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The Effect of Different Training Methods on Improving Cardiorespiratory Endurance

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Abstract. Marathon, walking, cycling and other sports have been popularized and developed around the world, and more and more people around the world have devoted themselves to these sports. Cardiorespiratory endurance is the core element to describe human health, and it is also the key to supporting people to complete these high-intensity aerobic exercises, which are very important for the human body. In the pursuit of better sports performance and performance in sports, people often use a number of ways to train. However, different exercise methods have different goals and effects, and one training method is not suitable for all people. Inappropriate training methods may cause sports injuries and backfire. At present, the three mainstream training methods in the world are high-altitude training, continuous training and interval training. Choosing the appropriate training methods for oneself can make the training more efficient and help achieve the training goals smoothly. This article adopts the literature review method for research. By analyzing and summarizing domestic and foreign literature, it is found that different training methods have different effects on improving human cardiopulmonary endurance. This provides a relevant reference basis for various groups of people to choose scientific training methods to improve cardiopulmonary endurance and enhance sports performance in the future.

Keywords: Cardiopulmonary endurance, altitude training method, continuous training method, interval training method

1. Introduction

Cardiorespiratory endurance refers to the ability of the respiratory system to inhale oxygen, the circulatory system to transport oxygen, and the skeletal muscles to utilize oxygen during sustained physical activity, reflecting an individual's cardiopulmonary function and aerobic endurance [1]. The training of cardiorespiratory endurance usually includes the following methods: altitude training, continuous training, and interval training. Different training methods have their own characteristics, and ultimately, their effects on improving cardiorespiratory endurance also vary to some extent. One method is not suitable for everyone; different people with different training purposes, should choose the right training program for their own situation. Inappropriate training methods may result in sports injuries that are counterproductive. In this paper, literature analysis was used to study the effect of different training methods on the improvement of cardiopulmonary endurance. The purpose is to select training methods scientifically for all kinds of people in the future, successfully complete

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the exercise goal, and improve the exercise efficiency. To provide relevant reference for selecting appropriate training methods.

2. Altitude training method

2.1. Concept and mechanism

Altitude training is a method used to develop aerobic endurance, anaerobic endurance and strength endurance by taking advantage of the natural environment of low oxygen content in the air of the plateau area [2]. Among them, the current mainstream includes the "high living, high training method", "low living, high training method" and so on [1]. Altitude training aims to induce a series of physiological adaptations in athletes through hypoxia stimulation, so as to improve their aerobic endurance, cardiopulmonary function and overall exercise performance. The physiological mechanism of altitude training is mainly based on the stimulation effect of the hypoxic environment on various systems of the human body. Hypoxia conditions stimulate the kidney to secrete erythropoietin (EPO), which acts on the bone marrow to produce more red blood cells and enhance oxygen transport capacity [3]. The heart and lungs need to work more efficiently to meet the body's demand for oxygen. Cardiac output increases and pulmonary ventilation increases, which increases the endurance of the cardiopulmonary system. At the same time, the hypoxic environment will stimulate the increase in the number of capillaries in muscle tissue, and enlarge the capillaries, so that the contact area for gas exchange increases, thereby improving the delivery efficiency of oxygen and nutrients [4]. The number and activity of mitochondria in muscle cells are also increased, improving aerobic metabolic capacity and energy production efficiency.

2.2. Changes in performance and physiological and biochemical indicators

Long-distance running, rowing, swimming and other sports athletes after a period of altitude training method in the test items and competition results have been significantly improved compared with before; the physiological and biochemical indicators were measured again, showing that the results have also changed. Some athletes showed an increase in VO2 max, while others did not. The reason for this phenomenon may be related to genetic factors [5]. The amount of hemoglobin in the body of cyclists increases, the level of mitochondria is improved, and the ability of the body to resist oxidation and lactate is also improved. When comparing adolescent cyclists trained at different altitudes, those who trained at high altitude had higher hemoglobin levels than those trained at low altitude [6]. Similar results were obtained in other experiments. Those who trained at an altitude of 2,000 m were classified as G1 group, those who lived at an altitude of 1850 m and trained at 2200 m were classified as G2 group, and those who trained only at 300 m were classified as G3 group. The amount of Hb in G2 group trained at 2200m and G1 group trained at 2000m was higher than that in G3 group trained at 300m, and the increase of Hb in G2 group was greater than that in G1 group [7]. After altitude training, the vertical jump height of elite judo athletes increased from 34.94±5.02cm in the pre-stage to 37.78±5.68cm in Post-0 stage. The vertical jump height of the last two Post-1 and Post-2 stages was lower than that of Post-0 stage, but higher than that of the pre-stage [8]. In the course of the experiment, some athletes withdrew from the experiment due to injuries or other irresistible factors during training. There were also cases in which various biochemical indicators of the body and performance decreased after a period of altitude training, such as the decrease of EPO content [9], the decrease of acceleration and peak velocity, and the decrease of vertical jump height of judo athletes were lower than those of previous training stages and ordinary training athletes.

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Therefore, the intensity and time of altitude training still need to be strictly monitored to find the most suitable training program for athletes, so as to prevent excessive training from causing athletes' state to decline and causing injuries.

3. Continuous training method

3.1. Concept and mechanism

Continuous training method refers to a training method with low load intensity, long load time, and continuous practice without interruption. It is mainly used to develop general endurance fitness, which can enable the body's motor functions to produce stable adaptations under the stimulation of prolonged loads, and cause adaptive changes in internal organs; and it can enhance the energy supply capacity of the aerobic metabolic system and the intensity of aerobic exercise under this energy supply state; it can lay a solid foundation for further improving the anaerobic metabolic capacity and the intensity of anaerobic work [10,11].

3.2. Changes in performance and physiological and biochemical indicators

The continuous training method has been applied among track and field athletes, and different types of continuous training have all demonstrated effective improvements in cardiovascular endurance. For 15KM, the average pace was 5min/km, and some trainees saw improvements in their performance; for 20KM, the average pace was 4min/km, and some trainees showed better endurance after continuous training; for 30KM, the average pace was 4.5min/km, and the endurance performance of trainees was relatively stable, with some trainees improving their performance after long-term training [12]. These data indicate that the continuous training method has a significant effect on improving long-distance running performance, especially in medium and long distances (such as 20KM and 30KM), where the endurance quality of the trainees has been notably enhanced. After long-term continuous training for adolescent football players, the average maximum oxygen uptake of the CT group increased from 51.06±4.60 to 53.54±4.28 [13]. A series of changes also occurred in physiological and biochemical indicators. After training, the levels of hemoglobin and hematocrit increased, while the white blood cell count fluctuated within the normal range. However, some athletes experienced a decrease in red blood cell count, which was lower than that of ordinary people or even the normal value, and were diagnosed with exercise-induced anemia. This phenomenon is very common among endurance athletes [14]. After rigorous training, the resting heart rate of the athletes has decreased. One of them has even dropped from 66 beats per minute to 44 beats per minute. The reason for this is the increase in stroke volume, which leads to an increase in cardiac output, allowing them to complete the required intensity of exercise with lower energy consumption. The average improvement rates in 5000 meters, 1000 meters, and half marathons are 10%, 11%, and 13%, respectively [12]. Continuous training effectively enhances the body's oxygen transport capacity and endurance level, while maintaining the normal function of the immune system. For endurance athletes or long-distance running enthusiasts, continuous training is an effective training method, but it is necessary to pay attention to the training intensity and recovery to avoid the negative effects of overtraining.

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4. Interval training

4.1. Concept and mechanism

Interval training refers to a training method that strictly regulates the interval time of multiple exercises, so that the body is in a state of incomplete recovery and repeated exercises. Through the strict interval training process, the heart function of athletes can be significantly enhanced. By adjusting the intensity of exercise load, the various functions of the body can produce adaptive changes that match the relevant sports. Through different types of interval training, the energy supply capacity of glycolysis metabolism or phosphate and glycolysis mixed metabolism or glycolysis and aerobic metabolism mixed energy or aerobic metabolism can be effectively developed and improved. By strictly controlling the interval time, it is beneficial for athletes to stabilize and consolidate their technical movements in the fierce confrontation and complex and difficult competition environment. Through the stimulation of a higher load heart rate, the body's anti-lactic acid ability can be improved to ensure that athletes have the ability to continue exercise under the condition of maintaining a higher intensity [10]. It can be divided into short-distance interval training, medium-distance interval training, and changing-distance interval training. Each of these can be subdivided [15].

4.2. Changes in performance and physiological and biochemical indicators

Interval training plays an important role in half marathon training, especially high-intensity interval training (such as 400 meters ×15 times, 800 meters ×12 times, 1000 meters ×10 times, etc.), which can significantly improve the speed endurance and maximum oxygen uptake level of athletes [16]. It also has a significant effect in middle- and long-distance running training, improving athletes' aerobic capacity, anti-lactic acid capacity and cardiopulmonary function. After high-intensity interval training, the football players' 12-minute running performance increased from the initial 2974.030±62.379 meters to 3059.440±39.343 meters, the sprint speed and bounce height also increased, and the overall physical fitness level improved [17]. In another study on young football players, sprint interval training improved their peak VO2, anaerobic threshold and knee joint strength, with peak VO2 increasing from 48.1±7.4 to 55.3±7.5 [18]. During the training process, the control of training intensity (heart rate 170-180 beats/min) and the adjustment of interval time are very important. Excessive training can easily lead to fatigue and affect the state, and should be avoided in the week before the competition [16].

5. Conclusion

In recent years, with the enhancement of people's health awareness, they have been actively participating in various aerobic exercises. As one of the extremely important factors, the training methods for cardiopulmonary endurance have also attracted much attention. Effectively improving cardiopulmonary endurance can increase people's experience and participation. Maximal oxygen uptake, hemoglobin quantity, hematocrit, mitochondrial level, and lactate threshold are all important physiological and biochemical indicators for evaluating cardiopulmonary endurance. Different training methods have their own advantages and disadvantages in improving cardiopulmonary endurance, and appropriate training methods should be selected according to individual conditions and training objectives. The altitude training method is professional and more difficult, and the conditions are limited. It is mainly used in all kinds of athletes, and is relatively less used in the

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general population. Continuous training may be more suitable for endurance events, such as long-distance running and ultra-distance running. The principles of interval training may be applicable to events that require improving speed and endurance, such as half-marathons and middle-distance running. No matter which training method is selected, it is necessary to scientifically and reasonably control the training intensity and monitor the changes of their physiological and biochemical indicators to minimize the damage and improve the efficiency of training. By summarizing the domestic and foreign literature, this article has certain reference significance for the selection of training methods, but the range of subjects selected is small, the number of subjects is limited, and the results have certain limitations. There is still a lot of work to study on the effects of different training methods on cardiopulmonary endurance, and the differences in the effects of the same training method on cardiopulmonary endurance of different people (such as different ages, genders, and health statuses) can be further explored. The differences in the effects of different training methods on the cardioresetive endurance of the same population, and the effects of different training methods on the cardioresetive endurance, to explore the best training program for different people.

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