

Physiological Basis and Key Points of Aerobic and Anaerobic Endurance Training in Football

Junkai Zhu^{1, a}

¹College of Arts and Sciences, Shanghai Maritime University, Shanghai 201306, China.

^aSmu_2018@163.com

Abstract

Football is a kind of antagonistic collective ball event based on aerobic energy supply and anoxic energy supply. Among them, aerobic endurance is closely related to the maximum oxygen uptake. The primary goal of aerobic endurance training is to maintain the training intensity between aerobic energy supply and anoxic energy supply for as long as possible. However, anoxic endurance is related to the ability of muscle anoxic hydrolysis, the ability to eliminate lactic acid during exercise, the ability of buffering lactic acid in blood and the tolerance of brain cells to blood lactic acid. Most of the aerobic endurance training adopts high intensity intermittent training and overload intermittent training. In addition, for high-level footballers, speed endurance training should be close to the ultimate intensity and practice time should exceed 20 seconds.

Keywords

Football, aerobic endurance training, physiological basis.

1. The Energy Supply Characteristics of Football

Football games have the characteristics of long time, high intensity and intermittent exercise, which determines that both aerobic metabolic energy supply system and anaerobic metabolic energy supply system need to be fully mobilized. The activities of football players in the competition are long and irregular, performing high, medium and low three kinds of intermittent exercise with ball and no ball sports intensity, and players need to have excellent aerobic endurance and ATP-CP system energy supply ability in the competition. 1) Anaerobic metabolism dominated by ATP-CP energy supply. In football games, players should have a lot of short-distance sprint, sudden stop, jump, collision and other explosive movements, players must have excellent rapid movement ability and good explosive force. The ATP-CP energy supply system is the energy supply basis for short time and large intensity movement. This form of energy supply does not produce lactic acid. In football, the form of movement corresponding to the ATP-CP energy supply system is short-distance fast sprint run. The average heart rate in the competition was about 170 b/min, and most of the time the heart rate was between 140 and 200 b/min. This also indicates the characteristics of alternate energy supply for aerobic and anaerobic metabolism in football. 2) Aerobic metabolism based on an aerobic energy supply system. The characteristics of long time and high intensity sprint in football match occupy the short time of the whole game, which determines that most of the time of football match mainly depends on aerobic metabolism to provide energy. To ensure the energy supply in 90 minutes of competition time, delay the emergence of fatigue, reduce the degree of fatigue, and ensure the recovery ability of the intermittent exercise in the competition process, we must improve the aerobic exercise ability. Therefore, football players complete the game, aerobic metabolic capacity is the basis.

2. The Physiological Basis and Key Points of Aerobic Endurance Training in Football

2.1. Physiologic Basis for Aerobic Endurance Training

Aerobic endurance is closely related to maximal oxygen uptake. The oxygen in the air enters the lungs by breathing, and in the lungs it diffuses into the blood and binds to the hemoglobin in the blood. Then, under the action of the heart, the blood transports oxygen to the capillary network of the tissue, which disperses oxygen from the capillary network to the tissue and is involved in metabolic activities within the tissue. In addition to age, sex and heredity, the main factors determining the maximum oxygen uptake are: (1) ventilation in the lungs. The greater the lung ventilation, the more oxygen you breathe in the lungs. The amount of oxygen inhaled in the body is not only related to the function of pulmonary ventilation, but also to the matching of the depth and frequency of respiration; (2) the dispersion of oxygen from the alveoli to the blood. The gas exchange between the alveoli and blood is achieved by diffusion. Whereas the factors affecting the diffusion ability are related to the circulating blood volume of the lung, the partial pressure of the gas and the area of the alveolar membrane; (3) the ability of the blood to bind oxygen. The content of hemoglobin in the blood is a major factor affecting the ability of blood to bind oxygen. There is no doubt that the higher the hemoglobin content, the greater the ability of blood to bind oxygen; (4) the ability of the heart to pump blood. In unit time, the more blood circulation, the more oxygen is transported, that is, the larger the cardiac output, the stronger the ability to transport oxygen, so the quality of heart function is an important factor affecting the maximum oxygen uptake; (5) the ability of oxygen to diffuse from blood to tissue. This ability is influenced by the size of the oxygen pressure difference between the blood and tissue fluid, the number of capillaries open in the tissue, and the thickness of the capillaries; (6) the metabolic ability of the tissue. The aerobic metabolic capacity of the tissue is a direct factor affecting the maximal oxygen uptake. Studies have shown that fast muscle fiber has lower ability to use oxygen than slow muscle fiber, so athletes with higher slow muscle fiber percentage have greater oxygen intake and better natural aerobic endurance.

The higher the maximum oxygen intake, the more oxygen is at your disposal. Joseph Keul believes that the improvement of aerobic capacity is that the training intensity is as long as possible between aerobic and anaerobic energy supply, which is the primary goal of the training. Training results show that three times a week, 30 to 40 minutes each run, swimming and cycling, can effectively improve the maximum oxygen intake level. Paying attention to the timely interval in training and keeping the heart rate in a certain range is effective to improve the aerobic endurance of athletes.

2.2. Main Points for Aerobic Endurance Training

To develop aerobic endurance, we must improve the maximum oxygen intake. The main factor affecting the maximum oxygen intake is the ability of oxygen supply, and the ability of oxygen supply mainly depends on the myocardial contractility. Therefore, the essence of aerobic endurance training is to improve the myocardial contractility of athletes. Its main method is to keep the pace of practice within the range of aerobic metabolic energy supply, the main method is two. One is the uninterrupted uniform load method. Using about 70% of my maximum strength to run continuously can increase myoglobin content and the storage capacity of muscle sugar element, improve the ability of energy supply and regulation of sugar and fat, and the other method is variable speed load method. First let the athlete do the exercises according to the standard of 70% to 85% of his intensity, heart rate 160 beats / min, then go to the jogging recovery period, and then do the next group of exercises when the heart rate drops to about 120 beats / min. At present, it is generally believed that aerobic capacity training is the best in the absence of or near anaerobic threshold intensity. This kind of training can stimulate the

increase and exclusion rate of lactic acid, and the athlete does not produce acidosis in the body, so the training can be maintained for a long time. Anaerobic threshold training is a kind of training mode to improve the capacity of aerobic metabolic system. The anaerobic threshold of each athlete should be determined first, and then 80%~85%~90% of the anaerobic threshold intensity should be used for continuous uniform running respectively. The research shows that the training intensity of aerobic endurance should reach 70% of the maximum load intensity and 75% of the maximum oxygen intake, so that the training can really meet the needs of the actual competition.

3. Physiological Basis and Key Points of Anaerobic Endurance Training in Football

3.1. Physiologic Basis for Anaerobic Endurance Training

Anaerobic endurance refers to the ability of the body to supply energy to the muscle for a long time under the condition of insufficient oxygen supply in exercise. The need for a short period of time in the football match repeated sprint run, in front of the continuous attack and defense are closely related to this. (1) The ability of the muscle to anaerobically ferment energy supply. Footballers require high levels of lactate dehydrogenase activity in the leg muscles when completing short-distance repeated rushing with and without ball action. The activity of lactate dehydrogenase in muscle is closely related to anaerobic endurance. The stronger the ability of anaerobic metabolism, the better its anaerobic endurance. (2) The ability to eliminate lactic acid in exercise. The muscle involved in the work is not only the site of lactic acid production, but also the main site of oxidized lactic acid, because the motor muscle is the main tissue that fully mobilizes the respiratory function of the cell. Studies have shown that lactic acid from motor muscle oxidation accounts for at least 65% of the total lactic acid elimination, indicating that most of the lactic acid generated by motor muscle during exercise is eliminated by direct oxidation during exercise. Therefore, the stronger the ability of anaerobic fermentation in muscle, the better the anaerobic endurance. (3) The ability to buffer lactic acid in the blood. Lactic acid is a strong acid substance that quickly enters the blood after it is formed within the muscle. There are a variety of buffers in the blood that neutralize the lactic acid that enters the blood. In which sodium bicarbonate is a major buffer, usually it has a variety of buffers in the blood that neutralize the lactic acid that enters the blood. where sodium bicarbonate is a major buffer, usually its content in the blood is called "alkali reserve". It goes without saying that the more alkali is stored in the blood, the stronger the ability to buffer lactic acid. (4) Tolerance of brain cells to changes in blood lactate. When the PH in the blood changes, the athlete's ability to work decreases. Athletes often undergo anaerobic training, and their brain cells are more resistant to lactic acid.

3.2. Key Points for Anaerobic Endurance Training

The statistical analysis of football live competition shows that the ratio of sprint time to jogging time is about 1:7 and walking time is about 1:14, so athletes need to have good non-lactic acid anaerobic ability. According to the study, the current decisive limiting factor for the fitness of footballers is not the player's cardiopulmonary function, but the player's muscle endurance level, especially the level of muscle anaerobic endurance. Therefore, it is of great significance to develop the muscle anaerobic endurance of football players. To develop non-lactic acid anaerobic endurance, the practice principle of high intensity small interval is more popular, and intermittent training is the main training method. A multi-group short distance (10-30-50 m) sprint is generally used to control the large intensity training of intermittent time to improve the rapid decomposition and synthesis ability of ATP and CP. In addition, with the improvement of full-time defense, the functions of athletes are more comprehensive. Athletes are often in a

continuous sprint, so the importance of anaerobic lactic acid endurance training is more prominent. Anaerobic lactic acid endurance training, some coaches also use overload intermittent training method, this training to maintain athletes blood lactate at a high level of 12 mg molecules, so that the body in the training to endure a longer period of lactic acid stimulation, so as to adapt to and improve the tolerance of lactic acid. The maximum intensity should be used for 1 to 2 minutes of continuous practice, and the interval should be 2 to 3 times of the practice time.

A study of the concentration of lactic acid in a good football player's game showed that the lactate supply system was greatly stimulated during a game. The game analysis also proves that the higher the level of football, the more fast running distance. Therefore, it is necessary to specifically train the ability of the lactate energy supply system and the ability to repeat high-intensity activities. The game analysis and training show that speed endurance training is beneficial to footballers. However, this training is only suitable for high-level athletes because of the high mental and physical requirements of speed endurance. When the training time is limited, it is more suitable for other content training. Speed endurance training can be divided into non-lactic acid anaerobic endurance training and lactate anaerobic endurance training. The purpose of non-lactic acid endurance training is to improve the ability to perform extreme exercise in a relatively short period of time, while the purpose of lactate endurance training is to improve the ability to perform continuous high-intensity exercise. The strength of the exercise should be close to the ultimate strength when performing speed endurance training, which means that the training should be carried out according to certain intermittent principles. During the training period, the practice time of 10 to 20 seconds is difficult to achieve satisfactory training effect, so the recommended practice time should be more than 20 seconds. In non-lactic acid endurance training, to ensure a high intensity throughout the training process, the duration of the exercise should be shorter (20 to 40 seconds) and the rest of the practice time should be relatively longer (2 to 4 minutes). In lactic acid anaerobic endurance training, the practice time should be 30~120 seconds, and the rest time should be as long as the practice time to make the athletes gradually achieve fatigue effect.

4. Conclusion

Football is a competitive sport in which aerobic and anaerobic metabolism alternates to provide energy. Among them, based on aerobic metabolic energy supply, ATP-CP energy-based anaerobic metabolic energy supply is the key. Aerobic endurance is closely related to the maximum oxygen uptake, and the development of aerobic endurance must increase the maximum oxygen uptake. The essence of aerobic endurance training is to improve the myocardial contraction ability of athletes. The main method is to keep the exercise speed within the range of aerobic metabolic energy supply. Anaerobic endurance depends on the ability of the muscle to provide anaerobic fermentation, the ability to eliminate lactic acid in exercise, the ability to buffer lactic acid in the blood, and the ability of brain cells to tolerate changes in blood lactic acid. The essence of anaerobic endurance training is to develop the level of muscle anaerobic ability of athletes, which adopts the practice of high intensity small interval, and intermittent training is the main training method.

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