INTRODUCTION

One of the most important skills in football is aerobic endurance. (Marković & Bradić, 2008; Stolen, Chamari, Castagna, & Wisloff, 2005). We define aerobic endurance as the ability to perform work over a longer period of time in conditions of aerobic metabolism (Vucetic V. & Šentija, 2004). Generally accepted parameters for aerobic power assessment are: a) the maximum oxygen uptake (VO2max), the amount of oxygen that the body can spend in one minute, and b) the anaerobic threshold, the maximum intensity of the workload where the accumulation of lactic acid and its degradation are in the balance. The increase in maximal oxygen uptake (VO2max) causes an increase in stroke volume of the heart, which results in increased cardiac output (the maximum amount of blood ejected by the heart into the bloodstream in one minute) (Tanisho & Hirakawa, 2009; Vucetic V. & Šentija, 2004). Soccer players of national and international league have aerobic capacity i.e. maximal oxygen uptake (VO2max) average of about 60 - 65 ml/kg/min (Vucetic V. & Šentija, 2004). In sports practice and science we use two methods of aerobic training, ordinary continuous training and interval aerobic training (Ekblom, 1986; Evans, 1997; Friel, 1998). There are a significant number of studies within domain of interval and continuous aerobic training and their impact on functional ability. Within these studies the effects of interval and continuous aerobic training on VO2max in soccer players are proven. (Baquet, Gamelin, & Mucci, 2010; Jan Helgerud, 2007; J. Helgerud, Engen, Wisloff, & Hoff, 2001; Martin & Coe, 1997). The increased level of VO2max in situational conditions (such as soccer games) helps soccer players to meet all the requirements of modern soccer. (Baquet et al., 2010) in their study confirm that interval training of aerobic endurance is more effective than continuous aerobic training in both categories; population of untrained young people and professional soccer players. (J. Helgerud et al., 2001; Stolen et al., 2005). Wisloff & Co. conducted the study among heart patient population and the patients were assigned to interval aerobic training three times a week. These patients showed greater progress than the group of respondents assigned to classic continuous aerobic training also three times a week and much greater progress compared to the group that only had daily exercise (walking, etc.) (Wong, Chaouachi, Chamari, Dellal, & Wisloff, 2010). The results of the study in soccer players who were engaged in various additional interval aerobic trainings combined with strength trainings showed the results of increased aerobic endurance and muscular endurance. (Wong et al., 2010). In his numerous studies, Bangsbo determined that...
high-intensity aerobic training for 8 to 12 weeks increases VO2max in the range of 5-11% but the load has to be above 85% if HRmax (maximal heart rate), (Iaia, Rampinini, & Bangsbo, 2009). Significant number of studies confirms the problem of aerobic endurance decrease during the season. (Bangsbo, 1999). A significant correlation between aerobic training and increased aerobic capacity was determined. High-intensity aerobic training – HIT (High Intensity Training) causes increased oxygen consumption which results with reduced energy use from anaerobic glycolysis and lactate production. (Baquet et al., 2010; Gibala & McGee, 2008; Hamilton, Nevill, Brooks, & Williams, 1991). Several studies proved that an athlete with high aerobic capacity re-sensitizes ATP and removes lactate rapidly during breaks. (J. Helgerud et al., 2001; Takahashi et al., 1995). Tanisho and Hirakawa (2009) in their work explain the protocols of training programs, which are conducted in the laboratory on the ergometers and the respondents were young soccer players. In previous studies, scientists are dealing with different impacts of interval and continuous training on a particular skill or several of them. There are only few studies about effects of various additional programs of interval and continuous aerobic training on selected population of young players, in order to prevent a decline in aerobic endurance during competition season.

Aim and hypotheses
The aim of the study was to determine the effectiveness of various programs of interval and continuous training of aerobic endurance in young soccer players (aged 18-19).

Hypotheses:
H1: It is expected that the IAT (interval aerobic training) will produce significant differences in aerobic endurance compared to CAT (continuous aerobic training).

METHODS
The subjects were 30 young soccer players from FC “Široki Brijeg” from Široki Brijeg. The team competes in the Premier League of Bosnia and Herzegovina, which consists of 16 teams.

Sample of variables included:
the number of completed distances within the beep test (Vucetic V. & Šentija, 2004).
FS – maximum heart rate FSmax(Hr) within the beep test

Experimental program
The experimental program was carried out for 6 weeks. After the initial measurements both groups were conducting assigned programs IAT and CAT. These programs were conducted after regular training during competition stage when the players are in a competitive rhythm. Additional training programs were implemented 2 times a week as a part of regular training. Period of 6 weeks was considered because previous studies indicated that transformation processes in aerobic endurance occur during period from 6 to 12 weeks (J. Helgerud et al., 2007; Martin & Coe, 1997b; Stolen et al., 2005; Tanisho & Hirakawa, 2009; Wong et al., 2010). Programs were conducted by two kinesiology graduates, specialized in soccer. In order to equalize the conditions in which they conducted training programs, both groups were training on Mondays and Wednesdays. Trainings were held on the grass court. Sample of 30 respondents were divided into two groups by pairing method (standard first league players are equally distributed in both groups). One group was assigned to IAT (interval aerobic training) and the other group to CAT (continuous aerobic training).

Programs were set up in such a way that the continuous training was conducted within frames of constant load retention at the level 75-80% of FSmax, while interval training was set up so the loads remained equal during entire 6 weeks. For treatment monitoring we used FT80 GPS polar watch, (Heart Rate Watch Company/USA), which monitors heart rate with software (Polar Personal Trainer software) on laptop Toshiba 1 550. For each subject in particular, the target heart rate FS was determined, i.e. the intensity of training IAT and CAT. This experiment has its own significance and necessity because of the problem that occurs during the competitive part of the season, which is reflected in the decline of aerobic capacity. The initial and final measurement was carried out on the court of FC Siroki Brijeg of Soccer center “Musa Karacic”.

Training procedure is presented in Table 1

Statistical methods
The obtained results were analyzed with the software package Statistica for Windows, ver 8.0. Basic descriptive statistics for each variable was made. The arithmetic mean, standard deviation, minimum value, maximum value, measure of sym-
metry and measure of curvature in variable distribution was calculated. Normal distribution was tested by Kolmogorov-Smirnov test. In order to determine the differences between the groups at the end of experiment we applied univariate analysis of variance (ANOVA). The level of statistical significance will be determined according to the level of error 0.05.

RESULTS AND DISCUSSION

In Table 2 we presented the results of statistical analysis; arithmetic mean, min and max result, standard deviation. In further elaboration we applied ANOVA with repeated measures. The results indicate significant interaction, which means that applied forms of training have different effects. There is a statistically significant interaction between applied methods of training and training process effects: F=10.86; p <0.05. Partial eta squared = 0.27 large effect (bigger effect size) (Levine, T. R. & Hullett, C. R. 2002). Considering the results obtained by statistical analysis it can be determined how training programs give different effects.

From Graph 1 we can conclude that interval aerobic program (IAT) has a positive effect (Baquet et al., 2010). Although there were no statistical differences between initial and final states (Table2) there has been progress. Considering that the aim was to keep the existing capacities that are acquired in the preparatory period, the IAT provides a positive effect on aerobic capacity in young soccer players. This type of training significantly reduces the duration of the training, which is a positive step in today’s training process.

Table 1. Training procedure

<table>
<thead>
<tr>
<th>Initial measuring</th>
<th>Time</th>
<th>Continuous</th>
<th>Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st week</td>
<td>2x a week 1x20 min., 75-80% of HRmax.</td>
<td>2x a week, 4x3min, 90-95% of HRmax.</td>
<td></td>
</tr>
<tr>
<td>2nd week</td>
<td>2x a week 1x20 min., 75-80% of HRmax.</td>
<td>2x a week, 4x3min, 90-95% of HRmax.</td>
<td></td>
</tr>
<tr>
<td>3rd week</td>
<td>2x a week 1x20 min., 75-80% of HRmax.</td>
<td>2x a week, 4x3min, 90-95% of HRmax.</td>
<td></td>
</tr>
<tr>
<td>4th week</td>
<td>2x a week 1x20 min., 75-80% of HRmax.</td>
<td>2x a week, 4x3min, 90-95% of HRmax.</td>
<td></td>
</tr>
<tr>
<td>5th week</td>
<td>2x a week 1x20 min., 75-80% of HRmax.</td>
<td>2x a week, 4x3min, 90-95% of HRmax.</td>
<td></td>
</tr>
<tr>
<td>6th week</td>
<td>2x a week 1x20 min., 75-80% of HRmax.</td>
<td>2x a week, 4x3min, 90-95% of HRmax.</td>
<td></td>
</tr>
</tbody>
</table>

Final measuring

Table 2. Arithmetic mean, min and max result, standard deviation

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>AS</th>
<th>Min</th>
<th>Max</th>
<th>SD</th>
<th>Skewnes</th>
<th>Kurtosis</th>
<th>max D</th>
<th>K-S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial</td>
<td>30</td>
<td>12,74000</td>
<td>11,300</td>
<td>15,200</td>
<td>0,99398</td>
<td>-0,198201</td>
<td>0,079032</td>
<td>p&lt;.20</td>
<td></td>
</tr>
<tr>
<td>Final</td>
<td>30</td>
<td>12,69067</td>
<td>11,000</td>
<td>14,800</td>
<td>0,94328</td>
<td>-0,521578</td>
<td>0,110634</td>
<td>p&lt;.20</td>
<td></td>
</tr>
</tbody>
</table>

Legend: N- number of respondents, AS- arithmetic mean, Min – the lowest value, Max – highest value, SD- standard deviation, Skewnes- the degree of symmetry, Kurtosis – the degree of peakedness

Table 3. Results of repeated measures ANOVA

<table>
<thead>
<tr>
<th></th>
<th>Df</th>
<th>F</th>
<th>p</th>
<th>Partial eta-squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>1</td>
<td>1,275</td>
<td>0,268</td>
<td>0,043</td>
</tr>
<tr>
<td>R1*Interv/cont</td>
<td>1</td>
<td>10,86</td>
<td>0,002</td>
<td>0,279</td>
</tr>
</tbody>
</table>

From Graph 2 it is obvious that the applied form of training has given positive effect, although progress wasn’t statistically significant, there was no decline in aerobic capacity which was the actual objective of the treatment. Aerobic endurance was maintained at the optimum level for the group assigned to interval aerobic training.

Graph 3 reviews that the effects of continuous training are not significant, but with clear decline of aerobic capacity. A group of soccer players that was assigned to continuous training had a significant decrease in aerobic capacity, which makes this method of training ineffective in preventing the decline in aerobic capacity that occurs during competition as shown in this study (Jan Helgerud, 2007; J. Helgerud et al., 2007). Therefore, such continuous training is not applicable in young soccer players since it can not improve aerobic endurance. Analyzing football game, we can conclude that the movements are not identical with the movements in continuous aerobic trainings. This does not mean that continuous training is not significant in the training process, but that it is necessary to modify the programs of treatment into different forms in order to accomplish bigger effects.

CONCLUSION
Based on the obtained results it can be concluded that the applied forms of training give different effects and so we confirm the hypothesis. This study shows how the training process is performed and what effects can be expected from the interval and continuous training. This study provides information for coaches, who are seeking for optimal treatments how to stop the decline in aerobic endurance during the season and at the same time maintain endurance and increase it to a higher level. This paper offers new modes in training aerobic endurance programming. Interval training of aerobic endurance, as such, is a better work model vs. continuous training when applied in young soccer players. Considering that soccer is essentially interval activity with constant changes in direction, interval training is closer to the structure of motion in a soccer game and, as such, is more effective than continuous training in preventing the decline of aerobic capacity in young soccer players during the season.

REFERENCES


Correspondence:
Zarko Kostovski
Ss. Cyril and Methodius University in Skopje
Faculty of Physical Education
Zeletnicka b.b.
1000, Skopje, Macedonia
e-mail:zarkokostovski@hotmail.com
ВЛИЈАНИЕТО НА ИНТЕРВАЛНО И КОНТИНУИРАНО АЕРОБНО ТРЕНИРАЊЕ КАЈ МЛАДИ ФУДБАЛЕРИ

УДК:  
(Оригинален научен труд)

Дамир Црњач1, Стипе Блажевиќ2, Мате Бrekalo1, Жарко Костовски3 и Кристијан Мариќ1

1Факултет за Науки, Универзитет во Мостањ, Босна и Херцеговина
2Економски Факултет, Универзитет во Ријека, Хрвачка
3Универзитет Св. Кирил и Методиј, Факултет за физичка култура, Скопје, Р. Македонија

Абстракт
Истражувањето е базирано на примерок од 30 млади фудбалери поделени во два субпримерока (сеоко јо 15 испитаника). Дополнителниот кинезиолошки јереиман на интервално и аеробно тренирање беше применет со цел да се превенира опаѓањето на аеробна издржливост за време на натпреварувачката сезона. Добиениите резултати со јооми на униваријантната анализа на варијанси (АНОВА) истакнува дека групата што тренираше со интервална аеробна програма (IAT) има некои положителни подобрувања во доменот на аеробна издржливост, додека групата што тренираше според програмата на континуиран аеробен тренинг (CAT), имаше опаѓање на аеробната кацација.