

## Research Article

# Endurance Monitoring Method for Rock Climbers Based on Multisensor FDA Model

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The quality of sports performance mainly depends on the scientific degree of sports training. The best monitoring and control of the whole process of sports training is an important guarantee for improving the scientific degree of training. For the scientific monitoring of sports training process, many scholars have carried out research from many aspects. Current research still finds that athletes still have many problems with the protection of their own physical endurance. (1) The monitoring of the sports training process by coaches and athletes is still mainly spontaneous. The monitoring of athletes has not yet formed a system. (2) At present, the monitoring of athletes is mainly carried out from a single discipline or a certain field, and there is no systematic monitoring system. (3) There are many common problems in the monitoring items of the training process in the existing research. Existing studies have relatively little content on specific characteristics. In this paper, a dynamic monitoring system for the training process of elite rock climbers is established, and a training operation mode for rock climbers is established. (1) This paper sorts out the various subsystems of the training system. The monitoring system of sports training process mainly includes target system, personnel organization system, and software and hardware system. In addition, the sports training system proposed in this paper also includes monitoring content system, implementation system, and evaluation system. The sports training process monitoring system also includes a subsystem for monitoring the development of athletic ability of athletes. We take on the training load condition monitoring subsystem; daily physical function state and psychological state monitoring subsystem; and physical and mental health monitoring subsystem. (2) In addition, this paper establishes an operation mode dominated by “scientific research leaders.” The model includes three parts: “Administrative Managers, Scientific Research Leaders, and Coaches.” (3) Finally, this paper establishes five basic guiding ideologies for the evaluation of training process monitoring results. This paper establishes three reference standards for the evaluation of monitoring indicators.

## 1. Introduction

The fundamental purpose of competitive sports training is to cultivate high-level athletes. Athletes can achieve excellent athletic performance in competition. Athletes can win glory for the country and become excellent athletes. The quality of sports performance mainly depends on the scientific degree of sports training. Especially in the 21st century, the competition of competitive sports has really reached a white-hot level. At present, each country is paying more attention to the scientificization of the sports training process. Rock climbing is a competitive sport. The fundamental purpose of this type of sports training is to train high-level athletes. The training of this type of competitive sports can cultivate a

group of athletes with high-level athletic ability for the country. However, the level of performance in this type of sports depends on the scientific level of sports training. After entering the 21st century, competitive sports has developed to a new stage. All countries have paid more attention to the application of science and technology in the process of sports training. Some regions have established competitive sports training methods supported by multisensor FDA technology. The monitoring of the training process in the existing research focuses more on the monitoring of the training results, while ignoring the monitoring of the training process. The scientificization of sports training refers to the use of scientific theories and methods for training. We generally use advanced technology to intervene in the movement

process. Effectively implement the whole process of exercise monitoring training. This approach facilitates the dynamic process of achieving desired goals. At the same time, the scientific degree of China's competitive sports training process is constantly improving [1–3]. However, overall the development of competitive sports is still at a low level. In recent years, the scientific level of training of Chinese sports teams at all levels has been greatly improved. China has achieved relatively good results in many Olympic Games. But we also need to be clear about our own shortcomings in the exercise monitoring process. In general, China's sports scientific research strength is still relatively weak [4–7]. The outstanding problems in the training practice of Chinese athletes are manifested in many aspects.

We also found that there are many deficiencies in the endurance monitoring of Chinese athletes. A core problem at the current stage is that scientific research and training are not closely integrated [8–11]. Coaches have limited awareness and level of mastering scientific knowledge and using science and technology. In addition, the monitoring of the movement process in the existing research also focuses on the regular movement within a large period range. Existing studies are insufficient for monitoring the regular activities of movement in small cycles. Monitoring is carried out according to the law of the annual large cycle and does not adapt to the reality of small cycle training. In this study, literature analysis was carried out through literature analysis, survey analysis, case study, and other methods. In addition, this paper uses different methods such as comparative analysis and mathematical statistics to compare and analyze the entire movement process. On the one hand, the blindness of training refers to the unclear understanding of the characteristics and laws of the project. In addition, blindness is also manifested in the low level of scientific training in the training process. Therefore, the best monitoring and control of the whole process of sports training is an important prerequisite for effectively improving the level of sports competition and sports performance. Generally speaking, there are many types of monitoring of sports activities. On the one hand, training institutions need to take effective measures to monitor the physical function of athletes and formulate effective monitoring indicators. Training institutions can also use reasonable methods and means to improve the efficiency of training monitoring. This monitoring method is helpful to obtain the information on the sports effect of athletes in time and then analyze the main factors affecting the training effect and propose further targeted strategies. This method is also an important guarantee for improving the scientific degree of training. The scientific material of the training process mainly refers to improving the success rate of athletes from a macro perspective. Shorten the athlete training period and extend the athlete's competition time. This method mainly refers to strengthening the scientific monitoring of the training process and improving the pertinence and effectiveness of the training [12–15]. Scientific researchers cannot study and deeply grasp the rules of the project. Existing research on specific projects, specific issues of the research level, is not high; the ability to tackle key problems is not strong. Existing

research cannot provide effective, specific, and quantitative guidance on training. Promote the successful training methods and experience of advantageous projects, and increase the guidance and support of science and technology for sports training. Establish and continuously improve the scientific training monitoring service system. The scientific degree of the training process of physical fitness projects needs to be improved. Existing studies have found that the current rock climbing training process has problems such as blindness and unclear breakthroughs [16–19].

Through the scientific monitoring of the sports training process, the scientific level of Chinese athletes' training can be effectively improved. Many scholars have carried out research from different aspects. The State Sports General Administration has established training monitoring, sports psychology, sports trauma, and medical supervision laboratories with the focus on training monitoring, as well as key laboratories for sports nutrition, information research, physical training and recovery, etc. At the 2004 Athens Olympics, the Chinese Olympic Corps won 32 gold medals, ranking second in the gold medal list. One of the most important experiences was during the 2004 Olympics. The scientific and technological preparations of the General Administration of Sports of China "focusing on training and monitoring" have achieved remarkable results. The scientific level of sports training has been greatly improved. However, through the analysis of the current situation of monitoring of sports training process in China, it is found that there are still many problems: (1) Sports teams or coaches conduct scientific monitoring of the sports training process. This selection is largely spontaneous [20–24]. The selection did not form a fixed mechanism with a certain department head. The method did not become a regulation that had to be followed during training. (2) At present, monitoring is mainly carried out from a single discipline (such as physiology, biochemistry, etc.) or a certain field (psychological ability, exercise load, etc.). At present, there is no systematic monitoring system. (3) At present, there are many researches on the common problems of each item of training process monitoring, but less researches on the combination of special characteristics. (4) The monitoring of the training process at the current stage places too much emphasis on the monitoring of the training results. Oversight of the training process is neglected. (5) The monitoring of the training process is mainly based on the regularity of the annual major cycle. This paper sorts out the monitoring system of the rock climbing movement process. Research has found that elite rock climbers need to monitor the entire training process. The results of this study are reflected in the following three aspects. First, this paper sorts out the concept, connotation, and extension of sports training process monitoring. This article analyzes the classification and main characteristics of the exercise training process. It is not suitable for the current situation of the rapid increase in the number of international sports competitions. Facts show that we need to use a variety of methods to monitor and evaluate athletes' physical function, athletic ability, technical and tactical characteristics, fitness level, and the effectiveness of training methods [14, 25–27].

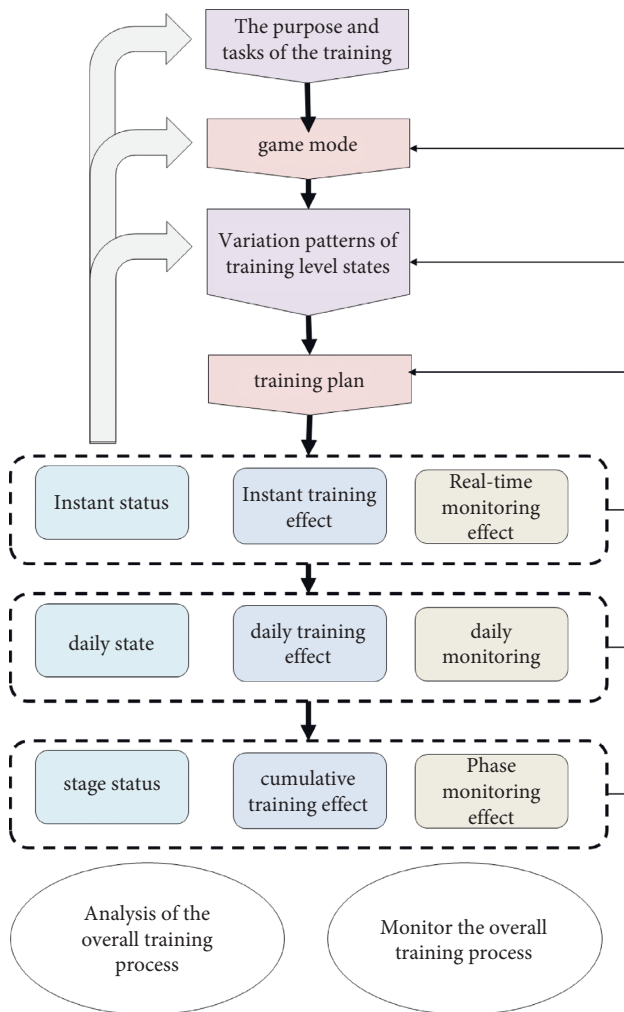


FIGURE 1: The framework of the movement phase monitoring.

We need to take measures such as nutritional supplements, physical recovery, and load adjustment, so that our country's rock climbing projects can be rewarded. Athletes were able to win precious gold medals at the Athens Olympics, mainly due to their training with small cycle, multilevel, high-quality characteristics. By scientifically monitoring athletes, promoting training through competition, and combining competition and training, it is in line with the new trend of international competition and training. The main deficiencies of foreign research are that the combination of special in-depth and systematic research is far from enough. For example, current research on sports psychology lacks monitoring of training and competition preparation processes. The monitoring of athletes' mental state requires systematic research. The psychological changes of athletes during the preparation of large-scale competitions are very significant. Effective monitoring and adjustment can be implemented by effectively exploring the changing laws of athletes' psychological states [28–31]. This method plays a positive role in improving training effects and competition results. To sum up, scientific monitoring of the training process is a strong guarantee for scientific training. Scientific monitoring is the premise for athletes to

achieve good sports performance [32–34]. Therefore, this paper tries to follow the dynamic, individual, holistic, and systematic principles from a multidisciplinary perspective. This paper conducts a systematic study on the scientific monitoring of the sports training process of rock climbing in our country. The research framework of this paper is shown in Figure 1.

## 2. The Review of Research on Sports Training Process Monitoring and Rock Climbing Project Training Process Monitoring

This paper analyzes according to the viewpoint of system theory, and the system is composed of different elements. Generally speaking, large systems are composed of different subsystems. The overall benefit of the system depends on the degree of integration of the various elements of the system. The benefits of large systems depend on the degree to which small systems and individual elements are integrated. Each subsystem and each element can be organically integrated. The systems are interconnected and infiltrated to form a reasonable structure.

*2.1. Theory of Monitoring Training Process from the Perspective of Physical Education.* Concepts are the main expressions reflecting the sport of rock climbing. Concept analysis is mainly to understand the essence of things. The essence of things is also the main feature of a certain type of phenomenon. Through the unified planning of the inherent laws of the overall concept, it is beneficial to make up for the defects of the existing problems. Concepts are the basis of research questions. The research results of this paper reveal the essential laws of the movement monitoring process of rock climbers. This paper establishes five subsystems for monitoring the process of sports training. This paper preliminarily constructs the theoretical system of sports training process monitoring. Secondly, this paper constructs a monitoring content system for the training process of our country's outstanding rock climbers. In general, the monitoring of the training process of elite rock climbers mainly includes two categories: the monitoring of decisive factors and the monitoring of influencing factors. Sports monitoring methods can also effectively protect the physical function of athletes. The method can ensure the normal progress of sports training activities of athletes. This method helps athletes perform at their best in competitive play. Since the traditional sports training has been overtrained, the ability of the coaches lacks the use of information monitoring equipment. With the continuous application of new technologies, computer monitoring technology can obtain and master data on athletes' physical functions and movement processes from multiple dimensions. These data help researchers develop a reasonable exercise program. The definition of a concept is a form of thinking that reflects the essential properties of an object. Only the connotation and extension of the concept of the research question are clarified. Only then can we clearly define the scope and content of the research question in this paper. This paper can provide

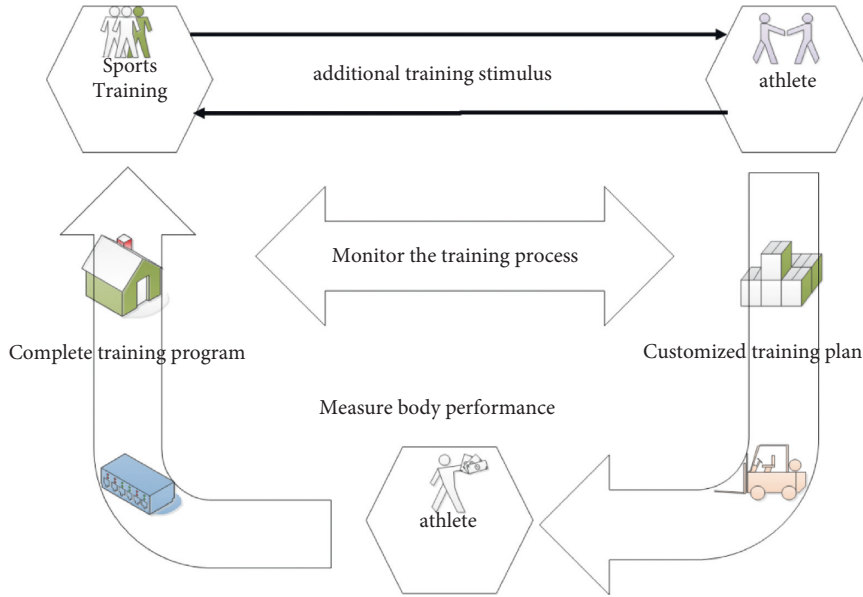


FIGURE 2: The variability of factors in the implementation of the exercise training process.

researchers with a clear direction. This paper can clarify the subject, object, and essence of the research question. Therefore, it is very necessary to conduct an in-depth analysis of the main related concepts studied in this paper. The research in this paper requires a clear interpretation and scientific definition of the concept, laying the theoretical foundation for the whole study. The model research framework is shown in Figure 2.

**2.2. The Case Study on Monitoring the Training Process of Elite Athletes.** Sports training is the basic form of activity in competitive sports. All things in the universe and various activities of human society are the same. Sports training is constantly moving and developing in the dimension of time and space. Its performance in time is the steps and procedures of sports training. The process of athletic training deserves the attention of most people. The athletic training process is defined as the steps and procedures in which athletic training is performed. Sports training can reflect the long term in the time dimension. Athletic training has inherent properties. From this definition, it can be seen that as long as sports training occurs, the sports training process will exist objectively. The coaches will formulate a scientific exercise plan according to the needs of the athletes during the exercise. These contents include sports training, special training, diet adjustment, daily training plan, and other aspects for athletes. According to the needs of this research, we divide “sports training process” into two kinds: narrow sense and broad sense. In a narrow sense, the meaning of the performance of the “exercise training process” is limited. The main body of sports training participates in sports activities under the guidance of coaches and accumulates over the course of each training session.

The calculation principle of local consistency is relatively simple, mainly using Kendall Concorde coefficient, and the specific calculation formula is as follows:

$$W = \frac{\sum (R_i)^2 - n(\bar{R})^2}{1/12K^2(n^3 - n)}. \quad (1)$$

The calculation formula of single-sample statistics is as follows:

$$t = \frac{\bar{X} - \mu}{\delta_x / \sqrt{n - 1}}. \quad (2)$$

The calculation of the statistics of the hypothesis of the single-body sample is as follows:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2/n_1 + n_2 - 2(1/n_1 - 1/n_2)}}. \quad (3)$$

The point  $P(X_c, Y_c, Z_c)$  is spatially related to  $O$  and  $OP$ . The model has significant applications in the field of image recognition processing. The specific point is marked as  $p(x, y)$ . Using the geometric relationship of central keyhole imaging, the following proportional relationship can be obtained:

$$x = \frac{fX_c}{Z_c}, y = \frac{fY_c}{Z_c}. \quad (4)$$

Considering the influence of target vehicle's speed and penalty function on obstacle avoidance, the following obstacle avoidance function is selected:

$$J_{obs,i} = \frac{S_{obs}v_i}{(x_i - x_o)^2 + (y_i - y_o)^2 + c}. \quad (5)$$

**2.3. Training Process Monitoring New Indicators and New Technology Application Research.** Training time usually refers to the start of the preparatory activities of a training session until the end of the training session. It can also be

expressed as the accumulation of training sessions over a period of time. The training process does not include time outside the training session. In a broad sense, an “athletic training process” is when an athlete engages in a training activity. Athletes participate in training sessions and for the entire duration outside of training sessions. The exercise session includes the duration of the training session. Exercise time also includes all time outside of training sessions. Time outside the training session is considered a continuation of the training session. The movement process reflects the adjustment of physical function between training sessions. The exercise time can be one day, one week, one month, one year, many years, etc.

Therefore, we believe that the concept of “monitoring” is clear. Among them, the monitoring subsystem of competitive ability development status has high practicability, daily physical function state and mental state monitoring subsystem, physical and mental health monitoring subsystem, and nutritional status monitoring subsystem. The action of the subject of monitoring behavior is in accordance with the plan to achieve a certain purpose or task.

The smaller the MAE value is, the higher the prediction quality is. Suppose there are  $n$  items in the system, the score set predicted by the algorithm is  $\{p_1, p_2, \dots, p_n\}$ , and the corresponding actual score set is  $\{r_1, r_2, \dots, r_n\}$ ; MAE calculation formula is as follows:

$$\text{MAE} = \frac{\sum_{i=1}^N |p_{ui} - q_{ui}|}{N} \quad (6)$$

Coverage index calculates the ratio of predicted items to all unscored items, so as to measure the comprehensiveness of prediction. Assuming that  $h$  items are predicted, the calculation method of coverage is as follows:

$$\text{Cov} = \frac{h}{n} \quad (7)$$

Recall index is also used to evaluate the system effect in the field of information retrieval. The larger recall value is, the better the recommendation quality of the algorithm is.

$$\text{recall} = \frac{\text{Hits}}{|\text{test}|} = \frac{|\text{test} \cap \text{Top} - N|}{|\text{test}|} \quad (8)$$

In order to verify the clustering effect of user attributes, the contour coefficient  $S$  is used to evaluate the clustering result, and the specific expression is

$$S(i) = \frac{b(i) - a(i)}{\max\{a(i), b(i)\}} \quad (9)$$

Monitoring behavior is a set of activities to control the behavior of the object by analyzing the status of the object. For example, when a bank adopts a monitoring system, it is to know the security situation of the bank through the monitoring system, so as to achieve the purpose of safety. Factory floor by monitoring every aspect of production. Generally speaking, the coach will lead the entire sports training process. Coaches further formulate sports training goals and athlete training plans by comprehensively evaluating the physical function and sports competition level of

rock climbers. The coaching staff will organize and distribute facilities for sports training activities according to the plan. Therefore, sports trainers need to use new technologies to monitor the physical state of athletes in an all-round way to support the formulation of sports training plans and work according to established procedures, thereby producing a “qualified product.” Students also often formulate certain learning goals and corresponding study plans and identify deviations from goals or plans through self-monitoring. Student groups consciously adjust to achieve the purpose of learning. The main influencing factors of sports performance and training process are shown in Figure 3.

There are few studies in China on monitoring the exercise training process. There are few scholars who have explained it in detail. In the existing research, only individuals who have conducted in-depth research on this issue were retrieved.

### 3. Basic Theoretical Problems of “Sports Training Process Monitoring”

*3.1. Research on the Combination of Training Process Monitoring and Training Theory.* The concept used in existing research is training monitoring. Training process monitoring and exercise monitoring belong to the same concept. First of all, the controllability of training is an important symbol of scientific training. Second, training monitoring is an important method for coaches to exercise control over training. Due to the influence of various interference factors, the actual effect of training control is not necessarily the same as the predetermined target. Using training monitoring can find out the deviation between the actual effect of training and the expected goal and adjust it in time and make the training return to the predetermined track to ensure the realization of the best training goal. Training monitoring plays a role in training control. On the one hand, coaches formulate training plans, implement sports training, and apply training stimulation to athletes. Five monitoring subsystems together constitute the impact mechanism of the monitoring activities of rock climbers. This study carried out a specific study on the monitoring system of rock climbing activities and sorted out five main factors that affect the performance of athletes in rock climbing. These factors together constitute the main content that affects the physical activity of rock climbers. Based on the relevant achievements of the existing research on coaches and athletes, the system builds a monitoring index system for five types of influencing factors, and the system monitors the above five types of indicators in real time through a systematic monitoring model. This study follows the principles of comprehensiveness, systematization, pertinence, feasibility, relative independence, and comparability. Based on the existing research results of coaches, athletes, and relevant experts, this paper constructs a monitoring index system for the training process of elite rock climbers. Through training monitoring, coaches can measure the response of the athlete’s body to training stimuli. The assistant coaches evaluate the training effect and provide a reference for formulating a more scientific training plan. In addition, training

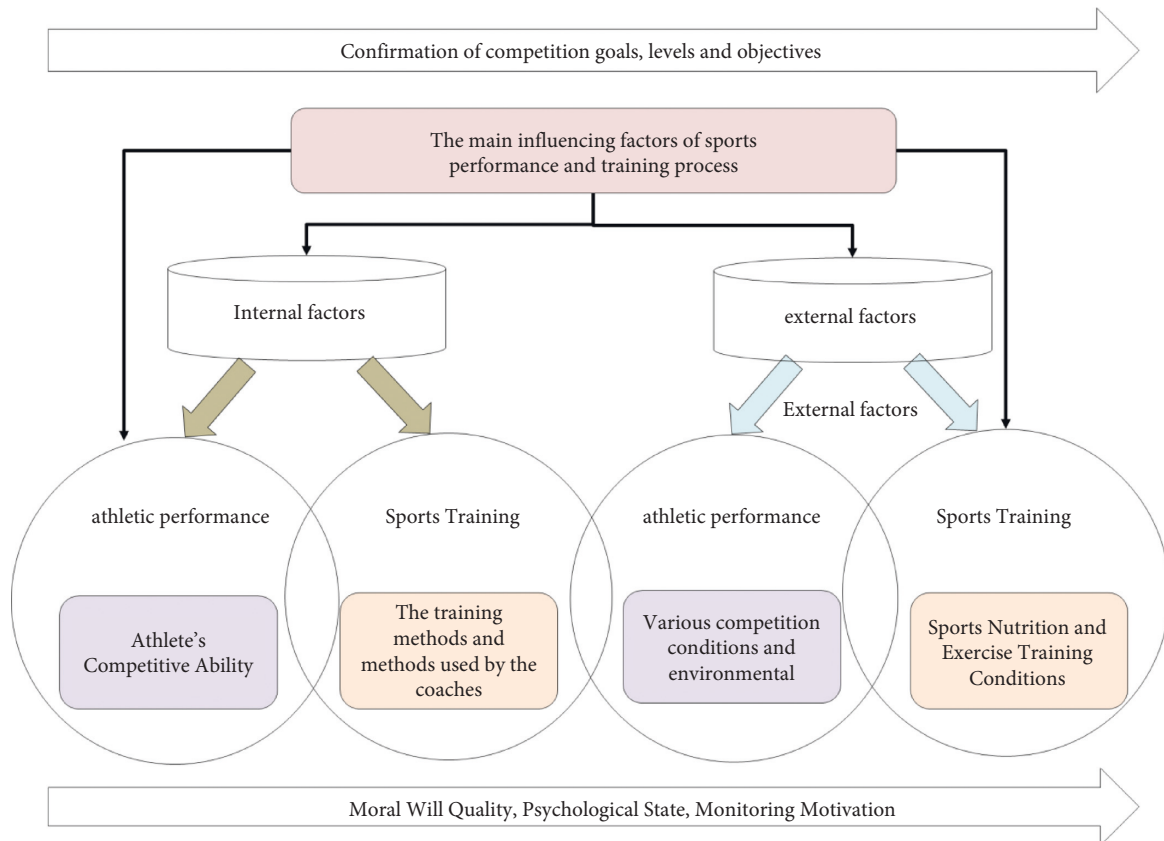


FIGURE 3: The main influencing factors of sports performance and training process.

monitoring allows the athlete's response during training to be measured as the athlete completes the training program. Auxiliary trainers are evaluated against the training program. Evaluate the quality of training an athlete has completed. Provide a basis for controlling the training quality of athletes.

During the training process of athletes, it is very important to monitor the training effect, from the point of view of finding problems, analyzing problems, and solving problems. Current practices are clearly insufficient. We monitor the training process, not only to check the effect of training, but more importantly to find the specific problem of poor training. Coaches are the leaders of training activities and determine the goals of sports training, as well as the formulation of training plans and the specific organization and implementation of the training process. Therefore, the trainer is also an important factor in the monitoring of the training process. In the specific test, sometimes experts in various fields cannot complete the test work in person, and corresponding personnel are required to assist in completing the work. We adjust for the reasons. This requires that we must monitor every aspect of training, for example, the type and amount of load an athlete undertakes for each training session. The training intensity is monitored and the proportion of each load intensity is analyzed. At the same time, many implementation factors need to be monitored during the training process, including injuries, nutrition, psychology, etc. Therefore, the monitoring of the sports training

process not only includes the monitoring of the training effect, but also needs to pay attention to the monitoring of various influencing factors in the training implementation. Model analysis results are shown in Figure 4.

Consider that the steps of exercise training are themselves a dynamic process. Therefore, the monitoring of the training process is also a dynamic process. As long as the exercise training process takes place, exercise-related monitoring should be carried out. An important feature of the athletic training process is its long-term and uninterrupted nature. Therefore, training process monitoring should also be a long-term, uninterrupted process. Scientific researchers and coaches are the main body of sports training monitoring. Through the overall optimization and coordinated development between the systems in this paper, the maximum function of the system can be exerted. The system can play the maximum benefit of the whole system. Competitive sports training process is a complex system engineering. The system monitors the athlete's training process. The purpose of monitoring is to optimally integrate the various elements that make up the training system. The system optimizes the training effect through training. They are responsible for the development of a monitoring plan for the exercise training process. They are also responsible for the selection and design of monitoring methods, implementation of the monitoring process, analysis of monitoring results, determination of regulatory information, etc. They organize and control the entire athletic training process.

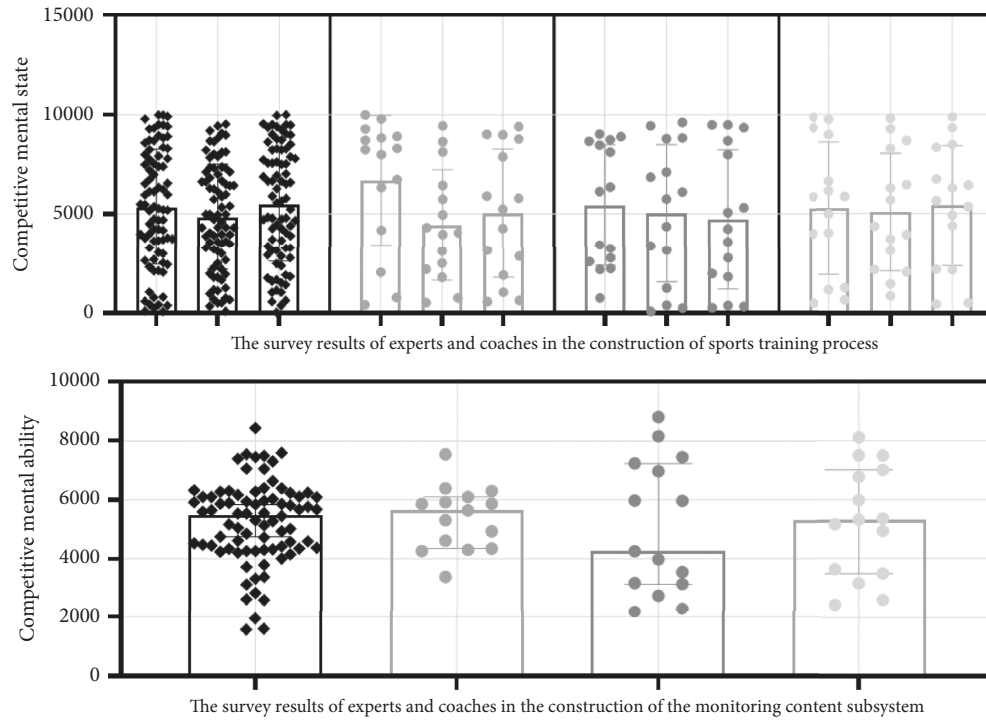


FIGURE 4: The survey results of experts and coaches in the construction of the monitoring content subsystem.

Scientists monitor the entire exercise session. Athletes are the only objects to be monitored during sports training. In the training process, the training load, competitive ability, and body function of the athlete need to be considered. The changes and recovery of the athlete’s body, injuries, nutrition, etc. are all direct objects of monitoring during sports training. Model analysis results are shown in Figure 5.

The main purpose of sports training is to maximize the potential of the human body and ensure that sports can create the best results. Training needs to achieve this purpose and ensure that the training process is scientific. Existing research needs to improve the quality of training and then improve the training effect. The purpose of sports training process monitoring is to constantly check, monitor, and evaluate sports behavior. The monitoring and implementation of the sports training process is divided into two stages. The first stage is to monitor and examine various factors in the athlete’s training process. The second stage is to evaluate and analyze the monitoring results. This article proposes revisions or suggestions for the next stage of the training plan. These two processes do not exist in isolation but are closely linked. The former is the premise and foundation of the latter. The latter is the purpose and result of the former. This paper establishes a comprehensive, systematic, and effective monitoring system for sports training process, i.e., scientific monitoring of the process of implementing sports training. The core components of the scientific monitoring content system established in this paper mainly include two aspects: one is the construction of the monitoring content subsystem of the sports training process; the other is the screening and determination of the specific indicators of each monitoring content subsystem.

Among them, the establishment of the monitoring content subsystem is the primary problem to be solved in the monitoring of the training process of each sports event. Model analysis results are shown in Figure 6.

3.2. *The Concept, Connotation, and Extension of “Sports Training Process Monitoring”*. The ultimate goal of athletes participating in sports training is to achieve good sports performance in competitions. Good athletic performance is primarily achieved through athletic training. The monitoring of the sports training process is to ensure the training effect of the athletes, so that the athletes can train scientifically during the training process. Ensure that athletes achieve good sports performance in competitions. Therefore, the content of sports training process monitoring should mainly be to monitor the impact of sports performance and sports training process, so that all factors are beneficial to athletes to finally obtain good sports performance.

In summary, this paper summarizes the research content. This paper considers that the main factors affecting sports performance and sports training include two aspects: internal factors and external factors. The internal factors are mainly the factors of the athletes’ own competitive ability. The main factors include the athlete’s body shape, function, and athletic quality, including the athlete’s technology, tactics, psychology, and intelligence. The external factors are mainly the adaptation to the training and competition environment: the natural environment, social environment, sports nutrition guarantees and sports medical guarantee, and other conditions during exercise. Model analysis results are shown in Figure 7.

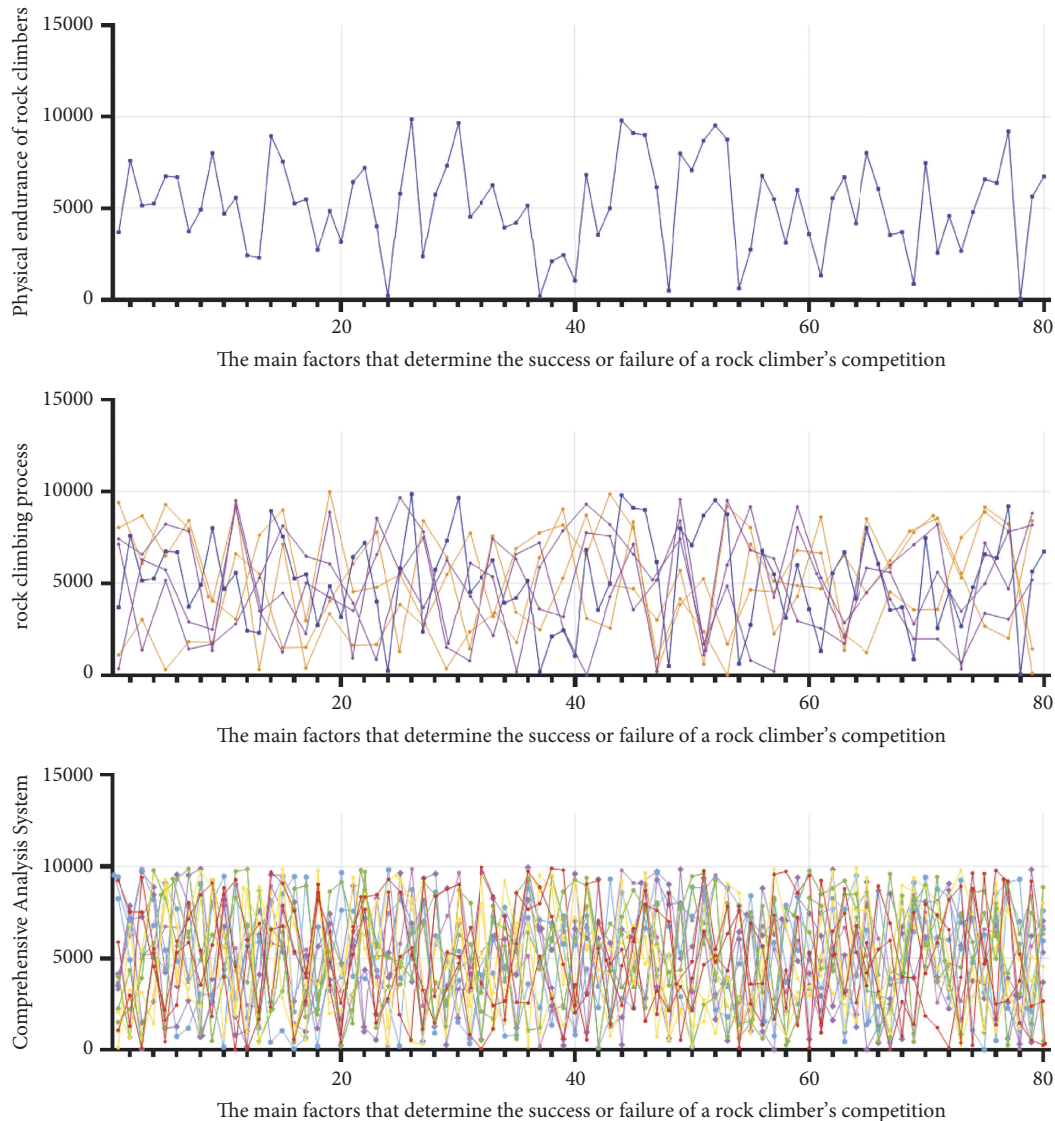


FIGURE 5: The main factors that determine the success or failure of a rock climber's competition.

From the above analysis, it can be seen that the factors affecting the sports performance and the implementation of the sports training process are relatively complex. Some factors are beyond the control of athletes and coaches. The current athlete's competition environment, referee's behavior, competition rules, social conditions, etc. will all have an impact. Therefore, the monitoring content of the sports training process is selected. Often there is a need to choose what athletes and researchers can control. In general, there are many factors that influence athletic performance and the implementation of the athletic training process. The importance of various influencing factors is also different. Therefore, through the research of this topic, the main goals are as follows: (1) Establish a systematic idea of comprehensive monitoring of athletes' training process with multidisciplinary, multiangle, and multi-index. (2) Conduct theoretical research on training process monitoring, in order to guide practice and provide theoretical basis. (3) Through the preliminary research on the scientific monitoring system

of the training process of elite rock climbers, provide reference for the specific training practice of our country's elite rock climbers.

When selecting monitoring indicators, on the one hand, the importance of indicators should be considered, including the influence of natural growth, training factors, or other factors. Factors that are subject to change or can be modified are usually selected for monitoring. For adult athletes, height is usually relatively stable and should not be used as a monitoring metric. Athletes' personality is related to their blood type, and their personality is generally not easy to change. Athletes' weight, strength, and body fat ratios change frequently. This article can choose these indicators. Model analysis results are shown in Figure 8.

The characteristics of each sport and the rules of winning are different. The index systems for monitoring the sports training process of different sports are different. This paper further explores the connotation and extension of "training process monitoring." This paper initially constructs a



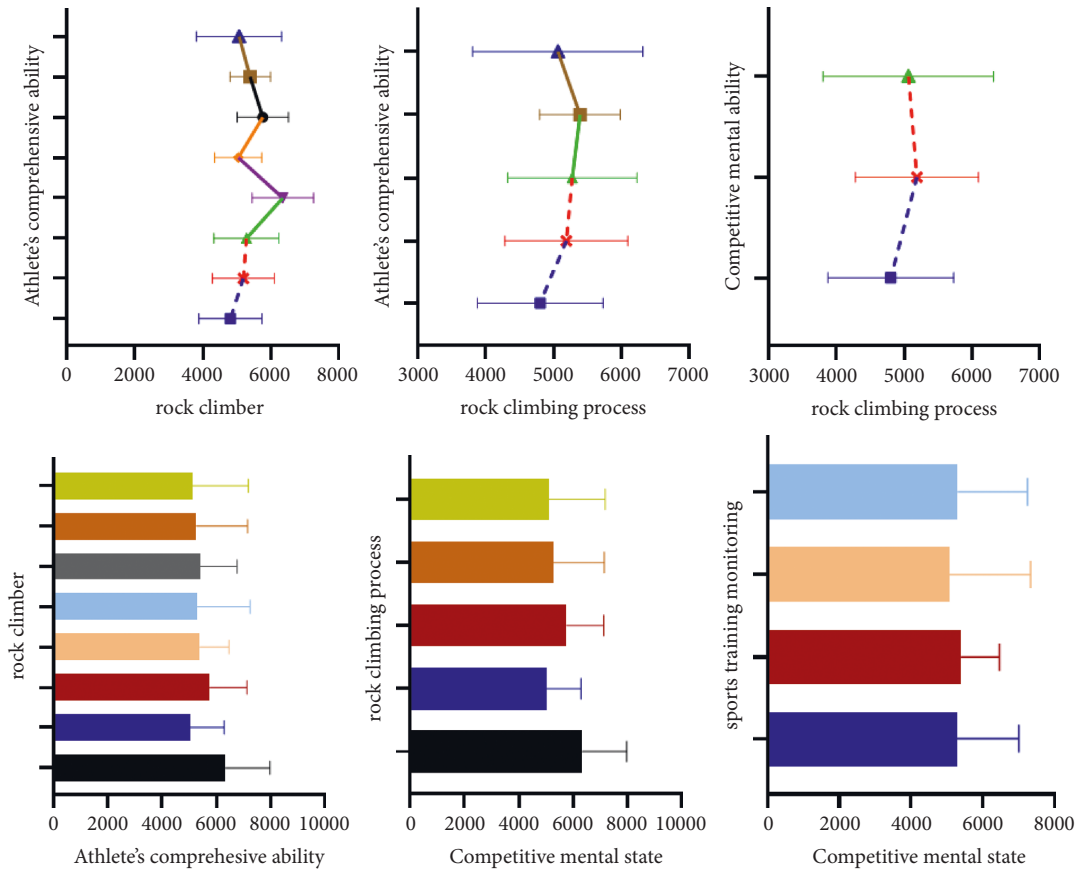


FIGURE 6: The main factors that determine the success or failure of a rock climber's competition.

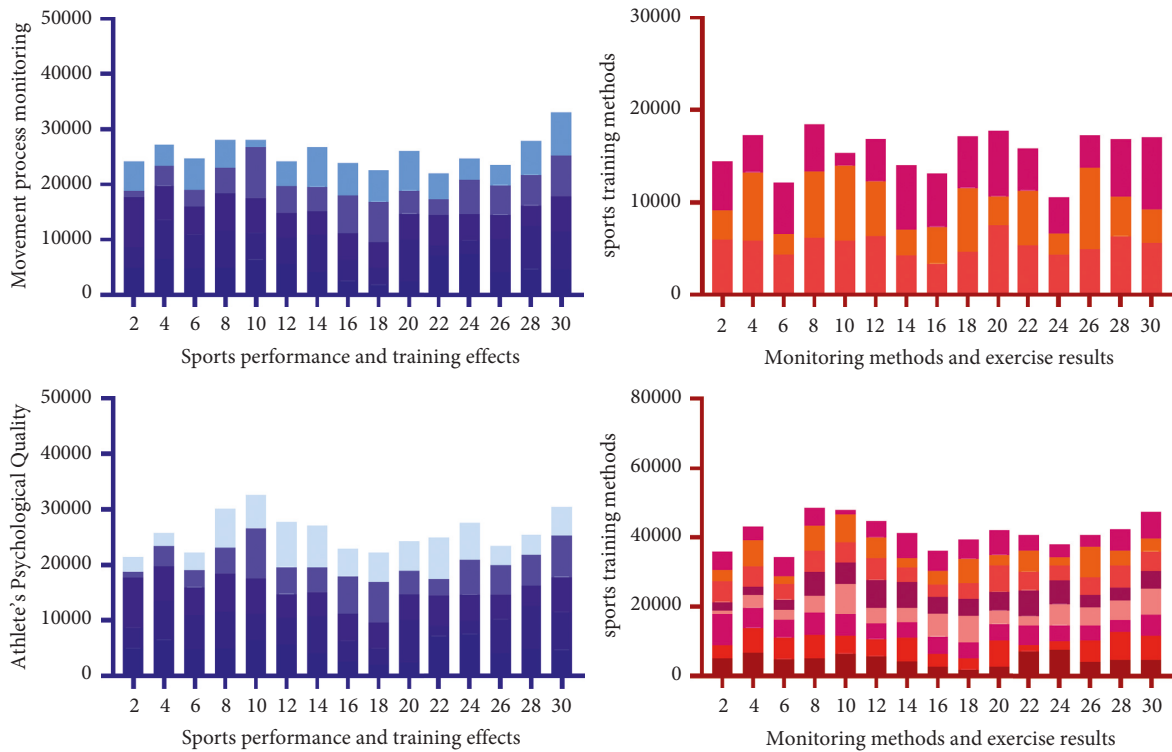


FIGURE 7: Comprehensive results analysis of the effect of rock climbing on physical function.

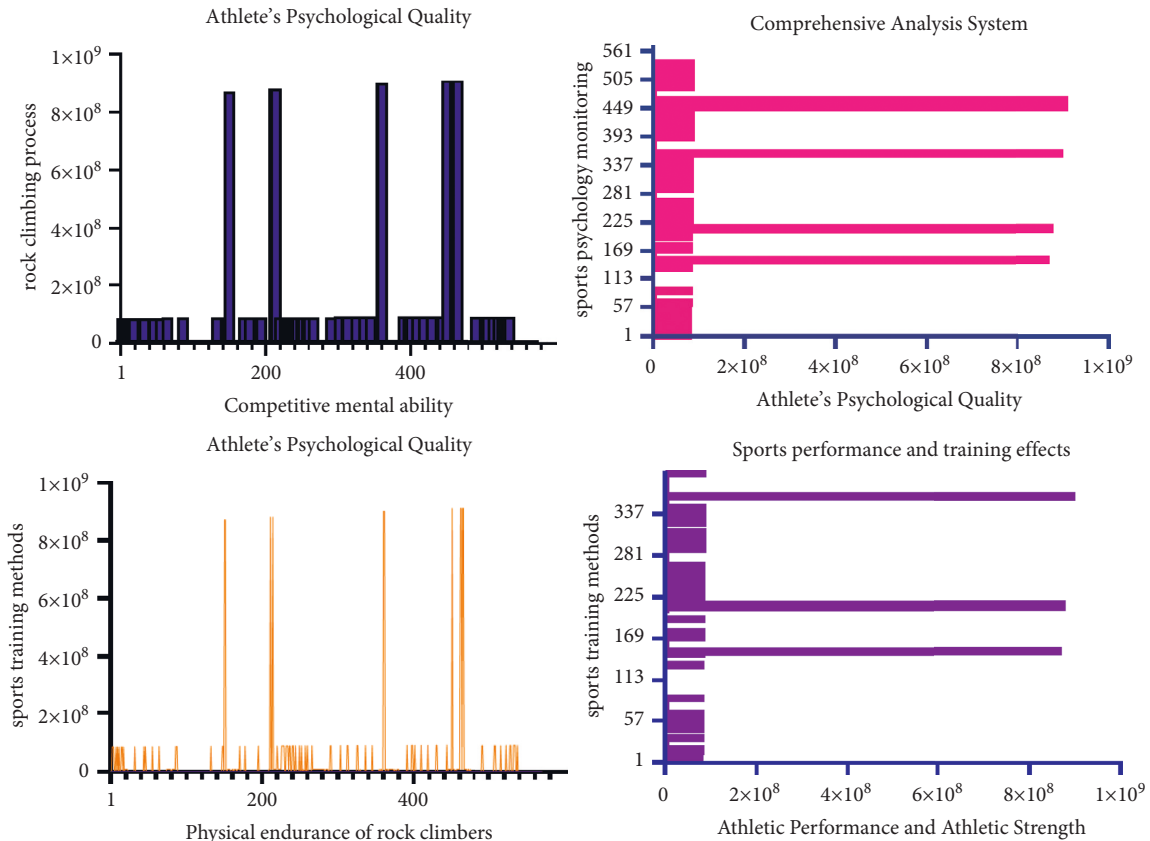


FIGURE 8: The introduction to translation tools and the translation tasks.

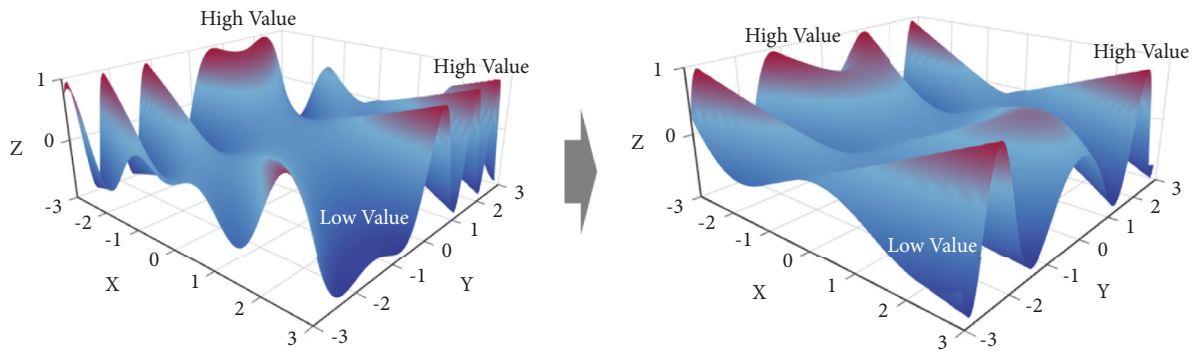


FIGURE 9: The schematic diagram of result monitoring and process monitoring of sports training.

theoretical system of scientific monitoring of the training process of elite athletes. In this paper, a scientific monitoring system for the training process of our country's outstanding rock climbers is established. This paper explores the operation mode of the scientific monitoring system for the training process of excellent rock climbers in our country. For the same event, regular training results are formed according to the athlete's physical development and motor skills. At each stage of the athlete's training process, the focus and indicators of scientific monitoring are different, based on different periods of the big cycle of annual training. The focus of scientific monitoring of the athletic training process and the timing of indicator testing vary. For the same sport,

due to individual differences, the focus and indicators of athletes' training process monitoring will also be different. For the same monitoring index, the monitoring and evaluation standards for different events and different athletes should also be different. Model analysis results are shown in Figure 9.

3.3. Definition of the Concept of "Sports Training Process". Competitive ability development status monitoring subsystem: This paper mainly examines the subsystems of athletes' evaluation of training effects. Competitive ability is the decisive factor for athletes' performance. Improving the

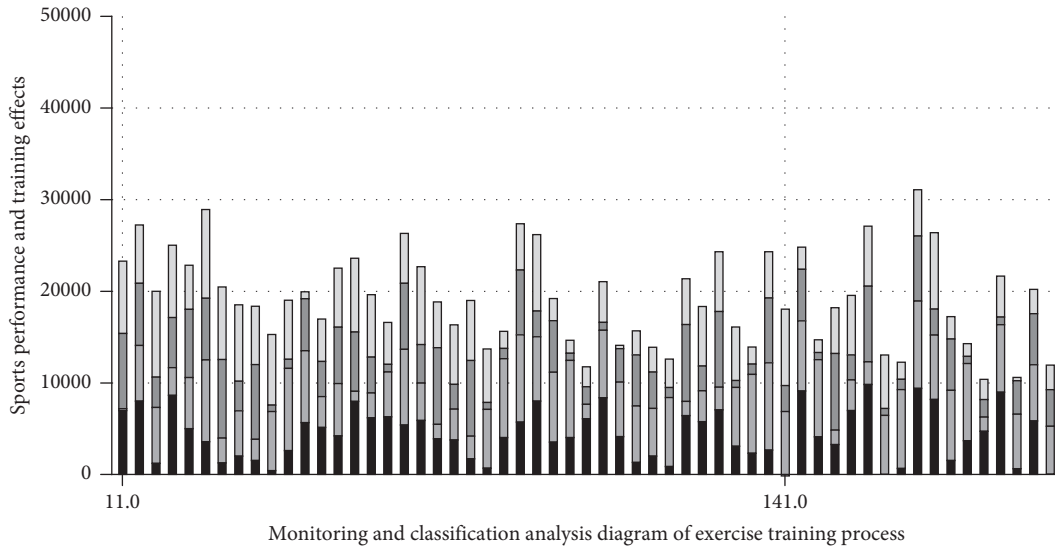


FIGURE 10: Monitoring and classification analysis diagram of exercise training process.

athletic ability of athletes is the fundamental task of sports training. The quality of sports training is mainly reflected in whether the athletes' competitive ability has been effectively improved. Therefore, each factor that constitutes competitive ability should be the content to be monitored. Model analysis results are shown in Figure 10.

The monitoring of the development of athletes' competitive ability mainly includes factors such as physical fitness. Specifically, these factors include monitoring of form, function, quality, technical ability, tactical ability, and psychological ability. Through systematic monitoring, this paper mainly checks whether the exercise training can be carried out effectively according to the special needs and whether training goals are effective in improving all aspects of an athlete's performance. This paper examines the adopted training plan, training methods, and means through systematic analysis. This article analyzes the endurance of athletes in the training process. Athlete training load condition monitoring subsystem: The system mainly analyzes the development of athletes' competitive ability, through the scientific monitoring of the training process of our country's outstanding rock climbers. Carry out research on the operation mode of rock climbing and explore the optimal solution for scientific monitoring. This paper attempts to take the system theory as the guiding ideology. This paper further enriches the existing research results on the physical function monitoring of rock climbers through the research on the development structure and organizational model of the sports monitoring system. The system can maximize the advantages of multisensor FDA technology and monitor athletes' exercise process and exercise effects in an all-round way. The monitoring system can integrate multisource data and further analyze the main factors affecting the training effect of athletes. The standard is that scientific research serves training practice. The rules are formed by monitoring the "best competitive state" with analysis of the training effect of athletes. The development of competitive ability mainly depends on the athlete's own various training loads.

Athletes' competitive ability needs to be improved appropriately. The training load actually experienced by the athlete during training requires further analysis. Therefore, the system mainly monitors the various loads and load intensity that athletes actually bear during training. During training and competition, the daily physical and mental state of the athletes was monitored. The system is mainly to ensure the normal training and competition of athletes and provide good physical and mental state monitoring. A good physical and mental state is a prerequisite for athletes to participate in training. This article monitors the impact of training on physical function and psychology of athletes, with systematic analysis of physical and mental fatigue and recovery of athletes. Model analysis results are shown in Figure 11.

*3.4. Definition, Connotation, and Extension of "Monitoring".* This paper further analyzes and examines the actual effect of the training method. The research results of this paper provide a basis for arranging the next training. Athlete's physical and mental health monitoring subsystem: Like the physical and mental state monitoring subsystem, this system is provided to ensure the normal training of athletes. The system serves athletes by providing a method of monitoring good physical and mental training. In addition, the method can safeguard the health of the athlete, to ensure the normal performance of the athlete's sports training activities. The games will participate in the competition in the best competitive state and achieve excellent sports results. The monitoring of sports training process is a systematic project. What matters is the human factor. In the past, people mistakenly thought that monitors were tests. How the results are used is up to the coach. And the coaches cannot fully understand the monitoring information. The result is a disconnection between research and training. Therefore, the study believes that the task of monitoring personnel is not

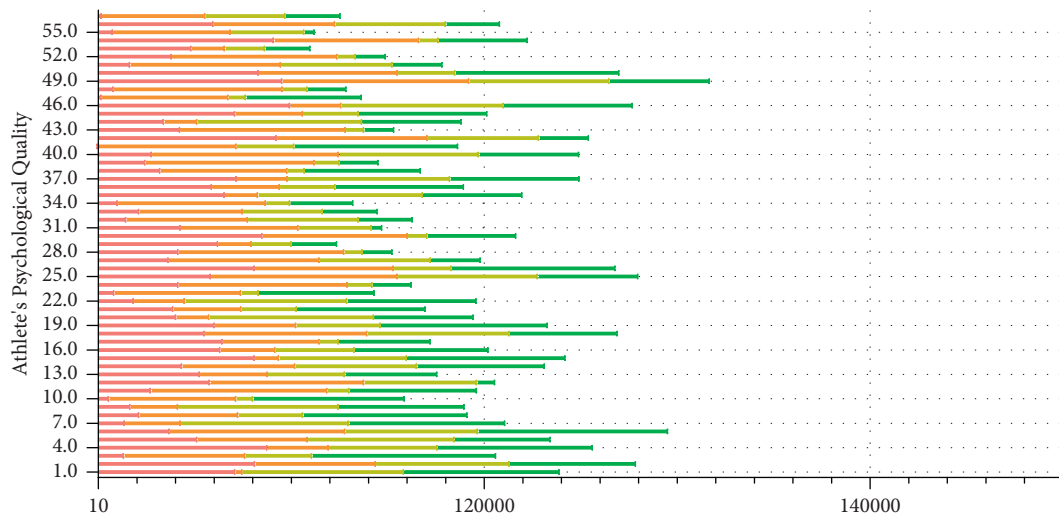


FIGURE 11: Classification and analysis of contents of psychological monitoring of climbing athletes.

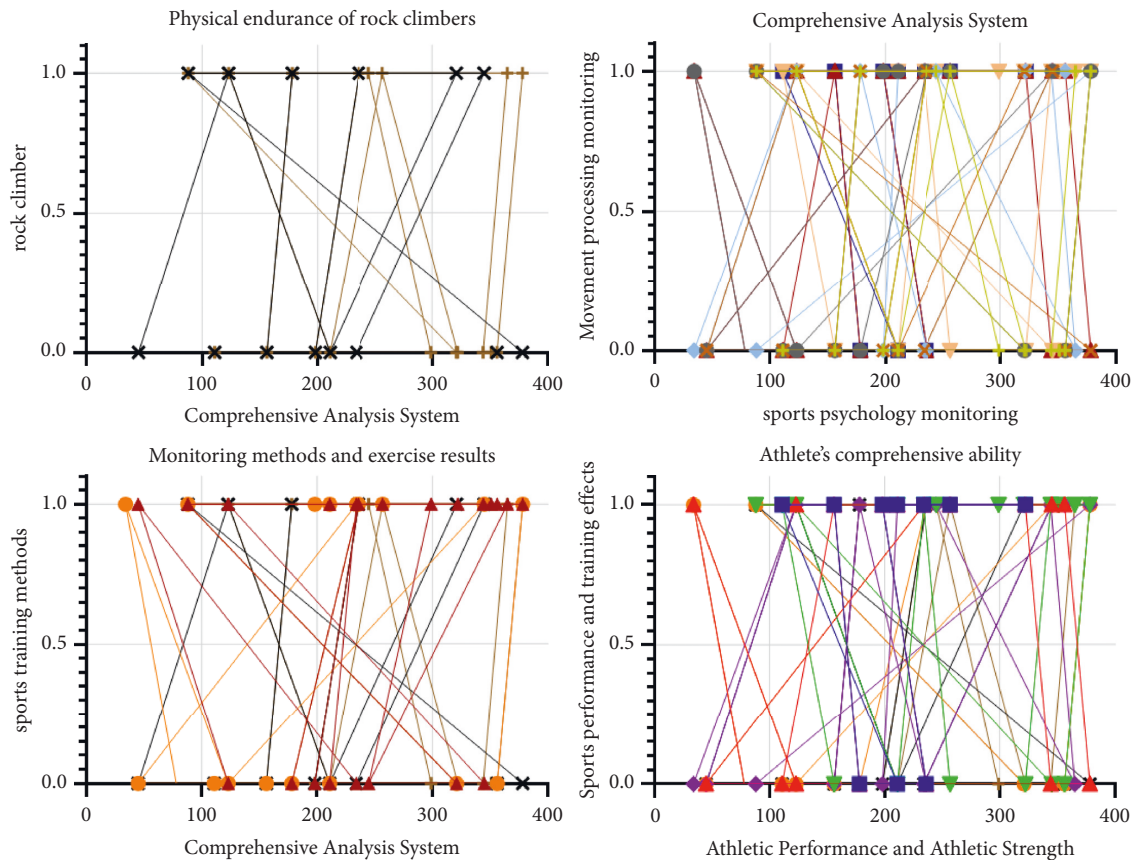


FIGURE 12: Analysis on the competitive psychological ability index of excellent rock climbers.

only monitoring, but also analyzing monitoring results, thereby formulating control information. However, this part of the content is isolated mainly for the convenience of analyzing the problem. At the same time, athlete's health is often linked to injury. Athletes require specialized medical staff services. The monitoring of physical

and mental states focuses on the monitoring of the physical and mental recovery of athletes during training. Then, the monitoring of physical and mental health mainly focuses on the monitoring and prevention of physical and mental diseases of athletes. Model analysis results are shown in Figure 12.

## 4. Conclusion

*4.1. Construction of the Monitoring Content System and Subsystem in Sports Training Process.* Nutritional status monitoring subsystem: This system is a subsystem to ensure the normal training and competition of athletes. Athletes require different amounts of energy during any exercise. Athletes need a variety of vitamins and trace elements to adjust their physical condition. All activities of athletes need nutrition to support. This article monitors the nutritional status of athletes, on the one hand, to ensure the necessary energy for athletes' training, and provides a variety of nutrients that maintain the body's work, to ensure that athletes participate in training and competition with optimal nutritional status. On the other hand, the system also provides a reference for analyzing the physical function of athletes. According to the analysis of the connotation and extension of sports training process monitoring, we believe that the main subject areas involved are sports training, special training, and sports physiology, including sports biochemistry, sports biomechanics, and so on.

For the physical function of athletes, sports training regards it as an important part of physical fitness, a systematic classification of bodily functions. There is no clear consensus yet. To facilitate analysis of the operation of athletic training practices, this article further classifies the physical performance indicators of athletes. This study mainly includes two aspects. On the one hand, it includes content that is directly related to growth in athletic performance. After a period of training, the functional indicators of the movement circle can significantly change. In the process of monitoring the sports training process, such indicators are mainly periodic monitoring indicators. These metrics can often be used to aid in the inspection phase of training effects. On the other hand, these indicators can positively reflect the main situation of the athlete's functional changes, including heart rate, blood lactate, blood urea nitrogen, etc. There are many general goals for monitoring the exercise training process. First, effective monitoring metrics need to be identified. Use reasonable methods and means and follow efficient monitoring activities implementation procedures. This method is beneficial to timely check the effect of athlete's training, analyze the reasons for the various effects, and propose specific countermeasures. In sports training process monitoring, such indicators are mainly real-time monitoring and daily monitoring indicators. These indicators are mainly used to monitor the size of the body's training load. It includes functional indicators of the body's fatigue recovery status and physical health.

*4.2. The Main Factors in the Implementation of the Exercise Training Process.* 80% of experts thought this classification was relatively appropriate. 20% of the experts considered it inappropriate. There are many experts who hold negative opinions in the return visit. The main reason for their denial is that they think it is difficult to distinguish mental abilities from mental states. It is more difficult to achieve that in

practice. We also need to consider these issues in the initial classification. In practice, the design contents of many psychological scales and questionnaires often intersect with each other. It is difficult for the system to find a psychological scale or questionnaire that can address these questions. Based on fully summarizing and exploring the existing training rules, an index system for scientific monitoring of the training process of elite rock climbers is constructed. This paper explores its operation mode and practice method. However, it is precisely because of this that we feel it is necessary to systematically analyze the exercise training process. This article needs to analyze the psychological problems of athletes in all aspects. Therefore, we need to monitor athletes from the perspective of competitive mental ability and competitive mental state. The so-called competitive psychological ability mainly includes the athlete's psychological ability, which refers to the individual psychological characteristics of the athlete related to training and competition. According to the needs of training and competition, grasp and adjust the psychological process of athletes. The focus of sports system analysis is to analyze the athletic ability of athletes. This has also become an important part of the monitoring of athletes' competitive ability.

*4.3. The Controllability of the Implementation Factors of the Sports Training Process.* It should be noted that these three are not completely separate. The analyses of different systems are both distinct and complementary. Competitive mental ability is the same as physical ability, skill, and tactical ability. This ability is gradually formed through the transformation of the special training process, to meet the needs of the special development of physical exercise. It focuses more on the development of athletes' abilities. The athlete's competitive mental state is actually the actual performance of the athlete's mentality. It focuses on the monitoring of short-term psychological changes in athletes. Competitive mental ability can be rapidly improved through continuous exercise. Mental health is the guarantee for athletes to maintain good competitive mental ability and competitive mental state. At the same time, good competitive mental ability and competitive mental state are beneficial to the mental health of athletes. They help to resist the occurrence of various mental illnesses. We need better serve the sports training practice service for our country's sports scientific research, in order to improve the scientific level of competitive sports training in our country, formulate sports research and training policy services for relevant departments of the State Sports General Administration, provide reference for the system and operation mode, and provide reference for our country's rock climbing sports to prepare for the 2008 Beijing Olympic Games.

## Data Availability

The data used to support the findings of this study are available from the author upon request.

## Conflicts of Interest

The author declares that there are no conflicts of interest.

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