Monitoring the Physiological and Biochemical Indicators of Teenage Male Rowers during Winter Training

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Abstract. Rowing is an aerobic endurance events, the human aerobic ability and anaerobic ability are very high requirements. In this study, 10 teenage male rowers were selected as subjects, and their body shape, sports quality, biochemical indexes, maximum oxygen intake, lactic acid, fujian, dynamometer performance and related indexes were measured. On the body shape, body function, biochemical metabolism, movement quality indexes of comprehensive evaluation, can understand the athletes' physical fitness level and characteristics, through the analysis of some physiological and biochemical indexes of athletes, the athletes were evaluated by special aerobic and anaerobic exercise capacity, comprehensive evaluation of the athletes' physical fitness, hope to provide experiment basis for training plan, and to explore the feasibility of using physiological parameter prediction rowing results.

1. Introduction

Rowing is a project that requires a higher level of function to propel the boat forward in the water. Rowing is dominated by aerobic metabolic energy supply. Although aerobic ability is the main part of rower's ability, in addition, it must have very high anaerobic and comprehensive ability [1]. In sports, these abilities are realized through the use of muscle oxygen and energy conversion. Muscles use energy materials such as sugar and fat stored in the body to convert them into energy during rowing training and competition. The physiological requirement of rowing is in the first place. The characteristics of energy metabolism in rowing events are manifested in a variety of comprehensive energy supply with aerobic energy as the main source, which requires a high demand for both aerobic and anaerobic energy systems and requires strong physical strength to support them. Some studies have shown that the main energy of rowing comes from the aerobic energy supply system, and a small part of the energy comes from the anaerobic energy supply system [2]. With the increasingly fierce competition in rowing events and the approaching of sports level, the requirement for speed of athletes is becoming higher and higher. Only by keeping the range and frequency of technical movements for a long time can we win the competition. This puts forward a high demand for the aerobic ability of rowers, which requires both the athletes to exert their maximum sports potential and the ability to maintain long-term sports [3, 4].

The improvement of athletic ability is the ultimate effect of sports training. The antioxidant capacity of athletes is also closely related to the athletic ability of athletes. In the process of sports training, the change of athletes’ antioxidant status is an important aspect of sports training. As athletes are constantly stimulated by external loads, the degree and frequency of oxidative stress in tissues is...
higher than that of ordinary people. Therefore, the body's antioxidant capacity is enhanced, and the body's free radical scavenging ability is enhanced to protect the body from free radical attacks. Good health, the maintenance of athletes' training results, the delay of sports fatigue, the improvement of athletic ability and the promotion of recovery are of great significance [5, 6].

The key to scientific training is to master the scale of training. If the training intensity is not reached, there will be no training effect. Exceeding the strength that the body can withstand, it will cause excessive training and even sports injuries [7, 8]. In China, almost all the outstanding coaches are athletes. In the process of sports training, they often rely on their own rich experience to train. They lack scientific physiological and biochemical monitoring methods. The medical staff only know how to monitor, but they don’t know how to train. The close cooperation between staff and scientific research personnel and the effective implementation of training and monitoring combine the effects of sports training with physical function assessment to greatly improve the scientific training level of swimming programs and ensure the effective improvement of sports performance. Cooperate with the coaches to promote the scientific development of sports training [7-10].

Rowing is aerobic endurance-based sports. The athletic performance depends mainly on the athlete's aerobic capacity, but the anaerobic capacity cannot be ignored. To properly arrange the training to make the athlete's aerobic and anaerobic energy supply system develop reasonably, firstly, the athlete's aerobic and anaerobic exercise ability should be evaluated, and the appropriate training content should be arranged according to the evaluation result. Numerous studies have shown that VO$_{2\text{max}}$ and lactic acid strontium are good indicators reflecting the aerobic capacity of rowers [8-10]. They are increasingly valued in research and training practice. The VO$_{2\text{max}}$ and lactate spoutum of the athletes can be measured to understand the athlete's aerobic capacity and can be Training potential. The dynamometer simulation test is closely related to water sports. The dynamometer special sports test for athletes can indirectly understand the athlete's anaerobic capacity, aerobic capacity and special sports ability. Biochemical indicators play an important role in the monitoring of exercise training [4, 8, 10, and 11].

Short-term monitoring of biochemical indicators can reflect athletes' response to training sessions; long-term biochemical indicators monitoring can assess the effectiveness of training programs. Because the individual differences of biochemical indicators are generally large, and in practice, the training effect is evaluated mainly by longitudinal comparison [12-13]. To accurately use the biochemical indicators for functional assessment, it is necessary to determine the basic values of the athlete's biochemical indicators for later training. Comparison. Understanding the athlete's physical fitness level is the basis for developing a scientific training program. This involves indicators of body shape, body function, biochemical metabolism, and exercise quality [14, 15]. A study of the relationship between these indicators and athletic performance can identify the main factors that are closely related to improving performance. The study confirms the use of stepwise regression analysis to statistically analyze the indicators of athletes in all aspects, and establish a performance prediction model, which can extract the factors that have the greatest impact on sports performance [15, 16]. The study of the role and contribution of these factors can be used for athletes to select materials, select players and better evaluate the athlete's physical fitness, or to develop training plans to focus on the factors that have the greatest impact on rowing.

2. Materials and Methods
10 teenage male rowers were selected and given informed written consent for the study. All training procedure were performed under supervision. During the entire winter training of the athletes, the system tracking test method is adopted to complete the sampling test to assess the athlete's physical function, and the test results are promptly fed back to the coaches, the training arrangements are adjusted in time, reasonable opinions are provided, and the athletes' system training is guaranteed. The physiological and biochemical indicators monitored include red blood cells, white blood cells, hemoglobin, hematocrit, blood urea, creatine kinase, testosterone and cortisol.
Table 1. Subject characteristics. Data are expressed as Mean ± SD.

|   | N   | Age (years) | Body mass (kg) | Height (cm) | VO₂ max (mL·kg⁻¹·min⁻¹) |
|---|-----|-------------|----------------|-------------|--------------------------|
| 10| 16.3±1.9 | 53.3±3.7 | 181.2±3.4 | 43.6±3.5 |

3. Results
During the whole winter training period, the average level of red blood cell count increased by 4.8% (P≤0.05) in the second stage of winter training compared with the first stage, which was shown in figure 1. After that, the average level of red blood cell count showed a downward trend, but the value between the two time points. No significant difference (P≥0.05) was achieved by independent sample T test.

Figure 1. Trend of Red Blood Cell Number changes during winter training

The average level of creatine kinase in the first stage after the start of winter training was the highest during the whole winter training period, which was significantly higher than that in the second stage, the third stage and the fourth stage (shown in figure 2). From the first stage to the second weekend, the average level of creatine kinase decreased 16.7% (P ≤ 0.05), after which the change in creatine kinase was small and basically stable. There was no significant difference in the 2-4 phase phosphocreatine by independent sample T test (P ≥ 0.05).

Serum creatine kinase (CK), also known as phosphocreatine kinase, contains CK in human skeletal muscle, myocardium, brain, and smooth muscle, with a high content of skeletal muscle. CK is one of the key enzymes in skeletal muscle energy metabolism, and its role is to catalyze the reversible transfer of high energy phosphoric acid between ATP and CP. It is a catalytic enzyme for energy supplementation and ATP recovery after exercise in short-term intense exercise, and is closely related to energy balance and metastasis during exercise and exercise. Under normal circumstances, muscle cells are structurally intact and function properly, making CK rarely penetrate the cell membrane. Studies have shown that both high-intensity and low-intensity training increases serum CK activity. The difference in the amount of CK between muscle cells and blood is particularly large. Therefore, changes in serum CK activity can be used as an important sensitive biochemical indicator for assessing muscle tolerance and understanding skeletal muscle micro-injury and its adaptation and recovery. At present, many coaches use the serum CK index as one of the basis for adjusting the training intensity.
The trend of testosterone showed a slight increase during the whole winter training period, and there was a significant increase in the fourth stage, which was shown in figure 3. The first stage to the second stage increased by 1.3% (P ≥ 0.05), and the second stage to the third stage increased by 1.6% (P ≥ 0.05), but the difference between the average levels of testosterone between the two stages was not significant. The independent sample T test did not reach a significant level, and the fourth stage testosterone level increased significantly by 8.1% (P ≤ 0.01), and there was a significant difference in the independent sample T test.

4. Discussion

Nowadays, the level of competition is getting higher and higher, and the competition is becoming more and fiercer. In the process of competitive sports training, body composition has different effects on the body from the mechanical and energy metabolism, and has an impact on the physiological characteristics and exercise ability of the human body. The structure and proportion of the body composition are reasonable, and it is very important to effectively control the weight, scientifically arrange the training, and ensure the best exercise ability. At the same time, different sports, different forms of exercise, different requirements for the athlete's body composition. With the rapid improvement of the level of modern competitive sports, people have fully recognized the close relationship between the athlete's physical composition and athletic ability. It is more important to use the physiological and biochemical indicators to detect and evaluate the athlete's bodily functions. A series of physiological changes produced by the body during exercise are an objective reflection of the body's exercise load, that is, the body's ability to stress exercise. The training load is too small, and the exercise capacity is not improved. If the training load is too large, it may not only improve the exercise capacity, but will damage the health of the body. Therefore, in sports training, reasonable physiological and biochemical monitoring methods and indicators are used to diagnose and evaluate.
athletes' ability to withstand training load, actual physical function status, scientific and effective training, so as to scientifically select and strengthen medical services. Supervising, adjusting the training load, quickly and effectively recovering, preventing the occurrence of excessive training and sports injuries, the sports potential of the excavator body, and improving the athletic ability are all very important and have become an important part of scientific training.

Scientific training methods are the key to improving athletic ability, preventing excessive fatigue and speeding up recovery. Therefore, scientific monitoring of training and game load intensity is a necessary condition for coaches to carry out scientific training and an important part of scientific training. Physiological and biochemical monitoring of sports training is a major component of training monitoring. It uses physiological and biochemical principles and methods to determine some physiological and biochemical indicators in athletes during exercise training to evaluate the intensity and quantity of athletes during training and training methods. And the rationality and effectiveness of the means and the adaptive information and recovery effects of the body on sports training can objectively, accurately and quantitatively reflect the athlete's physical function status, thus helping the coaches understand the training effect, correctly evaluate and adjust the training method.

5. Conclusion
Indicators such as red blood cells, hemoglobin and creatine kinase can reflect the changes of body function and nutritional status of adolescent athletes during winter training. Combined use of heart rate, blood lactate and other indicators can well monitor the changes in training load of young athletes during winter training and athletes. The physical response provides a basis for timely adjustment of the training load.

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