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Vol. 14 June 2016 No. 2
# TABLE OF CONTENTS

- **Matej Majerić**
  (Original Scientific Paper)
  *The Importance of Sport in Students’ Lives and the Frequency of Sport Participation Among Students - Gender Differences* .......................................................... 3-6

- **Eirik Nerland and Stig Arve Sæther**
  (Original Scientific Paper)
  *Norwegian Football Academy Players-Players Self-Assessed Competence, Perfectionism, Goal Orientations and Motivational Climate* .......................................................... 7-11

- **Izet Rađo, Haris Alić, Izet Bajramović, Eldin Jelešković, Nedim Ćović, Slavenko Likić and Amel Mekić**
  (Original Scientific Paper)
  *Functional Strength Training Effects on Knee Flexors and Extensors Power Output in Football Players* .......................................................... 13-16

- **Dragan Krivokapić and Gabriela Tanase**
  (Original Scientific Paper)
  *Methods for Evaluation of Some Psychomotor Abilities* .......................................................... 17-19

- **Rajko Milašinović, Stevo Popović, Radenko Matić, Jovan Gardašević and Duško Bjelica**
  (Original Scientific Paper)
  *Body Height and its Estimation Utilizing Arm Span Measurements in Male Adolescents from Southern Region in Montenegro* .......................................................... 21-23

- **Slobodan Andrasic, Darijan Ujsasi, Milan Cvetkovic, Dejan Orlic and Zoran Milic**
  (Original Scientific Paper)
  *Impact of Recreational Fitness Training Program on Dynamic Strength of Women* .......................................................... 25-29

- **Jovan Gardasevic, Dusko Bjelica, Ivan Vasiljevic and Rajko Milasinovic**
  (Original Scientific Paper)
  *The Effects of the Training in the Preparation Period on the Repetitive Strength Transformation with Cadet Level Football Players* .......................................................... 31-33

- **Zoran Milošević, Jovan Vuković, Nebojša Maksimović and Radenko Matić**
  (Original Scientific Paper)
  *The Correlation between Physical Characteristics and Motor Skills of Female Secondary School Pupils* .......................................................... 35-38

- **Ifet Mahmutović, Izet Rađo, Munir Talović, Rasim Lakota, Haris Alić and Eldin Jelešković**
  (Original Scientific Paper)
  *Level of Transformation of Motor Skills in Female Volleyball Players Influenced by Training Operators* .......................................................... 39-43

- **Svetislav G. Popović, Jelena Bajić Šestović, Nevena Đurović Mašanović and Sanja Vlahović**
  (Review paper)
  *Planning Network of Sports Facilities in the Context of Montenegro Case Study: Herceg-Novi, Podgorica* .......................................................... 45-51

Guidelines for the Authors ........................................................................................................................................ 53-71

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The Importance of Sport in Students’ Lives and the Frequency of Sport Participation Among Students - Gender Differences

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Abstract

The main purpose of this research was to analyse the gender differences among students at the University of Ljubljana in the importance of sport in their lives and the frequency of sport participation. The research was done in the 2013 academic year on a random sample of 3% of the students (N = 1390); a questionnaire about students’ lifestyles was used (Majerič, 2013). In this study, two variables were analysed: the importance of sport in students’ lives and the frequency of sport participation; the data were analysed with SPSS for Windows. The basic statistical parameters for both variables were calculated. To calculate the gender differences, a t-test for independent samples and the Mann-Whitney U test were run. For the variable ‘importance of sport in students’ lives’, 61.93% of male and 53.20% of female respondents reported that sport is important and very important in their lives. The gender differences were small but statistically significant (p=0.013). For the variable ‘frequency of participation in sport activity’, 79.61% of male and 77.10% of female respondents reported that they were sport active every day, 4 to 6 times a week or 2 to 3 times a week. The gender differences in this variable were also statistically significant (p=0.000). Our findings and conclusions provide useful guidance to the closer and wider professional public who organize sport programmes for students.

Key words: sport activity, students, importance, frequency, gender differences

Introduction

According to the World Health Organization (WHO, 2010), human health depends on ecological conditions (21%), genetics (21%), the quality of the health care system (8%), and lifestyle (50%). From this perspective, it is the lifestyle of the individual that is crucial for health and quality of life. In this context, physical activity plays an important role in all stages of the life of the individual. It is necessary for the normal biological, social, and psychological development and health of young people. It is also known that regular and appropriately selected sport activity for adults and the elderly can maintain their vitality and protect them against disease; it also allows a better quality of life (Škof, 2010). Therefore, it is vital that young people are aware of the importance of a healthy lifestyle, of which physical activity is an integral part. Young people should have good conditions for physical activity. They should be engaged in different sport activities as often as possible. According to the World Health Organization (WHO, 2010), to maintain health, people aged 18–64 should do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or do at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous-intensity activity. This is not only important for the student years, but also for all later stages of life. Only in such a way can physical activity be an important part of a healthy lifestyle.

Various studies have revealed sport activity to be an important factor in the lifestyle of students at the University of Ljubljana. Majerič (2002, N = 1614) observed that 62.4% of interviewed male students and 54.2% of female students regard sport as an important factor in their lives. Similarly, Markelj (2004, N = 705) stated that 53% of all students share this belief; however, men consider sport activity to be a more important part of their lives than women do. Likewise, Majerič and Markelj (2010, N=1116) found that 63.5% of interviewed students of both genders regard sport as an important factor in their lives, although the authors reported that men often consider sport to be very important whereas women were mainly less explicit in defining its importance. Several other studies on students also revealed sport activity as an important lifestyle factor during the student years (Bettina, 2000; El Ansari et al., 2013) with the authors claiming sport activity to be more important for male students. Altogether, it could be concluded that sport activity represents an important value for students whilst indicating that the motives for it also need to be examined. Some analyses on the motivation of Slovenian students for sport participation revealed that students participate in sport not only to spend their free time in a useful way but mostly for reasons of health, fitness, achieving good looks, and as a way of socializing (Petkovšek, 1980; Majerič, 2002; Markelj, 2004; Cerar, 2014). These findings have been confirmed by studies in other countries, indicating that the main motive for the sport participation of students carries a social note combined with health prevention, re-energizing oneself, internal motivation, teamwork, fun, followed by external motivation and competition (Shao-Hua et al., 2006; Santos Legnani et al., 2011; Afshanepurak et al., 2012; Cerar, 2014). When attempting to understand the importance of sport activity among students, the findings of researchers reporting on various motives for sport participation of different genders should also be considered. Sirard, Pfeiffer, and Pate (2006) found that the main motivational factors for

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sport participation in men are competition, social contacts, and health, whereas among women social contacts come first, followed by health and then competition. Egli, Bland, Melton, and Czech (2011) as well as Guedes, Santos Legnani, and Legnani (2012) stated that men are more motivated for sport by internal factors (strength, challenge, body fitness), whereas women are more motivated by external factors (weight watching, achieving good looks). In these studies, a comparison between the genders of all age groups has revealed a higher motivation and a higher degree of sport participation in men in comparison to women. According to the findings, it could be concluded that sport activity is an important factor in the lifestyle of students of both genders; however, the motivation for participation in men and women is different.

Available research on the sport participation of students at the University of Ljubljana, which was performed on representative samples, shows the increase in the proportion of sport active students. According to the data from Petkovšek (1980, N=1061), 56% of male and female students were sport active in 1979. Majerič (2002) found that 70.3% of enlisted students of both genders were sport active in 2002. Observing a sample of students from 2006 at three Slovenian universities, Majerič and Markelj (2010) found that 81.2% of the interviewed subjects participated in sport. All of these studies indicate that male students participate in sport more often than the female students do; similar conclusions have been reached in some studies from other countries. In the research among students from seven UK universities. El Ansari et al. (2013) found that 40% of females and 66% of males participated in vigorous exercise for at least 20 minutes on ≥3 days in the week, or participated in moderate exercise for at least 30 minutes on ≥5 days in the week. This is analogous to reports from the USA, where 44.2% of students exercised vigorously for at least 20 minutes or moderately for at least 30 minutes on at least three out of the previous seven days (American College Health Association, 2007). However, some findings are less positive. In Hong Kong, only 9% of female and 26% of male university students exercised vigorously for 20 min or more, at least three times a week (Lee & Loke, 2005).

Based on theoretical introduction, the main purpose of this empirical research was to analyze the gender differences among students at the University of Ljubljana regarding the importance of sport in student’s life and frequency of sport participation.

Methods

The research was conducted in March and April in the 2013 academic year on a random sample of 3% of the students of the University of Ljubljana (N = 1390). A questionnaire on student lifestyles was used (Majerič, 2013). The survey was based on the consideration of ethical aspects of research involving human studies, in accordance with the principles of the Helsinki-Tokyo Declaration. Before the start of the implementation of the survey, participants gave written consent to participate in the survey. The survey was voluntary. In accordance with the relevant legislation, the protection of personal data and the anonymity of participants was considered. In this study, two variables were analyzed: 1) the importance of sport in students’ lives, and 2) the frequency of participation in sport. In the first variable, respondents had to choose one answer on a six-item Likert scale. In the second variable, students had to choose one answer from among seven. The data from the variables was analyzed with SPSS for Windows, and the basic statistics parameters for both variables were calculated. For the variable ‘importance of sport in student’s life’, a t-test for independent samples was run to calculate the gender differences. To calculate the gender differences for the variable ‘frequency of sport participation’, a Mann-Whitney U test was run.

Results

Table 1. The importance of physical activity in student’s life for male and female – basic statistics

<table>
<thead>
<tr>
<th>Gender</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male students</td>
<td>N</td>
<td>18</td>
<td>30</td>
<td>58</td>
<td>109</td>
<td>160</td>
<td>190</td>
</tr>
<tr>
<td>%</td>
<td></td>
<td>3.19</td>
<td>5.31</td>
<td>10.27</td>
<td>19.29</td>
<td>28.32</td>
<td>33.63</td>
</tr>
<tr>
<td>Female students</td>
<td>N</td>
<td>10</td>
<td>47</td>
<td>136</td>
<td>180</td>
<td>212</td>
<td>212</td>
</tr>
<tr>
<td>%</td>
<td></td>
<td>1.25</td>
<td>5.90</td>
<td>17.06</td>
<td>22.58</td>
<td>26.60</td>
<td>26.60</td>
</tr>
</tbody>
</table>

Legend: N – number of respondents; % – percentage of respondents; Six-Likert scale – ‘1’ means that physical activity is not important and ‘6’ that it is very important

Table 2. The importance of physical activity in student’s life – gender differences

<table>
<thead>
<tr>
<th>Gender</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>SEM</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male students</td>
<td>565</td>
<td>4.65</td>
<td>1.345</td>
<td>.057</td>
<td>0.013</td>
</tr>
<tr>
<td>Female students</td>
<td>797</td>
<td>4.47</td>
<td>1.276</td>
<td>.045</td>
<td></td>
</tr>
</tbody>
</table>

Legend: N – number of respondents, M – mean; SD-standard deviation; SEM – Standard Error Mean; p – value for statistically significant differences; *p≤0.05.

The first analysis (Table 1) shows that sport is a very important part of students’ lives for both sexes. For the variable ‘importance of sport in students’ lives’, 61.95% of male and 53.20% of female respondents reported that sport is important and very important in their lives (the highest values: 5 and 6 on a six-item Likert scale). The analysis (Table 2) of mean values for the same variable showed that the mean values were slightly higher for male students (male students’ mean values = 4.65;
female students’ mean values = 4.47). Although small differences in mean values were found, the t-test for equality of means showed that gender differences were statistically significant (p=0.013).

### Table 3. The frequency of participation in physical activity for male and female students – basic statistics

<table>
<thead>
<tr>
<th>Gender</th>
<th>Never</th>
<th>Once or several times a year</th>
<th>Once or twice per month</th>
<th>Once a week</th>
<th>Two to three times per week</th>
<th>Four to six times per week</th>
<th>Every day</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male students</td>
<td>N</td>
<td>13</td>
<td>17</td>
<td>22</td>
<td>62</td>
<td>175</td>
<td>189</td>
<td>81</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>2.33</td>
<td>3.04</td>
<td>3.94</td>
<td>11.09</td>
<td>31.31</td>
<td>33.81</td>
<td>14.49</td>
</tr>
<tr>
<td>Female students</td>
<td>N</td>
<td>8</td>
<td>16</td>
<td>48</td>
<td>111</td>
<td>331</td>
<td>202</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>1.00</td>
<td>2.00</td>
<td>6.01</td>
<td>13.89</td>
<td>41.43</td>
<td>25.28</td>
<td>10.39</td>
</tr>
</tbody>
</table>

Legend: N – number of respondents; % – percentage of respondents

### Table 4. The frequency of participation in physical activity – gender differences

<table>
<thead>
<tr>
<th>Me</th>
<th>SD</th>
<th>MR</th>
<th>Sum of Ranks</th>
<th>U</th>
<th>Z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male students</td>
<td>5.44</td>
<td>1.326</td>
<td>723.41</td>
<td>404385.00</td>
<td>198776.000</td>
<td>-3.597</td>
</tr>
<tr>
<td>Female students</td>
<td>5.18</td>
<td>1.188</td>
<td>648.78</td>
<td>518376.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Legend: Me – median; SD-standard deviation; MR – mean rank; SR – sum of ranks; U – value for the calculation of statistically significant differences; Z – value for approximation of U for large samples; p – value for statistically significant differences; *p<0.05.

The second analysis (Table 3) showed that students of both genders practice sport very often. For the variable frequency ‘participation in sport activity’, 79.61% of male and 77.10% of female respondents reported that they were sport active every day, 4 to 6 times a week or 2 to 3 times a week. Sport participation included a variable in a range of different activities from walking to cycling and various games. The analysis (Table 4) of median values showed that male students were practicing sport more often (median values = 5.44) than females did (median values = 5.18). Although the differences are not large, the Mann-Whitney U test confirmed that gender differences in variable frequency of sport participation were statistically significant (p=0.000).

### Discussion

When analysing the importance of physical activity in students’ lives, the findings of this study support previous research conducted among students in Slovenia (Majerič, 2002; Markelj, 2004; Majerič & Markelj, 2010; Cerar, 2013). The findings are also comparable with other studies (Bettina, 2000; El Ansari et al., 2013). We have confirmed that sport at the University of Ljubljana remains a very important part of the lives of both male and female students; students of both sexes were practicing sport very often. Nevertheless, male students were more sport active than female ones were. In this paper, we did not analyse the motivation for sport participation among students, but we propose understanding the gender differences in the contexts and findings of Majerič (2002), Markelj (2004), and Cerar (2014). They found that motives for physical activities among male and female students were different. Male students were involved in physical activity due to competition, socializing, and health; but female students, due to health, socializing and then competition. These findings also support research conducted in other countries (Sirard, Pfeiffer, & Pate, 2006; Egli, Bland, Melton, & Czech, 2011; Guedes, Santos Legnani, & Legnani, 2012).

If we consider the last Bologna reform, done in 2010, which has transformed organized sport programmes from compulsory, curricular activity to non-compulsory, extracurricular activities, the frequency of physical activity among students at the University of Ljubljana in 2012 was still very high. In our study, we found that 79.61% of male and 77.10% of female respondents reported that they were sport active every day, 4 to 6 times a week, or 2 to 3 times a week. We also found that male students were more sport active than female students were. Our findings support the findings of El Ansari et al. (2013) and data from the American College Health Association (2007). Regardless of the Bologna reform in Slovenia, we hope that we will never report such a small proportion of sport active students as reported by Lee and Loke (2005), with only 9% of female and 26% of male university students exercising vigorously for 20 min or more, at least three times a week.

In our research, we did not analyse the frequency of sport activity participation in such a way that we could compare the data with the recommendations of WHO (2010). However, we think that the frequency of sport activity participation among male and female students at the University of Ljubljana remains sufficient so that it can be said that the majority of students were physically active enough to maintain their health.

Our conclusion is that there were many reasons for these positive findings of sport activity as an important part of student’s life and the high frequency of participation in sport activity among male and female students. Examining the findings in greater detail reveals that a systematic and planned implementation of physical education in elementary and middle school, which is based on carefully prepared curricula, is definitely a highly important factor. Another significant factor is a rich sport tradition, which is one of the reasons that Slovenia is known as a ‘sport nation’. Ultimately, we can conclude that sport activity is currently one of the main focal points of a healthy lifestyle, of which young people, future intellectuals, are apparently aware.
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Norwegian Football Academy Players-Players Self-Assessed Competence, Perfectionism, Goal Orientations and Motivational Climate

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Abstract

Grounded in the theoretical framework of achievement goal theory and perfectionism theory, the purpose of this study was to examine how self-assessed perceived abilities covariance these variables among Norwegian football academy players. 140 adolescent football players participated, representing three football academies. Perceived competence was reported as equivalent to or better than others. Perfectionism scores showed personal standards as the highest of the dimensions of perfectionism, while perceived parental pressure was lowest. In contrast, mean task orientation and perceived mastery climate were higher than ego orientation and perceived performance climate. The correlation analysis showed that perceived competence correlated positively with personal standards. Personal standards correlated positively with the rest of the perfectionism dimensions as well as ego orientation, perceived mastery- and performance climate. Concern over mistakes was positively correlated with ego-orientation. Overall, findings suggested that personal standards correlate with perceived competence, while these variables also relate to other perfectionism dimensions, goal orientations and perceived motivational climate. Therefore, coaches should highlight the importance of high personal standards, as a potentially maladaptive function on talent development.

Key words: talent development, perceived competence, perfectionism, goal orientations, motivational climate

Introduction

Talented football players are expected to be highly motivated in order to be able to develop into future elite level players. This motivation should nurture the players’ ability to undertake frequent training (Ericsson, Krampe, & Tesch-Römer, 1993), be able to successfully self-regulate (Toering, Elferink-Gemser, Jordet, & Visscher, 2009) and hold the right attitudes (Sæther, 2014) regarding their own development. In order to foster talented young players, football academies have become an important development arena. Being part of a football academy environment is associated with many advantages, i.e. high-level coaches, training facilities (Ashworth & Heyndels, 2007), potentially increasing the motivation to continue training for a professional career.

Even so, academy players will encounter a range of personal and interpersonal challenges that might affect their development (Richardson, Gilbourne, & Littlewood, 2004). Two common challenges are the high expectation environment the players are a part of involving considerable personal pressure especially from coaches. Several researchers have underlined the importance of high quality coach-athlete relationships in order to reduce stress, improve performance and enjoyment of competitive experiences (Kristiansen & Roberts, 2010). Similarly Rodahl et al. (2015) highlight the quality of the coach-athlete relationship as a significant factor in enhancing mental toughness, which may subsequently increase the athlete’s ability to cope with stress (Nicholls, 2011). However, even if the coach is the most important supplier of a stable and predictable social environment, the players are also faced with their own expectations. The players are therefore dependent on the ability to assess their own skills and abilities (Kannekens, Elferink-Gemser, Post, & Visscher, 2009), even if they constantly are assessed by their coaches. High standards have been integrated into large parts of the world of sports. Perfectionism is a personality construction, which has been related to several types of maladjustments. Frost et al. (1990), described perfectionism as individuals’ tendency to set unrealistically high standards of performance, distinguish perfectionists from those who are highly competent and successful. Hamacheck (1978) argued that perfectionism is a bidimensional concept, and drew a distinction between normal (adaptive) and neurotic (maladaptive) perfectionism. Adaptive perfectionism is characterized by high personal standards of achievement and getting pleasure from getting the work done. Adaptive perfectionists are also capable of choosing inaccurate solutions in situations. They put forth maximum efforts in the pursuit of their standards, but are able to accept personal limitations and environmental obstacles if they do not accomplish the ideal performance (Dunn, Causgrove Dunn, & Syrotuik, 2002). Maladaptive perfectionists, however, is driven by an overwhelming fear of failure. Even though both adaptive and maladaptive perfectionists set high standards of performance, maladaptive perfectionists tend to be overly critical about themselves (Frost et al., 1990), and are infrequently satisfied with their performance, because of their lack of freedom to make mistakes (Dunn et al., 2002). Previous research on talented athletes has found a significantly higher prevalence of adaptive perfectionism than maladaptive perfectionism (Dunn et al., 2006). Since adaptive perfectionism is self-referential, athletes set high personal standards not dependent on external factors such as pressure from coaches and parents.
In achievement contexts, athletes are assumed to be motivated through their state of goal involvement, described as ego or task involvement (Ommundsen, Roberts, Lemlye, & Miller, 2005). It is assumed that people are predisposed to be egotistical or task involved, and these predispositions are called goal orientations, which differ between ego and task orientations. Ego orientation is associated with maladaptive behavior and is characterized by athletes defining success as having higher ability than others (Nicholls, Cobb, Wood, Yackel, & Patashnick, 1990). How well the athlete has performed is rated lower than winning, receiving recognition and being better than others. Difficulty and one’s ability is assessed as high or low compared to members of a normative reference group (Ommundsen, Roberts, & Kavussanu, 1998). On the other hand, task orientation is associated with adaptive behavior. This orientation is characterized by athletes who assess their ability and task difficulty from their own sense of mastery, understanding and knowledge. Task orientation involves a self-referential definition of success as the result of improving ability or the achievement of something that is personally challenging (Nicholls et al., 1990). It is important to acknowledge that achievement goal orientations are orthogonal (Roberts, 2012). Athletes can be higher or lower in both or either orientation at the same time. Therefore, it is important to consider the simultaneous combination of task and ego orientation, rather than focusing on whether an athlete is task or ego oriented. Pensgaard and Roberts (2000) found that elite-athletes scored high for both orientations. However, if an athlete scores high on ego-orientation and low on task orientation, s/he is more exposed to burn out and diminished motivation for their development.

Even though athletes are predisposed to act in a task or ego-involved way in an achievement context, the motivational dynamics of the context and their respective group will also have a influence on the adopted goal of action. Motivational climate refers to how the goal structures of what is emphasized are perceived by participants in a particular setting (Ommundsen et al., 2005). As with goal orientations, motivational climate is also divided into two elements; performance and mastery climate. If the environment promotes interpersonal competition, achieving results and public recognition of skill demonstrations, the climate is more likely a performance climate (Ames, 1992). The best players get the most attention and constructive feedback, and the criteria for success is winning and being better than others (Roberts, 2012). The athletes do not have much self-determination, and this climate is associated with ego-involve-ment and maladaptive behavior. Mastery climate, on the other hand, is characterized by coping and learning. The athlete is allowed to fail, in the knowledge that this may promote self-de-determination and choices (Ommundsen et al., 2005). In this environment progress and efforts are important criteria to master, and coaches will be concerned to promote equal recognition, time and attention for all players. This climate is not concerned with interpersonal competition, but focuses more on self-referential criteria for success and task involvement (Ames, 1992). The climate is also assumed to vary between training and competitions, where there is a greater performance-oriented focus during competitions than in training.

Talent development is a long-term process, where the outcomes are highly unpredictable. This has led researchers and practitioners to focus on parts of the development process in order to be able to refine the variables affecting this process. Motivational factors are considered to affect this development process to a large extent. Grounded in the theoretical framework of achievement goal theory and perfectionism theory, the purpose of this study was to examine how self-assessed perceived competence covariance these variables among Norwegian football academy players.

Methods

Participants

140 male football players, aged between 12-19 years (M age = 14.07, SD = 1.85), participated in this study. The young players were recruited from three different football academies. Two of the academies work as a team within a club, while the third academy is a non-club related academy, where the players play for different teams. Consent for the study was obtained from the leaders and coaches of the academies, after we described the purpose of the study.

Measures

Perfectionism

The Multidimensional Perfectionism Football Scale (MPS-Football) (Dunn et al., 2002) was used to assess the degree of the athletes perfectionism. The scale is a 34-item measure that includes a 7-item personal standard-scale (e.g. “I hate being less than the best at things in football”) (Cronbach’s alpha=.561), an 8-item concern over mistakes scale (e.g. “When I fail even slightly in competition, for me, it is as bad as being a complete failure”) (Cronbach’s alpha=.701), a 9-item perceived parental pressure scale (e.g. “My parents set very high standards for me in football”) (Cronbach’s alpha=.747), a 6-item perceived coach pressure scale (e.g. “I feel like I can never quite live up to my coach’s standards”) (Cronbach’s alpha=.620), and 4-item doubts about actions scale (e.g. “I tend to get behind in my work because I repeat things over and over”) (Cronbach’s alpha=.560). In the analysis, the doubts about actions items are excluded because of the subscales’ validity, and other study concerns over the subscale (Dunn et al., 2002). Respondents were asked to consider their feelings about themselves and others on a 5-point scale, from 1=Incorrect to 5=Correct.

Goal orientations

A Norwegian version of the Perception of Success Questionnaire (POSQ) (Roberts, Treasure, & Balague, 1998) was used to assess the degree of the athletes’ goal orientations. POSQ consists of 12 statements, which includes two 6-item subscales measuring task (e.g. “I show personal progress”) (Cronbach’s alpha=.726) and ego orientations (e.g. “I do it better than my opponents”) (Cronbach’s alpha=.784). The stem for each item was “When I play football, I feel most successful when…” . Respondents were asked to answer on a 5-point scale from 1=Strongly disagree to 5=Strongly agree.

Motivational climate

To measure the perceived motivational climate, a Norwegian version of the Perceived Motivational Climate in Sport Questionnaire (PMCSQ) (Roberts & Ommundsen, 1996). The respondents were asked to consider 19 items with the stem “during soccer training at the academy, I find that…”, and includes two subscales. The mastery climate subscales consist of 9 statements (e.g. “Efforts are rewarded”) (Cronbach’s alpha=.759), and 10 statements regarding performance climate (e.g. “The coaches favour certain players”) (Cronbach’s alpha=.782). Responses were indicated on 5-point Likert scales, from 1=Strongly disagree, to 5=Strongly agree.
Perceived competence

Unlike the measurements of perfectionism, goal orientations, and motivational climate, the measurement of perceived competence is not collected from a standardised measuring instrument. The basis of the instrument is the four indicators for talent in soccer (physical, physiological, sociological and psychological), formed by Williams and Reilly (2000). Sæther (2014) modified this to technical, tactical, mental, social and physical abilities. The respondents was asked to compare themselves to the other players on the academy, and consider if they are 1=Poorer than most, 3=Equivalent, or 5=Better than most. The scores on the five variables were added together, and the average used as a measure for their perceived competence (Cronbach’s alpha=.596).

Procedure

Assessment was conducted before or after a regular training session with two of the academies. With the last academy, players were gathered by the coaches to answer the questionnaire. Before the administration of the questionnaire, the participants were told that the general purpose of the study was to investigate what characterises talented young soccer players. It was also emphasised that there were no right or wrong answers, and that responses were voluntary and anonymous.

Data analysis

In this analysis data were screened for missing data, potential outliers, and assumptions of normality. For all of the questionnaire scales, mean scores were computed. In the results section descriptive statistics and Pearson product-moment correlation coefficients are presented. The scale reliability is presented under materials and method.

Results

In Table 1 descriptive statistics for the variables are presented. As the table shows, the respondents perceived their competence was equivalent or better than other teammates.

Table 1. Descriptive statistics of perceived competence, perfectionism, goal orientations and perceived motivational climate

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Std</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived competence</td>
<td>107</td>
<td>2.40</td>
<td>5.00</td>
<td>3.75</td>
<td>0.600</td>
</tr>
<tr>
<td>Personal standards</td>
<td>107</td>
<td>1.29</td>
<td>5.00</td>
<td>3.50</td>
<td>0.733</td>
</tr>
<tr>
<td>Concern over mistakes</td>
<td>107</td>
<td>1.25</td>
<td>4.50</td>
<td>2.64</td>
<td>0.666</td>
</tr>
<tr>
<td>Perceived parental pressure</td>
<td>107</td>
<td>1.00</td>
<td>4.22</td>
<td>2.00</td>
<td>0.634</td>
</tr>
<tr>
<td>Perceived coach pressure</td>
<td>107</td>
<td>1.17</td>
<td>5.00</td>
<td>2.59</td>
<td>0.690</td>
</tr>
<tr>
<td>Ego orientation</td>
<td>107</td>
<td>1.67</td>
<td>5.00</td>
<td>3.83</td>
<td>0.751</td>
</tr>
<tr>
<td>Task orientation</td>
<td>107</td>
<td>1.50</td>
<td>5.00</td>
<td>4.37</td>
<td>0.572</td>
</tr>
<tr>
<td>Performance climate</td>
<td>107</td>
<td>1.10</td>
<td>4.70</td>
<td>2.96</td>
<td>0.666</td>
</tr>
<tr>
<td>Mastery climate</td>
<td>107</td>
<td>2.89</td>
<td>5.00</td>
<td>4.20</td>
<td>0.534</td>
</tr>
</tbody>
</table>

When it comes to perfectionism, personal standards scores were higher than for the rest of the dimensions of perfectionism, while perceived parental pressure was lowest. It is also worth noting that mean task orientation and perceived mastery climate was higher than ego orientation and perceived performance climate.

Table 2. Pearson correlations of perceived competence, age, perfectionism, goal orientations and perceived motivational climate

<table>
<thead>
<tr>
<th>Variables</th>
<th>PC</th>
<th>Age</th>
<th>PS</th>
<th>COM</th>
<th>PPP</th>
<th>PCP</th>
<th>Ego</th>
<th>Task</th>
<th>PC</th>
<th>MC</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-.202*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PS</td>
<td>.246*</td>
<td>.143</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COM</td>
<td>.061</td>
<td>.040</td>
<td>.326**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPP</td>
<td>.090</td>
<td>-.126</td>
<td>.267**</td>
<td>.310**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCP</td>
<td>.042</td>
<td>.114</td>
<td>.330**</td>
<td>.503*</td>
<td>.549**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ego</td>
<td>.161</td>
<td>.202*</td>
<td>.483**</td>
<td>.218*</td>
<td>.050</td>
<td>.109</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task</td>
<td>.047</td>
<td>.052</td>
<td>.183</td>
<td>.036</td>
<td>.121</td>
<td>.186</td>
<td>.293**</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PC</td>
<td>.109</td>
<td>.169</td>
<td>.224*</td>
<td>.402**</td>
<td>.380**</td>
<td>.547**</td>
<td>.103</td>
<td>-.119</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>MC</td>
<td>.146</td>
<td>.037</td>
<td>.254**</td>
<td>.034</td>
<td>.060</td>
<td>.031</td>
<td>.008</td>
<td>.275**</td>
<td>-.164</td>
<td>1</td>
</tr>
</tbody>
</table>

Legend: PC=Perceived competence; PS=Personal Standards; COM=Concern over mistakes; PPP=Perceived parental pressure; PCP=Perceived coach pressure; Ego=Ego orientation; Task=Task orientation; MC=Mastery climate; PC=Performance climate.

In Table 2 correlation coefficients are reported. The correlation coefficients show that all of the dimensions of perfectionism correlated positively with each other and with perceived performance climate. A positive correlation is also found between concern over mistakes and ego orientation (.218, <0.05). Task orientation was found to correlate positively with ego orientation (.293, <0.01) and perceived mastery climate (.275, <0.01).

Discussion

Previous research has shown a relationship between personal standards, task orientation and perceived mastery climate (Appleton, Hall, & Hill, 2009; Dunn et al., 2002; Hall, Kerr, & Matthews, 1998; Ommundsen et al., 2005), as well as between the remaining perfectionism dimensions, ego-orientation and perceived performance climate. Some researchers have made a distinction between adaptive (PS, Task and MC) and maladaptive motivational profile (COM, PPP, PCP, Ego and PC) (Ommundsen et al., 2005). The present study shows that talented soccer players score higher on the dimensions that are assumed to be adaptive, rather than on the dimensions that are assumed to be maladaptive. These results show that the participants’ success criteria are more self-referential, which means that they are not necessarily dependent on a normative reference group or acknowledgment to feel successful (Dunn et al., 2002;
Nicholls et al., 1990; Ommundsen et al., 1998). People who scored high on the adaptive motivational profile are also capable of accepting limitations and environmental obstacles when they don’t accomplish the ideal performance (Dunn et al., 2002). For young football talents it would be advantageous to score high on the adaptive dimensions, as they may be unstable in their performances. In order to develop, it can be important to be a part of a climate where they are allowed to experience failure and learn from these experiences. It is also worth noting that personal standards are the only dimension in the motivational profiles that correlate significantly with perceived competence. This indicates that there is a positive relationship between setting high personal standards and high perceived competence. The relationship can be explained by the realistic standards adaptive perfectionists set to themselves (Dunn et al., 2002), and the pleasure of achieving these standards which can lead to a higher competence feeling. The individuals in football academies should set these personal standards according to their own development goals.

Earlier studies have found a negative or non-significant correlation between the remaining perfectionism dimensions and perceived competence (Hall, Kerr, Kozub, & Finnie, 2006; Hall et al., 1998) while this study found a non-significant correlation. At the same time, personal standards positively correlate with all the other perfectionism dimensions. Parker (1997) argued that personal standards may be maladaptive, if they lead to an increase in the maladaptive dimensions of perfectionism. When personal standards lead to more doubts about action, and more perceived pressure from parents and coaches, they may be associated with a more negative pursuit for achievements. Players can therefore set their personal standards based on external factors such as their parents’ and coaches’ expectations. High personal pressure, especially from coaches, is one of the main challenges that may affect football academy players’ development (Richardson et al., 2004). Personal standards also correlate positively with perceived performance and mastery climate, which can indicate that standards are not just based on mastery criteria, but also dependent on and regulated by recognition from others (Ames, 1992; Roberts, 2012). In such large groups as the football academies, it may be reasonable to compare oneself to other players, and set their standards based on comparison with other players in the academy. The academies quality can, in other words, affect the individuals’ personal standards.

Even though the participants’ scores were higher on the dimensions that address development as an important characteristic, many of these dimensions correlate significantly positively with the assumed maladaptive dimensions. In football, and sport generally, a strong competitive element exists that is difficult to change (Ommundsen & Roberts, 1999). Some studies have suggested that introducing mastery-oriented criteria, and at the same time maintaining performance-oriented criteria, will lead to an equally positive and effective motivational strategy as a focus entirely on mastery criteria (Ommundsen & Roberts, 1999). It is important to stress that many of the participants in this study are not just at development stage, but that they also compete in adult competitive football, where the performance and competitive element is stronger (Ommundsen & Roberts, 1999). It may be reasonable to assume that mastery-oriented elements are stronger in training, while the competitive elements are stronger in competition. Even though the athletes may be motivated to continue training for a potential professional career by being a part of a football academy environment (Ashworth & Heyndels, 2007), one should consider the motivational climate in the group. The young athletes develop at a different pace, and if the coaches focus solely on results and interpersonal comparison, instead of on the individuals’ development, many of the athletes may lose motivation and the pleasure of playing football.

It would be advantageous to consider the overall relationship between the two motivational profiles. As we know, goal orientations are orthogonal (Roberts & Kristiansen, 2012). The present results support that, where the goal orientations are positively correlated. Since the players are part of academies where they may be replaced and the competition is hard, the maladaptive dimensions can be hard to change. At the same time it is important that the adaptive dimensions are underlying and stronger, because of the mastery and self-referential criteria they entail (Ames, 1992; Frost et al., 1990; Nicholls, 1984). It will be important not only for the players to be aware of this, but also the coaches, parents and significant others, because of their influence. As supported by earlier research, a high quality coach-athlete relationship may reduce stress, increase performance and enjoyment of the competitive experience (Kristiansen & Roberts, 2010; Rodahl et al., 2015). Supporting parents can also influence these factors.

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Functional Strength Training Effects on Knee Flexors and Extensors Power Output in Football Players

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University of Sarajevo, Faculty of Sport and Physical Education, Sarajevo, Bosnia and Herzegovina

ABSTRACT

Study aim was to compare and reevaluate effects of additional strength training program in football players after eight week application. Program was designed to increase power and strength of knee extensors and flexors using neuromuscular adaptation. In overall, 18 senior level football players completed intervention in preparation period executing program as part of warm up 2-3 times per week. Using t-test for dependent samples statistical significance of the possible change was evaluated in peak torque, total and average work changes measured using Biodex isokinetic dynamometer. All measuring procedures were done for both limbs. Results are suggesting that statistically significant change observed in both limbs for the peak power output and average work load in flexion and extension, respectively. Other research papers are suggesting that increase of power and strength of knee muscles can help in preventing of injury occurrence. LCA injury can be prevention when femoral biceps strength is increase. This training modality based on neuromuscular adaptation is noninvasive with good effects in performance increase. Using training loads with body weight intensity is a good way to establish prevention to possible knee injury with simultaneous power increase, with minimum of chance to reach unwanted overtraining.

Key words: effects, isokinetic, football, knee stabilizers, training

Introduction

Football includes specific activities of cyclic and acyclic type intended for offence and defense. Short sprints, jumps, quick stops, landings, turns, kicks and duels are specific activities of high intensity which footballers often repeat during the game. During the game these activities are followed chronologically, for example, after jump footballer does the sprint and after sprint comes duel or kick. Different factors like tactics, position of a player in team and level of competition can affect average frequency of repetitions of specific football activities with or without a ball. The biggest difference among footballers of top and average quality is in the amount of activities of high intensity (Verheijen, 1998). In order to have quality performance and average quality is in the amount of activities of high intensity. Individual resistance can provide additional advantages in traditional procedures of training of strength in order to improve muscle imbalance and stability of knee joint of elite footballers (Śliwowski et al., 2015). The aim of this study was to examine the effects of experimental program of exercises of strength integrated into regular training on the level of isokinetic strength of dynamic knee stabilizers.

Methods

Experimental Approach

Study was designed as a test–retest procedure to disclaim possible improvement of power and strength output of knee muscles as an effect of the functional strength training, respectively. In overall, training program was conducted for eight consecutive weeks with frequency of 2-3 sessions per week lasting around 20 minutes. Functional strength training has been conducted prior to the main tactical training. Specificities of the training (Table 1 and Table 2) suggests intensive pre workout with possible post activation potential. Training loads were similarly distributed in each session as well as in weekly microcycle, respectively. Overall process was supervised using verbal communication and information’s obtained from players in real time during exercise performance. Pain and comfortability was marked as low, moderate and high rated by player’s individual perception. If the player at any time marks exercise as hard immediate termination was made. All the exercises modalities were suitable to the temporal demands of the football game, optimally stimulating functional demands, motivating and not excessive for avoiding possible over training occurrence.

Subjects

Eighteen senior level football players (mean±SD: age: 23±1.2; height: 178±6.5 cm; weight: 70.5±11.3 kg) from local club voluntary agreed to participate in study. All the procedures and training were conducted in spring time during preparation
period for the competition season. Inclusion criteria for participants were: i) at least 15 games played in previous competitive part of the year, ii) participation on at least 70% training sessions, iii) three years of playing experience. All participants were healthy without knee or ankle injuries in last 10 months or other conditions that might affect the study procedures and outcomes.

All subjects signed written consent approved by Ethical Committee of the Faculty of Sport and Physical Education - University of Sarajevo. Procedures, testing’s and training interventions were made according the ethical standards proposed by the Helsinki Declaration.

### Table 1. Training program features

<table>
<thead>
<tr>
<th>Contents</th>
<th>Specifics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration</td>
<td>8 weeks</td>
</tr>
<tr>
<td>Part of the training</td>
<td>Warm up</td>
</tr>
<tr>
<td>Training frequency</td>
<td>2-3 per week</td>
</tr>
<tr>
<td>Intervention time range</td>
<td>15 – 30 min.</td>
</tr>
</tbody>
</table>

### Isokinetic testing procedures

Strength and power output of the knees extensors and flexors were evaluated using Biodex Isokinetic System (Shirly New York). Standard procedure of five maximal voluntary contractions at speed of 60 °/s in concentric (CON/CON) mode has been applied (Drouinet al., 2004). This procedure is most commonly used by the practitioners in training of football players. After five minute form up of riding bicycle ergometer at 100W subjects were asked to perform five dynamic stretching exercises in preordered sequences. After initial screening subjects performed isokinetic testing procedures in range of motion (ROM) at 80° in extension direction from flexed angle at 90°. Correction of gravity was done according to the recommendation (Anderson et al., 2010). Power and strength variables obtained from testing were monitored as follows: - Peak torque of the left knee extensors (EXTLEF60); Peak torque of the right knee extensors (EXTRIG60); Total work of the left knee extensors (EXTWLRG60); Total work of the right knee extensors (EXTWLF60); Average power output of the left knee extensors (AVGPELF60); Average power output of the right knee extensors (AVGPERG60); Peak torque of the left knee flexors (FLXLEF60); Peak torque of the right knee flexors (FLXRIG60); Total work of the left knee flexors (FLXTWLF60); Total work of the right knee flexors (FLXTWRG60); Average power output of the left knee flexors (AVGPFLF60); Average power output of the left knee flexors (AVGPFGRG60).

### Table 2. Exercises performed

<table>
<thead>
<tr>
<th>Exercises</th>
</tr>
</thead>
<tbody>
<tr>
<td>Back Squat</td>
</tr>
<tr>
<td>Half squat isometric</td>
</tr>
<tr>
<td>Front lounge</td>
</tr>
<tr>
<td>Side lounge</td>
</tr>
<tr>
<td>Lounge + power step</td>
</tr>
<tr>
<td>Lateral movement – knee angle 30 deg.</td>
</tr>
<tr>
<td>Lounge behind static leg</td>
</tr>
<tr>
<td>Walking against leaning on the opponent (rambling)</td>
</tr>
<tr>
<td>Leg hops with 10m run</td>
</tr>
</tbody>
</table>

### Statistical analysis

Normality of data distribution was tested using Kolmogorov–Smirnov test. To determine statistical differences in power and strength output from baseline till study end t-test for dependent samples was used. All data were reported as mean and standard deviation values unless otherwise stated. Conventional statistical significance of p<0.05 noted significant change of the mean between trials. Statistical software package SPSS 21.0 was used.

### Results

Data distribution did not significantly differ from the normal data distribution assumptions, respectively. Results of the research showed statistically significant differences between initial and final measurements (p<0.05) in favor of final measurement (Table 3). Quantity statistically significant changes on univariate level occurred in variables of maximum strength of extensors of right and left leg (EXTLEF60), (EXTRIG60), then in overall work, strength of extensors of right leg (EXTWLRG60), and maximum strength of flexors of left leg (FLXLEF60). Significant training effects manifested through statistically significant changes occur in overall work of strength of flexors of left and right leg (FLXTWRG60), (FLXTWLF60), and in the change of the average strength of flexors and extensors of both legs (AVGPFRG60), (AVGPFLF60), (AVGPELF60), (AVGPERG60).

### Discussion

Experimental program of exercises integrated into regular football training with the type of resistance, intensity and volume can improve level of isokinetic strength of dynamic stabilizers of knee. The possibility of generating the optimal level of strength is important for quality realization of specific football activities of high intensity. Aagaard et al. (1996) state that different regimes of muscle work can improve isokinetic strength of knee extensors and flexors (quadriceps - hamstring), followed by better performance of complex leg movements and ball kicks. The aim of improvement the level of isokinetic strength of dynamic stabilizers of knee of footballers is better performance of specific football activities during the game, reduction of risk of injuries and reduction of negative effects tiredness. However, trainer always needs to have in mind that football is a sport of timing and collaboration and factors which determine the success of the game. Because of that, apart from the exer-
cise of strength of knee stabilizers, we used situational stimulus 1 against 1 in this experimental program. Combined program of training of strength and speed running gives better results than the conventional training of strength in terms of performance of strength of footballers (Kotzamanidis et al., 2005). The skills of strong and coordinative performance are necessary and important in all football activities. Apart from the exercises of strength, this experimental program included stimulus of proprioception and flexibility of muscles and ankles and neuromuscular stimuli in terms of jumps and short sprints. Neuromuscular training includes increased activity of medial hamstring which can potentially reduce risk of injuries without contact (Zebis et al., 2008). During the realization of exercises of strength and stabilization, exercises on sagittal, frontal and transversal plane were also performed. Apart from this there are exercises with changed angles and speed performance. In order to move to another, more complex exercise, footballer needs to acquire the previous one. In other words, each proceeding exercise is extension of the previous one. Problem which condition trainers are exposed to during the realization of the program is that footballers have good performance of certain exercise in a different period (Komes, 2006). Exercises of strength and endurance are performed in that way that the feet are set parallel. The advantage of parallel set of feet is in setting the load on longitude of instep which is stronger than the internal. This removes the possibility of lowering insteps which results with flat feet which causes additional instability. During the creation of the program of strength with focus on strengthening the knee stabilizers the situations like low movement control (new exercises, new demands, current tiredness or tiredness from a previous game or training, insufficient warm-up, motivation etc) were predicted. Also the effects of the program depend on the flows and the limitations which are discovered by diagnostics of strength, coordination and flexibility. Finding the disbalance and creation of adequate program is the best prevention (Komes, 2006). Apart from determination of current disbalance, it is necessary to detect knee injuries and similar injuries from the past. Football skills are one-sided and demand asymmetric motor patterns and can improve of asymmetric adaptations in locomotor functions of lower limbs (Fousekis et al., 2010). Some segments of knee are not according to its natural positions after which knee becomes unstable which can cause injury and therefore disturb continuance of desired form. It is well known that footballers after injuries have difficulties in achieving top form during the season. There is a need for development of preventive programs in training of footballers, which will prevent the injuries of lower limbs. These programs should be applied as soon as possible. Studies conducted in different sports showed promising results in reducing the frequency of injuries during performance of different procedures which included one or more exercises with focus on trainings of balance, strength and agility (Caraffa et al., 1996; Heidt et al., 2000). Better strength of knee of a footballer can improve control of movements, better stops and delay of tiredness. Additional training of strength should be part of football training, so that knee injuries and all other injuries are reduced to minimum. It is recommended that future researches include trainings which start with inhibition of tense muscles by working with special rollers. It is known that tense muscles are the problem which causes dysfunction of knee joint. This study did not treat the reduction of potential injuries, which is a flaw of this study.

| Table 3. Differences in power and strength isokinetic output after the training intervention |
|-----------------------------------|----------------|----------------|----------|----------|
|                                   | Initial       | Final          |          |          |
|                                   | n=16          | Mean ±SD       | Lower    | Upper    | Mean ±SD       |          |          |
| EXTLEF60                          | 209.77        | 28.7           | 216.9    | 23.3     | -18.22         | 3.97     | -1.35    | 0.19     |
| EXTRIG60                          | 211.06        | 32.09          | 221.44   | 27.51    | -20.92         | 0.16     | -2.07    | 0.05*    |
| EXTWLF60                          | 499.97        | 95.66          | 586.4    | 117.13   | -161.26        | -11.57   | -2.43    | 0.026*   |
| EXTWRG60                          | 521.65        | 96.9           | 604.41   | 92.71    | -133.41        | -32.11   | -3.44    | 0.003**  |
| AVGPELF60                         | 130.76        | 19.24          | 144.56   | 20.99    | -23.12         | -4.48    | -3.12    | 0.006**  |
| AVGPERG60                         | 137.14        | 23.85          | 146.03   | 20.55    | -16.22         | -1.55    | -2.55    | 0.02*    |
| FLXLEF60                          | 117.16        | 16.51          | 125.74   | 16.9     | -15.94         | -1.21    | -2.45    | 0.02*    |
| FLXRIG60                          | 122.5         | 17.76          | 133.35   | 20.16    | -17.05         | -4.63    | -3.68    | 0.002**  |
| FLXTWLF60                         | 337.33        | 83.35          | 421.03   | 99.18    | -145.24        | -22.14   | -2.86    | 0.01*    |
| FXTWRG60                          | 345.91        | 63.2           | 423.32   | 61.91    | -114.82        | -40      | -4.36    | 0.001**  |
| AVGFLPF60                         | 83.82         | 12.03          | 95.09    | 12.88    | -17.58         | -4.95    | -3.76    | 0.002**  |
| AVGPFGR60                         | 89.01         | 11.28          | 101.25   | 16.28    | -17.25         | -7.21    | -5.13    | 0.001**  |
| AGANLF60                          | 56.55         | 8.44           | 66.18    | 16.24    | -17.44         | -1.82    | -2.6     | 0.01*    |
| AGANRG60                          | 58.55         | 7.75           | 60.76    | 6.63     | -5.61          | 1.17     | -1.37    | 0.18     |

Legend: * p<0.05, ** p<0.01

Research show that use of functional football movements with own body weight (squats, front lounge, duels, jumps, sprints, lounge) specific for football with the adequate distribution of loadings and periodization improve the performances of strength without disturbing the football performance. It is important to find such training contents which are similar to the demands and movements of real situational performance and to create adequate components of loadings.
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Methods for Evaluation of Some Psychomotor Abilities

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ABSTRACT

For estimation of psychomotor and sensor abilities different kinds of tests are used in the form of devices representing different technical devices which help examining sensomotor and psychomotor functions in certain conditions, as well as more complex motor abilities and skills that depend on CNS characteristics, vegetative nervous system and other functional systems and body states. These devices can be used for examining some parameters of psychomotor functions-such as speed of reaction through reactivity meter or devices for examining sensor abilities-such as audiometer, ortoriter, color tests etc. In the scope of examining psychomotor skills and abilities, frequently used are different kinds of tests in the forms of devices serving for measuring ocultomotor coordination-such as Omega and Sinusoida, then Tumer’s device for measuring coordination and dissociation of hands’ movements with visible control, O-Conor’s dexterimeter and Medeo’s dexterimeter-used for examining dexterity of fingers, Tremometer for examining hand stability and preciseness of movements, Minesota test for examining dexterity of hands and tapping tests like “paper-pen” for examining speed and accuracy of simple movements. For examining more complex sensomotor abilities or different motor skills, special tests are used in the form of simulator, simulator and different technical devices, adjusted to specific sports situation. This category of tests includes different kinds of simulators and simulators used for examining certain aspects of sports activity.

Key words: tests, functions, sensomotor, simulator

Introduction

Contemporary research in the field of psychomotor abilities of a man are focused on discovering legalities determining motor behavior by which they contribute to improvement of sports results. Individual movements in the whole are the product of neuropsychological activity whose characteristics determine the structure of motor abilities. Each movement reflects increased number of elements, such as: irritation of receptors, transfer of impulse to the processing center and activation of nerves innering the muscles whose contraction causes movement.

For estimation of psychomotor and sensor abilities different kinds of tests are used in the form of devices representing different technical devices which help examining sensomotor and psychomotor functions in certain conditions, as well as more complex motor abilities and skills that depend on CNS characteristics, vegetative nervous system and other functional systems and body states, according to Barrett (2003). These devices can be used for examining some parameters of psychomotor functions-such as speed of reaction through reactivity meter or devices for examining sensor abilities-such as audiometer, ortoriter, color tests etc. In the scope of examining psychomotor skills and abilities, frequently used are different kinds of tests in the forms of devices serving for measuring ocultomotor coordination-such as Omega and Sinusoida, then Tumer’s device for measuring coordination and dissociation of hands’ movements with visible control, O-Conor’s dexterimeter and Medeo’s dexterimeter-used for examining dexterity of fingers, Tremometer for examining hand stability and preciseness of movements, Minesota test for examining dexterity of hands and tapping tests like “paper-pen” for examining speed and accuracy of simple movements.

For examining more complex sensomotor abilities or different motor skills, according to Fadde (2006) special tests are used in the form of simulator and different technical devices, adjusted to specific sports situation. This category of tests includes different kinds of simulators used for examining certain aspects of sports activity.

Methods

Methods used in the field of psychomotorics have to be adequate to the subject of examination and informative enough, as it is the case with all other sciences, meaning they have to provide objective examination of the monitored property and describe it in the best possible way.

Methods for psychomotor abilities’ evaluation were developed primarily in psychology, biology and neurology, but they also had great implementation in the field of sport science (Bićo, 1995). Examination of psychomotoric space has been quite mastered since the earliest researches at the beginning of the 20th century, so the findings in that area have contributed to better knowing of motoric abilities’ structure.

Evaluation of psychomotor abilities is commonly used by test-devices, of which we will mention the way of work and use of those most commonly used.

Reactionmeter CRD (Complex reactivity meter) is the most complex in this group of measuring instruments for estimation of psychomotor abilities. The CRD series precedes cybernetic model of intelligence because the mental processes are reconsidered in terms of cybernetic processing of information (reception, processing, control and regulation of information). Mental functions examined by CRD, according to Fadde (2007) are: reception (observing phenomena and changes of lighting and sound signals, discrimination of location and height of signals,
their identification and visual orientation) Fadde (2007) and elaboration (short-term and long-term memorizing, reasoning, convergent that is inductive thinking and instruction-led deducting and concluding, i.e. operative thinking.

CRD series has four blocks (tests of attention and three groups of tests of reaction-simple, elective and complex) with 34 tests in total. This series is psychometrically interesting for three reasons:

a) for theoretical bases,

b) for the first computerized version of battery tests of ability and

c) as predecessor of cybernetic model of intellectual functioning.

Theoretical bases of reactometers CRD series are Pavlov’s nervous processes of excitation and inhibition which have the ability of irradiation (diffusion over cortex), concentration (i.e. localization in the spot of primary appearance) and alternation according to the law of mutual induction.

CRD series is one of the first computerized portable battery tests because all the reactions of examinees are automatically registered. The following indicators are automatically registered: quantitative indicators (total and average time of tasks’ solving, total number of mistakes an total number of points), qualitative indicators (maximal speed of complex reaction, indexes of emotional stability-total ballast as a difference in speed of tasks’ solving, unused experience as amount of difference between maximal and individual achievements, the beginning ballast as a difference between maximal speed and the speed of doing in the first half of tests series, the final ballast as a difference between maximal speed and speed of activity in the other half of tests series) and indicators of functional disorders and frustration tolerance (functional blockade as a measure of non-reacting time).

Standard reactometer is shaped like a box behind which an examiner sits and controls the switch for electricity and selection of stimulus program (modality of color or height of sound). The front side (faced to the examinee) has a cord with keys for hands or pedals for legs. On one or both sides there is an electronic numerator for the reaction speed. Before testing, the examinee practices in a way that he has been presented a stimulus and then allowed to respond with the given reaction. During that, the device is set on manual tasking. When the examinee understands when he is expected to do, he passes to automatic tasking and registration of answers. During examination of simple reaction, the examinee is asked to respond uniformly (for example, by hand or leg), and in elective reaction the examinee has to assimilate his reply to the given stimulus in previously asked way (for example to respond on the low sound by his right hand, on the red light by the left leg).

Tremormeter is a device made to measure stability (tremor) of a hand. Task of the examinee is to pull a metal peak through openings of different diameters, without touching their edges. Touch of the edge closes a circuit which is automatically registered. The following indicators are automatically registered: accuracy and velocity, but it is also the test of emotional stability and oculomotor coordination. Task of the examinee is to pull a metal disk from the beginning to the end of the sinusoidal ra-bit as fastas possible and with the fewest touches as possible. Actually, the disk has two cylinders going into the channel. Touch of one, other or both cylinders closes the circuit that switches on the mjerac vremena and numerator). So, not only the number of touches is registered, but also the length of cylinders with the edge of the metal channel. Three parameters of efficacy are measured: total time for task accomplishment, total time of mistakes’ duration and the total number of mistakes.

Device for taping tests used for examining manual speed. The device is consisted of a board on which is placed a metal panel, numerator (is not visible on the picture) and a metal peak (on the picture under stopwatch). Task of the examinees is to touch the panel as many times as possible within the given time. At every touch, a circuit is ‘stopped’ and that is the signal for registration that the numerator remembers.

\textbf{Sinusoidal test-device} is made for examining hand ability and oculomotor coordination. Task of the examinee is to pull a metal disk from the beginning to the end of the sinusoidal rabbit as fast as possible and with the fewest touches as possible. Actually, the disk has two cylinders going into the channel. Touch of one, other or both cylinders closes the circuit that switches on the mjerac vremena and numerator). So, not only the number of touches is registered, but also the length of cylinders with the edge of the metal channel. Three parameters of efficacy are measured: total time for task accomplishment, total time of mistakes’ duration and the total number of mistakes.

\textbf{Dotting-test} was also made for measuring psychomotor accuracy and velocity, but it is also the test of emotional stability. The examinee is using „an electronic pen“ and trying to guess as many openings as possible as they are passing by in one slit.

\textbf{Results}

By factor analysis of psychomotor abilities in a series of researches Schmidt and Wrisberg (2004), Schmidt and Lee (2005), Williams and Ward (2003), etc. the following agents of its efficacy were isolated:

- Precise control of arms, hands and legs control in objects manipulation.
- Coordinated work of arms and legs in small and big movements.
- Psychomotor orientation based upon fast reaction and accurate evaluations of the movement direction.
- Simple time of reaction refers to speed of the same replies of the examinees in miliseconds to the same visual or auditory stimulus.
- Simple velocity of massive movements of hands, disregarding precision.
- Manipulative dexterity referring to fine, controlled, precise and fast movements of hands, arms and fingers.
- Abilities of aiming and firing referring to visual-motor targeting.
- Stability of movements expressed by their preciseness during the time with optimal strength and speed.

As a result of need for creating a unique methodological access in examination of man in situations related to sport, quantitative methods began to be used in researches such as algorithms, mathematical modeling, theory of automatic management and other methods characteristic for technical sciences (Ericsson, 2001). However, that couldn’t completely give the answer to many questions related to reaction and behavior of man in sports activities, because there are many factors which refer to sports success.

\textbf{Discussion}

Lately, for some research areas in psychomotorics researchers have accepted a multidisciplinary approach which is more and more situational-contextual oriented, where different methods and techniques are used, starting from technical measuring, through mathematical describing and modeling, to monitoring physiological parameters, examining psychophysical states, abilities and features of personality in sports situations, according to Williams and Ward (2003). Naturally, these examinations and measuring are done under different experimental and external conditions where the sports activity of a man is
done. Accordingly, seen more broadly, it can be said that in psychomotor examinations are used all those methods used for describing dynamic of a man in sports situations, as well as special methods including man’s reaction and behavior in those.

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Body Height and its Estimation Utilizing Arm Span Measurements in Male Adolescents from Southern Region in Montenegro

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ABSTRACT

The purpose of this study was to examine the body height in Montenegrin male adolescents from southern region as well as the relationship between arm span as an alternative to estimating the body height, which would vary from region to region in Montenegro. Our investigation analyses 87 male adolescents from the southern region in Montenegro. The anthropometric measurements were taken according to the protocol of the International Society for the Advancement of Kinanthropometry (ISAK). Means and standard deviations regarding the anthropometric measurements were obtained. The relationships between body height and arm span were determined using simple correlation coefficients and their 95% confidence interval. Then a linear regression analysis was performed to examine the extent to which the arm span can reliably predict body height. The results displayed that male Southern-Montenegrins are 182.53±7.53 cm tall and have an arm span of 184.55±9.03 cm. Compared to other studies, the results of this study have shown that this gender made Southern-Montenegrins the tallest population, taller than most of nation around the Europe. On the other hand, expectably, the arm span reliably predicts body height in this gender. However, the estimation equations which have been obtained in Southern-Montenegrins are, different alike in general population, since arm span was closer to body heights (2.03±1.50 cm), more than in general population. Hence, this study also confirms the necessity for developing separate height models for each region in Montenegro.

Key words: stature, armspan, region, boys, Montenegro

Introduction

The unusual tallness of Montenegrin highlanders was a fact recognized by European anthropologists more than 100 years ago (Bjelica, Popović, Kezunović, Petković, Jurak, & Grasgruber, 2012). A sample of 800 Montenegrin men measured by Robert W. Ehrich (Coon, 1975) at the beginning of the 20th century gave the highest average in all of Europe (177 cm), with some districts approaching 178 centimeters. Furthermore, a contemporary research study conducted by Pineau, Délamarche, and Božinović (2005), showed that the male population of the Dinaric Alps is on average, the tallest in whole Europe. Thus, this study has challenged many scientists to believe that Montenegrins are still the tallest population in Europe and Bjelica and his collaborators (2012) confirm they are very tall but not the tallest with 183.2 centimeters. From the reason the sample in this study was created by university students, a more recent study was conducted as a national survey (Popović, Bjelica, & Hadžić, 2014) and it confirmed the results of the previous study and found the average body height of Montenegrin male adolescents were 183.74 centimeters tall. From this reason the modern Montenegrins fall partly into the Dinaric racial classification (Bjelica et al., 2012), the authors did believe the male population that live in the southern region might be much taller than average Dinaric Alps subjects, mostly due to the much better lifestyle in the coastal area. Hence, the purpose of this study was twofold. The first purpose was to examine the body height in Montenegrin male adolescents from southern region as the authors did believe this is the place where the population may reach the full potential of the Dinaric Alps, while the second purpose was to examine the relationship between body height and arm span as an alternative to estimating the body height, which would vary from region to region in Montenegro.

Methods

The nature and scope of this study qualifies 87 male adolescents from the southern region in Montenegro to be subjects. The average age of the male subject was 18.29±0.63 years old (range 17-19 yrs). It is also important to emphasize that the authors could not accept adolescents with physical deformities that could affect body height or arm span, and without informed consent were excluded from the study. The exclusion criterion was also being non-Southern Montenegrin.
whose quality of performance was evaluated against prescribed “ISAK Manual” prior to the study performed these measurements. The age of the individuals was determined directly from their reported date of birth.

The body height presents the perpendicular distance between the top of the head (the vertex) and the bottom of the feet. It was measured using stadiometer to the nearest 0.1 centimeters in bare feet with the participants standing upright against a stadiometer. The respondents had to put their feet together and move back until their heels touched the bottom of the stadiometer upright. Their buttocks and upper part of their back have also been touching the stadiometer upright while their head didn’t have to touch the stadiometer. The respondent’s head had to be in the Frankfort horizontal plane. This was achieved when the lower edge of the eye socket (the orbitale) is horizontal with the trigon. The vertex was the highest point on their head, otherwise the respondents had to raise or lower their chin until it was in the Frankfort horizontal plane to align their head properly.

The arm span is the anthropometric measurement of the length from the tip of the middle fingers of the left and right hands when raised parallel to the ground at shoulder height at a one-hundred eighty degree angle. It was measured using a calibrated steel tape to the nearest 0.1 centimeters in bare feet on a level concrete floor with their upper backs, buttocks and heels against the wall which provide support. The participant’s head was also in the Frankfort horizontal plane and the arms were outstretched at right angles to the body with palms facing forwards. The measurement were taken from one middle fingertip to the other middle fingertip, with the tape passing in front of the clavicles while two field workers supported the elbows. The measurements were taken twice, and an average of the two readings was calculated. When the two measurements agreed within 0.4 centimeters, their average was taken as the best estimate for the true value. When the two initial measures didn’t satisfy the 0.4 centimeters criterion, two additional determinations were made and the mean of the closest records was used as the best score.

The analysis was carried out using 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 body heights and arm spans within this gender group was carried out using a t-test. The relationships between body height and arm span were determined using simple correlation coefficients and their 95% confidence interval. Then linear regression analyses was performed to examine the extent to which arm span can reliably predict body height. Finally these relationships were plotted as scatter diagrams and regression lines. Statistical significance was set at p<0.05.

Results

A summary of the anthropometric measurements is shown in Table 1. The mean of the arm span for male subjects was 182.53±7.53 centimeters, which was 2.03±1.50 centimeters more than the body height and statistically insignificant (t=-1.604, p<0.111). The relationships between arm span measurements and body height were determined using simple correlation coefficients and their 95% confidence interval. The results of the linear regression analysis are shown in Table 3. The relationships between body height and arm span was high and significant in the sample.

The results of this study proved that Southern-Macedonian males are very tall with an average of 182.53 centimeters, but not taller than general male population in Montenegro with 183.21 centimeters (Quanjer et al., 2014) and Central- Montenegro. Parallell to this fact, they are still one of the tallest in Europe. It does not come close to 184.6 centimeters documented by Pineau et al., 2015). From the results this study reached, probably, the tallest people might live on the northern part of Montenegro, mostly due to the reason the average body height in Central (Vujović et al., 2015) and Southern (this study) part of Montenegro did not reach the average body

Discussion

The results of this study proved that Southern-Macedonian males are very tall with an average of 182.53 centimeters, but not taller than general male population in Montenegro with 183.21 centimeters (Quanjer et al., 2014) and Central- Montenegro. The age body height in Central (Vujović et al., 2015) and Southern (this study) part of Montenegro did not reach the average body height in Central (Vujović et al., 2015) and Southern (this study) part of Montenegro did not reach the average body
height in whole Montenegro. On the other hand, the 182.53 centimeters average height of Southern-Montenegrin men is taller than 181.3 centimeters of the Lithuanians (Popović, Bjelica, & Hadžić, 2014), 180.9 centimeters of the Serbs (Grozdanov, 2011), 180.6 centimeters of the Icelanders (Bjelica et al., 2012) and many other nations. However, there is a hypothesis that Montenegrin males did not reach their full genetic potential yet, since they have been influenced by various environmental factors (wars, poor economic situation, etc.) in the last few decades (Popović, Bjelica, Molnar, Jakišić, & Akpinar, 2013), while these influence was the smallest on the South part of Montenegro. Therefore, the authors believe that these circumstances had a negative bearing on the secular trend in Montenegro, while it is expected that the secular changes affecting height will go up in the following 20 years, comparing it to developed countries where this trend has already stopped.

Figure 1. Scatter Diagram and Relationship Between Arm Span Measurements and Body Height Among the Applied Sample

On the other hand, expectably, the arm span reliably predicts body height in this gender. However, the estimation equations which have been obtained in Southern-Montenegrins are, different alike in general population, since arm span was closer to body heights (2.03±1.50 centimetres), more than in general population (Bjelica et al., 2012). This confirms the necessity for developing separate height models for each region in Montenegro.

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Impact of Recreational Fitness Training Program on Dynamic Strength of Women

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A B S T R A C T

In addition to multivariate analysis of covariance (MANCOVA) it was found that there were statistically significant differences between the experimental and control groups in three of the five motor variables in favor of the experimental group (p=0.00). In general, it can be concluded that the application of the experimental treatment for 10 weeks in the experimental group led to an increase; improved results in variables Push-ups, body folding 30 s and pull-ups in high jump on the shaft.

Key words: treatment, motor capacity, women

Introduction

In modern conditions of life and work one of the most popular areas of physical education is the area of recreation. Recreation stems from the need of society to investigate and scientifically study the specific connection between work and other activities, as well as the relationships that affect the psychosomatic status of man. It is a freely chosen, individual or organized social activity, which by means of physical exercise and sports recreational activities allows people an active and healthy fun and entertainment, which helps them to maintain good health, physical and work fitness, and to express their creativity they were largely denied by specialized work (Mitic, 2001). Nowadays, there are a lot of programs in the framework of recreation and it allows us to select the one that best suits us, through which we achieve the set objectives, and which is of course in positive correlation with our health condition. Selection of motion activities is left to us with a big support of qualified, professional staff that will give us the best instructions and help in monitoring the effects of physical exercise on the body (Zaciorski, 1995; Stojiljkovic et al., 2005).

Recreational fitness programs result primarily from the present way of life which is characterized by busy life activities, often related to stressful situations, as well as hypokinesia as a disease of modern man. Hypokinesia (lack of bodily movement) carries a variety of ailments and diseases of modern man, which are primarily reflected in reduced functioning of the locomotor system, the decline of motor capacity, and therefore to a great extent the decline of functional characteristics. These circumstances (and some others), has led modern men to seriously tackle their health, persistence, their life, and especially the quality of life, and with the help of experts, seek advice and opportunities to preserve and improve their health, and thereby live more qualitative and easier life. Recreational fitness programs are physical activities that primarily affect the improvement of human health, increasing their motor capacity, functional characteristics, the necessary fitness for life and work, and thus prosperity, good mood and easier coping with all life difficulties (Ničin, 2003).

In the context of research Cvetković (2003), Kloubec (2005), Čokorilo (2005), Sekendiz, Altun, Korkusuz, and Akin (2007), Obadović et al. (2008), Borer (2008), Babayiğit et al. (2009) dealt with similar topics. The aim of their research was to investigate the effects of fitness exercise (Pilates, tae-boa, aerobics) on the strength of the abdomen and lower back, abdominal muscle endurance and flexibility of the lower back of adult women. The authors concluded the positive effect of modern Pilates programs, fitness programs, aerobics on the abdomen and lower back, muscular strength, muscular endurance and flexibility of adult women, regardless of the fact that the body weight and fat percentages were not statistically significantly different. Also, it was concluded that the applied experimental exercise program three times a week caused the transformation processes of motor capacity of the subjects, i.e. that the changes in the results of motor manifestations were higher than in the application of some other treatment.

Research problem is to analyze the effects of fitness training program on the dynamic strength of women. The subject of the study is the dynamic strength. The aim of the study is indicating the possibility of increasing the dynamic strength in women who perform recreational exercise for just 10 weeks. The study started with the assumption (H1): There are statistically significant differences in the effect of the model of the group guided recreational program on the dynamic strength of women in the experimental group of subjects.

Methods

The sample was made up of female subjects, aged 22-40 years, all from Belgrade, who practiced in the fitness club "Hercules" (experimental group), and women who did not do...
any sports, employed in service organizations on the territory of Belgrade. The total sample in the study consisted of 60 subjects, of which N=30 of the experimental group, who implement recreational exercise program, and N=29 of the control group, who did not implement recreational exercise program. The subjects from both groups were tested before starting an exercise program and after the exercise program.

The assessment of motor capacity was carried out in June 2015 and September 2015, which included measurements at two time points.

The assessment of motor capacity used the standard motor tests (Bala, 2010; Obradovic, 1999; Kukolj, 2006):

1) Push-ups,
2) Pull-ups in high jump on the shaft,
3) Body lift 30 s,
4) Leg folding 30 s,
5) Squats on both feet 30 s.

The survey was conducted on a sample of recreational trainees from Belgrade. The assessment of motor capacity was carried out in early June 2015 when it the initial condition was established. The experimental group was tested in the fitness club "Hercules" in Belgrade, while the control group was tested in the gym of the primary school "Petar Kocic" in Belgrade, where the testing of motor capacity was conducted in the school’s gym. In addition, after 10 weeks of training, a second measurement was performed which was realized in the same places with the same groups of women, using the same tests and the fact that testing was carried out by the same person (the author of the paper).

Description of the experimental treatment
The experimental program was led by the author of the study and was implemented, conducted in Belgrade in the fitness center "Hercules". It was only applied to the experimental group subjects. The control group was not practicing under such circumstances but only certain subjects indicated that they had, along with some fixed training mode in with dumbbells and small weights in the gym, used only a treadmill or bicycle, but once a week.

The experimental program consisted of the training which included the replacement of load in the form of anaerobic and aerobic mode, in the 2 to 1 ratio in favor of aerobic mode. Aerobic training was conducted in the experimental group of subjects. Trainings included 5-10 minutes of skip warm-up, aerobic-anaerobic part of the training in the duration of 35-40 minutes (the main part of the training). It consisted of different exercises. Strength exercises were performed at the end of each training for 10-minutes. Certain exercises on the parterre were followed by stretching exercises for 10 minutes.

Each training was designed to prepare the body for the exercise through the warm-up program, which gradually grew into a cardiac stage for a period of thirty minutes, in the form of varied choreography, which included all parts of the body. Breaks between the movements lasted only a few seconds. There were also squats, lunges, and sometimes weights to enrich the exercise so it would not be monotonous. The second part of the training included the exercises on the mat, which shaped leg muscles, inner thighs (inner lodge of the thigh), abdominal muscles, glutaeal muscles, arms and shoulders with a focus on increasing muscle strength (muscle hypertrophy). The very end of the training was dedicated to stretching and relaxation exercises. The key to a successful exercise lies in concentrating on each movement and breathing, with full awareness of the body, while the experimental group subjects performed each exercise correctly and powerfully under the constant supervision of a fitness instructor.

Abdominal muscles, which are particularly demanding area in women, were treated with the following exercises on the floor:
1) classic abdominal muscles in the intervals of 30 s or 60 s,
2) "bicycle"
3) "scissors"
4) "squat" and
5) all kinds of exercises to stimulate abdominal muscle region; raising to the sitting position with squatting legs, lifting the legs to the vertical position with the assistance co-trainees, and lifting the hull from the surface 60 s.

Arm muscles were treated with the following exercises:
1) forearm bending with small weights (0.5 and 1 kg)
2) lifting dumbbells overhead, but all with imitating certain movements of individual martial arts that are a part of tae-bo workout.

Shoulder muscles were treated with the following:
1) lateral raise,
2) front lateral raise,
3) overhead press with weights of 0.5 to 1 kg.

Back muscles were treated with the following exercises:
1) rowing in a sitting position,
2) "deadlift" (single-handed)
3) "dead" lift (both hands).

Each exercise for a specific muscle region was performed in 4 series, in each training, all muscle regions in 8-10 with repetitions in 4 series. Exercises for the abdominal region were done by two series in each training. Exercises and intensity of work were performed in the zone of submaximal loads in order to obtain the best effect and for the exercises to have the maximum effect on women's health, and to achieve the goal, the increase of muscle strength.

Statistical analysis of the data contained calculating descriptive characteristics: arithmetic mean (AM) and standard deviation (S), minimum (MIN) and maximum (MAX) values of the measurement results and the coefficient of variation (CV). In order to determine statistically significant differences between the groups of subjects, the initial and final measurement applied multivariate variance analysis (MANOVA). In order to determine the effect of the training program between the two tests (determining statistically significant difference between the initial and final measurement) multivariate covariance analysis (MANCOVA) was applied.

Results
Based on the descriptive statistics value, one can see a remarkable variability of the results in the experimental and control groups in all the analyzed motor variables at the initial and final measurement. This is due to the large age range of the subjects and their initial level of strength.

It should be noted that the groups included women who had previously been engaged in sports, which can be indicated by the maximum values of the measurement results at the initial and final measurement (e.g. 27 body foldings for 30 s in the experimental group, or 25 squats on both legs for 30 s). The subjects were of different social status.

Some subjects had never been subjected to any process of training (0 pull-ups on the shaft, 0 leg foldings for 30 s), and some had been engaged in some sport before. Due to this fact there are big differences between the recorded minimum and maximum values of the measurement results.
Table 1. Descriptive Variable Statistics

<table>
<thead>
<tr>
<th>Measurement Variable</th>
<th>Group</th>
<th>AM</th>
<th>S</th>
<th>MIN</th>
<th>MAX</th>
<th>CV (%)</th>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Initial</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Push-ups (freq.)</td>
<td>Experimental</td>
<td>2.07</td>
<td>3.35</td>
<td>0</td>
<td>13</td>
<td>161.84</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>3.22</td>
<td>3.92</td>
<td>0</td>
<td>13</td>
<td>121.74</td>
</tr>
<tr>
<td>Body fold 30s (freq.)</td>
<td>Experimental</td>
<td>15.81</td>
<td>5.00</td>
<td>0</td>
<td>27</td>
<td>31.63</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>16.83</td>
<td>3.54</td>
<td>13</td>
<td>23</td>
<td>21.03</td>
</tr>
<tr>
<td>Pull-ups on the shaft (freq.)</td>
<td>Experimental</td>
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<td>1.72</td>
<td>0</td>
<td>6</td>
<td>84.31</td>
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<tr>
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<td>Control</td>
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<td>1.77</td>
<td>0</td>
<td>5</td>
<td>91.24</td>
</tr>
<tr>
<td>Leg fold 30s (freq.)</td>
<td>Experimental</td>
<td>11.30</td>
<td>5.07</td>
<td>0</td>
<td>22</td>
<td>44.87</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>13.33</td>
<td>3.34</td>
<td>9</td>
<td>21</td>
<td>25.06</td>
</tr>
<tr>
<td>Squats on both legs 30s (freq.)</td>
<td>Experimental</td>
<td>16.07</td>
<td>6.42</td>
<td>5</td>
<td>28</td>
<td>39.95</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>15.17</td>
<td>5.59</td>
<td>5</td>
<td>24</td>
<td>36.87</td>
</tr>
<tr>
<td>Final</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Push-ups (freq.)</td>
<td>Experimental</td>
<td>4.56</td>
<td>5.12</td>
<td>0</td>
<td>19</td>
<td>112.58</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>3.28</td>
<td>3.64</td>
<td>0</td>
<td>13</td>
<td>110.98</td>
</tr>
<tr>
<td>Body fold 30s (freq.)</td>
<td>Experimental</td>
<td>18.54</td>
<td>4.09</td>
<td>10</td>
<td>28</td>
<td>26.32</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>16.72</td>
<td>3.01</td>
<td>12</td>
<td>22</td>
<td>18.00</td>
</tr>
<tr>
<td>Pull-ups on the shaft (freq.)</td>
<td>Experimental</td>
<td>3.48</td>
<td>1.72</td>
<td>1</td>
<td>7</td>
<td>49.42</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>2.44</td>
<td>1.79</td>
<td>0</td>
<td>5</td>
<td>73.66</td>
</tr>
<tr>
<td>Leg fold 30s (freq.)</td>
<td>Experimental</td>
<td>12.15</td>
<td>5.23</td>
<td>2</td>
<td>23</td>
<td>43.05</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>13.83</td>
<td>3.03</td>
<td>3</td>
<td>19</td>
<td>21.91</td>
</tr>
<tr>
<td>Squats on both legs 30s (freq.)</td>
<td>Experimental</td>
<td>17.15</td>
<td>5.77</td>
<td>7</td>
<td>27</td>
<td>33.64</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>16.11</td>
<td>5.94</td>
<td>6</td>
<td>25</td>
<td>36.87</td>
</tr>
</tbody>
</table>

Legend: MIN – minimum recorded values, MAX – maximum recorded values, AM – arithmetic mean, S – standard deviation; CV – coefficient of variation

Values of the multivariate Wilk’s F-test indicated that there was no statistically significant difference (p=0.57) between the different groups of subjects (experimental and control) with respect to the dynamic strength in the value of F=0.79 at the initial measurement. The individual analysis of each motor variable led to a conclusion that these differences do not exist in any of the tested variables (p>0.05). It can be concluded that the groups were approximately equal (comparable situation of dynamic strength) before the application of the experimental treatment in the form of initial and advanced group fitness exercise program.

Table 2. Results of Multivariate Analysis of Variance at the Initial Measurement

<table>
<thead>
<tr>
<th>Group</th>
<th>Variable</th>
<th>f</th>
<th>p</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>Push-ups</td>
<td>1.11</td>
<td>0.30</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Body fold 30 s</td>
<td>0.56</td>
<td>0.46</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>Pull-ups on the shaft</td>
<td>0.03</td>
<td>0.86</td>
<td>0.79</td>
<td>0.57</td>
</tr>
<tr>
<td></td>
<td>Leg fold 30 s</td>
<td>2.25</td>
<td>0.14</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Squats on both legs 30 s</td>
<td>0.24</td>
<td>0.63</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Legend: f – univariate F-test; p – level of statistical significance of the F-test; F – multivariate Wilk’s F-test; P – statistical significance of multivariate F-test

As suggested, in order to determine the actual effects of the application of the experimental treatment multivariate covariance analysis (MANCOVA) was performed, and the results are shown in Table 3.

Analysis of the results in Table 3 can lead to a conclusion that there are statistically significant differences (p=0.00) between the experimental and control group subjects in the dynamic strength in the value Wilk’s test F=5.29. By equalizing the subjects before the application of the treatment and individual observation, it can be concluded that these differences existed in 3 of 5 examined variables. Statistically significant differences were observed in the evaluation variables for the repetitive strength of arms and shoulders, and the strength of the torso:

1) Push-ups (p=0.00),
2) Body fold 30 s (p=0.00) and
3) Pull-ups on the shaft (p=0.01) in favor of the subjects in the experimental group.

Considering the variables for the assessment of dynamic strength of the body, using other variables leg folds 30 s and dynamic leg strength, squats on both legs 30 s, statistically significant differences were not found (p>0.05).

Neutralizing the difference of the initial measurement, the subjects in the experimental group achieved better results. Comparing the adjusted means in all variables, in the Push-ups variable, the ratio was 5.22 in the experimental group by 2.28 push-ups than in those from the control group. In the Body fold 30 s variable ratio was 18.85 by 16.26 in favor of the subjects in the experimental group, while the ratio of arithmetic means in the third tested variable, Pull-ups on the shaft, amounted to 3.45 by 2.50 in the control group subjects.

Discussion

The study was conducted in order to determine the effects of group fitness program of exercise on the dynamic strength in women aged 22-40 years. The applied experimental exercise program twice a week for 10 weeks, caused a change in the results of the repetitive strength of arms and shoulders, as well as in a variable for assessing the dynamic body strength in the
experimental group subjects. The application of initial and advanced level of exercises (exercises listed in the parts of the experimental program), caused the changes in terms of repetitive strength of arms and shoulders, and repetitive strength of the torso.

Table 3. Multivariate Analysis of Covariance for the Assessed Variables (MANCOVA)

<table>
<thead>
<tr>
<th>Factor</th>
<th>Variable</th>
<th>f</th>
<th>p</th>
<th>Group</th>
<th>AM*</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Push-ups</td>
<td></td>
<td>13.74</td>
<td>0.00</td>
<td>Experimental</td>
<td>5.22</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Control</td>
<td>2.28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body fold 30 s</td>
<td></td>
<td>12.36</td>
<td>0.00</td>
<td>Experimental</td>
<td>18.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Control</td>
<td>16.26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pull-ups on the shaft</td>
<td></td>
<td>8.62</td>
<td>0.01</td>
<td>Experimental</td>
<td>3.45</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Control</td>
<td>2.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leg fold 30 s</td>
<td></td>
<td>0.02</td>
<td>0.88</td>
<td>Experimental</td>
<td>12.86</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Control</td>
<td>12.77</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Squats on both legs 30 s</td>
<td></td>
<td>0.01</td>
<td>0.99</td>
<td>Experimental</td>
<td>16.74</td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Control</td>
<td>16.73</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Legend: f – univariate f test; p – level of statistical significance of f test; F – multivariate Wilk’s F test; p – statistical significance of multivariate F tests; AM* - adjusted arithmetic mean.

The results show positive changes in the dynamic strength as the motor capacity of women involved in the group fitness exercise program. The subjects who applied this method, achieved better results in the final measurement in 3 out of 5 motor tests included in this research. Fitness method is a system of physical exercises primarily aimed at increasing the body strength. Such method included the work on muscle tone, influenced the improvement of motor capacity in the experimental group, because it activated the movements of the spine and allowed the body to relax. The very performing of repetitive contractions in trainings, using certain exercises such as the "Hundred, Roll - up", "Single leg circles", "Scissors", "Shoulder bridge" and many other, contributed to the increased strength of the torso muscles, which resulted in the improved outcome after the treatment for a period of 2 months in the experimental group subjects. This confirmed the research hypothesis and the treatment can be considered successful.

Recreation with its means, content and methods has an impact on the correction of negative side effects, which affect the reduction of the working capacity function, impair health and lead to the emergence of early disability. This means that recreation represents an integral part of preventive action when it comes to health and becomes an integral part of modern medicine. The aim was to, by permanent and systematic involvement in recreation, create a positive habit for conceived, organized, meaningful and useful way of spending leisure time. Exercises for the development of repetitive strength of arms and shoulders, applied in an experimental program of exercise, contributed to the growing strength of arms and shoulders in the experimental group subjects.

It was found that the program significantly affected the repetitive muscle strength of the torso, and arms and shoulders. It primarily referred to the muscles m. rectus abdominus, m. oblicus internus et externus abdominus, mm. deltoidei, mm. pectorali, m. latissimus dorsi, m. triceps brachi and m. biceps brachi which increased their strength. During the implementation of the experimental program, not only was the improvement of motor capacity being in the focus, but also the state of the development of the mind and body. Possibly the crucial role belonged to the development of the system for the transport of oxygen which was impacted in the introductory parts of the fitness program and the main parts of the program using the movement exercises, breathing exercises, which are again an integral part of every workout. It was worked on proper breathing, the relationship between inhalation (inspiriuma) and exhalation (expiriuma), which could affect such obtained results.

It can also be assumed that the tests, in addition to sensitivity to pain, also involved some connotative characteristics responsible for pregnancy of the motivational structure (self-domination, superego, and probably superego formation), which could be developed in the experimental group subjects during the implementation of the group fitness training. If we consider that the repetitive strength was under the mechanism of regulators of excitement duration, we get that it was distinguished by repeating certain movements to failure. A general feature of this mechanism is the duration of the activity itself the performance of which requires significantly less strength than the maximum possible, hence the selected tests.

The obtained research results confirm the expected transformation possibilities provided by an organized physical exercise and confirm previous results of Obradović et al. (2008). By observing the work so far and expectations for future experimental exercise programs of a similar type for women who want to succeed in their objective and the result of each training, it is possible to expect the improvement of their physical and mental health, as well as further progress in terms of strength, which will provide a better and more qualitative life.

Further research of this type should include more variables for assessing repetitive strength of certain parts of the body, the treatment should last longer, at least 6 months, and the sample of subjects should be more homogeneous in terms of age groups in order to avoid greater variability of results.

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The Effects of the Training in the Preparation Period on the Repetitive Strength Transformation with Cadet Level Football Players

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

Abstract

The main aim of the research was to identify a level of quantitative changes of the repetitive strength with fifteen years old football players under the influence of the programmed football training of a six weeks preparation period. The training programme covered forty-four training units. The research was made on a sample of 120 cadet level football players. To estimate the repetitive strength three tests have been used: Lying-sed for 30 seconds, Push-ups and Lifting upper body while lying on stomach. In the area of comparative statistics, we used discriminant parametric procedure t-test for big paired samples. It can be concluded that there are statistically significant differences in all three variables to estimate the repetitive strength. This confirmed the hypothesis that the expected significant positive quantitative changes of basic-motor abilities influenced by the proposed model of training in preparation period with fifteen years old football players. The authors were guided by the fact that this kind of training program in preparation period is very effective in terms of raising the repetitive strength level with fifteen years old. The obtained results can be directed towards innovation plans and programs in the preparation period, and the adaptation of the same needs of the respective population.

Key words: football, effects preparation period, repetitive strength

Introduction

Football is a sport that is characterized by numerous and varied complex dynamic kinesiology activities that are characterized by a large number of cyclic and acyclic movements (Gardasevic & Bjelica, 2013). It is evident that all four moments of play, possession of the ball, the opponent’s possession of it, the transformation after winning the ball and the transformation after losing the ball depends on the ability of players to perform certain movements of varying intensity, in different directions and the different sections of the field (Gardasevic & Bjelica, 2014). They must have developed basic and specific motor abilities (Gardasevic, Bjelica & Popović, 2015). One of the basic motor skills, which should be at a high level, is a repetitive force.

The physical strength has a great importance in football. A specific strength with football player is reflected by the strength reflection while jumping, the pushing strength with sprint, strength of stopping and pushing while changing the moving direction, strength of kicking by foot and with a head, strength of throwing the ball with a hand, stability on the ground and in the air, in duels (Gardasevic, 2010). One of the factors that affect the strength is the football players is their age. In child’s development the strength increases with increasing a muscle size. Psychomotor strength, primarily static and repetitive, according to some authors is 50% innate, and systematic training can have a significant effect on it.

The main objective of this study was to determine the level of quantitative changes of repetitive strength in football cadet level, under the influence of a programmed football training which included one preparatory period of forty-two days.

Methods

This was a longitudinal study with an aim that in the two time-varying points determine quantitative changes of repetitive strength in football cadet level (15 year±6 months) under the influence of programmed training process, which included a summer preparation period for the competition season in a unique cadet league of Montenegro and the cadet league middle region of Montenegro. The training program lasted 42 days and was carried out on the auxiliary football field of FC Sutjeska Niksic. The training program included 44 trainers units, within which 8 friendly matches were played.

For data processing only the results of those respondents who have undergone a complete program of work and who have joined the initial and final measurement are taken. This study included a sample of 120 young cadet football players of 4 teams, all from Niksic. Before programmed work all respondents had passed medical check-ups to make sure they could access the training process. When selecting the instruments (tests) it was taken into account that they meet the basic metric characteristics, which means the appropriate age and objective material and spatial conditions. For the assessment of repetitive strength the following tests were used:

1. Lying-sed for 30 seconds (MRSLSJ)
2. Push-ups (MRSSKL)
3. Lifting upper body while lying on stomach (MRSSKL)

Considering that these are a cadet age players (15-year-olds±6 months), in a sensitive period of psychophysical development, program is tailored specifically to their age, taking into account the time spent in the previous training process. Time
structure of the training ranged from 60 to 120 minutes, depending on the goals and objectives of the training unit and it was divided into 3 phases:

- Introductory-preparatory part (25-30% of the duration of training)
- The main part (60-65% of the duration of the training)
- The final part (up to 10% of the duration of training)

In the introductory-preparatory part of the training the emphasis was on raising the operating temperature in children. As a tool a various elementary games with a ball were used that enabled work on the elementary basics of technique and tactics, also the various polygons with exercises coordination were used. A variety of games and exercises to increase joint mobility and strengthen muscles also applied at this stage.

At the first stage of the main part of the training the intensity is slightly increased compared to the warm-up phase and the training program was implemented through a variety of ball games. With a game method the respondents were taught and practiced football skills through a large number of repetitions. At the second stage of the main part of the training the players mostly had a free game on two goals that allowed them a creative activities and highlight of individual, imagination, independent thinking and hard work, applying the elements that teach by the method of the game from the first stage of the main part, and thus strengthening the willing quality. At this stage of the training the intensity was the greatest. At the final part of the training the task was lowering the physiological curve to an optimum level, and low-intensity activities were used: stretching and relaxation exercises, competitive game of penalty kicks, free kicks.

Data obtained from the survey were analyzed using descriptive and comparative statistics. In the area of descriptive statistics for each variable both in the initial and the final state central and dispersion parameters were processed as well as measures of asymmetry and flatness. The hypothesis of normal distribution of results was tested on the basis of Kolmogorov and Smirnov test. In the area of comparative statistics, to determine differences in the variables used to estimate the repetitive strength at the start (initial state) and at the end (final state) of the training program in the preparation period, we used the discriminative parametric procedure Student's t-test for large dependent samples.

### Results

In Tables 1 and 2 are shown the basic descriptive statistical parameters of variables for estimations of the repetitive strength in the initial and final measurement, where the values of central and dispersion tendency were calculated: arithmetic mean (Mean), standard deviation (Std. Dev.), standard error of arithmetic mean (Std. Error), the coefficient of variation (CV%), minimum (Minimum) and maximum (Maximum) values, the range of results (Range), the curvature coefficient (Skewness) and elongation (Kurtosis), as well as the values of Kolmogorov and Smirnov test (K-S test).

First the central and depression parameter of variables for assessing repetitive strength in the initial state were analyzed (Table 1).

<table>
<thead>
<tr>
<th>No.</th>
<th>Variables</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Std. Error</th>
<th>CV%</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Range</th>
<th>Skewness</th>
<th>Kurtosis</th>
<th>K-S test</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MRSLSII</td>
<td>25,08</td>
<td>3,20</td>
<td>0,29</td>
<td>12,74</td>
<td>19</td>
<td>33</td>
<td>14</td>
<td>0,28</td>
<td>-0,54</td>
<td>0,11</td>
</tr>
<tr>
<td>2</td>
<td>MRSSKLI</td>
<td>16,73</td>
<td>7,69</td>
<td>0,70</td>
<td>45,97</td>
<td>3</td>
<td>35</td>
<td>32</td>
<td>-0,06</td>
<td>-0,30</td>
<td>0,16</td>
</tr>
<tr>
<td>3</td>
<td>MRSZULI</td>
<td>37,93</td>
<td>6,69</td>
<td>0,61</td>
<td>17,63</td>
<td>25</td>
<td>53</td>
<td>28</td>
<td>0,00</td>
<td>-0,52</td>
<td>0,68</td>
</tr>
</tbody>
</table>

By analyzing the central and dispersion parameters of variables for assessing the repetitive strength in the initial state-it is evident that the variable Push-ups (MRSSKLI) has a great heterogeneity of results, standard deviation shows us the great deviation of individual results from arithmetic mean, as well as a large coefficient of variation, which has the largest value in this test of all motor variables. This is because there are players who have made only 3 pushups, but there are also some that made even 35, so there is a large range of results, which is again an indicator that the low class football clubs take less into account the development of repetitive strength of players. The values of skewness and kurtosis are in the range of -1 to +1, meaning that the curvature and elongation of results do not differ significantly from normal schedule, provided that the skewness at the variable Lifting upper body while lying on stomach (MRSZULI) shows an ideal symmetrical schedule of results, which means there is no obliquity of curve. Values of Kolmogorov and Smirnov test shows that the results are normally distributed.

Central and dispersive parameters of variables for estimation of the repetitive strength in the final measurement showed the following values (Table 2).

<table>
<thead>
<tr>
<th>No.</th>
<th>Variables</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Std. Error</th>
<th>CV%</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Range</th>
<th>Skewness</th>
<th>Kurtosis</th>
<th>K-S test</th>
</tr>
</thead>
<tbody>
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<td>1</td>
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<td>29,54</td>
<td>2,81</td>
<td>0,26</td>
<td>9,56</td>
<td>25</td>
<td>37</td>
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<td>0,37</td>
<td>-0,09</td>
<td>0,18</td>
</tr>
<tr>
<td>2</td>
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<td>30,10</td>
<td>9,28</td>
<td>0,85</td>
<td>30,83</td>
<td>15</td>
<td>50</td>
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<td>-0,33</td>
<td>0,22</td>
</tr>
<tr>
<td>3</td>
<td>MRSZULF</td>
<td>46,23</td>
<td>6,70</td>
<td>0,61</td>
<td>14,48</td>
<td>33</td>
<td>64</td>
<td>31</td>
<td>0,14</td>
<td>-0,55</td>
<td>0,09</td>
</tr>
</tbody>
</table>

By analyzing the central and dispersive parameters of variables for estimation of the repetitive strength in the final stage-it may be noted that the values of arithmetic means in all three variables at a higher level than in the initial state. Also, it is noticeable that with all three variables the results are more homogenous than in initial state, though the results of variable Push-ups (MRSSKLF) still belong to the moderate homogenous group. The standard deviation in this variable tells us about the great deviation from the arithmetic mean, for the reason that there is a large range of the results. The positive values of skewness means inclination of the results towards the worse results, which means that the tests are quite hard for this age. Kurtosis values are negative for all three variables and talk about slight platykurtic, but not statistically significant. The values of Kolmogorov and Smirnov test shows that the results are normally distributed in all three variables.

To determine the statistical significance (significance) of differences in arithmetic means (partial quantitative changes) of
variables for estimation of the repetitive strength, the t-test was applied to for large dependent samples. The values of t-test were on the level of significance (Sig.) from 0.01 (p≤0.01) in all the variables for the evaluation of repetitive strength. The statistically significant partial quantitative effects were significant at the reliability level p <.01 for all variables between the initial and final states, at the level of statistical significance (significance), p <0.01. It can be concluded that the training program of work in preparation period has led to statistically significant differences in all variables for estimation of the repetitive strength. Based on the results gained it can be noted that there are statistically significant differences in all variables for estimation of the repetitive strength, and therefore can be said that there was a statistically significant positive partial effects of the training program in the preparation period, and the t-test values were significant at the reliability level p <.01 for all variables for estimation of the repetitive strength.

**Table 3.** The values of t-test between the arithmetic means of the initial and the final measurement of variables for evaluating repetitive strength

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error</th>
<th>Correlation</th>
<th>T-test</th>
<th>Sig.</th>
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<td>0,29</td>
<td>0,81</td>
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<td>0,26</td>
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<td></td>
</tr>
<tr>
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<td></td>
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</tr>
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<td>MRSSKLI</td>
<td>16,73</td>
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<td>0,80</td>
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</tr>
<tr>
<td>MRSSKLF</td>
<td>30,10</td>
<td>9,28</td>
<td>0,85</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Par 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MRSZULI</td>
<td>37,93</td>
<td>6,69</td>
<td>0,61</td>
<td>0,96</td>
<td>-46,41</td>
<td>0,00</td>
</tr>
<tr>
<td>MRSZULF</td>
<td>46,23</td>
<td>6,70</td>
<td>0,61</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on the results gained it can be noted that there are statistically significant differences in all variables for estimation of the repetitive strength, and therefore can be said that there was a statistically significant positive partial effects of the training program in the preparation period, and the t-test values were significant at the reliability level p <.01 for all variables for estimation of the repetitive strength.

**Discussion**

On the basis of the obtained parameters it can be concluded that the statistically significant partial quantitative effects (changes) in all the variables for estimation of the repetitive strength obtained as a result of the training program applied in the preparation period. The method of work that has been applied in this training program abounds with exercises dominated by powerful explosive movements, so that the positive transformations are not unexpected. In this age it comes to an increase in biological growth and development of muscles, increase of muscle cross-section, which can certainly contribute to positive results (Gardasevic, Bjelica & Vasiljevic, 2016).

Based on the results of t-test for large dependent samples, with the variables for estimation of the repetitive strength the statistically significant differences were determined in all pairs of variables between the initial and final states, at the level of statistical significance (significance), p <0.01. It can be concluded that the training program of work in preparation period has led to the positive transformation in all variables that were estimating, by the structure of a hypothetical setting of the models, the repetitive strength. In this research the authors were guided by the fact that such a training program of work in preparation period is a very efficient way of working in terms of raising the level of repetitive strength with cadet football players. The authors conclude that the summer period of 42 days, at cadet football players, with such training work program, is optimal for lifting the repetitive strength to the level required for the competition. The gained results can be directed towards innovation of plans and programs of work in the preparation period, and adjusting the same to the needs of the population concerned.

**References**


Gardasevic, J., & Bjelica, D. (2013). Efekti programiranog tre-
The Correlation between Physical Characteristics and Motor Skills of Female Secondary School Pupils

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

Abstract
Secondary school age of female pupils, specific for intensive changes of physical characteristics, in particular for variability of motor expression, is the inspiration for numerous researches as well as of “demands” of contemporary practice of physical education within schools. We have measured physical characteristics and tested motor skills of 228 female pupils of the first grades of secondary schools from Novi Sad. The evaluation of the above-mentioned characteristics and skills has been carried out using the EUROFIT Program of measuring. By applying the canonical correlation analysis we obtained the results pointing to the existence of statistically significant correlation—out of 7 potential canonical factors 3 are statistically significant, as follows: CAN1—female pupils with higher body mass and sub-skin fat are less successful at test for static strength evaluation (MIZDR), aerobic-anaerobic endurance test (MISTR), shuttle running speed (MCUNT), and static balance test (MFLAM), CAN2—female pupils with small body mass are less successful at pliability, static force and dynamic force tests, and CAN3—female pupils with exceptional body height are more successful at tests for lower extremities explosive strength measuring. Based on the insight into the obtained structure of canonical factors it can be concluded that determined correlation of body characteristics and motor skills originate up to a significant extent from feminine gender characteristics of female pupils, who, at the studied age, represent the (un)favourable biomechanical functional basis for manifesting of skills responsible for an efficient motor behaviour.

Key words: Physical characteristics, motor skills, female secondary school pupils

Introduction
A high level of correlation with most motor abilities is one of the properties of pupils’ body characteristics. However, depending on the survey participants age, in particular in the subsample of female pupils, the above-mentioned relation changes its direction and intensity so that at the age of 11-12 already (Malacko, 2007), and particularly after the age of 13, physical abilities (Figure 1) are “lagging behind” compared to their physical development (Ivanić, 1996). Such a trend is reflected throughout the entire adolescent period and represents the subject of interest in researches of a large number of authors (Bajrić et al., 2011; Branković et al., 2012; Milojević et al., 2014; Simić et al., 2015).

Methods
The research has been carried out on the sample of 228 female pupils of secondary schools from Novi Sad (grammar school, medical and technical school) within the group of pupils of 15.6 years of decimal age with the aim to determine the correlation between their body characteristics and motor skills. The evaluation of the above-mentioned characteristics and skills has been carried out using the EUROFIT Program of measuring and testing (Đrljačić et al., 2012). For evaluation of body characteristics we analysed the variables of AVISI – body height, AMASA - body mass, ANABC - skinfold on the upper arm biceps, ANATR
- skinfold on the upper arm triceps, ANALE - skinfold on the back, ANABO - skinfold on the side and ANAPO - skinfold on the lower leg. The insight into motor abilities has been made via the variables of MFLAM - standing on one leg – “Flamingo”, MTAPR - hand tapping, MPRET - bending in sitting position, MSKOK - standing long jump, MDINA - hand dynamometric, MLESE - torso lifting, MIZDR - body pull-up endurance, MCUNTR - 10x5 meters running and MISTR - endurance shuttle running. The evaluation of correlation of the research topics for female pupils has been carried out via canonical correlation analysis by applying Bartlett’s Lambda Test and its testing by means of the corresponding $h^2$ - test.

### Results

Table 1 presents the results of the correlation level between the body characteristics and motor abilities of female pupils.

<table>
<thead>
<tr>
<th>Table 1. Canonical factors and their significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>7</td>
</tr>
</tbody>
</table>

Legend: R - Canonical correlation, $\lambda$ - Square canonical correlation, $\chi^2$ - Hi square test, ss – degrees of freedom, P – Significance of $\chi$ test

The analysis of relation of the applied body measures and motor abilities tests has shown that in a latent area there is their statistically significant correlation. Out of 7 possible pairs of canonical factors 3 are statistically significant at the level of concluding of $p=0.01$.

The first two factors have approximately equal value of canonical correlation coefficient, meaning the significance in explaining the correlation of the analysed areas, while the third one has significantly lower value of this coefficient. After determining the number of statistically significant canonical factors, in the further analysis we proceeded with determining their structure in both of the studied areas.

In the area of body characteristics (Table 2), the first canonical factor is unipolar. Positive projections to this dimension were shown by body mass (0.65) and five skinfolds - skinfold on the upper arm biceps (0.67), skinfold on the back (0.90), skinfold on the side (0.83) and skinfold on the lower leg (0.71).

In the area of motor abilities (Table 3) the first canonical factor is bipolarily defined. The variables of body pull-up endurance (-0.82) and endurance shuttle running (-0.50) are found on the negative pole. Logical negative values but in the matrix with positive denominator have been found for “Flamingo” (0.41) and shuttle running (0.58) variables.

The insight into the correlations of the first pair of canonical factors from the system of variables of body characteristics and first canonical factor from the system of variables of motor abilities leads to the conclusion that it is of the dominant morphological structure considering more numerous and intensive projections of body characteristics variables.

The variables for evaluation of skinfolds on the belly, backs and side record the highest presence in the first canonical factor, which shows that female pupils with a higher body mass and sub-skin fat are less successful at test for static strength evaluation (MIZDR), shuttle running speed (MCUNTR), aerobic-anaerobic endurance test (MISTR), and static balance test (MFLAM).

The obtained results confirm up to a significant extent the findings of other authors who conclude that exceptionally feminine constitutional type of female gender person represent in biomechanical and physiological sense, an unfavourable foundation to demonstrate the abilities responsible for an efficient motoric behaviour in complex kinesiological activities of high information and energy requirements in a time units (Metikoš et al., 1989).

The second canonical factor in the area of body characteristics is unipolar and defined with a high negative correlation with the body mass (-0.57). It is the matter of the survey participants with exceptionally small body mass, shorter body height and somewhat higher fat tissue in the lower body parts.

In the area of motor skills the second canonical factor is also unipolarly defined. Negative and relatively high projections to this dimension were shown for the variables used to evaluate pliability (-0.53), dominant hand static force (-0.70) and dynamic force of belly muscles and hip joint flexor (-0.52).

Hence, the above-mentioned canonical factor is dominantly motoric considering that only one variable from the system of body characteristics has significant projections while three motor variables (MPRET, MDINA, and MLESE) have statistically significant correlation.

<table>
<thead>
<tr>
<th>Table 2. Canonical structure of body factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body characteristics</td>
</tr>
<tr>
<td>-----------------------</td>
</tr>
<tr>
<td>AMASA</td>
</tr>
<tr>
<td>AVISI</td>
</tr>
<tr>
<td>ANATR</td>
</tr>
<tr>
<td>ANABC</td>
</tr>
<tr>
<td>ANALE</td>
</tr>
<tr>
<td>ANABO</td>
</tr>
<tr>
<td>ANAPO</td>
</tr>
</tbody>
</table>

Legend: AVISI – body height, AMASA - body mass, ANABC - skinfold on the upper arm biceps, ANATR - skinfold on the upper arm triceps, ANALE - skinfold on the back, ANABO - skinfold on the side, ANAPO - skinfold on the lower leg
cally significant projections into this factor. The analysis of the structure of the second pair of canonical factors shows that female pupils of smaller body mass are less successful at pliability, static force and dynamic force tests. Starting from the projections of variables of body height and skinfolds of the lower body parts (that are not statistically significant) it can be assumed that the origin of the determined correlation is in a relatively smaller built of the survey partic-

Table 3. Canonical structure of motor skills factors

<table>
<thead>
<tr>
<th>Motor skills tests</th>
<th>CAN1</th>
<th>CAN2</th>
<th>CAN3</th>
</tr>
</thead>
<tbody>
<tr>
<td>MFLAM</td>
<td>0.41*</td>
<td>-0.25</td>
<td>-0.02</td>
</tr>
<tr>
<td>MTAPR</td>
<td>-0.06</td>
<td>0.19</td>
<td>-0.15</td>
</tr>
<tr>
<td>MPRET</td>
<td>-0.05</td>
<td>-0.53*</td>
<td>-0.00</td>
</tr>
<tr>
<td>MSKOK</td>
<td>-0.49</td>
<td>-0.48</td>
<td>0.60*</td>
</tr>
<tr>
<td>MDINA</td>
<td>-0.10</td>
<td>-0.70*</td>
<td>-0.18</td>
</tr>
<tr>
<td>MLESE</td>
<td>-0.34</td>
<td>-0.52*</td>
<td>-0.38</td>
</tr>
<tr>
<td>MIZDR</td>
<td>-0.82*</td>
<td>-0.13</td>
<td>-0.38</td>
</tr>
<tr>
<td>MCUNT</td>
<td>0.58*</td>
<td>0.28</td>
<td>0.17</td>
</tr>
<tr>
<td>MISTR</td>
<td>-0.50*</td>
<td>-0.10</td>
<td>-0.03</td>
</tr>
</tbody>
</table>

Legend: MFLAM - standing on one leg – “Flamingo”, MTAPR - hand tapping, MPRET - bending in sitting position, MSKOK - standing long jump, MDINA - hand dynamometric, MLESE - torso lifting, MIZDR - body pull-up endurance, MČUNTR - 10x5 meters running and MISTR - endurance shuttle running

The third canonical factor in the area of body characteristics is defined unipolarly with only one variable, i.e. body height (0.68) showing high positive projection. In the area of motor skills this factor is also unipolar and it is defined by high positive projection of standing long jump variable (0.60). The analysis of significant projections of body characteristics and motor skills, as well as into those that are not statistically significant shows that female pupils with exceptional body height are more successful at tests for lower extremities explosive strength measuring. High results in the standing long jump reflect an explosive leg power and lower extremities length, which we logically come to know via female pupils’ body height.

Similar findings that confirm the impact of longitudinal skeletal dimension on explosive power demonstration can also be found at other authors (Kurelić et al., 1975; Korovljev et al., 2010). Kurelić emphasises that “increased longitudinal measures with constant body volume and quantity of fat tissues are accompanied, primarily, by relative reduction in the ballast mass, which creates better potentials for successful executing of motion tasks, primarily of locomotion type”, and later on that "the skeletal longitudinal dimensionality factor affects positively the excitation intensity regulation factor”.

Discussion

The conducted study of correlation between body characteristics and motor skills of female pupils of secondary schools lead to isolating of three canonical factors. The first canonical factor is determined by higher correlation between the body mass of female pupils, which originates from the sub-skin fat tissue and lower success rate at energy regulation evaluation tests - static strength evaluation (MIZDR), shuttle running speed (MCUNT), aerobic-anaerobic endurance test (MISTR), and static balance test (MFLAM). In practice of physical education in schools we “see” such examples among obese and less physically active female pupils, which at the same time through diet culture and exercising is also the way of educational acting.

The second canonical factor is determined by characteristics of female pupils with smaller body mass – increased fat tissue in lower body parts and their poorer results at pliability (MPRET), static force (MDINA), and dynamic force (MLESE) tests. The challenge of physical education in schools can be recognised in a new diet culture and exercising aimed at establishing of a higher level of motor skills and body composition of a balanced topological and active-ballast ratio.

The third canonical factor expressed in relatively lowest correlation coefficient, is manifested via high and positive projections of body height and standing long jump (MSKOK) – female pupils with exceptional body height are more successful at tests for lower extremities explosive strength measuring. It is justified to expect, in particular in relation of out-curricula involvement of teachers of physical education, that such female pupils need to be “directed”, more than others, towards the sports disciplines (basketball, volleyball, athletics, swimming, etc.) where they can valorise their potential talent and “natural” morphological-motoric dispositions.

In addition to the learning value of objectivization of correlation between body characteristics and motor skills and female pupils of secondary school, the obtained results of the study contribute significantly to creating “guidelines” for effective and humane professional-pedagogical acting of all stakeholders in educational process.

References


Level of Transformation of Motor Skills in Female Volleyball Players Influenced by Training Operators

Izet Mahmutović, Izet Rado, Munir Talović, Rasim Lakota, Haris Alić and Eldin Jelešković
University of Sarajevo, Faculty of Sport and Physical Education, Sarajevo, Bosnia and Herzegovina

ABSTRACT

The aim of this paper is to determine the level of improvement of motor skills of female volleyball players influenced by kinesiological operators in a period of 6 months. Research was conducted on sample subject of 130 female volleyball players aged from 13±0.6 (mean±SD). Sample variables are divided in two groups: 9 variables of assessment of basic motor skills and 5 variables of assessment of situational motor skills. Analysing difference of arithmetic means between of initial and final measures of treated variables it is determined that there is statistically significant difference on the level Sig=0.001, except for variables of Jelka test which determines speed duration of female volleyball players. Analysis of quantity changes of basic motor skills, shows that the most important projections on selected discriminative function of basic motor skills have the following variables: body lifting in 30 sec; dynamometry of a hand, hand tapping; pull-up: throwing a 1 kg ball from lying position; side defence movement; push-up on bars and situational motor skill are the variables: precision of tactic serving; consecutive bumping; wall-spikes. Comprehensive development of female volleyball players and diversity in the level of volleyball specialization of the development will depend on systematic work on treated motor skills. This program appeared to be efficient. However, it is necessary to gradually increase the demands for the female volleyball players and to put the accent on performance of acquired situational motor skills in future work.

Key words: volleyball, motor skills, female volleyball players, transformational processes, training operators

Introduction

The psychometric skills are the dominant part of volleyball as a sport (Kim, Penney, Cho, & Choi, 2006; Macfadyen & Bailey, 2002). Due to its development volleyball became an Olympic sport with high levels demands for technique, physical condition and tactics aspects grow rapidly. The applied program was intended to establish motor skills i.e. fast performance of motor skills or techniques. Fast performance is on higher level in terms of ballistic movements, which basic characteristic is the absence of control of feedback. Volleyball is part of technique of external movements, and levels of coordination performance (Cosma, Rusu, & Paunescu, 2013; Katić, Grgantov, & Jurko, 2006). Plan and program of volleyball training is important activity of trainer and the whole expert team. (Milanović, Jukić, Čustonja, & Šimek, 2006; Mouron, 2014; Živković & Nešić, 2013). It reduces coincidences to minimum and achieves optimal sport results which answers the needs and demands of the volleyball players and the conditions of the training process. Specification of movements when playing volleyball demands great engagement of the whole body. Determination of dimensions which define the influence of transformational processes of anthropometric forms, motor skills and situational motor skills is very complex and multidimensional subject. Since the good structure of anthropological characteristics is a precondition for efficient performance or acquiring the technical and tactical elements in volleyball game also the monitoring of mentioned three anthropological areas is relevant.

The aim of this research is to establish the level of improvement of motor skills of female volleyball players influenced by kinesiological operators in a period of 6 months. The aim of the research includes complete research procedure and initial and final measurements. Also the aim of the research is to determine the effects of program on controlled anthropological characteristics of female volleyball players.

Methods

Sample subjects

Research was conducted on sample of 120 female volleyball players at the age of 13±0.6 years. Research included healthy female players which, apart from their volleyball training, attend the regular classes of physical education. All participants signed written contest for participation in study regulated according to the Declaration of Helsinki. Study was approved by Ethical Committee of Faculty of Sport and Physical Education at University of Sarajevo.

Sample variables

Sample variables are divided in two groups:
1. Variables for assessment of basic motor skills: hand tapping (MBFTAP); Bent to the front over a bench (MFLPRK); stick handling (MFISK); pull-ups (MRCZGV); push-ups on bars (MSAVIS); body lifting in 30 sec (MRCPPRE); dynamometry of a hand (MRADSA); hand tapping, (MBFTAP); pull-ups (MRCZGV); throwing a 1 kg ball from lying position (MFEBML); side defence movement (MAGKBO).
2. Variables for assessment of situational motor skills: pre-
cision of tactic serving (SMPTS); consecutive passes (SMUOČ); wall-spikes (SMSLZ); Japan test (SMJAT); Jelka test (SMJET).

Analysis was conducted in program SPSS 22.0. The analysis of changes was conducted in order to determine the level of possible improvement of motor skills i.e. in period of 6 months training program. Univariate t-test for dependent samples was used to determine significance between arithmetic means of applied variables before and after training program. Canonical discriminative analysis was applied in order to determine global quantitative changes. Determination of statistical significance of each discriminative variable is based on Bartlett’s Hi-Square test. A discriminative analysis was conducted in order to explain percentage of total explained variance.

Results

Analysing the difference between initial and final measurements (Table 1), hand tapping (MBFTAP) is statistically significant. Since the difference between two arithmetic means was -1.17 in favour of final measurement, t-test result was -7.47, of 119 was statistically significant on the level p=0.001. Bent to the front over a bench (MFLPRK) in examining the differences between arithmetic means of initial and final condition was 13.1 in favour of final measurement which shows that it is statistically significant t-test is 5.2 with of 119 df statistically significant on the level of the significance (p=0.001). Stick handling test (MFISKI) which examined flexibility of shoulders, based on determined differences between initial and final measurements it can be concluded that this program of this experimental research improved flexibility of shoulders of female volleyball players. The difference was 16 and t means of AS initial and final result was 4.9 with 119 df is also statistically significant on level p=0.001. AS difference of arithmetic means between initial and final results; pull-ups (MRCZGV) was -1.5 in favour of the second measurement t-test was -4.86 with 119 df is statistically significant on level of significance p=0.001.

Table 1. Testing the differences of arithmetic means of variables for assessment basic motor skills

<table>
<thead>
<tr>
<th>Paired Differences</th>
<th>Mean</th>
<th>SD</th>
<th>t</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1 MFEBMLI – MFEBMLF</td>
<td>-257.75</td>
<td>389.11</td>
<td>-7.26</td>
<td>119</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Pair 2 MBFTAPI – MBFTAPF</td>
<td>-1.175</td>
<td>1.72</td>
<td>-7.47</td>
<td>119</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Pair 3 MFISKI – MFISKF</td>
<td>16.0</td>
<td>35.18</td>
<td>4.98</td>
<td>119</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Pair 4 MFLPRKI – MFLPRKF</td>
<td>13.17</td>
<td>27.25</td>
<td>5.29</td>
<td>119</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Pair 5 MAGKBOI – MAGKBOF</td>
<td>30.18</td>
<td>88.81</td>
<td>3.72</td>
<td>119</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Pair 6 MRCZGV1 – MRCZGVF</td>
<td>-1.52</td>
<td>3.42</td>
<td>-4.87</td>
<td>119</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Pair 7 MRADSAI – MRADSAF</td>
<td>-21.1</td>
<td>19.62</td>
<td>-4.94</td>
<td>119</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Pair 8 MRCPREI – MRCPREF</td>
<td>-2.57</td>
<td>1.89</td>
<td>-14.91</td>
<td>119</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Pair 9 MSAVISI – MSAVISF</td>
<td>-237.11</td>
<td>281.38</td>
<td>-9.23</td>
<td>119</td>
<td>p&lt;0.001</td>
</tr>
</tbody>
</table>

Push-up on bar test (MSAVIS) showed the difference between AS initial and final measurements and the arithmetic means of treated variables is AS=-237.1 in favour of final measurement, t-test was -9.2 with of 119 df is statistically significant on level p=0.001. Variables of body lifting in 30 sec. (MRCPRE) show the difference of arithmetic means between initial and final results and the arithmetic mean was AS=-2.5; t-test=-14.9 which is with 119 df is statistically significant on level p=0.001. Throwing a ball of 1kg test (MFEBML), shows the differences between these two measurements and the result is AS -257.7; t-test =-7.26 which is significant on the level p=0.001. Side defence movement test (MAGKBO) shows AS difference between initial and final measurements which was 30.1; t-test=3.7 with of 119 df statistically significant on level of significance p=0.001. Dynamometry of a hand test (MRADSA) shows AS difference between initial and final measurements and the results was AS=-21.1 in favour of the second measurement where results of arc t-test = -11.7 with of 119 df, statistically significant on level of significance.

Table 2. Testing differences of arithmetic means for assessment of situational motor skills

<table>
<thead>
<tr>
<th>Paired Differences</th>
<th>Mean</th>
<th>SD</th>
<th>t</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1 SMUOP1 - SMUOPF</td>
<td>-1.91</td>
<td>7.90</td>
<td>-2.65</td>
<td>119</td>
<td>0.009</td>
</tr>
<tr>
<td>Pair 2 SMUOČI - SMUOČF</td>
<td>-5.21</td>
<td>8.32</td>
<td>-6.86</td>
<td>119</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Pair 3 SMPTSI – SMPTSF</td>
<td>-5.12</td>
<td>2.71</td>
<td>-20.70</td>
<td>119</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Pair 4 SMSLZI - SMSLZF</td>
<td>-2.42</td>
<td>3.01</td>
<td>-8.79</td>
<td>119</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Pair 5 SMJATI - SMJATF</td>
<td>34.40</td>
<td>170.26</td>
<td>2.21</td>
<td>119</td>
<td>0.029</td>
</tr>
<tr>
<td>Pair 6 SMJETI – SMJETF</td>
<td>43.61</td>
<td>283.99</td>
<td>1.68</td>
<td>119</td>
<td>0.095</td>
</tr>
</tbody>
</table>

In order to determine transformation of situational motor skills we used T-test for two dependent groups (Paired-Samples T-test), which show us differences between arithmetic means (Table 2). In Table 2 we can see that statistically significant differences are present on level p=0.001, except for variables of Jelka test (SMJET) which determinates speed endurance of female volleyball players. Variable of consecutive passes (SMUOP) tested differences of AS means SMOP, and the results are AS=-1.9, t-test=-2.6 with of 119 statistically significant on level p=0.001.

Table 3. Significance of isolated discriminative function

<table>
<thead>
<tr>
<th>Function</th>
<th>Eigenvalue</th>
<th>% of Variance</th>
<th>Cumulative %</th>
<th>Canonical Correlation</th>
<th>Motor skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.202</td>
<td>100</td>
<td>100</td>
<td>0.41</td>
<td>Basic motor skills</td>
</tr>
<tr>
<td>1</td>
<td>1.044</td>
<td>100</td>
<td>100</td>
<td>0.72</td>
<td>Situational motor skills</td>
</tr>
</tbody>
</table>
Variables of situational motor skills which includes elements of techniques: consecutive passes (SMUOČ), precision of tactic serving (SMPTS), wall-spikes (SMSLZ) show statistically significant differences on p=0.001. Variable of Japan test (SMJAT) and Abalak’s test (SMABT) show statistically significant differences on level p=0.001.

Table 4. Significance of the discriminative function

<table>
<thead>
<tr>
<th>Test of Function(s)</th>
<th>Wilks' Lambda</th>
<th>Chi-square</th>
<th>df</th>
<th>p</th>
<th>Motor skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.832</td>
<td>42.827</td>
<td>9</td>
<td>p&lt;0.001</td>
<td>Basic motor skills</td>
</tr>
<tr>
<td>1</td>
<td>0.489</td>
<td>167.269</td>
<td>6</td>
<td>p&lt;0.001</td>
<td>Situational motor skills</td>
</tr>
</tbody>
</table>

Analysis of differences of matrix of covariance between initial and final measurements of basic motor skills (p=0.014) and situational motor skills (p=0.001) showed statistically significant differences in covariance of analyzed matrix. Table 3 shows discriminative function of basic motor skills (r=0.41), which presents correlation of data which are the base of discriminative analysis and which prove that correlation exists. Means of situational motor skills show one discriminative function which displays relatively high means (r=0.72). Therefore we can conclude that there is relatively high correlation.

Table 4 shows statistically significant on level p=0.001. Wilk’s lambda test shows discriminative strength and it is 0.83. Table 5 shows strength of discriminative function was deducted from data of situational motor skills. It is determined that there is statistically significant difference since Wilks Lambda is 46 and statistically significant one level which p=0.001.

Table 5. Structure matrix of discriminative function

<table>
<thead>
<tr>
<th>Basic motor skills</th>
<th>Function 1</th>
<th>Situational motor skills</th>
<th>Function 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRCPRE</td>
<td>0.687</td>
<td>SMPTS</td>
<td>0.902</td>
</tr>
<tr>
<td>MRADSA</td>
<td>0.570</td>
<td>SMUOČ</td>
<td>0.271</td>
</tr>
<tr>
<td>MBFTAP</td>
<td>0.432</td>
<td>SMSLZ</td>
<td>0.252</td>
</tr>
<tr>
<td>MRCGV</td>
<td>0.324</td>
<td>SMJAT</td>
<td>-0.078</td>
</tr>
<tr>
<td>MFBEML</td>
<td>0.238</td>
<td>SMJET</td>
<td>-0.074</td>
</tr>
<tr>
<td>MAGKBO</td>
<td>-0.222</td>
<td>SMUOP</td>
<td>0.074</td>
</tr>
<tr>
<td>MSAVIS</td>
<td>0.222</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MFISK</td>
<td>-0.171</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MFLPRK</td>
<td>-0.145</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Analysis of means of basic motor skills (Table 5) shows that the most significant projections on isolated discriminative function have variables MRCPRE, MRADSA, MBFTAP, MRCGV, MFBEML, MFBEML, MAGKBO, MSAVIS. Based on correlation of applied variables with the first discriminative function therefore with variables that differentiate first from the second test can be concluded that mentioned tests are the most responsible for deducted results.

Table 6. Centroids of examined groups

<table>
<thead>
<tr>
<th>Basic motor skills</th>
<th>Function</th>
<th>Situational motor skills</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROUP 1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1.00</td>
<td>-450</td>
<td>-1.022</td>
<td></td>
</tr>
<tr>
<td>2.00</td>
<td>-450</td>
<td>1.022</td>
<td></td>
</tr>
</tbody>
</table>

Discussion

In order to achieve the best results, female volleyball players need to go through certain transformational processes (Melrose, Spaniol, Bohling, & Bonnette, 2007). Comprehensive development of female volleyball players and diversity in the level of volleyball specialization of the development will depend on systematic work on coordination, and exposure to multiple exercises and skills during the childhood and adolescence (Drabik, 1996; Bompa, 2000.). During the volleyball training, increase of flexibility significantly reduces injuries of ligaments and muscles and improves stability of locomotor system (Janković, Janković, & Đurković, 2003; Lansdaal et al., 2016) especially for the age which was treated in this research. Applied exercises with medium intensity and exercises of cyclic and acyclic type include: coordination, endurance, speed and explosive strength during the six month period, show that exercises which develop endurance with changeable intensity and great strength and the exercises of coordination need to be included too (Marelić, Đurković, & Rešetar, 2008; Milanović, Šalaj, & Gregov, 2011). All variables of basic motor skills which were presented in this experimental program had statistically significant transformational process. Coordination in volleyball is one of the most important elements in equation of specification of success in volleyball (Gabbett, Georgieff, & Domrow, 2007). During the growth and development characteristics of certain muscles can be equal and certain muscles can have different characteristics. Body force is ability of development of muscle strength. Force of hand is a reflection of development of a body. Good coordination includes muscles that are most adequate for certain tasks and they inhibit antagonists and regulate frequency of nerve impulses (Barbara & Clarac, 2011; Shah, 2012). Synchronization parts of regulation centres and peripheral locomotors mechanism is necessary for coordination (Metikos, Milanović, Prot, Jukić, & Marković, 2003). Well-coordinated movements are more economical and faster that poor coordinated movements. Coordination is of, course, closely related to technique of volleyball. If a volleyball player wants to perform techniques effectively he needs to have developed coordination. Well-co-
ordinated player is able to acquire and perform new skill quickly. What's more important volleyball player who is well coordinated consumes less energy (Ilies, Bakk, & Suskovic, 2013; Rashad & El-Agamy, 2010). Coordination is influenced by several factors (Drabik, 1996): intelligence of an athlete (ability to solve complex and unpredictable motor tasks) systematic training (improves kinaesthetic senses and coordination, precision and the speed of movements): received motor knowledge (motor experience) and the level of development of other motor skills (low level of speed, strength, endurance, flexibility, and other motor skills influences badly on coordination). Since the program content was based on improvement of specific skills mostly isolated from the game, it was expected that certain variables of situational motor skills which are represents of technical skills of female volleyball players would have more significant changes in the final measurement in relation to the initial measurements. The fact that female volleyball players have managed to insert acquired elements into the game explains the effect of the program, but only as a segment which is a part of the game and not a segment which makes the game.

Today, volleyball presents the area of human action which includes developed technology in preparation of both, an athlete and the teams. It also includes engagements of experts and scientists in process of selection, guidance, training and management. These procedures are intended for efficient preparation of athletes and presentation of attractive performances of athletes on competitions. Volleyball is one of the most attractive and the most popular sports in the world. Volleyball is close to the audience due to its simplicity of the rules, small demands in equipment, space and audience’s identification to the players. In order to achieve the best results, female volleyball players need to go through certain transformational processes. Specific motor skills i.e. game techniques (with and without a ball) are dominant part of volleyball as a sport. Technique is the main part of volleyball and it influences the result. Volleyball game during its development has improved its segments. Contemporary game demands acquisition of techniques (rational movements with the ball or without it in order to solve certain tasks). Together with appliance of elements of technique of the game it demands good acquisition of tactics individual and team as well. It is unthinkable for a top player not to be prepared for perfect performance of technical and tactical element. In order to achieve this it is necessary to perform adequate and optimal condition preparation of volleyball players as a fundament of all movement performances on a volleyball court. It has to be played maximum attention to the phase of learning, acquisition or perfect performance of the elements in order to make them faster, stronger and more precise. Therefore, any technical element of the volleyball game is not possible to perform without adequate conditional preparation (e.g. hitting the ball won’t be efficient, if the female volleyball players are not on the optimal level of speed strength hand the spike demands explosive strength of legs etc.). Quality of the game and winning depends on that. Considering the facts from deducted results we can conclude that the accent needs to be put on application of the acquired situational skills and to choose the papers that will provide knowledge of the performance of these skills. If we choose this type of learning it is assumed that volleyball players will apply this technique on a more dynamic way with great number of repetition. Significant quantity improvements can be explained by the fact that the content of training process is conceptualized in that way the subjects during the training were faced with the situations that required stability and orientation during the activities whether they are static or dynamic. Therefore it's not surprising that variable which determinates static strength has the highest projection on discriminative function. This program appeared to be efficient. However, it is necessary to gradually increase the demands for the female volleyball players.

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Planning Network of Sports Facilities in the Context of Montenegro Case Study: Herceg-Nov, Podgorica and Danilovgrad

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ABSTRACT

Sports facilities of a city through the long history of development of the city, starting with ancient Greece and Rome, have been evermore recognized as important areas of the city, the place of communication and interaction between people, places of unwinding everyday social life, so-called point of the urban gatherings. In addition to the social aspect, facilities for sport are often involved in the formation of the visual identity of a city. The land intended for sport and recreation are areas which are in the planning document designed to develop sports and recreational facilities, outdoors or indoors. Globalisation and the transition effects in Montenegro contributed faster transformation of society. This paper explores the urban parameters for the planning of sports and recreational zones in the city. During the transition period, the last 25 years, the system of planning and land management has experienced a major transformation in terms improper planning development of sports facilities, not supporting sports and recreation needs of the residents. For central and coastal region of Montenegro, it is characteristic rapid urbanization with significant migration and dominant construction of residential blocks and tourist facilities on the coast. The planning area for residential, has not been accompanied by adequate network of sports facilities. The purpose of this paper is to determine whether the existing network of sports facilities in Herceg-Nov, Danilovgrad and Podgorica can meet the needs of the residents, as well as to provide recommendations for further development of the network of sports facilities.

Key words: urban parameters, town planning, sports and recreational zone, the network of sports facilities

Introduction

This paper presents analytical study of areas for sport and recreation for city zones of Herceg-Nov, Podgorica and Danilovgrad. The research is based on mapping of existing sports facilities in these cities, and on comparison of realized and needed areas for sport. The aim is to identify the condition of the existing network of sports facilities, its potential deficiencies and possibilities for its improvement.

Methods

The paper predominantly applies analytical approach in research (collecting archive materials, graphic and photographic documentation, measurement in the field, etc.). Starting point is data collection for each of the sports facilities that are located within the limits of the city zones of Herceg-Nov, Podgorica and Danilovgrad. Data analysis was performed using the following scientific methods: method of analysis, comparison method, inductive-deductive method and the method of synthesis. Descriptive and normative methods were also used.

The network of sports facilities, whether existing or planned defines the schedule of sports facilities in the municipalities, their typology, number and capacity of facilities. Planning of the network of facilities is based on an analysis of the needs of the population of areas for sport and recreation, the analysis of the existing network, as well as on the implementation of spatial planning norms.

The norm for calculating the surface area required for outdoor sports is 3 m²/res, while the norm for indoor sports surface is 0.5 m²/res (Ilić, 1998).

Herceg-Nov

Herceg-Nov is a city with a specific urban structure, which has been developing over a longer period of time, starting with the founding of the city in the year 1382. Period under the Turkish rule, is characterized by the formation of the first public baths - a precursor of indoor pools. During the Austro-Hungarian era (from 1797 to 1918), the city began to develop linearly outside of the city walls, and it is a period of intensive development of sports activities. In that period, first sports clubs were registered (in 1926 Jadran Swimming Club). The period after the Second World War is characterized by intensive construction of objects of different typologies, among which is a significant number of new sports facilities and areas. Post-war documentation recognizes the needs of the population for sport and recreation and defines standards for the planning of these areas. In accordance with the dominant affinity towards water sports (swimming and water polo), outdoor swimming pools were built along the seashore (starting with the first one built on Škver, in 1952). There is also the construction of playgrounds (football, basketball, tennis). With the opening of the Institute Igalo in 1949, the city received a significant increase in the capacity of space for sports activities (Indoor swimming pool, multipurpose hall for volleyball, basketball and indoor sports - football, outdoor facilities...).

The first sports center, in the municipality of Herceg-Nov,
wasn't built until 2007, with the surface of 6,000 m² and the capacity of 3,000 seats (depending on the occasion, the number of seats varies between 2,250 and 3,625 seats). The center includes sports halls for the following sports: basketball, handball, volleyball and boxing, multipurpose courts for basketball and handball with stands and three tennis courts with stands and locker rooms, auxiliary tennis court and a bocce court. The position of the sports center is, on one hand, is logical due to the commitment of Igalo as a preparatory center for athletes, however, on the other hand, the position of the centre in the network of sports facilities in Herceg Novi is not adequate, because of the disbalance it creates as it is the only sports center of its size in the municipality. Distance from one end point of the municipality to the sports center is about 20 km.

Promenade Pet Danica is one of the unique forms of spaces, designed, among other things, for sports and recreation. Its surface was not considered a part of open spaces for sport. The average width of the walkways is 4.50 m. The total length of the coastline from Kamenari to Njivice is 24.8 km, of which 2/3 are active walkways.

### Podgorica

Through planning zone/units (Nova Varos, Novi Grad, Stara Varos Podgorica, Konik, Masline, Zagoć, Rogami-South Tolosi, Donja Gorica, Đajabce-Čemovsko field), the paper emphasizes the disproportion in the development of sports and recreational areas.

After World War II, in July 1946 through planning documents, sports and recreational areas attain separate locations, among them stand out: City Stadium (1947), an outdoor sports courts (basketball court in Njegoš park, 1955), Football stadium "Crvena stijena" (1964), the sport airport in Čemovsko polje (1980), Shooting center "Ljubović" (1981), and also one of the points is still the referential mark of the city-Sports center "Morača" (1983) with surrounding sports fields.

This way, through planning documents there were designed unique systems: the northern part of the site- the sports and recreational area Stara Zlatica-Krnjevina, the eastern part of the city- sports and recreational areas in Konik (between the village Ribnica, Vrela Ribnička and Konika), on the south part of the city- sports stadium "Zabjelo" (south of Ljubovića) and the west part of the city- park Kruševac-Tolosi, with smaller facilities forsports and recreation. Length of three most important rivers in the urban center (Moraca, Zeta and Rayon) is up to 9,000 km, while arranged paths are less than one kilometer.

Within the a study (Živković, 1975), as a response to the question "In your opinion, what important things are missing in Titograd for normal and comfortable life of its inhabitants", the majority of respondents (25%) answered "sports facilities".

### Danilovgrad

In the area of Danilovgrad municipality that counts 18,472 people, according to the last census, in 2011, was built more sports facilities which are to serve the citizens of this city and beyond, due to the favorable geographical position of the municipality and good road connections to other Montenegrin towns. All sports facilities and spaces adapted to different generations, especially children and youth, such as: city Danilovgrad sports hall, sports hall "Kalezić" stadium "Bracha Velašević" Danilovgrad ("Izkrva" stadium), the stadium "Zora" in Spuz, small stadium sports in Danilovgrad, the stadium for football "San Siro" in Spuz, tennis courts at Lazine and sports facilities within in barracks "Milovan Saranović" and a sports center with a shooting range at the Police Academy.

In the area of the Municipality there are the following sports: football, handball, basketball, volleyball, karate, judo, chess, athletics, mountaineering and fishing. It is organized into 14 teams (4 football clubs, 2 handball, chess, boxing, karate, judo, taekwondo, athletics club, mountaineering association and fishing section) competing in various ranks of competition, with more than 2,200 members. Sports events are numerous, software designed and maintained permanently, and are financed by the donor principle.

Guided by the norms for land which are necessary for the sport, based on number of population, leads to numerical indicators for indoor and outdoor areas for the sport needed at the level of the entire municipality of Danilovgrad. The sum of the available outdoor and indoor areas and the difference between the required and available surfaces for sport numerically are also shown in Table 3. Summing up the results of Table 3, it can be concluded that the municipality Danilovgrad necessary 19,617 m² indoor and 6,800 m² outdoor spaces for sport and recreation.

### Results

The municipality of Herceg-Novı covers about 23,500 ha, of which the urban area, which is the subject of this research is 1,600 ha (Part of Sutorina, Igalo, Herceg-Novı, Podi, Meljine, Zelenika, Baošići, Denovići, Kumber, Bijela and Kamenari).

According to the General Urban Plan GUP from 1988, Herceg-Novı was fourth in the Republic of Montenegro by the number of sports facilities at the municipal level (4 closed and 11 open, the total area of 15.265 m²) behind Nikšić, Podgorica and Pljevlja, while the surface of sports facilities per capita, occupied the first place in the Republic (1.9 times more land per capita than the national average). According to the Spatial Plan of the Municipality PPOHN, in the municipality of Herceg-Novı, in 2007, there were 8 closed and 14 open sports facilities, which amounts to 1,758 inhabitants per 1 building. Spatial Plan of the municipality envisages the construction of new facilities, which would, by 2020, achieve norms of 2.5 m² per capita and 1000 inhabitants per 1 sports facility (open or closed).

Plans that have been made over the last 15 years in Herceg-Novı did not focus enough on the network of space facilities. They are predominantly oriented towards the development of tourism and recreational facilities which are complementary to tourism. According to PPOHN, 150 ha golf courses are going to be built in the area of Sutorina, paragliding is being developed in the area of Zelenika, which has exceptional natural conditions, while there are also plans for the development of the sport of diving in Bijela. A major recreational center in Baošići is also being considered, which would cover the coast from Kumber to Kamenari.

Currently, in the municipality of Herceg-Novı, there are 11 closed sports facilities and 31 open areas for sports activities (Table 2). The current situation is such that the municipality of Herceg-Novı lacks 36.768 m² of open space for sport and 7,825 m² of closed areas intended for sports activities (Table 1).

Area of the task, placed under the borders of GUP-a Podgorica, is 49,323 ha. In 1972 there has been a deficit in terms of capacity intended for sports and recreation. According to the former condition, the sport occupies 0.45 square meters per person. Special emphasis is placed on water sports and therefore capacities that are supposed to be achieved by 1991 (50,000 people per one swimming pool, 50 seats per 1,000 people, 0.8 m² of courts per citizen, 1 employee per 100 users, 10 m² per seat).
Table 1. Overview and the Sum of indoor and outdoor surfaces for sport in the urban area of Herceg-Nov, according to the typology of sports facilities

<table>
<thead>
<tr>
<th>TYPE OF SPORTS FACILITIES</th>
<th>NUMBER OF OBJECTS</th>
<th>CLOSED SPACES FOR SPORT</th>
<th>OPEN SPACES FOR SPORT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Indoor</td>
<td>Outdoor</td>
</tr>
<tr>
<td>Sports Center</td>
<td>1</td>
<td>1780 m²</td>
<td>3940 m²</td>
</tr>
<tr>
<td>Sports Hall</td>
<td>1</td>
<td>460 m²</td>
<td>/</td>
</tr>
<tr>
<td>Sportshall Near The High School</td>
<td>1</td>
<td>450 m²</td>
<td>*800 m²</td>
</tr>
<tr>
<td>Sports Hall Near The Primary School</td>
<td>4</td>
<td>1641 m²</td>
<td>*4620 m²</td>
</tr>
<tr>
<td>Closed Pools</td>
<td>1</td>
<td>825 m²</td>
<td>/</td>
</tr>
<tr>
<td>Open Pools</td>
<td>7</td>
<td>/</td>
<td>5775 m²</td>
</tr>
<tr>
<td>Tenis Courts</td>
<td>9</td>
<td>/</td>
<td>4100 m²</td>
</tr>
<tr>
<td>Open Courts (Basketball, Volleyball, Football)</td>
<td>9</td>
<td>/</td>
<td>8020 m²</td>
</tr>
<tr>
<td>Football Courts 110*75m</td>
<td>4</td>
<td>/</td>
<td>33000 m²</td>
</tr>
<tr>
<td>Balloons-Closedcourt</td>
<td>3</td>
<td>2400 m²</td>
<td>/</td>
</tr>
<tr>
<td>Boccia</td>
<td>2</td>
<td>/</td>
<td>686 m²</td>
</tr>
<tr>
<td>TOTAL:</td>
<td>11 + 31</td>
<td>7556 m²</td>
<td>55.521 m²</td>
</tr>
</tbody>
</table>

MUNICIPALITY POPULATION

| HERCEG-NOVI | 30763 |

Legend: * areas included in category of open courts

According to the existing situation from 2012, areas for sport and recreation in the territory of Podgorica are around 50 ha. This research showed that the same capacity reached an area larger than 100 ha (area of sports airport on Čemovsko polje is approximately 65 ha). The reason for not including the contents of the existing capacity is inadequate utilization of its full potential. A similar example is the Equestrian center in Donja Gorica, which area is around 7 ha. According to the norms provided for of sports and recreational areas for 2025, it should amount around 316 ha in the subject area.

The lack of basic elements in capital city are indoor courts capacities (with which Podgorica disposal partially or unsuccessfully) as well as the Olympic Stadium, which due to their size do not disturb other urban functions, but it improves them.

There is an evident lack of the indoor and outdoor sports facilities in Rogami and Dajbabe Čemovsko polje, while in other eight planned units, there is necessary to provide indoor facilities (Table 2).

Table 2. Overview of existing indoor and outdoor areas for the sport in the urban territory of Podgorica

<table>
<thead>
<tr>
<th>Planning Unit</th>
<th>Area (ha)</th>
<th>Number of inhabitants in 2013. (m²)</th>
<th>The planned number of inhabitants in 2025. (m²)</th>
<th>Required areas for the outdoor courts (2025) (m²)</th>
<th>Available areas for outdoor courts (m²)</th>
<th>Required areas for indoor courts (2025) (m²)</th>
<th>Available areas for indoor courts (m²)</th>
<th>DISTINCTION Outdoor courts (m²)</th>
<th>DISTINCTION Indoor courts (m²)</th>
<th>DISTINCTION Total (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 Nova Varoš</td>
<td>177.96</td>
<td>11625</td>
<td>13491</td>
<td>6746</td>
<td>40473</td>
<td>25506</td>
<td>9790</td>
<td>-18761</td>
<td>32503</td>
<td>13743</td>
</tr>
<tr>
<td>02 Novi Grad</td>
<td>503.13</td>
<td>26413</td>
<td>34962</td>
<td>17481</td>
<td>104866</td>
<td>41340</td>
<td>32477</td>
<td>-23859</td>
<td>72409</td>
<td>48550</td>
</tr>
<tr>
<td>03 Stara Varoš-Zabjelo</td>
<td>624.81</td>
<td>35664</td>
<td>39493</td>
<td>19747</td>
<td>118479</td>
<td>21500</td>
<td>11980</td>
<td>-1754</td>
<td>106499</td>
<td>104746</td>
</tr>
<tr>
<td>04 Konik</td>
<td>673.98</td>
<td>29939</td>
<td>30066</td>
<td>15033</td>
<td>90198</td>
<td>711450</td>
<td>3200</td>
<td>-696417</td>
<td>86998</td>
<td>-609419</td>
</tr>
<tr>
<td>05 Mašline</td>
<td>372.52</td>
<td>7776</td>
<td>8201</td>
<td>4101</td>
<td>24603</td>
<td>9000</td>
<td>0</td>
<td>-4900</td>
<td>24603</td>
<td>19704</td>
</tr>
<tr>
<td>06 Zagorič</td>
<td>473.74</td>
<td>16816</td>
<td>18142</td>
<td>9071</td>
<td>54426</td>
<td>35593</td>
<td>1700</td>
<td>-26522</td>
<td>52726</td>
<td>26204</td>
</tr>
<tr>
<td>07 Rogami</td>
<td>/</td>
<td>176</td>
<td>2076</td>
<td>1038</td>
<td>6228</td>
<td>0</td>
<td>800</td>
<td>1038</td>
<td>5428</td>
<td>6466</td>
</tr>
<tr>
<td>08 Tološi</td>
<td>556.65</td>
<td>15079</td>
<td>18661</td>
<td>9331</td>
<td>55983</td>
<td>11338</td>
<td>2050</td>
<td>-2008</td>
<td>53933</td>
<td>51926</td>
</tr>
<tr>
<td>09 Donja Gorica</td>
<td>493</td>
<td>5244</td>
<td>7409</td>
<td>3705</td>
<td>22227</td>
<td>76150</td>
<td>5480</td>
<td>-72446</td>
<td>16747</td>
<td>-55699</td>
</tr>
<tr>
<td>10 Dajbabe-Čemovsko polje</td>
<td>1056.42</td>
<td>2286</td>
<td>2631</td>
<td>1316</td>
<td>7893</td>
<td>1260</td>
<td>1900</td>
<td>56</td>
<td>5993</td>
<td>6049</td>
</tr>
<tr>
<td>SUM</td>
<td>49.323.21</td>
<td>151018</td>
<td>175132</td>
<td>87566</td>
<td>525396</td>
<td>933137</td>
<td>67557</td>
<td>-845571</td>
<td>457839</td>
<td>-387732</td>
</tr>
</tbody>
</table>
Leading the table presentation of available outdoor and indoor areas, as well as displaying the required area for sports activities in indoor and outdoor, according to the standards, we conclude that the urban area of Danilovgrad, that counts 6,852 inhabitants according to the last census in 2011, it is necessary 1,006 m² indoor and 10,906 m² outdoor areas for sports (Table 3).

**Table 3.** Overview and the sum of indoor and outdoor surfaces for sport in the urban area of Danilovgrad, according to the typology of sports facilities and overview of collecting the required, available and difference between indoor and outdoor areas for the sport in the area of Danilovgrad municipality

<table>
<thead>
<tr>
<th>URBAN AREA</th>
<th>TYPE OF SPORTS FACILITIES</th>
<th>NUMBER OF OBJECTS</th>
<th>CLOSED SPACES FOR SPORT</th>
<th>OPEN SPACES FOR SPORT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Indoor</td>
<td>Outdoor</td>
</tr>
<tr>
<td>Danilovgrad</td>
<td>City football stadium &quot;Braće&quot;</td>
<td>1</td>
<td>/</td>
<td>7.400m²</td>
</tr>
<tr>
<td></td>
<td>Velašević-stadium &quot;Iskra&quot;</td>
<td></td>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td></td>
<td>City sport hall Danilovgrad</td>
<td>1</td>
<td>900m²</td>
<td>/</td>
</tr>
<tr>
<td></td>
<td>Sports center with a shooting range at the Police Academy</td>
<td>1</td>
<td>1.300m²</td>
<td>/</td>
</tr>
<tr>
<td></td>
<td>Small stadium sports Danilovgrad</td>
<td>1</td>
<td>/</td>
<td>950m²</td>
</tr>
<tr>
<td></td>
<td>Sports hall of elementary school &quot;Vuko Jovović&quot;</td>
<td>1</td>
<td>220m²</td>
<td>/</td>
</tr>
<tr>
<td></td>
<td>Outdoor sports facilities (basketball, handball, volleyball, soccer)</td>
<td>3</td>
<td>/</td>
<td>1.300m²</td>
</tr>
<tr>
<td></td>
<td>Total (available areas for sport)</td>
<td></td>
<td>2.420m²</td>
<td>9.650m²</td>
</tr>
<tr>
<td></td>
<td>Total (required areas for sport)</td>
<td></td>
<td>3.426m²</td>
<td>20.556m²</td>
</tr>
<tr>
<td></td>
<td>Difference required/available areas for sport</td>
<td></td>
<td>1.006m²</td>
<td>10.906m²</td>
</tr>
<tr>
<td>Municipality</td>
<td>Population</td>
<td></td>
<td>REQUIRED AREAS FOR SPORT</td>
<td>AVAILABLE AREAS FOR SPORT</td>
</tr>
<tr>
<td>Danilovgrad</td>
<td>18,472</td>
<td></td>
<td>9.236m²</td>
<td>35.416m²</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2.436m²</td>
<td>35.799m²</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>DIFFERENCE IN SPACE COVERED</td>
<td>6.800m²</td>
</tr>
</tbody>
</table>

Description of the networks

The network of sports facilities in Herceg Novi has developed linearly along the main road, or along the coast. There is an apparent unevenness in the distribution of sports facilities in the municipality. The highest concentration of sports facilities is in the area of Igalo, which has been recognized as a suitable area for sports, while the network is not as developed from Kumbor to Kamenari, in said area there is only one sports hall of note located next to the elementary school "Orjenski Bataljon" in Bijela. As Igalo is the end point of a linearly developed city, an imbalance is created in the network of sports facilities.

Water sports are the prevalent ones (sailing, diving, swimming, water polo). Their maintenance in the open depends on the outside temperature and the temperature of the sea, and is confined to a limited period during the year. Indoor and outdoor pools are distributed evenly and are 2 km away from each other, which meets the needs of the population in the summer months, while in the winter months all activities related to water sports are transferred to the indoor pool of the Institute Igalo.

Football courts are arranged at approximately equal distance from one another (6 km), and cover the mentioned area. Outdoor sports facilities are evenly distributed, but there aren't enough of them to fulfill the norms. There is a lack of indoor sports surfaces from Zelenika to Kamenari, and the whole area gravitates towards the sports hall in Bijela.

In the local community of Zelenika, which covers 87.50 ha and has enough capacity to remedy the lack of closed areas, a suitable location for a new sports center could be found, which would make sports activities gravitate less towards Igalo and Bijela (Figure 1).

The division of the urban core of Podgorica on planning units eases the further division of the city into separate smaller sports centers. Given that the city develops spontaneously and simultaneously in the radial direction, the peripheral parts of the city core are neglected by insufficient elaboration of urban functions through the planning documentation, which further enhances the illegal construction and unplanned development (Figure 2).

Novi Grad, Nova Varoš and Stara Varoš-Zabjelovo have the highest concentration of sports facilities. By this analysis it is noticed that the least developed parts are rural parts of the city: Rogami and Đababe-Cemovsko polje.

The lack of the plan is reflected in the deterioration of objects whose lifetime is exceeded the current needs of modern society, so in a near future is planned a reconstruction (reconstruction of open water polo pool with bleachers in SC "Morača", and its transformation into a closed and reconstruction halls in which there is an indoor pool in multifunctional hall for indoor sportive). Thus, there is a risk of overcrowding and losing importance of location, such as the construction of the central tennis cup in complex SC "Morača" with 2,000 seats, 6 extra courts, 3 badminton courts and 3 courts for pado-
ing, recreational section for children to high standards of ITT, medical center, fitness, spa center and other supporting facilities for further popularization of tennis in Montenegro. This approach widely suppresses already built New Town sports infrastructure, so these facilities should be provided to the new city center.

PUP Podgorica creates a network outside the top three most important urban ensembles, and provides a new direction of development of the city, by planning on the construction of the City stadium in Stari Aerodrom-Konik, and by relocating an existing one, the capacity and the location is not adequate for major international matches. The surface of foreseen facility would equate 2.435 m².

The same plan provides direction of the city to the north, not so exploited potential of Maslina and Zlatice, by constructing two football fields in DUP "Zlatica B" (courts with artificial backed by established standards of FIFA, which will be built in the forest park Zlatica).
Defects in previous plans and the inability of the maximum exploitation of the existing situation, compensates by completely collapsing them to create a supposedly better conditions. Therefore, it is planned a new outdoor sport complex with a variety of facilities at the site of the Shooting Center "Ljubović" or Tološka šuma.

Looking at the network of sports facilities of the city Danilovgrad we can see a certain unevenness in the spatial distribution. The highest concentration of sports facilities is about public educational institutions, preschools, elementary and secondary schools, where they represented outdoor sports facilities for various sports (basketball, volleyball), a gym within the primary school and sports town hall. It can be said that the school population networks of these objects quite well spatially adapted given the negligible distance of this area of educational institutions (Figure 3).

The main benchmark sports facility is the city's football stadium, "Iskra", intended for young people, and located at a distance of a kilometer of part of the group of sports space with educational units. Danilovgrad also includes a sports center with a shooting range in the Police Academy complex, also at a distance of about a kilometer from the city's football stadium, "Iskra", and from the sports town hall located next to educational institutions.

Distance of the same social activities, specifically indoor and outdoor sports area, in the urban area of Danilovgrad, easily outperforming thanks to excellent and well thought out urban pattern of the city, as well as the relatively good infrastructure connections between the blocks.

Discussion

The network of sports facilities in Herceg Novi is predominantly linear, with a significant number of sports facilities being located in the area of Igalo.

Planning of the network of sports facilities is a particularly sensitive issue. Taking into the account the needs of all residents, both those who are active in sports, and those who need to provide space for recreation, according to age categories. The current situation is such that the municipality of Herceg Novi lacks 36.768 m² of open space for sport and 7.825 m² of closed areas intended for sports activities. Herceg-Novi did not develop enough facilities for sport and recreation, even though the municipality has a lot of potential. Spatial Plan of the municipality of Herceg Novi predicted that by the year of 2020, a lot of new facilities would have developed which would fulfill the norm of 2.5 m²/res.

Podgorica with its existing capacity relative fulfill the conditions specified by PUP Podgorica, at the level of the urban core of the city. However, disproportionally division of capacity and harsh segregation of specific planning unit is fatal for urban development of Podgorica. Thus, it is important that peripheral zone of GUR-a Podgorica, ie planning unit Čemovsko Fields Donja Gorica, Konik, Rogami, Masline and Tološi, to be activate in terms of sports and recreational facilities.

The synthesis of various urban functions, with respect to the morphology of the terrain and using the same for the purpose of activating sports and green areas, would greatly reduce the devastation of urban space and the invasion of illegal construction that characterizes today's modern city.

Sports facilities for each city are particularly important category and a healthy society is a basic requirement of any sustainable development in which sport and sports activities play an indispensable role. Based on available data for municipality of Danilovgrad on the number of individual sports asso-

Figure 3. Overview of the network of sports facilities in the urban part of Danilovgrad
ations the information is obtained that every 18th resident of the municipality in sports, and it is in sports activities included every 8th resident.

Given the expressed interest of the young population for sports and the importance of sport for the health of the population, while keeping in mind the geo-strategic position of the municipality is necessary to these objects and surfaces provide a much better treatment in all respects. This means, above all, seriously planned investment in available sports facilities in the part of renovation and reconstruction in order to get an architectural comfortable areas, as well as increasing the capacity of indoor and outdoor areas for sport. Within blocks structure are needed outdoor spaces for sport and recreation, and it is necessary to increase the capacity of the indoor area along the border of cadastral municipality, due to their relative density in the center.

It is evident that the city needed areas for sport and recreation elderly population. The city needs new promenade area outside the block structure. In this way, all age groups were ensured equal treatment in the area of sports and recreational activities.

It is important to note that through a variety of urban plans, detailed, general, space plans, areas for sports and recreational activities are not accented sufficiently. Thoughtful implementation in the planning documents these areas get a lot of importance and become a representative areas of the city.

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Revised March 2016

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Original Scientific Paper

Transfer of learning on a spatial memory task

Selcuk Akpinar¹, Stevo Popović¹², Sadettin Kirazci¹

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Abstract word count: 236

Number of Tables: 3

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2.5.1. Table heading

Table heading should be written above the table, in Title Case, and without a full stop at the end of the heading. Do not use suffix letters (e.g., Table 1a, 1b, 1c); instead, combine the related tables. See example:
✓ Table 1. Repeated Sprint Time Following Ingestion of Carbohydrate-Electrolyte Beverage

2.5.2. Table sub-heading

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

2.5.3. Table footnotes

Table footnotes should be written below the table.

General notes explain, qualify or provide information about the table as a whole. Put explanations of abbreviations, symbols, etc. here. General notes are designated by the word Note (italicized) followed by a period.
✓ Note. CI: confidence interval; Con: control group; CE: carbohydrate-electrolyte group.

Specific notes explain, qualify or provide information about a particular column, row, or individual entry. To indicate specific notes, use superscript lowercase letters (e.g. a,b,c), and order the superscripts from left to right, top to bottom. Each table’s first footnote must be the superscript a.
✓ "One participant was diagnosed with heat illness and \( n = 19 \).
✓ "n = 20."

Probability notes provide the reader with the results of the tests 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.

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

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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 below 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.

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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 |

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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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(Family name, initials)

3. Publication type:

(Please suggest the type of your publication: original scientific papers, review articles, editorials, short reports, peer review - fair review, or invited papers and award papers)

4. Numbers:

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c) If the study includes participation of human beings or animals, please fill out the compliance/assessment by an ethics committee:
This study complies with the ethics committee of (state the name of the institution):

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By signing, all authors confirm the agreement with the contents of the statement in the previous chapter and that the information they provided on these pages is true.

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## 3. Evaluation:

*(Please rate the following: 1 = Excellent; 2 = Good; 3 = Fair; 4 = poor)*

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**Publication date:**
- Summer issue – June 2016
- Autumn issue – October 2016
- Winter issue – February 2017
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- DP - Dynamic positioning courses
- Offshore courses

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University of Montenegro

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Volume 14, 2016, 3 issues per year; Print ISSN: 1451-7485, Online ISSN: 2337-0351

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Montenegrin Journal of Sports Science and Medicine

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Executive Editor: Stevo Popovic, Montenegro  
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Volume 5, 2016, 2 issues per year; Print ISSN: 1800-8755, Online ISSN: 1800-8763

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