

A Method for Improving Aerobics Performance Considering the Principles of Sports Mechanics

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Abstract: In aerobics, the principles of sports mechanics can be used to explain and predict the performance and physical condition of athletes. Through scientific strength training, skill training, body posture adjustment, and scientific evaluation, the performance of aerobics can be effectively improved. By studying the current situation of general aerobics performance, it was found that competitive aerobics in China has not been fully developed, and students' knowledge is aimed at training aerobics for the purpose of further education. Therefore, it is important to analyze the principles of sports mechanics in improving the performance of aerobics. Finally, by effectively formulating training plans, scientifically evaluating athletes' training results, combining intelligent training with sports mechanics and biotechnology, and utilizing motion capture technology and biofeedback mechanisms for fine movement adjustments, these strategies aim to improve aerobic training results and strengthen the implementation of more personalized training plans.

Keywords: Kinematics; Aerobics; Performance improvement; Physical training

1. Introduction

Over the past few decades, calisthenics has rapidly gained popularity around the world, becoming a popular competitive and fitness activity. However, in order to improve the performance of aerobics, it is necessary to deeply understand and apply the principles of motion mechanics. This paper will discuss the application of the principle of motion mechanics in aerobics, and put forward some targeted improvement strategies. Motion mechanics studies the relationship between changes in the state of motion of an object and the forces applied to it. In calisthenics, the principle of motion mechanics can be used to explain and predict the athlete's performance and body state. For example, Newton's second law can explain the relationship between acceleration and force in a jumping motion, the law of conservation of momentum can be used to explain the maintenance and adjustment of body posture, and the law of conservation of energy can analyze and optimize the efficiency of an athlete's movement.

2. Status of aerobics performance

With the improvement of the technical level of aerobics, the difficulty of movements is also constantly changing. If athletes want to achieve good competition results, they need to use higher difficulty to design and arrange. Among them, the completion quality of difficulty in aerobics is the most important. With the revision of various versions of the rules, more detailed explanations have been provided for the minimum standards and deduction criteria for each difficulty. If the quality of difficulty completion is high, higher completion points can be obtained. If the quality of difficulty action completion is poor, it will result in a decrease in difficulty and completion points. Therefore, it is necessary to improve the understanding and requirements for the completion quality of the entire set of movements, strengthen the targeted training, and continuously improve the performance ability of athletes in order to better cope with the increasingly fierce competition. Competitive aerobics has developed rapidly with the rise of aerobics. In recent years, youth competitive aerobics in various countries have made significant progress. Although it started relatively late in China, in the process of cultivating youth competitive aerobics, it has gradually developed towards standardization and systematization, especially in the training of basic skills. It is constantly developing along the unique characteristics of competitive aerobics. This has kept the development of the project thriving [1].

At present, the domestic competitive aerobics are basically carried out in various universities and

professional sports associations in China, and the development of middle school sports and fitness teams in various provinces and cities is not very good. Many high school competitive aerobics athletes generally study for the purpose of studying only for further study [2], so their sports level will not be greatly improved in a short time. Therefore, in the middle school, the level of competitive aerobics athletes has not improved for a long time. Therefore, in terms of physical quality, movement design and the quality of completed movements, there is a big gap compared with the international and domestic high-level competitive aerobics [3]. Therefore, competitive aerobics players in high school should start from improving the stability of movements, improving technical movements, strengthening the training of comprehensive quality, improving the difficulty of movements, and improving the innovation and quality of complete sets of movements, so as to form their own style of movements stably.

3. The importance of the principle of exercise mechanics in the improvement of aerobics performance

In recent years, many scholars have conducted extensive research on aerobics and expressed many different opinions. Firstly, the principles of sports mechanics can help us understand and analyze the movement performance and physical state of aerobics athletes. In aerobics, the posture, smoothness, accuracy, and aesthetics of athletes' movements are all very important factors, and the principles of sports mechanics can help us understand the relationship between these factors and the forces applied to athletes. Every movement of aerobics is coordinated with various parts of the body, and through the coordination of hands and feet, one's body reaches a perfect state to obtain ideal scores. These are all combined with the theoretical basis of sports mechanics principles. Therefore, studying the role of sports mechanics principles in aerobics and improving their aerobics performance has high value [4].

In order to maintain physical stability, aerobics athletes need to overcome various external obstacles, so from the start to the end, they must be in a relatively stable equilibrium state, which is the so-called equilibrium stability. Equilibrium stabilization can also be described by the stability coefficient. The stability coefficient refers to the difference between the balance moment and the flipping moment, the ratio of the body weight and the gravity arm, also known as the balance moment. When the stability coefficient is less than 1, it indicates that the athlete has received external interference and its body balance is broken. When the stability coefficient = 1, the athlete's body is in a critical state. When the stability coefficient is greater than 1, it indicates that the athlete's body has overcome the external interference and is in a state of balance.

Through the analysis of the mechanical principles of static and dynamic movements, it can be found that improving the performance of aerobics athletes can be achieved by improving the balance and stability of movement. From the above analysis, it can be seen that the larger the supporting surface area, the smaller the height of its center of gravity, and the larger the weight, the better its balance and stability. Therefore, various methods such as appropriately expanding the support surface range, reducing the center of gravity position, increasing the balance angle and strength can be used to enhance the stability of athletes' balance, thereby improving their sense of balance and ultimately improving their performance in the competition[5].

4. Aerobics performance improvement path based on the principle of motion mechanics

4.1 Effectively develop training plans based on the principles of motion mechanics

Through the analysis of the movement mechanics principle of aerobics movement, it is helpful for athletes and coaches to analyze the key points of each movement, and carry out targeted and personalized training and practice for the aerobics athletes in the usual training, so as to make the aerobics score better and make the athletes get better performance in the competition. In training, coaches can provide targeted training plans for athletes according to the stress of aerobics movements to help them overcome their weaknesses.

Some athletes have poor balance, for example, in leg swinging movements where two legs are straight and together, one leg is slightly bent, and the other leg swings left and right, with high requirements for the height of the swing. During the process of completing this action, it is necessary to strictly control the height and height of the swinging leg, as the inertia of rotation and the support points of the body have a significant impact on the stability of this action. In the early stage of swinging the legs, it is necessary to use the principle of center of gravity to rotate the muscles, allowing the legs to obtain greater initial velocity and rotational kinetic energy, thereby driving the body to rotate. In the final stage of the movement, in order to maintain stability and balance of the body, it is necessary to bring the center of gravity closer to the axis of rotation, in order to better control the acceleration and

braking of both legs. In the twist type of movements, the body rotation is performed on a certain straight line, which requires appropriate adjustments to the relationship between the waist and limbs to ensure the size and strength of the rotation, and to ensure uniform, fast, and accurate movements to achieve high scores. Through the relevant mechanical analysis of the movement, it can be seen that in the process of turning, the amplitude of the arms and feet and the selected rotation radius will have an impact on the completion of the movement. If the body cannot maintain its center of gravity well in the movement, there is likely to be a deviation of the movement, which will affect the play of the movement. In the process of completing the rotation, it is necessary to grasp the extension of the limbs, grasp the timing and intensity of the power, keep all parts of the body balanced, and properly control the floating rotation of the rotation, so that the rotation of the body is smooth. Such situations can be guided by a coach, by training their body in terms of balance, so that they can better use their strength in the game.

4.2 Scientific evaluation of athlete performance based on the principles of sports mechanics

The technique of aerobics and the reserve plan of the body is a closely related process of gradual development from low to high, and the training plan must be controlled. The principle of motion mechanics can be an ordered combination of the sequential nature of the training process and the logical nature of the training content. It shows the logical connection of training content in different stages of the training process. First, it is possible to observe the movements of the athletes, including key movements such as starting, jumping, and landing, and analyze their technical details. Through the principles of motion mechanics, we can understand the fluidity, accuracy and aesthetics of the movement, as well as the strength, speed and rhythm of the athlete during the execution of the movement. Secondly, the body posture can be measured, which affects the performance of the athlete to a great extent. By measuring the Angle, position and posture of the body, it is possible to understand whether the athlete's body posture meets the technical requirements and analyze its impact on the stability and control of the movement.

Some aerobics athletes have weak endurance and may experience physical exhaustion during long-term competitions. Therefore, coaches can provide them with overloaded training based on their physical condition, allowing them to persist in high-intensity training even when fatigued, thereby cultivating their perseverance, overcoming various difficulties, and completing competition tasks. Some athletes have poor explosive power in their lower limbs, and the height of their takeoff cannot meet the requirements for the subsequent twist movements, resulting in movement errors and low scores. Based on this, coaches should guide athletes to regularly strengthen their lower limb strength training, so that they can proficiently master the methods and timing of exertion, and provide appropriate guidance on the strength and amplitude of the rotation. Only in this way can the combination of sports movements be more coherent and beautiful, and ultimately achieve better aerobics results.

In short, the scientific evaluation based on the principle of sports mechanics can help to understand the performance level of athletes, find out the existing problems and the direction of improvement, and provide a scientific basis for further improving the technical level of aerobics athletes.

4.3 Intelligent training by combining motion mechanics and biotechnology

With the progress of science and technology, especially the rapid development of biotechnology and artificial intelligence technology, it provides a new perspective and tools for the training of aerobics. Based on the principle of sports mechanics, combined with biotechnology (such as EMG, ECG, etc.) and artificial intelligence technology (such as machine learning, deep learning, etc.), the athlete's training process can be intelligently monitored and guided.

Specifically, EMG technology can be used to monitor the muscle activities of athletes in the training process in real time, and the monitoring data can be processed and analyzed through machine learning and deep learning technology to obtain key information such as the muscle fatigue degree and the accuracy of movement posture of athletes in the training process. Then, according to the information, the principle of motion mechanics is used to adjust the training plan in real time to achieve better training results.

In addition, virtual reality (VR) and augmented reality (AR) technology can also be used to provide athletes with a realistic and interactive training environment, so that athletes can train in a scene closer to the real game, thereby improving the efficiency and effect of training. For example, VR technology can be used to simulate the game scene and let the athletes train in the simulated game to improve the competition adaptability and psychological quality of the athletes.

In this way, not only can improve the scientific and effective training, but also can reduce the risk of injury in the training process, so as to improve the training enthusiasm of athletes and competition results. This method fully embodies the combination of motion mechanics principle and modern science and technology, and opens up a new path for the performance improvement of aerobics.

4.4 Fine-grained motion adjustment through motion capture technology and biofeedback mechanism

Every movement of calisthenics needs fine regulation to achieve the best results. However, it is difficult for traditional training methods to accurately evaluate and adjust every minute movement of athletes. To do this, we can combine motion capture technology and biofeedback mechanisms to provide athletes with a completely new way to train.

First of all, the motion capture technology is used to capture the three-dimensional motion of the athletes' training process to obtain the detailed data of each movement of the athletes. These data can include the athlete's body posture, joint Angle, movement speed and other aspects of information. Then, based on these data, using the principle of sports mechanics to accurately analyze and evaluate the movement of athletes, find out the problems and shortcomings in the movement.

Next, a biofeedback mechanism can be used to feed the results of action analysis back to the athlete in real time. This can be done by sight, sound or touch. For example, virtual reality technology can be used to display the movements of athletes in a three-dimensional form, so that athletes can intuitively see their movements and adjust according to feedback information. Or, you can use sound or vibration and other ways, the movement of the athlete for real-time prompt and guidance.

In this way, athletes can fine-tune their movements during training, thereby improving the accuracy and effect of their movements. This method can not only improve the science and effectiveness of training, but also enhance the athletes' self-perception and self-adjustment ability, which is of great significance for improving the performance of aerobics.

5. Conclusion

In the process of studying the impact of principles of sports mechanics on the performance of aerobics and improving methods, I gained a deep understanding of the mechanical characteristics and performance of aerobics. By applying this knowledge, more targeted training plans can be developed to improve athletes' performance. Overall, strengthening strength training, especially core and limb strength training, can enhance body stability and movement control. Combining appropriate skill training can optimize the smoothness and accuracy of movements, thereby improving technical proficiency. In addition, by analyzing and adjusting the mechanical parameters during the exercise process, the performance of athletes can be more accurately evaluated and potential problems can be identified. This helps to adjust the training plan in a timely manner to achieve better results. Although some progress has been made, there are still many aspects that need further research. For example, more types of training methods and techniques can be explored to further improve the performance of aerobics. At the same time, further research can be conducted on the physical characteristics and advantages of different athletes to achieve more personalized training plans.

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