EFFECTS OF HIGH-INTENSITY INTERVAL TRAINING ON OBESE COLLEGE STUDENTS

EFEITOS DO TREINAMENTO INTERVALADO DE ALTA INTENSIDADE EM UNIVERSITÁRIOS OBESOS

EFECTOS DEL ENTRENAMIENTO POR INTERVALOS DE ALTA INTENSIDAD EN ESTUDIANTES UNIVERSITARIOS OBESOS

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ABSTRACT

Introduction: Sports are a great promoter of health and high-intensity interval training (HIIT), as an aerobic activity, has great potential to promote lipid improvement in obese college students. Objective: This study aimed to develop research on HIIT-based protocols controlling body mass index and blood pressure in obese college students. Methods: Compared with traditional medium-intensity continuous training (MCT), the focus of the research has the characteristics of a relatively short time, fast effect, and high interest among participating volunteers. Results: Many studies have suggested that this program effectively controls weight and blood pressure in obese college students. Some studies have even proven that its effect is better than that of MCT. Conclusion: The long-term effect of HIIT requires further research to be verified, and its standardization and safety also need further scientific support. ***Level of evidence II; Therapeutic studies - investigation of treatment outcomes.***

Keywords: High-Intensity Interval Training; Obesity Management; Students; Health Promotion.

RESUMO

Introdução: É constatado que os esportes são grandes promotores de saúde e o treinamento intervalado de alta intensidade (HIIT), como uma atividade aeróbica, tem grande potencial na promoção de melhora lipídica em universitários obesos. Objetivo: Elaborar uma pesquisa dos protocolos baseados em HIIT controlando o índice de massa corporal e a pressão sanguínea de universitários obesos. Métodos: Em comparação com o tradicional treinamento contínuo de média intensidade (MCT), o foco da pesquisa tem as características de tempo relativamente curtas, efeito rápido e alto interesse entre os voluntários participantes. Resultados: Um grande número de estudos sugeriu que este programa é eficaz no controle do peso e pressão sanguínea de universitários obesos. Alguns estudos até provaram que seu efeito é melhor do que o do MCT. Conclusão: O efeito a longo prazo do HIIT exige maiores pesquisas para ser verificado, a sua padronização e segurança também necessitam de maiores embasamentos científicos. ***Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

***Descritores*:** *Treinamento Intervalado de Alta Intensidade; Manejo da Obesidade; Estudantes; Promoção da Saúde.*

RESUMEN

Introducción: Se sabe que el deporte es un gran promotor de la salud y el entrenamiento por intervalos de alta intensidad (HIIT), como una actividad aeróbica, tiene un gran potencial para promover la mejora lipídica en estudiantes universitarios obesos. Objetivo: Desarrollar una investigación sobre protocolos basados en HIIT que controlen el índice de masa corporal y la presión arterial en estudiantes universitarios obesos. Métodos: En comparación con el entrenamiento continuo de intensidad media tradicional (MCT), el enfoque de la investigación tiene las características de tiempo relativamente corto, efecto rápido y alto interés entre los voluntarios participantes. Resultados: Un gran número de estudios ha sugerido que este programa es eficaz para controlar el peso y la presión arterial en estudiantes universitarios obesos. Algunos estudios han demostrado incluso que su efecto es mejor que el del MCT. Conclusión: El efecto a largo plazo del HIIT requiere más investigación para ser verificado, su estandarización y seguridad también necesitan más base científica. ***Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.***

***Descriptores*:** *Entrenamiento de Intervalos de Alta Intensidad; Manejo de la Obesidad; Estudiantes; Promoción de la Salud.*

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INTRODUCTION

According to the physical condition of colleges, every college will carry out corresponding physical health tests for students in different semesters. The results of physical health tests can reflect the development of students' bodies on the one hand, and many problems on the other hand. In China, according to the survey statistics of relevant health institutions and relevant functional departments, it is found that the number of overweight adults in China is about 300 million, the overweight rate is 22.9%, the obesity rate is about 60 million, and the obesity rate is 7.2%. Compared with small and medium-sized cities, the overweight rate and obesity rate in big cities are 30.0% and 12.4% higher respectively[1]. Prevention and control of obesity have also become

urgent problems to be solved. HIIT (High Intensity Intermittent Training) is a kind of exercise mode introduced into China by European and American countries in recent years[2,3]. With the fast-paced development of society, people have to pay more attention to their work and life, but their health problems have become more and more prominent. This pair of contradictory groups has produced the exercise mode of high--intensity intermittent training.However, high intensity interval training based on the percentage of MAS (maximum aerobic speed, which is called maximum oxygen uptake speed in some literatures, expressed by vVO2max) has also been proved to improve the cardiopulmonary endurance of athletes safely and efficiently at home and abroad[4-6]. In addition, the high-strength intermittent training is very appropriate to the needs of college students.

Research methods

There are 60 obese young men in some college fitness clubs in Guangxi. Specific conditions: the weight is relatively stable in recent 3 months; No habit of physical exercise, no regular physical exercise, such as jogging, skipping rope, playing ball and so on; There are no contraindications to exercise, no organic diseases, and diseases that are medically considered incapable of strenuous exercise, such as angina pectoris, tumor, etc. The average age of 14 overweight and obese adolescents is 23.2 3.41 years old, and the average BMI is 30.99 5.51 kg/m2. The average age of 14 healthy people was 23.77 1.48 years old, and the average BMI was 20.44 1.21 kg/m2. All participants are healthy right-handed. After DEBQ, medical history inquiry and physical examination, they have no history of smoking, drinking and taking psychotropic drugs. They have normal vision or corrected vision, and are not color-blind. All participants can take the basic color test. Exclude patients with cardiovascular disease, mental illness, eating disorder or food allergy; Willing to participate in research and sign informed consent form. In addition, the data of the two groups of subjects are counted and analyzed, and it is judged that there is no significant difference in evaluation indexes between the two groups. Then, a one-week pre-experiment is conducted between the experimental group and the control group, with the purpose of making the subjects in each group master the content of this group's exercises, familiarizing themselves with their movements, and at the same time, mastering the level of each group of subjects, and testing whether the formulated training plan can be carried out smoothly in the experiment. After the end of the pre-experiment, the formal experiment lasted for 8 weeks. Finally, under the same conditions as before the test, the same test as before the test was conducted. By analyzing the data before and after the experiment, a conclusion was drawn. In addition, both the experimental group and the control group are responsible for the implementation. At the same time, the monitor of the 2017 physical fitness special class of Physical Education Institute of anyang normal University participated in the experimental process as an assistant. As shown in Figure 1.

The study is Purely observational studies which no need to registry ID of ICMJE, and all the participants were reviewed and approved by Ethics Committee of GUANGXI MINZU NORMAL UNIVERSITY, China (NO. 2021046)

Figure 1 by randomly selecting two classes from a non physical education major freshman boys' physical education class, they were informed that they had been selected to participate in a physical education experimental study, clearly informed that there were some risks in the experiment, and screened out students who had regular exercise habits, asthma, heart disease, or had undergone surgery and other sports contraindications in the past year. They did not undergo systematic training, and the subjects had no muscle injury and other sports injuries within one year. Finally, through screening, there were 30 subjects in each of the two classes, and 60 subjects in the two classes. The cycle of most high-intensity intermittent training and medium-intensity continuous training is 6 to 15 weeks, and the frequency of intervention is mostly 3 times per week, while the 8-week exercise intervention is the most. Moreover, according to the climate change of Anyang, the weather will become colder and colder with the passage of time. The cold weather will not only affect the experimental results but also the test results of evaluation indicators. Therefore, the period of this experiment was determined to be 3 times a week, a total of 8 weeks.

Results and tests

Test indicators and methods

In order to prevent the subjects from having abnormal psychology due to knowing that they are the subjects in advance and bring about experimental errors, a single blind experiment was adopted. In order to prevent the subjects from having abnormal psychology due to knowing that they are the subjects in advance and bring about experimental errors, a single blind experiment was adopted. After the same time of warm-up and resistance training, the experimental group performed 30

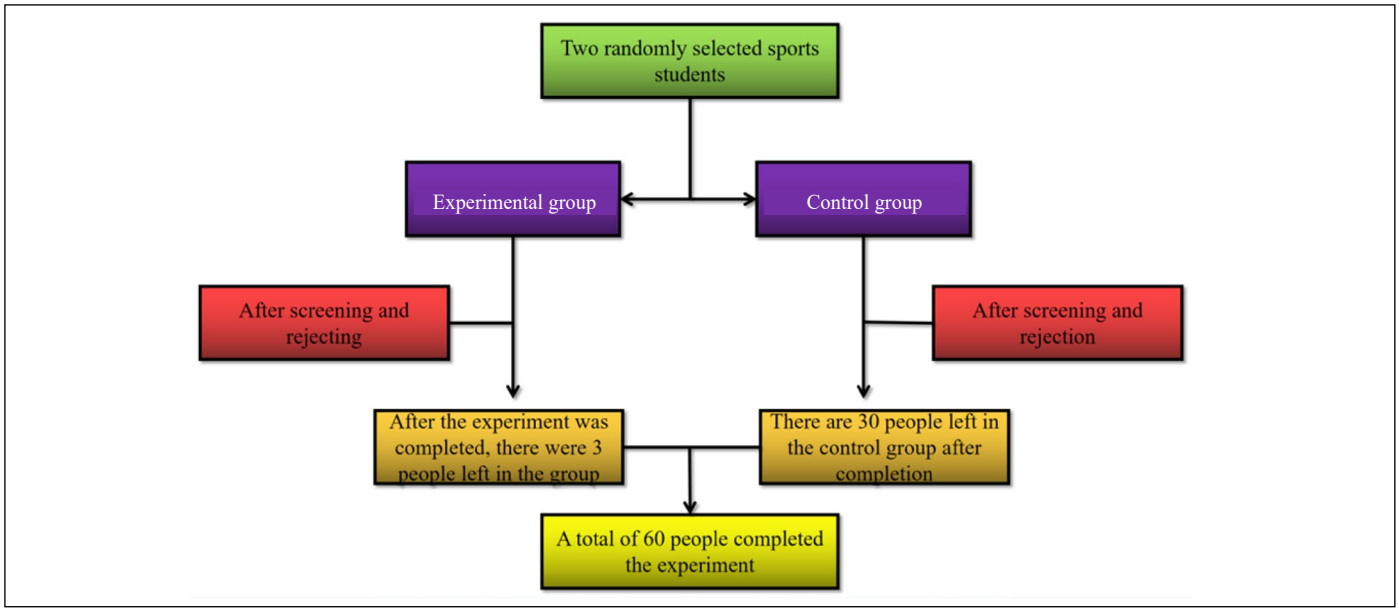

Figure 1. Flow chart of selecting subjects.

minutes of intermittent high-intensity exercise and the control group performed 30 minutes of aerobic exercise. The specific exercise prescription is formulated as follows: (1) Exercise purpose: after exercise with different exercise prescriptions, the experimental group and the control group can reduce body weight, reduce body fat percentage, reduce waist hip ratio, reduce BMI, improve physical fitness and promote fat metabolism. On this basis, the effects of two kinds of exercise prescription on reducing fat were compared; (2) Exercise intensity and control: the control of exercise intensity is mainly adjusted through the monitoring of immediate heart rate and subjective exercise intensity; (3) Exercise time: 90 minutes; (4) Exercise frequency: four times a week (Monday, Wednesday, Friday and Sunday). The total exercise time is 45 minutes. The basic design of resistance exercise is as follows. During the experiment, the exercise design will be gradually adjusted according to the physical conditions of the subjects. As shown in Table 1.

Intermittent high-intensity exercise: the exercise time of each group is 1min, the intermittent time is 1min, and the cycle lasts for 3 groups, with a total exercise time of 30 minutes.

This exercise prescription is an exercise prescription of intermittent high-intensity exercise combined with resistance exercise[7]. On the premise that the resistance exercise of the two groups is completely consistent, it mainly focuses on intermittent actions with high intensity and heart rate control of more than 150 times / min. During the exercise, the exercise intensity shall be controlled at the heart rate of more than 150 times / min, and the subjects will not feel uncomfortable during the exercise. Finally, the relaxation and finishing activities, mainly slow walking and ligament stretching, stretch the ligaments of the joints above and below the subject's body to eliminate the fatigue after exercise. The first week of exercise prescription implementation is the adaptation stage of exercise action learning and physical function. After that, the exercise intensity is gradually adjusted according to the principle of progressive difficulty according to the adaptation of the physical function of the subjects.

Analysis of test results

After eight weeks of exercise training, the heart rate of the experimental group decreased from 77.13 ± 3.74 beats / min before the experiment to 71.73 ± 2.05 beats / min after the experiment, with a significant difference ($P < 0.01$); The diastolic blood pressure decreased from 79.07 ± 5.90mmhg before the experiment to 74.07 ± 3.06mmhg after the experiment ($P < 0.01$); The systolic blood pressure decreased from 120.27 ± 7.06mmhg before the experiment to 114.27 ± 3.71mmhg after the experiment ($P < 0.01$). The heart rate of the control group decreased from 75.80 ± 2.62 beats / min before the experiment to 72.33 ± 2.38 beats / min after the experiment ($P < 0.01$); The diastolic blood pressure decreased from 77.67 ± 3.72 mmHg before the experiment to 73.27 ± 2.19 mmHg after the experiment ($P < 0.01$); The systolic blood pressure decreased from 119.80 ± 5.9mmhg to 116.07 ± 3.13mmhg ($P < 0.05$). Relying on exercise to exercise heart function, keeping proper weight, quitting smoking and drinking can keep quiet heart rate in a relatively slow and stable interval. Professor Wu Jie, a famous scholar in China, has observed the quiet heart rate of more than 5,000 healthy adults, and found that, without the interference of various diseases, people's heart beat is related to autonomic nerve and humoral regulation. According to the data, for example, the adult quiet heart rate can be maintained at 70 beats per minute, and the life span can be close to 80 years old. The quiet heart rate of the subjects decreased from 87.90 beats / min before the intervention to 75.45 beats / min, with a decrease of about 12.45 beats / min. after paired sample t test, it was significantly decreased ($P < 0.01$); The left hand grip strength increased from 28.83 pounds before intervention to 31.10 pounds, an increase of about 2.27 pounds; The grip strength of the right hand increased from 31.73 pounds before the intervention to 34.13 pounds, an increase of about 2.40 pounds. After paired sample t-test, the grip strength of left and right hands were significantly increased ($P < 0.01$). In order to ensure that each subject can reach the target intensity, the 100% MAS speed of the experimental group should be greater than or equal to 3.6m/s, and the heart rate should be greater than or equal to 160 / min; The maximum value of MAS in the control group is 3.8m/s and the average maximum heart rate is 200 / min. in order to ensure that each subject can reach the target intensity, the 60% MAS speed of the experimental group should be greater than or equal to 2.3m/s and the heart rate should be greater than or equal to 120 / min. As shown in Figure 2.

During the experiment, according to the real-time heart rate monitoring conducted by the experimenters using firstbeat, the maximum heart rate of the subjects during exercise can reach 200 / min, corresponding to 97.2% VO2max, and the minimum heart rate during the interval is 110 / min. most of the time, the heart rate can exceed 160 / min. After 8 weeks of aerobic exercise combined with high-intensity intermittent strength training, the average skin fold thickness of the upper arm of the subjects decreased from 34.84 mm to 27.16 mm, a decrease of about 7.68 mm; The average thickness of the skinfold at the lower corner of the scapula decreased from 38.77 mm to 30.61 mm, a decrease of about 8.16 mm. Through paired sample t-test, the skin fold thickness of the two places decreased significantly ($P < 0.01$). The paired sample t-test of the data before and after the experiment in the experimental group shows that $p<0.01$, which indicates that there is a significant difference in the changes of the experimental group's 12-minute running performance before and after the experiment. High-intensity interval training can effectively improve the subjects' 12-minute running performance. Before the experiment, the average running score of the control group in 12 minutes was 1954.84, and the standard deviation was 234.29. After 8 weeks of experimental intervention, the average running score of the control group in 12 minutes was 2122.58, and the standard deviation was 207.30. The results of the control group before and after the experiment were $p<0.01$ by paired sample T-test, which indicated that there was a significant difference in the results of the 12-minute running of the control group before and after the experiment. Moderate intensity continuous training can effectively improve the results of the subjects' 12-minute running. After the experiment, the experimental group's 12-minute running performance is more concentrated than the control group's.

Table 1. Basic ways of resistance movement.

Exercised muscle groups	Group count	Intermittent time
Abdominal muscles	15times×3	2min
Chest muscle	12times×3	2min
Back muscles	12times×3	2min
Shoulder muscles	12times×3	2min
Hip muscles	12times×3	2min
Leg muscles	12times×3	2min

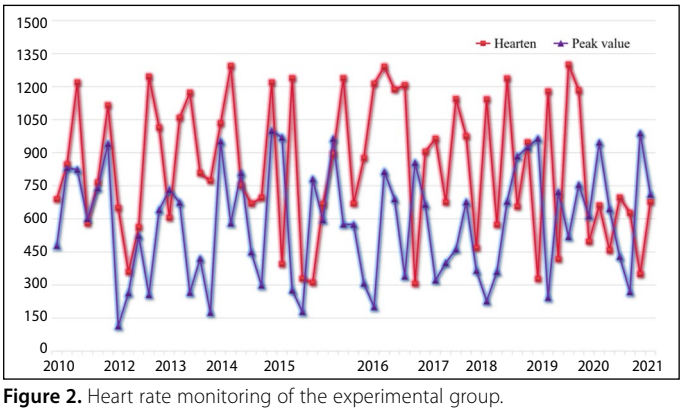

Figure 2. Heart rate monitoring of the experimental group.

CONCLUSION

It can be seen from the above data changes that aerobic exercise combined with high-intensity intermittent strength training can effectively improve the body shape and body composition of the subjects; The data of physiological indicators show that this intervention can effectively improve and prevent obesity and its secondary diseases, improve blood lipid metabolism, improve the fluidity of blood vessels, increase the capacity of heart pumping blood output, and reduce the burden on the heart. Both high-intensity interval training and moderate-intensity continuous training can effectively improve the body composition of ordinary male college students, and there is no difference between the two training methods. In terms of sports ability, the two training methods can significantly improve the results of 50m, 1000m, 5min, MAS and 12min running, and the effect of high-intensity interval training is more remarkable. The influence on the standing long jump only showed a highly significant difference before and after the experiment in the high-intensity interval training group. It shows that both intermittent high-intensity exercise combined with resistance exercise and aerobic exercise combined with resistance exercise can significantly reduce the waist hip ratio of young male obese people. However, compared with the two exercise methods, intermittent high--intensity exercise combined with resistance exercise has a better effect on reducing the waist hip ratio of young male obese people.

The author declare no potential conflict of interest related to this article

AUTHORS' CONTRIBUTIONS: The author made significant contributions to this manuscript. Tan Junhui: writing and performing surgeries; data analysis and performing surgeries; article review and intellectual concept of the article.

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