Monitoring Pre-competition Indicators in Elite Adolescent Racewalkers

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Abstract: This study tracked the physiological and biochemical indicators of five elite adolescent racewalkers during the phase training before the final of the 18th Jiangsu Provincial Games. The results indicate that the training of adolescent racewalkers should follow the principle of individual differences. In the training plan, emphasis should be placed on the arrangement of speed intensity and training load. Adjustments should be made in a timely manner based on the changes in the athletes' physiological and biochemical indicators. In addition to rational training, attention should also be paid to nutritional supplementation, especially in the recovery from physical fatigue. Furthermore, given the significant emotional and psychological fluctuations of adolescent athletes, timely psychological counseling is also necessary.

Keywords: Adolescents, Racewalkers, Physiological and Biochemical Indicators, Monitoring

1. Introduction

Racewalking is an endurance sport primarily based on aerobic metabolism, characterized by its strong technicality, long duration of movement, and high energy expenditure [1]. Numerous factors influence racewalking performance, among which the most significant are nutritional reserves, scientific pre-competition training, and psychological factors. Scientific pre-competition training is the key element. Although the condition of athletes can be observed through the coaches' experience, monitoring physiological and biochemical indicators is more scientific and rational. Combining coaches' observations with training monitoring to adjust athletes' pre-competition training status is a necessary condition for achieving good performance in competitions. The Jiangsu Racewalking Team has consistently achieved excellent results in various major competitions, which is also attributed to the development of amateur racewalking training and the supplementation of outstanding reserve talents.

The Huai'an Sports School, as a key national training base for racewalking reserve talents, provides ample faculty and material support for the cultivation of outstanding adolescent racewalkers. It also achieved remarkable results at the 18th Jiangsu Provincial Games held in July 2014. This study will analyze the pre-competition physiological and biochemical monitoring data of five key athletes from Huai'an and explore scientific strategies and outcomes based on different stages of physiological and biochemical indicators, in order to provide reliable experience and methods for the scientific training of adolescent racewalking amateurs.

2. Research subjects and methods

2.1. Research subjects

Five adolescent athletes from the Huai'an Racewalking Team.

2.2. Research methods

2.2.1. Interview Method

Inquiring about the athletes' subjective feelings of fatigue and physical condition after each phase of training.

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2.2.2. Questionnaire survey method

The questionnaire mainly covers aspects such as athletes' sleep, diet, nutrition, and psychology.

2.2.3. Experimental method

The 18th Jiangsu Provincial Games began in early July 2014. This study started tracking and researching in early May, with physiological and biochemical indicators measured every two weeks over an eight-week period. The monitored indicators included body weight, morning pulse, hemoglobin, testosterone, and ten urine parameters. Based on the results of these indicators, the athletes were guided to make corresponding adjustments to their training and nutritional supplements, as well as to observe the changes in physiological and biochemical indicators after these adjustments, thereby providing a scientific basis for pre-competition training adjustments and nutritional supplementation in amateur racewalking.

3. Results and analysis

Racewalking involves a high training load and significant energy expenditure, often placing athletes in a state of physiological stress and even reaching their physiological limits. The arrangement of the training plan is crucial; it should neither involve long-term overloading nor focus solely on speed training at the expense of endurance training [2]. Adjustments to the training plan at different stages can actively improve the athletes' physiological functions and prepare them fully for the final competition. The basic conditions of the five racewalkers at the beginning of May are summarized in Table 1.

Table 1 Summary of Basic Information of Five Athletes from Huai'an Racewalking Team

Name	Gender	Date of Birth	Height/cm	Weight/kg	Body Fat Percentage/%	Morning Pulse (beats/min)
Xie XX	Male	1998-03	171.5	61.5	9.70	54
YIN XX	Female	2000-01	155.5	50.5	19.50	58
GAO XX	Female	1997-11	162.2	49.4	18.70	60
ZHAO X	Male	1999-12	163.7	46.0	11.70	60
XU XX	Male	1999-06	159.0	46.5	10.90	58

Racewalking is a long-term aerobic endurance sport primarily fueled by aerobic energy supply. The level of hemoglobin directly affects athletes' training and competitive performance. Hemoglobin levels are typically influenced by training load, nutritional status, and hypoxia [3]. When the intensity and load of training are too high, physical function declines, and the number of red blood cells decreases, thereby affecting hemoglobin levels. Training is accompanied by the loss of trace elements in the human body. Iron-deficiency anemia is a common phenomenon among adolescent athletes. Therefore, malnutrition, especially the lack of iron required for hemoglobin synthesis, will directly impact hemoglobin levels.

As shown in Table 2 and Figure 1, the hemoglobin levels of the five team members generally increased in early May, showed a downward trend in early June, and gradually recovered from mid-June to early July. In early May, the training plan mainly focused on speed and intensity training with a moderate volume of exercise. The relatively suitable climate and temperature at the end of spring and beginning of summer may have contributed to the overall increase in hemoglobin levels among the five team members. However, the hemoglobin levels of athletes Yin XX and Zhao X decreased during the same period, with a significant drop in Yin XX's levels, which drew the coach's attention. Through interviews and questionnaire surveys, it was found that the athlete experienced significant psychological fluctuations, poor sleep quality, and irregular eating habits, including anorexia and picky eating. Iron-deficiency anemia was suspected to be the cause. In response, the coach adjusted the individual's training plan accordingly. Nutritionally, the athlete was provided with the iron supplement Hematinic, and a psychology teacher was also engaged to provide emotional counseling. From late May to early June, the training plan combined speed intensity with load volume, and the overall hemoglobin levels of the five team members decreased. This may have been due to the increasing temperature, increased exercise volume, and greater physical consumption and reduced recovery capacity of the athletes. In response, we guided the athletes to take iron supplements and rest actively, and gradually shifted the training plan from a combination of speed intensity and load volume to a

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load volume–dominated training. In early June, the overall hemoglobin levels increased as the body gradually adapted. In late June, as the competition approached, the training load gradually decreased, and the speed intensity gradually increased. During this period, the weather was hot, and the athletes were provided with sugary and electrolyte-containing beverages during training. Additionally, iron supplements continued until early July, and the overall hemoglobin levels gradually recovered, achieving the goal of storing energy and maintaining good physical function for the major competition.

Table 2 Changes in Hemoglobin Levels During Pre-competition Training Phases (Unit: g/L)

Name	April 27	May 16	June 3	June 16	July 2
Xie XX	138	149	136	140	143
Yin XX	128	110	125	120	132
Gao XX	110	114	112	110	108
Zhao X	125	121	120	125	128
Xu XX	129	134	125	128	135

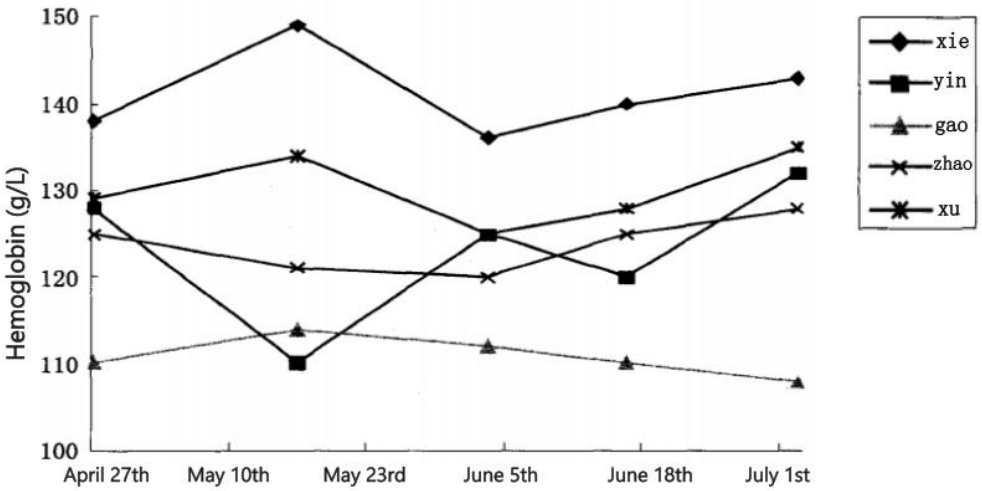

Figure 1 Changes in Hemoglobin Levels During Pre-competition Training Phases

Testosterone is a highly active substance secreted by endocrine cells in the human body. As a type of androgen, blood testosterone plays an important role not only in human growth, development, and metabolism but also in muscle strength development and fatigue recovery [4]. Numerous studies have investigated the relationship between blood testosterone levels and athletic performance in adolescent athletes. For example, Zhang Ying et al. [5] found that in adolescent football players, blood testosterone levels are significantly correlated with maximal oxygen uptake and maximal oxygen pulse. In adolescent racewalking competitions, which mainly include 5000m and 10000m events, high technical and speed requirements are placed on athletes. Therefore, high levels of blood testosterone can influence the athletes' anabolic processes and ultimately affect their competitive performance.

As shown in Table 3 and Figure 2, the blood testosterone levels of the five athletes exhibited a U-shaped change, with a significant decline around June. This may have been due to the increased training volume and rising temperatures during this period, which accelerated the breakdown of substances in the body while reducing synthesis. In response to this situation, the athletes were provided with nutritional supplements that can promote testosterone levels, such as Howei and Chang bai Xian ling Oral Liquid. By early July, the overall blood testosterone levels had increased, preparing the athletes for the final competition. Additionally, it is worth noting that during the period when the athletes were taking these supplements, Xie XX gained 1.5 kg in weight within half a month. After consulting with the coach, the intake of nutritional supplements was reduced accordingly. As the competition approached, Xie XX's weight gradually returned to a normal level.

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Table 3 Changes in Blood Testosterone Levels During Pre-competition Training Phases (Unit: ng/dL)

Name	April 29	June 2	July 3
Xie XX	454	420	470
Yin XX	34	24	41
Gao XX	54	46	48
Zhao X	438	423	456
Xu XX	398	410	427

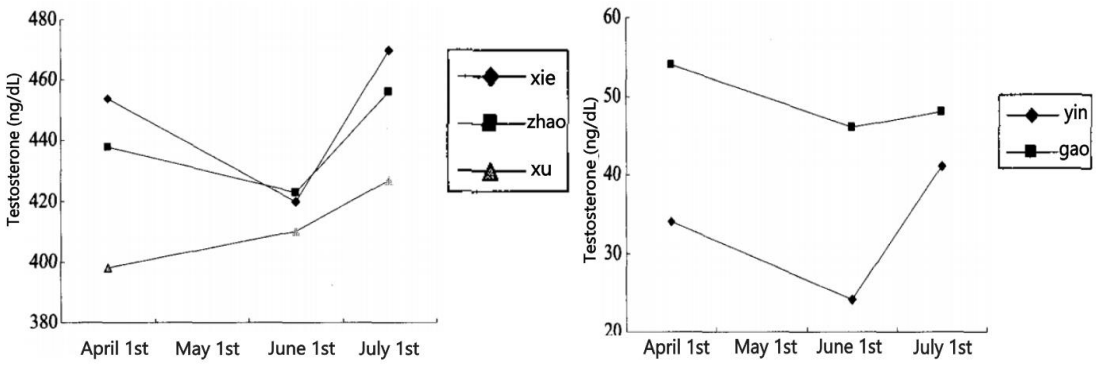

Figure 2 Changes in Blood Testosterone Levels During Pre-competition Training Phases

The monitoring of the ten urine parameters includes urine protein, bilirubin, occult blood, ketone bodies, etc. Racewalking is an endurance sport characterized by long duration and high energy expenditure. In the monitoring of these ten urine parameters among racewalkers, it has been summarized that urine protein shows a more pronounced response to exercise intensity. Therefore, this study uses urine protein as an indicator to reflect the training load and physical condition. In combination with the levels of hemoglobin and blood testosterone, it can be seen that from mid-May to June, athlete Yin XX showed a reduced recovery capacity and poor condition. This provided a basis for the coach to adjust the training plan (Table 4).

Table 4 Morning Urine Protein Levels After Intensity Training Before the Competition

Name	April 29	May 15	June 4	June 17	July 4
Xie XX	+-				
Yin XX		+-	+		
Gao XX	+-				+-
Zhao X					+-
Xu XX					

4. Conclusion

Adolescent athletes are in a critical period of physical development. During amateur training, their physical condition can change significantly. To ensure the normal conduct of amateur training and to protect the health of adolescent athletes, it is necessary for coaches and relevant sports workers to actively monitor the physical condition of athletes. The level of amateur training for adolescent racewalkers directly affects the supply of future talent in racewalking. As grassroots sports workers, it is essential to use training monitoring to provide scientific basis for athletes' daily life, psychological state, nutrition, and training plans. This study tracked the physiological and biochemical indicators of racewalkers at different training stages before the final of the 18th Provincial Games, providing reliable evidence for coaches to scientifically

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arrange training and offering scientific support for the Huai'an Racewalking Team to fulfill its tasks at the Jiangsu Provincial Games.

5. References

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