LETTER TO THE EDITOR

Modeling and Analysis of the Impact of Haze Environment on the Training Effect of Ice Climbing

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By analyzing the influence of haze environment on the training effect of ice climbing, training plan can be formulated more reasonably. This paper presents a modeling method for the effect of haze environment on ice climbing training based on global optimal solution. Firstly, chaos theory and particle theory are combined organically to map the evoked region of the motion individual's response to the first and second haze stimuli to the nuclear space, and obtain the physiological change factors of the motion individual. Then, using support vector machine theory, the signal transmission in the brain and the same physiological components in the body loop system are obtained, and the haze environment is extracted to climb. The objective function of haze environment on ice climbing training effect is established. The global optimal solution of haze environment on ice climbing training effect is solved. The influence model of haze environment on ice climbing training effect prediction is designed. The experimental results show that the model has the advantages of accuracy and small error, and can accurately predict the training effect of ice climbing in haze environment.

Haze Environment; Ice Climbing; Training Effect; Impact Model

1 Introduction

Ice climbing is a competitive sport derived from mountain climbing. As long as ice can be found, ice climbing can be carried out. It embodies adventure, stimulation, skill, strength, endurance, perseverance and courage, so that everyone who participates in it can fully develop their potential, experience the challenge of fear and enjoy the ultimate challenge. Ice climbing, developed from rock climbing, is a compulsory subject of mountain climbing and snow mountain climbing, and one of the basic skills of mountain climbing. Ice climbing is a sport with the aid of equipment, which requires high quality and durability of equipment. The birth of ice climbing depends mainly on the maturity and progress of three major technologies, namely, ice claw, ice pick and ice climbing technology, which act as the "hand", "foot" and "brain" on the ice surface. In the past, the extreme sports that professional athletes could engage in have become easy to get started and become the favorite winter sports for many outdoor sports enthusiasts because of the protection and development of ice waterfalls, ice walls and the continuous progress of ice climbing equipment in recent years.

Haze pollution is one of the most serious problems of environmental pollution in modern society. More and more evidences show that the physical damage of outdoor sports training group is greater than that of non-sports group in haze-polluted weather. In other words, the disadvantage of sports in haze-polluted weather is greater than the benefit. In the process of sports, the training effect of ice climbing directly affects the athletes' technical level and

sports quality. The training effect of ice climbing is usually influenced by many factors. As the most important link, environmental quality is an important factor to determine the training effect and sports quality of ice climbing. Therefore, how to improve the effect of ice climbing in a better environment has become the focus of research by relevant experts and scholars in the field of sports at this stage, which has attracted wide attention, and many good research results have emerged.

Bin Zhang published an article in the Journal of Ekoloji (Issue 107, 2019) entitled "Modeling and Analysis of the Effects of Aerobic Exercise on Human Cardiovascular Function in Haze Environment". This article mainly analyses the effects of aerobic exercise in haze on human cardiovascular function. Cardiovascular indexes of Aerobic Athletes in haze environment were collected by establishing human cardiovascular model. Taking the parameters of maximum oxygen uptake, maximum ventilation equivalent, oxygen pulse and maximum heart rate as constraints, considering the diffusion and penetration intensity of haze, the mathematical expression of the influence of aerobic exercise on human cardiovascular function in haze environment was established. The cardiovascular system of Aerobic Athletes in haze environment was modeled by using neural network method. The influence model of aerobic exercise in haze environment was established through the simulation of MATLAB and Simulink working platform. Inspired by this article and on the basis of writing, the influence of haze environment on the training effect of ice climbing was studied.

Li and Tian studied the effect of biofeedback training on sports training. With the help of deixis and modern instruments, this article transmits the physiological information of the body to the athletes so that they can learn to regulate their physiological functions. (Hsueh; Cheng, 2017) The implementation of sports biofeedback training needs five stages: introduction, identification, simulation, transformation and implementation. After a lot of research, this article finds that biofeedback training has positive effects on reducing athletes' anxiety, improving muscle performance, combining psychological skills training and improving the effect of sports training in different sports. However, it has not reached the same conclusion yet, so it finally puts forward the formulation of biofeedback for different sports. Some suggestions on training outline and improvement of testing instruments are given. However, although the research has good practicability, there are still some problems with large errors. Gao studied the effects of PNF and WBC on fatigue recovery after exercise in high temperature and humidity environment. The purpose of this method is to study the effects of PNF stretching and cryotherapy on physiological and training indexes after exercise in high temperature and humidity environment, and to provide some references and suggestions for athletes in recovery. Using self-control method, 12 adult male athletes (22.08±2.02 years old) were given three intervention tests, namely sit-in recovery group (CON), ultra-low temperature cryotherapy (WBC) and PNF stretching (PNF), 7 days apart. Each participant in the experiment used different ways of intervention and recovery after exercise to form their own control. Subjects were given an exhaustive exercise with incremental load in high temperature and humidity environment. The ambient temperature was 35 - 38°C and the humidity was 60% - 70%. Then they were given quiet rest, cryotherapy and PNF stretching intervention respectively. Physiological indicators and sports performance were collected in the experiment, and the results were analyzed by SPSS23.0 statistical software. However, the research also has the problems of low accuracy and large error.

In order to solve the problems existing in the existing research methods, a model based on the global optimal solution of haze environment on the effect of ice climbing training was designed.

2 Idea Description

2.1Modeling principle of the impact of haze environment on the training effect of ice climbing

In ancient times, human beings simply realized that the rhythm of life activities was closely related to the change of natural environment. "Neijing" once considered that human life, longevity, longevity and death were closely related to natural rhythm, geographical environment and the alternation of day and night. Therefore, people were required to choose appropriate training methods according to the changes of four seasons and the differences of natural environment. It is a basic principle of physical activity in ancient China (Li 2017) to follow the law of physiological change of organism and conform to the trend of heaven, earth and nature. A large number of research data show that the natural environment will have a certain impact on the effect of sports training.

In the process of establishing the prediction model of haze environment on ice climbing training effect, the sample data of historical haze environment on ice climbing training effect were collected first, and the influence layer structure of haze environment on ice climbing training effect was analyzed. The response loop of individual body to haze environment was formed. Based on this, the effect of haze environment on ice climbing training was predicted.

2.2 Study on the correlation between haze environment and ice climbing training effect based on mixed particles

In the process of establishing the influence model of haze environment on the prediction of ice climbing training effect, the chaos theory and particle theory are combined to map the evoked areas of ice climbing individuals' response to the first-level haze environment stimulation and the first-level haze environment to the nuclear space, to obtain the physiological changes of the body, and to obtain the transmission of signals in the brain by using support vector machine theory. The same physiological components are transported in the somatic loop system (Liu and Jiang 2017).

Assuming that the response of the individual to haze environment is transformed into a completely rational symbol, and the symbol is mapped to the nuclear space, the training set of the initial individual stimulated by haze is set up. After mapping, the initial data is converted to high dimension. In this space, there is a reversible relationship between haze environment and the predicted results of ice climbing training. The data are divided into k particles, in which Li represents the data content of the first particle.

The particle is defined as a hypersphere, and the center and radius of the defined sphere are calculated. Assuming that the positive or negative results of ice climbing individuals' response to haze can affect the subsequent decision-making behavior and decision-making quality, the distance between a random point in high-dimensional space and a hypersphere can be calculated. After obtaining the distance, the mixed particles need to be redefined to obtain the SUPP value (Xu et al. 2016). When SUPP is greater than one of its thresholds, the interaction between body stimulation and sports training has a significant impact on the training effect of ice climbing; otherwise it is considered to have no effect.

2.3 Haze environment based on global optimal solution and the impact model of ice climbing training effect

In the process of establishing the model of the influence of haze environment on the training effect of ice climbing, based on the physiological change factors of the sports body obtained above, the characteristics of the influence of haze environment on the training effect of ice climbing were extracted, and the objective function of haze environment on the prediction of the training effect of ice climbing was constructed. On this basis, the prediction of the training effect of ice climbing under haze environment was carried out.

After updating the set of physiological change factors of the moving body obtained under all dimensional decision-making scenarios as a whole, by calculating the individual historical optimum and the group overall optimum, after updating the physiological change factors of the moving body in each dimension, the velocity vector relationship in the decision-making process is expressed by formula (1).

$$v_i(t) = v_{i1}(t) + v_{i2}(t) + ... + v_{iD}(t) \tag{1}$$

Among them, $v_i(t)$ is regarded as a whole, representing the information of sports training effect, $v_i(t)$ is regarded as the sum of all dimensions, and the updating process of each dimension is searched incrementally. A massless particle i is represented by the velocity vector v_i.

$$v_i = [v_{i1}, v_{i2}, ..., v_{iD}]^T \in R^D, i = 1, 2, ..., N \tag{2}$$

Among them, N represents the number of particles in the population, reflecting the influence of haze environment on the training effect of ice climbing, D represents the number of decision-making influence features, and any particle in the population updates speed and location in the evolutionary process. A prediction model of haze environment on the training effect of ice climbing is established.

$$\begin{cases} vi(t+1) = wv_i(t) + c_1 r_1 (pBest_i - x_i(t)) + c_2 r_2 (gBest - x_i(t)) \\ x_i(t+1) = x_i(t) + v_i(t+1) \end{cases} \tag{3}$$

Among them, x_i represents the position vector, t represents the iteration times, w≥0 represents the inertial weight coefficient, c_1, c_2 ≥0 represents the acceleration coefficient, r1 and r2 represent the random number uniformly distributed in the interval [0, l], pBesti represents the individual optimal solution of the first particle, gBesti represents the global optimal solution of the population. After solving the model, the influence model of haze environment on ice climbing training effect is built.

3 Result

In order to prove the comprehensive effectiveness of the proposed haze environment based on mixed particles for ice climbing training effect prediction and optimization modeling, it is necessary to build a simulation platform of haze environment for ice climbing training effect prediction in the environment of Matlab. The subjects were 20 table tennis majors from a sports university in China, including 15 boys and 5 girls. The average age is 23 years old and the average length of exercise is 3 years. Twenty students were divided into two groups, 10 in each group. One group was set for ice climbing training in non-hazeenvironment; the other group was set for ice climbing training in haze environment. The experimental period was three months.

By using this model and Literature [1] model, this paper compares the statistical and actual fitting degree of the influence of haze environment on the training effect of ice climbing, and the results are shown in Figure 1.
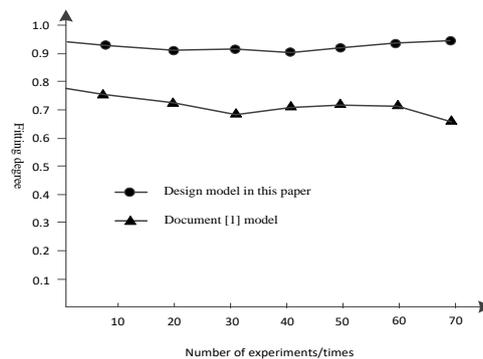
Figure 1 Comparison of statistical results with the real fitting degree

From the analysis of the figure above, we can see that the fitting degree of the state data of haze environment and actual statistics is between 0.9 and 1.0, and that of Literature [1] model is between 0.65 and 0.8. Comparisons show that the designed model has the characteristics of small error and high accuracy.

4 Discussion

This method is compared with the statistical results of literature [1] model on the effect of haze environment on ice climbing training. The results show that the designed model has the advantages of high accuracy and small error. The main reason lies in the model in this paper, first of all, chaos theory and the theory of particle organic combination of individual in primary fog to stimulate to movement and secondary fog stimulate response induced by mapping to the nuclear space, access to individual physiological changes factors, using the theory of support vector machine is then used for the transmission of signals in the brain and body loop system in the same physical composition, extraction of haze environment characteristics of ice climbing, and the effects of exercise training, improve the accuracy of the results.

5 Conclusion

Sports behavior itself is regarded as a background for analyzing cognitive initiation, memory and decision-making behavior of human behavior. The direct results of sports decision-making can be clearly observed or even measured. In order to improve the training effect of ice climbing, an optimized modeling method for predicting the influence of haze environment based on mixed particles on the training effect of ice climbing is proposed. The simulation results show that the model has the advantages of accuracy and small error, and can accurately predict the training effect of ice climbing in haze environment. This method can effectively solve the problems of traditional methods and lay a solid foundation for the good training of ice climbing.

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