Empirical Research on Special Anaerobic Capability Training Design for Football

Zhiqiang Yue

Shanghai Jianqiao University, Shanghai 201306, China

Abstract

In a sports environment, the anaerobic metabolism energy supply system of human muscle plays an important role in lifting movement, while the special anaerobic capacity for football does so in developing sports skills, which embodies the ability of muscles to do work under the conditions of phosphate and glycolysis supplying energy. For this purpose, specific operation procedures of special anaerobic training for football and corresponding load control methods are designed in the paper through corresponding theoretical analysis combining opinions of experts in relevant fields; training effects are further verified through simulation game experiment to interpret intensity differences of anaerobic training with and without dribbling the ball, providing the beneficial reference for coaches enriching training design ideas.

Keywords: Football, Anaerobic Capability, Training Design, Empirical Research.

1. RESEARCH BACKGROUND

1.1 Literature review

Physical fitness is an important support for tactical execution and technical action. Physical fitness training is an important task for people who love, pursue and have a certain basic skills of football. Generally speaking, the basic exercise capacity of football players is a comprehensive ability based on their good physical fitness and three parts - exercise quality, body structure and body ability, which are important part of exercise skills (Zhang et al., 2008). At the same time, these three parts are divided into other factors, main external expressions of which are relatively many, such as endurance, flexibility, agility and other exercise capacities. Lactic acid accumulated in the body can be removed by jogging and other light exercise. For example, the most popular speed running training - intermittent running, is multiple cycles of running and jogging (or rest). When it isn’t enough time to remove the lactic acid produced from running fast, you will too tired to run. The sprinter’s legs are relatively stout due to the fact that explosive force of muscles is mainly relied on in 100m or 200m sprints. This process is actually close to anaerobic exercise, and is an anaerobic endurance exercise (Shui et al., 2016). Sprinters use the fast muscle type A fiber for a long time, so their leg muscles are stronger than those of long distance runners. Football players on the field uses dribbling movement by starting speeding-up like sprints and kicking football which needs body bent at hips and stretching out of knees, for which their leg muscles are relatively stronger. This important parameter is usually expressed in 2 ways - absolute value of the maximum oxygen uptake capacity, i.e. utilization of oxygen in unit time (L/min) (Zhao, 2009), and efficiency value, i.e. utilization of oxygen per unit weight per unit time (ml/kg*min). Canoe players has the maximum absolute oxygen uptake ability due to the fact that the whole body is needed to participate in the high intensity exercise with oxygen uptake ability of a top man player up to 6.1L/min (Wang et al., 2016). But in the current football special anaerobic capability training, the relevant academic empirical research needs to be improved for achievement of good results eventually.

1.2 Purpose

The main research purpose of the paper is to explore designing ball training methods by combining negative control elements with different forms based on special characteristics of football and to further improves the training effect of special anaerobic capacity for football. In view of this, the present situation of the academic theories is analyzed in this paper, moreover; load control methods for anaerobic capability of football players and the specific operation processes are designed by combining many experiment methods. Besides, two kinds of experimental methods are used to verify effectiveness of the training for further analysis on intensity difference of anaerobic capability training with and without a player dribbling a ball; these experiments provide some
thoughts for football coaches with regard to training design, thus effectively improving training methods and means.

2. THEORETICAL BASIS FOR ANAEROBIC CAPABILITY TRAINING OF FOOTBALL PLAYERS

In recent years, although importance of special physical fitness and special anaerobic ability for football has been paid attention to by many scholars and coaches, more empirical researches are required to explore how to organize the training, how to identify the differences of physical training with and without balls with regard to training effects (Sun et al., 2014). Among them, anaerobic capacity is quite obvious, which is a performance capability of muscles under the condition that sugar and phosphate glycolysis supplies energy. In other words, it is a kind of oxygen metabolism energy supply system providing the ultimate capacity of ATP, increasing flexibility of human muscles in the exercise. It is expressed as sharp turn, sudden stop, slide tackle, repeated sprint and other specific activities with regard to its specific application in the football games. High strength movement of this kind of anaerobic capability plays a key role in the real exercise. In the actual training process, football players do not have the ability to sprint repeatedly under incomplete recovery. Therefore, in the actual design process, special training for anaerobic capability should be combined with the athletes’ physical conditions as well as their endurance level towards high-intensity exercise.

In the fast running, when oxygen breathed in is not enough for consumption of the body, anaerobic movement begins, while the lactic acid in the muscle begins to accumulate. Lactic acid is a substance that makes muscles fatigued and makes it difficult for the body to exercise. With the extension of the distance, “breathing difficulties” and “incapability in moving legs” will inevitably happen, which is mainly caused by accumulation of lactic acid. When the speed is increased to a certain extent, the energy from burning fat is not enough, so it is necessary to use a large amount of glycogen in the muscle to supply energy, at this moment, lactic acid is produced, i.e. when the load intensity of exercise is increased to a certain degree which is called LT (lactic acid threshold), lactic acid will accumulate. The maximum speed of lactate value maintained at the quiet time is called lactic acid threshold (LT); the speed at which lactic acid value is 4mmol/l is called OBLA (Lin et al., 2015). When the speed is slow, the lactic acid in the blood is maintained at about 1mmol/l (at quiet time). When speed reaches a certain degree, lactate value in the blood begin to rise (LT). Strenuous exercise can not be performed once lactic acid value is more than 4mmol/l (OBLA). LT is the starting point of the anaerobic energy supply, while OBLA is the upper limit point for aerobic energy supply. Comparison on changes of lactic acid in the blood before and after training for football players are shown in Figure 1.

![Figure 1. Comparison of Speed and Lactic Acid Value in Blood Before and After Training](image)

At this stage, with the rapid development of football, quality of games is further improved; players face more physical confrontation and tougher competition tasks, therefore; how to improve the level of physical training has become an inevitable problem considered by many coaches (Tao, 2011). Further analysis of the essence of physical fitness is required. Football competition forms and simulation forms lie in the development of players’ functional potential, with requirements for physical fitness of football players during technical confrontation further satisfied. Therefore, integration of technical and tactical training and improvement of players’ special physical ability development in the high intensity competition of football players have a great stimulating effect.
3. EMPIRICAL ANALYSIS

3.1 Research object and method

In order to explore the training results of Chinese football, a total of 90 football players are selected from national, provincial and municipal football teams in this paper, including 25 international top-notch football players, 45 top-notch players, 20 first-class athletes. Besides, 45 football coaches are selected, including 10 national-level coaches, 15 senior coaches, 15 mid-level coaches, 5 junior coaches. The training effects of respondents are registered and recorded in the corresponding forms.

Interview with football coaches should be carried out. 45 football coaches should be organized for effective communication on football training for some major events. For example, performance of coaches at world class sports competitions should be learned, especially for coaches having participated in the Beijing Olympics Games and London Olympic Games, deep interviews should be carried out. Only in this way can the next investigation activities be carried out. Secondly, effective communication with football players should be carried out. Interview personnel need to master relevant information and communicate with players at different stages according to different levels of football players to find out the key points. Especially for players who participated in the international large-scale events, key elements for on-the-spot performance should be found out, while interview about training modes should be paid special attention to for players at other levels. Finally, the questionnaire should be prepared. In this step, the questionnaire design is divided into two parts, that is, the questionnaire contents should be supplemented by using interview contents as information targeted at football coaches and players.

3.2 Training design of anaerobic capability

Training on anaerobic capability for football players is divided into two parts - speed which can be subdivided into lactic acid production and lactic acid maintenance, and endurance. Special anaerobic capability training enables players to reduce the reaction time in the game and to increase power output capacity in their movements, playing an important role in sprint, steal, shooting and other high intensity activities in games. In fact, anaerobic capability is the basis for movement of players in a long period of time, and the corresponding design should be carried out for body recovery after movement, so as to protect players accordingly.

3.2.1 Special routine exercises

Number: 12 people (excluding 2 goalkeepers).

Site: 30m*40m; or 50m*60m.

Organization method: several teams of players are divided for counteracting exercise which begins at two sides of the site at the same time, i.e. each team member needs to catch the ball, sprint immediately and finish shooting process; passing players need to stand beside the sign, face the direction of the restricted zone and pass the ball to the central circle. Two players should repeat this process for several times until training data of team members are obtained.

Duration of this event: 2s-10s, 5 teams;

Interval time and ratio: 50s-100s; interval ratio: 1:10.

3.2.2 Small football pitch competition with four goals

Number: 16 people (excluding 2 goalkeepers).

Site: 40m*30m*5m.

Organization method: 6 players are divided into two teams for 3:3 competition according to the rules of regular competition. Each team member should actively run and pass the ball with several sprints and corresponding defensive work. After a player loses the ball, his/her team members should actively counterattack to get the ball.
back and sprint. Personnel should be arranged on both sides of the pitch for assistant, and a ball should be thrown into the stadium immediately after the ball is out of bounds.

Duration: 6 teams, 80s.

Interval time and ratio: 80s-60s, with a ratio of 1:1.

3.3 Experimental test method

In this paper, lactic acid value test on football players are mainly carried out with the following two methods. The first method is to use the heart rate monitoring system made in Finland, which is widely used in sports training. Data are obtained from monitoring of a heart rate tester to reflect the actual situation of physiological load for football players (Qiu et al., 2009). In this research, full real-time monitoring is carried out on design contents for one training on 12 subjects to record changes of heart rate in real time. Effective statistics of heart rates are recorded during the tests with testing process video recorded; finally, change of heart rate is analyzed. The second method is to use portable blood lactic acid tester made in Japan, which can measure lactic acid concentration in human blood in a better way. It can provide reference parameters for the scientific training of football, so as to provide reference for improving performance of football matches. In addition, the information obtained in the system is sequentially imported into Excel 2007 and SPSS 19.0 statistical software, collated, analyzed and tested with paired sample t. According to the theory, the difference between significance and non-significance lies in that 0.05 and 0.01 are regarded as standards of P value.

3.4 Experiment results

Routine exercise on load intensity and changes of lactic acid for players should be conducted by each team. Repetitive high intensity sprint ability is required for players in a football game, in addition, sprints with distance longer than 30m also occupy a certain proportion in the game, therefore; sprints also have an important impact on the outcome of the game (Wu et al., 2013), based on which, the following two exercise forms are included by combining with design thoughts of special routine exercise. Under the condition that other factors are the same, to observe heart rate changes and recovery of players, exercise time for each group is adjusted to verify the exercise forms suitable for absolute speed exercise of football players.

Data obtained during exercise is shown in Table 1, in which 60%- 69%, 50% -59% and 70% -79% loads are obvious downward trend, wave change trend and steady upward trend separately by stages (Shi et al., 2011). In addition, with regard to blood lactic acid indicators, blood lactic acid value change is small when players are quite. There is unapparent blood lactic acid level during quiet time. Shooting under high-speed running proposes higher requirement on mastery of technical movement and running time, which conforms to actual situation of the game. It shows that the experiment can meet the requirement of anaerobic speed exercise.

<table>
<thead>
<tr>
<th>Load intensity</th>
<th>Experiment 1</th>
<th>Experiment 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>50%-59% intensity percentage</td>
<td>9.32±1.25*</td>
<td>6.31±0.22</td>
</tr>
<tr>
<td>60%-69% intensity percentage</td>
<td>35.24±5.21</td>
<td>28.12±4.21△</td>
</tr>
<tr>
<td>70%-79% intensity percentage</td>
<td>60.21±4.21**</td>
<td>33.21±3.24△△</td>
</tr>
<tr>
<td>Heart ratio (AVE)</td>
<td>134.2±3.24*</td>
<td>35.47±3.74△</td>
</tr>
<tr>
<td>Heart rate (MAX)</td>
<td>165.2±6.21*</td>
<td>62.5±5.12</td>
</tr>
</tbody>
</table>

Note: * represents P<0.05; ** represents P<0.01; △represents P<0.05; △△ represents P<0.01.

4. CONCLUSION

At present, special anaerobic capability training for football has clear scene application on all stages of society. In design process of training, with the real situation of games combined, practice of football players is designed according to training method in this paper; with load monitoring used, training forms, duration, interval time and other control factors are adjusted for scientific control on training process to improve special physical abilities of players. In design of special routine training, the heart rate changes and exercise intensity of football players are...
characteristic of asynchrony. The experiment shows that effects of speed and endurance exercise of lactic acid generation type can also be achieved by training for longer duration. In training of competitions with four goals, interval ratio and interval time exercises confirm to the requirement that the lactic acid generation type exercises with the maximum anaerobic speed & endurance is provided, while these exercises can reach the objective of lactate tolerance under anaerobic speed. Therefore, the ideas designed in this paper have verified the scientific nature of football anaerobic capability training, which can be references for practical teaching to a certain degree.

REFERENCES