

# IMPACTS OF HIGH-INTENSITY INTERVAL TRAINING ON BODY COMPOSITION OF FEMALE UNIVERSITY STUDENTS



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IMPACTOS DO TREINAMENTO INTERVALADO DE ALTA INTENSIDADE SOBRE A COMPOSIÇÃO CORPORAL DE ESTUDANTES UNIVERSITÁRIAS

IMPACTO DEL ENTRENAMIENTO POR INTERVALOS DE ALTA INTENSIDAD EN LA COMPOSICIÓN CORPORAL DE ESTUDIANTES UNIVERSITARIAS

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## ABSTRACT

**Introduction:** In recent years, high-intensity interval training has become a popular tool to help maintain body composition and reduce fat mass. It is believed that its benefits may extend to female college students. **Objective:** Analyze the impacts of high-intensity interval training on the body composition of female college students. **Methods:** Thirty high school girls at a university were selected as volunteers for an 8-week experiment. Divided equally into two groups, the experimental group received high-intensity interval training while the control group followed with routine physical training. Results were collected before and after the experiment for statistical analysis. **Results:** The waist circumference of the experimental group was reduced from  $83.74 \pm 4.55$  cm to  $76.49 \pm 4.48$  cm; hip circumference was from  $101.53 \pm 3.01$  cm to  $95.26 \pm 2.99$  cm; and body fat from  $37.29 \pm 2.09$  kg to  $32.93 \pm 1.68$  kg. The body composition index's body fat content was reduced from  $29.01 \pm 1.31\%$  to  $28.63 \pm 1.29\%$ . In contrast, the indexes of the control group did not change statistically compared to before training. **Conclusion:** High-intensity interval training can effectively improve the body composition of female college students, considerably impacting body fat reduction. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

**Keywords:** High-Intensity Interval Training; Obesity Management; Body Composition; Students.

## RESUMO

**Introdução:** O treinamento intervalado de alta intensidade tem se tornado uma ferramenta popular para o auxílio da manutenção da composição corporal e redução de massa gorda nos últimos anos. Acredita-se que seus benefícios possam estenderem-se ao público universitário feminino. **Objetivo:** Analisar os impactos do treinamento intervalado de alta intensidade sobre a composição corporal das estudantes universitárias. **Métodos:** Foram selecionadas 30 meninas do segundo grau em uma universidade como voluntárias para um experimento com duração de 8 semanas. Divididas igualmente em dois grupos, o grupo experimental recebeu treinamento em intervalos de alta intensidade enquanto o grupo de controle seguiu com o treinamento físico de rotina. Os resultados foram coletados antes e depois do experimento para análise estatística. **Resultados:** A circunferência da cintura do grupo experimental foi reduzida de  $83,74 \pm 4,55$  cm para  $76,49 \pm 4,48$  cm; a circunferência do quadril foi de  $101,53 \pm 3,01$  cm para  $95,26 \pm 2,99$  cm; e a gordura corporal de  $37,29 \pm 2,09$  kg para  $32,93 \pm 1,68$  kg. O conteúdo de gordura corporal no índice de composição corporal sofreu uma redução de  $29,01 \pm 1,31\%$  para  $28,63 \pm 1,29\%$ . Em contraste, os índices do grupo de controle não obtiveram alterações estatísticas quando comparados antes do treinamento. **Conclusão:** O treinamento intervalado de alta intensidade pode efetivamente aprimorar a composição corporal das estudantes universitárias, impactando consideravelmente na redução da gordura corporal. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

**Descritores:** Treinamento Intervalado de Alta Intensidade; Manejo da Obesidade; Composição Corporal; Estudantes.

## RESUMEN

**Introducción:** El entrenamiento interválico de alta intensidad se ha convertido en los últimos años en una herramienta popular para ayudar a mantener la composición corporal y reducir la grasa corporal. Se cree que sus beneficios pueden extenderse al público universitario femenino. **Objetivo:** Analizar el impacto del entrenamiento interválico de alta intensidad en la composición corporal de estudiantes universitarias. **Métodos:** Se seleccionaron 30 estudiantes universitarias de secundaria como voluntarias para un experimento de 8 semanas. Divididas a partes iguales en dos grupos, el grupo experimental recibió entrenamiento de intervalos de alta intensidad, mientras que el grupo de control siguió con entrenamiento físico rutinario. Se recogieron los resultados antes y después del experimento para su análisis estadístico. **Resultados:** La circunferencia de la cintura del grupo experimental se redujo de  $83,74 \pm 4,55$  cm a  $76,49 \pm 4,48$  cm; la circunferencia de la cadera fue de  $101,53 \pm 3,01$  cm a  $95,26 \pm 2,99$  cm; y la grasa corporal de  $37,29 \pm 2,09$  kg a  $32,93 \pm 1,68$  kg. El contenido de grasa corporal en el índice de composición corporal se redujo del  $29,01 \pm 1,31\%$  al  $28,63 \pm 1,29\%$ . Por el contrario, los índices del grupo de control no obtuvieron cambios estadísticos



cuando se compararon antes del entrenamiento. Conclusión: El entrenamiento interválico de alta intensidad puede mejorar eficazmente la composición corporal de las estudiantes universitarias, repercutiendo considerablemente en la reducción de la grasa corporal. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

**Descriptor:** Entrenamiento de Intervalos de Alta Intensidad; Manejo de la Obesidad; Composición Corporal; Estudiantes.

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## INTRODUCTION

Due to the progress of society and the continuous improvement of living standards, we began to rely more and more on mechanization and automation.<sup>1</sup> Coupled with the dependence on electronic equipment, many college students live a sedentary lifestyle and exercise less, resulting in poor physical health assessment results year by year. To improve the physical health of college students, we should start from two aspects.<sup>2</sup> First, it is necessary to cultivate students' independent awareness of physical exercise and gradually form the behavior of being able to participate in physical exercise independently, which requires long-term teaching and guidance.<sup>3</sup> Second, optimize physical education teaching and improve students' physical fitness. High-intensity interval training is a kind of exercise that can burn fat quickly through effective training in a short time.<sup>4</sup> Compared with the traditional sports training, the characteristics of high-intensity interval training are relatively short duration, quick effect and certain interest, which has important practical significance for reducing fat.<sup>5</sup> This study applies high-intensity interval training to college students' exercise, provides a basis for the development of high-intensity interval training in college physical education in the future, provides new ideas for college physical education teaching and students' independent exercise, and has practical significance for improving college students' physical health level.<sup>6</sup>

## METHOD

### Research object

For the purpose of the study, this paper consulted the previous data about the relationship between high-intensity intermittent exercise and the health status of college students, and designed a questionnaire to investigate college students' awareness of physical health and willingness to exercise at this stage. The study and all the participants were reviewed and approved by Ethics Committee of Sichuan Film And Television University (NO.SFTU20F08). According to the statistical results of the questionnaire, the subjects were screened, and a total of 30 sophomore girls from a certain university were selected to participate in the experiment. Before the experiment, it was determined that the selected college students were all physically ill and had no systematic exercise training and exercise habits, and were suitable for high-intensity interval training. Before the experiment, they had a relatively comprehensive understanding of the experiment in this paper, and signed a letter of understanding and volunteered to participate in the experiment in this paper. Before the experiment, the basic body shape and body composition of the subjects were tested, and the test results were recorded for later experiment comparison.

### Research methods

The experiment in this paper is a controlled experiment. Before the experiment, 30 female college students were randomly divided into experimental group and control group, with 15 persons in each group. The experiment lasted for 8 weeks, with 3 times of training per week, and each training lasted for 2 class hours (90 minutes). The training

process is the same as the frequency of previous physical education classes. The difference between the two groups is that the students in the experimental group carry out high-intensity interval training during physical education classes, and the training content mainly includes weight-bearing wave ratio jump, plate support, sit-ups and other actions. The control group received routine physical training, including jogging, jogging and free activities. In addition to the differences in the training content during the formal training period, the preparatory actions before the training and the stretching actions after the training are consistent between the two groups. In addition to the experimental training of physical education, the two groups did not engage in any other intense sports in their spare time, and their daily work and rest were also similar.

The female college students were tested before and after the experiment. The measurement environment was conducted in the school gymnasium with constant room temperature. The same group of staff measured and recorded before and after the experiment to minimize the impact of external factors. Test indicators mainly include weight loss effect related indicators and body composition related indicators. There are five indicators related to weight loss, including waist circumference, hip circumference, waist to hip ratio, BMI and body fat. There are six indicators related to body composition, including body fat content, skeletal muscle content, maximum oxygen uptake, TG (triglyceride), TC (total cholesterol) and LDL-C (low density lipoprotein cholesterol). The weight loss related indicators were measured by the Inbody body composition tester of the school of physical education. The measuring instrument of some indexes of body composition is conducted by means of venous blood and automatic biochemical analysis, and the tester is required to conduct it on an empty stomach.

## RESULTS

### Effect of high-intensity interval training on college students' weight loss

After 8 weeks of high-intensity interval training, the weight loss effects of the experimental group and the control group were measured first. The five indicators selected can reflect the basic situation of the students' body.

The changes of basic indicators of weight loss effect in the experimental group are shown in Table 1.

The data in Table 1 clearly shows the effectiveness of high-intensity interval training on college students' weight loss. The waist circumference index of the students in the experimental group decreased from  $83.74 \pm 4.550\text{cm}$  before training to  $76.49 \pm 4.484\text{cm}$  after training, with a large change of  $7.25 \pm 0.066\text{cm}$ . Hip circumference index decreased from  $101.53 \pm 3.018\text{cm}$  before training to  $95.26 \pm 2.998\text{cm}$  after training, with a large change of  $6.27 \pm 0.020\text{cm}$ . The waist to hip ratio index changed from  $0.81 \pm 0.030$  before training to  $0.82 \pm 0.040$  after training. Body fat decreased from  $37.29 \pm 2.095\text{kg}$  before training to  $32.93 \pm 1.681\text{kg}$  after training, with a change of  $4.35 \pm 0.414\text{kg}$ . Although there is no significant change in BMI index compared with the pre-test, the average value shows a certain downward trend, from  $31.14 \pm 1.589$  before

**Table 1.** Effect of high intensity interval training on female college students' weight loss.

Experience group	Before experiment	After experiment	Variation value	P value
Waist circumference	83.74±4.550	76.49±4.484	7.25±0.066	0.0000
Hip circumference	101.53±3.018	95.26±2.998	6.27±0.020	0.0000
Waist-to-hip ratio	0.81±0.030	0.82±0.040	0.00±0.010	0.0000
BMI	31.14±1.589	29.41±1.919	1.73±0.330	0.3636
Body fat	37.29±2.095	32.93±1.681	4.35±0.414	0.0000

training to 29.41 ± 1.919 after training, with a change value of 1.73 ± 0.330. Therefore, it can be explained that a certain period of high-intensity interval training can achieve the goal of weight loss.

In order to further reflect the comparison and compare with the relevant data of the control group, the weight loss effect indicators of the control group are shown in Table 2.

It can be seen from the data in Table 2 that after a period of general training, the college students in the control group had very significant changes (P). The waist circumference index of the students in the control group decreased from 84.86 ± 4.919 cm before training to 78.71 ± 5.060 cm after training, with a large change of 6.15 ± 0.140 cm. Hip circumference index decreased from 101.76 ± 3.098 cm before training to 96.34 ± 3.231 cm after training, with a large change of 5.42 ± 0.134 cm. The waist to hip ratio index changed from 0.82 ± 0.020 before training to 0.83 ± 0.030 after training. Body fat decreased from 37.13 ± 2.205 kg before training to 34.25 ± 1.823 kg after training, with a change of 2.88 ± 0.382 kg. Although there is no significant change in BMI index compared with the pre-test, the average value shows a certain downward trend, from 31.20 ± 1.688 before training to 29.67 ± 1.717 after training, with a change value of 1.53 ± 0.029. The data in Table 2 shows that a certain period of physical training can also achieve the effect of weight loss.

### The effect of high-intensity interval training on the regulation of college students' body composition

In addition to the relevant indicators of weight loss effect, in order to further study the impact of high-intensity interval training, the relevant indicators of body composition of the college students were measured and counted. See Table 3 for the change results of relevant indicators of college students in the experimental group.

The data in Table 3 shows that after 8 weeks of high-intensity interval training, the three indexes of body fat content, maximum oxygen uptake and TC of the students in the experimental group have significant changes compared with those before the experiment (P<0.05), and the maximum oxygen uptake has very significant changes compared with those before the experiment (P<0.01). The body fat content index of the students in the experimental group decreased from 29.01 ± 1.317% before training to 28.63 ± 1.291% after training, with a large change of 0.38 ± 0.026%. The maximum oxygen uptake index increased from 34.70 ± 1.559 mL/(kg · min) before training to 38.85 ± 1.205 mL/(kg · min) after training, with a large change of 4.15 ± 0.353 mL/(kg · min). TC index decreased from 4.98 ± 0.516 mol/L before training to 4.60 ± 0.555 mol/L after training, with a change of 0.38 ± 0.039 mol/L. In addition, although the three indexes of skeletal muscle content, TG and LDL-C have no obvious changes compared with the before the experiment, the average value shows a certain downward trend, which also proves the decrease of the body fat content of the athletes in the experimental group to a certain extent. The skeletal muscle content increased from 23.83 ± 0.798% before training to 24.32 ± 1.212% after training, with a change of 0.49 ± 0.414%. TG decreased from 0.96 ± 0.293 mmol/L before training to 0.86 ± 0.249 mmol/L after training, with a change of 0.10 ± 0.043 mmol/L. LDL-C decreased from 2.25 ± 0.479 mmol/L before training to 1.99 ± 0.324 mmol/L after training, with a change of 0.26 ±

0.155 mmol/L. Therefore, it can be explained that a certain period of high-intensity interval training can achieve the goal of losing weight, and has certain effects on reducing the fat content in the body of the college students, lowering cholesterol, and improving cardiopulmonary function.

The results of body composition changes of female college students in the control group are shown in Table 4.

The data results in Table 4 show that, except for the maximum oxygen uptake index, the control group that carries out routine sports activities has no significant changes in other indexes compared with those before training. The maximum oxygen uptake index increased from 34.23 ± 1.013 mL/(kg · min) before training to 36.79 ± 1.195 mL/(kg · min) after training, with a relatively large change of 2.56 ± 0.183 mL/(kg · min). It shows that routine sports activities have obvious effects on improving the cardiopulmonary function of the college students. However, in terms of improving body composition and reducing cholesterol content, short-term exercise effect is not obvious.

## DISCUSSION

High-intensity interval training can improve the metabolism and energy supply of the body and increase the energy supply capacity. In the process of high-intensity interval training, interval training increases the calories consumed by the body after exercise, so that more fat is burned, achieving obvious weight loss effect. Compared with traditional aerobic training, high-intensity interval training can not only burn fat more effectively, but also save time. High-intensity interval training can also effectively reduce appetite, thus controlling food intake and maintaining a negative balance between intake and consumption. Other studies have shown that high-intensity interval training can increase cardiac

**Table 2.** Weight loss effect of female college students in the control group.

Control group	Before experiment	After experiment	Variation value	P value
Waist circumference	84.86±4.919	78.71±5.060	6.15±0.140	0.0000
Hip circumference	101.76±3.098	96.34±3.231	5.42±0.134	0.0000
Waist-to-hip ratio	0.82±0.020	0.83±0.030	0.00±0.010	0.0020
BMI	31.20±1.688	29.67±1.717	1.53±0.029	0.6575
Body fat	37.13±2.205	34.25±1.823	2.88±0.382	0.0000

**Table 3.** Effect of high intensity interval training on body composition regulation of female college students.

Experience group	Before experiment	After experiment	Variation value	P value
Body fat content	29.01±1.317	28.63±1.291	0.38±0.026	0.0497
Skeletal muscle content	23.83±0.798	24.32±1.212	0.49±0.414	0.6150
Maximum oxygen uptake	34.70±1.559	38.85±1.205	4.15±0.353	0.0000
TG	0.96±0.293	0.86±0.249	0.10±0.043	0.0738
TC	4.98±0.516	4.60±0.555	0.38±0.039	0.0242
LDL-C	2.25±0.479	1.99±0.324	0.26±0.155	0.1297

**Table 4.** Body composition regulation effect of female college students in the control group.

Control group	Before experiment	After experiment	Variation value	P value
Body fat content	29.07±1.519	28.96±1.092	0.11±0.427	0.3396
Skeletal muscle content	23.80±1.597	24.30±1.818	0.49±0.221	0.4737
Maximum oxygen uptake	34.23±1.013	36.79±1.195	2.56±0.183	0.0000
TG	0.87±0.343	0.94±0.409	0.07±0.066	0.4780
TC	4.12±0.586	4.88±0.434	0.76±0.152	0.1808
LDL-C	2.37±0.519	2.15±0.537	0.22±0.018	0.2066

output and improve aerobic and cardiopulmonary function of athletes, which is consistent with the research results in Table 3 of this paper. The combination of exercise and rest in training is very convenient for people with poor physical fitness. The training content can be combined with fitness equipment according to the interests of the trainer to make the training more interesting and less boring, which is conducive to the input of the trainer, and is also easier to continue the training.

The accumulation of fat in the body is due to the caloric intake exceeding the energy demand of the body. Large muscle groups can participate in the process of high-intensity interval training. Therefore, combining high-intensity interval training with appropriate dietary nutrition can increase lean meat and reduce fat. So as to effectively reduce the body fat rate of college students, reduce the obesity risk of college students, reduce the risk of diseases caused by high body fat, and improve body composition. High-intensity interval training reduces body fat while maintaining lean body fat, and subjects can maintain a high basal metabolic rate for a period of time after rest. Therefore, high-intensity intermittent exercise is very effective for college students to reduce fat.

## CONCLUSION

This study analyzed the effect of high-intensity interval training on body composition and fat metabolism of obese college students through an 8-week intervention experiment. The results show that high-intensity interval training can effectively reduce the body fat of college students, and has good effects on improving the body composition and weight loss of subjects. Therefore, high-intensity interval training can be an effective intervention program for college students' fitness training. Due to the particularity of high-intensity interval training, teachers must guide students to prepare and perform final stretching exercises, and strictly control the intensity and load of exercises to avoid sports injuries. In addition, in addition to exercising, students should also be encouraged to eat and rest reasonably after class and improve their physical fitness and health by various means.

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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. Cai Xiaolin: writing and execution.

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