PULSE RATE BEFORE AND AFTER YO-YO 2 TEST AT YOUNG FOOTBALLERS AND DECIDING CHANGES AT SOME BLOOD PARAMETERS

Mihri Barış KARAVELİOĞLU¹, Halit HARMANCI¹, Alparslan ÜNVEREN¹

1-Dumlupınar University, School of Physical Education and Sport, Kütahya-Turkey

*Corresponding Author, E-mail: mbaris.karavelioglu@dpu.edu.tr

ABSTRACT

Aim of the study is to research into Yo-Yo2 interlaced recovery test effect on young footballers’ heart rate values and some blood parameters (blood lactate, Ph, sodium (Na), potassium (K) and calcium (Ca)).

12 male footballers whose average of age is 17.58 ± 0.66 year, average of height is 174.5 ± 7.83 cm and average of body weight is 63.66 ± 7.59 kg and who combat at U-19 amateur league, participate into the research as voluntarily. After and before Yo-Yo 2 test, footballers’ blood, lactate, Ph, Na, K and Ca values are detected via finger stick. During the test, sportsmen’s pulse rate values are recorded by polar watch. Paired sample t test is used to define differences between participant sportsmen’s blood, lactate, Ph, Na, K and Ca values before and after the test.

Our results showed that while there was no statistically significant difference between the values of PCO2 and PO2 (p>0,05), a significant difference was evident as regards the blood lactate, pH, Na, Ca and K values (p<0,05).

Key words: Yo-yo 2 Intermittent Recovery Test, Heart Rate, Some Blood Parameters.

Introduction

It is known that the football player’s technical capacity does not only affect the performance, but it has also a significant impact on the physical capacity and game performance (Little and Williams, 2007). Physical fitness, technical and tactical performances are important variables for performance measurement in team sports such as football. As football game is a very complex game it is difficult to investigate these important variables (Rosch et al. 2000). Soccer is an anaerobic sport based on aerobic motions that involves sprints, submaximal running, walking, dribbling with the ball, sudden acceleration, jumping, sudden turns, dual struggling, commutated runs and sliding interventions (Diker et al. 2011). It is also a sport that contains short rest intervals and requires ability to perform repeated high intensity exercise (Bangsbo, 1994; Reilly, 1997; Chuman et al., 2011). In order to cope with the required physiological performance, players may have to be skilled in various fitness components.

The use of fitness tests in the field help to analyze amateur and elite level (professional) soccer players’ capabilities for their performance (Svensson and Drust 2005). A number of physical tests have been used to evaluate the training status of elite soccer players according to differences in age, playing position, and elite level (Krustrup and all, 2003). The assessment of physical capacities of athletes is one of the most important issues in modern sports. Coaches and sport scientists use field and laboratory tests for screening candidates in selection procedures, or to monitor the effect of training regimes (Norkowski, 2002). A reliable and valid test is required to evaluate and design an athlete’s training program (Chuman et al, 2011). Bangsbo (1996) developed yo-yo intermittent recovery test in order to analyze the athletes’ performance who are interested in team sports. Yo-Yo Intermittent Recovery test is used to evaluate a persons’ ability to sustain repeated intense exercise.
(Delahunt et al, 2013; Bangsbo et al, 2008). In Yo-Yo test, participants run 20 m shuttle, but between each shuttle a resting period is placed. Thus, Yo-Yo test is a test that includes 10 seconds active resting periods among 2X20 m shuttle running in increasing speeds. A person runs until he/she could not protect his/her speed and at this point the obtained distance is expressed as the test result (Bangsbo et al, 2008). One intermittent field test that may meet the requirements of simultaneous stimulation of the aerobic and anaerobic energy system is the Yo-Yo intermittent recovery level 2 test (Yo-Yo IR2 test). This test lasts 2–10 min and consists of 20-m shuttle runs at rapidly increasing speeds interspersed with 10-s periods of active recovery. The Yo-Yo IR2 test has been used for testing in a number of sports such as basketball and Australian football, but the test has not yet been investigated in terms of physiological response and reproducibility. Likewise, the test still needs to be examined to determine whether it is a sensitive tool to evaluate the intense intermittent exercise performance of soccer players in different seasonal periods at different competitive levels, and in different playing positions (Krustrup et al, 2008). Also it is well-known that exercise causes various physiological changes depending on training stimulus (training duration, intensity) (Rovira et al, 2008). In this study we aimed to analyze the effect of Yo-Yo IR2 test on young players’ heart rate values and some blood parameters.

Materials and Methods

Twelve male football players from a U-19 amateur league volunteered to participate in this study. Mean age of the football players was 17.58 ± 0.66 years and mean weight and height of them was 63.66 ± 7.59 kg and 174.5 ± 7.83 cm, respectively. Before the study, the subjects were informed about the measurement and a consent form that includes possible risks and discomforts was signed by each participants.

Endurance Test

Yo-Yo Intermittent Recovery 2 test was applied in determining the participated players’ endurance capacity. Yo-Yo intermittent recovery 2 test consisted of 2X20 meters shuttle runs performed at increasing speeds with 10 s of active recovery. This test was carried out in 20-meter lines. Athletes’ 10 second resting area is determined by a 5 meter line which is drawn behind the starting line. Before starting the test the athletes were informed about the test and all of the tests were carried out on the synthetic grass field. Yo-Yo 2 test first has begun at 13km/h, after the first stage 2km/h, at the second stage 1km/h and at the other stages the speed was increased by 0.5 km/h and continued until the fatigue is reached. (Krstrup et al. 2003).

Measurement of Blood Parameters

Before and after the test the participant’s blood pH, calcium, potassium and sodium values were determined by a blood gas measuring device (Easy Stat Blood Gas Analyzer, Medica Corporation, ABD) using 100 μl blood samples taken from the fingertip into capillary tubes. The samples were assayed within 1-2 minutes. Before and after the test the athletes’ blood lactate levels were determined by Eco Twenty Care Diagnostic lactate analyzer. In order to perform the analysis, the fingertip was exposed with a lancet and the blood sample was taken into 20 μl capillary tube. For the analysis of blood samples in capillary tubes they were taken into 2.0 ml capped plastic sample container containing lysing agent. After the tight closing the container it was gently shaken by hand and the blood in capillary tube was provided to diffuse into the solution in the plastic container. The blood samples in plastic sample containers were placed in numbered spaces in the lactate analyzer tray. The analyzer was calibrated using 1.62 and 3.36 mmol.l-1 standard lactate concentrations in 2.0 ml tubes according to manufacturer’s instructions.

Statistical Analysis

The paired sample t-test was used to compare the values of mean blood lactate, pH, PCO2, PO2, sodium, potassium and calcium levels between pre and post Yo-Yo 2 test. Statistical analysis was performed by using SPSS 17.0 for Windows. \( P<0.05 \) was taken for statistical significance.

Results

The results of blood biochemistry parameters obtained pre and post Yo-Yo tests are summarized in Table 1, and shows that PCO2 and PO2 levels were not significantly different \( (p > 0.05) \). However, there was statistically significant differences as regard the blood lactate, pH, Na, Ca and Mg levels before and after the test \( (p < 0.05) \).
Table 1. Selected blood biochemistry parameters pre and post-Yo-Yo2 testing.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Pretest (mean±SD)</th>
<th>Posttest (mean±SD)</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lactate (mmol/l)</td>
<td>1,03±0,14</td>
<td>12,95±1,38</td>
<td>-29,29*</td>
</tr>
<tr>
<td>pH</td>
<td>7,43±0,32</td>
<td>7,23±0,41</td>
<td>11,98*</td>
</tr>
<tr>
<td>PCO₂</td>
<td>36,90±4,33</td>
<td>36,33±3,00</td>
<td>0,32</td>
</tr>
<tr>
<td>PO₂</td>
<td>64,80±7,94</td>
<td>68,79±3,51</td>
<td>-1,47</td>
</tr>
<tr>
<td>Na (mmol/l)</td>
<td>141,91±1,37</td>
<td>147,91±4,54</td>
<td>-4,45*</td>
</tr>
<tr>
<td>K (mmol/l)</td>
<td>5,83±0,97</td>
<td>7,47±1,82</td>
<td>-2,32*</td>
</tr>
<tr>
<td>Ca (mmol/l)</td>
<td>1,28±0,06</td>
<td>1,36±0,10</td>
<td>-2,68*</td>
</tr>
<tr>
<td>P&lt;0,05*</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The participants’ heart rates changes during Yo-YO 2 test are presented in Figure 1. The average distances traveled after exercise were determined as 1123, 33 ± 222, 68 m and average heart rates were recorded as 194, 33± 8,17 beats/min.

Figure 1. Heart rate changes of the participants during Yo-Yo 2 test.

Discussion

The physiological requirements of team sports such as football have been studied in a comprehensive manner on activity profile for many years (Ekblom, 1986; Bangsbo et al, 1991; Bradley et al, 2011). Football is an intermittent sport which is characterized by continuous movements with regular recovery intervals given after high intense exercises during the game. (Bangsbo et al., 2006; Krustrup et al., 2010; Bradley et al., 2011). Based on the results of heart beat, muscle tests and blood chemistry analysis, it has been stated that aerobic load is very heavy and that anaerobic energy transitions are also intense during the game(Bangsbo et al., 1994; Ekblom, 1986; Krustrup et al., 2003).

In order to assess the physical performance in football, numerous laboratory and field tests have been used. One of the widely used test is Yo-yo intermittent recovery 2 test which is a simple and a validated test that provides important information in observing the changes of performance and determining the capacity of implementing an individual’s repeated intense exercises (Bangsbo et al., 2008). Recent studies suggest that there is a high correlation between Yo-Yo intermittent recovery test and match performances (Krustrup et al., 2006; Bangsbo et al., 2008).

By using the Yo-Yo 2 intermittent recovery test, we found that the mean heart rate and blood lactate levels of the participating young players were 194,33 ± 8,17 beats/min and 10,62 mmol/l, respectively and running distance
on average was 1123 meters. Various reports have been made on football players’ performance and physiological changes during Yo-Yo 2 test. In their study with young soccer players, Karakoc et al (2013) reported that the average of running distance was 1028 meters and heart rate was 198 beats/min; Rampinini et al (2010) found that elite soccer players’ average running distance was 958 meters and heart rate was 189 beats/min; Mohr and Krustrup (2013) detected that the average of running distance in the season of semi-professional players was 1034 meters. Furthermore, Krustrup et al (2006) reported that elite soccer players’ average running distance was 1059 meters, heart rate was 191 beats/min and blood lactate average was 13.6 mmol/l. The differences between the reported performance and physiological values obtained with Yo-Yo 2 test may be explained by the age, training level, and implementation of the test in the training season and position of the player. We found that after Yo-Yo 2 intermittent recovery test the young players’ blood lactate, pH, Na, Ca and K values were significantly higher than the values before the test.

The release of potassium ions from muscles during exercise leads to increased electrical activity in muscles (Fenn, 1938; Medbo ve Sejersted, 1990). As the intensity of the exercise increases the potassium loss in skeletal muscle will eventually result in its accumulation in extracellular milieu (Medbo ve Sejersted, 1990). Medbo and Sejersted (1990) stated that the extracellular potassium ion may increase with the duration and severity of exercise and concentration, and also it can reach the peak values during exhaustive exercises. Hirche et al (1980) showed that following excitation the potassium loss occur in isolated muscles and this loss is more pronounced with the extended exercise duration. On the other hand, it has been shown that there is a substantially proportional relationship between the cellular potassium loss and sodium consumption in exercising muscles (Juel, 1986). In a study analyzing the biochemical parameters of race horses after maximal and submaximal exercises, Judson et al. (1983) reported that plasma sodium and potassium concentrations increased in parallel with maximal exercise whereas there were no changes in sodium concentration at the end of submaximal exercises.

An increase in blood Ca values with exercises were shown in various studies (Judson et al., 1983; Grimston, 1993). Bones are the main store of calcium (Judson et al., 1983). Grimston et al. (1993) stated that exercise will stimulate the blood parathyroid hormone and result in the increased releasing of calcium from the bones into the bloodstream. Medium and high intensity exercises lead to ionic changes by causing acidosis in the contracted muscles (Putman et al., 2003; McCartney et al., 1983; Kowalchuk et al., 1984; Lindinger et al. 1995).

As it is known, in normoxic conditions, transition from resting state to exercise, especially applied workloads greater than anaerobic ventilation threshold (60-70 % of maximum oxygen consumption), rapid changes take place in tissue (muscle) and blood (H+ ions) (Cerretelli ve Samaja, 2003). Lactic acid production in muscles leads to a decrease in muscle and blood pH values due to degradation of the lactic acid into hydrogen ions and lactate (Abbiss and Laursen, 2005; Juel, 1998; Bogdanis et al., 1994). It has been shown that muscle and blood pH values decrease approximately down to 6.4 and 6.94, respectively (Messonnier et al., 2007; Hermansen and Osnes, 1972). In our study, statistically significant differences were found between blood lactate, pH, Na, Ca and K after the Yo-Yo 2 test among young football players.

Conclusion

As a result, it is seen observed significant changes in young football player's arguments of blood lactat, ph, Na, Ca, K as an indicator of intensity training and a conclusion of fatigue, after the yoyo-2 test.

References


8. Bradley, P.S., Mohr, M., Bendiksen, M., Randers, M.B., Flindt, M., Barnes, C., Hood, P., Gomez, A., Andersen, J.L., Dimascio, M., Bangsbo, J.,


