IMPACT OF HIGH-INTENSITY INTERVAL TRAINING ON BODY MASS INDEX IN COLLEGE STUDENTS

IMPACTO DO TREINAMENTO INTERVALADO DE ALTA INTENSIDADE SOBRE O ÍNDICE DE MASSA CORPORAL EM ESTUDANTES UNIVERSITÁRIOS

IMPACTO DEL ENTRENAMIENTO POR INTERVALOS DE ALTA INTENSIDAD EN EL ÍNDICE DE MASA CORPORAL DE ESTUDIANTES UNIVERSITARIOS

Original Article
Artigo Original
Artículo Original

Gang Liu[1]
(Physical Education Professional)

1. Heilongjiang University, Physical Education Teaching and Research Department, Harbin, Heilongjiang, China.

Correspondence:
Gang Liu, Harbin, Heilongjiang, China, 150080.
liugangup@126.com

ABSTRACT

Introduction: Due to academic pressure, many college students feel unmotivated to exercise, leading to serious obesity problems. One of the effective resources for weight loss is high-intensity interval training, but there is no extensive research on the effect on this specific group. Objective: To explore the impact of high-intensity interval training on body fat index (BFI) in college students, analyzing the scientific basis and safety of this exercise training through heart rate indicators. Methods: Two experimental groups, MICT (moderate-intensity continuous training) and HIIT (high-intensity interval training), were compared. The HIIT group used stationary bicycles, according to the high-intensity interval training method. MICT is a moderate-intensity continuous training method, so the load was half that of the HIIT group. Results: The IGC of women after training was 22.81±2.87, the IGC was significantly reduced, and there was a very significant difference; the IGC of men after training was 22.74±2.12, the IGC was significantly reduced, and they very significant difference. This shows that the exercises have a good effect on weight loss. Conclusion: HIIT training is more effective, both in time and strength of adherence. It has a good effect on improving cardiopulmonary function, and optimizing IGC are strongly impacted. ***Level of evidence II; Therapeutic studies - investigation of treatment outcomes.***

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

RESUMO

Introdução: Devido à pressão acadêmica, muitos estudantes universitários sentem-se desmotivados para o exercício, acarretando a sérios problemas de obesidade. Um dos recursos eficazes para a perda de peso é o treinamento intervalado de alta intensidade, porém não há pesquisas amplas sobre o efeito nesse grupo específico. Objetivo: Explorar o impacto do treinamento intervalado de alta intensidade no índice de gordura corporal (IGC) dos estudantes universitários, analisando o embasamento científico e a segurança desse treinamento de exercício através dos indicadores de frequência cardíaca. Métodos: Dois grupos experimentais MICT (treinamento contínuo de intensidade moderada) e HIIT (treinamento intervalado de alta intensidade) foram comparados. O grupo HIIT utilizou bicicletas estacionárias, de acordo com o método de treinamento intervalado de alta intensidade. MICT é um método de treinamento contínuo de intensidade moderada, portanto a carga foi a metade do grupo HIIT. Resultados: O IGC das mulheres após o treinamento foi de 22,81±2,87, o IGC foi significativamente reduzido e houve uma diferença muito significativa, o IGC dos homens após o treinamento foi de 22,74±2,12, o IGC foi significativamente reduzido e houve uma diferença muito significativa. Isso mostra que os exercícios têm um bom efeito na perda de peso. Conclusão: O treinamento HIIT é mais eficaz, tanto em tempo quanto na resistência da adesão. Tem um bom efeito de melhora na função cardiopulmonar, sendo a otimização do IGC fortemente impactada. ***Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

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

RESUMEN

Introducción: Debido a la presión académica, muchos estudiantes universitarios se sienten desmotivados para hacer ejercicio, lo que conduce a graves problemas de obesidad. Uno de los recursos efectivos para la pérdida de peso es el entrenamiento de intervalos de alta intensidad, sin embargo, no hay amplias investigaciones sobre el efecto en este grupo específico. Objetivo: Explorar el impacto del entrenamiento interválico de alta intensidad en el índice de grasa corporal (IGC) de estudiantes universitarios, analizando la base científica y la seguridad de este entrenamiento de ejercicio a través de indicadores de frecuencia cardíaca. Métodos: Se compararon dos grupos experimentales MICT (entrenamiento continuo de intensidad moderada) y HIIT (entrenamiento por intervalos de alta intensidad). El grupo HIIT utilizó bicicletas fijas, según el método de entrenamiento por intervalos de alta intensidad. El MICT es un método de entrenamiento continuo de intensidad moderada, por lo que la carga era la mitad que la del grupo HIIT. Resultados: El IGC de las mujeres después del entrenamiento fue de 22,81±2,87, el IGC se redujo significativamente y hubo una diferencia muy significativa, el IGC de los hombres después del entrenamiento fue de 22,74±2,12, el IGC se redujo significativamente y hubo una diferencia muy significativa. Esto demuestra que los ejercicios tienen un buen

efecto en la pérdida de peso. Conclusión: El entrenamiento HIIT es más efectivo, tanto en tiempo como en resistencia a la adherencia. Tiene un buen efecto de mejora de la función cardiopulmonar, con un fuerte impacto en la optimización del IGC. ***Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.***

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

DOI: http://dx.doi.org/10.1590/1517-8692202329012022_0156 Article received on 03/15/2022 accepted on 05/31/2022

INTRODUCTION

The problem of College Students' weight loss has always been a focus of research by college students themselves and relevant researchers.[1] Through the research of previous literature, it can be found that many college students choose to limit their diet and reduce their calorie intake, so that their daily energy intake is less than the calories consumed. Although this method has achieved rapid results in a short time, but for the human body, it will lead to the reduction of the basic metabolic rate. Once the diet is stopped, it will lead to the increase of obesity.[2] Due to their busy schoolwork, some college students choose to buy relevant weight-loss drug products to lose weight. By limiting diet, especially the intake of high-fat and high calorie foods, reducing energy intake in the form of healthy diet, and increasing energy consumption through sufficient exercise, college students can effectively optimize their body composition, reduce fat proportion, strengthen muscle strength and improve body fat rate, so as to improve basic metabolic rate and promote healthy development, so as to improve the physical health of Chinese college students.[3]

At present, the optimization methods of body fat rate in sports and health circles mainly include mict and HIIT. Mict refers to medium intensity continuous training. In short, it is to exercise the aerobic endurance of athletes through long-term medium intensity exercise, so as to achieve the purpose of effective energy consumption. HIIT refers to high-intensity intermittent training, which is divided into intermittent period and exercise period. The exercise period will impact high-intensity exercise training in a short time, and the intermittent period will carry out soothing actions or rest. Compared with mict, HIIT can save a lot of exercise time, reduce the difficulty of long-term continuous exercise, and ensure the efficient combustion of fat. Therefore, HIIT is very suitable for college students and office workers with busy schoolwork, so it is becoming more and more popular. Taking college students as an example, this paper discusses the improvement of body fat rate by high-intensity intermittent training and studies the heart rate index in the relevant process, so as to systematically analyze the weight loss effect of college students.

METHOD

Type of study

Firstly, this paper adopts the literature research method, consults a large number of relevant literatures, and makes a systematic analysis on the origin and development of high-intensity intermittent training (HIIT) and its application in all aspects, so as to provide sufficient theoretical basis for this research. Finally, using the experimental method, by analyzing the effect of high-intensity intermittent training on College Students' physical fitness rate and monitoring their heart rate, we can analyze the weight loss effect of high-intensity intermittent training and prevent the side effects.

Data collection

This paper is designed through intra group comparison and inter group comparison. There are two experimental groups, mict and HIIT. Each group includes 10 boys and 10 girls. The study and all the participants were reviewed and approved by Ethics Committee of Heilongjiang University (NO. 2017FD12). The choice of boys and girls is determined by random lottery. First of all, all college students uniformly measure the body fat rate and heart rate index, and record the data. Then the experiment lasted for 6 weeks. HIIT group used the anaerobic power bicycle produced in Sweden, exercised for 4 minutes according to the method of high-intensity intermittent training, rested for 3 minutes, repeated the relevant actions, and completed 80 groups every day. The mict group also used the anaerobic power bicycle produced in Sweden. With the method of medium intensity continuous training, the exercise duration was the same as that of the HIIT group, but the load was only half of that of the HIIT group. In the process of exercise training, the heart rate meter is used to detect and analyze the heart rate of college students during exercise and after exercise and calculate the current body fat rate of college students after 6 weeks of exercise.

RESULTS

Changes of body fat rate of college students before and after high-intensity intermittent training

Boys and girls have different physical characteristics, so the same exercise has different effects on them. In view of this feature, this paper divides HIIT and mict into male group and female group to explore the changes of body fat rate before and after high-intensity intermittent training, so as to have a more scientific cognitive analysis of the improvement of body fat rate by high-intensity intermittent training.

As shown in Table 1, the body fat rate of girls in HIIT group was 29.12 ± 2.76 before training and 22.81 ± 2.87 after training. The body fat rate decreased significantly and there was a very significant difference ($P < 0.01$). The body fat rate before training in mict group was 29.71 ± 2.21, which was not different from that in HIIT group. The body fat rate after training was 25.51 ± 3.01, which was also significantly lower and had a very significant difference ($P < 0.01$). The change rate of body fat rate in HIIT group was 6.48 ± 2.01 and that in mict group was 3.42 ± 1.21, which proved that the effect of reducing body fat rate in girls' HIIT group was more obvious during the same period of exercise.

As shown in Table 2, the body fat rate of boys in HIIT group was 28.41 ± 2.45 before training and 22.74 ± 2.12 after training. The body fat rate decreased significantly and there was a very significant difference ($P \leq 0.01$). The body fat rate before training in mict group was 29.12 ± 2.74, which was not different from that in HIIT group. The body fat rate

Table 1. Changes of body fat rate of female college students before and after high--intensity intermittent training.

Option	Before	After	Change rate	P
HIIT	29.12±2.76	22.81±2.87	6.48±2.01	0.000
MICT	29.71±2.21	25.51±3.01	3.42±1.21	0.000

Table 2. Changes of body fat rate of male college students before and after high-intensity intermittent training.

Option	Before	After	Change rate	P
HIIT	28.41±2.45	22.74±2.12	6.11±1.21	0.010
MICT	29.12±2.74	24.47±3.31	4.72±1.11	0.000

after training was 24.47 ± 3.31, which was also significantly lower and had a very significant difference (P < 0.01). The change rate of body fat rate in HIIT group was 6.11 ± 1.21 and that in mict group was 4.72 ± 1.11, which proved that the effect of reducing body fat rate in male HIIT group was more obvious during the same period of exercise.

Based on the comprehensive analysis of the research results in Table 1 and Table 2, it can be found that the body fat rate of both HIIT group and mict group, boys and girls, has been significantly improved, which shows that exercise has a good effect on weight loss, and the fat reduction effect of HIIT group is better than that of mict group in different gender, This also proves the superiority of high-intensity intermittent training in improving body fat rate.

Detection and analysis of heart rate indexes of college students before and after high-intensity intermittent training

For college students, long-term lack of exercise or blind use of weight-loss drugs is easy to bring certain damage to the cardiovascular system. If they carry out high-intensity exercise, they may have a certain burden on the heart, resulting in some negative effects. Therefore, in order to prevent some side effects of sudden exercise on college students, this paper not only carried out the same warm-up activities before exercise, but also asked the subjects to wear a heart rate meter during relevant exercise to observe the changes of heart rate at all times. Once abnormal heart rate is found, it will be stopped in time. On the premise of normal heart rate, the heart rate before exercise, immediately after exercise and at an interval of 5 minutes, 15 minutes and 30 minutes after exercise were tested. To explore the changes of heart rate during and after exercise, so as to study the effects of related activities on cardiopulmonary function.

As shown in Figure 1, after the warm-up exercise, the systolic blood pressure of the two groups of subjects before the formal exercise is within the normal range. It can be seen from the measurement immediately after the training that the systolic blood pressure of the mict group is higher than that of the HIIT group. However, the average systolic blood pressure of the mict group is slightly higher than that of the HIIT group before the training, and the increase of the mict group is less than that of the HIIT group, It can be seen that the change range of systolic blood pressure in HIIT group is greater during exercise. It can be seen from the images after exercise that within 5 minutes after exercise, the reduction of systolic blood pressure in mict group is significantly higher than that in HIIT group, and shows a gentle downward trend within the next 25 minutes. The reduction of systolic blood pressure in HIIT group is less than that in mict group within 5 minutes, and it still maintains a rapid downward trend within 5 ~ 15 minutes, and the change range within 15 ~ 30 minutes is almost 0, Finally, they are basically in the same stable state. According to the change curves of the two, the change trend of mict is a significant decline within 5 minutes, which will remain relatively stable in the follow-up, and HIIT is a decline and stable state. The comparison between the two shows that the change of heart rate in HIIT group is relatively gentle, which is more conducive to the recovery after exercise and maintain good cardiac function.

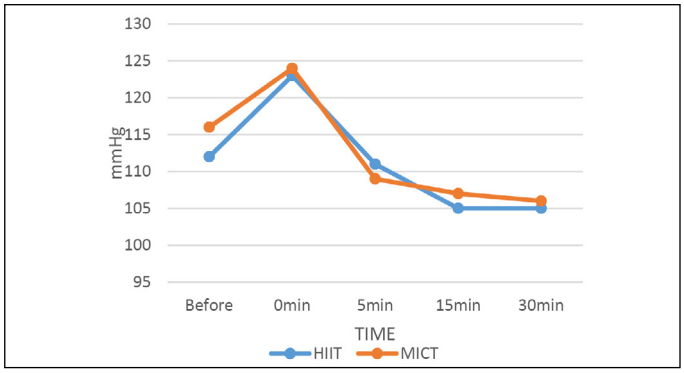

Figure 1. Changes of systolic blood pressure before and after high intensity interval training.

As shown in Figure 2, the diastolic blood pressure of the two groups before exercise is almost the same. During the overall exercise, the change range of diastolic blood pressure in HIIT group is much higher than that in mict group. The diastolic blood pressure in HIIT group decreases significantly within 5 minutes after exercise, shows a slow downward trend within 5 minutes to 15 minutes, and tends to be stable after 15 minutes. The diastolic blood pressure in mict group also decreased significantly within 5 minutes after exercise, and its change range was slightly lower than that in HIIT group. It continued to decline to the lowest point in a slightly slow range within 5 ~ 15 minutes, and increased slowly until stable after 15 minutes. In the process of overall diastolic pressure change, the final diastolic pressure in HIIT group is almost the same as the initial diastolic pressure, and the diastolic pressure in mict group is slightly lower than the initial diastolic pressure, which indicates that the intensity of cardiopulmonary exercise training in HIIT group is higher and the stability is stronger than that in mict group.

As shown in Figure 3, the relative values of heart rate recovery before and after training of the two groups are shown. In order to reduce the measurement error as much as possible, four measurements are carried out in this paper. As shown in the image, the data of the second, third and fourth times of HIIT group tends to be relatively stable, while the data of mict group shows a fluctuating state, but overall it is slightly higher than that of HIIT group. Therefore, it can be seen that HIIT group is relatively stable in terms of heart rate recovery.

Figure 4 shows the absolute value of heart rate recovery before and after exercise in the two groups. It can also be seen that the absolute value of HIIT group is relatively stable, and the absolute value of mict group fluctuates relatively, which is slightly higher than that of HIIT group as a whole.

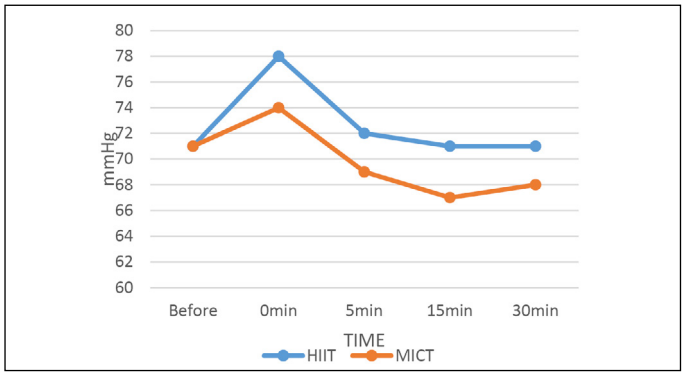

Figure 2. Changes of diastolic blood pressure before and after high-intensity intermittent training.

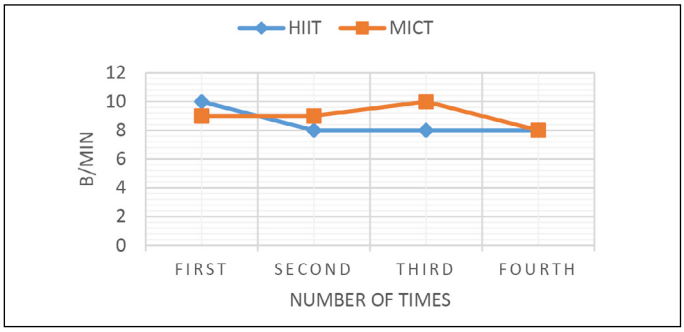

Figure 3. Relative value of heart rate recovery before and after high-intensity interval training.

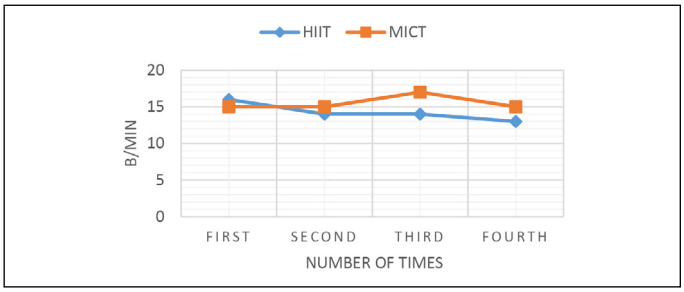

Figure 4. Absolute value of heart rate recovery before and after high-intensity interval training.

DISCUSSION

From a scientific point of view, a very important heat consumption link in the process of weight loss, in short, is to burn fat and provide energy for the body by taking in a large amount of oxygen and consuming it during exercise.[4] The more intense this process, the faster the fat consumption rate, the better the weight loss effect, and the higher the improvement range of body fat rate. Compared with medium intensity continuous training or some traditional exercise methods, high-intensity interval training has more intense exercise in a short time, so the oxygen consumption is higher and the burning range of fat is more intense, so that the fat content has a faster reduction rate. In addition, high-intensity interval training also drives the growth of muscles, so on the whole, the improvement of body fat rate will be higher than other methods.[5]

Psychologically, because there is enough rest time for high-intensity interval training, the subjects have a long time to rest after completing a group of exercise. In this rest process, they can attract attention by playing with mobile phones and reading books, so as to regulate their emotions. After getting enough rest, put yourself into the next short period of exercise with a positive mood. The subjects of moderate intensity continuous training can only repeat the monotonous exercise process for a long time, which is easy to produce physical fatigue and psychological fatigue, resulting in problems such as inattention, perfunctory action and negative coping. On the whole, the exercise effect is higher, and the intensity intermittent training is lower, so the improvement of their physique rate is also lower.

Finally, carry out relevant sports regularly. The school can carry out various sports activities, such as sports meeting, night running activities, 30-day punch in activities, etc. through large-scale sports activities, it can promote the importance of physical exercise, enhance the participation rate of students in sports activities, and enable students to communicate with each other through sports, so as to promote the harmonious development of the whole campus.

CONCLUSION

Through the collation of literature and experimental research, it can be found that among the existing sports training methods, high-intensity intermittent training has strong advantages compared with other methods. It can not only enable the trainer to maintain active and full sports enthusiasm in the training process, but also burn fat efficiently in a short time, which is more in line with the current fast-paced living habits, Therefore, high-intensity interval training has been popular since it was introduced into mass fitness. For colleges and universities, physical education teachers should give full play to their responsibilities and put forward a certain exercise plan according to the current physical condition of college students, so that college students in different physical states can use effective exercise methods to lose weight. At the same time, they should actively observe the exercise heart rate of College students and scientifically adjust the plan according to the differences of students. So as to ensure students' sports safety and physical and mental health.

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

AUTHORS' CONTRIBUTIONS: Every author has made an important contribution to this manuscript. GL: writing and execution.

REFERENCES

1. Group TLA. Association of the magnitude of weight loss and changes in physical fitness with long-term cardiovascular disease outcomes in overweight or obese people with type 2 diabetes: a post-hoc analysis of the Look AHEAD randomised clinical trial. Lancet Diabetes. 2016;4(11):913-21.
2. Mazurek Melnyk B, Slevin C, Militello L, Hoying J, Teall A, McGovern C. Physical health, lifestyle beliefs and behaviors, and mental health of entering graduate health professional students: Evidence to support screening and early intervention. J Am Assoc Nurse Pract. 2016;28(4):204-11.
3. Wittels P, Mansfield L. Weight stigma, fat pedagogy and rediscovering the pleasures of movement: Experiencing physical activity and fatness in a public health weight management programme. Qual Res Sport Exerc Health. 2021;13(2):342-59.
4. Gholinejad PM, Hojjati H, Ghorbani S. The effect of aerobic exercise on body composition and muscle strength of female students at elementary schools of Ali Abad Katoul in 2018. Int J Sch Health. 2019;6(4):27-33.
5. Dondzilo L, Rieger E, Jayawardena N, Bell J. Drive for thinness versus fear of fat: approach and avoidance motivation regarding thin and non-thin images in women. Cognit Ther Res. 2019;43(3);585-93.