

Study on the effect of high intensity interval training on physical health of college students in plateau environment

Ma Xinwen^{1,a,*}

¹Qinghai Normal University, Xining, Qinghai, China

^a549704171@qq.com

*Corresponding author

Abstract: Strong physical fitness is the prerequisite for college students to learn cultural knowledge, but also for the future work and life to provide a strong support and guarantee. However, there are few experimental studies on the influence of plateau environment on the physical health level of college students. Plateau area mainly because of its high cold hypoxia, so as to stimulate the human body, human body function in the environment to adapt to the adaptive changes. Therefore, it is of great significance to explore the teaching means, methods and ways to improve the physical health level of college students in plateau area by investigating the physical health level of college students in plateau environment and its influencing factors. High intensity interval training (HIIT) has been proven to improve physical fitness in the general population. Because of its short time, diverse form and content, and relatively thin movements, HIIT training is loved and welcomed by most students. However, there are few studies on the impact of high-intensity interval training on the physical health level of college students in plateau environment, especially for college students in plateau environment as research objects. High intensity interval training under high altitude environment is a relatively new research perspective. By exploring whether high-intensity interval training in the plateau environment can promote the physical health of college students, this paper designs training programs to conduct experimental intervention for college students in the plateau environment, providing a new training theory reference for university public physical education courses and a training method to improve physical health for college students in the plateau environment.

Keywords: high intensity, college students, plateau environment

1. Research significance

1.1 Theoretical significance

High intensity interval training (HIIT), as a new way of physical exercise, is often used in sports training, public fitness and sports rehabilitation, and has good exercise effects for different sports groups. In the context of the lack of physical exercise and the decline of physical health level of college students in the plateau environment, this study takes high-intensity interval training as an exercise intervention means and incorporates it into the experimental study to explore the feasibility and effectiveness of HIIT on the daily exercise of college students in the plateau environment. This paper summarizes the positive influence of the training method on the physical health of college students, provides suggestions for the implementation of HIIT in the public physical education courses of universities, and explores the training methods that can effectively improve and promote the physical health level of college students in the plateau environment.

1.2 Practical significance

In order to further improve the physical health level of college students under the plateau environment, a training method with high training efficiency and suitable for college students is needed. Starting from practice, this study compares the difference between high-intensity interval training and medium-intensity continuous training on the physical health of college students in plateau environment, and explores which training method is more effective. The daily training program more suitable for college students in the plateau environment can provide effective guidance for the formulation of

programs to enhance the physical health level of college students, provide reference for improving the effect of daily exercise of college students, establish a good form of physical exercise for students, and then broaden the vision of selecting exercise methods, improve the physical health level and exercise enthusiasm. Cultivate the interest of engaging in physical exercise, so that college students can learn more sports ways and develop the habit of lifelong physical education.

2. Research on high intensity interval training

2.1 Research status of high intensity interval training abroad

Two experts, Reindell and Roskanm [1], first proposed the concept of interval training in 1959 and published it.

Ernil Zatopek [2] was one of the first to train with this method and won gold MEDALS in the 5000 m, 10000 m and marathon at the 1952 Olympic Games in Helsinki, earning him the title of "Most Memorable Athlete". Since then, high-intensity interval training has been widely discussed and many people have tried to add this training method to sports training, and it has been preliminarily proved to have a good effect on improving athletes' competitive performance. Experts and scholars from various countries have studied and analyzed the existing physical exercise methods, and creatively obtained the high-intensity interval training method. Because this training method can consume a lot of energy and fat in a short time, it has been rapidly popular in Europe and the United States and widely used in fitness and fitness as well as athletes' daily training since its advent. With the continuous deepening of HIIT research, experts and scholars have found that it is not only suitable for modern lifestyles, but also can be used to improve people's cardiopulmonary function and absolute speed. It is of great benefit to the training of athletes.

Gibala and Mac Donald et al. [3] pointed out that high-intensity interval training (HIIT) has achieved excellent results in endurance training in recent years, and more research experiments have shown that high-intensity interval training can be used as the focus of endurance training. HIIT has a stronger physiological adaptability in healthy people or diseased groups. HIIT training time is significantly reduced, resulting in a decrease in the total amount of exercise.

Bartlett and Close et al. conducted an experiment on 8 male adults who participated in daily sports activities by running with high intensity interval training or running with moderate intensity for 50 minutes, and scored and compared the objective quantified perceived enjoyment of 8 male adults by using the physical activity enjoyment scale after the two running programs. The results showed that intermittent running was associated with a higher enjoyment rating than continuous moderate intensity running.

Costigan and Eather et al. [4] pointed out that high intensity interval training (HIIT) is a very effective method for improving physical fitness and exercise interest of adolescents, and it is worth promoting. Through the systematic study, the researchers elaborated that high-intensity interval training has obvious improvement effect on the heart and lung function of the trainers, and has a moderate impact on the body composition; The study found that the duration of high intensity interval training is one of the important factors to regulate the percentage of body fat, and the longer the duration of high intensity interval training, the more obvious the effect of fat loss. The researchers concluded that high-intensity interval training has a positive effect on both cardiopulmonary function and body composition in adolescents.

Ryzkova et al. used high-intensity interval training to train 16 female college students for 10 weeks, and the waist circumference, body fat percentage, waist-to-hip ratio and resting heart rate of female college students were greatly reduced. Balance and flexibility of the thoracic and hamstring muscles are greatly improved.

2.2 Research status of high intensity interval training in China

Scholar Hu Mengmeng conducted 12 cycles of experimental intervention on 75 college students. HIIT training three times a week has a significant difference in the percentage of body fat in body shape; There were significant differences in basal metabolic rate and comprehensive health score among physical health indicators. The indexes of cardiopulmonary endurance, muscle endurance and muscle explosive power were improved to different degrees, and had obvious effects on improving bone strength and preventing fracture risk in girls.

Scholar Wang Yan conducted an experimental intervention on 18 adult males, using moderate intensity continuous training method and high-intensity interval training method respectively, and selected males who did not often do physical exercise for a group intervention experiment. The two groups compared the changes of body composition, resting metabolic rate and lipid energy supply in the stage of excessive oxygen consumption. Conclusion Both methods can reduce the percentage of body fat, reduce abdominal fat and increase resting metabolic rate.

Scholar Li Xiaochen conducted an 8-week group experiment on 45 college students, and found that the cardiovascular endurance of the subjects had improved, and the improvement amplitude was higher than that of the medium-intensity continuous training group. The amplitude of muscle strength improvement is greater than that of moderate intensity continuous training. Flexibility is also improved; BMI and body weight were significantly reduced in body composition.

Meng Yixiao found that after 13 weeks of intervention of high-strength interval training and resistance training for college students, fat content and body fat percentage of the subjects decreased, indicating that the intervention of high-strength interval training and resistance training had a significant effect on weight loss for college students. In the indicators of health level, BMS and comprehensive health score showed statistically significant differences, indicating that the intervention of high-intensity interval training and endurance training can effectively improve the basic metabolism level and comprehensive health level of college students. In terms of physical fitness, endurance running index, sit-up index, pull-up index, 50 meter running index, standing long jump index have improved to varying degrees. In the comprehensive physical fitness test index, the data of eight sports indexes have been significantly improved, indicating that the intervention of high-strength interval training and resistance training can effectively improve the comprehensive physical fitness level of college students.

Wen Jianfei and Lou Kang [5] pointed out that after 12 weeks of experimental intervention, the body weight, BMI and waist circumference of the subjects were measured again, and it was found that both the experimental group and the control group showed significant declines, and the three indexes of the high-intensity interval training group showed more significant declines.

2.3 Brief summary

Combined with the research results of the above experts and scholars, the relevant research literature at home and abroad is analyzed. At present, the research on high-intensity interval training is gradually becoming comprehensive and multi-dimensional, which indicates the importance of the current sports academic circle on high-intensity interval training. However, at present, there are few experimental studies on the influence of high-intensity interval training on the physical health level of college students in the plateau environment, and there are few references. Therefore, this paper decided to start from the impact of high-intensity interval training on the physical health level of college students in the plateau environment, and analyzed the impact degree of HIIT on the physical health of college students in the plateau environment, so as to fill the gap in the application of HIIT training in the plateau environment, and promote the development of college students' daily exercise and public physical education.

3. Study on physical health status of college students in plateau environment

3.1 Foreign research status of physical health of college students in plateau environment

The International Council for Physical Fitness Research (ICPFR), the International Council for Biological Development Planning (IBP), and the World Health Organization (WHO) all published plans for physical fitness testing in the 1970s. People all over the world are concerned about the physical fitness level of their own countries and nations, and many countries have formulated their own national physical health testing plans and standards according to the above programs, which provides the basic conditions for the research and comparison of physical conditions worldwide.

Physical fitness is called physical strength in Japan, which is a comprehensive assessment of body and mind. The earliest recorded physical testing in Japan began in the year 12. The Japanese system test includes physical diagnostic test, athletic ability test and individual item test, and the test is mainly based on physical diagnostic test and athletic ability test. Every year, the Japanese sports association conducts physical fitness tests for school students, and every two years, it conducts a survey for the

entire population. In Japan, the state will issue each student a physical education textbook including physical fitness test items and the introduction of its standards, so that each student can clearly understand their own physical conditions and carry out targeted physical exercise, and improve the physical health of the whole nation to everyone.

The United States has always attached great importance to the physical health of its people, and closely related to the school curriculum to study the physical health of its people. Since the 1880s, some American colleges and universities have started to conduct Fitness Test, and similar surveys are conducted almost every year. The work of physical testing in the United States began with the release of the Physical Test Act in 1880, which also laid the foundation for the development of future testing work. According to Hirschland and Kraus, the physical fitness of American students is lower than that of their peers in European countries such as Australia, Italy, and Sweden. In 1957, President Eisenhower established the Presidential Commission on Youth Fitness, which is the prototype of the current Presidential Commission on Physique, Exercise and Nutrition PCPFS, and established the YFT (Youth Fitness Test) test index system, which began to be implemented in schools. Since 2012, YFT has been further developed into a national youth physical condition testing system similar to China's "National Student Physical Health Standards", and established the relevant physical fitness testing system (FITNESSGRAM). The system, which has been used in fitness testing across the country, provides teachers and parents with timely feedback on students' exercise. The test index is divided into four parts: body composition, flexibility, muscle strength and endurance quality, and the following indicators are used to test: BMI, seated forward bend, sit-up, pull-up, 1-mile walk and run [6].

3.2 Domestic research status of college students' physical fitness under plateau environment

In Comparative Analysis of Physical Fitness of College students in Plain Areas and Yunnan Plateau Areas, Chen Jing pointed out that the BMI of male college students living in Yunnan Plateau is generally higher than that of college students in plain areas, while there is little difference in female students. College students in Yunnan Plateau area have better lung capacity and worse physical fitness than college students in plain areas.

Hu Li, Long Linjie et al., in the article Study on Characteristics of Physical health Level of female college students living at different altitudes [7], in order to study the characteristics of physical health level of female college students living at different altitudes for different generations, 518 female college students from Liupanshui Normal University who entered the sub-plateau region during the same period in autumn 2015 were selected as subjects. Subjects were divided into low altitude group (family altitude $\leq 500\text{m}$, $n=55$), medium altitude group ($500\text{m} < \text{family altitude} \leq 1500\text{m}$, $n=353$) and high altitude group (family altitude $> 1500\text{m}$, $n=110$) according to the altitude of their family residence. The differences in physical health levels among the groups were analyzed. The results showed that with the increase of family altitude, the physical health levels of the groups increased. Female college students showed shorter body shape, better aerobic endurance and poorer lower limb flexibility.

In his article "Investigation on Physical Characteristics and Health Status of College Students in High-altitude Areas", he selected 100 native Tibetan students living in high-altitude areas of Tibet University as the research group, and 100 Han students living in plain areas as the control group. By reflecting the physical characteristics of college students in high-altitude areas, the study shows that students in high-altitude areas have more obvious advantages than students in plain areas in terms of physical form indicators, students in plain areas are better than students in high areas in respiratory function, students in high areas are better than students in plain areas in cardiovascular function, and students in high areas are better than students in plain areas in physical fitness. This is mainly due to the Tibetan students' lifestyle, sports lifestyle and other aspects of the impact caused by the need to strengthen the students to carry out effective physical exercise.

3.3 Summary

To sum up, both China and other countries in the world attach great importance to the state of national physical fitness, and a large number of in-depth studies have been conducted, showing that there are certain differences in the state of national physical fitness in different regions. There are many reasons for this difference, which are closely related to the natural environment, living habits, and acquired physical exercise. There are few literatures about the physical health status of college students in plateau environment in foreign countries, so the current research status mainly takes the physical health status of college students in plateau area in China as a reference. The objects of this experiment

are college students in plateau environment, hoping that this paper can provide references for domestic and foreign scholars to study the physical health status of college students in plateau environment.

4. Proposed research program

4.1 Monitoring of training load

The high intensity interval training method consists of two parts: training and interval. During high-intensity interval training, the heart rate at exercise intensity should reach 85%-90%HRmax (Max heart rate =220- age). The high-intensity interval training group records the heart rate during exercise immediately after each exercise and at the end of the interval (the next exercise begins). The exercise intensity of moderate-intensity continuous training is 60%-70%HRmax, and the heart rate is recorded during intervals between groups.

By measuring the number of radial pulse 10s immediately after exercise by each training means, multiplied by 6, reflecting the heart rate of students in 1 minute. During the training period, after the training of each group, the subjects were asked to monitor the load intensity by heart rate and subjective judgment according to the six grades of exercise intensity prescribed by the American College of Sports Medicine (ACSM) (as shown in Table 1), and the exercise intensity was determined according to the endurance capacity and subjective performance of the subjects during the training. Make appropriate inquiries to avoid discomfort in exercise and ensure safe training.

In addition, according to the improvement of the training endurance of the subjects, the movement duration of the training program and the interval time between groups were adjusted according to the subjective physical strength of the subjects, so as to control the exercise load to achieve the corresponding intensity.

Table 1: ACSM exercise intensity grade and subjective physical sensation grade

Strength class	Max heart rate (%)	PRE value	Subjective physical sensation	Heart rate range (estimate)
Ultra-small strength	<35	<10	Very light	<69
Low intensity	35-54	10-11	Light	70-106
Medium strength	55-69	12-13	Medium	107-136
Heavy intensity	70-89	14-16	Heavy	137-175
Subhigh strength	≥90	17-19	Very heavy	≥176
Super strength	100	20	Max	197

4.2 Determination of experimental scheme

A total of 154 relevant literatures were retrieved by inputting keywords "HIIT" and "high-intensity interval training" on CNKI. By consulting relevant literatures and establishing an action library, actions were selected from the action library and training programs were formulated. The inappropriately developed training programs were modified through expert interviews, and then pre-experiments were conducted. In order to prevent the interference of the pre-experiment to the formal experiment, there was no significant difference between the two groups of test results before the formal experiment. The results of the preliminary experiment were analyzed to verify the experimental hypothesis. The actions that students completed in poor quality or difficult to complete during the pre-experiment were modified and replaced with inappropriate actions after the expert interview. Finally, the movements with high quality and suitable exercise intensity were selected to determine the training program of this study.

The high-intensity interval training and medium-intensity continuous training of the formal experiment lasted for 8 weeks and were conducted three times a week (Tuesday, Thursday and Saturday), with a total of 24 training sessions. Each training session was divided into three parts: warm-up part, training part and relaxation part (5min, 20min and 5min respectively), with a total of 30 minutes of training each time. After 8 weeks of experiment, the data before and after the experiment of the two groups were compared to provide data support for the paper.

4.3 Control of irrelevant variables during the experiment

(1) Time: Both the experimental group and the control group carried out exercise intervention in the evening of Tuesday, Thursday and Saturday every week, and the specific time was selected in their spare time. During the exercise experiment, the experimental group was still in normal physical activity and routine exercise, and the exercise guidance and supervision of the experimental group and the control group were consistent, which could ensure the regularity of exercise, the unity of guidance and supervision, and the reliability of the quality of exercise intervention.

(2) The site and climate during the test and experiment: 50m and 800m / 1000m were carried out in the track and field on the west side of the school, and other events were carried out in the physical health testing center of the school (indoor), and the indoor temperature was maintained. In order to avoid the influence of outdoor climate factors on the test results, the test has been carried out in the case of relatively stable temperature difference and small wind speed.

(3) Keep the irrelevant variables relatively constant: The object of this experiment is the undergraduate students of Qinghai Normal University. During the experiment, the subjects were asked to wear sports shoes and sports clothes and maintain the normal diet and no bad habits during the experiment. Subjects in the two groups were strictly controlled and supervised on a daily basis and were not allowed to participate in any other form of physical exercise except normal physical exercise. After interviewing the subjects before the experiment, it was found that they had no intention to lose weight, and overweight students were excluded from the experiment at the beginning. The control of the above external factors will have a positive effect on reducing the error of the experimental results.

Test instruments, test indicators and test methods

In this paper, 9 test indexes of college students' physical fitness are selected, all of which are the testing instruments of college students' physical health stipulated by the National Standard of Physical Health of Students.

(1) Height and weight

Instrument: height and weight measuring instrument

Objective: To obtain the body mass index (BMI) and understand the development level of students' body morphology.

Test method: After taking off the shoes, the tested students stand on the bottom mat of the machine, back to the column and close to the height scale, legs together, look up and straight ahead, and wait until the height measurement bar automatically presses on the head and returns automatically, the instrument display will show the student's height and weight.

(2) BMI index

The Body Mass Index (BMI) is one of the standards commonly used in China and around the world to measure how fat and thin people are and whether they are healthy.

Calculation: Body mass Index (BMI) = weight/height squared (kg/m²), the ideal BMI (18.5-23.9), according to the World Health Organization (WHO) study of the standard, Asian people are considered to be overweight if the BMI is greater than 22.9.

(3) 50-meter run

Instrument: 50 meter running data tester

Objective: To collect the results of 50 meters running of two groups of students.

Test method: Students in groups of 6, occupy track 1-6, with a standing start position, when the individual is ready to press the switch on the 50 meters running tester and switch on the peripheral power supply. Open the main screen of the machine to enter the subject information. The teacher records the student number corresponding to each track on the display screen. Click the "OK" button on the main screen and wait for the machine to respond at this time. Students at each track is ready, when students hear the machine prompt "ready" and imitate the start of the "snap" immediately start. When students run to the finish line, such as hearing the peripheral equipment "ding" sound. It means that the line is finished, and then the candidate returns to the starting point, and the main screen of the 50-meter running tester displays the final score of the student's 50-meter running.

(4) Standing long jump

Instrument: standing long jump tester

Objective: To measure the explosive force of lower limbs.

Test method: Connect the connecting line between the host screen and the test pad, connect the power supply, follow the voice prompts, confirm the subject's information is correct, let them stand on the test pad, stand with two feet apart, stand behind the test pad jumping line, must not touch the starting line, no additional actions are allowed. After jumping, leave the test mat forward or left and right. The heel drop must be fully into the test pad area and ends when the subject's score is displayed on the main screen.

(5) Lung capacity

Instrument: spirometer

Objective: To test the maximum lung capacity of the subjects.

Test method: Click the power button, and then confirm the information of the subject on the instrument. Each student receives a one-time blow tube and tight-screw it. Students take a deep breath to the maximum, keep their mouth close to the blow tube to prevent the error of the score caused by gas leakage, blow air at a moderate uniform speed, and do not allow air exchange in the middle.

(6) 1000 meters, 800 meters run

Instrument: stopwatch

Objective: To test the endurance level of the subjects.

Test method: A group of 20 subjects shall adopt a standing starting position before the starting point, get ready to start when they hear the teacher's instructions for positioning, start when they hear the starting gun sound, and the timekeeper shall start timing synchronously until the students finish the finish line.

(7) Pull-ups

Instrument: horizontal bar

Objective: To test the upper limb and back strength of the subjects.

Test method: The test subjects jump up and hold the horizontal bar in front of their hands, and the arms are separated with shoulder width or slightly wider than shoulder width, and the whole person is suspended in the state of straight arms; Pull up with both arms, pull up to the lower jaw over the top of the horizontal bar is recorded as completed once, until you can not pull up and jump off yourself, the teacher records the number.

(8) Seated forward bend

Instrument: sit forward bend tester

Objective: To measure the students' sitting forward bending performance.

Test method: After the student enters the subject's student number, the display displays the student's information to confirm that it is correct, the student takes off his shoes and sits flat on the tester, the legs are tight, the sole of the foot is tight to the front end of the test version, and then the hands are stretched out and forced forward, and the fingers are used to slowly push the scale plate until the push is not moved, and the finger is not forced to leave the scale plate and the test stops immediately.

5. Conclusion

This study is mainly conducted by experiment. According to the title of the paper, college students in the plateau environment are selected as the experimental objects of this study. In combination with the high-intensity interval training and medium-intensity continuous training mentioned in the literature, relevant literature and books are consulted, relevant knowledge points are summarized, and the main characteristics of the plateau environment are summarized based on previous studies. Under the guidance and suggestion of the tutor, a set of experimental research on the effect of high-intensity interval training on the physical health level of college students is designed. Through literature review, it is found that high-intensity interval training and plateau environment have not been studied in previous studies. Therefore, the study in this paper on the impact of high-intensity interval training on

the physical health level of college students in plateau environment has certain theoretical and application value, the selection of college students living in the plateau as the experimental objects of this study can not only verify the effect of high-intensity interval training on the physical health level of college students in the plateau environment, but also serve as a reference and basis for future research on high-intensity interval training in the mainland and plateau areas.

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