VALUES OF SPEED AND AEROBIC CAPACITY PARAMETERS AS INDICATORS OF PHYSICAL FITNESS IN U18 AND U19 SOCCER TEAMS AT THE BEGINNING OF THE PRE-SEASON PERIOD

Jaroslav Teplan, Tomáš Malý, František Zahálka and Lucia Malá

Faculty of Physical Education and Sport, Charles University in Prague, Czech Republic

Abstract

The aim of this study was to evaluate and to compare the current situation in terms of intermittent training by two elite Czech U18 and U19 team categories before the start of the pre-season period. The U18 category consisted of 17 players (age: 17.6 ± 0.3 years, body weight: 71.1 ± 5.7 kg, body height: 178.2 ± 6.9 and body fat: 10.3 ± 1, 4%) and the U19 category consisted of 14 players (age: 18.3 ± 0.2 years, body weight: 74.9 ± 6.5 kg, body height: 181.5 ± 6.3 and body fat: 10.6 ± 1.6%). Speed parameters were assessed using 5 and 10 m acceleration tests and maximum speed test at 20 m (flying start). For monitoring and evaluating aerobic parameters, the Yo-Yo intermittent recovery test 1 (Yo-Yo IRT1) was used. In the 5 and 10 m tests, no significant differences were found. However, a significant difference was detected in maximum speed at 20 m (p = 0.04). The difference in the maximum covered distance between the teams was not significant (t29 = 0.60, p = 0.56). Furthermore, no significant differences were observed at the maximum heart rate (p = 0.66), decrease in heart rate during 1 minute after the test (p = 0.78) and maximum oxygen consumption (t29 = 0.59, p = 0.56). Insignificant differences could be caused by long-term inactivity of players in the transitional period. For objectification of the results of our investigative conclusions, it would be appropriate to follow both teams throughout the duration of the competitive period.

Key words: soccer, field test, youth, aerobic parameters, Yo-Yo IRT1

Introduction

Soccer player’s performance cannot be evaluated separately as factors of physical fitness, techniques, tactics and psychological factors. During the match, these factors constantly interact and mutually form an individual player’s game performance (Bangsbo, Mohr, Poulsen, Gomez, & Krustrup, 2006), which is important for achieving the superior aim, which is team performance. Soccer puts demands on the player in terms of physical fitness, namely strength and power, speed, agility, balance, stability, flexibility and adequate level of endurance (Bloomfield, Polman, & O’Donoghue, 2007; Malý, Zahálka, Malá, Buzek, Teplan & et al., 2012).

When assessing qualitative physical activities during the match, the most important are those performed at high intensity. High intensity is the main factor distinguishing players at the highest level (professional players) from players at the lower level (semi-professional and amateur players). High intensity actions include acceleration and maximum speed which are constantly repeated during the match (Little & Williams, 2006). Soccer is a sport characterised by intermittent load with the prevalence of aerobic energetic system. During the match, approximately 85 % of maximum heart rate (HRmax) occurs on average with the maximum heart rate around 98% HRmax (Bangsbo, 1994). In the second half, fatigue starts to appear and the amount of high intensity activities accordingly decreases. Simultaneously, the level of fine motor skills is lowered (physical and game skills).
The course of the game is variable and the player should be prepared to manage and quickly react to changing game situations (Silva, Santtiago, Papoti, & Gobatto, 2008), which are associated with the level of competition, the team’s tactics, the style of the opponent’s game and pitch quality. At the beginning of the pre-season period, players’ functional state and current fitness capacity should be detected by means of diagnostics. Consequently, the results should be implemented into the training process in order to plan the physical load of each player.

For optimization or improvement of special physical preparedness for the match, it is inevitable to create specific test batteries by means of which we can monitor the course and feedback on the load during training sessions and matches, as well (Rampinini, Coutts, Castagna, Sassi, & Impellizzeri, 2007). One of the most important field intermittent tests described over the last decade is Yo-Yo IRT1. Yo-Yo IRT1 was created for assessment of the ability to repeatedly perform actions in high intensity at short distance (Bangsbo, Jaia, & Krustup, 2008), which is a typical feature of a soccer match (Young, Newton, Doyle, Chapman, Cormack & et al., 2005).

Another important test for examining physical fitness include acceleration and maximum speed tests since the authors (Faude, Koch, & Meyer, 2012) found that linear sprint is the most frequent action leading to scoring a goal in professional soccer. Most of these sprints are performed without a ball and therefore the linear sprint should be a part of fitness training and testing. The aim of our study was to evaluate and compare the current state of physical fitness (aerobic and anaerobic demands) in two elite Czech U18 and U19 soccer teams of before the pre-season period.

**Methods**

**Subjects**

The research group consisted of U18 and U19 soccer players who play in the highest competitions in their age categories. Both teams belong to the same club in which the same conception of trainings is set. Throughout the weekly micro-cycle, players undergo five training sessions and one competitive match. The U18 category group was formed from 17 players (age: 17.6 ± 0.3 years, body weight: 71.1 ± 5.7 kg, body height: 178.2 ± 6.9 cm and body fat: 10.3 ± 1.4 %) and the U19 group consisted of 14 players (age: 18.3 ± 0.2 years, body weight: 74.9 ± 6.5 kg, body height: 181.5 ± 6.3 cm and body fat: 10.6 ± 1.6 %).

For more accurate data processing, we did not include goalkeepers in this study because their physical performance significantly differs from the other players and simultaneously these components do not primarily determine their performance. All players were instructed in a test protocol before the measurement.

**Methods of data collecting and processing**

Field testing was carried out before the summer pre-season period and after 4 weeks’ transition period without regulated individual programme. Measurements were performed on artificial surfaces of the second generation. The temperature during testing was 23°C and humidity 60 %. Prior to measurements, 15 minutes warm-up guided by an assistant coach was performed, which consisted of jogging (4 min), stretching (4 min), passing the ball (4 min) and 6 sprints at 10 m (3 min). During the whole training session, players’ HR was recorded by Polar RS400 heart rate monitors (Polar, Kempele, Finland). To perform speed tests, photocells (BROWER Timing System, USA), which recorded time with an accuracy of 0.01 second, were used.

**Acceleration test**

Acceleration was assessed by a 10 m test (A10) (Little & Williams, 2005; Wilson, Newton, Murphy, & Humphries, 1993), when at 5 m (A5) a lap time was recorded. The players started from a stationary position 0.1 m behind the photocells. They completed 2 trails, the better of which was assessed. The ratio of rest and load interval was 16:1. The 10 m test’s reliability detected in senior players by average intra-class correlation coefficient was ICC = 0.81 (Mirkov, Nedeljkovic, Kukolj, Ugarkovic, & Jarić, 2008) and in young professional players aged 17-19 years average ICC = 0.91 (Jullien, Bisch, Largouet, Manouvrier, Carling & et al., 2008).

**Maximum speed test**

Maximum speed was assessed using a 20 m flying sprint test (M20) which evaluates the ability to sprint at a short distance (Little & Williams, 2005). The player completes 20 m at maximum speed after a 10 m run-up. The players completed 2 trails, the better of which was assessed. The ratio of rest and load interval was 16:1. The maximum speed test’s reliability in senior players was ICC = 0.93 (Mirkov et al., 2008).

**Aerobic capacity test**

For monitoring and evaluation of aerobic parameters, Yo-Yo IRT1 was used according to Bangsbo (1994), Krustup, Mohr, Amstrup, Rasgaard, Johansen & et al. (2003) a Bangsbo et al. (2008). The test includes basic actions frequently occurring in a match (reaction, acceleration, deceleration and turning) (Teplan, Malý, Zahálka, Hráský, Kaplan & et al., 2012a). It puts high demands on aerobic metabolism and thanks to this test we can assess aerobic capacity parameters such as total covered distance, \( \text{VO}_2\text{max} \) (obtained from a prediction equation), \( \text{HR}_\text{max} \) and HR decrease for a period of 1 minute after the test. Yo-Yo IRT1 consists of repeated runs at 20 m according to an audio signal which is reproduced from a CD player. After completing 2x20 m, a 10 second active rest interval follows (walking, jogging) at 2 x 5 m. The test is terminated if a player does not manage to reach the 20 m distance (audio signal) in a row or is fatigued.
We recorded total distance run and for 1 minute after the test we monitored HR decrease. Thereafter the measurement was finished. We tested 8 players at once in one measurement. We tried to motivate players to maximum effort and competition between each other. During the test, each player has its own area which was 2 m wide and 25 m long (20 m for test run and 5 m for active rest) (Figure 1). The total test time did not exceed 20 minutes for one group. During the measurement, there were two examiners at both sides of the tested area in order to control the achieved distance (marked by a cone) at a given time. Yo-Yo IRT1 is, in terms of acceleration in individual runs, designed as follows: four runs (2x20m) at speed of 10 – 13 km.h⁻¹ (0 – 160 m), seven runs at 13.5 – 14 km.h⁻¹ (160 – 440 m) and afterwards the speed is increased after completion of eight runs by 0.5 km.h⁻¹ (i.e. after 760, 1080, 1400, 1720 m, etc.) up to exhaustion. The maximum distance which can be achieved is 3640 m (Castagna, Impellizzeri, Belardinelli, Abt, Coutts & et al., 2006). To assess VO₂max we used a prediction equation¹ according to Bangsbo et al. (2008):

\[ \text{VO}_2\text{max} (\text{ml.kg}^{-1}.\text{min}^{-1}) = \text{distance (m)} \times 0.0084 + 36.4 \]

Compliance of the variances of the compared groups was evaluated by Levene’s test. The significance of a difference between means of the compared group was assessed at the level of \( p \leq 0.05 \). The size of the observed effect between the monitored groups was assessed by Cohen’s “\( d \)” coefficient. This was calculated as a difference of means of the compared parameters and divided by the pooled standard deviation (1) (Thomas & Nelson, 1996). The coefficient was further classified as follows: \( d = 0.20 \) - small effect, \( d = 0.50 \) - moderate effect and \( d = 0.80 \) – large effect) (Cohen, 1992).

\[ d = \frac{x_1 - x_2}{s_F} \]
\[ s_p = \sqrt{\frac{s_1^2(n_1 - 1) + s_2^2(n_2 - 1)}{n_1 + n_2 - 2}} \]

(1)

Results are presented in tabular and graphical presentation. Statistics was processed using SPSS IBM ® ver. 20 software.

Results

Average values and standard deviations of the monitored parameters are listed in Table 1. In acceleration tests at 5 and 10 m, no significant difference was found between U18 and U19 groups. However, in 20m flying sprint, a significant difference in favour of the older category was detected \( (p=0.04) \). Players of the U18 category ran more on average in Yo-Yo IRT1 by 60 m (3.4 %) than those from the U19 group but this difference was not significant \( (p = 0.56) \). Younger players showed higher variability in the achieved performance when compared to the older category. Values of maximum heart rate were comparable. The difference in these values was, however, insignificant \( (p = 0.66) \). Heat rate recorded in the period of 1 minute after the test decreased in the U18 players by 29.7 beat.min⁻¹ and in the U19 category by 26 beat.min⁻¹. Similarly, this difference was not statistically significant \( (p = 0.78) \). Moreover, the level of maximum oxygen consumption in the observed groups was not statistically significant, either \( (p=0.56) \).
Teplan, J., et al.: Values of speed and aerobic capacity parameters as indicators...

Sport Science 6 (2013) 1: 87-94

Figure 4. Comparison of performance in Yo-Yo IRT1 test with other studies

Note: (1) n = 42, age = 18±4, level = amateur; (2) n = 23, age = 19±1, level = elite; (3) n = 16, age = U17, level = high trained; (4) n = 8, age = U18, level = high trained; (5) n = 14, age = 16.5 ± 0.3, level = national team; (6) n = 16, age = 16.4 ± 0.3, level = best league team; (7) n = 14, age = 16.6 ± 0.4, level = worst league team

Table 1. Results of speed parameters and Yo-Yo IRT1 between two teams from elite competition before the pre-season period

<table>
<thead>
<tr>
<th>Tests</th>
<th>U18</th>
<th>U19</th>
<th>t</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>Sprint 5 m (s)</td>
<td>1.05</td>
<td>0.06</td>
<td>1.05</td>
<td>0.03</td>
</tr>
<tr>
<td>Sprint 10 m (s)</td>
<td>1.81</td>
<td>0.09</td>
<td>1.80</td>
<td>0.05</td>
</tr>
<tr>
<td>20 m flying (s)</td>
<td>2.41</td>
<td>0.07</td>
<td>2.34</td>
<td>0.04</td>
</tr>
<tr>
<td>Yo-Yo (m)</td>
<td>1760.00</td>
<td>314.64</td>
<td>1700.00</td>
<td>227.77</td>
</tr>
<tr>
<td>HRmax (beat.min⁻¹)</td>
<td>193.53</td>
<td>10.68</td>
<td>192.07</td>
<td>6.58</td>
</tr>
<tr>
<td>Recovery 1 min (%)</td>
<td>14.23</td>
<td>7.93</td>
<td>13.50</td>
<td>6.31</td>
</tr>
<tr>
<td>VO2 max (ml.kg.min⁻¹)</td>
<td>51.18</td>
<td>2.64</td>
<td>50.68</td>
<td>1.91</td>
</tr>
</tbody>
</table>

Note: ** - p<0.01

Discussion

The pre-season period in soccer is usually much shorter (several weeks) in comparison to a long competitive season (several months) and often includes a higher number of training sessions (Tessitore, Meeusen, Cortis, & Capranica, 2007). However, climatic conditions of each country have to be considered as they influence the annual training plan (programme). Soccer competitions are not identical in different countries in terms of a number of pre-season periods (1 or 2), number of matches, character of the competition (spring-autumn, autumn-spring), etc. In the Czech Republic, players undergone two pre-season and transition periods during the season which remarkably influences their functional state in terms of activities performed at high intensity. At the beginning of the pre-season period, coaches usually prepare training sessions focused on development of aerobic capacity and various forms of field and laboratory tests in order to detect players’ fitness capacity. (Brink, Nederhof, Visscher, Schmikli, & Lemmink, 2010) mention that regular testing of players provides information on their individual changes in game performance in the course of time and prevent decline in aerobic capacity (90 % of performance). The purpose of testing at the beginning of the pre-season period is not only to observe the current fitness capacity and performance but it also has a health prevention character (e.g. muscle imbalances, muscle asymmetries, etc.).

In a soccer match, the most crucial skills are those related to power production capacity of neuromuscular system (e.g. sprint, fast duels against opponents) (Requena, Badillo, Villareal, Ereline, García & et al., 2009). The players have to be able to produce maximum speed (acceleration) in the range from 1.5 to 105 m during the game (Bangsbo, 1994). Elite players are able to perform approximately 30 – 40 sprints at different distances during the match (Mohr, Krustrup, & Bangsbo, 2003). 75.8 % of sprints in the match are shorter than 9 m (Vigne, Gaudino, Rogowski, Alloatti, & Hautier, 2010) and 96 % of sprints are under 30 m (Valquer, Barros, & Sant´anna, 1998). Svensson & Drust, 2004 suggest that physical predispositions for maximum speed runs and ability to quickly accelerate can play a decisive role in the final result of the match.
However, players only rarely achieve maximum speed during the match and therefore start and acceleration phases are important factors for the players’ performance (Jovanovic, Sporiš, Omrcen, & Fiorentini, 2011). The results of the 5 m and 10 m acceleration tests before the pre-season period in U18 and U19 categories did not reveal any significant difference. This fact can be caused by neuromuscular system inhibition in both categories which occurred in the transition period (significant reduction of physical activity). Speed abilities are determined by genetic predispositions and this could be also reflected in our measurement. To verify this theory, it would be appropriate to carry out testing after pre-season period or during the main season. A significant difference between the two categories was found in the maximum speed test at 20 m. Maximum speed is determined by running stride frequency and length which interact (Čoh & Babič, 2010). The running stride length is, to a certain extent, determined by anthropometric parameters (Čoh, Tomažin & Rausavlievič, 2007). Maximum speed at 20 m was the only parameter observed before the pre-season period in which there was a significant difference between both categories. However, this difference could be caused by higher average body height of the players (U19>U18). Yo-Yo IRT1 is one of the most important tests for team sports of intermittent character of load because there is a high correlation between Yo-Yo IRT1 and the number of activities performed at high intensity (r = 0.73, p = 0.003) (Bangsbo et al., 2008). Castagna, Impellizzeri, Cecchini, Rampinini, & Barbero-Álvarez (2009) revealed high correlation in young soccer players (r = 0.77, p < 0.001) and Krstrup et al. (2003) in adult soccer players (r = 0.71, p < 0.05). No significant relationship was observed between total run distance and Yo-Yo IRT1 (r = 0.42, p = 0.14) (Castagna, Impellizzeri, Cecchini, Rampinini, & Barbero-Álvarez, 2009; Krstrup et al., 2003). Most of these studies focused on Yo-Yo IRT1 implementation during the main season. Teplan, Malý, Zaháčka, Hráský, Malá & et al. (2012c) found that performance achieved in Yo-Yo IRT1 can divide more and less successful teams (according to their position in table). The most important and the most informative parameter in Yo-Yo IRT1 evaluation is total run distance. The average performance of a team which participates in international competitions is 2420 m. Teams which attempt to achieve the highest possible place in the table achieve 2190 m on average and average players in national competitions run approximately 2030 m. The shortest distance is achieved by semi-professional teams whose distance covered is around 1810 m (Castagna et al., 2006; Krstrup et al., 2003; Mohr et al., 2003). U18 and U19 players in comparison to adult players at both international and national levels are significantly behind before the pre-season period (U18: 27.3 % or 19.6 %, respectively; U 19: 29.8 % or 22.4 % respectively). Figure 4 shows the results of our study compared to the results of other studies dealing with similar age categories. Total run distance ≥ 2320 m is a good indicator and predisposition for performance in repeated sprints (Chauouachi, Manzi, Wong, Chaalali, Laurencelle & et al., 2010). Young players in U18 and U19 categories participate in the training process with adult players and therefore it is essential to prepare them in high quality of physical fitness capacity. When young players progress to adult category, it is necessary that players are able to cope with the demands of matches and training sessions (Reilly, Bangsbo, & Franks, 2000). When developing physical fitness abilities, pressure has to be exerted on fitness coaches so that technical and tactical skills are developed simultaneously (Teplan et al., 2012a). Values of VO2max calculated from a prediction equation are lower than values obtained from multistage running tests on a treadmill up to maximum effort in laboratory conditions (Bangsbo et al., 2008; Krstrup et al., 2003). Values of VO2max can be influenced by different levels of matches (the higher competitions in comparison with lower level competitions), training regimes and season within the annual training cycle. Players with high aerobic capacity are able to play at high intensity during the match (Reilly, Bangsbo, & Franks, 2000). Yo-Yo IRT1 evaluates not only aerobic load but also recovery processes after each completed section (2×20 m). Therefore, more accurate assessment of VO2max is by multistage running test up to maximum effort in laboratory conditions (Bangsbo et al., 2008; Castagna et al., 2006). The main reason and principle of the test usage is the ability to repeat intensive activities (Krstrup & Bangsbo, 2001; Krstrup et al., 2003). Moreover, Yo-Yo IRT1 provides more sensitive measurement of changes in player’s performance caused by intermittent load than VO2max (Young, Newton, Doyle, Chapman, Cormack & et al., 2005). Players with higher values of VO2max have greater glycogen stores which are necessary for energy release in actions performed at high load intensity or in sprints (Bangsbo & Mizuno, 1988). It also influences speed of regeneration processes after matches or intensive training sessions (Bangsbo & Mizuno, 1988). Barbero-Álvarez, Barbero-Álvarez, & Granda (2007) stated that at the beginning of pre-season period, professional players (n=9) underwent Yo-Yo IRT and their mean VO2max was 55.3 ± 1.3 ml.kg⁻¹.min⁻¹. Similarly Krstrup et al. (2003) tested professional soccer players at the beginning of the pre-season period (n=10) and the measured mean value of VO2max was 51.3 ± 1.1 ml.kg⁻¹.min⁻¹. When we compare our results with the study by Krstrup et al. (2003), we can see similar values (U18: 51.2 ± 2.6 ml.kg⁻¹.min⁻¹ and U19: 50.7 ± 1.9 ml.kg⁻¹.min⁻¹). In indirect testing of VO2max on a treadmill or in field testing, the relationship between HR and intensity is linear up to sub-maximum speed (George, Fisher, & Vehrs, 2002); simultaneously, it provides HRmax intervals which can be useful for aerobic training (Motta & Angelino, 2009). HR gradually increases during the test and reflects gradual increase of oxygen consumption (Krstrup et al., 2003).
HR depends on maximum capacity of each player with respect to his individual rhythm of adaptation and neuro-vegetative functions which increase or compensate the loss of fluids, electrolytes and acid-base balance occurring during training session or match (Mishchenko & Monogarov, 2000). Soccer match has a character of intermittent load in which high intensity periods alternate with low intensity periods (Teplan et al., 2012a) during which HR does not drop below 65% HRmax in elite players (Bangsbo, Gibala, Krstrup, González-Alonso, & Saltin, 2002). After completion of Yo-Yo IRT1 we can observe HRmax with standard deviation 99 ± 1% or similar to HRmax achieved on a treadmill, respectively (Krustrup et al., 2003). The number of high intensity actions decreases towards the end of the match (Bangsbo, 1994; Mohr et al., 2003).

Amount of actions performed at high intensity in soccer is one of the elements deciding a successful or unsuccessful result. Krustrup et al. (2003) add that elite players perform more high intensity actions than players at a lower level. Actions implemented at high intensity are interspersed with low intensity periods during which speed of recovery processes is important. During the match, high intensity activities are followed by short rest which is, however, not sufficient for full recovery (Barbero-Álvarez, Soto, & Granda, 2004; Dogramaci & Watsford, 2006). The recovery process is mainly determined by previous load (Bompa, 1999) and speed of recovery process is important for maintaining high physical fitness (Tessitore et al., 2008). Krstrup et al. (2003) also recorded recovery speed during 1 minute after test completion in professional players. They found out that HR decreased by 39 beat.min⁻¹ (21%). In comparison to our results we can state that professional players were better prepared in terms of recovery after physical load at the beginning of the pre-season period.

**Conclusion**

Based on results of our study we can conclude that in U18 and U19 players there were no significant changes in parameters of acceleration speed (5 and 10 m), aerobic capacity which was manifested by total run distance, HRmax, VO₂max and recovery over a period of 1 minute after test completion. Insignificant differences could have been caused by reduced physical activity during the transition period (4 weeks off) after the last match. The only parameter which revealed a significant difference was maximum speed at 20 m flying sprint. All monitored parameters are only a predisposition for successful game performance of a player in the match. The importance of diagnostics is clearly confirmed. It should not been used randomly; on the contrary, it has to provide clear results implemented in modification of training process. Regular planning and insertion of tests throughout the year is an important component of monitoring and affecting player's sport performance. For further optimization of the results, it would be appropriate to continue with the research directed to measuring both teams throughout the whole year (preferably at the beginning of the pre-season period, before the main season, in the middle of the main season and at the end of the season) in order to determine changes in physical fitness of both teams during the year.

**References**


---

**VRIJEDNOSTI PARAMETARA BRZINE I AEROBNOG KAPACITETA KAO POKAZATELJI TJELESNE KONDICIJE U18 I U19 NOGOMETNIH MOMČADI NA POČETKU RAZDOBLJA PRESEZONE**

**Sažetak**

Cilj ovog istraživanja bio je ispitati i usporediti trenutnu situaciju u smislu povremenih treninga po dvije elitne češke momčadi U18 i U19 kategorijama na početku razdoblja presezone. U18 kategorija sastojala se od 17 igrača (dob: 17,6 ± 0,3 godina, tjelesna težina: 71,1 ± 5,7 kg, visina tijela : 178,2 ± 6,9 i tjelesna mast: 10,3 ± 1,4 %), a kategorija U19 sastojala se od 14 igrača (dob: 18,3 ± 0,2 godina, tjelesna težina: 74,9 ± 6,5 kg, visina tijela: 181,5 ± 6,3, a tjelesna mast: 10,6 ± 1,6 %). Parametri brzine su ocjenjeni na 5 i 10 m ubrzanja i maksimalnim testom brzine na 20 m (leteći start). Za praćenje i vrednovanje aerobnih parametara, primijenjen je Yo-Yo isprekidani test oporavka 1 (Yo-Yo IRT1). U testovima 5 i 10 m nema značajne razlike. Međutim, uočena je značajna razlika u maksimalnoj brzini na 20 m (p = 0,04). Razlika u maksimalnoj radenoj udaljenosti između ekipa nije bila značajna (T29 = 0,60, p = 0.56). Nadalje, nisu zabilježene značajne razlike ni maksimalnog broja otkucaja srca (p = 0.66), smanjenje broja otkucaja srca tijekom 1 minute nakon testa (p = 0.78) ni maksimalne potrošnje kisika (T29 = 0.59, p = 0.56). Neznatne razlike mogu biti uzrokovane dugotrajnom neaktivnošću igrača u prijelaznom razdoblju. Za potpuno objektivizaciju rezultata i ovih zaključaka, bilo bi uputno slijediti obje momčadi tijekom trajanja natjecateljskog razdoblja.

**Ključne riječi:** nogomet, terenska ispitivanja, mladi, aerobik parametri, Yo - Yo IRT1

Received: December 3, 2012
Accepted: June 10, 2013
Correspondence to:
Jaroslav Teplan, MSc
Charles University in Prague
Faculty of Physical Education and Sport
16252 Praha 6–Veleslavín, J. Martiho 31, Czech
Phone: +420 2201 72288
E-mail: teplan@ftvs.cuni.cz