

SIGNIFICANCE OF CONTROLLING THE INTENSITY OF VARIOUS TYPES OF EFFORT IN FOOTBALL

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Abstract. The problem of evaluating and defining physical endurance of athletes has been the subject of a great body of research and scientific discussion. In team sports, especially football, the energy protection of working muscles in players requires the use of almost all metabolic pathways: aerobic, anaerobic and aerobic-anaerobic. Because of the varying pace of action, the share of energy conversions in muscle cells changes rapidly during a match. Another concern voiced by scientists and football coaches is the question of whether fitness training should always be performed with football balls. The aim of this paper was to present the necessity of monitoring the development of aerobic fitness in football players, and also to answer the question of whether motoric training in football may be performed with balls.

Key words: football, effort, intensity, aerobic/anaerobic training

Introduction

The problem of evaluating and defining physical endurance of athletes has been the subject of a great body of research and scientific discussion. Physical endurance is usually defined as a degree of the ability of an organism to repetitively perform a particular type of physical activity, expressed at the maximum load levels and efficient regeneration (Kubica 1995).

Aerobic training in football implies that the training program is designed to improve the oxygen transport system. It is an imperative during soccer match plays and training sessions that there is a good supply of oxygen to the active muscles, and that these tissues have the capability to use the oxygen that is provided by the circulatory system.

In team sports, especially football, the energy protection of working muscles in players requires the use of almost all metabolic pathways: aerobic, anaerobic and aerobic-anaerobic. Because of the varying pace of action, the share of energy conversions in muscle cells changes rapidly during a match. The share of mixed processes in

the work of muscles, including anaerobic glycolysis, is predominant during a match. In German first-division football players, blood lactate concentration was observed at 4–6 mmol/l, and in individual cases even 7–9 mmol/l. These biochemical changes in the blood indicate that anaerobic glycolytic processes were predominant in those players during the match.

Another concern voiced by scientists and football coaches is the question of whether fitness training should always be performed with football balls. According to Bangsbo (1994), this type of training has the advantage of activating muscle groups that are involved in specific sport activities on the pitch. Motivation is greater and all the technical and tactical aspects used during training may be implemented during a match. However, training with balls may provide an inadequate exercise intensity. Technical and tactical aspects of training may result in insufficient or even worse excessive effort.

Exercise training should engage major muscle groups in continuous activity for about 30 minutes a day, three days per week, for positive physiological benefits to be induced. The intensity of exercise should be in excess of 60% of the maximal heart rate (Reilly 2007).

Methods

The study was conducted on a group of first-division female footballers from the Olimpia Szczecin Club. Three different methods of training were used with different approaches to developing aerobic capacity. Each method was carried out in two different ways: conscious exercise control (with the display of heart rate), and the presentation without heart rate monitoring. The aim of the study was to present the necessity of monitoring the development of aerobic fitness in football players, and also to answer the question of whether motoric training in football may be performed with balls. The first stage of the study was based on interval runs with conscious monitoring of the heart rate and without the visual control of HR. The second stage of the study consisted of small games (4 × 4) where one team controlled the heart rate and the other pursued training according to verbal coaching. The last stage included running exercises with balls, where again two groups were established: one aware and one unaware of their HR.

Heart rate was analyzed using the 305 model HR monitor manufactured by Garmin, using the Garmin Training Center program. The concentration of lactic acid in blood was determined using Lange apparatus. All the examinations were carried out on physiologically similar groups, in identical temperatures.

Results

Studies on the first division female football players allowed for a comparative analysis of different types of training. The aim of the training was to develop aerobic efficiency below anaerobic threshold, calculated individually for each player. It was achieved in all cases when heart rate monitoring was used and players could constantly control their activity. This, however, was more difficult to achieve during the game, as the concentration on the play sometimes rendered it impossible to maintain adequate HR.

In interval training, repeated work bouts up to 5 min in duration are interspersed with recovery periods of somewhat similar lengths. High muscle lactate levels may be induced by the exercise bouts, and lactate levels in blood may rise progressively with each repeated effort. There is some evidence that the recovery from the intense efforts is improved as a result of aerobic training.

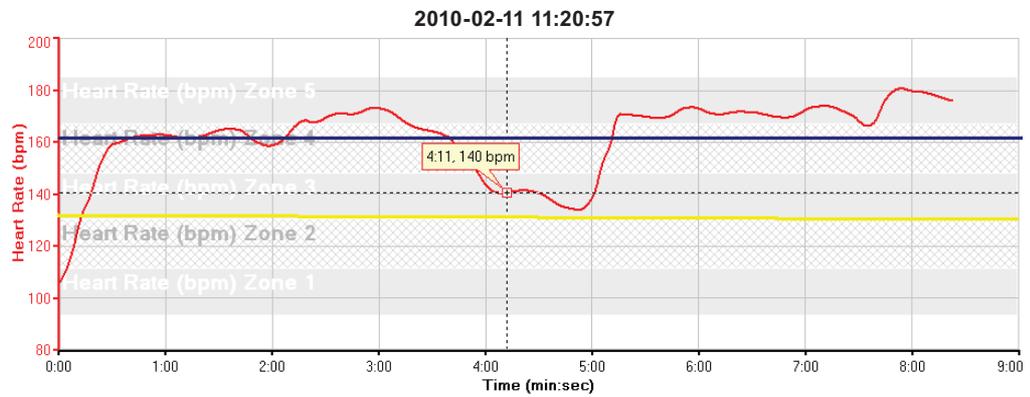


Figure 1. Running training without heart rate control

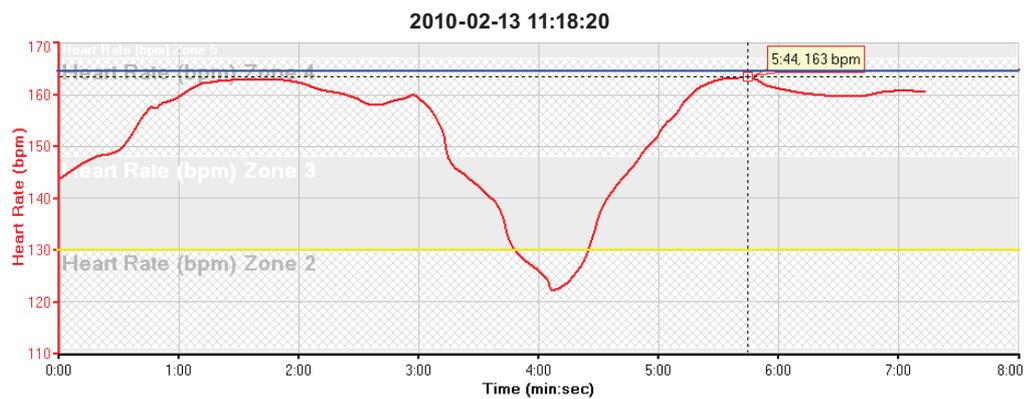


Figure 2. Running training with HR control

Soccer players are more attracted to drills performed with the ball than to formal fitness work, such as repetitive runs. In one study of the energy cost, dribbling a ball showed that heart rate and blood lactate were elevated by the task of dribbling, compared to normal running. Small sided games may be used to increase individual player's involvement in a game. It is possible to enhance participation of individual players by imposing conditions on play in smaller sided games by setting limits in the number of touches allowed, and directing play to certain areas of the fields.

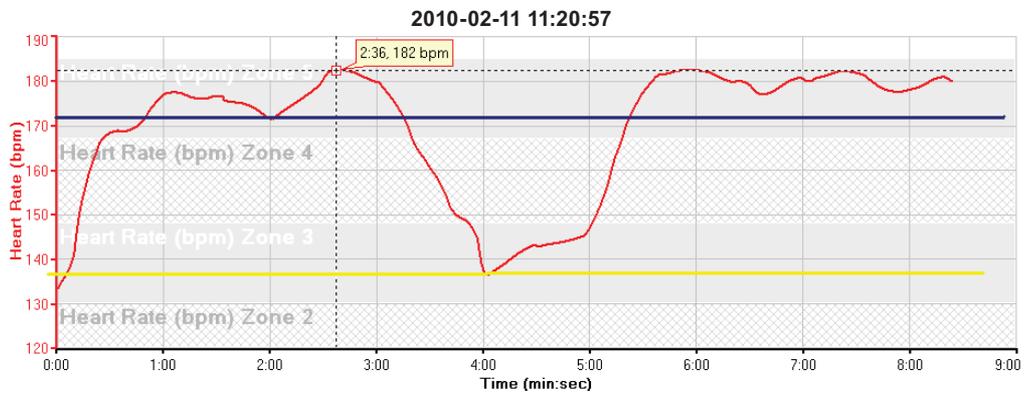


Figure 3. Small sided games without control of HR

All the cases of aerobic training without the HR monitoring included errors that could have affected the accuracy of the desired motoric trait. The greatest deviations from the planned norm could be noticed during the game, with the frequency of heart rate deviated from planned by more than 10 beats per minute.

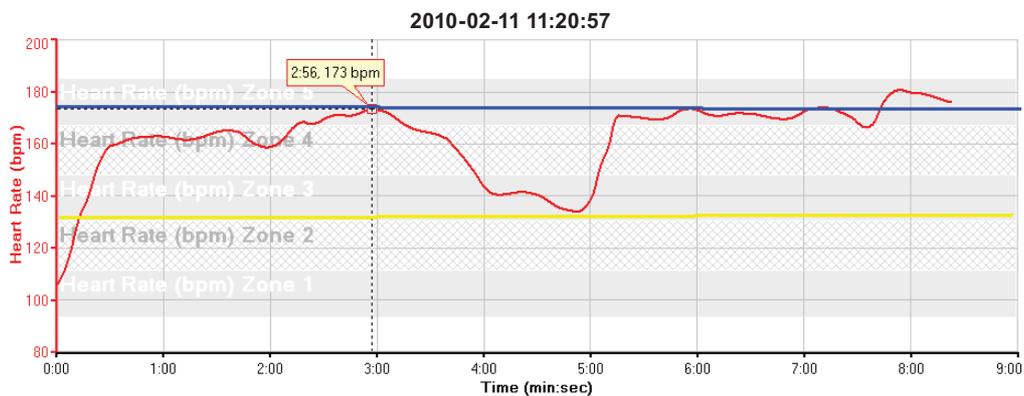


Figure 4. Small sided games with HR control

The examination of lactic acid concentration confirmed the characteristics of the heart rate. After the interval exercises with HR controlled by an athlete, the La concentration remained below 4 mmol/l. In training with uncontrolled HR, the lactic acid concentration reached 6.6 ± 2.5 mmol/l on average.

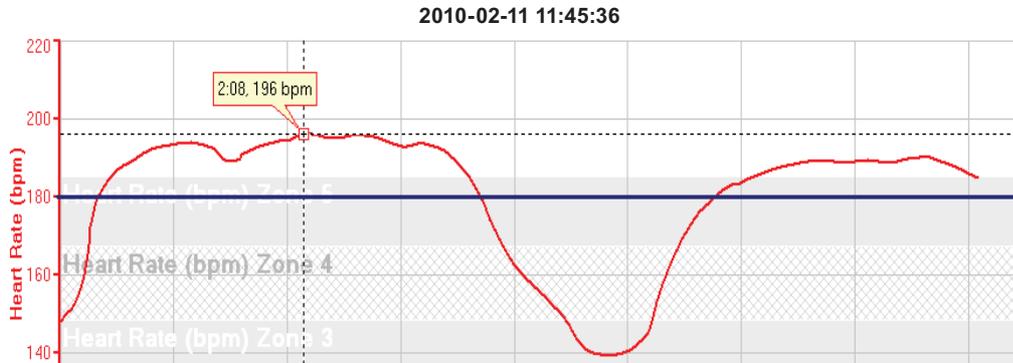


Figure 5. Running training with ball, without heart rate control

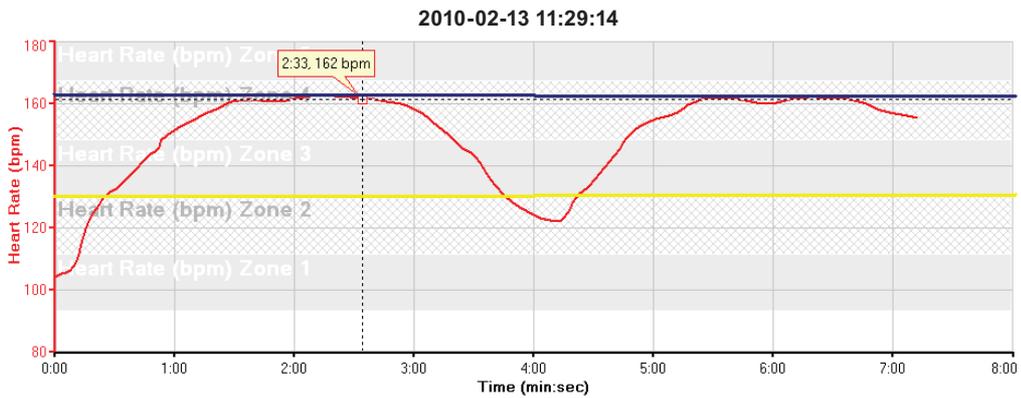


Figure 6. Running training with ball and with heart rate control

Discussion

Fitness training has to be multifactorial in order to cover the different aspects of physical performance in soccer. Aerobic and anaerobic training represent exercise intensities below and above the maximum oxygen uptake, respectively. However, during a training game, the exercise intensity for a player varies continuously, and some overlap exists between the three categories of training.

Soccer training embraces both preparation for match play and attaining the necessary physical conditioning to last a competitive season at an optimum level of fitness. The physiological strain in the various components of soccer training consist of a warm up, flexibility, running, and weight training, drills, games, and skills practice. It is evident from the heart rate and estimated energy expenditure values that the training increases in intensity as the session progresses. The hardest efforts are retained for match play, and this denotes that the major physiological

stimulus may come from playing the game. Running drills lack reliability when used as fitness tests to monitor progress in training, the likelihood being that players perform maximally in a game situation more readily (Reilly 2007).

The aerobic system is the main source of energy provision during soccer match play (Bangsbo 1994). This is indicated both by the measurements of physiological responses during games and by the metabolic characteristics of soccer players muscles. The amount of blood delivered to the active muscles during strenuous exercise depends on the cardiac output. The maximal heart rate is not increased as result of training and is not itself an indicator of fitness.

Small sided games are especially engaged in conditioned games during training sessions. The physiological load imposed by 4-a-side soccer incorporates anaerobic and aerobic components. The mean relative exercise intensity exceeds 82% VO_2max and mean blood lactate levels of 4 to 4.9 mmol/l. Time in possession of the ball is higher than in 11-a-side matches (Reilly 2007).

Conclusions

1. Football balls may be used in endurance training, but it should be done with HR monitoring.
2. Distinctly greater intensity of effort was achieved by players during a workout with balls. It also brings greater benefits to the specificities of the effort required in football.

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