

HIGH-INTENSITY INTERVAL TRAINING ON PHYSICAL FUNCTION IN OBESE COLLEGE STUDENTS



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TREINAMENTO INTERVALADO DE ALTA INTENSIDADE SOBRE A FUNÇÃO FÍSICA DE UNIVERSITÁRIOS OBEOS

ENTRENAMIENTO POR INTERVALOS DE ALTA INTENSIDAD EN LA FUNCIÓN FÍSICA DE ESTUDIANTES UNIVERSITARIOS OBEOS

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ABSTRACT

Introduction: Obese students easily accept high-intensity interval training due to its combination of exercise and rest. It is believed that, besides promoting the reduction of body mass index due to its aerobic character, such training can also positively impact the physical function of its practitioners. **Objective:** Study the effects of high-intensity interval training on body indexes and physical function of obese college students. **Methods:** Twenty obese college students were selected for four weeks of training. Distributed by equal random selection, the experimental group received four sessions of high-intensity interval training per week. The duration of training from the beginning of the preparatory activity to the end of the stretching activity totaled 1.5h. The control group performed their daily activities without intervention. The relevant physical function indices of the volunteers were evaluated and recorded before and after the intervention. **Results:** The lean mass index of the students in the experimental group increased from $1463,846 \pm 209,888\text{Kcal}$ to $1573,514 \pm 194,492\text{Kcal}$. The vital capacity increased from 2573.94 ml to 3553.98 ml. However, students in the control group showed no relevant changes. **Conclusion:** High-intensity interval training proved useful in improving college students' general health levels and helping them recover their normal body indexes. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

Keywords: High-Intensity Interval Training; Physical Conditioning, Human; Obesity; Students.

RESUMO

Introdução: O treinamento intervalado de alta intensidade é facilmente aceitável pelos estudantes obesos devido à sua combinação de exercícios e repouso. Acredita-se que, além de promover a redução do índice de massa corporal devido ao seu caráter aeróbico, tal treinamento também possa impactar positivamente sobre a função física de seus praticantes. **Objetivo:** Estudar os efeitos do treinamento intervalado de alta intensidade sobre os índices corporais e a função física dos estudantes universitários obesos. **Métodos:** Vinte estudantes universitários obesos foram selecionados para quatro semanas de treinamento. Distribuídos por uma seleção aleatória igualitária, o grupo experimental recebeu quatro sessões de treinamento intervalado de alta intensidade por semana. A duração do treinamento desde o início da atividade preparatória até o final da atividade de alongamento totalizou 1,5h. O grupo de controle realizou suas atividades diárias, sem intervenções. Foram avaliados e registrados os índices de função física relevantes dos voluntários antes e após a intervenção. **Resultados:** O índice de massa magra dos alunos do grupo experimental aumentou de $1463,846 \pm 209,888\text{Kcal}$ para $1573,514 \pm 194,492\text{Kcal}$. A capacidade vital elevou-se de 2573,94 ml para 3553,98 ml. Entretanto, os alunos do grupo de controle não apresentaram alterações relevantes. **Conclusão:** O treinamento intervalado de alta intensidade mostrou-se útil para melhorar o nível geral de saúde dos estudantes universitários e ajuda-los na recuperação de seus índices corporais normais. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

Descritores: Treinamento Intervalado de Alta Intensidade; Condicionamento Físico Humano; Obesidade; Estudantes.

RESUMEN

Introducción: El entrenamiento por intervalos de alta intensidad es fácilmente aceptado por los estudiantes obesos debido a su combinación de ejercicio y descanso. Se cree que, además de favorecer la reducción del índice de masa corporal debido a su carácter aeróbico, este tipo de entrenamiento también puede repercutir positivamente en la función física de sus practicantes. **Objetivo:** Estudiar los efectos del entrenamiento por intervalos de alta intensidad sobre los índices corporales y la función física de estudiantes universitarios obesos. **Métodos:** Se seleccionaron veinte estudiantes universitarios obesos para cuatro semanas de entrenamiento. Distribuidos por igual selección aleatoria, el grupo experimental recibió cuatro sesiones semanales de entrenamiento por intervalos de alta intensidad. La duración del entrenamiento desde el inicio de la actividad preparatoria hasta el final de la actividad de estiramiento fue de 1,5 horas. El grupo de control realizó sus actividades cotidianas sin intervención. Se evaluaron y registraron los índices de función física relevantes de los voluntarios antes y después de la intervención. **Resultados:** El índice de masa magra de los alumnos del grupo experimental aumentó de $1463,846 \pm 209,888\text{Kcal}$ a $1573,514 \pm 194,492\text{Kcal}$. La



capacidad vital aumentó de 2573,94 ml a 3553,98 ml. Sin embargo, los alumnos del grupo de control no presentaron cambios relevantes. Conclusión: El entrenamiento por intervalos de alta intensidad demostró ser útil para mejorar el nivel de salud general de los estudiantes universitarios y ayudarlos a recuperar sus índices corporales normales.

Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.

Descriptores: Entrenamiento de Intervalos de Alta Intensidad; Acondicionamiento Físico Humano; Obesidad; Estudiantes.

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INTRODUCTION

The change of diet structure, the increase of academic pressure, the proliferation of electronic products, the increase of junk food, and the lack of enthusiasm for sports are the main reasons for the frequent occurrence of obesity and overweight among modern college students.¹ With obesity and other problems, the detection of a series of health problems, such as hypertension, endocrine disorders and metabolic disorders, has gradually become younger. Losing weight through exercise is not only less likely to rebound, but also can help college students gain a healthier physique and exercise their will, and at the same time enhance their physical and mental health.² Among various sports methods, intermittent exercise is one of the most popular at this stage. Intermittent exercise is an explosive exercise method with high intensity in a short time. It mainly focuses on strength training, and at the same time, it intersperses a certain rest time, so that the body can still consume energy when it stops moving.³ Sports and rest time can be scientifically designed according to the physical quality characteristics of athletes, so as to achieve the best effect. For obese people with poor physical fitness and weak sports ability, intermittent training effectively combines sports and rest activities.⁴ Even people without professional sports training can adapt quickly, which is conducive to the continuous development of training.⁵ In addition to the function of weight loss, intermittent training can improve the balance, muscle strength and coordination of the body, so as to improve the overall health level.⁶ From the perspective of the function of intermittent training, this paper conducts a controlled experiment on the optimization and influence of intermittent training on the physical function of obese college students, which provides scientific guidance for further helping obese college students to shape healthy physique.⁷

METHOD

Subject of experiment

Through consulting the relevant literature, searching for the contents related to intermittent training and exercise weight loss, we made a visit to the relevant researchers, teaching staff, and coaches of sports major to reduce weight and fat. On the basis of investigating the current situation of simple obese college students, we designed a control experiment method of this paper. The study and all the participants were reviewed and approved by Ethics Committee of Hainan medical University (NO.20HNMUPE007). The experiment selected 20 pure obese and overweight college students selected by a university through a questionnaire survey, including 12 girls and 8 boys. On the basis of ensuring that the college students have no basic diseases, no recent injuries, and no other related diseases that are not suitable for physical exercise, and on the principle of voluntariness and a certain understanding of the experiment, the basic information of the selected research objects in this paper was counted. The results are shown in Table 1. There was no statistically significant difference between the experimental group and the control group in basic conditions, which met the requirements of this experiment.

Table 1. Basic information of the research object.

Option	Experience group	Control group
Height (cm)	172.156±5.521	168.835±5.317
BMI (kg/m ²)	28.951±2.702	26.954±3.738

Test time

The experiment lasted for a total of four weeks. Twenty overweight or obese college students were randomly divided into a control group and an experimental group, with 10 students in each group, six girls and four boys. The experimental group received intermittent training 4 times a week, and the training time lasted from the beginning of the preparatory activity to the end of the stretching activity for 1.3 h to 1.5 h. The main training content of preparation activity is joint activity and muscle stretching, about 25 minutes; The basic part is high-intensity interval training, no less than 40 minutes; The end part is muscle relaxation, about 25 minutes. The control group did not carry out additional physical training except for daily activities. Before and after the experiment, relevant physical function indexes of the students were tested and recorded.

Test method of each index

In this paper, we selected four indexes to measure the exercise ability: 50 meter speed, sitting forward flexion, reaction ability and balance ability. The 50 meter speed test uses an electronic track and field stopwatch. The distance of 50 meters in a straight line is measured in the track and field arena. A group of four people will time the test. Crossing, collision, pushing, etc. are not allowed during the test. The sitting posture forward bending tester is used for sitting posture forward bending, and the students take turns to test. Each student takes the highest score after 3 tests. Measurement of standing time with eyes closed.

The Breezing Pro portable energy tester produced by Nanjing Jianen Medical Company was used to measure the changes of body metabolism. Before the measurement, the students asked that they should not be too full at dinner the previous day, do not smoke or drink, and ensure adequate rest. The measurement was carried out on an empty stomach on the day of measurement and after a quiet rest of half an hour.

In the intermittent training exercise process of the experimental group, the psychology of the tested students was monitored every 10 minutes to ensure the heart rate reserve interval of 40%~60% for high-intensity exercise and 20%~40% for low-intensity exercise.

RESULTS

Influence of intermittent training on college students' physical quality

The height, BMI and vital capacity of the students were measured before the experiment and 4 weeks after the training. The results are shown in Table 2.

According to the changes in the basic physical quality of obese college students before and after the experiment in Table 2, there was no change in the height indicators between the experimental group and the control group, but there were significant changes in BMI and vital capacity indicators. Because all the students are college students,

Table 2. Changes of basic physical quality of obese college students before and after the experiment.

Option	Before experiment		After experiment	
	Experience group	Control group	Experience group	Control group
Height (cm)	172.156±5.521	164.835±5.317	172.156±5.521	164.835±5.317
BMI (kg/m ²)	28.951±2.702	26.954±3.738	27.256±2.781	26.832±3.511
Vital capacity (ml)	2573.944±1074.074	2396.392±1069.416	3553.982±940.340	2868.746±1112.242

the height development after adulthood has basically been finalized, so there will be no significant changes in the height indicators before and after the experiment. The BMI of students in the experimental group increased from 28.951 ± 2.702kg/m before training ² Drop to 27.256 ± 2.781kg/m². In the control group, the decrease of BMI index was not obvious, but the mean value was slightly decreased; The vital capacity index of the experimental group students increased from 2573.944 ± 1074.074ml before training to 3553.982 ± 940.340ml, while the vital capacity index of the control group increased from 2396.392 ± 1069.416ml before training to 2868.746 ± 1112.242ml, with a small increase in the control group. It shows that 4-week interval training can significantly improve the BMI and vital capacity of the students.

Influence of intermittent training on college students' sports ability

Intermittent training not only has a significant impact on the basic physical quality of students, but also has a significant impact on their sports ability. Table 3 shows the measurement results of the exercise ability of the students before and after the experiment.

Through the measurement of the four sports ability indicators of the tested students, it can be seen that the intermittent training has a very obvious effect on the four indicators of the experimental group students. Among them, the forward bending of sitting posture has a relatively large increase, from -0.314 ± 6.691cm before training to 0.767 ± 6.971cm. The other three indicators also showed varying degrees of increase, in which the 50 meter speed increased from 10.147 ± 0.689s to 9.148 ± 0.658s, the reaction time shortened from 0.415 ± 0.058s to 0.393 ± 0.062s, and the balance ability increased from 19.253 ± 9.034s to 20.098 ± 7.772s.

Effect of intermittent training on college students' body composition

In addition to the improvement of physical fitness and exercise ability, intermittent exercise also significantly improved the body composition of college students. Table 4 and Table 5 show the changes of body composition of college students before and after the experiment.

It can be seen from the changes in body composition of obese college students before and after the experiment in Table 4 that the muscle content of obese college students in the intermittent training experiment group increased significantly, from 45.829 ± 9.165kg before the training to 48.165 ± 8.873kg, and the content of inorganic salt, water and protein also increased to a certain extent. The content of inorganic salt increased from 3.858 ± 0.599kg before training to 4.032 ± 0.621kg, the content of water increased from 35.693 ± 6.978kg to 36.984 ± 7.008kg, and the content of protein increased from 9.881 ± 1.854kg to 10.177 ± 1.878kg, showing an upward trend. In contrast, there is no significant change in the control group, indicating that intermittent exercise has a significant effect on improving the muscle content of obese college students compared with general activities. At the same time, regular physical exercise can change the content of inorganic and organic substances in the body, especially the content of protein, which is closely related to the nutritional status of the human body and the metabolism of muscle cells. Therefore, intermittent exercise will also have a certain impact on the basic metabolic function of the whole body.

This paper also measured and compared the basic metabolic rate of the students before and after training, and the results are shown in Table 5.

Table 3. Changes of Sports Ability of Obese College Students before and after the Experiment.

Option	Before experiment		After experiment	
	Experience group	Control group	Experience group	Control group
50 m speed (s)	10.147±0.689	10.178±0.876	9.148±0.658	9.912±0.795
Forward bending of sitting body (cm)	-0.314±6.691	-0.346±6.263	0.767±6.971	-0.397±6.233
Reaction capacity (s)	0.415±0.058	0.418±0.048	0.393±0.062	0.416±0.046
Balance capacity (s)	19.253±9.034	17.995±9.467	20.098±7.772	18.461±8.639

Table 4. Changes of body composition of obese college students before and after the experiment.

Option	Before experiment		After experiment	
	Experience group	Control group	Experience group	Control group
Muscle content (kg)	45.829±9.165	45.200±8.000	48.165±8.873	45.200±8.000
Inorganic salt (kg)	3.858±0.599	3.798±0.573	4.032±0.621	3.798±0.573
Moisture (kg)	35.693±6.978	34.978±4.703	36.984±7.008	34.978±4.703
Protein (kg)	9.881±1.854	9.810±1.629	10.177±1.878	9.810±1.629

It can be clearly seen from the data in Table 5 that after intermittent training, the basic metabolic rate of students in the experimental group has significantly improved, from 1463.846 ± 209.888Kcal before training to 1573.514 ± 194.492Kcal. However, the students in the control group did not change much, only from 1404.263 ± 182.141Kcal to 1443.492 ± 188.229Kcal.

DISCUSSION

Compared with the traditional physical education training in colleges and universities, high-intensity interval training can quickly burn fat through efficient exercise in a short time. At the same time, it has the characteristics of relatively short total time, quick effect, and a certain degree of entertainment. It is more practical in the process of weight loss for college students. The improvement of material and energy metabolism can be achieved through high-intensity interval training, which can enhance the energy supply intensity of glycolysis pathway. Research shows that high-intensity interval training can improve the heart output per stroke of the trainers and improve their aerobic exercise ability. In the actual training, the training mode of combining work with rest is more practical for the people with poor physical strength. At the same time, the improvement of fun in the training process can be achieved through the combination of the trainers' hobbies and fitness equipment, which increases fun and makes it easier for the trainers to adhere to the training.

Through the analysis and comparison of experimental data, in addition to physical fitness and sports ability, intermittent training has a positive significance for the improvement of body composition of experimental group students. Skeletal muscle has the function of protecting bones, and its content will determine the strength and health of the human body. Skeletal muscle stores a large amount of water, inorganic salts and proteins. A small or serious loss of skeletal muscle content will cause the loss of corresponding substances, especially the lack of water components, which will lead to high blood viscosity, reduced metabolism

Table 5. Changes of body metabolism of obese college students before and after the experiment.

Option	Before experiment		After experiment	
	Experience group	Control group	Experience group	Control group
Basic metabolic rate (Kcal)	1463.846±209.888	1404.263±182.141	1573.514±194.492	1443.492±188.229

and low immunity. The experimental data shows that after 4 weeks of high-intensity interval training, the muscle content of the subjects in the experimental group shows a certain increase, which shows that on the basis of fat reduction, high-intensity interval training can effectively prevent the decline of skeletal muscle quality and improve muscle content and strength level.

CONCLUSION

As an important guarantee for national development, college students in the new era are also closely related to their health and physical quality with the destiny and future of the country. Therefore, it is urgent to improve the physical health of college students. The first task of physical education teaching in schools is to improve students' physical health. The key is to improve the quality of physical education teaching, so as to enhance students' health level. Intermittent training can effectively improve the cardiorespiratory function of teenagers. Long term and scientific intermittent training has the same effect on students with

various physical fitness levels and body composition. This paper studies the effect of interval training on the physical health of obese college students through experiments, and through comparison and analysis, identifies training methods that have better effects on the physical health of obese college students. After 4 weeks of high-intensity interval training, the physical fitness indicators and health status of the subjects changed significantly. The experimental results suggest that high-intensity intermittent training can significantly improve the quantifiable physical indicators of the subjects. For the teaching of improving the overall development of college students' physical quality, it provides a theoretical basis and practical plan with reference significance and practical effect, further explores the effective way of college students' training, and provides effective reference for the improvement of college students' physical health at this stage.

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AUTHORS' CONTRIBUTIONS: The author has completed the writing of the article or the critical review of its knowledge content. This paper can be used as the final draft of the manuscript. Every author has made an important contribution to this manuscript. Wenshan Du and Peiyu Wang: writing and execution.

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