no conflicts of interest.

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SportMont

ORIGINAL SCIENTIFIC PAPER

The Effects of Hyperbaric Oxygen and Active Recovery on Lactate Removal and Fatigue Index

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Abstract

The purpose of this study was to compare active recovery and recovery using hyperbaric oxygen on lactate removal and fatigue index. Fatigue index was measured through Running-based Anaerobic Sprint Test (RAST). Lactate clearance was measured using lactate analyzer. Recovery period is important since competitive events are sometimes very close one from the other.The design of this research was randomized pretest posttest control group design. Thirty students were randomly assigned to three groups consisted of 10 students, the first group doing recovery using 1.3 ATA hyperbaric oxygen after doing RAST, the second group doing recovery in 1.8 ATA hyperbaric oxygenafter doing RAST, and the third group doing active recovery with light intensity after doing RAST. Blood lactate concentration was measured before RAST, ten minutes after RAST, and after recovery either using hyperbaric oxygen or active recovery, and then they took RAST again to get the second fatigue index. Data was analyzed through Manova with .05 significant levels. Blood lactate level isthe lowest in those treated with Hyperbaric Oxygen 1.3 ATA has significant difference with active recovery (p=.008). Fatigue index of those treated with hyperbaric oxygen 1.3 ATA is the lowest (6.7 watts/second) vs HBO 1.8 ATA (7.85 watts/second) and active recovery (8.56 watts/second). Increasing oxygen supply to musculoskeletal system increases metabolism of waste substances and promotes recovery from fatigue. Hiperbaric Oxygen 1.3 ATA is more effective than HBO 1.8 ATA or active recovery in lactate removal.

Key words: *hyperbaric oxygen treatment, blood lactate, fatigue index, RAST*

Introduction

An excellent sport performance is supported by sport skills; strength, power, flexibility, balance, agility, speed, aerobic and anaerobic capacities, whereas anaerobic work is determined by substrate level and lactate clearance (Monedero & Donne,2000). Increased lactate results in decreased pH and decreased enzymatic work, and eventually ATP production is also slowered, and this condition will cause fatique and inhibit sport performance. So, optimal recovery process and accelerated lactate clearance would be of benefit to support sport performance. Optimalization of recovery is important to reduce fatique, to increase physiological adaptation to training and to reduce injury risks (Dupont & Moalla, 2004), especially in series competition. Accoding to Falks, Einbinder, Weinstein, Epstein and Karni (1995), lactate clearance is very important, and is done by increasing blood flow, and increasing lactate transport to form ATP again, so acceleration of lactate metabolism is crucial. Recovery activity dictates the speed by which lactate is metabolized in muscles as well as in the liver. Anaerobic work induces lactate production, and increase lactate production will decrease pH, and ATP production as well, and this eventually results in fatique, so fast recovery and acceleration of lactate metabolism is necessary for performance maintainance. Optimalization of recovery technique will increase physiological adaptation to sport performance and avoidance of sport injuries (Dupont & Moalla, 2004).

One among several methodes of recovery is using hyperbaric oxygen. Several studies have shown that passive rest in

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hyperbaric oxygen chamber able to speed up lactic acid clearance in the blood (Untari, 2003). Athlete conditioning should be done not only during training, but also during competition, and in between competition (Lattier & Millet, 2004). Hyperbaric oxygen has been used for recovey after high intensity activities. Hyperbaric oxygen is able to increase oxygen transport untill tissue level, to increase respiratory function as well as nervous function (Jain, 1996). The primary function of hyperbaric oxygen therapy is to accelerate the recovery of soft tissue by means of reducing local hypoxia, inflammation and edema (Staples & Clement, 1996). Draper and Whyte (1997) developed the Running-based Anaerobic Sprint Test (RAST).

Methods

The design of this study was randomized 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 badminton players, students of School of Sport Sciences, Surabaya State University. The age ranged from 19 to 23 years old. All three groups were doing Running-based Anaerobic Sprint Test (RAST) developed by Draper and Whyte (1997) after 10 minutes warming up. The first group was doing post exercise recovery in hyperbaric oxygen chamber with 1.3 atmospheric pressure (1.3 ATA) for 15 minutes after anaerobic test using RAST, the second group was doing post exercise recovery in hyperbaric oxygen chamber with 1.8 atmospheric pressure (1.8 ATA) for 15 minutes after anaerobic test using RAST, and the third group was doing active recovery (jogging) for 15 minutes after anaerobic test using RAST. Blood lactic acid was measured using lactate analyzer. To measure the effectiveness of hyperbaric oygen as well as active recovery on fatique index, the whole sample were doing Running-based Anaerobic Sprint Test (RAST) for the second time.

Kolmogorov-Smirnov was used to test normality of sample, and Box's Test of Equality was used to test sample homogenity. Data would be analyzed using appropriate statistics.

This study was approved in advance by Surabaya State University Board of Ethics with approval number: 10615.IO. Each participant voluntarily provided written informed consent before participating the study

Results

Kolmogorov Smirnov test shows p=.58 (>.05), and Box's equality test shows p=.138 (>.05), so sample is normal and homogen. Table 1 shows that blood lactate level is significantly different in group treated with HBO 1.3 against active recovery (p=.008), group treated with HBO 1.8 is not significantly different with active recovery (p=.94), and group treated with HBO 1.3 is not significantly different with HBO 1.8 as well (p=.263), so HBO 1.3 is significantly effective in reducing blood lactate compared with HBO 1.8 and active recovery.

Table 1. Blood lactic acid concentration after recovery in HBO 1.3 and 1.8, and active recovery, and fatique index after second time doing RAST

Dependent Variable	(I)	(J)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Blood lactic acid	HBO 1.3 ATA	HBO 1.8 ATA	1.0400	.91009	.263	-.8273	2.9073
		Active recovery	2.6200*	.91009	.008	.7527	4.4873
	HBO 1.8 ATA	HBO 1.3 ATA	-1.0400	.91009	.263	-2.9073	.8273
		Active recovery	1.5800	.91009	.094	-.2873	3.4473
	Active recovery	HBO 1.3 ATA	-2.6200*	.91009	.008	-4.4873	-.7527
		HBO 1.8 ATA	-1.5800	.91009	.094	-3.4473	.2873
Fatique Index	HBO 1.3 ATA	HBO 1.8 ATA	-.5428	.94273	.570	-2.4771	1.3915
		Active recovery	-1.7317	.94273	.077	-3.6660	.2026
	HBO 1.8 ATA	HBO 1.3 ATA	.5428	.94273	.570	-1.3915	2.4771
		Active recovery	-1.1889	.94273	.218	-3.1232	.7454
	Active recovery	HBO 1.3 ATA	1.7317	.94273	.077	-.2026	3.6660
		HBO 1.8 ATA	1.1889	.94273	.218	-.7454	3.1232

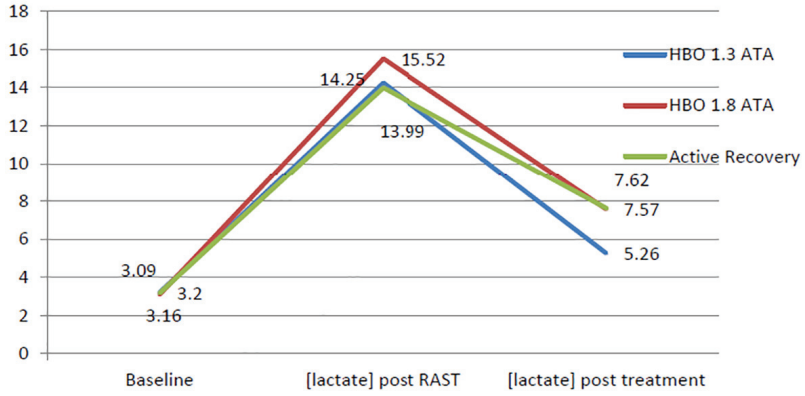

Figure 1. Blood lactate concentration in mMol/L during start of exercise, 10 minutes after RAST, and after recovery

Fatigue index after doing second RAST does not show any significant difference among those three treatment, HBO 1.3 vs HBO 1.8 (p=.570), HBO 1.3 vs active recovery (p=.077), and HBO 1.8 vs active recovery (p=.218).

Figure 1 shows that after treatment with HBO 1.3, HBO 1.8, and active recovery, blood lactate concentration after HBO 1.3 treatment is 5.26 mMol/L, significantly different with active recovery (5.26 mMl/L vs 7.62 mMol/L; p=.008), but not with HBO 1.8 (5.26 mMol/L vs 7.57 mMol/L; p=.263). HBO 1.8 is not significantly different with active recovery (7.57 mMol/L vs 7.62 mMol/L; p=.94).

Figure 2 shows fatigue index after doing RAST for the second time. Hyperbaric oxygen treatment using 1.3 ATA shows fatigue index of 6.7 watts/second, HBO 1.8 treatment shows 7.85 watts/second, whereas active racovery shows 8.56. So, HBO 1.3 produces the lowest fatigue index, meaning the least fatigue although comparisons of those three treatments against each other are not significantly different.

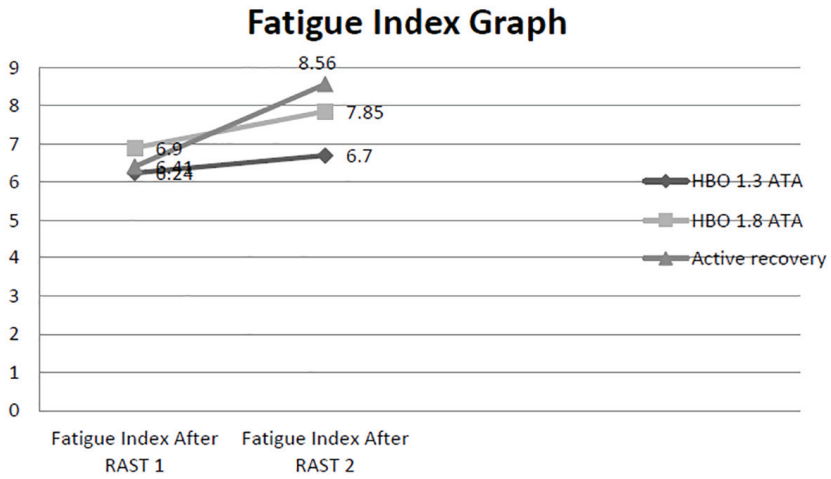

Figure 2. Fatique index in watts/second after doing the first RAST and the second RAST

Discussion

This study indicates that mild pressure of hyperbaric oxygen therapy (1.3 ATA) reduces blood lactate concentration significantly against active recovery, and eventhough there is a non significant difference in fatique index in second RAST, the score of mild hyperbaric oxygen therapy (1.3 ATA) is the lowest, indicating that it has a tendency to be more effective.

A continuous supply of oxygen to all tissues is necessary for the efficient production of ATP, and this supply is considered sufficient when aerobic metabolism is maintained (Robertson & Hart, 1999). By performing HBO treatment, more oxygen is dissolved in the plasma, increasing the oxygen reaching the peripheral tissues as well as increasing PaO2. HBO treatment is therefore expected to improve recovery from injury and fatigue (Ishii et al., 2005). Other study of mild pressure hyperbaric oxygen therapy using 1.3 ATA reduces oxidative stress as indicated by a significant decrease in serum reactive oxygen metabolites (p=.006), and a significant decrease of fatique as indicated by visual analog scale scores from 5.0 to 2.1 (p<.001) (Kim, Yukishita, & Lee, 2011). Studying the effects of hyperbaric oxygen on muscle fatigue. Shimoda, Enomoto, Horie, Miyakawa and Yagishita (2015) came to a conclusion that hyperbaric oxygen treatment contributes to sustained force production due to suppressing the muscle fatigue progression. In fact, HBO treatment has effectively increased recovery from fatigue. This was clearly seen at the Nagano Winter Olympics, where sports players experiencing fatigue were successfully treated, enabling the players to continue performing in the games (Ishii et al., 2005).

After high intensity exercise which is an anaerobic work, condition in working muscle is slightly hypoxic since oxygen is used intensively to change the ischemic condition of the working muscle and to metabolize lactate, and as a result oxygen pressure in the tissue drops. The haemodynamic and microcirculatory effects of hyperbaric oxygen appear to be effective in compensating ischemic conditions. Oxygen pressure in the tissues increase to levels close to normal. Hyperbaric oxygen causes vasoconstriction with a decrease in microcirculatory blood flow but with no decrease of oxygen pressure in the tissue. This reflexed vasoconstriction is useful to avoid hyperoxic condition with many bad consequences including tissue oxidation (Mathieu, 2009). Increasing oxygen supply to musculoskeletal system increases metabolism of waste substances and promotes recovery from fatigue. Hiperbaric Oxygen 1.3 ATA is more effective than HBO 1.8 ATA or active recovery in lactate removal.This study shows that HBO 1.3 ATA is optimal in bringing effective tissue oxygenation.

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Conflict of Interest
The authors declare that there are no conflicts of interest.

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ORIGINAL SCIENTIFIC PAPER

Comparative Study of Anthropometric Measurement and Body Composition between Junior Basketball and Volleyball Players from Serbian National League

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Abstract

The purpose of this study was to describe anthropometric characteristics and body composition of junior basketball and volleyball players from Serbian national league and to make comparison between them. Fifty-nine males were enrolled in the study divided into three groups: thirteen basketball players, fourteen volleyball players and thirty-two healthy sedentary subjects. All subjects were assessed for the anthropometric measures required for the calculation of body composition variables, using standardized procedure recommended by established literature. Data was analyzed using SPSS and the descriptive statistics were expressed as mean (SD) for each variable, while ANOVA and LSD Post Hoc tests were carried out to detect the effects of each type of sport. The results showed there was no significant difference in body mass index and bone content of body among the groups, while a significant difference was found for body height, body weight, muscle and fat contents of body among the groups. Basketball and volleyball players were significantly taller and heavier than the subjects of the control group, while there was not any significant difference between the body height and body weight of basketball and volleyball players. Muscle content of basketball players was significantly higher than control subjects, while a significant difference was not noticed between volleyball players and subjects of control group. Fat content in the body of basketball and volleyball players are significantly lower than the percent of fat content in the body of control group, while there was not found any other difference in this content. These findings may give coaches from the region better working knowledge and suggest them to follow recent selection process methods and to be more careful during the recruitment.

Key words: *sport, junior, basketball, volleyball, male*

Introduction

Morphological characteristics are of particular importance for orientation and selection in most sports disciplines, since in the equation of the specification of almost every sport and also each specific function in the team, the morphological dimensions occupy one of the most important positions. Identifying talented children, assessing their strength and weaknesses, assigning positions to the team and planning the training programs in the proper manner are the basis of each work. Therefore, the scientists all over the world are looking for the standard formula that can improve the performance of elite players and discover talents as precisely as possible (Popovic, Akpinar, Jaksic, Matic, & Bjelica, 2013).

Many researchers have hypothesized that practicing athletes might be expected to exhibit structural and functional characteristics that are specifically favorable for their specific sport (S.

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Singh, K. Singh, & M. Singh, 2010). Since each sport has its own specific demands, every athlete should have specific anthropometrical characteristics and body composition figures for his or her own sports discipline. Understanding the body composition is considered an essential part of the total management process (Wilmore, 1982). Body composition can affect strength and agility (Massuça & Fragoso, 2011), whereas body mass can influence an athlete's speed, endurance, and power, It is well known that excessive fat mass compromises the physical performance (Nikolaidis & Vassilios-Karydis, 2011), acts as a dead body mass in activities where the body must be repeatedly lifted during locomotion and jumping, decreasing performance and increasing energy demands (Ramos-Campo et al., 2014). On the contrary, muscle-skeletal mass is an indicator of sports performance, because it contributes to the energy production during high-intensity activities and provides absolute strength to athletes (Vila Suárez et al., 2008). From previous mentioned follows that modern athlete it should be fast, explosive and powerful. It should have more muscle mass and less fat tissue.

It is known, on body height cannot be much affected, because it is highly genetically conditioned dimension. On the other hand, body weight, the percentage of fat and muscle it can be changed a lot, and this fact should be used. Sometimes illegal substances are used for these purposes. Although there is little evidence of athletic performance enhancement following diuretic administration, their abuse is widespread among athletes who want to lose weight quickly. For example, diuretics use can allow an athlete to transiently reduce body weight, which is a clear advantage in wrestling, boxing, judo and weight-lifting as well as in general sports where weight categories are involved and among athletes who want to maintain a low body weight, such as female gymnasts and ballet dancers (Cadwallader, de la Torre, Tieri, & Botrè, 2010). Professional athletes commonly use anabolic-androgenic steroids to enhance performance. Anabolic-androgenic steroids include testosterone and its numerous synthetic analogs that have been modified to boost their anabolic, rather than their androgenic effects. Anabolic effects consist in protein synthesis, muscle growth, and erythropoiesis. Therefore, they allow athletes to increase muscle size and reduce body fat. Under the influence of anabolic-androgenic steroids muscles grow, increases muscle strength and density, recovering is faster from workouts and muscle injury, allowing them to train longer and harder (Piacentino et al., 2015). The results of using these unauthorized pharmacology it is augmenting performance but they bring the consequences and followed by an assessment of the health risks. The correct assessment of body composition in sport is important, since errors may lead to mistakes in training prescription and diet elaboration, and therefore affect the athletic performance (De Oliveira-Junior et al., 2016). Some sports, such as boxing, require much more knowledge regarding this topic than others, because of the weight limits. The following example, the sport of arm-wrestling, requires the selection of athletes with longer forearm bones (Popovic et al., 2013). The need to investigate the anthropometrical characteristics and body composition numbers of basketball and volleyball players is equally important, as adequate body composition and body mass figures, among other factors, contribute to optimal exercise routines and performance (Massuça & Fragoso, 2011). According to previous investigations (Hurst et al., 2017; Loureiro et al., 2017; Silva, Marcelino, Lacerda, & Vicente João, 2016; Pojskic, Separovic, Muratovic, & Uzicanin, 2014), successful participation in both basketball and volleyball games, requires not only a high level of technical and tactical skills, but also requires from each athlete suitable anthropometrical characteristics and body composition. This study aims to verify if data collected regarding the anthropometrical characteristics and body composition of Serbian athletes supports previous studies that have evaluated ideal anthropometric profiles of successful basketball players (Pojskic et al., 2014; Vaquera, Santiago, Gerardo, Rabago, & García-Tormo, 2015) and volleyball players (Lidor & Ziv, 2010; Carvajal et al., 2012).

The previous investigations confirm that players in both mentioned sports are usually taller than the players from other sports (Rahmawati, Budiharjo, & Ashizawa, 2007) as well as the subject from general population (Gaurav, M. Singh, & S. Singh, 2010). Basketball and volleyball require from their players handling a ball above their heads (Gaurav et al., 2010), therefore tallness is great advantage in these sports. Even though these sports have some similar requirements, basketball and volleyball are two sports with different technical skills and different training and playing procedures. Basketball has been described as an intermittent sport, being physically very demanding, requiring players to permanently repeat bouts of intense actions (sprinting, shuffling, jumping) with jogging, walking, or short periods of recovering between (Stojanovic et al., 2016). In this game, movement patterns significantly differ from volleyball, as it requires the fast and explosive application of basketball techniques such as rebounding, driving, lay-ups, jump shooting, shot blocking, fast breaks and high speed play (Pojskic et al., 2014), the average work intensity of a basketball game is above 85% of maximal heart rate and above 80% of VO2 max (Balciunas, 2006). On the other hand, volleyball is a sport in which there is no contact, in which two teams of six players are separated by a net. It requires a high standard of preparation in order to complete for three sets of competitive play and to achieve success. In this game, movement patterns are significantly different from the soccer, as it requires their attack and defense to be much more effective as well as the dominance over the net becomes the most decisive factor for victory. The top-level volleyball players do not have VO2 max values on the high level as typical endurance trained elite players in other sports, but they have an optimal level of aerobic capacity that is required for playing this game since it may sometimes continue for longer (Lidor & Ziv, 2010). This game also includes a large number of spiking, jumping, power hitting, blocking, and setting that is mainly based on a high level of strength and power (Lidor & Ziv, 2010). The authors believed it would be reasonable to compare the anthropometrical characteristics and body composition of these athletes to check if there any differences among them (Popović, Bjelica, Jakšić, & Hadžić, 2014). Obtained data can enable switching junior players from one sports discipline to another one during the growing up period. This study also aims to check if this is true for on part of Dinaric Alps countries (Serbia), the place where live the people with the biggest absolute size (Pineau, Delamarche, & Bozinovic, 2005). Many previous studies have accurately determined the ideal anthropometric profile of successful basketball and volleyball player (Marques & Marinho, 2009; Nepocatych, Balilionis, & O'Neal, 2017; Vukasevic, Spaic, & Masanovic, 2018). Based on these results we have insights into the requirements for competing at the top level in particular sports. But, we do not have many studies to compare performance between basketball and volleyball at competition level.

Hence, the purpose of this study was to describe anthropometric characteristics and body composition of junior basketball and volleyball players from Serbian national league and to detect possible differences in relation to competition level.

Method

Fifty-nine males were enrolled in the study. They have been divided into three groups: thirteen basketball players (17.08±0.28 yrs.) and fourteen volleyball players (17.36±0.74 yrs.) from the junior premier league in Serbia as well as thirty-two healthy sedentary subjects (17.34±0.60 yrs.).

All subjects were clinically healthy and had no history of recent infection disease, asthma or cardiorespiratory disorders. Onward, all of them gave their written consent and the local ethics committee approved the study protocol. All subjects were assessed for the anthropometric measures required for the calculation of body composition variables (Matiegka, 1921), using standardized procedure recommended by International Biological Program (IBP) standards respecting the basic rules and principles related to the parameter choice, standard conditions and measurement techniques, as well as the standard measuring instruments adjusted before measurement was carried out. Height and weight were measured in the laboratory with the subjects dressed in light clothing. Height was measured to the nearest 0.1 cm using a fixed stadiometer and weight was measured to the nearest 0.1 kg with a standard scale using a portable balance. Body mass index (BMI) was calculated as body mass in kilograms divided by height in meters squared (kg/m2). Skinfolds (mm) were measured at six sites using: triceps skinfold thickness, forearm skinfold thickness, thigh skinfold thickness, calf skinfold thickness, chest skinfold thickness and abdominal skinfold thickness, using a skinfold caliper. Each individual measurement and the sum of the six measurements were used for analysis. The circumferences of the upper and lower arm, and upper and lower leg were measured (cm), as well as the following diameters to the nearest 0.1 cm: elbow diameter, wrist diameter, knee diameter, ankle diameter, upper arm diameter, forearm diameter, thigh diameter, and calf diameter. To reduce measurement variation, the same investigator examined all subjects.

The data obtained in the research were processed using the application statistics program SPSS 20.0 adjusted for the use on personal computers. The descriptive statistics were expressed as mean (SD) for each variable. Analysis of variance (ANOVA) and LSD Post Hoc test were carried out to detect the effects for each type of sport (basketball or volleyball) on each variable: body height, body weight, body mass index (BMI), and muscle, bone and fat content of the body, as well as to control it by sedentary subjects. The significance was set at an alpha level of 0.05.

Results

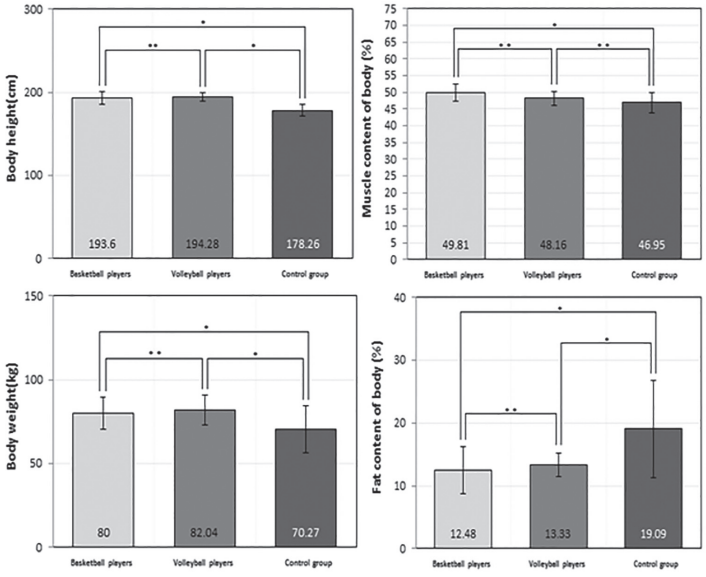
The anthropometric characteristics of subjects are shown in Table 1. There was no significant difference in body mass index and bone content of body among the groups, while a significant difference was found for body height (F=37.26), body weight (F=5.84) and other two contents of body among the groups: muscle (F=5.08) and fat (F=7.57).

Table 1. Descriptive data and ANOVA

Variables	Basketball (N=13)	Volleyball (N=14)	Control (n=32)	ANOVA
	Mean±Standard Deviation			
Height (cm)	193.60±7.70	194.28±5.30	178.26±7.27	0.000*
Weight (kg)	80.00±9.76	82.04±8.85	70.27±14.09	0.050*
BMI (kg/m2)	21.32±1.99	21.71±1.81	22.11±4.27	0.771^
Muscle content of body (%)	49.81±2.57	48.16±2.20	46.95±3.02	0.009*
Bone content of body (%)	16.95±1.15	16.52±1.20	17.34±2.47	0.434^
Fat content of body (%)	12.48±3.67	13.33±1.92	19.09±7.77	0.001*

Legend: N-number of subjects; BMI-body mass index; ^-non-significant; *-significant difference between groups

The significant differences of anthropometric characteris-



Legend: *=significance≤0.01; **=non-significance

Figure 1. Differences among the Subjects

tics among particular sports are shown in Figure 1. The LSD Post Hoc test indicates that basketball and volleyball players were significantly taller and heavier than the subjects of the control group, while there was not any significant difference between the body height and body weight of basketball and volleyball players. Muscle content of basketball players was significantly higher than control subjects, while a significant difference was not between volleyball players and subjects of the control group. Lastly, fat content in the body of basketball and volleyball players was significantly lower than the percent of fat content in the body of control group, while no other differences were found in this content.

Discussion

The results in this study support previous investigations indicating a strong difference regarding the body height among the athletes in these two sports and the subjects from the control group that represents general population (Gaurav et al., 2010) Based on this we can confirm the well-known axiom that selection is the only reason that can explain the observed difference. However, much more important finding regarding the body height is the fact that there was no significant difference among basketball and volleyball players. This finding leads us to conclusions that there are no specific demands regarding the body height between these two sports. The reason for growth tendencies basketball and volleyball players it is because their players are handling the ball above their heads (Gaurav et al., 2010) and their height helps them reach toward the basket or the top of the net as well as in the performance of defense elements. Taller basketball players have an advantage because the ball has to pass shorter distance from hand to the basket. Also, it provides them to start out closer to the rebound and their ability to jump higher than their opponents, and give them a chance to block their shoots. Taller volleyball players have an advantage because they can control both, defensive and offensive actions over the top of the net much easier. Thus, there is a tendency for the tallest children to be recruited in both sports, consequently selection criteria is very important. However, extra talented short players, especially those with a high vertical jump, shall also be selected and play a significant role in both sports disciplines (Popović et al., 2014). This conclusion can confirm the fact that male college and professional volleyball players, even the shortest players, are usually above average in height compared to the general population (Popović et al., 2014). For example, the average height of 2016 FIBA U17 World Basketball Championship players who played in Zaragoza in Spain, was 195.56 cm, while the average height of the national basketball teams who played semifinals, according to available data from official website, were following: the USA (198.17 cm), Turkey (195.75 cm), Lithuania (198.17 cm) and Spain (195.92 cm). On the other hand, the average body heights of the volleyball teams who played the finishing line CEV U17 Volleyball European Championship 2017 in Turkey were next: Russia (199.1 cm), Belarus (192.44 cm), Greece (187.5 cm), Italy (192.33 cm), Bulgaria (195.84 cm) and the Netherlands (188 cm). Average height of all participants in the championship was 189 centimeters. This proves that the players from our basketball and volleyball junior premier league are tall enough and they do not lag behind the top European and World players. However, this is not a surprise, as it is well known that the number of very tall subjects appears to be high in Dinaric Alpes area (Popovic, 2017), since 28% of people from general population were measured 190 centimeters or more in body height (Pineu et al., 2005; Bjelica et al., 2012).

Furthermore, it was expected that basketball and volleyball players were heavier than the subjects of the control group, mostly due to the reason they are significantly taller than they are. However, the reason why basketball and volleyball players are significantly heavier than subjects in control group can be supported with the fact that the average size of the basketball and volleyball players has increased dramatically in the past decades. Therefore, this could a result of better nutrition, especially in professional basketball leagues, partly due to the use of nutritional supplements. The body mass index (BMI; weight/height^2) is a parameter that is widely used in adult populations such as an internationally recognized definition of overweight and obesity (Kovac, Jurak, & Leskosek, 2012). Fortunately, the body mass index of all three groups is in the area of normal weight according to the established literature (Popovic, Masanovic, Molnar, & Smajic, 2009) and it did not show any significant differences among the groups.

Indeed, the authors found that the basketball players have significantly higher muscle content of body than the subjects of the control group. While there was not significant difference between volleyball players and the subjects of the control group. However, volleyball players have a slightly higher percentage of muscle content than control subjects, which is clearly seen in the table overview. These results may be explained by more demands to grow the muscle contents of the body in sportsmen, while a slightly higher percentage of muscle content of basketball players was found as this game requires intermittent activities when high-intensity activities are followed by low-intensity type of movements. It is well-known that muscle mass is important to improve strength and power which are then relevant to sport performance (Nikolaidis & Vassilios-Karydis, 2011). Our volleyball players have slightly higher values of muscle mass than the participants of the study in the control group but we are not to worry about that because the muscle mass of our volleyball players corresponds to the values in the established literature (Jeukendrup & Gleeson 2009) and higher differences in muscle mass are observed only in older years (Masanovic, 2008). While bone content of body did not show any significant differences among the groups and it corresponds the values in the established literature.

In sports like basketball and volleyball, a gravitational sport (Ackland et al., 2012), it is well known that excessive fat mass compromises the physical performance (Nikolaidis & Vassilios-Karydis, 2011). Therefore, the low percentage of fat content in the body of our basketball and volleyball players, and significantly lower than the percentage of fat content in the body of control subjects, showed that our players have high physical performance. However, it is very important to remember that athletes in elite team sports such as basketball and volleyball need a determined body fat percentage to perform well enough and achieve their full playing potential. The National Strength and Conditioning Association indicates that body fat percentages may vary from less than 7 percent to 17 percent among the male athletes, depending on the sports discipline. However, we would like to stress that these are just guidelines and the athletes would work together with their coaches and their personal physician to determine the appropriate individual body fat percentage to enhance their physical abilities and their health.

The importance of body composition in sport perfor-

mance is a primary concern in creating athletes' profiles as well as conditioning programs throughout a season at all levels of competition (Silvestre et al., 2006), in that describing anthropometric characteristics and body compositions of athletes and detecting possible differences in relation to competition levels may give coaches a better working knowledge of the studied groups of athletes. Moreover, the results of this study suggest that basketball and volleyball have a decreased percent of fat content if we compare it to the control group. This study also suggests that basketball and volleyball players have significantly increased muscle content, while the differences in the bone content are logical consequences. The part attributed to the body height is the main cause of selection process; and lastly, the part attributed to body weight could be the main cause of nutritional habits. Considering that the measurements were conducted in the middle of the season, this study is limited by the fact that changes in body composition and physical performance may occur from the start to the end of an athlete's training and competitive season (Silvestre et al., 2006). Kraemer et al. (2004) reported that players who enter a season with a high catabolic metabolic status could experience reductions in performance during a competitive season accompanied by detrimental changes in body composition. Accordingly, further studies should be very careful in projecting timelines for measuring anthropometric characteristics and body composition, mostly due to the fact that it has to be conducted either at the beginning or at the end of a season. It also has to be explicitly reported when the measurement was conducted.

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Conflict of Interest
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SportMont

ORIGINAL SCIENTIFIC PAPER

Pilates Improvement the Individual Basics of Service and Smash in Volleyball

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Abstract

A sample of 20 players 12-to 14-year old young male volleyball athletes participated in this study to test the improvement of agonistic performance, especially for the individual basics of the service and smash, using Pilates method in additional training sessions. The research was conducted with observation and manual and computerized detection for six months with tests for explosive strength detection and smash precision. The measuring the length of the lower limbs with the ASIS method showed a difference of a few millimetres between the two lower limbs and hypertrophy of the longest limb and hypotrophy of the shortest one. The athletes were divided into group A control (10 athletes) and group B (10 athletes). Only Group B participated in 20 additional training sessions with the Pilates method. The study showed improvement in performances with particular reference to the average percentage of crushing between 4 and 7%. Group B athletes, they found a uniform muscle toning and improved breathing control. The A group, motivated to perform the workouts with greater concentration, showed a performance improvement of a few percentage points. These athletes can improve the effectiveness of using unconventional methods to improve sports performance in a Team Sport.

Key words: *team sport, volleyball, posture, pilates, basic individual*

Introduction

The man has always tried to improve his physical performance by any method Physical activity, athletic performance, and recovery from exercise is enhanced by optimal nutrition (Mazzeo et al., 2016). Over the past 20 years, research has clearly documented the beneficial effects of nutrition on exercise performance (Mazzeo et al., 2016). There is certainly that what an athlete eats and drinks can affect health, body weight and composition, substrate availability during exercise, recovery time after exercise and exercise performance. As the research and interest in sport nutrition has increased, so has the sale of ergogenic aids, supplements and diet aids, all directed at improving sports performance (Mazzeo et al., 2013). Therefore, the athletic performance of young athletes often undergoes significant variations in both qualitative and quantitative terms (Montesano, 2016). Quality discontinuity in quality can be attributed to the incomplete acquisition of specific disciplinary techniques, while the quantitative one can be attributed to insufficient athletic training (Sedano, Marín, Cuadrado, & Redondo, 2013; Montesano, 2013). In many cases, however, these considerations have to add a reflection on organic-somatic restructuring occurring during the adolescent phase and affecting the ability to excretise the young person. From the analysis of the quality of sports performance in young volunteering athletes at competitive recreational level (Anderlini & Calducci, 1996), one of the performance variables was represented by postural imbalances (Duval-Beaupère, Schmidt, & Cosson, 1992).

Such manifestations, together with other factors such as the psycho-physical characteristics and the individual and team's skills and capability, the training methodology (Beccarini & Madella, 1997), the technical regulation of sports discipline, affect the effectiveness of the motor ge Beccarini and Madella (1997) suture, which is therefore subordinated not only to the

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intensity of the performance but the age and the athlete's psychophysical health (Montesano, 2013).

The athlete, engaged in both professional and competitive recreational activities, performs complex actions programmed and developed in training sessions that are often not replicated in agonistic contexts because of the incidence of the mentioned variables which are often not controllable.

The twenty athlete sample, participating in a youth volleyball championship of annual duration, highlighted the discontinuity of the agonistic performances and, by careful clinical-diagnostic examination, the diversification of the postures taken by the subjects both during the normal daily routine and during the Volleyball activities, training sessions and races.

The athletes, were subjected to competitive medical examinations for the release of agonistic medical and sports fitness during which the sports and orthopedic physicians identified the incidence of lower limb dissection among the many postural variables (Mazzeo, 2016; Mazzeo et al, 2015). The measurement, carried out, with the supine lying subject, calculating the distance between the upper anus thorax (ASIS) and the malleolus. The measurement provided results of some millimeter differences between the two limbs, despite the natural compensatory adaptation mechanism of the postural system which highlighted muscular hypertrophy of the quadriceps of the longest limb, for major load issues, and consequent short limb hypotonia. In the global evaluation, the interaction of the musculature with the various bodily, cervical, dorsal, lumbos, and abdominal areas (Le Huec, Aunoble, Leijssen, & Pellet, 2011) as well as the lower limbs was considered, and the exploration of explosive strength and some technical gestures such as and crushed.

By evaluating the results of the initial tests (Table 1), an intervention aimed at relaxation of the contracted areas, the strengthening of the lower muscle, has been hypothesized, not forgetting the importance of the technical movements (Montesano, 2014) in relation to the axes and the anatomic planes.

The aim was to test the improvement of agonistic performance, especially for the individual basics of the service and smash in volleyball play, using Pilates method in additional training sessions.

Methods

The research was developed by detecting explosive strength indices, referring to the Sargent test (P.G. de Salles da Costa Mendes, do Amaral Vasconcellos, G.F. de Salles da Costa Mendes, Tavares Fonseca, Dantas, 2012), and the percentage of precision in services and crushing exercises. The observational method and the manual and computerized survey were used, from September 2016 to March 2017, and the initial test results allowed the athletes to be divided into two groups. The control group A (identified athletes 1,2,3,4,5,6,7,8,9,10), consisting of athletes with the role of floating and central, and group B (identified athletes 11,12,13,14,15,16,17,18,19,20), consisting of athletes who have the role of crusher and the opposite who had more obvious symptoms of imbalances perhaps determined by the technical actions that exerted explosive and twisting movements. The two groups, during the agonistic vintage, followed the normal training methodology (Barba & Tafuri, 2007) prepared by the technical staff consisting of two weekly training sessions, featured by athletic, technical and tactical exercises, as well as by training sessions and official competitions.

For the improvement of the postural structure, it was supposed to use, with extra training sessions, the unconventional Pilates method (Korte, 2009), to be administered both in indoor and outdoor plants. The Pilates method (Miessner, 2012) is based on the development and refinement of the principles of health and muscle toning, with the application of Contrology exercises and the use of rehabilitation equipment to replace moving activities and aimed at stimulating muscle strength and activate deep muscles to work in opposition.

Addresses and objectives

The recipients of the survey were 20 young male athletes aged between 12 and 14, participating in volleyball competitions with competitive sports and medical competitions. The objectives of the study were to improve the postural layout, sport performance, and precision rates in performing the basics of services and crushing.

Additional Training

The team was divided into two groups of 10 athletes each and only one group (group B) was given 20 additional sessions in the gym, 3/4 monthly sessions, in addition to the normal training (Bompa, 1999) sessions conducted with the defined athletic-technical programming To start championship by technical staff. Additional relaxation and enhancement sessions were performed using the exercises with The Hundred, Roll Up, Roll Over, Leg Circles, Roll Legs, Double Leg Strech, Open Leg Rocher, Corkscrew, The Saw, alternate to skip high, medium, raced race; change of direction; run with speed variations; jumping of small obstacles; Jump.

Tests

The tests (Marella & Risaliti, 2007) were administered after an athletic session (Fox, Bowers, & Foss, 2005) consisting of an initial general activation, slow running for about 8 minutes, interrupted by 1 minute active recovery every 4 minutes, and mobilization exercises Articulate and stretching (Anderson, 2003) for a total of about 20 minutes of test preparation time. The survey was conducted in the volleyball field with athletes positioned on the bottom line of the field and at the three-meter area for the crush**.**

1) Detection of explosive strength by administration of the Sargent test (using a rope sized in cm hung on the wall):

1a) Determination, in height, of the starting metric grading: athletes positioned next to a wall, where a metric rope was placed in cm, with limbs inferior theses and a lying upper limb. Mark the height reached by the fingers of the lying limb (h1);

1b) Height measurement of metric jump grading: Athlete in the semicircular position (90 °) makes a jump and the measurement is detected match the highest point touched with the fingertips on the metric rope (h2);

1c) The value of the elevation (explosive force) is defined by calculating the metric difference between the jump height (test 1b) and the initial height (test 1a) ie h2 - h1.

This test has been performed three times and was considered the best difference between h2 and h1**.**

2) Scoring (precision) of the number of services (20 for each athlete in two steps) to five 18-m. bottom-set templates.

3) Scoring (accuracy) of the number of crashes made in three-step run (20 for each athlete in two steps) to five bottom-set silhouettes, about 10 m (Figure 1).

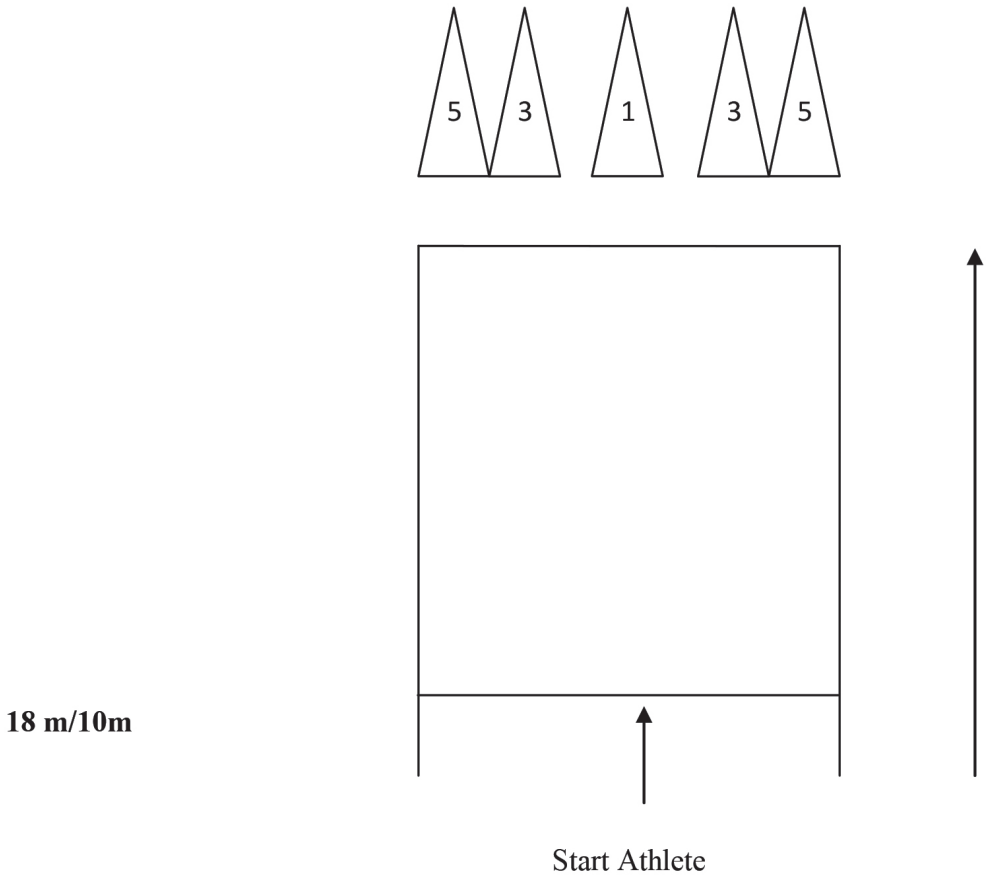

Figure 1. Tests 2 (two) and 3 (three)

In tests 2 and 3, the scoring score was awarded (5 points, 3 points, 1 point) with a theoretical maximum score of 100.

Materials

The technical materials and survey instruments used were selected according to the objectives of the research, the characteristics of the tests and the specificity of the proposed workout path. For collecting data they have been used to that purpose grid work (Tables 1, 2, 3).

Facilities and technical equipment used were:

Regulation volleyball court (18m x 9m)

Numbered figures

Volley Ball

Small tools of the Pilates Method: Mat, Gym band, Fit ball, Magic Circle

Great Tools: Leg press, multipower, solid body, barbells, benches

Results

Initial Recognition

Initial screening showed that the young athletes have shown different results for which the researchers decided to constitute two groups of 10 athletes each, A and B. Group A had an average percentage of about 60% of services and crushing efficacy, while that for Group B was about 70% (Table 1). It was observed that the fundamentals performed by the subjects with the left dominant limb were more precise.

Table 1. Initial detection of service and smash accuracy

Group A					Group B				
Atlethes	**Service**	**%**	**Smash**	**%**	**Atlethes**	**Service**	**%**	**Smash**	**%**
1c	55	55	77	77	11s	79	79	88	88
2c	66	66	64	64	12s	84	84	79	79
3c	78	78	82	82	13s	48	48	66	66
4c	47	47	66	66	14s	70	70	81	81
5c	48	48	58	58	15s	68	68	78	78
6c	39	39	45	45	16s	77	77	78	78
7p	69	69	56	56	17o	82	82	69	69
8p	58	58	49	49	18o	67	67	72	72
9p	69	69	61	61	19o	79	79	77	77
10p	72	72	65	65	20o	65	65	67	67

Legend: c-central; p-float; s-spiker; o-opposite

Intermediate Recognition

Intermediate detection was performed for Group B alone and the average percentage of services and crushing exercises increased by about 4.5%, attending around 75% with a single negative sign for the 12s athlete who reduced its Personal percentage for crushed by about 7% (Table 2).

Table 2. Intermediate detection of service and smash accuracy (Group B)

Atlethes	Service	%	Smash	%
11s	82	82	90	90
12s	85	85	72	72
13s	56	56	68	68
14s	71	71	81	81
15s	68	68	78	78
16s	81	81	79	79
17o	82	82	69	69
18o	69	69	72	72
19o	79	79	77	77
20o	71	71	69	69

Legend: s-spiker; o-opposite

Final Recognition

The final data showed (Table 3), for Group A, an average percentage of about 64%, an increase of 4% compared to the initial data, with particular reference to athletes 4c and 5c, which increased the performances by about 6-7%. Group B confirms the positive trend of an average percentage increase of around 77%, with a further 2% increase over the mid-term recession.

Table 3. Final detection of service and smash accuracy

Group A					Group B				
Atlethes	Service	%	Smash	%	Atlethes	Service	%	Smash	%
1c	59	59	78	78	11s	87	87	91	91
2c	66	66	65	65	12s	85	85	79	79
3c	80	80	82	82	13s	62	62	71	71
4c	56	56	69	69	14s	74	74	82	82
5c	54	54	64	64	15s	73	73	79	79
6c	48	48	49	49	16s	82	82	79	79
7p	71	71	62	62	17o	84	84	71	71
8p	58	58	51	51	18o	74	74	73	73
9p	69	69	63	63	19o	79	79	77	77
10p	74	74	67	67	20o	75	75	71	71

Legend: c-central; p-float; s-spiker; o-opposite

Table 3 shows the comparison of the final numerical data between group A and group B. The percentage of improvements, divided by groups, has been reported in Figure 2, group A, and in Figure 3, group B.

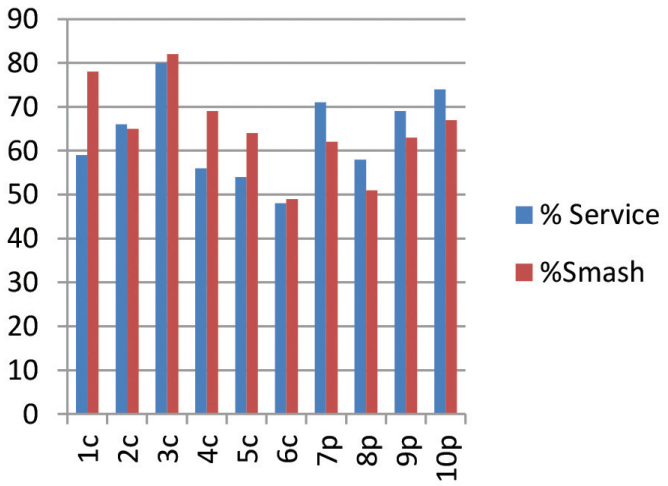

Figure 2. Final detection graphic of service and smash accuracy Group A

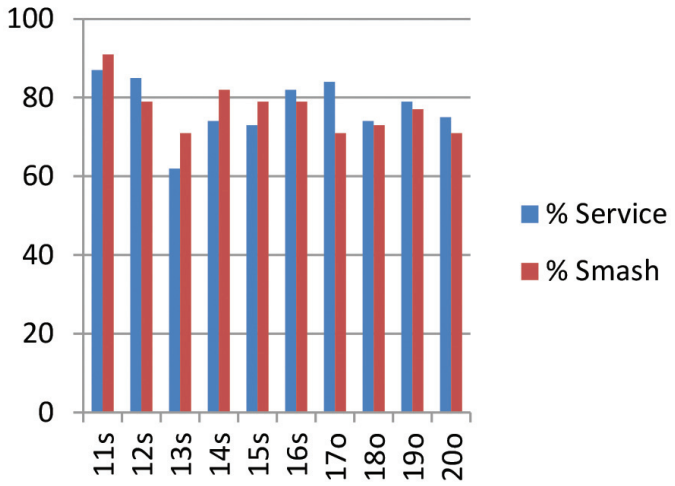

Figure 3. Final detection graphic of service and smash accuracy Group B

Discussion

The activity program envisages competition among equally skilled people, which is the best way to test your own athletic abilities and to evaluate your own progress, in order to promote physical, mental, social and spiritual growth. Determining the causes of discontinuous agonistic performance allows for predisposing training courses aimed at improving the psychophysical conditions of young athletes. The variables affecting youth performances are manifold and one of them is represented by postural imbalances that, in time, paramorphism can evolve, if not resolved, into dimorphisms (Negrini et al., 2005). The study showed the effectiveness of the use of unconventional methods (Bernardo, 2007) to improve sports performance and final results. The latter, collected at the end of the observation period, highlighted the improvement of the performances of the entire young volleyball champion. Group B athletes who expressed positive feedback on the additional method denoted the biggest increases in the average accuracy percentage of services and crunches but also Group A showed significant improvement in performance. Group B members stated that they received benefits from participating in the supplementary sessions with the Pilates method as they found a uniform muscle toning and improved respiratory control during sports practice. They also found the reduction of postural vices, limiting contractures and muscular atrophy, with the mobilization of the shoulder blades and the cervical, dorsal and lumbar extent. The adolescent age of the sample has undoubtedly favored an improvement in performance even in relation to a natural organic-muscle development but the chances of reducing the incidence of postural imbalances and the risk of injury are considered important variables in the programming of effective sport activity also if the athletic performance of young athletes often undergoes significant variations in both qualitative and quantitative terms. The discontinuity of performance can be attributed to the incomplete acquisition of specific disciplinary techniques, while the quantitative one can be attributed to insufficient athletic training.

The sport can be a beautiful and rewarding experience, it can promote the maturation and growth, can improve self-image and personal safety encouraging growth and stimulating enthusiasm for the comparison and the development of collaborative skills and relationships.

In conclusion, this model of teamwork suggests that athletes can improve their muscular endurance, flexibility and individual basics of service and smash using Pilates exercises that do not require equipment or a high degree of skill and are easy to master and use within a personal fitness routine.

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Conflict of Interest
The authors declare that there are no conflicts of interest.

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SportMont

ORIGINAL SCIENTIFIC PAPER

Research and Writing Development in the Area of Sport Science Publishing in Montenegro

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Abstract

The purpose of this study is to analyses the personal scientific production of Montenegrin sports sciences researchers, as well as trend of publication within Montenegrin sports sciences journals. This investigation subject included the studies published in the period from 2002 to 2017 that have been focused on the sports sciences issues. The electronic databases (Google Scholar, Scopus and Web of Science) were searched for research articles available until 6 September 2018. Then research findings were summarized in accordance with the PRISMA guidelines and the number of citation, h-index, i10-index as well as number of documents by authors were presented respectively. Results of this study indicated that the sports sciences researchers rapidly increased the number of publications from 2002 to 2017 and switch the writing language from Montenegrin to English, especially in last five years. The number of citations span from 100 and 2800 within most of researchers, while h-index and i10-index span from 4 to 30 in most cases in Google Scholar database, while the same researchers were cited quite lesser in Scopus and Web of Science databases. On the other hand, in Google Scholar database, there are three registered Montenegrin journals: Sport Mont journal (over 1000 articles published since 2002) is the most cited one with highest h-index (16), Montenegrin Journal of Sports Science and Medicine (over 80 articles) is the best ranked Montenegrin journal, while Journal of Anthropology of Sport and Physical Education (over 40 articles) was established in 2017 and the relevant analyses could not be possible to be completed, while the analyses in Scopus and Web of Science were conducted for the Montenegrin Journal of Sports Science and it was reached quite lower score too. It was indicated the highest impact was recognized in the last years, regarding to citations of available articles published by Montenegrin authors, as well as writing style of articles published in English. Hence, the further deployment is expected in upcoming period.

Key words: *improvement, ranking, researcher, journal, Montenegro*

Introduction

Bibliometric studies have, by and large, focused on the features of the fundamental sciences rather than the interdisciplinary sciences. Prior research has been highly focused on natural and technical science disciplines and not many investigations have dealt with the sports sciences as one of the most emerging and popular science nowadays. For example, over 25,000 is published annually in the area of sports sciences, and it is equal as in most natural and technical science disciplines (Personal communication, I. Varela Silva, 2017). For this reason, there is an increasing number of studies in which quantified scientific achievements are analyzed, both personally and institutionally, all in order to better evaluate scientific contribution in areas that show significant progress in the past period and must be ready to defend the entry into elite scientific society with solid arguments.

Development of sports science in Montenegro is related to the establishment of the Higher Pedagogical School in Cetinje, through the Faculty of Philosophy in Niksic, until the establishment of an independent Faculty for Sport and Physical Education at the University of Montenegro in 2008. Montenegrin Sports Academy, together with the faculty,

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played a major role in creating sports science and well educated staff that, at the end of the second decade of the 21st century has a recognizable status in the region, and wider. In front of the mentioned institution are founders, or co-founders of three scientific journals, and bearers of the annual scientific conference, and the hired staff is highly ranked in their fields when it comes to published works in prestigious international journals, and citation. Hence, the purpose of this study is to analyses the personal scientific production of Montenegrin sports sciences researchers, as well as trend of publication within Montenegrin sports sciences journals.

Method

This investigation subject included the studies published in the period from 2002 to 2017 that have been focused on the sports sciences issues. Considering that there are only three registered journals in Montenegro in this area: "Montenegrin Journal of Sports Science and Medicine", "Sport Mont" and "Journal of Anthropology of Sport and Physical Education", these three journals were used in the analysis, while the bibliographic characteristics of all researchers in the field of sports sciences whose affiliation is related to any discipline belonging to sports sciences has been processed.

Three electronic databases (Google Scholar, Scopus and Web of Science) were searched for research articles available until 6 September 2018. Aforementioned databases have been selected for several reasons, primarily because of their quality, then availability and their recognition among researchers in the field of sports science. "Google Scholar" is a database that is free and accessible without any restrictions. Even though it includes a large number and not reviewed documents, it does not promise the quality as "Web of Science" and "Scopus"; however, this database is specified, especially because of its availability and easy confidentiality. In contrast, "Scopus" is a database that's heading to the top, where "Web of Science" already is, and is increasingly accepted and used in European countries. Finally, "Web of Science" is the most prestigious database that has become a brand in the scientific public in most countries with a quality seal based on the subordinate legislation related to the promotion in academic careers.

The research findings were summarized in accordance with the PRISMA guidelines and the number of citation, h-index, i10-index as well as number of documents by author were presented for each of the aforementioned Montenegrin journals, but also for each individual researcher in the field of sports science who are among the best researchers by the given parameters determined in the method of this study.

Results

The first table (Table 1) shows the results obtained by analyzing the "Google Scholar" database. It is interesting to note that the journal "Sport Mont" has the highest number of citations, as well as h-index and i10-index, which was not unexpected, since this journal has been published since 2003 and has over 1000 published articles. It is followed by the "Montenegrin Journal of Sports Science and Medicine" with a significantly lower number of citations, while it is commendable that the "Journal of Anthropology of Sport and Physical Education" has managed to reach almost 300 citations in a very short period of time since its founding.

Table 1. Bibliometric analyses of Montenegrin journals in "Google Scholar" database on 6 September 2018

Journal	Number of Citations	h-index	i10-index
SMJ	1356	16	23
MJSSM	418	10	11
JASPE	287	10	10

Legend: SMJ – "Sport Mont" journal, MJSSM- "Montenegrin Journal of Sports Science and Medicine", JASPE – "Journal of Anthropology of Sport and Physical Education", h-index - is an author-level metric that attempts to measure both the productivity and citation impact of the publications of a scientist or scholar, i10-index - the number of publications with at least 10 citations; this very simple measure is only used by "Google Scholar", and is another way to help gauge the productivity of a scholar

The second table (Table 2) shows the results obtained by analyzing the "Scopus" database. Unfortunately, this database does not allow analysis of non-indexed journals. Even though two Montenegrin journals in the field of sports science (SMJ and MJSSM) are indexed in the aforementioned database, only the parameters for the "Montenegrin Journal of Sports Science and Medicine" were available, as the "Sport Mont" journal did not yet complete the indexing process. It has been recently accepted by this renowned database. It is interesting to note that the "Montenegrin Journal of Sports Science and Medicine" achieved a very significant result in the first year of tracking in the "Scopus" database and reached "Cite Score" 0.60 in 2017. It is interesting to point out the fact that the passing time in 2018 is excellent, so on the day, August 9, 2018, it has already reached "Cite Score" of 0.50, and in that way promised that in the current year it will certainly achieve a better result than in the previous one.

Table 2. Bibliometric analyses of Montenegrin journals in "Scopus" database on 6 September 2018

Journal	CiteScore 2017	SJR 2017	SNIP 2017
MJSSM	0.60	0.167	0.634
SMJ	Not calculated	Not calculated	Not calculated
JASPE	Not calculated	Not calculated	Not calculated

Legend: CiteScore -measures average citations received per document published in the serial, SJR - SCImago Journal Rank that measures weighted citations received by the serial, citation weighting depends on subject field and prestige (SJR) of the citing serial, SNIP - Source Normalized Impact per Paper measures actual citations received relative to citations expected for the serial's subject field

The third table (Table 3) shows the results obtained by analyzing the "Web of Science" database. Unlike the "Scopus" database, this database offers the ability to analyze citations and journals that are not indexed. After the analysis, it was noticed that the "Montenegrin Journal of Sports Science and Medicine", although with significantly fewer papers published so far, has significantly more citations than the "Sport Mont" journal. Very clear quality of the journal is reflected in the fact that it has more than one citation per published article, which is a great success for the journal because it was established not long so ago in 2012, and indexed in this database since 2015.

Table 3. Bibliometric analyses of Montenegrin journals in "Web of Science" database on 6 September 2018

Journal	Number of Citations	h-index	Average citations per item
MJSSM	86	4	1.15
SMJ	57	Not calculated	Not calculated
JASPE	0	Not calculated	Not calculated

The fourth table (Table 4) shows the results obtained by analyzing the "Google Scholar" database. However, this time the journals have not been analyzed, but Montenegrin researchers were. The interesting thing is that there are over 10 researchers with over 100 citations, and their frequency in the top 100 most highly cited researchers at the university is even more interesting. Specifically, five researchers in the field of sports science are among the top 30 most highly cited researchers in the entire University of Montenegro. If we were to judge by the number of citations in this database, it would be safe to say that sports science is one of the leading scientific fields at the university. It is interesting to add that in the category of social sciences, researchers in the field of sports science have a leading role at the aforementioned institution.

Table 4. Bibliometric analyses of top ten Montenegrin researchers in "Google Scholar" database on 6 September 2018

Researcher	Number of Citations	h-index	i10-index
Dusko Bjelica	2759	31	85
Stevo Popovic	2710	33	77
Jovan Gardasevic	1174	20	46
Rajko Milasinovic	551	15	17
Bojan Masanovic	387	13	15
Ivan Vasiljevic	294	9	9
Rasid Hadzic	277	11	12
Jovica Petkovic	207	7	6
Kemal Idrizovic	206	9	7
Miroslav Kezunovic	168	4	3

The fifth table (Table 5) shows the results obtained by analyzing the "Scopus" database. In relation to the previous analysis, it is evident that the number of citations is significantly lower. The answer to this difference lies in the fact that the "Scopus" database has a much narrower scope of documents, which leads to the conclusion that it should show higher quality. Namely, the "Google Scholar" database does not have a clearly defined proposition, but buys all available documents on the Internet and records them in its database, while the "Scopus" database has a clear protocol that every journal must follow from the moment it expresses the desire to index in this prestige database. Therefore, the bibliometric data obtained in the analysis in the "Scopus" index database shows more relevant data. Looking at the above mentioned table, it can be noticed that the rank of researchers in the list of top 10 most-cited researchers has changed significantly comparing to "Google Scholar" database, but there are certain changes, which indicate that certain researchers put much more emphasis on quality compared to quantity.

Table 5. Bibliometric analyses of top ten Montenegrin researchers in "Scopus" database on 6 September 2018

Researcher	Number of Citations	h-index	Documents by author
Stevo Popovic	281	8	34
Dusko Bjelica	246	7	36
Kemal Idrizovic	79	6	22
Jovan Gardasevic	43	3	20
Miroslav Kezunovic	33	2	8
Jovica Petkovic	26	1	5
Dragan Krivokapic	22	2	7
Rajko Milasinovic	11	1	3
Ivan Vasiljevic	11	2	10
Rasid Hadzic	10	1	5

The sixth table (Table 6) shows the results obtained by analyzing the "Web of Science" database. Compared to the previous two analyzed databases, it is evident that this database goes further when we talk about quality, since the number of citations has dropped drastically compared to the "Scopus" database. All in all, the fact is that "Web of Science" is the most recognizable brand among scientific databases, and a great number of academic promotion of researchers depends on publishing their scientific papers in journals indexed in this prestigious database. Analyzing the obtained results, it is clear that Montenegrin researchers have a significant number of published articles in journals indexed in "Web of Science", and several researchers have a significant number of citations.

Table 6. Bibliometric analyses of top ten Montenegrin researchers in "Web of Science" database on 6 September 2018

Researcher	Number of Citations	h-index	Documents by author
Stevo Popovic	205	6	29
Dusko Bjelica	182	5	27
Kemal Idrizovic	53	5	12
Miroslav Kezunovic	21	1	5
Jovica Petkovic	20	1	2
Rajko Milasinovic	7	1	2
Rasid Hadzic	6	1	5
Ljubojevic Milovan	5	1	1
Jovan Gardasevic	4	1	7
Dragan Krivokapic	4	1	1

Discussion

It is interesting to point out that Montenegrin researchers and publications issued by the Montenegrin institutions made a significant impact in the period it is talked about. First of all, it should be noted that Montenegrin researchers published a significant number of articles in prestigious international journals that are indexed in databases such as: "Web of Science" (SCI, SSCI, SCIE & ESCI) and "Scopus". However, by analyzing published articles, it is important to point out that before 2013 there were no published articles in the "Web of Science", while in the "Scopus" database the first article published by one of the Montenegrin researchers was in 2008. This data clearly indicates that sudden development on an individual basis has been made in the last decade. In addition to a significant number of articles published in prestigious journals, it is interesting to point out the article published by the authors Dusko Bjelica and Stevo Popovic (NCD Risk Factor Collaboration, 2017) in the prestigious journal "Lancet" indexed in the Q1 category (WOS), and the impact factor for 2017 was 53,254, which is not a frequent phenomenon among entire Montenegrin researcher society. The same has been significantly enhanced the number of citation of the two authors mentioned above. In addition to the above article, another article highlighting an impact factor of more than 10 is published by Stevo Popovic (Quanjer et al., 2014), published in the "European Respiratory Journal", with an impact factor assigned for 2017 was 12,242 and was also in the Q1 category (WOS). Articles published in the most prestigious journals have contributed significantly to the increase in the citation of those authors. Concerning the number of citations of Montenegrin authors in the field of sports sciences, it is interesting that five researchers in the field of sports science are in the top 30 most highly-cited scientists throughout the University of Montenegro. Also, on the overall list of "Google Scholar" database within the keyword "Sport Science", Montenegrin authors are highly ranked, Dusko Bjelica is at 29th, Stevo Popovic at 30th, while Jovan Gardasevic is at 57th place. All in all, the Montenegrin authors slowly occupy a recognizable place in the field of sports sciences in the entire world, and this has helped them greatly in investing in an annual scientific conference, but also in the publication of scientific journals.

When it comes to scientific journals, we should start from the most cited journal in the "Google Scholar" database, which was launched 15 years ago and reformed in 2016. Since then significant growth has been recorded. Specifically, from the fourteenth volume, the journal was standardized in accordance with recognizable international protocols, and from the fifteenth volume it was exclusively in English. Such editorial decisions were not popular; however, if we analyze the progress of the journal in the past three years, it is evident that the progress is huge, primarily because of inclusion in the "Scopus" database, but also because of the significant number of citations, both in the "Google Scholar" database and in the "Web of Science" "(while "Scopus" has not yet done an analysis, and it is expected very soon). The best example of this abrupt progress is the third edition of the fifteenth volume (Cosic Mulahasanovic, Nozinovic Mujanovic, Mujanovic, & Atikovic, 2017; Mohammed, & Choi, 2017; Nová, 2017; Oreb, Prlenda, & Oreb, 2017; Popovic, Gardasevic, Masanovic, Arifi, & Bjelica, 2017; Radas, Sesar, & Furjan-Mandic, 2017; Sermaxhaj, Arifi, & Bahtiri, 2017; Siljak, & Djurovic, 2017; Stankovic, Peric, Ruiz-Llamas, & Quiroga-Escudero, 2017; Zemková , Jeleň, Zapletalová, & Hamar, 2017), where the citation of this journal is at the level of high-quality journals that have been indexed for years in the world's leading databases. Therefore, it is rightly expected that "Sport Mont" journal will soon be accepted in the leading database of "Web of Science" and will continue to make progress in coming years. On the other hand, although a significantly younger journal, the "Montenegrin Journal of Sports Science and Medicine" made a sharper penetration towards an elite society in a much shorter period. Namely, the journal has been indexed since 2015 in the "Web of Science" database, while in the "Scopus" database since 2016. Even though it is indexed into the "Web of Science" database, this journal still does not have a certain impact factor, since it is in the "Emerging Source Citation Index", and the next step that this journal is expected to achieve is that the " Web of Science "database assigns an impact factor and to be included in one of

the remaining three bases (SCI, SSCI or SCIE). To reach that goal, the number of articles in each edition has increased, so in the first (Marques, Peralta, Sarmento, Martins, & Carreiro da Costa, 2016; Sarabon, Hirsch, & Majcen, 2016; Sæther, 2016; Silva, Marcelino, Lacerda, & Vicente João, 2016; Sindik, Mikic, Dodigovic, & Corak, 2016) or the second issue of the fifth volume (Arazi, Asadi, & Chegini, 2016; Novak, Milanovic, Radisavljevic Janic, Stefan, & Kristicevic, 2016 , Oliveira, Valladares, Vaz, & João, 2016; Roga, Erceg, & Grgantov, 2016; Stojanovic et al., 2016) five articles replaced with ten in the first (Bülent Okan, 2017; Cigrovski, Franjo, Rupcic, & Bakovic, 2017; Hurst et al., 2017; Jelicic, Uljevic, & Zenic, 2017; Morteza Tayebi, Mahmoudi, Shirazi, & Sangi, 2017; Gardasevic, Rasidagic, Krivokapic, Corluka, & Bjelica, 2017; Popovic, 2017; Serbes, Cengiz, Sivri, & Filiz, 2017; Sindik et al., 2017), and the second issue of the sixth volume (Josephson, & Williams, 2017; Kozinc, & Sharabon, 2017; Loureiro et al., 2017; Luptáková, & Antala, 2017; Mandic, Wilson, Clark-Grill, & O'Neill, 2017; Nepocatych, Balillions, & O'Neal, 2017; Sæther, 2017; Siljeg, Sindik, & Leko, 2017; Valleser, & Narvasa, 2017; Yildizer, Ozboke, Tascioglu, & Yilmaz, 2017), and continued with the practice of publishing twenty articles annually. It is also interesting to point out that acceptance rate is also frequently decreasing and for the period 2016-2017 amounts 12% for original research submitted. This fact is in favor of the argument that the quality of the accepted works is raised year after year, and therefore the citation of the journal is increasing, which is one of the main factors that influence the assignment of the impact factor. Finally, when the "Journal of Anthropology of Sport and Physical Education" is concerned, it is still premature to make certain projections for entering the most prestigious databases; however, the fact that the journal in the first year of its existence managed to be indexed in databases such as "DOAJ" and "Index Copernicus", as well as a number of other databases, says that the future lies ahead of this journal, especially because interest in publishing in this journal has been shown by a significant number of authors worldwide (Arazi, Olia, Nafissi, Moghadam, & Falahati, 2018; Gardasevic, Bjelica, Vasiljevic, Sermaxhaj, & Arifi, 2018; Herdy, Costa, Simão, & Selfe, 2018 ; Monson, Brasil, & Hlusko, 2018; Vukasevic, Vukotic, & Masanovic, 2018).

Regarding the limitations in this study, it is important to emphasize that it was not possible to analyze all the desired entities in the certain databases, because it was only available in the "Google Scholar" database. With regards to further inclusion of "Sport Mont" journal in the "Scopus" database, the possibility will open for further analyzing the data that were the subject of this study. Therefore, the recommendations for further study are to analyze bibliographic data of individual Montenegrin researchers, as well as Montenegrin publications, with the goal of providing more detailed scientific information to the scientific public and raising awareness of the need for further progress in this area. In conclusion, it is indicated that the highest impact was recognized in the last year, regarding to citations of available researches published by Montenegrin authors, as well as writing style of articles published in English. Hence, the further deployment is expected in upcoming period and need to be constantly followed.

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Conflict of Interest
The author declare that there are no conflicts of interest.

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SportMont

ORIGINAL SCIENTIFIC PAPER

Relative Age Effect Among Elite Youth Female Soccer Players across the United States

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Abstract

The consequence of relative age effect (RAE) has been an overrepresentation of athletes born early in the cohort and an underrepresentation of athletes born late in the cohort. There are significantly fewer studies that examine this phenomenon among female soccer players. Therefore, the purpose was to determine the existence of RAEs among elite youth female soccer players competing in the Elite Clubs National League (ECNL) during the 2012-2013 season. Player birthdates (U14-U18 N=7,294) were collected from the ECNL and compared to the birthdates distribution for the general population. Data revealed a RAE across all age groups (U14-U18) indicating a preference for the selection of the oldest in the cohort. An overrepresentation of players was observed in Q1 and an underrepresentation of players in Q4 among the U14-U17 age groups. Among the u18 age group, an overrepresentation of players was detected in Q2 and an underrepresentation of players in Q4. The birthdate distribution for the first and second halves of the playing season showed strong RAEs among the U14-U17 age groups. No statistically significant difference was found between the first and second halves of the playing season among players in the U18 age group.

Key words: *relative age effect (RAE), youth soccer, females*

Introduction

The relative age effect (RAE) in sport refers to a bias in distribution of athletes selected to elite level teams. More specifically, there is an overrepresentation of athletes born at the beginning of the competition year and an underrepresentation of athletes born at end of the competition year. The RAE phenomenon has been examined in sport since the early 1980s when Grondin, Deshaies, and Nault found significant RAEs among all levels (recreational, competitive and senior) of ice hockey players and elite levels in volleyball players (Grondin, Deshaies, & Nault, 1984).The majority of studies on RAEs have been conducted on male athletes and soccer has been characterized as a sport associated with significant RAEs (Cobley, Baker, Wattie, & McKenna, 2009; Musch & Grondin, 2001; Smith, Weir, Till, Romann, & Cobley, 2018).

The existence of RAEs among female athletes has yet to be confirmed. The recent systematic review and meta-analysis by Smith and colleagues on the RAEs among female athletes indicated a small RAE across varying sport contexts (Smith et al., 2018). Yet, despite the growth in women's soccer around the world (FIFA Activity Report, 2017) and the wealth of research published on RAEs in soccer there are significantly fewer studies that examine this phenomenon among female soccer players (Cobley et al., 2009; Smith et al., 2018). The results of this study are unique among the research on RAEs in female athletes.

The discrepancy in the findings on RAEs among females is highlighted by the results of Delorme, Boiche´ and Raspaud (2010) and Goldschmied (2011). Delorme et al. discovered RAEs among female youth and senior soccer players competing in France. In contrast, Goldschmied found no RAEs among professional players competing in the Women's United Soccer Association (WUSA) 2002-03 season (WUSA became defunct in 2003).

Therefore, the purpose of this study was to determine if the birthdate distribution among elite female youth soccer players competing in the Elite Clubs National League (ECNL) is significantly different from the general population. An overrep-

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resentation of players born early in the cohort and an underrepresentation of younger players would indicate the presence of RAEs among this group of elite athletes. It was hypothesized that a statistically significant RAE would be present among this group of elite level youth soccer players, indicating a bias against the selection of soccer players born late in the cohort.

Methods

Participants

Amateur elite youth female soccer players competing in the U14, U15, U16, U17, and U18 (N=7,294) age groups in the ECNL during the 2012-2013 season were used in this study. The ECNL was considered the highest level of club soccer for females in the U.S. and was made up of 73 clubs across the country in the 2012-2013 season. The season for ECNL teams started in September 2012 and culminated in the championship finals on July 10-15, 2013. The players competing in the ECNL range in age from 13 to 18 years of age and have all been selected and placed on a team after a series of trials.

Procedures

The birthdate for each player was collected from the individual team web pages from the ECNL web site (www.eliteclubsnationalleague.com). The birthdate of each player is public information and no private details were recorded. The birthdates of each player were compared to the birthdates of females in the general U.S. population born during the same years as the players. The birthdate range for the 2012/2013 ECNL players is 1992-1999. It should be noted that a player born between 8/1/1992 and 7/31/1993 can participate in the u18 age group as long as she is still in high school. The census birthdates were collected from the Center for Disease and Control and Prevention (CDC) vital statistics reports, which can be found on the CDC website (www.cdc.gov/nchs/vitalstats.htm). The vital statistics reports are made available to the public and contain no private information. The birthdates for the players and females in the general population were organized into quartiles based upon the 2012-2013 ECNL competition year of August 1st–July 31st. All birthdates were coded as follows: Q1=August-October, Q2=November-January, Q3=February-April and Q4=May-July.

Statistical Analyses

All data analyses were conducted using IBM SPSS predictive analytics software (Version 20; IBM Inc., USA). Each age group was analyzed for asymmetry in birthdate distributions. A series of chi-square ($\chi 2$) goodness-of-fit tests were used to determine differences between the observed birth months across the playing season (August-July) and expected birth month distributions for the births of females born in the U.S. from 1992-1999 (the same years as the players). The dependent variable for each analysis was the frequency of soccer players born in each quartile per age group. The level of significance was set at $p<.05$. Statistically significant chi-square ($\chi 2$) values were used to calculate an effect size w statistic to determine the strength of the RAE. According to Cohen (1992), the following w values indicate the effect sizes: small=0.1, medium=0.3, large=0.5. Post-hoc analyses were conducted for w values ≥0.1. Lastly, for statistically significant chi-square ($\chi 2$) values, standardized residuals were used to determine which observed birthdate quartiles differed from the expected distribution (Turnnidge, Hancock, & Côté, 2012). A value of ≥1.96 indicates an overrepresentation of births in the quartile and a value ≤-1.96 indicates an underrepresentation of births in the quartile (Sheskin, 2003).

Results

The birthdate distributions for the U14-U18 girls competing in the ECNL and the birthdate distributions for the general population are presented in Table 1, along with the results of the chi-square test, effect sizes, and standardized residuals. The chi-square analysis indicated a statistical difference between the observed and expected quartile distributions for all of the age groups, indicating significant RAEs: (U14) $\chi 2$ (3, n=1,443)=133.30, p<.001; (U15) $\chi 2$ (3, n=1,423)=103.47, p<.001; (U16) $\chi 2$ (3, n=1,458)=82.01, p<.001; (U17) $\chi 2$ (3, n=1,456)=70.00, p<.001; (U18) $\chi 2$ (3, n=1,514)=17.09, p<.001. When compared to the general population birth distribution, the chi-square test and the post hoc analyses revealed an overrepresentation of players born at the beginning of the cohort and an underrepresentation of players born at the end of the selection year for all age groups. The standardized residuals showed an overrepresentation of players born in Q1 and an underrepresentation of players born in Q4 for the U14, U15, U16, and U17 age groups. In the u18 age group, the residuals indicated an overrepresentation of players born in Q2 and an underrepresentation of players born in Q4. The effect sizes ranged from small (.10) to moderate (.30) with the largest effect sizes associated with the u14 age group (.30). According to the analysis, the magnitude of the effect size decreased as age increased.

Table 1. Birth Quartiles for the u14-u18 ECNL Girls' Age Groups

		Percent in quartiles							Standardized residuals			
Age group		Q1	Q2	Q3	Q4	X^2	p	w	Q1	Q2	Q3	Q4
U14 (n=1,443)	OBS%	36	28	20	15	133.30*	<.001	0.30	7.62	2.90	-3.06	-7.58
	EXP%	26	25	24	25							
U 15 (n=1,423)	OBS%	34	29	22	16	103.47*	<.001	0.27	5.78	3.40	-1.74	-7.45
	EXP%	26	25	24	26							
U 16 (n=1,458)	OBS%	34	26	23	17	82.01*	<.001	0.23	6.30	0.92	-0.88	-6.40
	EXP%	26	24	24	26							
U 17 (n=1,456)	OBS%	34	26	23	18	70.00*	<.001	0.22	5.60	1.17	-0.76	-6.07
	EXP%	26	24	24	26							
U 18 (n=1,514)	OBS%	25	28	25	22	17.09*	<.001	0.10	-0.67	2.63	1.08	-2.93
	EXP%	26	24	24	26							

Legend: OBS=observed; EXP=expected (general population); *p<.05; df=3 for each chi-square test

In Table 2, the birthdate distribution for each half of the season (August-January and February-July) is presented, together with results of the chi-square tests, effect sizes, and standardized residuals. A comparison of the birthdate distribution for the first and second halves of the playing season with the general population birthdate distribution, indicated a statistical difference for the following age groups: (U14) $\chi 2$ (1, n=1,443)=113.40, p<.001, (U15) $\chi 2$ (1, n=1,423)=85.48, p<.001; (U16) $\chi 2$ (1, n=1,458)=53.62, p<.001; and (U17) $\chi 2$ (1, n=1,456)=47.26, p<.001. The analysis revealed the majority of the players selected for the u14-u17 age groups were born between August and January. No statistical significant difference was observed in the (U18) $\chi 2$ (1, n=1,514)=3.63, p=.056 age group. The standardized residuals for the U14, U15, U16, and U17 age groups showed an overrepresentation of players born in the first half of the cohort and an underrepresentation of players born in the second half of the cohort. The effect sizes for the half-season distributions for the u14-u17 age groups were small to moderate and a decrease in the magnitude of the effect size was observed as age increased.

Table 2. Half-Season Births for the ECNL u14-u18 Girls' Age Groups

		Percent in halves		Standardized residuals				
Age group		**1st**	**2nd**	**X^2**	**p**	**w**	**1st**	**2nd**
U14 (n=1,443)	OBS%	65	35	113.40*	<.001	0.28	7.48	-7.57
	EXP%	51	49					
U15 (n=1,423)	OBS%	63	37	85.48*	<.001	0.24	6.50	-6.56
	EXP%	50	50					
U16 (n=1,458)	OBS%	60	40	53.62*	<.001	0.19	5.15	-5.20
	EXP%	50	50					
U17 (n=1,456)	OBS%	59	41	47.26*	<.001	0.18	4.83	-4.88
	EXP%	50	50					
U18 (n=1,514)	OBS%	53	47	3.63	.056	0.04	1.34	-1.35
	EXP%	50	50					

Legend: OBS=observed; EXP=expected (general population); *p<.05; df=1 for each chi-square test

Discussion

Previous research investigating the presence of RAE among female athletes has been inconclusive. Therefore, the objective of this study was to determine if a RAE existed among girls competing in the ECNL during the 2012-2013 season. It was hypothesized that girls born earlier in the cohort would be overrepresented across the league and girls born later in the cohort would be underrepresented. The hypothesis was supported among all age groups (U14-U18) in the ECNL. Girls born closer to the beginning of the selection year were more likely to be selected to teams in the ECNL. In contrast, girls born toward the end of the selection year were less likely to be offered a spot on a team in the ECNL during the 2012-2013 season. Among the U14-U17 age groups, a traditional RAE existed with an overrepresentation of players born in Q1 and an underrepresentation of players born in Q4. In the U18 age group, players born in Q2 were overrepresented while the youngest in the cohort, players born in Q4, were underrepresented. The effect sizes indicated the strength of the RAEs were most prominent during the early stages of player development and decreased as players aged.

The results of this study indicate RAEs exists among elite level youth female soccer players in the U.S. To our knowledge, this is one of few studies on RAEs that demonstrate such a strong pattern among elite youth female soccer players. Sedano and colleagues found RAEs among Spanish female soccer players competing at the Regional and National team levels (Sedano, Vaeyens, & Redondo, 2015). Yet other studies found little to no RAE among female soccer players (Nakata & Sakamoto, 2012; Romann & Fuchslocher, 2013; Vincent & Glamser, 2006; Van den Honert, 2012).

The reason for the systematic RAEs observed in this study is unclear. Traditional explanations for RAEs in sport have linked birthdate with maturation. Relative age effects among males indicate that those born earlier in the cohort are assumed to mature earlier than the youngest in the cohort. Maturation among males is associated with an increase in testosterone and muscle mass, resulting in an increase in power, strength, and speed; all beneficial for athletic performance (Rowland, 2005). Among females, however, maturation is associated with a decrement in athletic performance due to an increase in fat mass and a peak in aerobic capacity. The oldest females in a cohort have been shown to be disadvantaged in sport and reverse RAEs have been documented (Goldschmied, 2011; Till et al., 2010). The only anthropometric benefit gained with early maturation among females is height. The average peak height velocity for girls is 12 years of age and girls that go through an early growth spurt may have an advantage in sport (Smith et al., 2018). Although speculative, when two soccer players look similar in skill level, it is possible the coach may perceive the taller of the two players as more talented.

Competition for spots on teams may be the leading cause for the RAEs detected among all of the age groups in the ECNL. Competition is a necessary component for RAEs to occur in sport and the strongest RAEs have been detected among the most popular sports worldwide (Cobley et al., 2009; Schorer, Cobley, Büsch, Bräutigam & Baker, 2009; Smith et al., 2018). The greater the number of potential players vying for selection to teams, the more likely there will be RAEs. According to the United States Youth Soccer Association (USYSA), which registers approximately 85% of all youth soccer players (aged 5-19 years of age) in the U.S., there were 3,000,000 youth soccer players competing across the country in the 2012-2013 season (USYSA, 2013). Almost half of these players are female, underlining the popularity of soccer in the U.S among females.

Furthermore, the 2014 FIFA Women's Football Study indicated there were 4.8 million registered female soccer players worldwide and approximately half came from the USA and Canada (FIFA Women's Football Survey, 2014). Grondin et al. (1984) showed strong RAEs among youth ice hockey players

from the largest cities in Canada where competition was the highest. In contrast, weak RAEs were detected among volleyball players in Canada, where the selection pool was much smaller. Lidor, Côté, Arnon, Zeev and Cohen-Maoz (2010) found no RAEs among female basketball, handball, soccer, and volleyball players in Israel. The authors hypothesized the lack of competition, due to the small population size, would nullify any RAEs. Yet, in Brazil, where volleyball is considered a highly competitive sport, strong RAEs were found among elite female volleyball players competing at the highest level of play (Okazaki, Keller, Fontana, & Gallagher, 2011).

During the 2012-2013 season, the ECNL was considered the highest level of elite youth soccer among females in the U.S. Selection to an ECNL team can provide increased competition, where players get the opportunity to compete on a national level. In addition, the ECNL is a primary setting for player identification and recruitment among college soccer coaches since the foundation of the league in 2009. As a result, young female soccer players with aspirations to compete at the collegiate level may feel the ECNL is the most effective way to gain exposure to college soccer coaches nationwide. The consequence is an increase in competition among the players for selection to the teams and the outcome is an overrepresentation of players from Q1 and an underrepresentation of players from Q4. To further highlight the competitiveness of this league, the majority of girls listed among the player pools for the 2013 U.S. National U15, U17, U18, and U20 teams (U15 [64%], U17 [72%], U18 [71%], and U20 [82%]) were selected from ECNL clubs (US Soccer, 2013).

The birthdate distribution for the first and second halves of the playing season also indicated strong RAEs among the U14-U17 age groups. However, no statistically significant difference was found among the u18 age group. Players born between August and January were overrepresented among the U14-U17 teams, while players born between February and July were underrepresented, indicating a preference for the selection of older players. The proportion of players born in the first half of the season was highest among the U14s (65%) and decreased as age increased. The data also showed that the magnitude of the RAE decreased over time. The strength of the relationship was the largest among the U14s and the smallest among the U18s. Smith et al. (2018) observed a similar pattern among athletes in their systematic review and meta-analysis on RAEs within various female sports. It appears that the greatest level of bias against players born later in the cohort occurs during the early years of competition. However, this trend seems to dissipate as players get older.

The bias towards the selection of players born during the first half of the cohort among U14-U17 teams might be due to the coaches' perception that older players (physically mature) are more talented than their younger counterparts (Helsen, Starkes, & Van Winckel, 1998). As a result, players selected to elite-level soccer teams receive the benefits of increased competition, feedback, and higher levels of coaching (Cobley et al., 2009; Smith et al., 2018; Wattie, Cobley, & Baker, 2008). Subsequently, players selected to elite teams at a younger age may have an advantage in future selections, as these players gain greater exposure to more high-level coaches, perpetuating the RAE during the formative years. In addition, self-motivation is highest among athletes who perceive themselves as competent in their sport. Highly motivated athletes typically invest a greater amount of time and effort into developing their skills compared to athletes who do not perceive themselves as competent to compete at a high level in sport (Vincent & Glamser, 2006).

The evidence from this study indicates a clear bias toward the selection of older girls among teams participating in the ECNL. Girls born late in the cohort are less likely to be given an opportunity to participate in this elite level league. The consequence is a loss of potential talent and emphasizes the need for additional research to examine the mechanisms contributing to RAEs among females in sport. Helsen and colleagues have suggested coaching education as one approach to combat against the negative impact of RAEs in elite youth soccer (Helsen, Van Winckel, & Williams, 2005). Cobley et al. (2009) suggested player identification and selection place greater reliance on skill and movement rather than anthropometric components. It has also been suggested that athletes should be grouped according to their physical rather than chronological age; known as bio-banding (Cumming, Lloyd, Oliver, Eisenmann, & Malina, 2017).

As evidenced in professional soccer in Europe, despite 10 years of research on RAEs, there seems to be no change in the prevalence on this phenomenon among elite athletes (Helsen et al., 2012). Although attempts have been made to reduce RAEs among soccer players, the success of certain strategies have not proven successful. The Troendelag Regional Football Association (Norway) instituted a selection process where a minimum of 40% of the players must be born in the last six months of the playing year. Despite a clear attempt to reduce the magnitude of RAEs in the selection process, RAEs were prevalent among boys and girls at the higher levels of competition (Lagestad, Steen, & Dalen, 2018). Consequently, further research should focus on the underlying causes of RAEs among athletes, so effective strategies can be implemented among practitioners to reduce and remove the disadvantages to those born late in the sport calendar.

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Conflict of Interest
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SportMont

ORIGINAL SCIENTIFIC PAPER

A Study on the Relationship between Servant Leadership, Organizational Culture, and Job Satisfaction in Fitness Clubs

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Abstract

In the field of organizational behavior theory, the influence of servant leadership and organizational culture on the job satisfaction of organization members has been actively studied to effectively achieve the goals set by the organization. However, there is a severe lack of studies on the relationship between servant leadership, organizational culture, and job satisfaction in the sport industry. Therefore, this study empirically analyzed the causal relationships among the three variables by surveying 320 employees in fitness clubs located in Pusan, Korea. Surveys were conducted using the convenience sampling method, and a total of 300 surveys were used in the analysis. Data analysis methods included descriptive statistics analysis, exploratory factor analysis, reliability analysis, correlation analysis, and multiple regression analysis using SPSS 19.0. Key results from this study were as follows. First, servant leadership in fitness clubs had a positive influence on organizational culture. Second, servant leadership in fitness clubs had a positive influence on the job satisfaction of their employees. Third, the organizational culture of fitness clubs had a positive influence on the job satisfaction of employees. The results of this study can contribute to establishing strategies to advance the organizational performance and effective human resource management of fitness clubs.

Key words: *job satisfaction, organizational culture, organizational performance, servant leadership*

Introduction

Amidst uncertain global economic conditions, it is important for sport organizations to effectively utilize resources to satisfy their customers and achieve organizational objectives. As such, sport organizations are focusing on strengthening the core competitiveness of their organizations and improving their core business competencies to a global level. A key factor that must be considered in order to increase the competitiveness of an organization is human resource management; in this regard, the job satisfaction of organizational members is directly related to the productivity of the organization, and improving job satisfaction is considered a very important factor for the success of sport organizations (Ramezani, Teimori, & Nedaee, 2013).

Job satisfaction is defined as an emotional evaluation towards a job by an individual (Locke, 1976). Employees with high job satisfaction have lower turnover and absence rates than those with lower job satisfaction and are more likely to align with the organization, with a stronger tendency to continue working for their current organization (Lease, 1998). As such, job satisfaction is used as a key indicator in evaluating whether an organization has achieved its goals, and acts as a factor that causes members of the organization to strive for individual and organizational objectives (Jung, E. Lee, & S. Lee, 2004). Therefore, research on factors that can influence job satisfaction is necessary to improve organizational performance and human resource management in sport organizations.

Leadership refers to a process of influencing the members

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within an organization for the purposes of achieving organizational objectives, and can influence the attitudes and behaviors of its members and their interactions (Robbins & Judge, 2009). As such, a study on leadership in sport organizations found leadership to be an important variable that influences job satisfaction. In studies on leadership in the sport sector and job satisfaction, many researchers have focused on transactional leadership and transformational leadership, studying the relationship between the two variables (Ismaeelzadeh & Tavakkol, 2016). However, in the case of transformational/transactional leadership, they assume that leaders play a dominant role which is then followed by the members; as such, these forms of leadership are being criticized for their limitations in proactively responding to rapid changes in the management environment and nurturing intelligent and creative human resources, which are required for the sustainable growth of organizations (Chu & Lee, 2017). As such, there is a newfound highlight on studies that focus on servant leadership, which focuses on the delegation of authority and horizontal relationships instead of vertical relationships, between leaders and members, and its relationship with job satisfaction (Ji, 2012) in the sports industry.

A servant leader prioritizes serving the members of the organization instead of personal gain, and focuses on meeting the needs of its members (Spears, 1995). Rather than using their authority to achieve organizational objectives, servant leaders focus on the roles of presenting future directions, perceiving employees' difficulties, and healing their wounds (Barbuto & Wheeler, 2006). As such, servant leadership focuses on the dual focus of achieving organizational objectives as well as the growth and development of its employees, based on the emotional solidarity between the leader and the members of the organization (Mayer, Barders, & Piccolo, 2008), and it can play an important role in improving the overall satisfaction towards the work performed by the members of the organization.

When examining studies on the relationship between servant leadership and job satisfaction, a study on hospital employees (McCann, Graves, & Cox, 2014) revealed that the factors of servant leadership, including altruistic healing, emotional healing, wisdom, persuasion, and stewardship had positive correlations with factors of job satisfaction, including external satisfaction, internal satisfaction, and general satisfaction. A study on employees in the service industries (Kang & Kim, 2015) also found that servant leadership had a positive influence on job satisfaction; servant leadership factors that contributed to higher job satisfaction included wisdom, persuasion, and stewardship. There have been reports of significant positive relationships between the two variables in sport settings. The servant leadership factors of a marine sport center leader, including sense of community, vision, presentation, and forming bonds of sympathy, had positive influences on the job satisfaction of employees (Ji, 2012).

Along with leadership, another important factor that can influence job satisfaction is organizational culture. Organizational culture refers to the sets of values, beliefs, and ideologies shared among the members of an organization, and it is an important factor that influences the behaviors of individual members, as well as the overall behavior of the organization (Schermerhorn, Hunt, & Osborn, 1991). Therefore, the organizational culture of an organization can influence the job satisfaction of the members of the organization. For example, an organization with strong task orientation emphasizes task completion, achieving objectives, and competitive advantage, leading to low job satisfaction in employees (Cameron & Quinn, 1999); in an organization with strong relationship orientation, which is characterized by mutual teamwork and cooperation between employees, job satisfaction may be high (Wilkins & Ouchi, 1983).

The relationship between organizational culture and job satisfaction in previous studies has indicated that a diverse range of organizational cultures have had significant positive or negative influence on the job satisfaction of employees. In a study of employees of national oil companies (Zahari & Shurbagi, 2012), there was a high positive correlation between organizational culture factors, such as clan culture, adhocracy culture, market culture, hierarchy culture, and job satisfaction (r=.89). In a study with employees in small and medium enterprises who had participated in specialized training for SMEs (M. Kim, N. Kim, & No, 2017), market culture, hierarchy culture, clan culture, and adhocracy culture were the organizational culture factors that had positive influences on job satisfaction. However, in a study of elite sport leaders (Lee, 2011), adhocracy, clan, and market cultures all had negative influences on job satisfaction.

On the other hand, the role of a leader is very important in the formation and change of organizational cultures. In general, the beliefs, values, and behaviors of the chief executives of companies can significantly influence the formation of organizational cultures (Schein, 1983). Moreover, the helpful behaviors of leaders for their employees, including presenting visions for the members of the organization to make correct choices and helping them achieve organizational objectives in an effective manner, can contribute to the creation of a desirable organizational culture. It is also the role of a leader to seek stability in the organization amidst changing environments, and to create an organizational culture that can effectively respond to such changes (Sharaaz, 2014). Therefore, the leadership type of managers within organizations can influence the formation and change of organizational cultures.

Servant leaderships typically have a positive influence on organizational culture, as they maintain the value of community based on the values of trust, honesty, and consideration, as well as provide their members with appropriate opportunities for growth (Setyaningrum, 2017). In a study by Park (2011), who studied leaders in Taekwondo gyms, servant leadership had a positive influence on organizational culture. Specifically, trust, as a factor of servant leadership, contributed to the formation of aclan culture and ahierarchy culture; presenting vision contributed to creating a clan culture and a market culture; and modesty contributed to creating a hierarchy culture and an adhocracy culture. In a study on Chinese employees working in Korean conglomerates by Han, Kim and Kim (2016), the emotional healing factor of servant leadership had a positive influence on market culture, adhocracy culture, and clan culture; altruistic calling positively influenced adhocracy culture; and persuasion positively influenced advocacy culture. However, servant leadership did not have a significant influence on hierarchy-focused culture, with traits such as orders, rules, and regulations (Han et al., 2016).

As seen above, it is critical to understand the causal relationships among servant leadership, organizational culture, and job satisfaction to achieve organizational objectives and to establish effective human resource management strategies

in rapidly changing environments; however, there is a lack of studies that empirically analyze the relationship among these three factors in the sport industry. Moreover, the results of relevant existing studies have indicated differences in servant leadership factors and organizational culture factors that influence job satisfaction, as well as servant leadership factors that influence organizational culture, depending on the types of organizations (B. Kim & J.S. Kim, 2012). Therefore, empirical research is required on the characteristics of servant leadership and the types of organizational culture required for improving job satisfaction among members of sport organizations, as well as characteristics of servant leadership that influence the types of organizational culture in sport organizations. As such, this study has empirically analyzed the relationship between servant leadership, organizational culture, and job satisfaction in members of Korean fitness clubs.

Based on theoretical discussions on the relationship between servant leadership, organizational culture, and job satisfaction, the following hypotheses can be presented.

Hypothesis 1: The servant leadership of fitness clubs will influence organizational culture.

Hypothesis 2: The servant leadership of fitness clubs will influence job satisfaction of members of the organization.

Hypothesis 3: The organizational culture of fitness clubs will influence the job satisfaction of members of the organization.

Methods

Participants

This study selected a sample group of participants among employees of fitness clubs located in Pusan, Korea, and conducted a survey of 320 employees of fitness clubs using convenience sampling. A total of 300 valid surveys, excluding 20 with insincere responses, were used for analysis.

Measures

Aside from the general characteristics of participants, all survey items were composed of 5-point Likert scales. The surveys used were verified for content validity through an expert panel, and the formation validity and the reliability of the survey was verified using exploratory factor analysis and internal consistency analysis.

To measure the servant leadership of direct managers as perceived by their employees, the survey developed by Barbuto and Wheeler (2006) was translated to serve the goals of this study. The survey questionnaire on servant leadership was composed of five factors: altruistic calling, emotional healing, wisdom, persuasion, and stewardship, and each factor included four items. As shown in Table 1, the explanatory power of all servant leadership factors was found to be 81.97% of total variance; the reliability coefficients of the survey questionnaire were all over 0.7 (α=.896-.938), thus demonstrating reliability.

Table 1. Factor and Reliability Analysis of the Servant Leadership Survey

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Stewardship4	.907				
Stewardship2	.899				
Stewardship1	.881				
Stewardship3	.850				
Emotional2		.880			
Emotional3		.876			
Emotional4		.863			
Emotional1		.856			
Altruistic2			.889		
Altruistic3			.870		
Altruistic4			.857		
Altruistic1			.849		
Wisdom2				.884	
Wisdom3				.882	
Wisdom1				.842	
Wisdom4				.835	
Persuation3					.852
Persuation1					.836
Persuation2					.825
Persuation4					.818
Eigenvalue	3.389	3.381	3.326	3.223	3.075
% of Variance	16.943	16.906	16.632	16.116	15.374
Cumulative %	16.943	33.849	50.481	66.598	81.971
Cronbach's α	.935	.938	.933	.917	.896

Legend: Altruistic=Altruistic calling, Emotion=Emotional healing

To measure the organizational culture perceived by employees of fitness clubs, the measurement tools developed by Quinn and McGrath (1985) were used as a basis, along with survey items used by Jung, Nam and Kwon (2011), modified appropriately to serve the objectives of this study. The survey questionnaire on organizational culture was composed of the four factors of market culture, adhocracy culture, hierarchy culture, and clan culture, and each factor was composed of four items.

Table 2 shows that the explanatory power of all organizational culture factors was found to be 80.54% of total variance; the reliability coefficients of the survey questionnaire were all over 0.7 (α=.898-.929), thus demonstrating internal consistency.

Table 2. Factor and Reliability Analysis of the Organizational Culture Survey

Item	Factor 1	Factor 2	Factor 3	Factor 4
Adhocracy3	.880			
Adhocracy2	.866			
Adhocracy4	.855			
Adhocracy1	.779			
Hierarchy3		.939		
Hierarchy2		.932		
Hierarchy4		.853		
Hierarchy1		.848		
Clan3			.892	
Clan1			.870	
Clan2			.868	
Clan4			.832	
Market1				.893
Market3				.826
Market4				.789
Market2				.770
Eigenvalue	3.309	3.283	3.206	3.088
% of Variance	20.684	20.520	20.040	19.302
Cumulative %	20.684	41.204	61.243	80.545
Cronbach's α	.929	.924	.912	.898

To measure the job satisfaction of fitness club employees, measurement tools which were originally developed by Smith, Kendall and Hulin (1969), then translated and modified by Park (2009) to fit the purposes of this study, were used. It included one factor containing five items. The reliability coefficient was found to be α=.901 and thus reliable.

Data analysis

The SPSS 19.0 statistical program was used to analyze the 300 surveys collected for this study. To identify the demographic characteristics of the fitness club employees, frequency analysis was conducted. Multiple regression analysis was used to verify the study hypotheses. All statistical significance tests in this study were verified at the α=.05 level.

Results

Analysis of descriptive statistics and correlations

Table 3 shows the results of descriptive statistics and correlations between the three factors. The measurement variables showed significant positive correlations at p<.05 and p<.01 levels. However, there were no significant correlations between altruistic calling and hierarchy culture, and between stewardship and clan culture.

Table 3. Correlation between Servant Leadership, Organizational Culture, and Job Satisfaction (N=300)

Variable	M	SD	1	2	3	4	5	6	7	8	9	10
Altruistic	3.37	.95	1									
Emotional	3.20	.98	.383**	1								
Wisdom	3.43	.93	.304**	.355**	1							
Persuasion	3.36	.90	.386**	.397**	.348**	1						
Steward	3.35	.98	.364**	.344**	.288**	.188**	1					
Clan	3.54	.85	.131*	.306**	.152**	.191**	.097	1				
Adhocracy	3.50	.86	.451**	.430**	.324**	.352**	.318**	.415**	1			
Market	3.59	.75	.407**	.370**	.364**	.329**	.268**	.299**	.583**	1		
Hierarchy	3.47	.95	.093	.138*	.289**	.124*	.174**	.120*	.169**	.249**	1	
JobSatis	3.64	.73	.320**	.295**	.311**	.308**	.213**	.354**	.472**	.485**	.204**	1

Legend: p<.05*, p<.01**, Altruistic=Altruistic calling, Emotion=Emotional healing, Steward=Stewardship, JobSatis=Job Satisfaction

Hypothesis verification

The verification of the results of Hypothesis 1is shown in Table 4. Servant leadership explained 10.1% of the total variance in clan culture; only emotional healing was found to have a significant positive influence on clan culture. Servant leadership explains 31.4% of the total variance in adhocracy culture; the comparative influences of servant leadership factors were, in order, altruistic calling, emotional healing, and persuasion. Moreover, servant leadership explained 26.8% of the total variance in market culture; the comparative influences of servant

leadership factors were, in order, altruistic calling, wisdom, and emotional healing. Lastly, servant leadership explained 9.4% of the total variance in hierarchy culture; only wisdom had a significant positive influence on hierarchy culture. As such, Hypothesis 1, which proposed that servant leadership in fitness clubs influences organizational culture, was accepted.

Table 4. Influence of Servant Leadership on the Organizational Culture of Fitness Centers (N=300)

	Clan			Adhocracy			Market			Hierarchy		
Variable	B	SEB	β	B	SEB	β	B	SEB	β	B	SEB	β
Altruistic	-.006	.058	-.007	.234	.051	.258***	.181	.046	.230***	-.038	.065	-.038
Emotion	.236	.057	.272***	.192	.050	.217***	.119	.045	.156**	.016	.063	.017
Wisdom	.034	.057	.037	.094	.050	.101	.149	.045	.187**	.260	.063	.257***
Persuasion	.072	.060	.076	.108	.054	.112*	.085	.048	.103	.025	.067	.023
Steward	-.016	.054	-.019	.087	.047	.099	.044	.042	.058	.100	.060	.104
R^2		.101***			.314***			.268***			.094***	
F		6.954			26.871			21.581			6.096	

Legend: p<.05*, p<.01**, p<.001***, Altruistic=Altruistic calling, Emotion=Emotional healing, Steward=Stewardship

The verification of the results of Hypothesis 2 is shown in Table 5. Servant leadership explained 18.6% of total variance in job satisfaction. The comparative influences of servant leadership factors on job satisfaction were found to be in the order of wisdom, altruistic calling, and persuasion. As such, Hypothesis 2, which proposed that servant leadership in fitness clubs influences job satisfaction, was accepted.

Table 5. Influence of Servant Leadership of Fitness Clubs on Job Satisfaction (N=300)

Variable	Job satisfaction		
	B	SE B	β
Altruistic	.122	.047	.160*
Emotion	.078	.046	.105
Wisdom	.128	.046	.164**
Persuasion	.112	.049	.140*
Steward	.035	.044	.047
R^2		.186***	
F		13.376	

Legend: p<.05.*, p<.01.**, p<.001***, Altruistic=Altruistic calling, Emotion=Emotional healing, Steward=Stewardship

The verification of the results of Hypothesis 3 is shown in Table 6. Organizational culture was found to account for 31.9% of the total variance in job satisfaction; the comparative influences of the factors were found to be, in order, market, adhocracy, and clan. As such, Hypothesis 3, which proposed that organizational culture influences job satisfaction, was accepted.

Table 6. Influence of Organizational Culture of Fitness Clubs on Job Satisfaction (N=300)

Variable	Job satisfaction		
	B	SEB	β
Clan	.143	.045	.168**
Adhocracy	.187	.052	.223***
Market	.279	.059	.286***
Hierarchy	.058	.038	.075
R2		.319***	
F		34.387	

p<.05.*, p<.01.**, p<.001***

Discussion

This study was conducted to empirically identify the relationship between servant leadership, organizational culture, and job satisfaction in employees of fitness clubs. This section presents a discussion as follows, based on the study results.

First, servant leadership was found to have a significant positive influence on organizational culture. These results are in line with a study by Setyaningrum (2017) which has asserted that servant leadership is a leading variable that influences the maintenance and formation of organizational culture. Among the servant leadership factors shown by managers of fitness clubs, emotional healing had a positive influence on clan, adhocracy, and market cultures, with the exception of hierarchy culture. Therefore, to establish the bonds of sympathy through cooperation and communication between members, to strengthen adaptability to changing external environments,

and to maximize the productivity and efficiency of achieving organizational objectives (Quinn & McGrath, 1985), managers of fitness clubs should help employees who have had personal difficulties through emotional healing and, at the same time, create an environment where employees can freely state their difficulties (Barbuto & Wheeler, 2006).

Along with emotional healing, altruistic calling was found to be an important factor that influenced adhocracy culture and market culture in fitness clubs. Externally-oriented organizational cultures, such as adhocracy and market cultures, place importance on adapting to the external environment and competition (Quinn & McGrath, 1985), and may often overlook the relationships between members. Therefore, it is important for fitness club managers to place a priority on meeting employees' needs instead of personal gain through altruistic calling (Barbuto & Wheeler, 2006), forming emotional solidarity with the members of the organization, and aiming to achieve change and objectives within the organization.

Servant leadership in fitness clubs was found to have a statistically significant positive influence on job satisfaction. These results are in line with existing studies, which have asserted that servant leadership has a positive influence on job satisfaction (Kang & Kim, 2015; McCann et al., 2014). This indicates that managers should play the role of the servant leader to increase the positive attitudes of fitness club employees towards their jobs.

In particular, the sub-factors of servant leadership in fitness club managers, such as wisdom, altruistic calling, and persuasion, were found to influence job satisfaction. Therefore, the most important roles of fitness club managers as servant leaders are to present a direction to move forward for their employees and to focus on the attention of the employees and bilateral conversations, rather than engaging in authority, unilateral orders, and control, to raise job satisfaction (Barbuto & Wheeler, 2006).

Lastly, market, adhocracy, and clan cultures, among the organizational cultures of fitness clubs, were found to positively influence the job satisfaction of employees, while hierarchy culture did not have a significant influence on job satisfaction. These results are in line with a study by Kim and Hur (2013) studying public enterprises. Thus, to raise the job satisfaction of fitness club employees, managers of fitness clubs should strive for an externally-oriented organizational culture that respects improvements to productivity and the value of creativity, rather than oppressive methods through formal processes, orders, and control. Moreover, they should also strive to create an organizational culture that focuses on internal collaboration, such as trust, cooperation, and cohesiveness between the members of the organization (Quinn & McGrath, 1985).

This study has examined the characteristics of servant leadership and the types of organizational culture needed to improve the job satisfaction of fitness club employees and the characteristics of servant leadership that were appropriate for the types of organizational culture in fitness clubs. The results of this study may be helpful to provide basic data required for improving organizational performance and effective human resource management in fitness clubs.

Despite the implications of this study, the following limitations to the study, and future directions, can be noted. First, the level of servant leadership in fitness clubs relied on employee perceptions instead of self-evaluations of managers, which may have led to difficulties in accurately measuring the level of servant leadership of the managers. Second, as mentioned by B. Kim and J.S. Kim (2012), differences in organizational culture may lead to results in other sport organizations that differ from the aforementioned relationships among servant leadership, organizational culture, and job satisfaction in fitness clubs. Therefore, future studies should cover other sport organizations to empirically research the relationship among the three variables. Third, servant leadership, self-leadership, authentic leadership, and super leadership are being introduced into the realm of organizational behavior as alternatives to traditional leadership. Future studies should focus on the relationships among these new leadership types, organizational culture and job satisfaction to improve the organizational performance of sport organizations.

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Conflict of Interest
The authors declare that there are no conflicts of interest.

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SportMont

ORIGINAL SCIENTIFIC PAPER

Relationship between Tibia Length Measurements and Standing Height: A Prospective Regional Study among Adolescents in Southern Region of Kosovo

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Abstract

The purpose of this research is to examine standing height in both Kosovan genders in the Southern Region as well as its association with tibia length, as an alternative to estimating standing height. A total of 225 individuals (120 male and 105 female) participated in this research. The anthropometric measurements were taken according to the protocol of ISAK. The relationships between body height and tibia length were determined using simple correlation coefficients at a ninety-five percent confidence interval. A comparison of means of standing height and tibia length between genders was performed using a t-test. After that a linear regression analysis were carried out to examine extent to which tibia length can reliably predict standing height. Results displayed that Southern Kosovan male are 178.60±5.73 cm tall and have a tibia length of 39.93±2.34 cm, while Southern Kosovan female are 165.33±4.45 cm tall and have a tibia length of 35.50±2.07 cm. The results have shown that both genders made Southern-Kosovans a tall group, but shorter than general Kosovan population. Moreover, the tibia length reliably predicts standing height in both genders; but, not reliably enough as arm span. This study also confirms the necessity for developing separate height models for each region in Kosovo as the results from Southern-Kosovans don't correspond to the general values.

Key words: *prediction, measurement, stature, tibia length, kosovan*

Introduction

According to Komunat e Kosovës (2013), Kosovo is a democratic, multi-ethnic and secular republic which administratively is subdivided into seven districts (Ferizaj, Gjakova, Gjilan, Mitrovica, Peja, Pristina and Prizren) and five regions (Eastern, Western, Northern, Southern and Central). This study analyzes the standing height and its estimation utilizing tibia length measurements in adolescents in southern region which contains five municipalities (Dragas, Malisheva, Mamusha, Prizren and Suva Reka/Suharekë). This region (Figure 1) covers the area of 1,397 square kilometers and has population of 331,670 inhabitants, while average density per square kilometer is 240 inhabitants (Komunat e Kosovës, 2013). Although Kosovo doesn't have too big territory, it has a very varied relief that mostly belongs to Dinarides range and the author assumed this fact might influence the main objective of this study, because of the type of the soil as well as other socio-economical and geographical characteristics as a potential influencing factors (Arifi, 2017; Arifi, Sermaxhaj, Zejnullahu-Raçi, Alaj, & Metaj, 2017b).

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Figure 1. Geographical Location of Southern Region in Kosovo

There are lots of scientific findings which confirms that the measurement of standing height is a vitally important variable when assessing nutritional status (cited in Arifi et al., 2017a; Datta Banik, 2011; Popovic, & Bjelica, 2016), as well as when assessing the growth of children, evaluating the basic energy requirements, adjusting the measures of physical capacity and predicting the drug dosage and setting standards of physiological variables such as muscle strength, metabolic rate, lung volumes and glomerular filtration (Golshan, Amra, & Hoghogi, 2003; M. Golshan, Crapo, Amra, Jensen, & R. Golshan, 2007; Mohanty, Babu, & Nair, 2001; Ter Goon, Toriola, Musa, & Akusu, 2011). However, according to Quanjer and his collaborators (2014), the exact standing height cannot always be identified and resolved in the usual way (e.g. paralysis, fractures, amputation, scoliosis and pain). Because of these factors, an estimate of standing height has to be acquired from other reliable anthropometric indicators such as hand and tibia lengths, foot lengths, knee height, length of the forearm, length of the sternum, vertebral column length, sitting height, length of scapula, arm span as well as cranial sutures, skull, facial measurements et cetera (cited in Gardasevic, Rasidagic, Krivokapic, Corluka, & Bjelica, 2017; Popovic, 2017; Popovic, Gardasevic, Masanovic, Arifi, & Bjelica, 2017; Masanovic, Gardasevic, & Arifi, 2018a; Masanovic, Gardasevic, & Arifi, 2018b). Therefore, all these anthropometric indicators, which are used as an alternative to estimate standing height, are very important in predicting loss in standing height connected with aging. Also, to diagnose individuals with disproportionate growth abnormalities and skeletal dysplasia or standing height loss during surgical procedures on the spine (Mohanty et al., 2001), as well as to anticipate standing height in many older people as it is very difficult to measure it precisely, and sometimes impossible because of mobility problems and kyphosis (Hickson & Frost, 2003). Lastly, it is important to state that this knowledge finds its importance in sport science the standing height represents a significant factor which influences the success in various sport disciplines (Popovic, 2017).

Several researches have reported the benefit of using various body parameters in predicting standing height, and arm span happened to be one of the most reliable ones in adults (Hickson & Frost, 2003; Jalzem & Gledhill, 1993; Mohanty et al., 2001; Ter Goon et al., 2011), while some authors (Singh, Kumar, Chavali, & Harish, 2012) believe that foot length measurement is the most reliable predictor during adolescent age, due to the fact that ossification and maturation occurs earlier in the foot than the long bones and standing height could be more accurately predicted from foot measurement as compared to long bones during adolescent age. In addition, the relationship of long bones and standing height was found to vary in different ethnic and racial groups (Bjelica, Popovic, Kezunovic, Petkovic, Jurak, & Grasgruber, 2012; Brown, Feng, & Knapp, 2002; Popovic, Bjelica, Georgiev, Krivokapic, & Milasinovic, 2016; Popovic, Bjelica, Molnar, Jaksic, & Akpinar, 2013; Popovic, Bjelica, Tanase, & Milasinovic, 2015; Reeves, Varakamin, & Henry, 1996; Steele & Chenier, 1990) as well as various regions (Arifi, 2017; Arifi et al., 2017b; Milasinovic, Popovic, Matic, Gardasevic, & Bjelica, 2016; Milasinovic, Popovic, Jaksic, Vasiljevic, & Bjelica, 2016; Masanovic, Gardasevic, & Arifi, 2018c; Masanovic, Gardasevic, & Arifi, 2018d). Hence, researchers have derived a specific formula for calculating standing height from long bones for each ethnic/race group. The mentioned variations might be the case with tibia length predictions too, mostly due to the fact that the Dinaric Alps population has specific body composition than national as well as regional point of view (Popovic, 2017). Even though many studies with this essence are available on neighboring countries as well as worldwide population, only narrow data is available on Kosovan subjects, just one conducted by Popovic, Arifi and Bjelica (2017), and Popovic and Bjelica (2017) that has covered whole Kosovan population, and one regional analyses that confirmed Western-Kosovans have specific standing height/foot length ratio, comparing to general population in Kosovo (Popovic et al., 2017). Considering rather sparse recent scientific literature, the purpose of this research was to examine the standing height in both Eastern-Kosovan genders and its association with tibia length.

Methods

The nature of this research gave extension to the 225 high-school students last year (120 male and 105 female) from Southern Region of Kosovo to be subjects. Two reasons which qualified the selected individuals are: the first is related to the fact that the growth of an individual ceases by this age, while the second is related to the fact that there is no age-related loss in standing height at this age. The average age of the male subject was 18.40±0.56 years old (range 18-20 years), while the average age of the female subject was 18.36±0.50 years old (range 18-20 years). It is important to underline that the researchers have excluded from the data analysis of the individuals with physical deformities as well as those without informed consent. The exclusion criterion was also being non-Southern Kosovan.

The anthropometric measurements, including standing height and tibia length, were taken according to the protocol of the International Society for the Advancement of Kinanthropometry (Marfell-Jones, Olds, Stew, & Carter, 2006). The trained measurers have measured selected anthropometric indicators (same measurer for each indicator), while the quality of their performance was evaluated against the prescribed "ISAK Manual". Lastly, the age of the each subject was reached directly from the birthdays.

The analysis were performed by using the Statistical Package for Social Sciences (SPSS) version 20.0. Means and standard deviations (SD) were obtained for both anthropometric variables. A comparison of means of standing height and tibia length between genders was performed using a t-test. The relationships between

standing height and tibia length were determined using simple correlation coefficients at ninety-five percent confidence interval. Then a linear regression analysis were carried out to examine the extent to which the tibia length can reliably predict standing height. Statistical significance was set at $p<0.05$.

Results

A summary of the anthropometric measurements in both genders is shown in Table 1. The mean of the standing height for male was 178.60±5.73 centimeters and tibia length was 39.93±2.34 centimeters, while for female the standing height was 165.33±4.45 centimeters and tibia length was 35.50±2.07 centimeters. The sex difference between standing height and tibia length measurements was statistically significant (standing height: t=19.183; p<.000. and tibia length: t=14.927; p<.000).

Table 1. Anthropometric Measurements of the Study Subjects

Subjects	Standing Height Range (Mean±SD)	Tibia Length Range (Mean±SD)
Male	164.6-192.3 (178.60±5.73)	33.1-47.7 (39.93±2.34)
Female	158.0-184.0 (165.33±4.45)	30.7-40.7 (35.50±2.07)

In Table 2, the simple correlation coefficients and their ninety-five percent confidence interval analysis between the anthropometric measurements are displayed. The associations between standing height and tibia length were significant ($p<0.000$) and high in this sample, regardless of gender (male: 0.734; female: 0.639).

Table 2. Correlation between Standing Height and Tibia Length of the Study Subjects

Subjects	Correlation Coefficient	95% confidence interval	Significance p-value
Male	0.734	0.610-0.858	<0.000
Female	0.639	0.489-0.789	<0.000

The results of the linear regression analysis are shown in Table 3. The first of all models were extracted by including age as a covariate. However, it was found that the contribution of age was insignificant and therefore the age was dropped and estimations were derived as a univariate analysis. The high values of the regression coefficient (male: 0.734; female: 0.639) signify that tibia length notably predicts standing height in both Southern-Kosovan genders (male: t=11.740, $p<0.000$; female: t=8.432, $p<0.000$), which confirms the R-square (%) for the male (53.9) as well as for the female (40.8).

Table 3. Results of Linear Regression Analysis Where the Tibia Length Predicts the Standing Height

Subjects	Regression Coefficient	Standard Error (SE)	R-square (%)	t-value	p-value
Male	0.734	3.911	53.9	11.740	0.000
Female	0.639	3.443	40.8	8.432	0.000

The associations between tibia length measurements and standing height among the above models is sketched as a scatter diagrams (Figure 2).

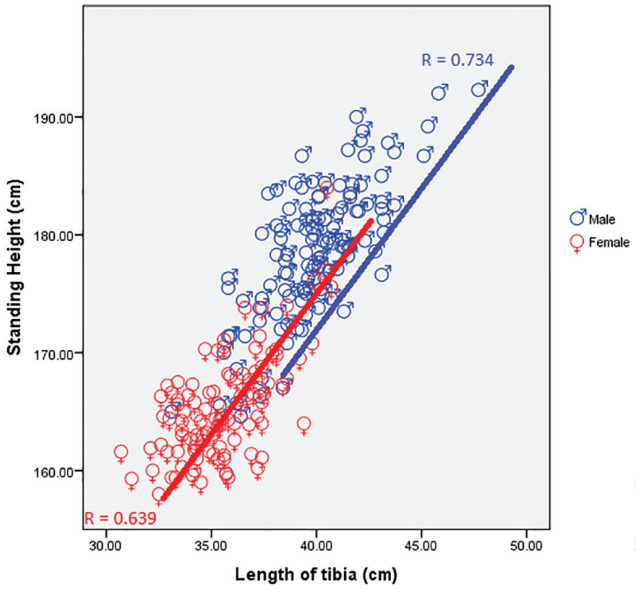

Figure 2. Scatter Diagram and Relationship between Tibia Length Measurements and Standing Height among Both Genders

Discussion

The assessment of standing height using various anthropometric measures is very typical from the past centuries and it has been attempted to be studied by many researchers. However, it is important to underline that the arm span has been obtained as the most reliable body indicator for predicting the standing height of an individual (Mohanty et al., 2001; Ter Goon et al., 2011), while tibia length is was very close (Khatun, Sharma, Jain, & Gupta, 2016; A. Kaore, B.P. Kaore, Kamdi, S. Kaore, 2012; Agnihotri, Smita, Jowaheer, & Pratap, 2009). In parallel, it is important to emphasize that the individual and ethnic variations referring to standing height and its association with tibia length might vary from ethnic group to ethnic group as well as race to race, because the racial and ethnic differences are affective on these measures and reduce the possibility of generalizing (cited in Bjelica et al., 2012). This fact confirms the study conducted by authors (Agnihotri et al., 2009) who confirmed a very high linear correlation between standing height and tibia length in both genders, while the research study conducted by Khatun and her collaborators (2016) shows significant correlation between standing height and tibia length in both genders of Indian population. The highest correlation coefficient in this population was found for tibia length in males (r=0.67) as well as in females (r=0.58).

All above-mentioned have confirmed the necessity for developing separate standing height models for each population on account of ethnic differences and the recent study conducted by Popovic and his collaborators (Popovic et al., 2017a; Popovic & Bjelica, 2017) who have analyzed the entire Kosovan population and have found specific correlation coefficient standing height and foot length in Kosovan male (r=0.669) and female (r=0.625) population; however, some recent studies have also confirmed the regional differences between the same ethnic groups too (Arifi, 2017; Arifi et al., 2017b; Popovic et al., 2017b; Milasinovic et al., 2016a; 2016b), which caused the need for additional caution, mostly due to the reason one of them was sampled by Western-Kosovans. Therefore, the main goal of this research was to test the hypothesis if above-mentioned facts are true for the Southern-Kosovans, that is, for the one of five Kosovan regions. As the correlation between tibia length and standing height was significant in both Southern-Kosovan genders, the tibia length measure therefore seems to be a reliable indirect anthropometric indicator for estimating standing height in both genders of Southern-Kosovan population.

The results of the study conducted by Popovic and his collaborators (Popovic et al., 2017a; Popovic & Bjelica, 2017; Masanovic, 2017) confirm the necessity for developing separate standing height models for both genders in Kosovo but the authors of the same study have recommended that further studies should consider dividing the population of this country to regional subsamples and analyze it separately, just to be sure there are no geographical differences (such as type of the soil) influencing the average standing height in both Kosovan genders as well as its association with tibia length. This concern was based on the fact that entire Kosovo doesn't fall into Dinaric Alps racial classification. In parallel, this study confirms the assumption mentioned above and also confirms that it is necessary to develop separate standing height models for each population on account of regional variations in Kosovo.

Next to highlighted issue, the obvious constraint of this research might also be the composition of the measured sample that consisted of high school students. This limitation is based on the fact there are some studies which assumed the growth of an individual doesn't cease by this age (Grasgruber, P., personal communication, 2016; Jurak, G., personal communication, 2017). This assumption might be supported by the fact that university-educated individuals have been founded to be taller than the high school population in Bosnia and Herzegovina (Grasgruber et al., 2017; Gardasevic et al., 2017), Poland (Wronka & Pawlinska-Chmara, 2009) and Hungary (Szollosi, 1998). On the other hand, this wasn't the truth in Montenegro (Popovic, 2016) and comparing the average standing height measures of this study to the results of some study sampled by university students might give the science much precise conclusions. One more obvious limitation of this study is also the fact that both genders of Kosovo did not reach their full genetic potential yet, since various environmental factors controlled their development. Further continuous monitoring is necessary, mostly due to the reason it is expected the secular changes influencing standing height will ascend in the following two or three decades.

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Conflict of Interest
The authors declare that there are no conflicts of interest.

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ORIGINAL SCIENTIFIC PAPER

Adaptation Study of the Problem Solving Inventory on the Turkish Athlete Population

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Abstract

The aim of this study was to examine the reliability and validity of Problem solving inventory (PSI) with Turkish athletes. The PSI was designed to clarify utility of problem-solving constructs across sports environment and thus facilitate the development of more comprehensive acknowledges about problem solving and mental health. The subjects were 204 males and 109 females totaling 313 athletes. Participants voluntarily completed the 32 item problem solving inventory. Afterwards, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were undertaken. EFA results yielded a satisfactory three-factor solution, the same as the English version. Cronbach alpha (α) reliability indices for the respective subscales were as follows: problem solving confidence (PSC) (.69), approach and avoidance (AA) (.73), and personal control (PC) (.68). The PSI explained 66% of the total variances. Moreover, CFA results provided the fit indices as Chi-Square (X^2)=912.8, df=461, X^2/df=1.98, Root Mean Square Error Approximation (RMSEA)=.07, Comparative Fit Index (CFI)=.93, Goodness of Fit Index (GFI)=.92, Normed Fit Index (NFI)=.90, Non Normed Fit Index (NFI)=.89 with 32 items and 3 sub-dimensions. The fit indices of the PSI in relation to EFA and CFA were at an acceptable level. The original 3-factor solution was supported by the Turkish athlete subjects. Results of the study introduced that the Turkish version of the Problem Solving Inventory is a valid and reliable measurement for Turkish athletes.

Key words: *problem solving, exploratory and confirmatory factor analysis, Turkish athletes*

Introduction

Psychological skill set of athletes and mental preparedness are major decisive contributor of the performance in sport setting (Mahoney, Gabriel, & Perkins, 1987; Gee, 2010). Athletes' psychological abilities such as concentration, emotional control, motivational orientation, coping with stress and anxiety are essential dimensions for peaking the performance (Crust, 2007; Smith, Smoll, & Cumming, 2007). Harmison (2011) indicated that developing the necessary psychological skills is not solely important factor for peaking athletic performance, but adversity-coping skills are also decisive factor on athletic performance.

Acceptance, positive reinterpretation and problem solving are emphasized as adversity coping strategies in sport setting (Galli & Vealey, 2008). Although each of those strategies are important for athletic development and better performance, problem solving skills has unique construct due to the dealing with the stressor directly. Heppner and Krauskopf (1987) defined the problem solving as "the complex interplay of cognitive, affective, and behavioral processes for the purpose of adapting internal or external demands or challenges."

In addition to problem-solving appraisal, researchers have used a number of strategies and measurements to assess applied problem solving (Heppner & Wang, 2003). First one has been to assess the nature and frequency of personal problems; the basic assumption has been that fewer problems suggest more effective problem solving. One of the earliest measures was the 330-item Mooney Problem Checklist (Mooney & Gordon, 1950); a second one has been to assess what is assumed to be problem-solving ability by providing a task that requires cognitive processes related to applied problem solving. The Means-End Problem

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Solving Procedure (MEPS) (Platt & Spivack, 1972) assesses one's cognitive ability to plan, step-by-step, the means of moving toward an effective solution of interpersonal problems. A third one has been to assess problem-solving attitudes and skills through self-report assessments, such as the Social Problem Solving Inventory (SPSI) (D'Zurilla & Nezu, 1980). A fourth strategy has assessed verbal reports of one's problem-solving activities that facilitate or inhibit progress toward resolving problems, such as the Problem Focused Style of Coping (PF-SOC) (Heppner, Cook, Wright, & Johnson, 1995). The multiple assessment strategies reflect the multifaceted nature of applied problem solving. Only the PSI, however, is conceptualized as a measure of problem-solving appraisal and has been recognized as one of the most widely used self-report inventories in applied problem solving (A.M. Nezu, C.M. Nezu, & Perri, 1989).

In sport context, implementing executive functions requires problem solving skills (Diamond, 2006). Moreover, problem solving skills has a major role on actual motor performance, besides processing information and making decision, (Ripoll, Kerlirzin, Stein, & Reine, 1995; Hristovski, 2012). Participating regular sport activities may lead to better problem solving skills. To illustrate, Jacobsen and Matthaeus (2014) examined the executive functions by administering tests of problem solving, decision making and inhibition among athletes and non-athletes. Their results indicated that athletes demonstrated higher problem solving scores compared to non-athletes. Similarly, Senduran and Amman (2015) demonstrated that high-school aged athletes feel more confident when they encounter the problem comparing to non-athletes. Furthermore, this study also indicated that the type of the sport was also major factor effecting the problem solving skills of athletes. Thus, investigating the problem solving approaches of athletes become an important topic in order to explicate how to improve athletic performance.

Although evaluating psychomotor approaches in problem solving strategies are important (Ripoll et al., 1995), assessing the individual differences in problem solving is another necessary aspect in sport context. Heppner and Petersen (1982) developed to an instrument to explicate personal problem solving approaches of individuals. Problem Solving Inventory aims to differ individuals with effective problem solving skills such as confidence, personal control, avoiding problems from those who perceive themselves as ineffective problem solvers (N. Sahin, N.H. Sahin, & Heppner, 1993). The first adaptation of PSI into Turkish language was completed among university students (Sahin et al., 1993), and results of primary-component analyses revealed a six factor structure, namely thinking approach, avoiding approach, estimator approach, self-trust approach and planned approach, unlike to three factor structure revealed by Heppner and Petersen (1982). All Cronbach's Alpha values of sub-dimensions were larger than 0.65 in Turkish version of the PSI. Although Turkish version of PSI was implemented among students from the School of Physical Education and Sports (Sözen, 2012), high school athletes (Senduran & Amman, 2015) and sport referees (Karaçam & Pulur, 2016) and found reliable, none of the study analyzed the validity of the instrument among these populations. Because the PSI was not developed specifically for the sport context, the validity of the model of the Turkish version that used in sport studies might be a doubtful, especially for studies focused on athletes.

Therefore, the purpose of this study was to investigate the reliability and validity of the Turkish version of the PSI among Turkish athletes in order to propose a valid model to measure problem solving skills.

Methods

Participants

The study sample consisted of 204 males (mean=21.34±4.10 years) and 109 females (mean=20.72±2.90 years) totaling 313 athletes (mean=20.87±3.65 years) who voluntarily participated.

Ethical administrative procedures

Prior to data collection, approval was obtained from the Ethics Committee of Nevşehir Hacı Bektaş Veli University. The author of the original scale was contacted to ask for permission which he kindly granted. During the questionnaire administration, each participant was briefed with regards to what is involved in the study and how their responses would be kept confidential. After participant briefing, athletes were informed that participation was voluntary and that they could withdraw at any time during the data collection process. After this, data was only collected from athletes who gave consent and volunteered to participate.

Measuring Instrument

Problem Solving Inventory which consists of total 35 items, was developed to measure self-understanding of individual athletes about problem-solving abilities. These abilities, also the sub-dimensions of the questionnaire, are; "Problem Solving Confidence" (items of 5, 10, 11, 12, 19, 23, 24, 27, 33,34, 35, α=.85), "Approach-Avoidance" (items of 1, 2, 4, 6, 7, 8, 13, 15, 16, 17, 18, 20, 21, 28, 30 and 31, α=0.84) and "Personal Control" (items of 3, 14, 25, 26 and 32, α=0.72). The range of correlation coefficients among these three factors vary from 0.38 to 0.49 (Heppner & Petersen, 1992).

Athletes who respond the PSI are provided with a likert scale and composed of 35 items, including 3 filler items and evaluated according to scoring system with the numbers of 1-6 (1=strongly agree to 6=strongly disagree). The lowest score that can be obtained from the inventory is 32 and the highest score is 192. Higher scores obtained from the scale indicate self-inability perception of individual about problem solving abilities and lower scores show that the one perceives himself/herself as adequate. 9^{th}, 22^{th} and 29^{th} items in scoring order are out of scoring in accordance with protocol. Moreover, there were inverse-scored items include; 1^{th} 2^{th}, 3^{th}, 4^{th}, 11^{st}, 14^{th}, 15^{th}, 17^{th}, 21^{th}, 25^{th}, 26^{th}, 30^{th} and 34^{th} items.

Procedure

The Turkish version of the PSI was only completed by Turkish athletes who voluntarily participated and signed consent forms. The translation procedure of the PSI was made by faculty members from English Language Department of Nevşehir Hacı Bektaş Veli University. They forward-translated the English version into Turkish, and the translated versions of the PSI were compared for deviations. Then another bilingual language expert back-translated the Turkish version into English to examine the retention of the meaning of the items. Three academics who are experts in the areas of physical education & sports sciences, sports psychology and psychometrics, reviewed the content of the preliminary PSI version to ensure that the questions were culturally appropriate to the Turkish athlete population.

Data analysis

Results of EFA & CFA analyses are presented in the following section. To determine the factor structure of the

multidimensional questionnaire, exploratory factor analysis that conducted by Statistical Package for the Social Sciences (SPSS) 21.0 was firstly used. Following this, confirmatory factor analysis was conducted by analysis moments of structures (AMOS) 18 to check statistical model. Comparative fit index (CFI>0.90, acceptable), non-normed fit index (NNFI>0.90 acceptable), normed fit index (NFI>0.90) and root mean square error of approximation (RMSEA<0.08, adequate model fit) (Maruyama, 1998) were used to check the data. Internal consistency of the adapted scale was checked by computation of Cronbach's coefficient alpha. Fit indices scores were used in order to prove model fits Öcal, 2011. The measurement model based on the fit indices was evaluated for construct validity.

Results

Descriptive statistics and Cronbach's alpha coefficients for the PSI scales are shown in Table 1. Specifically, Cronbach's alpha was 0.69 for Problem solving confidence, 0.73 for Approach-Avoidance, 0.68 for Personal control score. The mean value for Problem Solving Confidence was 26.22±7.11, for Approach-Avoidance was 53.78±12.44, for Personal Control was 24.08±6.64.

Table 1. Descriptive statistics for the three Problem Solving Inventory factors (N=313)

	No. of items	M±SD	Skewness	Kurtosis	Cronbach Alpha
Problem solving confidence	11	26.22±7.11	-.63	.59	.69
Approach – avoidance	16	53.78±12.44	1.07	1.62	.73
Personal control	5	24.08±6.64	.74	.61	.68

Initially, the factorability of the PSI (35 items) was examined. Well-recognized criteria for the factorability of a correlation were used. Firstly, it was observed that 33 of the 35 items correlated at least .3 with at least one other item, suggesting

Table 2. Factor loadings based on a principal components analysis with oblimin rotation for 32 items from the PSI (N = 313)

	1	2	3
Item5 (PSC)	.68		
Item10 (PSC)	.70		
Item11 (PSC)	.72		
Item12 (PSC)	.71		
Item19 (PSC)	.62		
Item23 (PSC)	.63		
Item24 (PSC)	.61		
Item27 (PSC)	.67		
Item33 (PSC)	.75		
Item34 (PSC)	.58		
Item35 (PSC)	.69		
Item1 (AA)		.55	
Item2 (AA)		.52	
Item4 (AA)		.54	
Item6 (AA)		.68	
Item7 (AA)		.70	
Item8 (AA)		.74	
Item13 (AA)		.79	
Item15 (AA)		.56	
Item16 (AA)		.70	
Item17 (AA)		.52	
Item18 (AA)		.78	
Item20 (AA)		.76	
Item21 (AA)		.51	
Item28 (AA)		.75	
Item30 (AA)		.54	
Item31 (AA)		.73	
Item3 (PC)			.60
Item14 (PC)			.62
Item25 (PC)			.60
Item26 (PC)			.56
Item32 (PC)			.79

Legend: Problem solving confidence (PSC), Approach and avoidance (AA), and Personal control (PC)

reasonable factorability. Secondly, the Kaiser-Meyer-Olkin measure of sampling adequacy was .70, above the commonly recommended value of .6, and Bartlett's test of sphericity was significant ($\chi 2$ (397)=2011.09, p<.05). Given these overall indicators, factor analysis was deemed to be suitable for all 35 items.

For the final stage, a principal components factor analysis of the PSI items, using varimax and oblimin rotations, was conducted, with three factors explaining 66% of the variance. An oblimin rotation provided the best-defined factor structure. The factor loading matrix for this final solution is presented in Table 2. The factor labels proposed by Heppner and Pettersen (1992) suited the extracted factors. Internal consistency for each of the scales was examined using Cronbach's alpha. The alpha levels were moderate: problem solving confidence (PSC) (11 items) (.69), approach and avoidance (AA) (16 items) (.73), and personal control (PC) (5 items) (.68). The PSI explained 66% of the total variances.

After EFA, CFA was used to test the factor structure that shows the sub-dimensions of Problem solving inventory over the data gathered from Turkish athletes. Firstly, for a model with 3 factors (problem solving confidence, approach and avoidance, and personal control) set in the original sub-dimension, goodness of fit statistics were calculated. The results

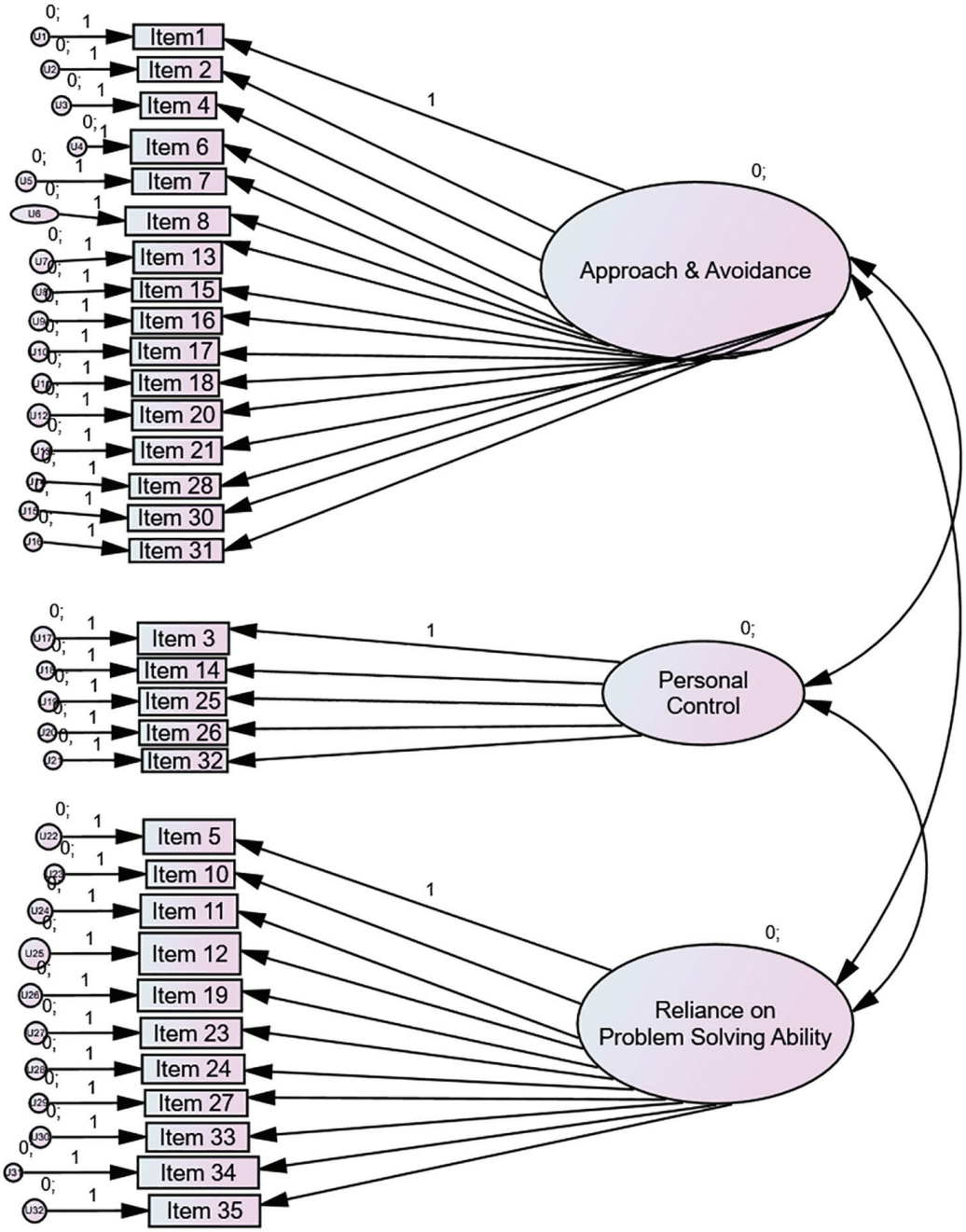

Figure 1. Hypothesized model of PSI

were as follows, Chi-Square (X^2)=912.8, df=461, X^2/df=1.98, Root Mean Square Error Approximation (RMSEA)=.07, Comparative Fit Index (CFI)=.93, Goodness of Fit Index (GFI)=.92, Normed Fit Index (NFI)=.90, Non Normed Fit Index (NFI) =.89. Therefore, it is evident that the model is coherent at a satisfactory level.

Discussion

The goal of the study was to evaluate the psychometric properties of the Problem Solving Inventory (Heppner & Petersen, 1992) on a Turkish population. Exploratory and confirmatory factor analysis results supported the initial structure of the questionnaire for the overall model.

A crucial personal resource for dealing with psychological health, stressors, and barriers etc. in sports is problem solving abilities. The competent problem solvers are flexible, adaptable people and they are able to create or find proper strategies to solve problems. It is to be expected problem solving abilities are very relevant for all sports stuff (athletes, referees, managers, sport psychologists, coaches etc.).

A number of measurement tools exist in the literature that has been developed to evaluate problem solving abilities in sports. As explained earlier, such measurements tools (e.g. the Mooney Problem Checklist, the MEPS, the SPSI and the PF-SOC) have been trialed in different environments.

The PSI has been found to have acceptable internal consistency estimates across a number of populations and cultures (e.g. Heppner, 1988; Heppner, Pretorius, Wei, Lee, & Wang, 2002). The inter-correlation among these three factors ranged from .39 to .69 across a range of studies on PSI (Heppner, 1988). Results suggest that the factors are not only interrelated but also independent enough to be considered as separate factors (Heppner & Wang, 2003). Consistent with our findings, subsequent studies using either exploratory factor analyses indicate that the PSI factors tend to replicate well across different age groups from various backgrounds, such as mid-western White college students (Cronbach's Alpha reliability values from .72 to .90) (Heppner, Baumgardner, & Jackson, 1985); French Canadian adults (Laporte, Sabourin, & Wright, 1988), Turkish college students (Cronbach's Alpha reliability values from .69 to .78 and total internal consistency was .88) (Sahin et al., 1993); Black South African college students (Cronbach's Alpha reliability values from .71 to .84 and total internal consistency was .89) (Heppner et al., 2002); Egyptian college students (Cronbach's Alpha reliability values from .76 to .88 and total internal consistency was .75) (Soliman, 2014); Romanian adults (Cronbach's Alpha reliability values from .78 to .84) (Marian & Roşeanu, 2012), and Mexican American high school students (Cronbach's Alpha reliability values from .66 to .77 and total internal consistency was .86) (Huang, 2005). Moreover, in another Mexican American high school students Cronbach's Alpha reliability values were as follows: .86 for PSI total, .77 for PSC, .76 for AAS, and .66 for PC (Huang & Flores, 2011). Summing across studies, the PSI total obtains average alpha coefficients around .80s, whereas two of the factors (PSC and AA) obtain average alpha coefficients in the low to mid .80s, and the third factor (PC) obtains average alpha coefficients in the low .70s. These results suggest that the PSI is internally consistent across different forms of the PSI used across different cultural groups (Heppner & Wang, 2003).

Additionally, to results of exploratory factor analysis, the confirmatory factor analysis results' indicated that the factor structure of the PSI supported the three factors of the PSI and a general problem-solving factor with Turkish athlete population. That is consistent with some other scientific studies those aimed to find factor structure model of the PSI with different samples would support the use of the three factors of the PSI include; Heppner et al. (2002) study on South African college students, Huang and Flores' (2011) on Mexican American high school students, Marian and Roşeanu's (2011) on Romanian adults, and Soliman's (2014) on Egyptian college students. Moreover, this study provides additional support for the generalizability of the PSI factor structure to a Turkish athletes sample. All these results suggest considerable consistency of the PSI factor structure across various cultures and different samples. In summary, similar to the current findings, other validity and reliability studies demonstrated that PSI is a valid data collection tool in different cultures.

The results of the present study introduced that Problem Solving Inventory-Turkish version has relatively strong psychometric properties, and is a valid and reliable test instrument to evaluate mental skills levels in Turkish sports contexts (athletes, university students, etc.).

The present study has some limitations. The sample of the study were formed by Turkish amateur athletes from a number of team and individual sports. Additionally, professional level athletes should be evaluated for applicability for use in a high level sport environment. Thus, continued evaluation of the PSI is necessary. Moreover, additional types of invariance testing (e.g., temporal, cross-cultural, and sport type), as well as other ongoing construct validity evaluation, needs to be considered in future research to gather new evidence on problem solving abilities.

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Conflict of Interest
The authors declare that there are no conflicts of interest.

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Special Features of Consumption of Water and Drinks by Kazakhstan Athletes

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Abstract

In Kazakhstan, the regime and habits of consuming liquids by athletes in various sports have not been sufficiently explored yet. The purpose of the study is to determine the amount, schedule and characteristics of consumption of drinks by sportsmen after the example of different sports. In 2017 15 volleyball players of the Burevestnik team in Almaty, 15 judo wrestlers of the national team of Kazakhstan, 15 wrestlers of the club team and 15 triathletes of the national team of Kazakhstan took part in the estimation of the regime of water and other liquids consumption. A valid questionnaire was used to study the data on the volume and water consumption schedule and other liquids. The amount of water and other drinks consumed was studied by reproducing drinking during 24 hours. The questionnaire put questions about the amount of water and beverages consumed prior to training, during and after it, and furthermore certain types of beverages were determined. Our research showed that 63.34% of the Kazakhstan athletes under examination drink the recommended norm (2-3 liters per day), another 6.69% of the investigated consume from 3 to 6 liters of liquid. The researched athletes do not consume enough liquid 2 hours before training. Only 20% of volleyball players, judoists and triathletes of national teams consume the recommended norm of liquid (400-600 ml). Most of the investigated athletes consume necessary amount of water and other beverages during training. 70.0% of respondents drink water and juices during training, and only 16.7% of them drink sport drinks.

Key words: *athletes, training, water consumption, water consumption schedule*

Introduction

A very important component in preparation of athletes and in their nutrition is the consumption of water and various drinks. Water - is a vital component of nutrition, as it performs important vital functions in the body.It is a universal solvent thatplays an extremely important role in ensuring the normal functioning of all organs and systems of the human body. Depending on the nature of sports activities and temperature conditions, the daily need for liquid for the athletes of various specializations ranges from 2-3 to 5-6 liters per day (Sawka, Montain, & Latzka, 2001; Cheuvront, Carter, & Sawka, 2003; Institute of Medicine, 2005; De Sousa, Da Costa, Nogueira, & Vivaldi, 2008).

For a long time there was an opinion that the amount of liquid consumed by athletes should be limited. Current scientific evidence has convincingly demonstrated the inconsistency of this approach to the athlete's water consumption schedule (Casa et al., 2000; Godek et al., 2010; Paken, 2010; Vasic, Dimitric, & Cokorilo, 2010; Novokshanova & Ozhiganova, 2013; Vasiljevic, Bojanic, Petkovic, & Muratovic, 2014). Lot of the information about water consumption and drinking liquids occurs in literature sources, but the information on them is pretty contradictory. In estimating water consumption the kinds of sport of biathlon are often referred to where there are weight categories, the possibility of regulating body weight by dehydration is analyzed.

The information on the suitability of drinking water and various sports drinks can also be found in literature sources. The advantage of carbohydrate-mineral drinks is often argued for (Boyadjiev & Tarulov, 1998). They are applied to replen-

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ish liquid in the body, to maintain normal blood glucose level and provide energy to the working muscles. Despite some differences, the composition of many sports carbohydrate and mineral drinks is almost the same: it is characterized by the mandatory availability of water, sugar and salt. Nikityuk et al. (2012) believes that it is possible to replenish the supply of liquid by clean water. Although in this case, sense of thirst is quenched, but it is followed by decrease in the plasma concentration of dissolved substances in it, which stimulates urination in its turn. Thus, in consuming clean water, only a short-term rehydration of the bodyis achieved.

In accordance with the recommendations of the American College of Medicine (Convertino et al., 1996), the athletes' water consumption schedule depends on many factors, firstly, on temperature, humidity, and solar radiation and can vary in different ranges. You should drink 5-7 ml/kg of body weight 4 hours before training or competition, another 3-5 ml/kg body weight or 400-600 ml of water should be added 2 hours before the exercise (Casa et al., 2000), and you should drink another 200-300 ml of water or special drinks 10-20 minutes before the beginning of physical exertion. During training and competition, the amount of liquids drunk should not cause the digestive tract discomfort. Noakes (2003) recommends the athletes to consume the maximum acceptable volume of liquid, reaching 400-800 ml per hour during the exercise. After training and competition, athletes are advised to consume the amount of liquid that was consumed during the load, while in the course of recovery, this volume is 1.5 times higher than that was spent during physical activity (Coyle, 2004).

Kazakhstan is mainly situated in hot climatic conditions, where the ambient temperature often reaches 30-40 degrees. In such conditions, there is a danger of dehydration. Therefore, the study of the volume and water consumption schedule of and other liquids during physical activity is relevant. In Kazakhstan, the regime and habits of consuming liquids by athletes in various sports have not been sufficiently explored yet.

The purpose of the study is to determine the amount, schedule and characteristics of consumption of drinks by sportsmen after the example of different sports.

Methods

Sixty athletes, including 15 volleyball players of the "Burevestnik" team in Almaty, which plays in the country championship, 15 judo wrestlers of the national team of Kazakhstan, 15 judo wrestlers of the club team and 15 triathletes of the national team of Kazakhstan took part in the estimation of the regime of water and other liquids consumption. The age of volleyball players was 19-22 years, their growth averaged 188.0±8.38 cm, body weight - on the average 78.11±7.68 kg, (BMI) -the body mass index averaged 22.1. The age of judoists was 20-28 years old, their average height was 174.3±8.3 cm, body weight - on the average 78.0±18.9 kg, BMI was on average 25.74. The age of judoists of the club team was from 17 to 21, their average height was 171.9±6.0 cm, body weight - 71.0±16.1 kg, BMI - on average 24.07. The age of the triathletes was 21-30 years old, their average height was 180.0±7.2 cm, body weight - on the average 65.5±7.1 kg, body mass index BMI averaged 20.2. A valid questionnaire (Baranauskas, 2012) was used to study data on the volume and mode of consumption of water and other liquids by directly interviewing each researcher. We studied the amount of water and other drinks consumed by method of reproduction of drinking during 24 hours. The questionnaire presented questions about the amount of water and beverages consumed prior to training, during and after it, and furthermore certain types of beverages were determined.The length of the questionnaire was not limited and lasted in average of 30-45 minutes. The survey was carried out during training camps at the place of their holding in April and May.We have received the permission by the Ethics Committee of the KazNU named by Al-Farabi for the purposes of conducting the research and carrying out biomedical research with the voluntary consent to participate in the research. Confidentiality of the research data was observed.

Statistical analysis of the study data was carried out using the "Statistical Package for Social Sciences" program (SPSS, version 16). Analyzing the data, the percentage distribution of answers on the questionnaire was calculated. The criterion $\chi 2$ (chi-square) was applied for the analysis of categorical data. Statistical reliability was with p less than or equal to 0.05.

Results

Upon ascertaining water consumption by the Kazakhstan sportsmen during the researchit has been determined that 26.65% of Kazakhstan athletes consume 1-2 liters of water per day, 41.67% consume 2-3 liters of water per day, 21.67% consume 3-4 liters of water per day. Estimating the consumption of water and other beverages among sportsmen of different sports, it should be noted that consumption of drinks from 2 to 3 liters per dayis 73.3% among the triathletes (χ^2=18.867, p<0.001), 40% among the judoists of the club team, 26.7% among volleyball players. From 3 to 4 liters consume 33.3% of volleyball players and 40.0% of judoists of the national team. From 4 to 6 liters of water and other beverages consume 6.7% of the investigated (Table 1).

Table 1. Water and other Beverages Consumption by Kazakhstan Athletes

No	The amount of water and other beverages consumption	Volleyball players n=15	Judoists of the national team n=15	Judoists of the club team n=15	Triathletes n=15	$\bar{X}$
1	Less than a liter	13.3	0	0	0	3.32
2	1-2 liters	20.0	33.3	40.0	13.3	26.65
3	2-3 liters	26.7	26.7	40.0	73.3	41.67
					χ^2 =18.867, p<0.001	
4	3-4 liters	33.3	40.0	6.7	6.7	21.67
5	4-5 liters	6.7	0	6.7	6.7	5.02
6	5-6 liters	0	0	6.7	0	1.67

Athletes are advised to consume a sufficient amount of liquid before, during, and after training with the aim of maintaining an optimal balance of liquid in body during physical activity, dehydration thus being avoided. The results of the study show that 58.3% of the Kazakhstan athletes researched by us consume 200-400 ml 2 hours before training, and 25% of them 400-600 ml, among the triathletes, 73.3% (x2=11.200, p<0.02) of the investigated consume 200-400 ml 2 hours before training and 60.0% (x2=10.333, p=0.07) among the judoists of the national team of Kazakhstan (Figure 1).

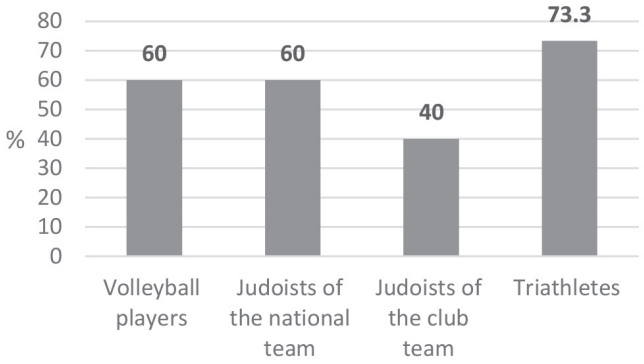

Figure 1. The percentage distribution of the athletes that consume200-400 ml of drinks 2 hours before the workout

Athletes should consume an average of 400-600 ml of beverages 2 hours before the training starts as the recommended daily rate. We have established that only 20% of the volleyball players, judoists of the national team and triathletes consume recommended amount of beverages, and only 10.0% of the respondents consume more than the recommended rate (from 600 to 1400 ml). It should be taken into account that 6.7% in each group of the investigators do not consume any beverages 2 hours before training at all (Figure 2).

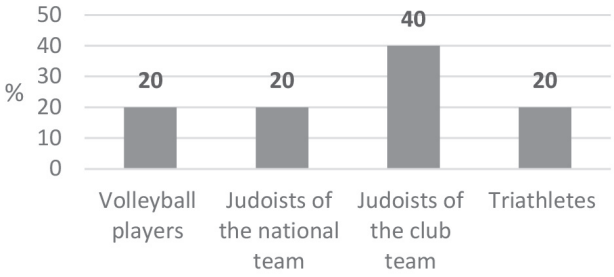

Figure 2. The percentage distribution of the athletes that consume 400-600 ml of drinks 2 hours before training

It is also important for athletes to consume enough water and drinks during the training. So while trainingathletes are recommended to consume 200-400 ml. of beverages every 15-20 minutes. Thus, during the 2 hourtraining, it is recommended to consume 700-1000 ml of beverages. Our research shows that water and other beverages consumption of investigated athletes mostly does not comply with the recommended standards. Thus, 13.3% of investigated athletes said that they do not consume anything during the training, 20.0% of investigates consume 200-400 ml, 30.0% of them consume 400-600 ml and 28.4% of investigated athletes consume 600-1000 ml and even more than that (Table 2).

Table 2. Water and other Beverages Consumption by Kazakhstani Athletes during Training

No	The amount of water and other beverages consumption during training	Volleyball players n=15	Judoists of the national team n=15	Judoists of the club team n=15	Triathletes n=15	$\overline{X}$
1	Do not consume anything at all	20	0	13.3	20.0	13.3
2	200-400 ml	6.7	26.7	26.7	20.0	20.0
3	400-600 ml	26.7	20.0	26.7	46.7	30.0
					χ^2 =3.933, p=0.97	
4	600-800 ml	26.7	20.0	6.7	13.3	16.7
5	800-1000 ml	20.0	26.7	0.0	0.0	11.7
6	1000-1400 ml	0.0	6.7	20.0	0.0	6.7
7	1400-1600 ml	0.0	0.0	6.7	6.7	1.6

Comparing the consumption of water and other beverages during the training among investigated athletes, we found out that the greatest number of triathletes (46.7%) consume 400-600 ml of beverages (x2=3.933, p=0.97). Italso should be noted that among the judoists of the national team of Kazakhstan 53.4% of athletes consume 600-1600 ml of liquid and 46.7% among volleyball players, whereas this amount of liquid among triathletes is taken only by 20.0% of the investigated athletes (Table 2).

Analyzing the data of liquid consumption after training we found out that the recommended rate of liquid consumption (400-800 ml.) is consumed only by 58.4% of the investigated athletes, and the volume exceeding noted standardis consumed by 15.0% of the investigated athletes while 26.6% of the investigates consume only 200-400 ml or do not consume any liquids after training at all (Table 3).

Table 3. Water and other Beverages Consumption by Kazakhstani Athletes after Training

No	The amount of water and other beverages consumption after the training	Volleyball players n=15	Judoists of the national team n=15	Judoists of the club team n=15	Triathletes n=15	$\overline{X}$
1	Do not consume anything at all	0.0	13.3	0.0	0.0	3.3
2	200-400 ml.	26.7	40.0	6.7	20.0	23.4
3	400-600 ml.	26.7	20.0	46.7	60.0	38.4
					χ^2 =10.667, p=0.08	
4	600-800 ml.	13.3	13.3	33.3	20.0	20.0
5	800-1000 ml.	20.0	13.3	6.7	0.0	10.0
6	1000-1400 ml.	0.0	0.0	0.0	0.0	0.0
7	1400-1600 ml.	13.3	0.0	6.7	0.0	5.0

During the research, it was also revealed that 70.0% of respondents mostly consume water and juices during training, 16.7% consume special sports drinks and 13.3% do not consume anything during the training at all (Figure 3).

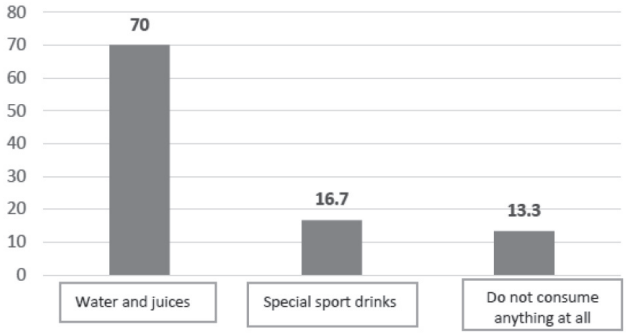

Figure 3. The percentage distribution of the athletes that consume different types of beverages

We also found out during the research the way Kazakhstan athletes control the body liquid balance, whether they weight themselves or not, and what weight loss is observed after training. The results showed that 86.7% of volleyball players and 10% of triathlonists do not weight themselves. On the contrary, 93.3% of judoists of the national team and the same number of judoists of the club team do it regularly. The largest amount of weight loss due to the loss of body liquids during the training which is up to 2.5 kg is observed of 28.6% of the judoists of high sportsmanship, and 57.1% of less trained judoists lose up to 1.5 kgof body weight.

Discussion

Optimal hydration of the body is of vital importance for humans. It has now been established that insufficient water consumption or moderate dehydration may cause the risk of developing chronic diseases (Gurevich, 2017).Water loss under moderate physical activity for 1 hour at temperature of 20-25˚ reaches 1-2 liters for the athletes with 70 kg body weight, 2-5% of body weight may be lost under physical activities due to endurance with sweat. 1% water loss causes thirst, 2-3% - reduced endurance and strength, 5% - a health disorder.

According to Vorobyova et al. (2011) in order to avoid the risk of dehydration and physical performance reduction, athletes are advised to use special drinks containing carbohydrates and electrolytes, which are more favorable for sports than consuming water, during training or competition and after them.

Our researches have shown that 41.67% of investigated Kazakhstani athletes consume 2-3 liters of water and beverages per day and 21.67% consume 3-4 liters. Similar results are received by other authors as well. For example, French scientists believe that judoists of their country, being the strongest in the world, consume 2.5-2.7 liters of water and other liquidper day (Filaire, Maso, Degoutte, Jouanel, & Lac, 2001; Degoutte & Filaire, 2003; Finaud et al., 2006). A smaller amount of water and liquids which is equal to1.4 liters is consumed by representatives of the sport as taekwondo in England (Fleming &Costarelli, 2007), and Brazilian athletes consume 1.6-2.0 liters (Rossi, Goya, Matayoshi, Pereira, & da

Silva, 2009). German runners consume 2.6-2.7 liters per day (Kemmler et al., 2006), and US runners –consume 2.7-2.8 liters per day (Barrak et al., 2010). Similar results were obtained by Martin, Lambeth and Scott (2006) during the research of English football players who consumed 2.4-2.5 liters, Ozdemir and Ersoy (2008) - Turkish weight lifters who consume 2.8-3.0 liters of water per day. According to Vasic and Jakonic (2008) the minimum amount of body liquid should be 1.5-2 liters. It is convincingly proved that there is no success in sports if the athlete has a proper hydration.

Casa et al. (2000) indicate that athletes should consume 400-600 ml of water 2 hours before the training, whereas according to our data only 20% of investigated Kazakhstan athletes consume such amount of water, and only 10% consume more than the recommended rate (from 600 to 1.400 ml).

Our research has shown that only 16.7% of investigated Kazakhstan athletes consume special sports drinks. Despite the fact that the advantages of sports drinks are obvious, the share of Kazakhstani athletes consuming them among the athlete dour research was taken from is comparatively small. Analysis of the types of liquid that Russian athletes use to quench their thirst conducted by Novakshanova and Ozhiganova (2013) showed that only 6% of Russian athletes regularly use sport drinks (rehydration) during sports. The overwhelming majority of the investigated people- 72% consume water for rehydration, 8% - fruit/vegetable juice, 14% prefer other drink (fermented milk, ice tea, water with ascorbic acid).

The Godek et al. (2010) data, which studied the volume of liquid consumption and sweating of football players of different sports skills, also witnesses in favor of sports drinks consumption. The authors found that the players of higher sportsmanship, consuming more sport drinks, the total liquid consumption and loss of sweat were smaller compared to less trained players which mainly consume water. Millard-Stafford et al. (2007) also believe that carbohydrate sport drinks saturated with caffeine support hydration, cardiovascular and thermoregulatory function.

It has been established that only 63.34% of the investigated Kazakhstan athletes consume the recommended norm (2-3 liters per day), another 6.69% of the investigated consume 3 to 6 liters of liquid. The investigated athletes do not consume enough liquid 2 hours before training. Only 20% of volleyball players, judoists and triathletes of national teams consume the recommended norm of liquid (400-600 ml). The majority of the investigated athletes (78.4%) consume the necessary amount of water and other drinks, reaching up to 1000 ml during training, 70.0% of investigated consume water and juices during training and only 16.7% consume sports drinks. The amount of liquid consumed by the investigated athletes is also insufficient after training. The recommended norm (400-800 ml) is consumed only by 58.4% investigators.15% of the investigated sportsmen consume the volume reaching up to 800-1600 ml.

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Conflict of Interest
The authors declare that there are no conflicts of interest.

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SportMont

ORIGINAL SCIENTIFIC PAPER

Latent Structure of the Morphological Characteristics and Motor Basic Abilities and Situational to Basketball Players 14-15 years

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Abstract

The purpose of this research is Latent Structure of the morphological characteristics and motor basic abilities and situational to basketball players 14-15 years. The sample was of 84 basketball players aged 14-15 who have followed the training process of basketball game. The variable samples are 23, 11 of them in morphological space, 8 tests in the area of basic motor character and 4 of them in situational motor of basketball game. In this research our experiment is extracted in two main components which explain 79.16% the general variance of the morphological system, from which are extracted two morphological elements, with this we confirmed the previous scientific knowledge that was enabled to use during the research more precisely in extracting the latent structure in the morphological area. While in the motor area are extracted three main components that explain together 63.60% the variance of the basic and situational motor system of which three factors are extracted.

Key words: *structure, morphological, motor basic and situational, basketball*

Introduction

Basketball is focused on the methodological approach of learning the highest level of the game as well as the rise of motor and specific movements. Some research studies have took on base the morphological characteristics and the motor space, which are specific indicators for the development of the next basketball player (Trninić, 1996; Petrov, 2011; Kryeziu & Asllani, 2016). The game of basketball is a complex activity and task requirements which are specific skills selected for each player, depending on his position in the team, which performs certain tasks in the game of basketball (Trninić, Karalejić, Jakovljević, & Jelaska, 2010). At the same time, morphological characteristics describe physical structure and influence the overall motor-functional and situation-related efficiency of a basketball player (Jeličić, 2006; Trninić, 2006).

The best trends in raising of basketball skills, the importance is to determine the structure factor according on tests of static force, flexibility, repetitive force, explosive force and balance. Based on numerous researches which are limited only on motor tests, it is noted that achieving success in basketball game along motor tests is needed to see off other segments of anthropological status of future players (Trninić et al., 2010; Kocić & Antonijević, 2013). Anthropological space is inportant atribute for definition of basketball structure in motor space, particulary in preparing of basketball players for basketball game for specific actions of the basketball game (Jukić, Milanović, &Vuleta, 2005).

The analyse of structural space on morphological characteristics, motor basic and situational testes typical of basketball game are specifically for each basketball player, because the dynamics and structure of basketball player, the development is unique in the morphological space as well as in the basic and situational motor. Characteristics of basketball players of this age treated in this research are related to the adolescence age. The present level of science knodwelege in

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this area is noticed that: motor dimensions in many researches appear in certain ways with different tasks.With application of factorial analysis are revealed more and more factors which prove the existence of many motor factors as they are: strength, speed, coordination, flexibility, etc and which has led to the question how many motor dimensions objectively exist and what is the ratio between them. We may say that this research will achieve valid and important results in some basic and morphological parameters, situational motor skills of new basketball players.

The purpose of this research is latent structure of the morphological characteristics and motor basic abilities and situational to basketball players 14–15 years.

Methods

Sample entities

This research consists active players (males) of age 14-15 years old who plays in cadet's league, some of them are incorporated from pioneer's league which will play in cadet's league beside Basketball Federation of Kosovo.

Total number of entities that are tested in this research is 84, which are divided in 7 teams with 12 players. Tested teams of Mitrovica Region are: Basketball Club BC "Mitrovica", Basketball Club BC "Trepça" from Mitrovica, and Basketball Club BC "Vushtrriabasket" from Vushtrri. While the Pristina Region are those teams: Basketball Club BC "Collage Universi", Basketball Club BC "Fatosat", Basketball Club BC "Albabasket", and Basketball Club BC "Probasket" all those clubs from Pristina.

Variable samples

Instruments for measuring morphological variables they have treated 11 variables. Whereas, motor space with situational motor are treated 8 tests motor into basic character, and 4 of typical situational motor of basketball game.

Morphological variables: 1.Body weight; 2. Body height; 3. Length of leg; 4. Foot length; 5. Foot width; 6. Arm circumference; 7. Thighs circumference; 8. Calf circumference; 9. Palm length; 10. Palm width with open fingers; 11. Arms length.

Basic motor and situational variables: 1. Jump high above the place; 2. Jump from the place with the step height; 3. Jump length from the place; 4. Speed running 20 m (higher start); 5. Throwing the medicin ball from the chest; 6. Profound warp (flexibility); 7. Abdominal muscles; 8. T-Agile test; 9. Ball dribble between cones (zig-zag); 10. Ball dribble and shooting in 30 sec; 11. Shooting for 2 points; 12. Free shooting.

Measuring instruments are applied-tested according to the authors (Blasković, 1982; Erčulj, 2005; Pojskić, Šeparović, & Užičanin, 2010; Bajgorić, Bilić, & Bonacin, 2013).

Statistical analysis

Data were processed with SPSS statistical software programine package version 21.0 for Windows, research latent structure of space that will be explored through factor analysis.

Results

In Table 1 are presented main characteristic roots (LAMBDA) as well as their partial and cumulative contribution to the clarification of the overall variability. Characteristic roots are listed by size and are 11 of them, but valuable only by Hotteling method and the criterion GK (Gutman-Kaiser). Two main components were extracted which together account for 79.16% of the overall variance of the morphological system. The first characteristic root of system explains 56.29% of general variance. Second characteristic root explains 22.87% of general variance.

Table 1. Key characteristics and explanatory parts of the common variance in the morphological area

Comp.	Total	% of Variance	Cumul. %	Total	% of Variance	Cumul. %	Total
1	6.193	56.298	56.298	6.193	56.298	56.298	5.502
2	2.516	22.871	79.169	2.516	22.871	79.169	4.474
3	.595	5.411	84.580				
4	.502	4.566	89.146				
5	.306	2.785	91.931				
6	.286	2.601	94.532				
7	.256	2.325	96.857				
8	.152	1.381	98.238				
9	.098	.887	99.126				
10	.066	.598	99.724				
11	.030	.276	100.000				

In Table 2 in the first component are designed with high values in all variables that give insight into the human morphological dimensions. Second component has high projections at AARMCI-Arm circumference .669, ATHICI-Thighs circumference .721 and ACALCI-Calf circumference .629 are indicative of body mass and capacity. The value of communality for all variables ranges from .55 to .95. Reliability for each variable depends on the size of the communality, respectively the uniqueness.

Table 3 on base of the parallel matrix projections we noticed that high projections in the first factor have realized variables: ABADHE-Body height .923, ALENGL-Length of leg .943, AFOOLE-Foot length .832, APALML-Palm length .893, APWOFI- Palm width with open fingers .747 and AARMLE-Arms length .908. Based on the projections in the first factor of variables, this factor can be named as: Longitudinal skeleton factor.

In the second factor the high projections have realized the

Table 2. Main components and communality

variable	1	2	H2
ABADWE	.843	.491	.953
ABADHE	.868	-.366	.887
ALENGL	.764	-.490	.823
AFOOLE	.779	-.333	.718
AFOOTW	.728	.139	.550
AARMCI	.568	.669	.771
ATHICI	.639	.721	.929
ACALCI	.696	.629	.881
APALML	.755	-.434	.758
APWOFI	.694	-.304	.575
AARMLE	.860	-.354	.866

Legend: ABADWE-Body weight; ABADHE-Body height; ALENGL-Length of leg; AFOOLE-Foot length; AFOOTW-Foot width; AARMCI-Arm circumference; ATHICI-Thighs circumference; ACALCI-Calf circumference; APALML-Palm length; APWOFI-Palm width with open fingers; AARMLE-Arms length

variables ABADWE-Body weight .867, AFOOTW-Foot width .472, AARMCI-Arm circumference .911, ATHICI-Thighs circumference .994, ACALCI-Calf circumference 932. Based on projections in second factor, this factor can be named as: Volume factor and body mass index.The matrix of the orthogonal projections of variables in the factor. The structure of this matrix does not differ much from the matrix of parallel projections.

Table 3. The matrix of parallel projections and orthogonal projections

variable	The matrix of parallel projections		The matrix of orthogonal projections	
	1	2	1	2
ABADWE	.234	.867	.547	.951
ABADHE	.923	.049	.941	.383
ALENGL	.943	-.118	.900	.222
AFOOLE	.832	.040	.846	.341
AFOOTW	.426	.472	.596	.626
AARMCI	-.107	.911	.222	.872
ATHICI	-.096	.994	.263	.960
ACALCI	.018	.932	.355	.938
APALML	.893	-.068	.868	.254
APWOFI	.747	.028	.758	.299
AARMLE	.908	.058	.929	.386

In Table 4 intercorrelations between factors, is realized important correlation between factor 1 longitudinal of the skeleton and factor 2 volume and body mass.

Table 4. Intercorrelations between factors

Comp.	Factor 1	Factor 2
Factor 1	1.000	
Factor 2	0.361	1.000

Legend: Factor 1. The longitudinal of the skeleton; Factor 2. Volume and body mass

In Table 5 are presented main matrix characteristics (LAMBDA) as well as their partial and cumulative contribution to clarify the general variability. The characteristic ranks are sorted by size and 12 matrix are obtained but valid according to the Hotteling method and GK criteria (Gutman-Kaiser), three main components have been extracted which together account for 63.60% of the variance of the entire motor and situational system. The first characteristic matrix of the system explains 42.512% of the overall variance. The second characteristic matrix explains 12.31% of the general variance. The third characteristic matrix explains 8.77% of the common variance of the motor and situational variables system.

Table 5. The main matrix characteristic of basic and motor variables and situational

Comp.	Total	% of Varaianca	Cumul. %	Total	% of Variance	Cumul. %	Total
1	5.101	42.512	42.512	5.101	42.512	42.512	5.043
2	1.478	12.314	54.826	1.478	12.314	54.826	1.833
3	1.053	8.776	63.602	1.053	8.776	63.602	1.089
4	.913	7.612	71.214				
5	.761	6.340	77.554				
6	.742	6.186	83.740				
7	.568	4.729	88.469				
8	.431	3.591	92.060				
9	.402	3.353	95.413				
10	.349	2.906	98.318				
11	.171	1.427	99.745				
12	.031	.255	100.000				

Table 6 shows the matrix of three-factor components as well as variability communality. The first component is designed with high values MJUHIP-Jump high above the place .855, MJUPSH- Jump from the place with the step height .868, MJULEP-Jump length from the place .792 and MTTEST-T-Agile test -847 which indicate the dimensions of the explosive and velocity force. While the other high values in this component are MMEDCH-Throwing the medicin ball from the chest .607, and MABDMU-Abdominal muscles .648 which provide knowledge of the explosive force of the hands and the abdominal muscle strength. From high-current situational motors are projected in the first and second component. In the first component is MBDBCZ-Ball dribble between cones (zig-zag) -.798 and MBDSHO-Ball dribble and shooting in 30 sec .509 whereas in the second component is MSHO2P-Shooting for 2 points .681 and MFRESH-Free shooting .763 all of them shows the speed with obstacles and accuracy of throwing in the basket. In the third component with the highest value was designed variable MPROAR-Profound warp (flexibility) .800 flexibility test. The value of communality for all variables ranges from .38 to .78. Reliability for each variable depends on the size of the communality, respectively the uniqueness.

Table 6. Main Components and communality

variable	1	2	3	H2
MJUHIP	.855	-.169	-.005	.760
MJUPSH	.868	-.180	-.005	.786
MJULEP	.792	-.228	.022	.680
MSRU20	-.660	.258	-.006	.502
MMEDCH	.607	.059	.107	.383
MPROAR	.218	-.247	.800	.748
MABDMU	.648	.043	-.447	.622
MTTEST	-.847	-.029	.074	.723
MBDBCZ	-.798	-.117	-.157	.676
MBDSHO	.509	.413	-.140	.449
MSHO2P	.125	.681	.390	.632
MFRESH	.298	.763	-.012	.672

Legend: MJUHIP-Jump high above the place; MJUPSH- Jump from the place with the step height; MJULEP-Jump length from the place; MSRU20-Speed running 20 m (higher start); MMEDCH-Throwing the medicin ball from the chest; MPROAR-Profound warp (flexibility); MABDMU-Abdominal muscles; MTTEST-T-Agile test; MBDBCZ-Ball dribble betweencones (zig-zag); MBDSHO-Ball dribble and shooting in 30 sec; MSHO2P-Shooting for 2 points; MFRESH-Free shooting

Table 7 on base of first matrix factor of parallel projections there are projected high-value variables which are expressing the explosive force of feet and hands, repetitive force, agility, and speed running with cofactors .561-.897, based on this projections this cofactor can be named as: propulsion factor of lower and upper extremities, repetitive force, agility.

In second factor of projections with higher values they have realized: Ball dribble and shoot on basket 30 sec, shoot for two points, and free shooting with cofactor .429-.790 this factor can be named as: the accuracy factor of throwing in the basket. The third high projection factor has achieved a single factor (Folding of the trunk before sitting), with cofactor 837. This factor can be named as: factor of body flexibility.Showen the matrix of orthogonal projections of factor variables. The structure of this matrix does not change from matrix of parallel projections.

Table 7. Matrix of parallel projections and orthogonal projections

variable	Matrix of parallel projections			Matrix of orthogonal projections		
	1	2	3	1	2	3
MJUHIP	.881	-.055	.035	.869	.118	.016
MJUPSH	.897	-.064	.038	.883	.112	.019
MJULEP	.837	-.113	.075	.813	.049	.061
MSRU20	-.720	.164	-.066	-.686	.025	-.058
MMEDCH	.561	.166	.092	.591	.272	.069
MPROAR	.240	.013	.837	.222	.011	.830
MABDMU	.641	-.001	-.444	.652	.154	-.460
MTTEST	-.813	-.117	.076	-.838	-.283	.104
MBDBCZ	-.724	-.262	-.130	-.773	-.398	-.096
MBDSHO	.367	.429	-.228	.458	.516	-.262
MSHO2P	-.123	.790	.229	.028	.751	.185
MFRESH	.043	.778	-.182	.203	.798	-.230

In Table 8 the matrix intercorrelation of the moving factors it seems there is no significant correlation between them, and the factors between them are independent of each other.

Table 8. Correlations between factors

Comp.	Factor 1	Factor 2	Factor 3
Factor 1	1.000		
Factor 2	.199	1.000	
Factor 3	-.025	-.060	1.000

Legend: Factor 1. Propulsion factor of lower and upper extremities, repetitive force, agility; Factor 2. The accuracy factor of throwing in the basket; Factor 3. Factor of body flexibility

Discussion

In this modest research is treated sample of basketball players which were evaluated in morphological characteristics, basic motor typical tests of basketball game. In the current research, in general, the same factors are extracted into the latent space. If we look at the research papers with research character in morphological characteristics we may see that some researches with search character we may compare them with our research paper. At the longitudinal factor of the skeleton, the other authors have reached to introduce into the latent space (Aruković, 2013) to Bosnian basketball players he has also extracted the same factor. In others authors researches (Hadzic et al., 2016), have had to paper-experiment with title analysis of morphological structure characteristics on new basketball players, in which they extracted the same factor as our research, in which they are determined for the longitudinal skeletal factor. Also the Croatian authors have extracted the same longitudinal skeleton factor (Trninić, Jeličić, & Foretić, 2013). Other morphological latent dimensions are presented by authors (Šišić, Krespi, & Pojskić, 2015) to Bosnian basketball players in which factor was extracted as the volume and body mass factor with 37% of the high correlation variance. In this area he applied the program to students on characteristics of basketball players in the factorial space in which the same factor was extracted with the authors from Bosnia and Herzegovina (Korjenić, Jelčić, Vučić, Elkaz, & Varešlija, 2013). The basketball game takes place to win the game, respectively to achieve the most successful points in the basket because accuracy as a skill engine is sensible, but as a goal we also got to work-experiment authors (Daskalovski & Naumovski, 2011) so in their work is extracted as the second factor the accuracy factor of the throw in the basket. The same factor of the typical accuracy of the basketball game is also extracted by the author (Kryeziu, 2016), the content of this factor suggests that a latent specific dimension type of basketball game, dealing with a latent specific dimension in the successful realization of the accuracy of the dribble and throw-in technique, the shot for two points from half-distance and free-throw for one point. Tests of propulsion forces of lower and upper extremities, of repetitive force and agility authors (Jukić et al., 2005) have had to do the work-experiment determining the latent structure of characteristics the process of preparation of basketball players in which are the main skills of basketball player in extracted factors in the latent space and which are typical actions during the basketball game, by which is extracted the factor of the propulsion force of the lower and upper extremities, the repetitive force, and the agility. Also in other researches we have the same factors presented as we have the case with the author (Šabotić, 2013), in this case it is suggested that the basketball game performance will be a good influence on the development of specific motor skills of basketball players. The other motor test was taken for study by the authors (Jukić et al., 2005) in which they had for the paper-experiment the determination of latent structure, the characteristics of preparation process of basketball players, the flexibility tests had static and dynamic space, in this case has extracted the body's flexibility factor as in our research. Also the authors (Kocić & Antonijević, 2013) has had to paper-experiment the structure of motor skills in basketball game in which it has extracted the factor in the latent space. The resulting results may have an excuse or methodological approach applied to the latent structure research on morphological characteristics and the basic and typical situational motor testing of the basketball game, in particular we have a review of basketball players.

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Conflict of Interest
The authors declare that there are no conflicts of interest.

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SportMont

ORIGINAL SCIENTIFIC PAPER

Relationship between Foot Length Measurements and Body Height: A Prospective Regional Study among Adolescents in Central Region of Kosovo

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Abstract

The research purpose is to examine standing height in association with foot length in both Kosovan genders in the Central Region, as an alternative to estimating standing height. A 193 individuals (100 male and 93 female) were examined. The anthropometric measurements were taken according to the protocol of ISAK. Body height and foot length relationships were determined using simple correlation coefficients at a ninety-five percent confidence interval. A comparison of means of standing height and foot length between genders was performed using a t-test. After that a linear regression analysis were carried out to examine extent to which foot length can reliably predict standing height. Results displayed that Central Kosovan male are 180.32±5.88 cm tall and have a foot length of 26.41±1.09 cm, while female are 166.77±4.72 cm tall with a foot length of 23.61±0.92 cm. The results have shown that both genders made Central-Kosovans a tall group, taller that general Kosovan population. Moreover, the foot length reliably predicts standing height in both genders; but, not reliably enough as arm span. This study also confirms the necessity for developing separate height models for each region in Kosovo as the results from Central-Kosovans don't correspond to the general values.

Key words: *prediction, measurement, stature, foot length, Kosovan*

Introduction

According to Komunat e Kosovës (2013), Kosovo is a democratic, multi-ethnic and secular republic which administratively is subdivided into seven districts (Ferizaj, Gjakova, Gjilan, Mitrovica, Peja, Pristina and Prizren) and five regions (Eastern, Western, Northern, Southern and Central). This study analyzes the standing height and its estimation utilizing foot length measurements in adolescents in central region which contains eight municipalities (Glogovac/Drenas, Gračanica, Kosovo Polje/FushëKosovë, Lipljan, Novo Brdo, Obilic, Podujevo and Pristina). This region (Figure 1) covers the area of 2,470 square kilometers and has population of 477,312 inhabitants, while average density per square kilometer is 233 inhabitants (Komunat e Kosovës, 2013). Although Kosovo doesn't have too big territory, it has a very varied relief that mostly belongs to Dinarides range and the author assumed this fact might influence the main objective of this study, because of the type of the soil as well as other socio-economical and geographical characteristics as a potential influencing factors (Arifi, 2017; Arifi, Sermaxhaj, Zejnullahu-Raçi, Alaj, & Metaj, 2017b).

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Figure 1. Geographical Location of Central Region in Kosovo

There are lots of scientific findings which confirms that the measurement of standing height is a vitally important variable when assessing nutritional status (cited in Arifi et al., 2017a; Datta Banik, 2011; Popovic & Bjelica, 2016), as well as when assessing the growth of children, evaluating the basic energy requirements, adjusting the measures of physical capacity and predicting the drug dosage and setting standards of physiological variables such as muscle strength, metabolic rate, lung volumes and glomerular filtration (Golshan, Amra, & Hoghogi, 2003; M. Golshan, Crapo, Amra, Jensen, & R. Golshan, 2007; Mohanty, Babu, & Nair, 2001; Ter Goon, Toriola, Musa, & Akusu, 2011). However, according to Quanjer and his collaborators (2014), the exact standing height cannot always be identified and resolved in the usual way (e.g. paralysis, fractures, amputation, scoliosis and pain). Because of these factors, an estimate of standing height has to be acquired from other reliable anthropometric indicators such as hand and foot lengths, knee height, length of the forearm, length of the sternum, vertebral column length, sitting height, length of scapula, arm span as well as cranial sutures, skull, facial measurements et cetera (cited in Gardasevic, Rasidagic, Krivokapic, Corluka, & Bjelica, 2017; Popovic, 2017; Masanovic, 2017; Masanovic, Gardasevic, & Arifi, 2018a; Masanovic, Gardasevic, & Arifi, 2018b). Therefore, all these anthropometric indicators, which are used as an alternative to estimate standing height, are very important in predicting loss in standing height connected with aging. Also, to diagnose individuals with disproportionate growth abnormalities and skeletal dysplasia or standing height loss during surgical procedures on the spine (Mohanty et al., 2001), as well as to anticipate standing height in many older people as it is very difficult to measure it precisely, and sometimes impossible because of mobility problems and kyphosis (Hickson, & Frost, 2003). Lastly, it is important to state that this knowledge finds its importance in sport science the standing height represents a significant factor which influences the success in various sport disciplines (Popovic, 2017).

Several researches have reported the benefit of using various body parameters in predicting standing height, and arm span happened to be one of the most reliable ones in adults (Hickson & Frost, 2003; Jalzem & Gledhill, 1993; Mohanty et al., 2001; Ter Goon et al., 2011), while foot length measurement is the most reliable predictor during adolescent age, due to the fact that ossification and maturation occurs earlier in the foot than the long bones and standing height could be more accurately predicted from foot measurement as compared to long bones during adolescent age (cited in Singh, Kumar, Chavali, & Harish, 2012). In addition, the relationship of long bones and standing height was found to vary in different ethnic and racial groups (Bjelica, Popovic, Kezunovic, Petkovic, Jurak, & Grasgruber, 2012; Brown, Feng, & Knapp, 2002; Popovic, Bjelica, Georgiev, Krivokapic, & Milasinovic, 2016; Popovic, Bjelica, Molnar, Jaksic, & Akpinar, 2013; Popovic, Bjelica, Tanase, & Milasinovic, 2015; Reeves, Varakamin, & Henry, 1996; Steele & Chenier, 1990) as well as various regions (Arifi, 2017; Arifi et al., 2017b; Milasinovic, Popovic, Matic, Gardasevic, & Bjelica, 2016; Milasinovic, Popovic, Jaksic, Vasiljevic, & Bjelica, 2016; Masanovic, Gardasevic, & Arifi, 2018c). Hence, researchers have derived a specific formula for calculating standing height from long bones for each ethnic/race group. The mentioned variations might be the case with foot length predictions too, mostly due to the fact that the Dinaric Alps population has specific body composition than national as well as regional point of view (Popovic, 2017). Even though many studies with this essence are available on neighboring countries as well as worldwide population, only narrow data is available on Kosovan subjects, just one conducted by Popovic and his collaborators (Popovic, Arifi, & Bjelica, 2017a; Popovic & Bjelica, 2017) that has covered whole Kosovan population, and one regional analyses that confirmed Western-Kosovans have specific standing height/foot length ratio, comparing to general population in Kosovo (Popovic, Gardasevic, Masanovic, Arifi, & Bjelica, 2017b). Considering rather sparse recent scientific literature, the purpose of this research was to examine the standing height in both Central-Kosovan genders and its association with foot length.

Methods

The nature of this research gave extension to the 193 high-school students last year (100 male and 93 female) from Central Region of Kosovo to be subjects. Two reasons which qualified the selected individuals are: the first is related to the fact that the growth of an individual ceases by this age, while the second is related to the fact that there is no age-related loss in standing height at this age. The average age of the male subject was 18.26±0.44 years old (range 18-19 years), while the average age of the female subject was 18.15±0.36 years old (range 18-19 years). It is important to underline that the researchers have excluded from the data analysis of the individuals with physical deformities as well as those without informed consent. The exclusion criterion was also being non-Central Kosovan.

The anthropometric measurements, including standing height and foot length, were taken according to the protocol of the International Society for the Advancement of Kinanthropometry (Marfell-Jones, Olds, Stew, & Carter, 2006). The trained measurers have measured selected anthropometric indicators (same measurer for each indicator), while the quality of their performance was evaluated against the prescribed "ISAK Manual". Lastly, the age of the each subject was reached directly from the birthdays.

The analysis were performed by using the Statistical Package for Social Sciences (SPSS) version 23.0. Means and standard deviations (SD) were obtained for both anthropometric variables. A comparison of means of standing height and foot length between genders was performed using a t-test. The relationships between standing height and foot length were determined using simple correlation coefficients at ninety-five percent confidence interval. Then a linear regression analysis were carried out to examine the extent to which the foot length can reliably predict standing height. Statistical significance was set at $p<0.05$.

Results

A summary of the anthropometric measurements in both genders is shown in Table 1. The mean of the standing height for male was 180.32±5.88 centimeters and foot length was 26.41±1.09 centimeters, while for female the standing height was 166.77±4.72 centimeters and foot length was 23.61±0.92 centimeters. The sex difference between standing height and foot length measurements was statistically significant (standing height: t=17.955; p<.000, and foot length: t=19.259; p<.000).

Table 1. Anthropometric Measurements of the Study Subjects

Subjects	Body Height Range (Mean±SD)	Foot Length Range (Mean±SD)
Male	170.3-198.8 (180.32±5.88)	24.20-29.20 (26.41±1.09)
Female	157.3-185.0 (166.77±4.72)	21.70-26.50 (23.61±0.92)

In Table 2, the simple correlation coefficients and their ninety-five percent confidence interval analysis between the anthropometric measurements are displayed. The associations between standing height and foot length were significant ($p<0.000$) and high in this sample, regardless of gender (male: 0.709; female: 0.641).

Table 2. Correlation between Body Height and Foot Length of the Study Subjects

Subjects	Correlation Coefficient	95% confidence interval	Significance p-value
Male	0.709	0.603–0.904	<0.000
Female	0.641	0.481–0.801	<0.000

The results of the linear regression analysis are shown in Table 3. The first of all models were extracted by including age as a covariate. However, it was found that the contribution of age was insignificant and therefore the age was dropped and estimations were derived as a univariate analysis. The high values of the regression coefficient (male: 0.709; female: 0.641) signify that foot length notably predicts standing height in both Central-Kosovan genders (male: t=9.94, $p<0.000$; female: t=7.96, $p<0.000$), which confirms the R-square (%) for the male (50.2) as well as for the female (41.0).

Table 3. Results of Linear Regression Analysis Where the Foot Length Predicts the Body Height

Subjects	Regression Coefficient	Standard Error (SE)	R-square (%)	t-value	p-value
Male	0.709	4.174	50.2	9.94	0.000
Female	0.641	3.641	41.0	7.96	0.000

The associations between foot length measurements and body height among the above models is sketched as a scatter diagrams (Figure 2).

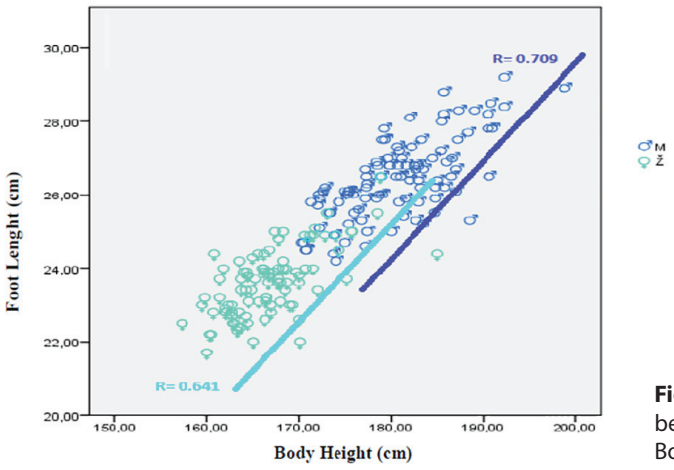

Figure 2. Scatter Diagram and Relationship between Foot Length Measurements and Body Height among Both Genders

Discussion

The assessment of standing height using various anthropometric measures is very typical from the past centuries and it has been attempted to be studied by many researchers. However, it is important to underline that the arm span has been obtained as the most reliable body indicator for predicting the standing height of an individual (Mohanty et al., 2001; Ter Goon et al., 2011), while foot length is was very close (Kanchan et al., 2008; Singh et al., 2012; Uhrova et al., 2015). In parallel, it is important to emphasize that the individual and ethnic variations referring to standing height and its association with foot length might vary from ethnic group to ethnic group as well as race to race, because the racial and ethnic differences are affective on these measures and reduce the possibility of generalizing (cited in Bjelica et al., 2012). This fact confirms the study conducted by Chinese authors (Cheng et al., 1998) who confirmed a very high linear correlation between standing height and foot length in both genders, as well as in another study which confirmed that foot length can explain up to 77% variations in standing height (cited in Uhrova et al., 2015), while the research study conducted by Uhrova and her collaborators (Uhrova et al., 2015) shows significant correlation between standing height and all measure anthropometric parameters in both genders of Slovak population. The highest correlation coefficient in this population was found for foot length in males (r=0.71) as well as in females (r=0.63).

All above-mentioned have confirmed the necessity for developing separate standing height models for each population on account of ethnic differences and the recent study conducted by Popovic and his collaborators (Popovic et al., 2017a; Popovic & Bjelica, 2017) who have analyzed the entire Kosovan population and have found specific correlation coefficient in Kosovan male (r=0.669) and female (r=0.625) population; however, some recent studies have also confirmed the regional differences between the same ethnic groups too (Arifi, 2017; Arifi et al., 2017b; Popovic et al., 2017b; Milasinovic et al., 2016a; 2016b), which caused the need for additional caution, mostly due to the reason one of them was sampled by Western-Kosovans. Therefore, the main goal of this research was to test the hypothesis if above-mentioned facts are true for the Central-Kosovans, that is, for the one of five Kosovan regions. Hence, in the present research it was remarked that the foot length/standing height ratio in Central-Kosovan male is bigger (male: 50.2%; female: 41.0%) comparing to entire Kosovan (male: 44.3%; female: 38.6%) and Western-Kosovans (male: 40.2%; female: 39.4%), while it is still lesser than other available population that estimate over 70% each and more in male population, while female population is much more in parallel to previously measured populations.. As the correlation between foot length and standing height was significant in both Central-Kosovan genders, the foot length measure therefore seems to be a reliable indirect anthropometric indicator for estimating standing height in both genders of Central-Kosovan population. Even though these relations are similar, the estimation equations, which are obtained in the Central-Kosovans, considerably differ from entire Kosovans, Western-Kosovans and other available populations.

The results of the study conducted by Popovic and his collaborators (Popovic et al., 2017a; Popovic & Bjelica, 2017) confirm the necessity for developing separate standing height models for both genders in Kosovo but the authors of the same study have recommended that further studies should consider dividing the population of this country to regional subsamples and analyze it separately, just to be sure there are no geographical differences (such as type of the soil) influencing the average standing height in both Kosovan genders as well as its association with foot length. This concern was based on the fact that entire Kosovo doesn't fall into Dinaric Alps racial classification. In parallel, this study confirms the assumption mentioned above and also confirms that it is necessary to develop separate standing height models for each population on account of regional variations in Kosovo.

Next to highlighted issue, the obvious constraint of this research might also be the composition of the measured sample that consisted of high school students. This limitation is based on the fact there are some studies which assumed the growth of an individual doesn't cease by this age (Grasgruber, P., personal communication, 2016; Jurak, G., personal communication, 2017). This assumption might be supported by the fact that university-educated individuals have been founded to be taller than the high school population in Bosnia and Herzegovina (Grasgruber et al., 2017; Gardasevic et al., 2017), Poland (Wronka & Pawlinska-Chmara, 2009) and Hungary (Szollosi, 1998). On the other hand, this wasn't the truth in Montenegro (Popovic, 2016) and comparing the average standing height measures of this study to the results of some study sampled by university students might give the science much precise conclusions. One more obvious limitation of this study is also the fact that both genders of Kosovo did not reach their full genetic potential yet, since various environmental factors controlled their development. Further continuous monitoring is necessary, mostly due to the reason it is expected the secular changes influencing standing height will ascend in the following two or three decades.

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Conflict of Interest
The authors declare that there are no conflicts of interest.

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SportMont

ORIGINAL SCIENTIFIC PAPER

Differences in Repetitive Strength and Strength of Kicking a Ball between Soccer Players U14 and Children who are not Involved in Soccer

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Abstract

The research is conducted with the aim of setting out the differences in repetitive strength of legs, torso, hands and shoulder girdle and strength of kicking a ball between soccer players U14 and children who are not involved in soccer. The sample consists of two groups of respondents. The first subsample group was comprised of 20 respondents of chronological age between 12.50±0.43 who were actively involved in training process at soccer team Stars, and the other subsample included 20 respodents of chronological age between 12.50±0.62 involved in system of Physical Education but who were not involved in training process of other sport branches. Canonical Discriminant Analysis within set of four motoric variables is used to determine the basic difference between groups and the contribution of each variable taken individually in overall discrimination groups. The sample of respondents who train soccer achieved better results in all applied tests. All tests showed statistical significance in discrimination of groups other than the test for assessing the strength of kicking a ball which is at the very margin of significance.

Key words: *repetitive strength, strength of kicking a ball, differences, children*

Introduction

The achievement of notable results in sports activities is conditioned by quality fitness preparedness, and the strength segment is certainly one of the most important. The dynamic strength, or the ability to develop muscular forces that enable the repetition of some simple movements related to lifting or shifting the weight of a load or body, or the ability to repeat the movement of the load or body, by overcoming resistance by isotonic muscle contractions is called repetitive strength (Nićin, 2000). Developing repetitive strength up to an optimum level makes adopting a wide array of technical-tactical elements and application of acquired skills and habits in a soccer game easier and of better quality. Determination of the initial condition for a more successful planning and programming of further training is significant for the development of repetitive strength in soccer (term endurance in strength is used in practice and literature). During the training process, current measurements are also important to give us information on whether the development takes place in the desired direction and the final measurements inform us about the level of ability that we have achieved through the training process.

A high-quality level of development of all strength segments is one of the basic preconditions for a successful realization of different demands of a soccer game. Repetitive strength is important for successful performance of all elements of a soccer game, primarily in securing a stable position of the standing leg, which allows manipulation of the ball with the other leg, then in passing the ball, receiving the ball, hitting the ball, dribbling and feinting, in jumps and hitting the ball with the head, change in direction of movement, in a duel game, as well as in creation of a kinetic chain of the swinging leg as a prerequisite for a stronger and more precise impact, i.e. in carrying out all technical-tactical elements of a soccer game with or without a ball, to a lesser or greater extent. The coefficient of inertia of repetitive strength is

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about 0.50, which indicates that it can be significantly influenced through training (Dž. Idrizović & K. Idrizović, 2001).

Physical fitness training should include situations arising from the soccer game itself (Bangsbo, 1994). This approach gives fitness training clear goals and we assume that the best training is situational training, the one most similar to the situation in the game. With modern soccer, more attention should be paid to training of the speed of action that resembles specific situations in the game (Bangsbo, 1994).

In this study, a segment of basic (repetitive strength) and specific motor functions (strength of kicking a ball) was examined. The entire motor space can be divided, according to the intensity and quality of the manifestation capability, into basic and specific. Basic motor skills are those that most people possess, and specific ones are created and developed through specific means, which is most common among athletes. Basic motor skills are the basis in every motor learning and represent the elementary value in the total area of human motoring. Specific motor skills are acquired and conditioned by the specificity of the training process of the sports branch (Bala, 2003). Specific motor functions include capabilities that directly affect the sporting result, since their structure, character and intensity of load are very close to the activities performed in competitions and show the biggest connection with the achieved sporting success (Malacko & Radjo, 2004). Systematic training can significantly influence the development of specific physical abilities of fourteen-year-olds, permanently settled in the Mediterranean part of Montenegro (Bjelica, 2006). Research work found out that sprint and technical skills are the most discriminating variables for boys aged U-13 and U-14, while cardiorespiratory endurance is an important feature of boys aged U-15 and U-16 (Vaeyens et al., 2006). On the sample of 120 soccer players of cadet age, significant statistical differences in the strength of kicking a ball have been obtained after the preparatory period of six weeks (Gardasevic, Bjelica, & Vasiljevic, 2017), while the sample of 122 respondents showed statistically significant differences between athletes and non-athletes (Kvesić, Brekalo, Crnjac, Katanić, & Risteski, 2016).

Repetitive strength is in great positive correlation with precision (Rakočević, 1997). There is a high positive relationship between repetitive strength and speed and coordination, and especially with static strength, because they are regulated by the same mechanism in the CNS - the mechanism for regulating the duration of excitation (Kurelić et al., 1975).

This study aims to check the existence of difference between two groups of respondents in test segments of basic motor function estimation, within which the repetitive strength is assesed and the test for assesment of specific ability in soccer - the strength of kicking a ball. The aim of the study is to determine the differences between groups of respondents in the area of measured capabilities. In the difference analysis segment, the author is particularly interested in which variables contribute to the discrimination among the groups the most, and whether the training process or systematic training is responsible for the possible better development of measured potential of respondents belonging to the group of soccer players.

Methods

In terms of time determination, this research is of transversal character, and consists of one-time measurement of the corresponding indicators of basic-motor and specific skills of U14 soccer players. Regarding the degree of control, this scientific research belongs to the category of field research carried out in natural living conditions (Bala, 2007).

The sample of respondents who underwent research was derived from a male population of chronological aged between 12.50±0.62 for those attending physical education classes and 12.50±0.43 for respondents who train soccer, residing mainly in the city center of Niksic municipality. Respondents began testing on a voluntary basis with the consent of their parents since they are minors. For the purpose of informing, the purpose of the research as well as its significance were previously explained to both groups of respondents. Bearing in mind that according to the criterion of time determination this research is of transversal character, there was no significant drop out of the sample of respondents. The sample of respondents was divided into two groups according to the criteria for attending regular classes of physical education or additional training in the form of soccer training. The first sample consists of 20 boys who are actively involved in the training process in Soccer club Stars, and the second sample consists of 20 boys who are involved only in the process of physical education.

The group of respondents training soccer has been in the training process for 5 years±6 months and has competed during two seasons in the selection of younger pioneers and pioneers at the republic level, in addition to attending physical education classes like the first group. During the weekly microcycle, they have three training units for a duration of 60 to 90 minutes, as well as a match for the duration of 60 minutes. The group of respondents not involved in the training process of any sports branch is involved in the physical education within the national programme, 3 times a week for 45 minutes. Within this research, the following measurement instruments were used: for estimating the repetitive strength of the arm and shoulder belt - Ground push-ups, for estimating the repetitive strength of the trunk - Lifting the trunk while lying on the back, for estimating the repetitive strength of legs - Squatts with a load of 10 kg and for evaluation of the strength of kicking a ball.

All tests were carried out in a gym, except for the test for estimating the strength of kicking a ball, which was realized at a soccer field. Tests were carried out by a team of surveyors made up of researchers and two meters, who are graduated professors of physical education. Previously, the meters specifically examined the standardization of the measuring instruments and were prepared for testing.Testing was done in the morning from 9 am to 11 am. Tests were performed so that the previous test did not adversely affect the results in the next test, and the respondents had enough time to recover between tests. On the first day of testing, the abilities of the repetitive strength of legs were tested (Squatts with a load of 10 kg) as well as the repetitive strength of the arm and shoulder belt (Ground push-ups) for both groups of respondents. On the second day, the abilities of the repetitive strength of the trunk (Lifting the trunk while lying on the back) were assessed as well as the test of the strength of kicking a ball.

The obtained survey data were processed using descriptive and comparative statistics. Arithmetic mean, standard deviation (Std.D.), standard arithmetic mean errors (Std.E.), minimum (MIN) and maximum MAX) result were all conducted within the descriptive statistics. When it comes to comparative statistics, a canonical discriminatory analysis was applied in order to obtain an image of the general difference between the groups of respondents and the individual contribution of each variable in general discrimination (the structure of the discriminatory function).

Results

Based on the shown quantitative values of the central and dispersive statistics for both samples of respondents, it is noted that the average values of results in all tests are greater for respondents who train soccer, whose minimal and especially maximum test results are significantly higher than children who do not train soccer (Table 1).

Table 1. Central and dispersive statistics of respondents who train soccer and who do not train

variable	sample	Mean± Std.D.	Std.E.	min	max
Ground push-ups (freq.)	A	8.4±2.7	0.6	5	15
	B	6.1±3.7	0.8	1	15
Lifting trunk while lying on back (freq.)	A	39.8±7.6	1.7	28	54
	B	22.3±9.3	2.0	6	42
Squatts with load of 10 kg (freq.)	A	61.7±22.3	4.9	30	110
	B	27.8±6.3	1.4	18	40
Strenght of kicking a ball (0.1 m)	A	27.1±4.1	0.9	20	34
	B	19.9±3.8	0.8	14	28

Legend: A - respondents involved in training process at soccer team Stars; B - respodents involved in system of Physical Education

The obtained results were further processed by Canonical Discriminant Analysis (Table 2), where a discriminating function was obtained with a significantly large canonical correlation coefficient (Rc=0.86). The applied method provides an overview of the general difference between the sample of respondents in the applied system of variables. In addition, the individual contribution of each variable in general discrimination of groups (the structure of a discriminative function) was calculated (Table 3).

Table 2. Results of canonical discriminatory analysis

Canonical correlation (Rc)	Wilks' Lambda (λ)	Chi-square (χ^2)	Sig.
0.86	0.32	67.80	0.00

The results in Table 2 indicate that the discriminatory strength of tests, shown by the Wilks'-Lambda test, is high (0.32), indicating that the differences between the respondents are statistically significant (Sig.=0.00). The canonical correlation coefficient (Rc) indicates that the significance of the canonical function, i.e. the discriminativeness of the function, is explained with 86%. The explained coefficient of correlation on the whole set of tests has a high value (Chi-square=67.80).

The results of the structure of the discriminative function show that the greatest contribution to the discriminative function are tests for the assessment of basic-motor abilities, in this case the specific repetitive strength of the muscle groups of the arm and shoulder belt, trunk and leg muscles, while the strenght of kicking a ball has not shown significant contribution to the discriminatory function (Table 3).

Table 3. Structure of discriminative function

Variable	DF 1
Ground push-ups (freq.)	0.47
Lifting trunk into sitting position (freq.)	0.39
Squatts with load of 10 kg (freq.)	0.34
Strenght of kicking a ball (0.1m)	0.28

Discussion

Based on the results shown, we can conclude that the obtained discriminatory factor (function) is statistically significant for the discrimination of groups of respondents in the area of applied variables (Sig.=0.00), which is also based on a very high coefficient of canonical correlation (Rc=0.86). The results of the arithmetic mean of the analyzed variables show that the sample of respondents who train soccer achieved better results in all applied tests. All tests showed statistical significance in discrimination of groups other than the test for assessing the strength of kicking a ball which is at the very margin of significance (0.28).

In variables for estimation of the repetitive strength of the arm and shoulder belt, the achieved difference is statistically significant, which indicates that this group of muscles is not neglected in the training process regardless of the specificity of the soccer game. We assume that the content structure of the training process in Soccer club Stars consists of strength programmes aimed at the optimal development of all major muscular regions in order to balance them.

The sample of respondents who train soccer achieved better results in the muscle strength test of the abdominal wall. This can be explained by the significant role of the muscular region of the abdominal wall for the successful performance of technical elements in soccer. In relation to the obtained test results that measure the repetitive strength of the abdominal region of muscles, it is possible to assume that the difference between the groups in this variable is due to the training stimuli aimed at strengthening this muscular region as well as the impact of the stimulus of an intense soccer game.

The test for assessment of the repetitive strength of leg muscles is also a significant discriminator of the group of respondents. Children who train soccer have achieved statistically better results in this variable as well. The results obtained in this test can be said to be expected due to the reason of the dominance of the muscular region of the lower extremities in the

realization of the movement tasks of a soccer game (passing the ball, kicking the ball, sprinting and changing running direction, dueling, jumping ...), which lead to a certain degree of hypertrophy of the current musculature. Such an affect certainly leads to a significant increase in strength as a motor skill, thus the conclusion that this was reflected in the better results of the respondents belonging to the group of soccer players. The poorer results of respondents who attend physical education classes can be interpreted as inadequate teaching, low frequency of classes, avoiding classes as well as a number of other disturbing factors.

The test for the assessment of the strength of kicking a ball lacked statistical significance in the difference between the groups, although it was at the very margin of significance with a coefficient of 0.28. If we take a look at the arithmetic mean, as well as the minimum and maximum result of both groups of respondents, it is undisputed that boys who train soccer have achieved better results, but this did not lead to achieving statistical significance. An important condition for achieving good results in this test is the relation of explosive strength and soccer technique, which were not the subject of this study, where an explanation should be sought for the lack of statistically significant differences among the groups of respondents.

The mentioned differences between respondents in favour of soccer players can be attributed to the transformative processes of the training process. The assumption is that the training process decisively influenced the capabilities that defined the researched area and raised them to a higher level in the group of soccer players. The age of respondents is marked as a sensitive period for development of general endurance and dynamic strength endurance (Krsmanović, 1999; Nićin, 2000), and it is therefore assumed that the training process influenced the achieved differences in tested capabilities, through various movements, in favour of the respondents who train soccer. Study results of motor-functional abilities of children who are not engaged in sports activities and children who train soccer (Molnar, 1998) show a prominent difference in the level of repetitive strength in favour of children who train soccer. Successful players have better results in strength tests, flexibility, speed, aerobic endurance, anaerobic capacity and several technical skills than those less successful (Vaeyens et al., 2006). It has also been proven that differences in basic motor skills are in favour of boys attending a soccer school (Radosav et al., 2003). On the sample of 120 soccer players of cadet age, significant statistical differences in the strength of kicking a ball have been obtained after the preparatory period of six weeks, thus from this aspect I can ascertain the expected differences between soccer players and children who are not engaged in sports in the tests for the assessment of repetitive strength (Gardasevic, Bjelica, Vasiljevic, & Milasinovic 2016). On a sample of 122 respondents, statistically significant differences were found between athletes and non-athletes in basic motor functions assessment tests (throwing medicine ball, long jump, high jump, plank, sprint at 100m, side-shifts, running with changing direction, and running at 400m), while the differences were not achieved in anthropometric variables (body height and body weight) and in flexibility assessment tests (Kvesić et al., 2016).

More broadly speaking, children's health is much better when they are involved in sports, and parents also evaluate the health of their children as much better. Children also benefit from participating in sports activities with regard to their overall performance in school and behavior in general (Felfe, Lechner, & Steinmayr, 2016). The results of the same study on over 5000 respondents also provide evidence that the positive effects of sports in a club are partly explained by increased physical activity. Participating in sports clubs challenges children to take the initiative and plan, implement and achieve the set goal. Dealing with sports exposes children to working with other children in the team, which can make them better team players in other situations in life, and thus can explain the reduction of peer problems. Winning in competition can lead to a child's self-esteem, while defeat, despite possible negative effects on children's self-esteem, can teach them how to deal with such a situation.

Students who practice sports have good physical fitness and thus guarantee optimal conditions for proper growth. Adequate aerobic capacity reduces the risks of modern diseases such as diabetes, arteriosclerosis, hypertension, etc. Children who do not engage in sports due to poor general fitness often avoid physical activity, which threatens them to become more prone to physical deformities and the aforementioned diseases of today.

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SportMont

ORIGINAL SCIENTIFIC PAPER

Effect of Ballistic Warm-up on Isokinetic Strength, Balance, Agility, Flexibility and Speed in Elite Freestyle Wrestlers

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Abstract

The aim of this study is effect of ballistic warm-up on isokinetic strength, balance and some parameters in male elite freestyle wrestlers. Thirteen elite freestyle wrestlers at the age of 20.15±2.11 yrs, with 174.54±7.14 cm height and 81.67±15.36 kg weight participated in the study. Measurements were performed two different warm-up protocols. Running protocol at submaximal level on the treadmill for 10 minutes was applied for every wrestler. Ballistic Warm-up protocol involved 13 different movements for multi-muscle groups lasting for 10 minutes. Flexibility, speed, agility, balance, hand grip and isokinetic leg strength parameters were measured. Wilcoxon Signed Rank test was performed to find the difference between the protocols. Consequently, differences were found in flexibility, right hand grip strength, right posteromedial and posterolateral balance, left posteromedial and posterolateral balance, left and right hamstring and quadriceps strength parameters. Ballistic warm-up protocol can be more effective in many parameters, especially strength compared to ordinary warm-up.

Key words: *freestyle wrestling, ballistic warm-up, isokinetic strenght, balance, agility*

Introduction

In wrestling, strength, speed, technique, practical intelligence and flexibility are required skills to pull, push, throw and lift the opponent, stop their attacks or outmaneuver them (Halloran, 2008). It is believed that proper and sufficient warm-up exercise enhances performance while reducing the risk of injury and muscle pains. There are a couple of stretching techniques called as static, ballistic, dynamic and PNF stretching that are preferred by athletes during warm-up time for various reason (Bacurau et al., 2009). The first method is static stretching meaning that target muscles or muscle groups are slowly elongated to stretching point and that position is held for a certain time (Costa, dos Santos, Prestes, da Silva, & Knackfuss, 2009). Static stretching, among diverse methods used in wrestling and many other branches, is frequently performed before exercise and athletic performance. It is widely accepted that static stretching increases flexibility and performance while reducing the risk of injury (Evetovich, Nauman, Conley, & Todd, 2003). However, while different studies presumed that static stretching cause a decline in strength production in relevant muscle groups, other scientists have recently found a decline in sprint speed as well (Chaouachi et al., 2008). Another type of static stretching is PNF (proprioceptive neuromuscular facilitation). Although not a stretching type exactly, it is a technique combining passive and isometric stretching to achieve maximum static flexibility. PNF is a method that a muscle group is passively stretched, then, isometrically contracted against resistance in this stretched position and finally, passively stretched through the increased range of motion, and it describes stretching techniques allowing relaxation after any isometric contraction (Bradley, Olsen, & Portas, 2007). In their study (Bradley et al., 2007) found that PNF stretching produces greater decrease in motor neuron activity compared to static stretching. Dynamic stretching is performed when a muscle is stretched to the movement limit of joint in a stretched position, and contraction and relaxation occur with subsequent

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repetitions, and this type of stretching also defined as the resistance of joint movement (Yamaguchi & Ishii, 2005). Although many studies present the positive effects of dynamic stretching (Yamaguchi, Ishii, Yamanaka, & Yasuda, 2007), athletes are recommended to combine static and dynamic stretching for a better harmony. However, the results of some studies indicate that static stretching may cause a decrease in performance in some cases and thus, the effect of dynamic stretching may decline as well (Amiri-Khorasani, Calleja-Gonzalez, & Mogharabi-Manzari, 2016). Mostly used in branches like gymnastic and dance that flexibility is highly effective, ballistic stretching is a method involving rhythmic springing after a short stretching (M.T. Woolstenhulme, Griffiths, E.M. Woolstenhulme, & Parcell, 2006). It generally involves springing, swinging, bouncing-rebouncing and a sequence of rhythmic movements, and the terms like dynamic, fast, isotonic or kinetic are widely used to describe ballistic stretching. In this type of stretching, movement is repeated without stopping at pain threshold (Guissard & Duchateau, 2006) report that ballistic stretching stimulates stretching reflex thanks to its stimulating effects on homonymous alpha motor neuron firing (big lower motor neurons in brainstem) of type I and type II receptors in muscle spindle. The activation of this stretching reflex causes contraction in the stretched muscle (Woolstenhulme et al., 2006) maintain that ballistic warm-up is highly effective on high jump in basketball players and recommend ballistic stretching exercise in basketball competitions and training. In the same study, they also state that ballistic stretching is more effective in increasing flexibility compared to static stretching. Various stretching activities for improving flexibility during warm-up differ in every training or sports branches. Trainers and athletes wish to know which stretching protocols are most useful for athletic performance during warm-up time before training. While some researchers claim that stretching does not affect performance negatively, some others point out its negative effect. Although not as much as a gymnast, high flexibility is necessary for wrestlers as well. Therefore, this study aims at examining the effect of ballistic warm-up on isokinetic strength, balance, agility, flexibility and speed in elite freestyle wrestlers.

Methods

Thirteen elite male freestyle wrestlers at the age of 20.15±2.11 yrs, with 174.54±7.14 cm height and 81.67±15.36 kg weight participated in the study, 26.78±4.43 kg/m^2 body mass index and 13.02±6.01% body fat percentage values were taken as descriptive statistics (Table 1). In addition, resting heart beat was determined as 75.38±8.14 beats/min since a submaximal warm-up protocol with 70% intensity according to the Karvenon method was to be applied after running Measurements.

Table 1. Descriptive statistics

Variable	Mean±SD
Age (year)	20.15±2.11
Height (cm)	174.54±7.14
Weight (kg)	81.67±15.36
Body mass index (kg/m2)	26.78±4.43
Body fat percent (%)	13.02±6.01
Resting heart beat (beats/min)	75.38±8.14

Study design

The research assessed flexibility, speed, agility, grip strength, balance and isokinetic leg strength. The assessments lasted for 2 days with 1 day interval. The first day, Measurements after running, a warm-up protocol at submaximal level for 10 minutes on the treadmill (Hp Cosmos, Germany) was applied to every wrestler, followed by measurements. After Ballistic Warm-up protocol involving 13 different movements lasting for 10 minutes was applied to the wrestlers who had rested for 1 day and then, again the measurements followed. Participation was on a voluntary basis and the wrestlers signed a consent form. They were informed about the assessments in detail. It was considered that assessments were made while the wrestlers delivered their best performance. Before each measurement, the subjects were allowed to practise to understand the test and then, measurement was performed. It was repeated 5 times at the angular speed of 60 degree. Ballistic warm-up was performed with 13 different movements lasting for 10 minutes. Each wrestler performed warm-up exercise under the supervision of a trainer and with a video projected on wall through an overhead projector. There was no interval between the movements and utmost attention was given to perform the warm-up protocol as correctly as possible.

Ballistic warm-up movements are as follows: 1. Side leg swing on the bar; 2. Front leg swing on the bar; 3. While standing, passing to push-up position on hands. In facedown position with hands put on the ground, stretching by twisting the waist backward and standing up by walking on hands again; 4. Stretching forward by raising arms straight and trying to touch the head to knees while legs are brought to a stretched position; 5. Right and left stretching in a persistent and rhythmic way; 6. Stretching forward in front bench position and throwing the head backward with back open; 7. Opening legs shoulder width apart and bouncing down to touch on right foot and opening up right arm. Then, touching on left foot and opening up left arm; 8. Passing through the anterior knee (frontal passe) standing on foot, taking a side passe position and lowering it. Side passe, taking frontal passe position and lowering it; 9. Walks with right and left legs; 10. Passing through the knee, stretching the knee with hand, rising on tiptoes and taking steps. Repeating the same exercise with the other leg; 11. Pulling right front knee and bounding. Then, pulling left front knee and bounding; 12. Wide-move walking with right and left leg; 13. Putting the heel a foot ahead, holding the foot, pulling the tiptoe toward yourself and reaching forward, and touching the head to the knee. Repeating the same exercise with the other leg.

Testing Measurements

Tanita: Bioelectrical impedance from foot to foot was measured using the Tanita-305 body-fat analyser (Tanita Corp., Tokyo, Japan) which provides a print-out of measured impedance and calculated body fat.

Hand Grip Strength: Hand grip strength was measured using hand dynamometer.

Sit-and-reach flexibility: The sit-and-reach test was con-

ducted using the Flex-Tester apparatus (Novel Products Inc., USA).

20-m sprint run: The 20-m sprint test was performed on an indoor synthetic 60 m sprint track.

Y Balance: Balance was measured through Y balance test.

Agility: To assess agility, the Illinois agility test was performed.

Resting Heart Beat: Resting heart beat was recorded using telemetry (Polar Oy Finland).Your pulse at rest (the best time to get a true resting heart rate is first thing in the morning before you get out of bed).

Isokinetic Leg Strength: Biodex system was measured by 3 pro isokinetic force dynamometer.

Statistical Analysis

Analysis of thedatawas done in the SPSS 22.0 package program. Descriptive statistics were shown as mean ± standard deviation for discontinuous and continuous numerical variables. On the data acquired from the research, the Friedman test was performed to compare the results obtained from two different warm-up procedures, and the Wilcoxon Signed Rank test was performed to find the difference between the groups.

Result

When the data obtained from the research was evaluated, statistically significant differences were found in flexibility, right hand grip strength, right posteromedial and anterior balance, left anterior, posteromedial and posterolateral balance, right and left hamstring, and right quadriceps strength parameters in ballistic warm-up protocol.

When the averages were examined, it was found that the wrestlers group had best result with (Table 2): Flexibility (cm) 5.29% increased; Speed (sec) 0.72% increased; Agility (sec) 1.62% increased; Right hand grip strength (kg) 5.52% increased; Left hand grip strength (kg) 5.61% increased; Right anterior balance (cm) 2.27% decreased; Right posteromedial balance (cm) 5.82% increased; Right posterolateral balance (cm) 5.16% increased; Left anterior balance (cm) 0.41% decreased; Left posteromedial balance (cm) 4.58% increased; Left posterolateral balance (cm) 5.99% increased; Right hamstring 60º.s-1 (N.m-1) 9.54% increased, Right quadriceps 60º.s-1 (N.m-1) 3.77% increased; Right ratio 3.05% decreased, Left hamstring 60º.s-1 (N.m-1) 5.92% increased; Left quadriceps 60º.s-1 (N.m-1) 2.80% increased, Left ratio 0.62% decreased.

Table 2. Measurements after running and after ballistic warm-up

Parameter	After running	After Ballistic Warm-up	Sig.
Flexibility (cm)	35.00±6.64	36.85±5.81	.002*
Speed (sec)	31.89±1.73	31.66±2.03	.727
Agility (sec)	17.86±1.11	17.59±1.21	.382
Right hand grip strength (kg)	51.58±7.71	54.43±7.72	.003*
Left hand grip strength (kg)	52.02±7.63	54.94±5.73	.071
Right anterior balance (cm)	77.92±4.80	76.15±6.37	.324
Right posteromedial balance (cm)	105.62±9.58	111.77±7.92	.004*
Right posterolateral balance (cm)	99.62±9.26	104.77±12.53	.003*
Left anterior balance (cm)	75.54±6.22	75.23±5.703	.697
Left posteromedial balance (cm)	105.62±7.56	110.46±5.95	.000*
Left posterolateral balance (cm)	101.38±9.68	107.46±7.68	.002*
Right hamstring 60º.s-1 (N.m-1)	140.33±24.73	153.73±23.76	.004*
Right quadriceps60º.s-1 (N.m-1)	221.93±35.13	252.49±32.32	.003*
Right ratio	63.08±6.44	61.15±8.25	.400
Left hamstring 60º.s-1 (N.m-1)	141.67±23.22	150.062±24.78	.002*
Left quadriceps 60º.s-1 (N.m-1)	235.76±51.10	242.37±57.38	.152
Left ratio	61.23±8.20	60.85±10.08	.838

Discussion

The aim of this study is to analyse the effect of ballistic warm-up on isokinetic strength, balance, agility, flexibility and speed in elite freestyle wrestlers. When the data obtained from the research was evaluated, statistically significant differences were found in flexibility, right hand grip strength, right posteromedial and anterior balance, left anterior, posteromedial and posterolateral balance, right and left hamstring, and right quadriceps strength parameters in ballistic warm-up protocol. Wrestling is a sport with many performance dynamics. To apply these dynamics at maximum level is important to be successful in training and competitions. Flexibility is usually included in the program of many sports branches as an important part of warm-up procedure. However, it is not right to limit performance with flexibility only. At the same time, there are many studies as to whether or not flexibility enhances athletic performance. In his study on wrestlers (Çelebi, 2014) found no significant impact on strength when he compared static stretching, dynamic stretching and control group, but participants displayed a relatively better performance compared to the control group after static stretching and achieved relatively lower scores after dynamic stretching. Manoel, Harris-Love, Danoff and Miller (2008), Moran (2012) and Demirci (2013) found similar results in their studies conducted in different branches. Static stretching gives rise to criticism and discussions in many studies due to its negative or ineffective outcomes in competing athletes' performance (Çelebi, 2014; Kistler, Walsh, Horn, & Cox, 2010). Kistler et al. (2010) state that it is disadvantageous to include static stretching exercises in warm-up program for short distance races up to 100 m. Other studies found that static stretching during warm-up time has negative impact on athletes' maximal strength as well (Costa et al., 2009). In endurance sports, elite athletes are recommended to exclude static stretching techniques before

moderate-intensity cycling training because it reduces acute cycling economy (Wolfe, Brown, Coburn, Kersey, & Bottaro, 2011). In running, it was found that static stretching damages neuromuscular function that causes slow start (Damasceno et al., 2014). As is seen, there are many studies claiming that static stretching is not recommended before athletic competitions or activities requiring high levels of strength (Bradley et al., 2007). On the other hand, some researchers point out the increasing effects of dynamic stretching on performance in contrast to static stretching, or present results indicating that it does not have any negative effects (Bacurau et al., 2009; Curry, Chengkalath, Crouch, Romance, & Manns, 2009; Vetter, 2007). Yamaguchi and Ishii (2005) indicate that dynamic stretching exercises during warm-up time enhance strength. In addition, similar studies were conducted by Amiri-Khorasani et al. (2016), Colak, (2012), Faigenbaum, Bellucci, Bernieri, Bakker and Hoorens (2005), Gourgoulis, Aggeloussis, Kasimatis, Mavromatis and Garas (2003), Yamaguchi and Ishii (2005). Famisis (2015) found that the two dynamic flexibility protocols significantly enhance sprint pace. In another study conducted (Amiri-Khorasani et al., 2016) that DS during a warm-up is more effective than SS as a preparation to the abrupt acceleration and speed required in soccer.According to the results of the study (Chatzopoulos, Galazoulas, Patikas, & Kotzamanidis, 2014) DS protocol is more appropriate than SS for activities that require balance, rapid change of running direction (agility) and movement time of the upper extremities. The participants were 31 high school students who were basketball, handball, volleyball player or athlete. The first protocol involved 3 min jogging followed by 7 min static stretching. Second protocol consisted of 3 min jogging followed by 7 min dynamic stretching, and third protocol consisted of 3 min jogging followed by 7 min rest. Compared to static protocol, dynamic protocol performed better in balance, agility and movement time. In some sports branches, the significance of and relationship between flexibility and strength are very notable. Particularly, in such branches as gymnastic and dance that high levels of flexibility, agility and strength are important, ballistic stretching is heavily preferred in warm-up routines (Woolstenhulme et al., 2006). There are also studies asserting that recently popular ballistic stretching is less likely to reduce maximal strength and its exercises can be preferred. In their strength assessments conducted with freestyle weights, (Barroso, Tricoli, Santos Gil, Ugrinowitsch, & Roschel, 2012) found that static, ballistic and PNF stretching decrease the number of repetitions and total volume. In the study, static stretching resulted in 20.8% decrease in total volume while ballistic stretching resulted in 17.8% decrease. In another study examining the effects of ballistic and static stretching on maximal strength and flexibility, (Bacurau et al., 2009) reveal that static stretching reduces maximal strength while ballistic stretching does not have any impact on maximal strength. Woolstenhulme et al. (2006) found an acute increase in vertical jump after 20 minutes in a basketball group that performed ballistic stretching in training, and recommended to trainers to consider using ballistic warm-up protocol in trainings. Similarly, in their study on the impact of ballistic training on volleyball players' preseason prep time (Newton, 1999) observed a significant improvement in vertical jump performance in elite athletes thanks to ballistic training. On the other hand, Unick, Kieffer, Cheesman and Feeney (2005) examined the effects of static and ballistic stretching on vertical jump performance in trained women and found that the two stretching protocols do not cause a significant difference in vertical jump performance. Samuel, Holcomb, Guadagnoli, Rubley and Wallmann (2008) state that static stretching and ballistic stretching do not have any effect on vertical jump, quadriceps and hamstring strength. However, Kumar and Chakrabarty (2010) found that after 6 week ballistic and static stretching exercise, ballistic exercise significantly increased the flexibility of hamstring muscles in athletes compared to static exercise. Guissard and Duchateau (2006) maintain that ballistic stretching stimulates stretching reflex. According to literature studies, it is found that stretching protocols can affect athletes' performance in different ways. Different exercises athletes perform during warm-up time can cause small positive increases or differences in their performance and scores, and such differences can change the outcome in competitions. Hence, each stretching protocol in warm-up time should be in line with the requirements and needs of the sports in question. Literature review reveals that different protocols produce different effects. While the effects of ballistic stretching have been assessed in many sport branches, no study was found on wrestling. Thus, this study attempted to examine the responses of freestyle wrestlers to ballistic stretching exercise and found that positive effects observed in other branches are also observed wrestling. The study assessed the freestyle wrestlers.

We can say that ballistic warm-up protocol in freestyle wrestlers can be more effective on performance in strength, flexibility and balance in particular compared to ordinary warm-up, and thus, ballistic exercises can be used as part of warm-up protocols.

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ORIGINAL SCIENTIFIC PAPER

Attitudes of Consumers from Autonomous Province of Vojvodina toward Advertising through Sport in relation with the Frequency of Watching Sports Events

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Abstract

This investigation was aimed at gaining relevant knowledge about the attitudes of the consumers from the Autonomous Province of Vojvodina toward advertising through sport in relation with the frequency of watching sports events. The sample included 451 students from Faculty of Sport and Physical Education,Faculty of sport and tourismin Novi Sad and Chemical, Biotechnology and Medicine Department in Subotica, and it was divided into six subsample groups: consumers who do not watch sports events at all, consumers who do watch sports events 1-30 minutes, consumers who watch sports events 31-60 minutes, those who watch them 61-90 minutes, those who watch them 91-120 minutes, as well as those who watch sports events more than 120 minutes during one typical day. The sample of variables contained the system of three general attitudes which were modelled by seven-point Likert scale. The results of the measuring were analysed by multivariate analysis (MANOVA), univariate analysis (ANOVA), and Post Hoc test. Based on the statistical analyses, it was found that significant differences occur at multivariate level, as well as between all three variables at a significance level of p=.00. Hence, it is interesting to highlight that it was found that significant differences showed up between the attitudes of consumers toward advertising through sport among the frequency of watching sports events. The significant differences were found in two out of three variables, while the consumers who do not watch sports events had much more negative attitudes toward advertising through sport.

Key words: *attitudes, advertising, sports events, Vojvodina*

Introduction

The conclusions of the pioneering studies in the mentioned area that have been published by Bauer and Greiser (Popović, 2011) and Lutz (Klačar & Popović, 2010) have initiated the ideas which have to do with the fact that customers' attitudes towardadvertising represent some of the crucial factors in increasing the efficiency of advertising campaigns, mostly for the reason that cognitive ability of the customers toward advertising is contained in their feelings and thoughts (Muratović, Bjelica, & Popović, 2014). If we continue and go further with the investigation of this question, we will find that there have been numerous studies researching customers' attitudes toward advertising, but most of them observed these attitudes in general (Popovic, 2011b; Popovic, Molnar, & Radovanovic, 2011a; Popovic, Matic, Milasinovic, Jaksic, & Bjelica, 2015a; Popović, Matić, Milasinovic, Hadzic, Milosevic, & Bjelica, 2015b; Popovic, Matic, Milasinovic, Vujovic, Milosevic, & Bjelica, 2015c). However, some of them have brought to a conclusion that the attitudes toward advertising used to have a negative trend during the 1960s and 1970s (Popovic, Bjelica, Jaksic, &

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Georgiev, 2013; Popovic, 2015; Popovic, & Milasinovic, 2016), while some have found some favourable attitudes during the same period (Popović, 2011). These inconsistencies have cast doubt on the commercial campaigns which use the elements of specific mediums and have an impact on customers' attitudes this way (Popović, 2011). Some authors believe that one of the most relevant media is precisely sport; that is, players and their teams, sports events and sports facilities (Bjelica & Popović, 2011), mostly because these elements can influence customers' attitudes and make significant oscillations in attitudes in comparison with other elements (Bjelica, Popović, Jakšić, Hadžic, & Akpinar, 2014b; Bjelica &Popovic, 2015a; Bjelica, &Popovic, 2015b; Bjelica, Gardasevic, Vasiljevic, &Popovic, 2016a; Bjelica, Gardasevic, Vasiljevic, & Popovic, 2016c; Zoric, Masanovic, & Gardasevic, 2017; Gardasevic, Zoric, & Masanovic, 2017; Masanovic, Zoric, & Gardasevic, 2018; Gardasevic, Zoric, & Masanovic, 2018; Bajramović, Zoric, & Masanovic, 2018; Gardasevic, Bajramovic, & Masanovic, 2018; Zoric, Gardasevic, & Bajramovic, 2018). For that reason, many researchers recognize sport as an independent advertising platform which can be used by business subjects for overpassing the negative attitudes that customers have towards advertising. Consequently, another question arises: How does watching sports events affect customers' attitudes towards advertising through sport? An issue that not many researchers have met with so far (Masanovic, Zoric, & Gardasevic, 2017; Zoric, Masanovic, & Gardasevic, 2018; Bjelica, Gardasevic, & Corluka, 2018; Corluka, Bjelica, & Vukotic, 2018; Vukotic, Corluka, & Masanovic, 2018; Milovic, Corluka, & Masanovic, 2018; Djurisic, Perovic, & Masanovic, 2018; Kovacevic, Milosevic, & Masanovic, 2018), and revealing that is precisely the aim of this study.

Methods

The population of this study consisted of students of the Faculty of Sport and Physical Education,the Faculty of Sport and Tourism in Novi Sad and the High School of Vocational Studies for Education of Teachers and Coaches in Subotica who were residents on the territory of Serbia during the survey, while the sample was organized by combining or decomposing, so that the different properties of said population and the various spaces in which it existed were treated.

The questionnaires were distributed to undergraduate students in printed and electronic form. A total of 470 questionnaires were collected, but 19 questionnaires were excluded from the analysis, since they were not adequately filled, so that 451 respondents (randomly selected students of the Faculty of Sport and Physical Education, Faculty of Sport and Tourism in Novi Sad and Chemical, Biotechnology and Medicine Department in Subotica).The research instrument was a standardized questionnaire (Popović, 2011) which consisted of two parts, general attitudes towards sports commercials and socio-demographic characteristics of respondents when the frequency of sporting eventsduring a day was taken into consideration. The system of variables in this questionnaire contained three statements that the respondents needed to evaluate according to the seven-degree Likert scale and the six socio-demographic characteristics of the respondents (Not watching at all, 1-30 minutes, 31-60 minutes, 61-90 minutes, 91-120 minutes, and more than 120 minutes). Completing the questionnaire did not last too long, about 10 minutes on average, and respondents participated voluntarily in the survey. It is important to point out that the survey was anonymous and that all responses were strictly confident. It is also worth noting that the respondents, in addition to all the above mentioned, had the opportunity to withdraw their participation in the survey at any moment, but none of them decided to do so.

Empirical data were analysed using the statistical package for social sciences (SPSS 20.0), and as a first step, descriptive statistics was used for calculating the frequency in the first place, then the arithmetic mean, the standard deviation, as well as the measures of the asymmetry Skewness and measures of tailedness Kurtosis for each of the claims. Since the variables in this study were on nonparametric scales, for the detailed analysis that followed, it was necessary transform them into higher order scales using Blom's method. Then, using the multivariate variance analysis (MANOVA), the univariate variance analysis (ANOVA) and the LSD Post Hoc test, the differences in the general attitudes of the respondents towards advertising in sport in relation to the frequency of watching sports events during the day have been found.

Results

The first table shows descriptive statistics for all three claims that are in relation with the general attitudes of the respondents towards advertising in sports. First of all, the arithmetic mean which reflects the positive values of attitudes when all three claims are concerned is depicted, while the values of standard deviation show that the elements together do not deviate significantly from the arithmetic mean. When it comes to measures of asymmetry (Skewness) and tailedness (Kurtosis), the negative values of asymmetry in all variables show that most of the results are right from the mean, among the higher values, while the negative values of flattening, for all three are variable (GSS1, GSS2 and GSS3), show that the distribution is more flat than normal, i.e., that there are more results accumulated on the distribution tails.

Table 1. General attitudes towards advertising in sport

	Mean	S.D.	Skewness		Kurtosis	
			Statistic	S.E.	Statistic	S.E.
GSS1	4.80	1.637	-.409	.115	-.370	.229
GSS2	5.18	1.569	-.615	.115	-.266	.229
GSS3	4.53	1.495	-.244	.115	-.245	.229

Legend: GSS1–My general opinions is in favor of advertising in sports; GSS2–Comprehensively, I consider advertising in sports a good thing; GSS3–Comprehensively, do you like or dislike advertising in sports

In the continuation of this study, comparative statistics of general attitudes towards sports advertising are shown. They were obtained by using the multivariate variance analysis (MANOVA), the univariate analysis of variance (ANOVA) and the LSD Post Hoc test, in order to determine the difference in the general attitudes of the respondents towards adver-

tising in sport in relation to the frequency of watching sport events during the day.

By inspecting the second table which shows the results of the multivariate analysis, it is clearly evident that there is a statistically significant differencein the whole system of the compared parameters in the general attitudes towards advertising in sport related withthe frequency of watching sport events during the day (p=.013).

Table 2. Multivariate significance of differences in the system of general attitudes towards advertising in sport among respondents with different habits of observing sport events

		N	Mean	S.D.
GSS1	Not watching	73	4.38	1.449
	1–30	119	4.93	1.706
	31–60	98	4.63	1.646
	61–90	48	5.12	1.645
	91–120	43	5.00	1.558
	>120	70	4.90	1.678
	Total	451	4.80	1.637
GSS2	Not watching	73	4.77	1.629
	1–30	119	5.35	1.634
	31–60	98	5.01	1.523
	61–90	48	5.44	1.500
	91–120	43	5.40	1.383
	>120	70	5.24	1.555
	Total	451	5.18	1.569
GSS3	Not watching	73	3.97	1.404
	1–30	119	4.55	1.572
	31–60	98	4.31	1.453
	61–90	48	5.15	1.429
	91–120	43	4.63	1.448
	>120	70	4.90	1.364
	Total	451	4.53	1.495

F=1.999; p=.013

By inspecting the third table showing the results of the univariate analysis, it is clearly noted that there were also statistically significant differences in general attitudes towards advertising in sport in relation to observing sport events in a single variable (GSS3), while in two variables (GSS1 and GSS2) stated discrimination has not been established.

Table 3. Univariate significance of differences in the system of general attitudes towards advertising in sport among respondents with different habits of watching sport events

	F	p
GSS1	1.883	.096
GSS2	1.993	.078
GSS3	5.226	.000

Inspecting the next three tables which show the results of the Post Hoc test, will indicate the significance of the differences between the pairs of individual entities with different habits when observing sport events in question for each variable. According to the results that have appeared on the univariate level, statistically significant differences in the individual parameters with all three variables are noticed.

Table 4. Identification of significant differences in the system of general attitudes towards advertising in sport using the Post Hoc test between individual entities with different habits of watching sport events in the statement "My general opinion is in favor of advertising in sports"

vs	Not watching	1–30	31–60	61–90	91–120
1–30	.024				
31–60	.323	.178			
61–90	.015	.491	.087		
91–120	.050	.817	.218	.715	
>120	.059	.894	.295	.462	.752

It was concluded at the first claim, "My general opinion is in favor of advertising in sports", that there are differences between respondents who do not observe sport events and those entities that observe them 1-30, 61-90 and 91-120 minutes a day. We can notice that members of the group who watch sport events 61-90 minutes a day have the most positive answers, while the least positive results are seen in respondents who do not watch sport events.

Table 5. Determining significant differences in the system of general attitudes towards advertising in sport using the Post Hoc test between individual entities with different habits when watching sport events at the question "In a comprehensive way, I consider advertising in sport a good thing"

vs	Not watching	1–30	31–60	61–90	91–120
1–30	.012				
31–60	.314	.108			
61–90	.021	.752	.121		
91–120	.037	.879	.178	.898	
>120	.069	.640	.341	.506	.414

The second claim "Comprehensively, I consider advertising in sport a good thing", led to a conclusion that there are differences between respondents who do not observe sporting events and those entities that observe sporting events 1-30, 61-90, and 91-120 minutes a day. We can notice that members of the group who watch sporting events 61-90 minutes a day have the most positive answers, while the least positive results are seen in respondents who do not watch sporting events.

Table 6. Determining significant differences in the general attitude system towards advertising in sport using the Post Hoc test between individual entities with different habits when watching sporting events is in the question of "Comprehensively, do you like or dislike advertising in sports"

vs	Not watching	1–30	31–60	61–90	91–120
1–30	.009				
31–60	.141	.229			
61–90	.000	.017	.001		
91–120	.020	.754	.229	.092	
>120	.000	.109	.010	.370	.337

We came to the conclusion that with the third claim: "Comprehensively, do you like or dislike advertising in sports?", there are differences between respondents who do not observe sporting events in general and most other entities. Also, there are differences among respondents who watch sporting events 61-90 minutes a day and those entities that watch sporting events 1-3 and 31-60 minutes per day. Finally, differences are still noticed among the respondents who observe sporting events from 31-60 and over 120 minutes a day. We can notice that members of the group who watch sporting events 61-90 minutes a day have the most positive answers, while the least positive results are seen in respondents who do not watch sporting events.

Discussion

The results showed that the respondents have a very positive attitude towards advertising in sport, which is confirmed with the high value of the arithmetic mean for all three variables, and that almost two thirds of the respondents have a positive attitude towards advertising in sport, which is reflected in the extremely negative values of the asymmetry measures. It is important to mention that these results are in accordance with the results of the previous studies (Bjelica & Popović, 2011; Popovic, 2011b; Popovic, Molnar, & Radovanovic, 2011a; Popovic, Matic, Milasinovic, Jaksic, & Bjelica, 2015a; Popovic, Matic, Milasinovic, Hadzic, Milosevic, & Bjelica, 2015b; Popovic, Matic, Milasinovic, Vujovic, Milosevic, & Bjelica, 2015c), and that there are no significant differences that should be mentioned. The results obtained also clearly indicate that respondents who live in different locations, such as the United States, Turkey, Montenegro, Serbia, and Bosnia and Herzegovina, have positive attitudes towards advertising in sport, while, for the sake of comparison, it is worth mentioning that according to Mittal (1994), various studies point to negative attitudes when advertising products in traditional industries in question.

Therefore, it is more than obvious that the use of sport in modern business communication has influenced significantchange of the general attitude of consumers when advertising is concerned, and recognizing the attractiveness of sports has enabled business organizations to approach sports consumers, and affect their behaviour in more subtle way.

By determining the difference in the general attitudes of the respondents towards advertising in sport in relation to observing sporting events during the day, this study found differences in attitudes among respondents who have different habits of watching sporting events over the course of the day. These differences occurred in one of three variables at the univariate level. With all three variables "My general opinions is in favor of advertising in sports", "Comprehensively, I consider advertising in sports a good thing" and "Comprehensively, do you like or dislike advertising in sports", it is noticed that

members of the group watching sporting events 61-90 minutes a day, have the most positive answers, while the least positive results are seen in respondents who do not watch sporting events. It is interesting to note that significant differences were found between consumers who observed sporting activities at different time intervals, which was the case in previous studies (Molnar, Lilić, Popović, Akpinar, & Jakšić, 2011; Popović, Jakšić, Matić, Bjelica, & Maksimović, 2014; Popović, Bjelica, Georgiev, & Akpinar, 2011b; Popovic, Matic, Milasinovic, Jaksic, & Bjelica, 2015d; Popovic, Matic, Milasinovic, Hadzic, Milosevic, & Bjelica, 2015e; Popovic, Matic, Milasinovic, Vujovic, Milosevic, & Bjelica, 2015f; Popović, Jakšić, Matić, Bjelica, & Maksimović, 2015g).

These results are very important for business entities in Serbia but also for the scientific public, mainly because they cannot connect all potential consumers who observe sports activities at different time intervals in a homogeneous group, which is in accordance with previous research studies (Bjelica, Popović, Jakšić, Hadžić, & Akpinar, 2014b; Bjelica, & Popović, 2015a; Bjelica, & Popović, 2015b; Bjelica, Gardasevic, Vasiljević, & Popović, 2016; Bjelica, Gardasevic, Vasiljevic, & Popovic, 2016c).

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Conflict of Interest
The authors declare that there are no conflicts of interest.

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ORIGINAL SCIENTIFIC PAPER

A Content Analysis of Published Articles in Montenegrin Journal of Sports Science and Medicine from 2012 to 2018

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Abstract

Montenegrin Journal of Sports Science and Medicine (MJSSM) is a scientific journal that exists for five years and has so far released 75 scientific papers in 12 editions. The papers are from various fields of sports science - biomechanics, physiology, sports medicine, anthropology, methodology and other areas of sports. In this paper, we classified works by fields, method of address analysis and found that the most numerous works from the physiology of sports, which are the most cited and best quoted in scientific databases. We have also established that the published works had themes - the most up-to-date tendencies in sports science. These research can be useful for further theoretical research, as well as for theoreticians. The authors of the works are researchers from all over the world, as well as the editorial board. The MJSSM includes works from exact disciplines, primarily physiology of sports, as well as from social sciences, thus achieving a synergistic effect. The highly cited topics in the field of physiology of sports are raised by the work of social sciences. These topics when they find themselves in the magazine with a social label increase their own visibility.

Key words: *science, journal, sport, medicine, Montenegro*

Introduction

Sixth year of publication of the Montenegrin Journal of Sports Science and Medicine (MJSSM) was marked by the 1st edition of the 7th volume, which is in summary the 12th edition of this scientific journal. In the latest issue, 10 scientific papers have been published. The authors are from different countries, from the USA, Croatia, Bosnia and Herzegovina, Estonia, Lithuania, Spain, Hungary, New Zealand, Turkey, Serbia and Montenegro, Slovenia, Portugal and Brazil. The scientific journal has an editorial board of twenty members with respectable scientists from all over the world. The beginning of the publication was very difficult for editors because high standards were set, and the authors could not then be repatriated by publishing in an internationally recognized magazine. However, due to the quality of the work, the situation changed successfully, and the magazine reached the highest level in the world of science.

In 2015, Montenegrin Journal of Sports Science and Medicine entered the Web of Science and in 2016 the Scopus, and since then we have no problems because now there is a much greater interest than there is a space, so now we are working on technical improvement in terms of design, proofreading by the lecturer whose natural language is English, so that we become more recognizable by authors and index databases. We expect that even in 2017 we will get Impact Factor by Web of Science, which would be the biggest success related to publishing activity of scientific journals in Montenegro ever (Popovic, personal communication).

Magazines that would be used in practice will be published in English, which can be a limitation for Montenegrin non-scientific and general public due to insufficient knowledge of English. The publication of papers in the Montenegrin Journal of Sports Science and Medicine and Sport Mont journals is a condition for scientists to advance

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to academic titles, which sometimes creates problems for the editorial office, because the pressure comes especially from those who lack professional knowledge and quality, Popovic acknowledges.

Picture 1. Journal's web page

The Montenegrin Journal of Sports Science and Medicine has united authors and works from the field of natural and social sciences who have thus contributed to the development of sports science, dealing with diverse and interesting topics.

Methods

Content analysis is a method often present in media researches that qualitatively and quantitatively systematize primarily journalistic forms of communication, so statistical methods are used, in the simpler form of addition and descriptors, due to the detection of frequencies and the frequency of topics and messages in the processing of data. Content analysis units in this paper are the titles of scientific papers published in the Montenegrin Journal of Sports Science and Medicine, from September 2012 to March 2018. During this period, 75 papers were published in 12 editions of the journal. The papers are classified by the fields of sports science - biomechanics, physiology, sports medicine, anthropology, methodology and other works.

Results

A wide variety of topics is from the *physiology of sports* that is part of sports medicine, and it examines the body and its functions during physical activity. Works in this area are - "Comparative Analysis of Morphological Characteristics of Goalkeepers in Football and Handball" (Milanovic, Vuleta, & Sisic, 2012), "Comparison of Instep Kicking Between Preferred and Non-Preferred Leg in Young Football Players" (Bjelica, Popovic, & Petkovic, 2013), "Plasma Growth Hormone and Prolactin Levels in Healthy Sedentary Young Men After Short-Term Endurance Training in Hot Environment" (Cicioglu & Kiyici, 2013), "Qualitative and Hierarchical Analysis of Protective Factors Against Illicit Use of Doping Substances in Athletes Calling a National Anti -Doping Phone-Help Service" (Mohamed, Bilard, & Hauw, 2013), "Effect of Half-Time Cooling on Thermoregulatory Responses and Soccer-Specific Performance Tests" (Zhang et al., 2014), "Effect of Egg White Protein Supplementation Before Acute Resistance Training on Muscle Damage Indices in Untrained Japanese Men" (Hasegawa et al., 2014), "Age-Related Patterns of Physical and Physiological Characteristics in Adolescent Wrestlers" (Demirkan, 2015), "Acute Effect of Lower-Body Vibration as a Recovery Method After Fatiguing Exercise" (Nepocatych , Balilionis, Katica, Wingo, & Bishop, 2015), "Effect of Menthol on Respiratory and Perceptual Responses to Exercise in Firefighter Protective Gear" (Zhang, Balilinois, & Casaru, 2015), "Performance-enhancing effects of dietary nucleotides: to mitochondria play a role?" (Ostojic, 2015), "The acute effects of hip abductors fatigue on postural balance" (Sarabon, Hirsch, & Majcen, 2016), "Acute Response of Some Iron Indices of Young Elite Wrestlers to Three Types of Aerobic, Anaerobic, and Wrestling Exercise" (Tayebi, Mahmoudi, Shirazi, & Sangi, 2017), "Pulmonary Function in Prepubescent Boys: The Influence of Passive Smoking and Sports Training" (Jelicic, Uljevic, & Zenic, 2017) and "Analysis of Dietary Intake and Body Composition of Female Athletes over a Competitive Season" (Nepocatych, Balilionis, & O'Neal, 2017), "Muscle Damage Indicators after Land and Aquatic Plyometric Training Programs" (Wertheimer, Antekolovic, & Matkovic, 2018).

Sports medicine applies medicine and science for the prevention, detection, treatment and rehabilitation of injuries caused by sports, exercise or recreation. The themes of sports medicine published in the MJSSM are: "Evaluation of Behavior to Pain Measures in Athletes - A Correlative Analysis" (Kumar, Sandhu, & Shenoy, 2013), "Osgood Schlatter's disease - A burst in young football players" (Domingues, 2013), "Overuse Knee Injuries in Athletes" (Kezunovic, 2013), "Theoretical Issues and Methodological Implications in Searching Visual Search Behaviours: A Preliminary Study Comparing the Cognitive and Ecologic Paradigms" (Afonso, 2013), "Perceived Muscle Soreness, Functional Performance and Cardiovascular Responses to an Acute Bout of Two Plyometric Exercises" (Arazi, Asadi, & Chegini, 2016), "Common Injuries of

Picture 2. Collage of the front pages (2012-2014)

Collegiate Tennis Players (Valleser & Narvasa, 2017) and "Common Running Overuse Injuries and Prevention" (Kozinc & Sarabon, 2017).

Biomechanics works on the techniques of athletes' movement and improvement solutions are included in the MJSSM. The works are as follows: "The Influence of Basketball on the Asymmetry in the Use of Limbs" (Cvorovic, 2012), "Effects of Internal, External and Preference of Attentional Focus Feedback Instructions on Learning Soccer" Head Kick" (Miçooğulları, Kirazcı, & Altunsöz, 2012) and "Comparison of training and competition opportunities in leisure time among people with intellectual disabilities in selected European countries" (Francova, Valkova, & Sinkovsky, 2013), "The Effect of Kick Type on the Relationship between Kicking Leg Muscle Activation and Ball Velocity" (Cerrah, Soylu, Ertan, & Lees, 2018).

Anthropology of sports that studies the links between certain disciplines and characteristics of athletes in MJSSM was represented by the following works: "Predictors Affecting the Ranking in Women Armwrestling Competition" (Akpinar, Zileli, Şenyüzlü, & Tunca, 2012), "Future of Alpine Skiing Schools-gender related programs" (Cigrovski, & Prlenda, 2014), "Do Significant Achievements of a National Football Team Can Strengthen National Identity in Montenegro?" (Popovic & Bjelica, 2014), "Analysis of the Relevant Factors of Retaining Women in Judo" (Sindik, Rendulic, Corak, & Lewis, 2014), "Why Left-handers / footers are overrepresented in some sports?" (Akpinar & Bicer, 2014), "Comparison of Fitness Levels between Croatian and Lithuanian Students" (Novak, Podnar, Emeljanovas, & Marttinen, 2015), "Body Height and Its Estimation Using Arm Span Measurements in Bosnian and Herzegovinian Adults" (Popovic, Bjelica, Tanase, & Milasinovic, 2015), "Analysis of the Relevant Factors for Engaging Women in Various Sports in Croatia" (Sindik, Mikic, Dodigovic, & Corak, 2016), "Comparison of Psychological Skills, Athlete's Identity, and Habits Physical Exercise of Students of Sport Faculties in Four Balkan Countries" (Sindik et al., 2017), "Local Geographic Differences in Adult Body Height in Montenegro" (Popovic, 2017), "Physical Activity can not be treated as a predictor of anthropological status among six-year-old children" (Lovric, Jelaska, & Bilic, 2018), "Differences in Physical Activity and Academic Performance between Urban a nd Rural Schoolchildren in Slovenia" (Sember, Morrison, Jurak, Kovac, & Starc, 2018).

During 2017, teachers and associates of the Faculty of Sport and Physical Education conducted 41 anthropometric measurements, on individuals, clubs and representative selections from the country and abroad were tested for different ages. Teachers and associates of the Faculty of Sports, in cooperation with the Student Parliament, also implement a project - diagnosing student population at the University of Montenegro, which will contribute to the creation of a representative database for future scientific research work and adequate preventive recommendations to the Montenegrin population when it comes to the health status of young people.

Picture 3. Collage of the front pages (2015-2018)

In the Montenegrin Journal of Sports Science and Medicine, works from *sports methodology*, *pedagogy* and *anthropo-motoric* and *anthropometry* are also presented: "Metric Characteristics of One Battery of Motor Measuring Instruments" (Jaksic, Matic, & Cvetkovic, 2013), "The Coaching Process in Football - A qualitative perspective" (Sarmento, Pereira, Anguera, Campaniço, & Leitão, 2014), "Comparison of the Anaerobic Power of Brazilian Football Professional Players Grouped by Tactical Position" (Santos et al., 2014), "Comparative Study of Anthropometric Measurement and Body Composition between Elite Handball and Basketball Players" (Muratovic, Vujovic, & Hadzic, 2014), "The Determination of Physical

Activity Levels of Trainers in Kastamonu, Turkey" (Gunay, Cengizhan, & Ozsari 2015), "Office Sitting Made Less Sedentary - A Future-forward Approach to Reducing Physical Inactivity at Work" (Chia, Chen, & Suppiah, 2015), "Presence of the Re (Sæther, 2016), "Match Analysis in Volleyball: a systematic review" (Silva, Marcelino, Lacerda, & Vicente João, 2016), "Accuracy and Criterion-Related Validity of the 20-M Shuttle Run Test in Well-Trained Young Basketball Players" (Stojanovic et al., 2016), "Inter and Intra Positional Differences in the Ball Kicking Among U-16 Croatian Soccer Players" (Radja, Erceg, & Grgantov, 2016), "Evaluation of Scoring Skills and Non Scoring Skills in the Brazilian SuperLeague Women's Volleyball" (Oliveira, Valladares, Vaz, & João, 2016), "The Influence of the Number of Players on Workload during Small-Sided Games Among Elite Futsal Players" (Hulka & Weisser, 2017), "Middle School Students Free-living Physical Activity on Physical Education Days, Non- Physical Education Days, and Weekends" (Marttinen, Fredrick, & Silverman, 2018), "The Perception of Autonomy Supportive Behavior as a Predictor of Perceived Effort and Physical Self-Esteem among School Students from Four Nations" (Hein et al., 2018), "A Physical Activity Learning Module Improves Medical Students' Skills and Confidence for Advising Patients on Physical Activity" (Mandic, Wilson, Clark-Grill, & O'Neill, 2018), "Force-Velocity Profiles of Elite Athletes Tested on a Cycle Ergometer" (Bozic & Bacvarevic, 2018), "Discriminate Scoring Skills and Non-Scoring Skills According to Results in the Brazilian Men's Volleyball SuperLeague" (Oliveira, Vaz, Pastore, & João, 2018).

In the field of *sport research* and *sociopsychology*, MJSSM's activities include: "Preliminary psychometric validation of the Multidimensional inventory of sport excellence: attention scales and mental energy" (Sindik, Botica, & Fiskus, 2015), "Socioeconomic, Personal and Behavioral Correlates of Active Commuting among Adolescents" (Marques, Peralta, Sarmento, Martins, & Carreiro da Costa, 2016), "The Impact of Social Capital Domains on Self-Rated Health among Serbian High School Students?" (Novak et al., 2016), "Health-Related Fitness Knowledge of Middle School Students in Public and Private Schools" (Serbes, Cengiz, Sivri, & Filiz, 2017), "Comparison of Standard and Newer Balance Tests in Recreational Alpine Skiers and Ski News" (Cigrovski, Franjo, Rupcic, Bakovic, & Matkovic, 2017), "Systemic Mapping of High-Level Women's Volleyball Using Social Network Analysis: The Case of Attack Survey, Freeball and Downball" (Hurst et al., 2017), "Medical Students Awareness of the Connections between Physical Activity and Health" (Mandic, Wilson, Clark-Grill, & O'Neill, 2017), "Swim Speed Tests as a Method for Differentiating the Profiles of Young Swimmers" (Siljeg, Sindik, & Leko, 2017), "Examining Attitudes of Physical Education Teacher Education Program for Students in Teaching Profession" (Yildizer, Ozboke, Tascioglu, & Yilmaz, 2017), "A Comprehensive Mapping of High-Level Men's Volleyball Gameplay Through Social Network Analysis: Analyzing Serve, Side-Out, Side Transformation and Transition" (Loureiro et al., 2017), "Collaborative Learning with the Application of Screen-Based Technology in Physical Education" (Luptáková & Antala, 2017), "Functional-Strengthening: A Pilot Study on Balance Control Improvement in Community-Dwelling Older Adults" (Josephson & Williams, 2017), "Perceived Autonomy Support and Basic Psychological Needs of Participants in a Women's Health-Related Exercise Program according to Exercise Stage of Change and Exercise Type" (Mehrtash & Ince, 2018).

In the field of *methodology in scientific research*, the paper was published: "Two Aspects of Bias in Multivariate Studies: Mixing Specific with General Concepts and" Comparing Apples and Oranges" (Sindik, 2014).

In the journal you can also find the "Report of the 9th International Scientific Conference on Transformation Processes in Sport" Sports Performance" (Popovic & Vujovic, 2012), "Report of the 10th International Scientific Conference on Transformation Processes in Sport" (Krivokapic & Muratovic, 2013).

In the previous issue of the magazine, the most numerous were works from Croatia 16, Turkey 12, Montenegro 8, Portugal 8 and USA 6 papers. Following are the number of authors from Serbia who were 5, Slovenia 3, Czech 2, Norway 2, Brazil 2, Iran 2, New Zealand 2 and one by authors from Slovakia, Switzerland, Japan, Singapore, Philippines and India.

Discussion

In this paper, we classified the topics from the MJSSM by fields, the method of analyzing the titles and we found that the most numerous are papers from thesports techniques (16), physiology of sports (15), sociopsychology of sports (15), and sports anthropology (12). The papers from the physiology of sports are the most highly quoted and best quoted, which is why the journal is advancing towards the highest scientific bases in sports science. We have also established that the published works had themes - the most up-to-date tendencies in sports science. This research can also be useful for further theoretical research, as well as for sports practitioners. Dr. Ines Varela-Silva of the British University of Lagboro, one of the researchers who attended the 14th International Scientific Conference "Transformational processes in sport - sports achievements", told the web portal of the University of Montenegro that sport can not be separated from society because it affects all its segments: "It is important to publish papers in journals dealing with sports science. However, if you want to achieve multi-disciplinarity or interdisciplinarity, then you have to work with people from other areas and publish works in editions related to sports science, but also to physical activity, public health. You can not separate sports from society, since it has an impact everywhere" (Maros, 2017). Varela-Silva emphasized the increasing productivity of scientists in the field of sports science, which publish up to 25,000 works annually, which is at the level of the publication in the field of IT technology.

The Montenegrin Journal of Sports Science and Medicine is related to a scientific conference organized by the University of Montenegro and the Montenegrin Sports Academy every year in early April, where respectable and respected professors and scientists working on a voluntary basis will be housed and respected, reviewed and edited by the magazine. The International Scientific Conference "Transformation Processes in Sports - Sports Achievements" was organized for the 15th time from 12 to 15 April 2018 in Budva, as well as the 14th Congress of the Montenegrin Sports Academy, which gathered around 150 researchers from all over the world.

In addition to organizing the conference, from 2017 the editorial board of the magazine started awarding the award for outstanding sports results on the international level and promotion of the Montenegrin sport. So far, this recognition has been won by basketball player Bojan Dubljevic, handball play-

er Ana Milacic and karate players Mario Hodzic. With this, the MJSSM further promoted its role in sports and the general public in improving the awareness of the importance of sports.

MJSSM is a part of the family of scientific journals in the field of sports in Montenegro. The Sport Mont journal has been published since 2003 and is the oldest scientific journal in the field of sports science and health in Montenegro, which is SCOPUS scientific base. The third journal Journal of Anthropology of Sport and Physical Education is published in 2017 and is currently being published in our language, and it is a project of younger colleagues from the Faculty of Sport and Physical Education.

To recall, the Montenegrin Journal of Sports Science and Medicine contains a wide range of topics - from social, humanistic, and natural sciences. The editorial board very skillfully fits the works from all areas of sports science, which is not an easy task because of the wide range and variety of themes. It is interesting to point out that social science topics are much less quoted than those in the field of exercise physiology, but the sports sciences that unite them into one scientific field succeed in making a good fit sometimes incompatible, which results in mutual benefits. Given that the topics in the field of exercise physiology are much more cited than topics in the field of social sciences, they raise the ranking of subjects in social sciences, while, on the other hand, topics from e.g. exercises physiology manage to find themselves in a magazine that has a social label, and thus become more visible and beyond the highly specialized journals in the field of exercise physiology.

To mention at the end, the Montenegrin Journal of Sports Science and Medicine is the only Montenegrin scientific journal that is indexed in the two most prestigious Web of Science and Scopus databases, which takes a leading position in scientific journals.

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Conflict of Interest
The authors declare that there are no conflicts of interest.

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REVIEW PAPER

A Breif Review of the Effects of Physical Activity in Subjects with Cardiovascular Disease: An Interpretative Key

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Abstract

Today is consolidated the importance of physical activity to health, so it is important to know the effects of exercise for primary prevention and secondary. A regular physical activity of mild intensity results in significant benefits in term of health, while a sedentary lifestyle and otherrisk factors contributeto development of chronic degenerative diseases, in particular cardiovascular. The advanced age does not contraindicate physical activity and exercise can prevent cardiovascular and disability diseases in the elderly. In the elderly person physical exerciseis able toimprove muscular tone and movement skills, of reduce the risk of sudden death caused by cardiovascular diseases, of reduce the development of tumors and metabolic disorders, as well as of delay the decline of cognitive function. The aim of this literature review is to clarify the link and the effects between physical activity, aging and cardiovascular diseases, providing practical indications for a useful physical activity for elderly subjects with cardiovascular problems;adapting to the skills of the elderly person, prescribed after careful assessment of the environmental conditions in which it must take place. In conclusion, a physical activity program finds a sure indication both in elderly subjects without and with pathologies and in the elderly with high risk of disability.

Key words: *sedentariety, movement, benefits, aging, diseases cardiovasculary, personalized activity*

Introduction

The evolution of lifestyles, along with the possibility of access to physical education from the social groups such as the elderly and children, have initiated a modification of perception and social meaning of the movement and physical activity, emphasizing the educational and social value and decreasing the competitive component (D'Isanto & Di Tore, 2016). Practicing regular physical activity offers several physical and mental benefits for elderly (Gaetano, 2016), including slowing the aging process, promoting psychological and cognitive well-being, reductionof the risk of physical disability,increasing longevity and greater functional independence (American College of Sports Medicine, 2009). The education to the physical activity, motor and sports should be the center of the teaching-learning processes and help the process of construction of knowledge and skills within the school (Raiola, 2013). And how much this knowledge and skills system can be conditioned by social and cultural aspects (D'Isanto, Altavilla, & Tafuri, 2017).Today is consolidated the importance of physical activity to health, so it is important to know the effects of exercise for primary prevention and secondary (Tiziana, Antonetta, & Gaetano, 2017). It is not easy to separate the effects of aging from the decrease in physical activity linked to age. Regular physical activity of moderate intensity leads to significant health benefits in all age groups; moreover, a sedentary lifestyle contributes, together with other risk factors, to the development of numerous diseases, in particular those of the cardiovascular apparatus. Several studies reinforce the view that physical activity has favorable effects on the state of health (Paffenbarger & Lee, 1997). In old age, physical activity is not contraindicated; on the contrary, it can prevent cardiovascular diseases and the disability of the elderly (Rengo, Leosco, & Iacovoni, 2004). There are

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many positive aspects of regular physical activity in the elderly (Shekelle, Maglione, & Mojica, 2003):

- reduction the risk of sudden death, heart attack or heart disease;
- reduction of up to 50% risk of developing colon cancer;
- the reduction of the risk of up to 50% of the development of type 2 diabetes;
- prevention or reduction of hypertension;
- reduction of the risk of developing cognitive impairment and dementia;
- the reduction of symptoms of anxiety, stress and depression;
- weight loss and decreased risk of obesity, with benefits of 50% compared to those with a sedentary lifestyle.

A sedentary lifestyle can contribute together with other risk factors to the development of various chronic diseases, particularly those affecting the cardiovascular system. Therefore, the primary objective of public health should be the development of strategies to promote the spread of physical activity in all environments and in all age groups. The promotion of physical activity is becoming a priority public health action, often included in health plans and programs all over the world. In Italy, in the National Health Plan of 2011-2013, the aim was to increase on average 10% physical-sport activity in free time among the elderly, starting from the consideration that physical activity has a protective effect not only for cardio-respiratory and cardio-vascular pathologies, but also for osteoarticular and metabolic diseases. In the USA, the Healthy People 2010 program identifies physical activity as one of the main health objectives, such as the European Union in the Public Health Program (2003-2008) indicates programs that support and promote physical activity. The perform of regular physical activity can therefore play a fundamental role in improving the functional abilities of the elderly and their quality of life.

The aim of this literature review is to clarify the link and the effects between physical activity, aging and cardiovascular diseases, providing practical indications for a useful physical activity for elderly subjects with cardiovascular problems.

Methods

The review of the literature and scientific documents was conducted through the use of several databases: PubMed, MedLine, Google Scholar. Relevant bibliographies were sought to identify the effects of physical exercise in individuals with cardiovascular disease.

Results

Sedentary lifestyle is a cardiovascular risk factor

There are numerous evidences of the beneficial effects of physical activity in countering the reduction of cardiocirculatory performance (Hakim et al., 1999; Hambrecht et al., 2000; Donal et al, 2011). In sedentary subjects, in fact, there is a more marked reduction in systolic function and cardiac output, accompanied by an increase in heart rate; subjects who have undergone long-term sickness, develop a hypokinetic syndrome overlapping that of aging. It is widely known that a lifestyle characterized by physical inactivity is a cardiovascular risk factor. A sedentary lifestyle is responsible for a significant increase in cardiac morbidity and mortality. Physical exercise has beneficial effects on cardiovascular disease, as demonstrated by Paffenbarger et al. (1997), in a study conducted on Harvard college students. This work has shown that a reduction in the risk of death in physically active subjects compared to sedentary ones. Furthermore, the authors showed that in the group of subjects who developed arterial hypertension and who carried out physical activity there was a reduction in mortality of 50%. The benefits of the exercise were also evident in the assessment of the incidence of coronary heart disease independently of other factors and suggesting that moderate sporting activity is associated with the reduction of the mortality. The study showed that in order to achieve a reduction in mortality of 20%, an exercise intensity is required that leads to an energy consumption of about 4200 KJules a week (equivalent to 30 minutes of exercise a day, for at least 4-5 days at week). An Inferior intensity were not sufficient to guarantee significant improvements in the prognosis. Physical activity of mild to moderate intensity has also shown benefits in elderly subjects (Wannamethee, Shaper, & Walker, 1998), indicating the need for a specific public health program that encourages physical exercise in this increasingly prevalent age group.

Effects of the physical exercise on the diseases cardiovasculary and suggestions

In the Longitudinal Study of Aging, conducted on subjects over seventy years old, the importance of maintaining a good level of physical activity in old age is further confirmed, demonstrating an inverse relationship between physical activity and mortality (Rakowski & Mor, 1992). The improvement of cardiac function is possible thanks to an increase in oxygen consumption and contractile capacity of the heart. Hasbeen shown that in elderly subjects with acute myocardial infarction, routine physical activity prior to the ischemic event favors both short-term and long-term survival (Rengo, Galasso, & Piscione, 2007).Significant effects of exercise on the blood pressure have been reported in patients with mild or initial hypertension, where it is possible through physical activity to prevent or slow down the evolution towards stable arterial hypertension. Some studies (Kokkinos, Narayan, & Colleran, 1995; Kokkinos& Myers, 2010) have shown that regular exercise in subjects with mild or moderate arterial hypertension induces a mean reduction in blood pressure in the following measure: 8-10 mmHg for maximum pressure and 7-8 mmHg for the minimum pressure. Therefore, it is advisable to use only aerobic running, favoring long distances, while avoiding repetitions (especially short ones), fartlek or training with net changes of pace (for example, of cross-country races). Aerobic training of moderate intensity, as well as the total duration of physical activity, play an important role in improving the HDL cholesterol and the elimination of the sedentariness could lead to a reduction of 15-39% of cardiovascular diseases, 33% of strokes and 22-33% of tumors (Sunami, Motoyama, & Kinoshita, 1999). A review of primary prevention in women shows that even walking an hour a week has a protective effect on the risk of death from cardiovascular disease (Oguma, Sesso, Paffenbarger, & Lee, 2002). Other reviews have shown that patients with cardiovascular disease benefit from a physical activity that consumes 1600 kcal per week to counter the progression of coronary heart disease and 2200 kcal per week for heart disease (Franklin & Swain, 2003). It is important to remember that a physical exercise, preferably aerobic, must be mild-moderate: 30 minutes of movement (walking, swimming, cycling, etc.) are sufficient a day, at least five times a week, to obtain benefits. The screening should be planned

for all seniors who wish to undertake a regular physical activity, both to identify subjects with chronic illnesses, symptoms linked at some diseases or to prescribe a program of appropriate and personalized exercises. The training must be practiced for several days a week and continued with a certain periodicity until becoming permanent. In general, the success of a program depends not only on the functional possibilities of the various interested parties, but also on the characteristics, intensity, duration of the exercise, its continuity and the repetition of the movements (Carlson, Ostir, & Black, 1999). In order to maximize these benefits and reduce possible risks, we recommend monitoring the heart rate by increasing the intensity of resistance exercises, using 60-70% of the maximum heart rate for that subject as a goal. The maximal heart rate defined by the equation is considered: HRmax=208-0.7×age, HRmax is predicted, primarily, by age alone and is independent of sex and physical activity (Tanaka, Monahan, & Seals, 2001).The decrease in resting heart rate is usually significant in the trained subjects and indicates the improvement of cardiovascular conditions. For a better and personalized definition of the maximal heart rate and to rule out any latent cardiovascular pathologies, it is always advisable, in the elderly subject, to perform an exercise electrocardiogram before planning a physical activity. Aging alters body composition and reduces its functionality and, consequently, increases the risk of disability and chronic diseases such as cardiovascular diseases, type 2 diabetes, obesity and certain types of cancer (Singh, 2004). Scientific evidence (Spirduso, Francis, & MacRae, 2005) confirm that regular physical activity can reduce the physiological effects of aging and a sedentary lifestyle amplifies the effects of aging, while an active lifestyle prolongs the expectation of life and limiting the progression of chronic diseases and disabling conditions.

Suggested physical activity for healthy subjects and with cardiovascular diseases

Walking is the most used activity, but for those who have orthopedic and/or excess weight problems, water or bike activities are more recommended. For healthy elderly there are no contraindications to the cardiovascular efficiency training, which can lead to improvements even higher than 20% (Huang, Shi, Davis-Brezette, & Osness, 2005) and in any case sensitive improvements already after the first three months of training. Many of the people suffer of problems at the cardiovascular system, naturally before being able to training subjects with these particular types of pathologies it is essential that the doctor gives the authorization and directives for the workouts. Regular aerobic activity is able to lower the heart rate and resting blood pressure, this allows the heart to reduce the workload and be less exposed to risks of overload diseases. Increasing the aerobic capacity of a person, improves the standard of living by providing more energy for everyday activities (American Association of Cardiovascular and Pulmonary Rehabilitation, 2004). In order to see the benefits, the training must at least have a duration of 12 weeks and must be practiced for at least two to three sessions a week. The duration of a single workout is at least 30 minutes of continuous exercise or accumulated with a heart rate at the beginning of the program of at least 10 beats below that recommended by the cardiologist (ACSM's, 2013).The training of people with stable cardiovascular diseases must be authorized by a doctor, the role of the coach is to develop a program in line with the guidelines of the cardiologist without compromising the basic cardio-circulatory functions. Tables 1 and 2 compares and illustrates two training protocols for heart patients and healthy people; while in Tables 3 and 4 two different activities are suggested for two subjects with different cardiovascular pathologies.

Table 1. Progression for intermittent aerobic exercise for people with normal functional capacity

Week	% Heart rate	Round (min)	Repose (min)	Repetitions
1-2	50-60	3-10	2-5	3-4
3-4	60-70	10-20	optional	2

Table 2. Progression for intermittent aerobic exercise for people with low functional capacity

Week	% Heart rate	Round (min)	Repose (min)	Repetitions
1-2	40-50	3-10	2-5	3-4
3-4	50-60	10-20	2	2
5	60-70	10-20	2	2

In Tables 3 and 4 two different activities are suggested for two subjects with different cardiovascular pathologies.

Table 3. Examples of dynamic physical activities for a patient with limited cardiovascular capacity of 60 year

Constant cardiovascular commitment and moderate intensity mild
Walk in the flat 3-4 km/h
Climb the stairs 20 steps in 20 sec
Go out and walk with the dog 3-4 km/h
Pedaling in the plains <12 km/h

Table 4. Example of activity for a 50-year low risk heart patient

In 6 weeks, the 3-4 sessions / week training program will stabilize as follows:
- 20-30 minutes of exercise bike: heart rate 100-110 beat / minute (preceded by heating and followed by cool-down)
- 3 sets of exercises for the abdominal muscles (15-20 repetitions)
- 3 sets of exercises for upper limb muscles (deltoid, triceps, biceps) (15-20 repetitions)
- 3 sets of exercises for the pectoral muscles (15-20 repetitions)
- 3 sets of exercises for back muscles (trapezius, dorsal, rhomboid) (15-20 repetitions)
- 3 sets of exercises for the muscles of the lower limbs (gluteus, adductors, abductors) (15-20 repetitions)

Discussion

The evolution of lifestyles, along with the possibility of access to physical education from the social groups such as the elderly and children, have initiated a modification of perception and social meaning of the movement and physical activity. Performing regular physical activity has beneficial effects on most organs and systems and is therefore essential for the primary prevention of a large number of diseases. From the evidences in the literature, contained in the present review, the physical exercise in older people produces three main benefits:

- improves functional capacity both in the healthy subject and in the patient with illness;
- is of supportive in widespread diseases such as arterial hypertension, diabetes and obesity;
- reduces the risk of developing chronic disabling diseases.

Although the beneficial effects of physical exercise increase with increasing frequency and intensity of activity, it is important to remember that the greatest benefits are due to moderate physical activity, as can be deduced from the various works mentioned in this document of review. A complete program, which integrates aerobic and anti-resistance activities, finds a sure indication in elderly subjects with and without pathologies or at high risk of disability. In conclusion, we can affirm that physical activity must be adequate to the subject's ability (organic, psychic, functional, etc.); be prescribed after correctly establishing intensity, duration and rhythm of repetition of the exercises and be congenial and suitable for the cultural, creative and emotional possibilities of the elderly person.

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Conflict of Interest
The authors declare that there are no conflicts of interest.

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REVIEW PAPER

Movement and Language Development as an Early Childhood Twin Strategy: A Systematic Review

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Abstract

In this review, a critical reading of the literary and scientific production focused on the themes of the body, movement and language learning was carried out, with particular consideration given to alternative teaching methods that use movement to favour the cognitive process. After searching the databases of Pub Med, PsycInfo, Sport Discus, Psyc Articles and Eric electronic, the choice was narrowed down to 8 international scientific studies with publication dates ranging between the years 1999 and 2017 concerning pre-school subjects between 2 and 5 years of age, excluding those regarding other target users and/or particular characteristics such as pathologies, obesity, and nutrition. All of these studies analysed the benefits of motor activity on language, communication, learning and academic performance. Of the 7 filtered studies, 4 examine the specific relationship between motor activity and language, while the other 3 between language and general academic performance. Through the analysis of the filtered reports and some of the bibliographical references used, we conclude that motor activity positively influences language, attention and concentration of the pupils in this age range, with effects on academic performance. Furthermore, it also improves motor skills as a result of decreased sedentary behaviour.

Key words: *movement, language, learning, pre-school*

Introduction

It is now a well-established fact that motor activity is of fundamental importance because it plays a primary role in the fields of socialization, emotionality and interpersonal relationships as well as in the pure physicality and well-being, contributing to the psychic development and promoting freedom from inhibitions towards oneself and others. The search for possible common elements or relationships between body, movement and language is a fundamental condition for researching a possible transversal teaching-educational methodology that improves academic performance. Motor activity is a fundamental factor during the child's growth in the formation of his/her personality (Raiola, 2013) because body and movement give a significant response to the communicative need with the use of languages that are not only verbal (D'Isanto, 2016, D'Isanto & Di Tore, 2016, Casolo, 2011). In the same manner that playing coincides with learning, dramatization helps the child to develop his/her potential and to satisfy his/her needs for socialization, creativity, autonomy (Rostagno & Pellegrini, 1978), involving various types of language to be used in a personal way, promptinga connection between linguistic expressivity and motor expressiveness and supporting the conquest of the ego through the process of identification. The dramatic-theatrical-ritual expressiveness is used at all ages even in the East (Raimondo, Kay, Ellender, & Akerman, 2012); for centuries, this has proven to be effective, even in cultures that are different from ours, in improving parameters such as inhibitory control, self-perception and cohesion (Valentini & Beretta, 2016).

Verbal language reaches a certain competence in early childhood and develops alongside the experiences of

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game-movement and the motor evolution underlying the establishment of basic motor patterns (Raiola, Tafuri, & Altavilla, 2015), which follow a genetically pre-established neuromotor activation (Meraviglia, 2012), heavily conditioning the subsequent complex learning processes and becoming the most important behaviour mediator and regulator through internal language structuring: from perception to symbolization and from the latter to verbalization. Movement and motor activity support and complete the process of symbolizing thought—a trait which had been considered for a long period of time as exclusive to the verbal communication system.

Academic success, performance in homework and tests depend both on a) factors closely related to school grades, such as: attention, concentration, memory, recognition and understanding of information, and b) from unconscious factors that play a statistically important role in learning, such as spatial-temporal perception, self-esteem, sedentariness and media consumption (Trudeau & Shephard, 2008); these are all factors that can be affected by physical activity. The inhibitory control is the centre of the highest cognitive functions and is based on mental processes that are closely related to attention, behaviour, emotions and mainly involves the neural networks in the prefrontal and parietal cortices. It has been proven that the inhibitory control ability is a fundamental predictor of both academic performance and cognitive development in early childhood (Diamond, 2013). Chaddock et al. (2012) carried out constant monitoring subsequent to the Eriksen Flanker test, one of the most used tests on the evaluation of this ability, showing that fitter children have superior performance results in accuracy and reaction times, better attention span control during the test and greater concentration directed towards the requested stimulus, therefore better cognitive control. This is also reflected in the modern theoretical foundations of Appraisal and cognitive theories, in which a close correlation between emotional experience and mental elaboration can be found, where the second is dependent on the former. This is confirmed by the work done by Scherer (1993) and Brosch, Scherer, Grandjean and Sander (2013).

The purpose of this review of the literature is to clarify what effects brings physical activity to different cognitive processes (language, verbal and non-verbal communication, learning) and academic performance.

Methods

The research was performed using databases from Pub Med, Psyc Info, Sport Discus, Psyc Articles, Eric, with the main filter being the year of publication 1999-2017. The keywords used in the search for the articles were: age 2-5 years; primary school; motor activity; language; learning; academic performance. Exclusion filters on the yielded results were: obesity; pathology; nutrition.

Results

The selection highlighted 7 articles concerning studies in the journals of African Journal for Physical, Developmental Psychology, Health Education, IDEA Fitness Journal, Journal of Physical Activity & Health, Journal of Physical Education & Sport, O & P Business News, Palaestra, Percentual and Motor Skill, and the Scandinavian Journal of Medicine & Science in Sports. Specifically, 4 studies examined the relationship between motor activity and language and 3 studies between language and general academic performance (Table 1).

Table 1. Relationship between physical activity and language (4 studies)-Relationship between language and academic performance (3 studies)

Year	Authors	Sample	Age	Activity	Results/Goals
2011	Goldstein, J. & McCoach, B.D.	1670	5 years	Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 (ECLS-K)	To evaluate cognition, knowledge and academic goals reached
2014	Nelson, E.L., Campbell, J.M., & Michel, G.F.	38	6-14 months; 18-24 months	Hand preference evaluation, through 2 measurements designed to identify the age-related manual skills. The measurements for infants evaluated the hand use to acquire objects in a monomanual manner and consisted of 22 objects presented individually to the child's midline and 10 pairs of objects presented in pairs.	Consistent right-handedness during childhood associated with advanced language skills at 24 months of age, measured by Bayley Scales of Infant and Toddler Development (Bayley–III; Bayley, 2006)
2015	Oudgenoeg-Paz, O., Leseman, P.M., (Chiel) Volman, J.M.	59	9-36 months 20-36 months	Exploration of 2 sets of objects: the children were filmed for 8 minutes while exploring each set	-Age of acquisition of motor stages - Spatial exploration - Spatial memory - Spatial processing - Spatial language
2015	Diaz-Williams, P., Silliman F.L., French, R., Nichols D., & Moorer-Cook, L.	30	3.6-5.3 years	Gross Motor Activities, structured table activities, structured table activities with letter tracing	Define gross motor activity effect of homework on children with a primary communicative difficulty of phonological disorder -Improve the phonological skills of young children

2015	Brighi, A., Mazzanti, C, Guarini, A., & Sansavini, A.	84	62.5 months (media)	Sociometric Interview for the evaluation of Reciprocal Nominations (RN) -Peabody Picture Vocabulary Test - Revised (PPVT-R; Dunn & Dunn, 1981) -The Social Competence and Behaviour Evaluation (SCBE-30) -Questionari Italiani del Temperamento (QUIT)	Study of the acceptance process amongst peers and peer group aggregation.
2015	Toumpaniari, K., Loyens, S., Mavilidi, M.F., & Paas, F.	67	4 years	Teaching 20 foreign words	-Interaction between physical activity and learning - Physical activity and its incremental effects on learning outcomes -The embodied activities become more pronounced when physical activities are embodied
2016	Marouli, A., Papavasileiou, G., Dania, A., & Venetsanou F.	29	3.5-5 years	Psychomotor program	Effect of an 8-week psychomotor program on motor skills and self-awareness of preschool children

This study was approved in advance by the University of Urbino (Italy). Each participant has voluntarily provided written informed consent before participating.

Discussion

Every little gesture or movement made, whether or not it may reflect a conscious goal of the subject who performs it, must be considered a motor activity. Nelson, Campbell and Michel (2014) tried to assess whether the choice consistency in the use of one of the two hands at 6-14 months of age is linked to better language skills at a later age (18-24 months) using the 3rd Edition Bayley Scale. The results show that subjects with strong right-handedness in the first period had better linguistic skills in the second, but that even those who did not have a strong lateralization in the first months had subsequent standard skills. The entire adult world population has a high percentage of right-handed lateralisation, probably also due to specific cultural, social and ethnic influences; in relation to the infancy period, Esseily, Jacquet and Fagard (2011) and Franco and Butterworth (2016) have verified a preference on the right hand for pointing but many other studies have had mixed results based on the choice of the hand or the finger according to the modality of use (Vauclair & Imbault, 2009; Kotwica, Ferre, & Michel., 2008; Michel, Sheu, & Brumley, 2002). Others find important relationships only during the fundamental stages of linguistic improvements (Jacquet, Esseily, Rider, & Fagard, 2012; Vauclair & Imbault, 2009; Bates, O'Connell, Vaid, Sledge, & Oakes, 1986), even if they do not explain their motivations. Wilbourn, Gottfried and Kee (2011) found a specificity of the female gender between the constant use of the right hand during childhood and verbal cognitive ability estimated at 10 and 17 years of age, correlating the phonological improvement also to the amount of exposure to listening to readings at 15 months of age in the mother-daughter relationship. Similarly, Fenson et al. (1994) had a gender advantage over linguistic development but with much lower percentage differences compared to males (1%-2%) and for an exclusive timeperiod between 8 and 30 months of age on a sample of 1803 subjects. Vauclair and Cochet (2012) found in children aged 10-40 months, the use of right-hand finger for pointing also in left-handed and ambidextrous subjects, confirming the hypothesis of Iverson and Goldin-Meadow, (2005) and Volterra, Caselli, Capirci and Pizzuto (2005) on the independence and specialization in language and gestural communication of the Broca Area with respect to the one dedicated to manual motor control, suggesting that gestures support language learning. Iverson (2010) indicates that the change of gestures predicts advances in the linguistic development of children, also in relation to the gesture-word modalities used in adulthood; also, that prior to the intentional use of hand and mouth for communication, sensorimotor links exist that provide the basis for their future cognitive interdependence, confirming the presence of multimodal coordination. This cerebral flexibility, already present in the neonatal period thanks to the establishment of relations between white and grey matter, is confirmed by Deniz Can, Richards and Kuhl (2013). In recent years, the focus on Cognition Embodied Theory and on its possible implications in the stimulation of language learning has increased exponentially (Mahon, 2015), even if part of the scholars do not share the results as they believe that now the structuring of the language is an emerging autonomous trait of the human species. Toumpaniari, Loyens, Mavilidi and Paas (2015) investigated whether combining gross-motor activities and gestures could improve foreign language acquisition in preschool children, verifying positive effects especially with *embodied*-type activities and also confirming those obtained from previous studies (e.g. Fedewa & Ahn, 2011; Tomporowski, Davis, Miller, & Naglieri, 2008; Strong et al., 2005; Sibley & Etnier, 2003) that used generic motor activities prior to the execution of a task, even in adolescence and adulthood. Lindgren and Johnson-Glenberg (2013) have recorded positive effects of using *embodiment* techniques in the fields of psychology, mathematics and linguistics, with advantages in both finding and retaining acquired concepts. Croom (2014) believes that *embodiment* enhances the 5 individual characteristics of the PERMA framework, leading to psychological well-being; Pouw, de Nooijer, van Gog, ZwaanandPaas (2014) argue that learning is, for all practical purposes, a cognitive process and is inextricably linked to the various experiences of the subject. This is also supported by Gogate and Hollich (2010), Iverson (2010), and Hockema and Smith (2009); therefore, it is justifiable to use not only *embodiment*-type techniques, but also theatrical *enact-*

ment gestures, as positively tested by Toumpaniari et al. (2015) and already suggested by Hostetter (2011) when analyzing the works of Cohen and Otterbein (1992) and Engelkamp and Cohen (1991). For Assaiante, Barlaam, Cignetti and Vaugoyeau (2014) the information received from the environment modifies and generates new interaction possibilities, defining and shaping the various reference frameworks for the subject, including motor and body frameworks; for Pulvermüller and Fadiga (2010) the latter is important both for the execution and understanding of the actions and the language used to describe them. Oudgenoeg-Paz, Leseman and Volman (2015) have analysed this possibility and hypothesize that exploration acts as a mediator between the achievement of the motor stages and the development of spatial cognition and language, eliminating the possibility that such developments are simply to be attributed to the general maturation process, given that the developmental relationships between motor skills, exploration, cognition and spatial language are highly specific. Perry, Samuelson, Malloy and Schiffer (2014) have demonstrated that specific categories are better acquired in specific contexts, and therefore stimulating environments full of opportunities can be used in a targeted way by competent subjects to offer focused and specific learning possibilities. Cross-sectional studies have demonstrated correlations between motor and language skills in both children with normal development (Alcock & Krawczyk, 2010) and those with developmental disabilities (Müürsepp, Ereline, Gapeyeva, & Pääsuke 2009; Hill, 2001). Karasik, Tamis-LeMonda and Adolph (2011) and Campos, Anderson and Telzrow (2009) also agree on linking walking, exploration and cognitive-linguistic development to the development of spatial language. Diaz-Williams, French, French and Nichols (2015) confirm that managing spatial practices in motion for phonological learning favours a solid memorization of terms thanks to the iconic spatial aid because it obliges a greater use of kinaesthetic stimuli, as well as being more engaging for children, even in subjects with a vocal production deficit. Furthermore, Diaz-Williams et al. (2015) found that the motor activities can enhance the learning of specific voice and language concepts, improving the focus on the task and on the production of sound to be emitted also through visual representations of basic concepts. By adding play-motor and drama activities in school exercise programs, it is possible, even at a more advanced age, to improve self-perception (Spanaki, Skordilis, & Venetsanou, 2010; Landazabal, 1999), body awareness (Sherborne, 1990), self-confidence and self-esteem in children (Zimmer, 2006), create programs aimed at developing specific motor skills (Lobo & Winsler, 2006) in relation to fitness aspects (Schmidt, Valkanover, Roebers, & Conzelmann, 2013; Mayorga-Vega, Viciana, Cocca, & De Rueda Villén, 2012), and therefore to counter obesity, with further results in social skills. The linguistic abilities expressed and the socio-emotional relationship with peers or in the cliques is already important at 4-6 years of age (Brighi, Mazzanti, Guarini, & Sansavini, 2015; Tallandini & Morsan, 2006), as children with poor linguistic skills are more at risk of being ostracized or isolated from their school friends (Menting, van Lier, & Koot, 2011). The emotional content of the aggregating environment influences both the adjustment phase and congregation (Snyders-Sowers & Kariuki, 1997), and once the group is formed, their members mutually influence each other (Dishion & Dodge, 2005), with further repercussions on academic performance. Moreover, through various Spearman correlations, Brighi et al. (2015) found that the linguistic competence scores of children are distinctly and positively connected to social competence and orientation, positive emotionality, attention and linguistic skills, along withtheir social reference group. The authors suggest thatthese relationship typesmay be bi-directional: language skills and competencies improve relationships and vice versa, in a virtuous cycle favoured by a stimulating environment. Physical activity, language and academic performance are certainly connected. It is feasible to consider the realization of learning paths based on dramatization using language, communication and personal expressive channel as mediators in the improvement of academic performance, influencing mnemonic and focusing abilities, personality, self-esteem and inhibitory control management. It is very important to promote interventions right from kindergarten in order to bring substantial benefits not only tothe development of motor skills, but also for future cognitive performance, given that good performance of the former has a positive response in the latter: through motor activity, better results are obtained in the intervention groups than in the control groupswith respect to all the parameters examined. Movement improves language, behaviour, self-efficacy and cognitive abilities. There are 3 theoretical approaches within developmental psychology: behaviourist, genetic, and psychoanalytic; the common factor of these theories is that language takes on a symbolic instrumental value, becoming the main thought medium and always affiliating itself to acorporeal paralanguage. This stems from sensorimotor activity, which will, in turn, be linked to psychomotor development.When strategic synergies are employed on spoken language, perceptive-motor skills, behavioural dynamics of relationships, improvements can also be achieved withdifficult subjects. Corporeal and sensorial dynamicstake on an important role and must be followedin parallel topsychological and relational development, given that they are regulated by psycho-cognitive levels. The processes of the self, of the Ego, are in continuous formation (Zimmer, 2006) and take place in a body that finds its coherence in rhythm, in movement or in its dynamics within a spatial context, allowing it to connote and denote itself in a relationship that is also the prescription of the limits and relationships it imposes, similarly to what already takes place in new-borns at a cerebral level (Deniz Can et al., 2013).Based on the data analysis, the benefits brought about by the development of motor skills and abilities have clearly emerged in the children of the age group taken into consideration, since the body is not only an extraordinary means to learn about reality, but also a formidable tool to discover, through active experience, one's potential and self. Through the body we learn to relate to our surrounding environment, learning and using interrelated motor gestures with cognitive, affective and linguistic skills to promote our global development—right from early childhood. We can now formulatesome guidelines on how to use motor activity, in order to optimize and maximize language learning and consequently improve academic performance, although we suggest in-depth future studies to find specific application methodologies that can be applied to most school settings. Studies have emphasized the scope of the body experience by highlighting its relationship with cognitive processes, taking also into account the new contributions in neuroscience that demonstrate the close relationship between subject, movement, language and learning.

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Conflict of Interest
The authors declare that there are no conflicts of interest.

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SportMont

REVIEW PAPER

Anabolic Steroid use in Sports and in Physical Activity: Overview and Analysis

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Abstract

Anabolic steroids,commonly referred to as anabolic androgenic steroids (AAS), are a family of hormones that comprises testosterone. Exposure to these substances can result in damage to human health, such as liver cancer, and to the environment. This class of doping substances cause an extensive increase in the muscular massandis being used to improve athletic performance. Athletes are still using them to increase physical performance and bodybuilders are using them to improve size and cosmetic appearance. For performance enhancing use, these substances generally used without interruption and during several weeks preceding a competition. The preferred method is "piling up" oral ingestion and injections.This type of treatment has been used in sport medicine to manage a variety of joint, tendon and soft tissue injuries.The long-term side effects of anabolic steroids are severe and will depend on dosage and duration. In particular, early death from cardiovascular disease, sterility in men and, in women, masculinization and possible irreversible effects constitute the most serious dangers. More recently, studies have suggested that psychological and behavioral changes and addiction may result from chronic anabolic steroid abuse. AAS were the first identified doping agents that have ergogenic effects and are on the International Olympic Committee's list of banned substances. This paper identify a) AAS increasing represent only one of many different classes of agents it is important to used by recreational bodybuilders and by athletes in the 21st century b) their side effects c) their effects on sports performance c) phenomenon of polypharmacy.

Key words: *anabolic androgenic steroid, sport, testosterone, doping, educational programme*

Introduction

Generality information about physical activity, doping and sport

Sports and physical activity are a considerable importance both for the physiological end ethic benefits, not only by improving the performance conditions of an athlete but also for the positive influence on the character and personality of an individual (Mazzeo, 2016; Mazzeo et al., 2016). Research may foster understanding about how and what sport to can help promote energy balance and healthy body weight (Mazzeo, 2016).

The role of sport and physical activity in adult and children, for optimizing bone mass and reducing obesity and insulin resistance, people with cardiac disease and older people, merit special attention. Effective strategies exist for managing obesity yet are rarelyused by physicians and researcher (Mazzeo, 2016). Furthermore a new pharmacological target to fight obesity and its associated diseases are represented for example, by study on adiponectin, a collagen-like plasma protein secreted by adipocytes, has been suggested to play a causal role in the development of obesity, insulin resistance and cardiovascular disease (Illiano et al., 2017).

Physical activity describe all movement produced by skeletal muscles which increases energy expenditure, whether it's exercise or sport. At present daily participation in moderate and vigorous physical activities is low, and activity decreases with increasing age (Mazzeo et al., 2016; Montesano et al., 2013a). In addition, sports activity, at any level, remains a competition and emulation in respect of the other competitors and towards ourselves (Raiola, 2011).

Experts on performance sport define performance sports as

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the result from a specific action, usually competitions designated by a number or a rating scale value. Since the ancient times, were researched illicit systems that could artificially improve the athletic performance, in addition to training and physical preparation; in ancient Greece for example, during the carrying out of the Olympic Games, the athletes used to assume an infusion of herbs and mushrooms in order to increase their performance (Mazzeo et al., 2016). Man has always tried to improve his physical performance (Mazzeo, 2016). The restive evolution and multiplication of doping methods and substances, the fear by athletes of harsh sports and legal sanctions as well as the inadequacy of the identification techniques for illegal substances, contribute to make a not accurate evaluation of the prevalence of the Doping phenomenon (Lippi & Guidi, 1999).

The consumption of banned and potentially harmful substances in sports has become a problem for the public health. Current estimations of the prevalence of doping in sports are relatively uncertain, as most investigative tools do not reflect an absolute statistical power (Mazzeo et al., 2016). Exist not only doping in professional sport, but also affects amateur athletes (Mazzeo et al., 2016). Furthermore, the desire to enhance their physical abilities did not even spare the disabled athletes (Mazzeo, Santamaria, & Iavarone, 2015; Montesano, Tafuri, & Mazzeo, 2013b). Therefore, dopingis the assumption of substances or the recourse at particular methods which are able to artificially increase an athlete's performance during a sports competition, contrary to sports morals and despite physical and psychological health (Mazzeo, 2016; Lippi et al., 1999).

To estimate the use of prohibited drugs and other forms of doping in sports fields, in 1998 the National Italian Olympic Committee (CONI) and the National Research Council (CNR), appointed an independent committee designed to conduct a survey to ascertain the knowledge and opinions of the Italian athletes on doping practices (Scarpino et al., 1990). 1015 athletes and 216 sports professionals where interviewed during the survey. In total, 30% of athletes, coaches and sports managers and 21% of doctors stated that the athletic performance can be improved by using drugs or other doping techniques. In particular, more than 10% of athletes expressed the opinion that amphetamines and anabolic steroids are frequently used in national and international level. Moreover, the percentage of athletes and sports professionals that retain harmful the use of doping methods and prohibited drugs was higher than the percentage that considered their use effective (Scarpino et al., 1990; Mazzeo, 2016).

Drugs, substances biologically and pharmacologically active and medical practices, which their application is considered doping; are divided, in compliance with the provisions of the Strasbourg Convention and under the indications of the International Olympic Committee (IOC) and other international organizations responsible in the sports sector, in classes, according to their chemical and pharmacological character and their corresponding effect (Mazzeo et al., 2016; Mazzoni et al., 2011).WADA, significantly modified the Prohibited List of the IOC Medical Commission, binding from the end of 2003 and updates every year (Table 1).

Table 1. 2017 WADA prohibited substances and methods

Substances and methods prohibited in and out competition
S1 Anabolic agents
S2 Peptide hormones, growth factors, related substances and mimetics
S3 Beta- 2 agonists
S4 Hormone and metabolic modulators
S5 Diuretics and masking agents
M1 Manipulation of blood and blood components
M2 Chemical and physical manipulation
M3 Gene doping
Substances and methods prohibited in competition
In addition to the categories S1 to S5 and M1 to M3,
S6 Stimulants
S7 Narcotics
S8 Cannabinoids (sativa, indica and derivates)
S9 Glucocorticosteroids
Substances prohibited in particular sport
P1 Alcohol
P2 Beta-blockers

Over time, doping has shown a great ability to discover and always use new substances and appropriated the new scientific discoveries (Anti Doping Convention 1989). Botrè (2008) distinguishes three main periods about the evolution of substances to identify (Table 2).

The first one–the early age-includes "in competition drugs"; the second period–the androgenic anabolic steroids age–includes "in and out competition drugs". The third age-protein chemistry and molecular biology age-includes the newly discovered in genetic engineering used for the treatment of diseases too. Now, in the "gene doping age", the new frontier of doping is the use ofcells,genes, genetic elements, or the modulation ofgene expression with the aim to increase the performance and not easy to detect (Botrè, 2008). This last period includes the blood doping. Indeed, the blood transfusion and administration can boost the capacity to transport the oxygen to the muscles. Therefore, before 1980, AAS were used primarily by elite athletes. After 1980, AAS used by elite athletics and by general population to enhance personal appearance (Kanayama & Pope, 2017).

Already in the early 1900s it was realized that the use of substances to increase physical performance, not only falsified the results of competitive sport but it was also very dangerous for the health (Calatayu, Alcaide, Zurian, & Benavent, 2007). For this reason, in 1928 the International Association of Athletics Federations became the first International Sport

Table 2. Evolution of substances to identify

	Period	Substances to identify
Origin early 1970s	1970	Stimulants, narcotics, drugs of abuse
Synthetic anabolic androgenic steroids (AAS)	Mid 1970–2000	Synthetic anabolic androgenic steroids, beta-blockers, diuretic, cannabinoids, glucocorticoids, human chorionic gonadotropin, endogenous testosterone and/or precursor, erythropoietin and analogs
Protein Chemistry and Molecular biology Age	2000-present	Designer steroids, hormone and hormone receptors modulators
	2003-present	Blood doping
	2005-present	Peptide hormones
Gene Doping Age	2008-present	No substances but cells, genes, genetics elements, modulation of gene expression

Federation (IF) to ban the use of stimulating substances. Only after the death of a cyclist at the Olympic Games in Rome in 1960 urged the relevant authorities to introduce the first anti-doping test.

It should be noted that the use of these "doping" products used to improve performance may not only not result in an advantage in terms of sports performance but, on the contrary, entails serious damage to the health of the athlete. Among the most frequently "abused" substances in the world of sports, anabolic steroids (AAS) and peptide hormones must certainly be considered (Mazzeo, 2016; Anawalt, 2018).

Anabolic steroids

Anabolic-androgenic steroids (AAS) are synthetic derivatives of testosterone and are a class of compounds studied and synthesized to stimulate body and muscular growth (anabolic effect) (Vasic & Jakonic, 2007). In men, testosterone is the principal secreted androgenand the Leydig cells synthesize the majority of testosterone.In women, testosterone also is probably the principal androgen and is synthesized both in the corpus luteum and the adrenal cortex by similar pathway (Celotti & Negri Cesi, 1992). Some authors use the term "steroids" to refer both to androgens and to anabolic steroids, since both have the same basic chemical structure. Since years anabolic agents are the most frequently detected doping substances in sports (Mazzeo et al., 2016). The testicular principle, we now know, is the male sex hormone testosterone, which was first synthesized in 1935. Experimental studies in both animals and humans showed that testosterone possessed both anabolic and androgenic action (Fragkaki et al., 2009). The androgenic actions of testosterone are those actions involving the development and maintenance of primary and secondary sexual characteristics, at the same time the anabolic actions consist of the positive effects of testosterone in inhibiting urinary nitrogen loss and stimulating protein synthesis, particularly in skeletal muscle (Goldman & Basaria, 2018).

Moreover, anabolic steroids, technically known as anabolic-androgenic steroids, are synthetic derivatives of testosterone, modified to enhance its anabolic actions (promotion of protein synthesis and muscle growth). The testosterone precursorsandrostenedione and dehydroepiandrosterone are weak androgens that can be converted peripherally to testosterone. However, natural testosterone is rapidly degraded by the liver so the plasmatic level required for the accomplishment of his anabolic effect, are not reached. AAS exert their pharmacological effects by binding to a cytoplasmatic receptor and moving into the nucleus incrementing RNA polymerase activity and synthesis of RNA and specific proteins (Goodman & Gilman's, 1990). AAS are used to increase muscle mass and are being used to improve athletic performance. Consequently, athletes are still using them to increase physical performance and bodybuilders are using them to improve size and cosmetic appearance. AAS were the first identified doping agents that have ergogenic effects and are on the International Olympic Committee's list of banned substances (Mazzeo et al., 2016).

About, 60 different AAS are available that vary in their chemical structure and thus in their metabolic fate and physiological effects (Celotti et al., 1992; Modlinski & Fields, 2006; Hakansson, Mickelsson, Wallin, & Berglund, 2012). The most popular AAS used as doping substances are: *oximetolone, oxandrolone, testosterone undecanoate, nandrolonedecanoate, nandroloneundercanoate, methandrostenolone, metiltestosterone, stanazolo.* To reach high dosages and rapid effects, steroid users practice a method known as "staking" which consist in the intake of two or more steroids in high dosages. Another method, called "pyramiding" provides a progressive increase of steroids dosage. The pyramid protocol is alternated with drug-free, process defined as "cycle" (Huang & Basaria, 2018). Screening procedures for AAS in World Anti-Doping Agency accredited laboratories are based mainly on gas chromatography-mass spectrometry, although liquid chromatography-mass spectrometry is becoming increasingly more valuable. The use of carbon isotope mass spectrometry is also of increasing importance in the detection of natural androgen administration, particularly to detect testosterone administration (Ahrens, Starcevic, & Butch, 2012).

Drugs bases on the AAS effects have been listed by the IOC (International Olympic Committee) as substances assumed for doping purpose (Mazzoni et al., 2011). More specifically, a extensive use of AS is registered in sports in which is required a significant muscle mass (weight lifting, box, fight, gymnastics, shot put) as well as in sports where the increment of muscle mass allows an increase in speed potential of an athlete (American football, speed races and high jump) (Celotti et al., 1992). Furthermore, other categories of athletes using AAS are Bodybuilders (man and a very small number of women), which not participate in elite athletic competition, but their target is to reach a particular physical appearance (Anawalt, 2018). In addition to their ability to promote the muscular growth and strength, AAS are able to reduce the time of physical recovery after intense and protracted physical activity and to stimulate aggressive and determined attitude, basic requisites in sports where is required physical contact with the opponent (Modlinski & Fields, 2006). The public has access to AAS through the internet and illicit sites and there is no monitoring program to detect AAS use by non-elite athletes.

AAS are frequently used by men even if since 1990 the use of AAS by women has undergone a significant increase. In 1997, in fact, according to the American statistics, about 175,000 female adolescences have admitted to assume AS with a 100% increase since 1991. As for male adolescences, according to current American, there are 325,000 consumers with over one million of adolescences who have not used AAS at the age 12 to 17. The percentage of youth assuming these drugs without medical prescription rises above the 6% according to an American estimation for the year 1993 (Modlinski & Fields, 2006). This percentage rises to over 50% if only adult male bodybuilders are assessed.

The declaration of the *American College of Sport Medicine* related to the use of AAS is the following: 1) the use of anabolic steroids during training in association with an adequate diet may contribute to increase body weight, especially on behalf of lean body mass; 2) in some individuals the use of anabolic steroids develop the effects induced by training in muscular strength if associated with an high-protein diet; 3) anabolic steroids are not able to modify the aerobic power and ability; 4) the use of AS can cause serious damage at liver and cardiovascular level, reproductive system and psychological disorders even on therapeutic doses; 5) the use of AS among athletes is against the rules and the ethical principles of sports.

Pharmacokinetic of as

AS are administered orally or by injection. Those ingested orally (danazol, fluoximesterone, methyl testosterone, oxandrolone, stanazolol) are absorbed from the stomach and, considering their short half-life are rapidly eliminated; in the liver they result more toxic than steroid administered by injection, and they are more effective. Inject able steroids (testosterone propionate, testosterone enanthate, testosterone cypionate) are characterized by: a) a delayed metabolism, reduced elimination and a longer permanence in the organism (a characteristic that increases the chances of detection with the anti-doping test); b) they imply less liver toxicity; c) a lower activity than orally administered steroids. The injections can be determined up to one month after administration, whereas oral only up to a maximum of two weeks when administered intermittently (Goodman & Gilman's, 2011).

Way of administration

AAS can be administrated orally or parenterally. When steroid injections are performed, Kenacort (triamcinolone) or Celestone (betamethasone) are the most commonly used preparations. The steroid is often mixed with local anaesthetic. For assumption of AAS, typically, to achieve high doses and rapid effects is used a method called "stacking," which involves the concurrent use of two or more steroids in high doses (Mottarm & Gorge, 2000). The use of such association is based on the assumption that each steroid has a different physiological action. The assumption involves the gradual increase in dose ("pyramiding"); athletes, begin with low-doses, reach the peak and then slowly decrease the dose for a period of time which can range from 4 to 18 weeks. The "pyramid" protocol consists in alternating steroid assumption with periods of suspension, process defined as "cycling". The dose (50-200 mg daily) used in this procedure is 200 times higher than the recommended dosage employed for therapeutic reasons (5-20 mg/day) (Mottarm & Gorge, 2000). The dose is reduced gradually during the months preceding the competition, to reduce the chances of failing the anti-doping test before the race (Table 3).

Table 3. The main AS used as doping substances and their dosage

STEROID- ChemicalName	TERAPEUTIC dosage	DOPING dosage*
oxymetholone	25-50 mg/die per os.	50-150 mg/die os.
Oxandrolone	2.5-5 mg/die per os.	15-20 mg/die os.
Testosterone Undecanoato	40-60 mg/die per os.	200 mg/die os.
Nandrolone decanoate	50 mg/ settimana i.m.	200-400 mg/week i.m.
Nandrolone Undecanoate	80.5 mg/settimana i.m.	170-340 mg/week i.m.
Methandrostenolone	15-30 mg/die per os.	50-250 mg/die os.

*Assay valuesare onlyindicative, derivedfromplasma assaysperformedduringdoping controlson the self-declaredoroccasional. Some expertsare extremelyunderestimated

The most commonly used antidoping tests, consist in measurement of serum testosterone, FSH and LH. The exogenous testosterone, non testosterone AAS or hCG suppress circulating FSH and LH concentrations, measurement of serum testosterone, FSH and LH concentrations are functional for determining the likelihood of AAS use (Anawalt, 2018). The ratio measure is not only urinary testosterone and luteinizing hormone (T/LH), but also the relationship between testosterone and epitestosterone (T/E). Recently, it was determined that a ratio T/LH greater than or equal to 30 represents a more sensitive marker of the use of AS compared to a T/E ratio greater than or equal to 6 (Takahashi, Tatsugi, & Kohno, 2004).

Side effects

AAS have been associated with a diversity of adverse effects that take in many organ systems (Table 4). The anabolic effect is determined by a local nitrogen (azotes) increment with an increase of new formed proteins, by the rise in glycogen, phosphorus content and phosphorus compounds of high energy potential, by an accentuated oxygen consumption on muscular level and by an increased water content in muscle mass (Goodman & Gilman's, 1990).AAS abuse causes significant side effect. In men, the abuse of this substances may cause infertility, azoospermia, testicular atrophy, and gynecomastia. Women may develop excessive body hair growth, menstrual irregularity, hypertrophy of sebaceous glands, acne. Other side effects are: 1) Prostatic Hypertrophy; 2) premature cease of growth caused by premature epiphysis closure; 3) Alteration of cardiovascular function; 4) increase of platelet aggregation and plasmatic levels of low density lipoproteins (LDL). Moreover, AAS cause liver damage; euphoria, aggressiveness, psychosis. Their action in central neuron system involves the dopaminergic neurotransmission and produces amphetamine-like activity. They induct a sensation of euphoria which may result in

increased aggressiveness. Sometimes, AAS abuse may lead to withdrawal syndrome, like alcohol or other drug abuse (Stella et al., 2005; Stella et al., 2003). A study conducted on 160 athletes including 88 AAS users and 68 control athletes, showed that the prime difference between the two groups concerned the incidence of psychiatric effects; in fact, 23% of users manifested maniacal symptoms, hypomania and depression (Pope & Katz, 1994).

Table 4. The mainside effects of AAS

Proven Effects
Increase in fat-free mass Increase in body weight Increase in arm girth Increase in leg girth Increase in bench press and squat scores Increase in libido
Side Effects
Hepatocellular damage Cardiovascular disease (stroke, MI) Psychological disturbance LH, FSH, SHBG sperm count and fertility index
Men
gynecomasty (development of breasts), atrophy of the testicles, diminished libido, reduced fertility and impotence, interrupted growth in adolescent
Women
hirsutism (excessive hair growth, especially on the face), masculinization of the voice and the body, alopecia (hair loss), atrophy of the breasts and uterus, hypertrophy of the clitoris, menstrual irregularities, amenorrhea (lack of menstruation), and oligomenorrhea (light menstruation)
Effects common to males and females
severe acne musculoskeletal injuries: ruptured tendons, torn muscles liver problems: development of bloody cysts in the liver, jaundice, liver cancer cardiovascular problems: increased risks of arteriosclerosis, thromboembolisms, myocardial infarctions, strokes, edema, hypertension mental problems: anxiety, irritability, aggressiveness, loss of perception of certain realities and values, insomnia, nightmares, depression, suicidal thoughts, mental confusion, hallucinations, delusions of grandeur, paranoid personality disorder, schizophrenia, and other psychoses physical and psychological dependence

Prolonged use of high doses of AAS, especially if taken orally, it causes significant side effects leading to serious health risks. There are a few reports on the endocrinological and pathological changers in AAS abusers (Takahashi et al., 2004).

Other side effects

AS are extremely toxic for liver. One of the most grave consequence is certainly peliosishepatis (Broeder et al., 2000), a disease characterized by the formation of hemorrhagic cysts (sometimes at splenic level), which can break and cause intra-abdominal haemorrhage, and death of the patient. Regarding the effects on glucose metabolism, AAS reduce glucose tolerance and increase insulin resistance (Pärssinen et al. 2000). In addition, AAS a use cause immune system suppression. Many studies have shown that immunoglobulin levels (IgG, IgM and IgA) were significantly lower steroid users compared to control groups (Saygin et al., 2006; Goldman & Basaria, 2018). These studies suggest that high doses of anabolic steroids alter the immune mechanism and that the suppression of the immune system for a long period could lead to higher risks of infection or certain malignant cancers. Last but not least, studies conducted on animals and humans suggest that AAS use, associated with an intense training period, may cause severe damage on connective tissue, which reduce the mechanical and elastic properties of tendon (tendon rupture) (Liow & Tavares, 1995; Laure, 1997). Therefore, there are a very important and negative effects derivate by use of these drugs, on various organ systems in men and women (Goldman & Basaria, 2018). Some of these side effects are mild and reversible but others are irreversible and consequently fatal.

Conclusions

Though the number of positive steroid tests at Olympic events appears to be decreasing, the high level of anabolic steroid usage by body-builders and weightlifters and the disturbing level of abuse by the young in the community shows that much remains to be make to deactivate the anabolic steroid problem.In the USA, the problem has been tackled by utilizing educational programmes in colleges, schools and gymnasia and encouraging medical practitioners to adopt a sympathetic attitude towards steroid abusers, particularly by advising on and treating side-effects of anabolic steroids (Mazzeo, 2016). Therefore, the use of AAS should be banned from the sport, making a work of supervision and accountability of the sports centers and authorities in this field. AS use for doping purposes is a dangerous practice, that exposes who uses them to considerable risks. Preventing and treating the hormonal pathologies and instructing athletes to a healthy "health of sport" are two necessities not only for the physicians, but for every operator involved in the sport competition and more generally

of motor activity (Mazzeo, 2016; Dobs, 1999).

In conclusion, this practice must be discouraged not only for social and moral reasons but also for toxicological reasons; Doping substances must be banned from sports, making a work of vigilance and authority accountability of sports nucleus and authorities in this field. More studies need be carried out and immediate educational programme centred on schools should be instigated.

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Conflict of Interest
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1. UNIFORM REQUIREMENTS

1.1. Overview

The *Sport Mont Journal* (SMJ) applies the Creative Commons Attribution (CC BY) license to articles and other works it publishes.

The submission with SMJ is free of charge but author(s) has to pay additional 190 euros per accepted manuscript to cover publication costs. If the manuscript contains graphics in color, note that printing in color is charged additionally.

SMJ adopts a double-blind approach for peer reviewing in which the reviewer's name is always concealed from the submitting authors as well as the author(s)'s name from the selected reviewers.

SMJ honors six-weeks for an initial decision of manuscript submission.

Authors should submit the manuscripts as one Microsoft Word (.doc) file.

Manuscripts must be provided either in standard UK or US English language. English standards should be consistent throughout the manuscripts accordingly.

Format the manuscript in A4 paper size; margins are 1 inch or 2.5 cm all around.

Type the whole manuscript double-spaced, justified alignment.

Use Times New Roman font, size eleven (11) point.

Number (Arabic numerals) the pages consecutively (centering at the bottom of each page), beginning with the title page as page 1 and ending with the Figure legend page.

Include line numbers (continuous) for the convenience of the reviewers.

Apart from chapter headings and sub-headings avoid any kind of formatting in the main text of the manuscripts.

1.2. Type & Length

SMJ publishes following types of papers:

Original scientific papers are the results of empirically- or theoretically-based scientific research, which employ scientific methods, and which report experimental or observational aspects of sports science and medicine, such as all clinical aspects of exercise, health, and sport; exercise physiology and biophysical investigation of sports performance; sport biomechanics; sports nutrition; rehabilitation, physiotherapy; sports psychology; sport pedagogy, sport history, sport philosophy, sport sociology, sport management; and all aspects of scientific support of the sports coaches from the natural, social and humanistic side. Descriptive analyses or data inferences should include rigorous methodological structure as well as sound theory. Your manuscript should include the following sections: Introduction, Methods, Results, and Discussion.

☑Open Submissions ☑Indexed ☑Peer Reviewed

Original scientific 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;
- Maximum number of references is 30;
- Maximum combined total of 6 Tables/Figures.

Review papers should provide concise in-depth reviews of both established and new areas, based on a critical examination of the literature, analyzing the various approaches to a specific topic in all aspects of sports science and medicine, such as all clinical aspects of exercise, health, and sport; exercise physiology and biophysical investigation of sports performance; sport biomechanics; sports nutrition; rehabilitation, physiotherapy; sports psychology; sport pedagogy, sport history, sport philosophy, sport sociology, sport management; and all aspects of scientific support of the sports coaches from the natural, social and humanistic side.

☑Open Submissions ☑Indexed ☑Peer Reviewed

Review papers should be:

- Up to 6000 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 100.

Editorials are written or commissioned by the editors, but suggestions for possible topics and authors are welcome. It could be peer reviewed by two reviewers who may be external or by the Editorial Board.

☐Open Submissions ☑Indexed ☑Peer Reviewed

Editorials should be:

- Up to 1000 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 10.

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.

☑Open Submissions ☑Indexed ☐Peer Reviewed

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.

☐Open Submissions ☑Indexed ☐Peer Reviewed

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;
- Maximum number of references is 30;
- 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;
- A signed form that states the study was not previously published, nor has been submitted simultaneously for consideration of publication elsewhere, that states that all of the authors are in agreement with submission of the manuscript to SMJ, and that, for studies that use animal or human individuals, authors must include information regarding their institution's ethics committee, and which identifies the official approval number;
- 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)

1.4. Peer Review Process

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.

SMJ uses ad-hoc reviewers, who volunteer to analyze the merit of the study. Typically, one or two expert reviewers are consulted in a double-blind process. Authors are notified by e-mail when their submission has been accepted (or rejected). Minor changes in the text may be made at the discretion of the editors-in-chief and/or associate editors. Changes can include spelling and grammar in the chosen language, written style, journal citations, and reference guidelines. The author is notified of changes via email. The final version is available to the author for his or her approval before it is published.

1.5. Open Access License and Publisher Copyright Policies

SMJ applies the Creative Commons Attribution (CC BY) license to articles and other works it publishes. If author(s) submit its paper for publication by SMJ, they agree to have the CC BY license applied to their work. Under this Open Access license, the author(s) agree that anyone can reuse their article in whole or part for any purpose, for free, even for commercial purposes. Anyone may copy, distribute, or reuse the content as long as the author(s) and original source are properly cited. This facilitates freedom in re-use and also ensures that SMJ content can be mined without barriers for the needs of research. On the other hand, the author(s) may use content owned by someone else in their article if they have written permission to do so. If the manuscript contains content such as photos, images, figures, tables, audio files, videos, et cetera, that the author(s) do not own, SMJ will require them to provide it with proof that the owner of that content has given them written permission to use it, and has approved of the CC BY license being applied to their content. Otherwise, SMJ will ask the author(s) to remove that content and/or replace it with other content that you own or have such permission to use. SMJ provides a form the author(s) can use to ask for and obtain permission from the owner.

In addition, the author(s) may freely use the content they previously published in a paper through another publisher and they own the rights to that content; however, that's not necessarily the case and it depends on the license that covers the other paper. Some publishers allow free and unrestricted reuse of article content they own, such as under the CC BY

license. Other publishers use licenses that allow reuse only if the same license is applied by the person or publisher reusing the content. If the article was published under a CC BY license or another license that allows free and unrestricted use, the author(s) may use the content in the submitted manuscript provided that the author(s) give proper attribution, as explained above. If the content was published under a more restrictive license, the author(s) must ascertain what rights they have under that license. SMJ advices the author(s) not to include any content in the submitted manuscript which they do not have rights to use, and always give proper attribution.

The editors of SMJ consider plagiarism to be a serious breach of academic ethics. Any author who practices plagiarism (in part or totality) will be suspended for six years from submitting new submissions to SMJ. If such a manuscript is approved and published, public exposure of the article with a printed mark ("plagiarized" or "retracted") on each page of the published file, as well as suspension for future publication for at least six years, or a period determined by the editorial board. Third party plagiarized authors or institutions will be notified, informing them about the faulty authors. Plagiarism will result in immediate rejection of the manuscript.

SMJ only publishes studies that have been approved by an institutional ethics committee (when a study involves humans or animals). Fail to provide such information prevent its publication. To ensure these requirements, it is essential that submission documentation is complete. If you have not completed this step yet, go to SMJ website and fill out the two required documents: Declaration of Potential Conflict of Interest and Authorship Statement. Whether or not your study uses humans or animals, these documents must be completed and signed by all authors and attached as supplementary files in the originally submitted manuscript.

1.6. After Acceptance

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

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

1.7. Code of Conduct Ethics Committee of Publications

SMJ is hosting the Code of Conduct Ethics Committee of Publications of the **COPE** (the Committee on Publication Ethics), which provides a forum for publishers and Editors of scientific journals to discuss issues relating to the integrity of the work submitted to or published in their journals.

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:

Talented High School Football Players' Perception of Talent Identification Criteria

Original Scientific Paper

Talent Identification Criteria

Vazjwar Matin[1] and Stig Arve Sæther[1]

[1]University of Science and Technology, Department of Sociology and Political Science, Trondheim, Norway

Corresponding author:

S. A. Sæther

Norwegian University of Science and Technology

Department of Sociology and Political Science

Dragvoll, 7491 Trondheim, Norway

E-mail: stigarve@ntnu.no

Word count: 2,946

Abstract word count: 236

Number of Tables: 3

Number of Figures: 0

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.

2.1.4. Authors

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.

2.1.6. Corresponding author

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.

2.1.7. Manuscript information

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*

2.3. Main Chapters

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.

2.3.3 Statistics reporting

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".

2.3.4. 'Acknowledgements' and 'Conflict of Interest' (optional)

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.

2.4.1. References style

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):

Nepocatych, S., Balilionis, G., & O'Neal, E. K. (2017). Analysis of dietary intake and body composition of female athletes over a competitive season. *Montenegrin Journal of Sports Science and Medicine, 6*(2), 57-65. doi: 10.26773/mjssm.2017.09.008

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. doi: 10.1007/s00421-007-0468-x

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. doi: 10.1249/01.MSS.0000058441.94520.32

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

Williams, R. (2016). Krishna's Neglected Responsibilities: Religious devotion and social critique in eighteenth-century North India [Electronic version]. *Modern Asian Studies, 50*(5), 1403-1440. doi:10.1017/S0026749X14000444

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.

If you use data from another published or unpublished source, it is the authors' responsibility to obtain permission and acknowledge them fully.

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)

2.6. Figures

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

All graphic materials should be of sufficient quality for print with a minimum resolution of 600 dpi. SMJ prefers TIFF, EPS and PNG formats.

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

Figures and figure legends should be completely intelligible without reference to the text.

The price of printing in color is 50 EUR per page as printed in an issue of SMJ.

2.6.1. Figure legends

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)

2.6.3. Sub-figures

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)…

2.7. Scientific Terminology

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

Measurements of length, height, weight, and volume should be reported in metric units (meter, kilogram, or liter) or their decimal multiples.

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

Percentage	Degrees	All other units of measure	Ratios	Decimal numbers
✓ 10%	✓ 10º	✓ 10 kg	✓ 12:2	✓ 0.056
× 10 %	× 10 º	× 10kg	× 12 : 2	× .056

Signs should be placed immediately preceding the relevant number.		
✓ 45±3.4	✓ p<0.01	✓ males >30 years of age
× 45 ± 3.4	× p < 0.01	× males > 30 years of age

2.8. Latin Names

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

- ✓ First time appearing: *musculus biceps brachii*

Abbreviated: *m. biceps brachii*

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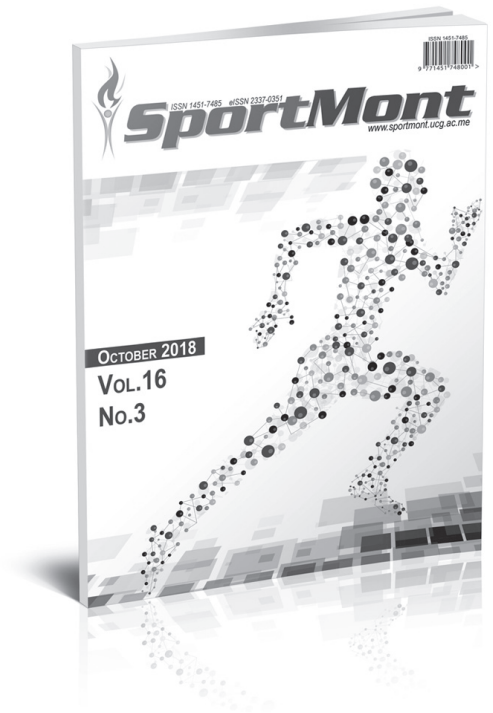

ISSN 1451-7485

Sport Mont Journal (SMJ) is a print (ISSN 1451-7485) and electronic scientific journal (eISSN 2337-0351) aims to present easy access to the scientific knowledge for sport-conscious individuals using contemporary methods. The purpose is to minimize the problems like the delays in publishing process of the articles or to acquire previous issues by drawing advantage from electronic medium. Hence, it provides:

- Open-access and freely accessible online;
- Fast publication time;
- Peer review by expert, practicing researchers;
- Post-publication tools to indicate quality and impact;
- Community-based dialogue on articles;
- Worldwide media coverage.

SMJ is published three times a year, in February, June and October of each year. SMJ publishes original scientific papers, review papers, editorials, short reports, peer review - fair review, as well as invited papers and award papers in the fields of Sports Science and Medicine, as well as it can function as an open discussion forum on significant issues of current interest.

SMJ covers all aspects of sports science and medicine; all clinical aspects of exercise, health, and sport; exercise physiology and biophysical investigation of sports performance; sport biomechanics; sports nutrition; rehabilitation, physiotherapy; sports psychology; sport pedagogy, sport history, sport philosophy, sport sociology, sport management; and all aspects of scientific support of the sports coaches from the natural, social and humanistic side.

Prospective authors should submit manuscripts for consideration in Microsoft Word-compatible format. For more complete descriptions and submission instructions, please access the Guidelines for Authors pages at the SMJ website: http://www.sportmont.ucg.ac.me/?sekcija=page&p=51. Contributors are urged to read SMJ's guidelines for the authors carefully before submitting manuscripts. Manuscripts submissions should be sent in electronic format to sportmont@ac.me or contact following Editors:

Dusko BJELICA, *Editor-in Chief – dbjelica@ac.me*
Zoran MILOSEVIC, *Editor-in Chief – zoranais@eunet.rs*
Jovan GARDASEVIC, *Managing Editor – jovan@ac.me*

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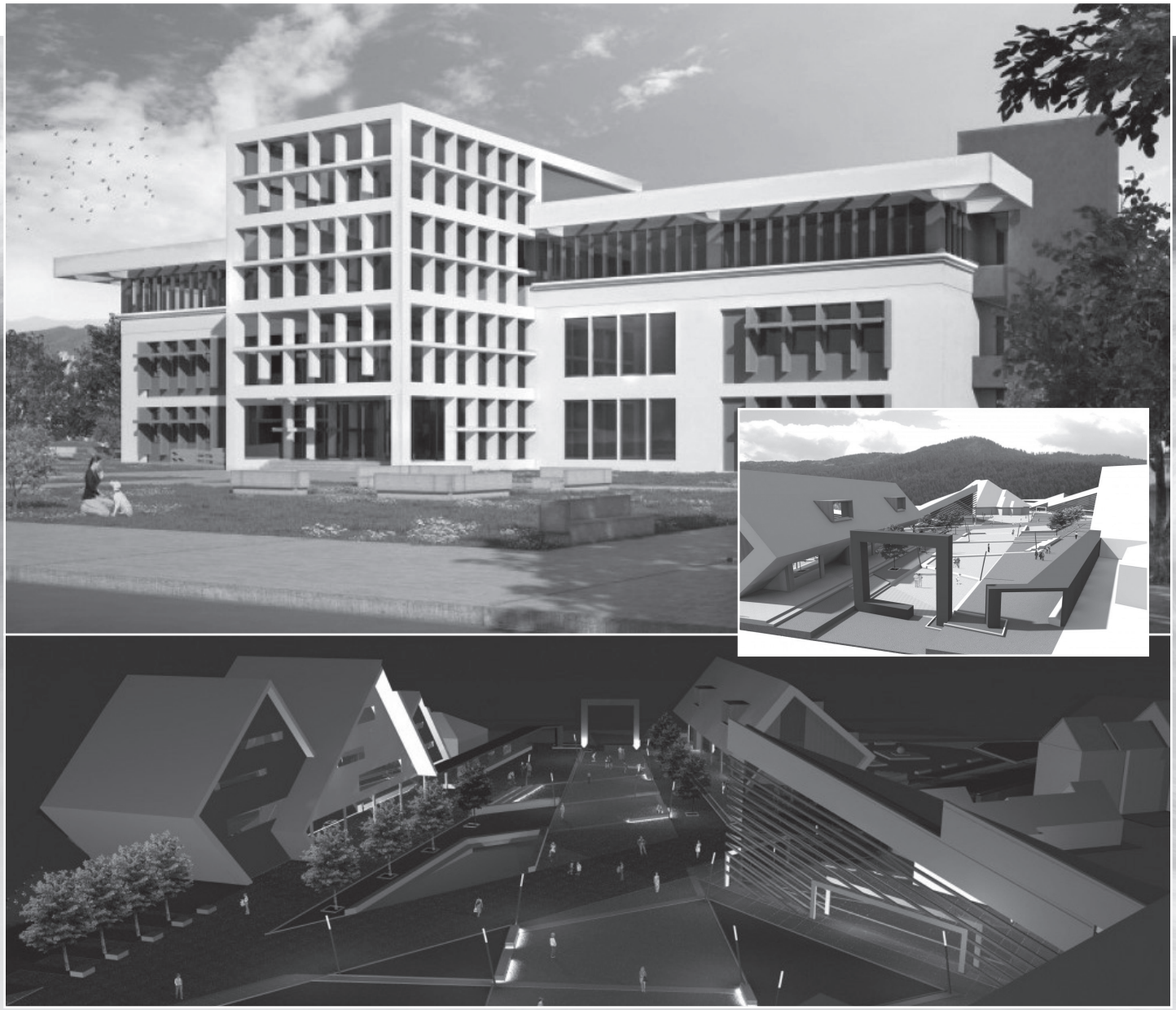
ARHITEKTONSKI FAKULTET

UNIVERSITY OF MONTENEGRO
FACULTY OF ARCHITECTURE



The goal of establishment of our institution is the education highly qualified professional cadre based on the best knowledge of the theory and practice in the world, and its application to the development and implementation of plans and projects in the space - as a basic condition for the quality valorization, programming, management and protection of natural and inherited built environment. In this way conceptualized school forms internationally experts in all areas of creativity - in the field of urban planning, architecture, construction and design - which includes the ability to create useful objects, architectural forms of all categories, urban and vacant space at different levels. Such qualified cadre are the spiritus movens of development of culture and technology in the modern world.

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We follow the highest academic and professional standards

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The University of Montenegro is the leading higher education and research institution in Montenegro. It is a public institution, established by the state, operating as a unique legal entity represented by the Rector. It is an integrated university organized on the model of the most European universities. Organizational units are competent for provision of study programmes, scientific-research and artistic work, use of allocated funds and membership in professional associations.

Since its foundation, the University of Montenegro has continuously been conducting reforms in the area of education and research, while since 2003 in line with the trends in EHEA. After adoption of the Bologna Declaration, University of Montenegro organized systematic preparation of documents aligned with it. Already in 2003, the experimental teaching programme started and today, all studies are organised in line with the Bologna principles. During the last two years systematic reforms of the University`s study programes have been conducted in order to harmonize domestic higher education system with European standards and market needs to highest extent.

The University of Montenegro has unique academic, business and development objectives. It comprises 19 faculties and two research institutes. The seat of the UoM is in Podgorica, the capital city, while university units are located in eight Montenegrin towns. The University support services and centers (advisory services, accounting department, international cooperation, career orientation) are located in the Rectorate.

Academic community of University of Montenegro is aware of the importance of its functioning for further development of the state and wider region. It has been so far, and will be in the future, the leader in processes of social and cultural changes, along with the economic development.

In the aspect of attaining its mission, University of Montenegro is oriented towards the priority social needs of the time in which it accomplishes its mission; open for all the students and staff exclusively based on their knowledge and abilities; dedicated to preservation of multicultural and multi-ethnic society in Montenegro; entrepreneurial in stimulating social and economic application of supreme achievements within the scope of its activities.

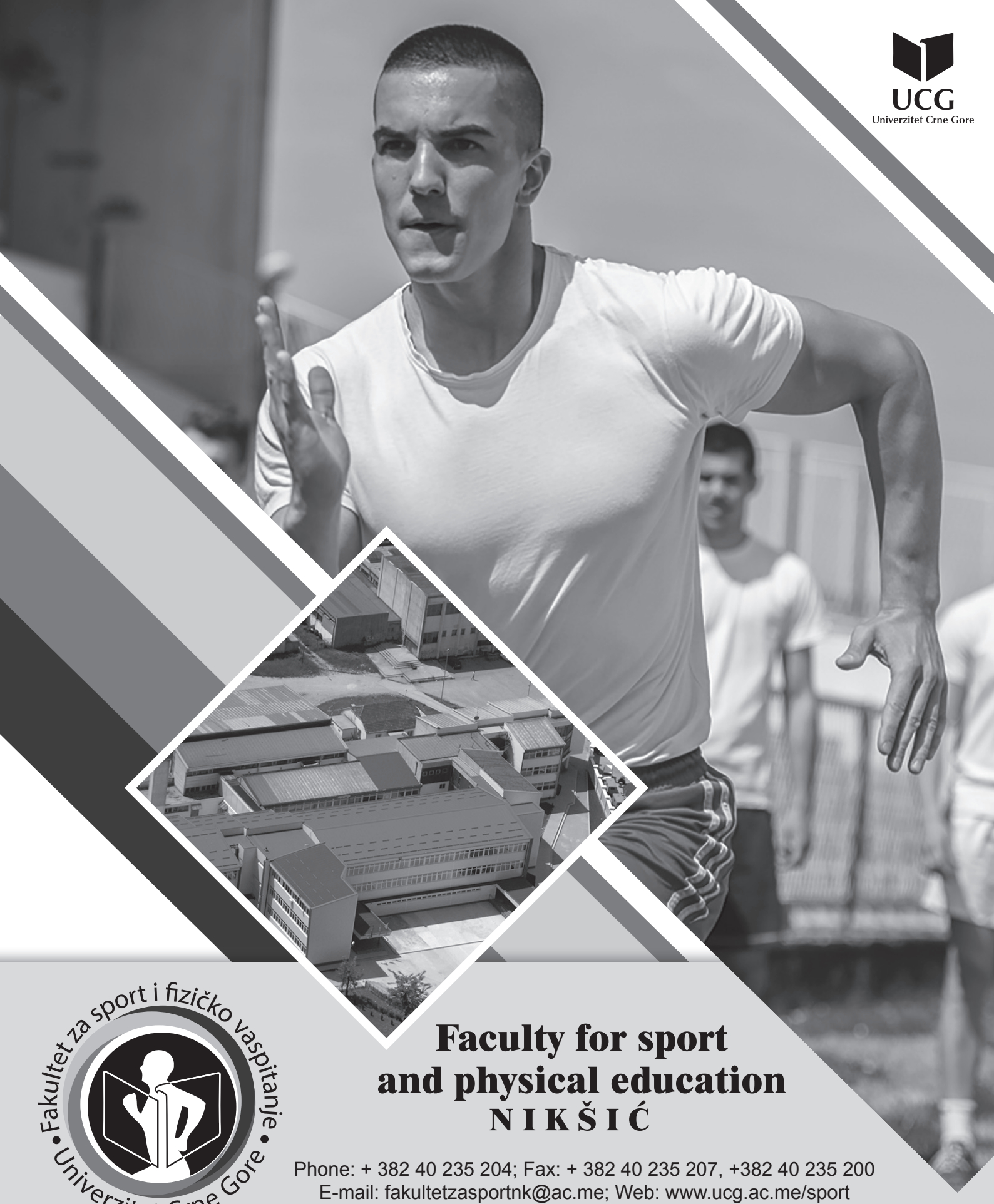
In 2015/16 there were a total of 1.192 employees at UoM, 845 of which were engaged in teaching. In the same year there were 20.236 students registered at all three cycles of studies.

Internationalization is high on the agenda of UoM priorities, thus it has participated in a number of international projects – over 50 projects funded under the Tempus programme, over 15 Erasmus Mundus Action 2 projects for student mobility, a number of projects under FP7 funding scheme or IPA supported projects, Erasmus + capacity building and International credit mobility projects and other.

For more information about University of Montenegro, please visit our website www.ucg.ac.me or send e-mail to pr.centar@ac.me.

BE PART OF OUR TEAM

CRNOGORSKI OLIMPIJSKI KOMITET
MONTENEGRIN OLYMPIC COMMITTEE



UCG
Univerzitet Crne Gore

Fakultet za sport i fizičko vaspitanje
Univerzitet Crne Gore

Faculty for sport and physical education
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Znanje i zdravlje!

Montenegrin Journal of Sports Science and Medicine

MONTENEGRIN JOURNAL OF SPORTS SCIENCE AND MEDICINE

ISSN 1800-8755

CALL FOR CONTRIBUTIONS

Montenegrin Journal of Sports Science and Medicine (MJSSM) is a print (ISSN 1800-8755) and electronic scientific journal (eISSN 1800-8763) aims to present easy access to the scientific knowledge for sport-conscious individuals using contemporary methods. The purpose is to minimize the problems like the delays in publishing process of the articles or to acquire previous issues by drawing advantage from electronic medium. Hence, it provides:

- Open-access and freely accessible online;
- Fast publication time;
- Peer review by expert, practicing researchers;
- Post-publication tools to indicate quality and impact;
- Community-based dialogue on articles;
- Worldwide media coverage.

MJSSM is published biannually, in September and March of each year. MJSSM publishes original scientific papers, review papers, editorials, short reports, peer review - fair review, as well as invited papers and award papers in the fields of Sports Science and Medicine, as well as it can function as an open discussion forum on significant issues of current interest.

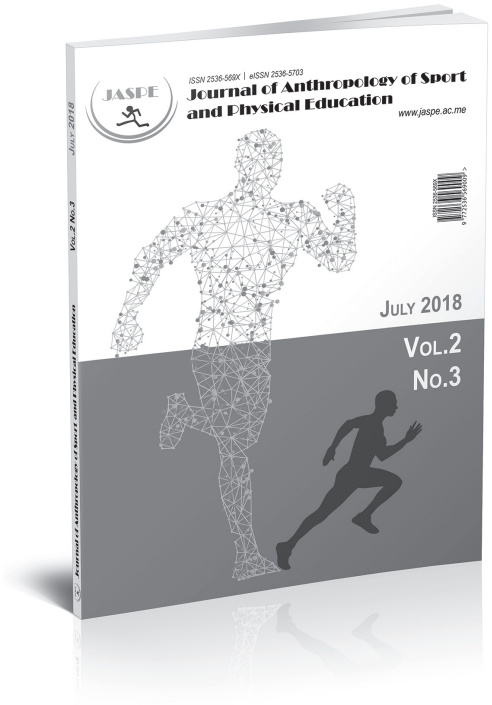
MJSSM covers all aspects of sports science and medicine; all clinical aspects of exercise, health, and sport; exercise physiology and biophysical investigation of sports performance; sport biomechanics; sports nutrition; rehabilitation, physiotherapy; sports psychology; sport pedagogy, sport history, sport philosophy, sport sociology, sport management; and all aspects of scientific support of the sports coaches from the natural, social and humanistic side.

Prospective authors should submit manuscripts for consideration in Microsoft Word-compatible format. For more complete descriptions and submission instructions, please access the Guidelines for Authors pages at the MJSSM website: http://www.mjssm.me/?sekcija=page&p=51. Contributors are urged to read MJSSM's guidelines for the authors carefully before submitting manuscripts. Manuscripts submissions should be sent in electronic format to office@mjssm.me or contact following Editors:

Dusko BJELICA, Editor-in Chief – dbjelica@ac.me
Stevo POPOVIC, Editor-in Chief – stevop@ac.me
Selçuk AKPINAR, Executive Editor – sakpinar@nevsehir.edu.tr

Publication date: Spring issue – March 2019
Autumn issue – September 2019

Journal of Anthropology of Sport and Physical Education



ISSN 2536-569X

Journal of Anthropology of Sport and Physical Education (JASPE) is a print (ISSN 2536-569X) and electronic scientific journal (eISSN 2536-5703) aims to present easy access to the scientific knowledge for sport-conscious individuals using contemporary methods. The purpose is to minimize the problems like the delays in publishing process of the articles or to acquire previous issues by drawing advantage from electronic medium. Hence, it provides:

- Open-access and freely accessible online;
- Fast publication time;
- Peer review by expert, practicing researchers;
- Post-publication tools to indicate quality and impact;
- Community-based dialogue on articles;
- Worldwide media coverage.

JASPE is published four times a year, in January, April, July and October of each year. JASPE publishes original scientific papers, review papers, editorials, short reports, peer review - fair review, as well as invited papers and award papers in the fields of Anthropology of Sport and Physical Education, as well as it can function as an open discussion forum on significant issues of current interest.

JASPE covers all aspects of anthropology of sport and physical education from five major fields of anthropology: cultural, global, biological, linguistic and medical.

Prospective authors should submit manuscripts for consideration in Microsoft Word-compatible format. For more complete descriptions and submission instructions, please access the Guidelines for Authors pages at the JASPE website: http://www.jaspe.ac.me/?sekcija=page&p=51. Contributors are urged to read JASPE's guidelines for the authors carefully before submitting manuscripts. Manuscripts submissions should be sent in electronic format to jaspe@ac.me or contact JASPE's Editor:

Bojan MASANOVIC, *Editor-in Chief – bojanma@ac.me*

Publication date: Winter issue – January 2019
Spring issue – April 2019
Summer issue – July 2019
Autumn issue – October 2019

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UNIVERZITET CRNE GORE
PRAVNI FAKULTET – PODGORICA

UNIVERZITET CRNE GORE
PRAVNI FAKULTET PODGORICA

Faculty of Law was founded on October 27th, 1972 in Podgorica as a scientific and artistic educational institution, in which educational and research work was organized in the area of law and similar social studies. While making into law the establishment of this institution, Assembly of Socialistic Republic of Montenegro highlighted that "The establishment of this institution of high education is necessary for meeting overall demands of the society of the Republic". Faculty of Law is one of the founding fathers of the University of Montenegro.

During the forty-five years of its existence Faculty of Law grew to a modern, contemporary, scientific and artistic educational institution. Forty-five generations studied at the faculty. About 17.000 students enrolled at the faculty and 4285 students graduated from the faculty. About 15 percent of the students studied abroad. Part of the best students continued postgraduate and doctoral studies at prominent university centers. Most of the former students stayed in Montenegro due to family ties. 88 professors and associates worked at the faculty, out of whom there were 26 guest professors. Today most of the professors and cadre at the faculty are former students.

Faculty organizes graduate and postgraduate studies. There are teaching and cadre resources for organizing specialist and doctoral studies in all the areas of law.

As a university branch Faculty of Law realizes a big number of its planned aims and tasks and finds soulutions for many important questions of cadre organization, technical and material problems. With the help of the University of Montenegro, faculty largely develops the international coorporation net.

Faculty follows world trends and achievements in the area of high education with the aim to coordinate its work with European and world demands. This year faculty made the first steps in realization of Bologna declaration. There is enough cadre for all the necessary teaching at the faculty.

The faculty was founnded because of expression of need to reach the neccessary standard for socio-economic, political, cultural and social development of Montenegro. During its overall existence faculty shared the fate with Montenegrin society. It will continue to do so by making steps towards implementing new practises and creating new relations, with the help of implementatation of modern European trends .

The faculty is a complex organization and managing institution nowadays.

University of Montenegro
FACULTY of ECONOMICS PODGORICA

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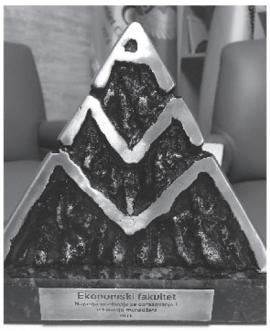
Faculty of Economics
University of Montenegro

The Faculty of Economics celebrated its 57th anniversary this year, and it is the oldest higher education institution in the country. Since its establishment, 8,630 students graduated at our Faculty.

Today, Faculty of Economics is a largely interdisciplinary institution, characterized by expressed dynamism in its work. Employees at the Faculty are dedicated to constant improvements and enhancements, all in accordance with the needs brought by the changes.



We provide our students with the best theoretical and practical knowledge, enabling them to develop critical spirit in approaching economic phenomena and solving concrete problems in daily work. From September 2017, at the Faculty, the new generation will start a 3 + 2 + 3 study, which will improve the quality of studying.

Development of Faculty of Economics in the coming period will follow the vision of development of the University of Montenegro, pursuing full achievement of its mission

Comprehensive literature, contemporary authors and works have always been imperative in creation of new academic directions at Faculty of Economics, which will form the basis of our future.

Faculty and its employees are dedicated to developing interest in strengthening the entrepreneurial initiative, creative and interdisciplinary approach among young people, using modern teaching and research methods. In this regard, the Faculty has modern textbooks and adequate IT technology, which supports the objectives set.

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UNIVERSITY OF MONTENEGRO
FACULTY OF MECHANICAL ENGINEERING
Podgorica

www. ucg.ac.me/mf

Mechanical engineering studies in Montenegro started during the school year 1970/71. On April 15th, within the Technical Faculty, the Department of Mechanical Engineering was formed. The Department of Mechanical Engineering of the Technical Faculty was transformed in 1978 into the Faculty of Mechanical Engineering, within the University "Veljko Vlahović". Since 1992 the Faculty of Mechanical Engineering is an autonomous University unit of the University of Montenegro. It is situated in Podgorica.

The University of Montenegro is the only state university in the country, and the Faculty of Mechanical Engineering is the only faculty in Montenegro from the field of mechanical engineering.

Activities of the Faculty of Mechanical Engineering can be divided into three fields: teaching, scientific-research work and profes- sional work.

Two study programmes were accredited within the Faculty of Mechanical Engineering:

- Academic study programme MECHANICAL ENGINEERING
- Academic study programme ROAD TRAFFIC

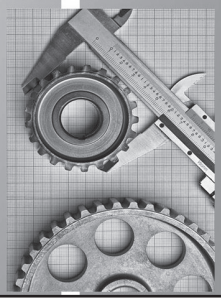
The study programmes are realised according to the Bologna system of studies in accordance to the formula 3+2+3.

On the study program Mechanical Engineering it is possible to study next modules:

- Mechanical Engineering – Production
- Applied Mechanics and Construction
- Energetics
- Energy Efficiency
- Mechatronics
- Quality

At the Faculty of Mechanical Engineering, as organisational units, there are centres and laboratories through which scientific-re- search and professional work is done:

- Centre for Energetics
- Centre for Vehicles
- Centre for Quality
- Centre for Construction Mechanics
- Centre for Traffic and Mechanical Engi- neering Expertise
- Centre for transport machines and metal constructions
- 3D Centre
- Didactic Centre – Centre for Automation and Mechanomics training
- European Information and Innovation Centre
- Cooperation Training Centre
- Laboratory for Metal Testing
- Laboratory for Turbulent Flow Studies
- Laboratory for Vehicle Testing
- Laboratory for Attesting of Devices on the Technical Examination Line



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We have expanded the quality of our journals considerably over the past years and can now claim to be the market leader in terms of breadth of coverage.

As we continue to increase the quality of our publications across the field, we hope that you will continue to regard MSA journals as authoritative and stimulating sources for your research. We would be delighted to receive your comments and suggestions, mostly due to the reason your proposals are always welcome.

Look Inside!

Sport Mont Journal

Editors-in-Chief: **Dusko Bjelica**, Montenegro; **Zoran Milosevic**, Serbia
Managing Editor: **Jovan Gardasevic**, Montenegro

Volume 16, 2018, 3 issues per year; Print ISSN: 1451-7485, Online ISSN: 2337-0351

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Executive Editor: **Selçuk Akpınar**, Turkey
Associate Editors: **Mehmet Uygur**, USA; **Catalina Casaru**, USA; and **Predrag Bozic**, Serbia

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www.mjssm.me

MSA Conference 2019

16th Annual Scientific Conference of Montenegrin Sports Academy "Sport, Physical Activity and Health: Contemporary Perspectives"

http://www.csakademija.me/conference/

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MONTENEGRIN SPORTS ACADEMY

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