



The Effects of High-Intensity Interval Training and Moderate-Intensity Continuous Training on Body Mass Index and Cardiopulmonary Function in Obese College Students

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Abstract: Objective: To observe the effects of high-intensity interval training (HIIT) and moderate-intensity continuous training (MICT) on body mass index (BMI) and cardiopulmonary function in obese college students. Methods: Fifty obese students from the first to third year of our university were randomly selected to participate in this study and were randomly divided into two groups, with 25 students in each group participating in different training programs. The groups were divided into HIIT and MICT groups, respectively, and they participated in high-intensity interval training and moderate-intensity continuous training for 3 months. Before and after the different interventions, the average BMI, vital capacity, and resting heart rate were measured. Results: There was no significant difference in BMI measurements between the two groups of obese college students before the intervention ($P>0.05$). Before and after the intervention, both groups showed a significant decrease in average BMI compared to before the intervention ($P<0.05$). After the intervention, the average BMI of the MICT group was significantly lower than that of the HIIT group ($P<0.05$). There was no significant difference in vital capacity and resting heart rate measurements between the two groups of obese college students before the intervention ($P>0.05$). After different interventions, both groups showed a significant increase in average vital capacity and a significant decrease in average resting heart rate compared to before the intervention ($P<0.05$). After the intervention, the average resting heart rate of the MICT group was significantly lower than that of the HIIT group ($P<0.05$). Conclusion: Both high-intensity interval training and moderate-intensity continuous training can significantly improve BMI and cardiopulmonary function in obese college students, with moderate-intensity continuous training having certain advantages in improving BMI and resting heart rate.

Keywords: college students, obesity, body mass index, cardiopulmonary function, moderate-intensity continuous training, high-intensity interval training

1. Introduction

In today's society, the issue of obesity is becoming increasingly serious, particularly among college students[1]. For college students, obesity not only affects their appearance but also may impact their physical health. Given this situation, it is essential to actively encourage obese college students to engage in physical exercise. Moderate-intensity continuous training is a form of aerobic exercise performed at a moderate intensity[2]. While this type of training requires a longer duration, consistent adherence can effectively enhance cardiopulmonary function and aid in weight management. High-intensity interval training (HIIT), on the other hand, involves alternating between high-intensity and low-intensity exercises[3]. This training method entails brief periods of high-intensity activity followed by immediate recovery at a lower intensity, which effectively burns fat and improves cardiopulmonary function. Additionally, HIIT requires minimal equipment dependency, making it accessible with simple fitness equipment. Based on these considerations, this study randomly selected 50 obese students from the first to third year of our university to observe the effects of HIIT and moderate-intensity continuous training on body mass index (BMI) and cardiopulmonary function in obese college students.

2. Materials and Methods

2.1 Materials

Fifty obese students were randomly selected from first to third-year students at our university to participate in this study. The enrolled students were randomly divided into two groups, with 25 students in each group, to participate in different training programs. The groups were designated as the HIIT group and the MICT group, respectively, and they underwent high-intensity interval training and moderate-intensity continuous training for a duration of 3 months. The HIIT group consisted of 13 males and 12 females, aged 19 to 23 years, with an average age of (21.21 ± 0.35) years and a BMI ranging

from 26 to 30 kg/m², with an average of (28.58±4.17) kg/m². The MICT group consisted of 14 males and 11 females, aged 20 to 23 years, with an average age of (21.19±0.41) years and a BMI ranging from 26 to 30 kg/m², with an average of (28.16±3.18) kg/m². The basic characteristics of the two groups of college students were comparable (P>0.05).

2.2 Intervention Methods

2.2.1 HIIT Group

The training content was designed according to the reference literature[4], with each training session lasting 60 minutes. The training content included exercises such as jumping jacks, push-ups, and high knees, divided into warm-up preparation (10 minutes), main body (40 minutes), and cool-down (10 minutes). The training took place at the Changsha Medical College track and gymnasium, with one training session per week on Mondays, Wednesdays, and Fridays, for a continuous period of 3 months.

2.2.2 MICT Group

The training content, duration, and location were consistent with the HIIT group, but the exercise intensity differed. The exercise intensity was controlled using a combination of target heart rate and subjective perceived exertion.

2.3 Observation Indicators

Before and after the different training interventions, the BMI index and cardiopulmonary function of the two groups of obese college students were measured. The observation indicators for cardiopulmonary function included vital capacity and resting heart rate.

2.4 Statistical Analysis

The collected data results were summarized, and statistical analysis was performed using Microsoft Excel 2003 and SPSS 22.0. The pre-test and post-test data results were described using mean ± standard deviation. The t-test was used for difference testing, with a significance level set at P<0.05.

3. Results

3.1 Comparison of Body Mass Index (BMI) Measurements Before and After Intervention in the Two Groups of Obese College Students

The comparison of BMI measurements between the two groups of obese college students before the intervention showed no significant difference (P>0.05). However, when comparing before and after the intervention within each group, both groups exhibited a significant decrease in average BMI compared to before the intervention (P<0.05). Furthermore, after the intervention, the average BMI of the MICT group was significantly lower than that of the HIIT group (P<0.05). See Table 1 for details.

Table 1. Comparison of BMI Measurements Before and After Intervention in the Two Groups of Obese College Students ($\bar{x} \pm s$, kg/m²)

Group	Sample Size	Pre-intervention BMI	Post-intervention BMI
HIIT Group	25	28.58±4.17	23.29±2.28 (1)
MICT Group	25	28.16±3.18	21.21±3.75 (1)
T-value	/	0.400	2.370
P-value	/	0.691	0.022

Compared to pre-intervention, significant difference, (1) P<0.05

3.2 Comparison of Average Vital Capacity and Resting Heart Rate Before and After Intervention in the Two Groups of Obese College Students

Before the intervention, there was no significant difference in the average vital capacity and resting heart rate measurements between the two groups of obese college students (P>0.05). However, after different interventions, both groups showed a significant improvement in average vital capacity and a significant decrease in average resting heart rate compared to before the intervention (P<0.05). After the intervention, the average resting heart rate of the MICT group was significantly lower than that of the HIIT group (P<0.05). See Table 2 for details.

Table 2. Comparison of Average Vital Capacity and Resting Heart Rate Before and After Intervention in the Two Groups of Obese College Students ($\bar{x} \pm s$)

Group	Sample Size	Vital Capacity (ml)		Resting Heart Rate (beats/min)	
		Pre-intervention	Post-intervention	Pre-intervention	Post-intervention
HIIT Group	25	2598.23±25.31	2875.36±15.69 (1)	86.23±2.15	82.51±1.09 (1)
MICT Group	25	2599.51±19.87	2870.54±16.75 (1)	86.21±1.98	79.33±2.01 (1)
t-value	/	0.199	1.050	0.034	6.954
P-value	/	0.843	0.299	0.973	< 0.001

Compared to pre-intervention, significant difference, (1) $P < 0.05$

4. Discussion

In today's society, obesity is becoming increasingly prevalent, especially among college students. Obesity not only affects physical health but also can lead to a range of health issues such as hypertension and diabetes [4]. Therefore, seeking effective weight loss methods is crucial for obese college students. In response to this situation, actively guiding obese college students to engage in physical exercise is imperative [5]. Currently, there is a wide variety of physical exercise options available. In this study, we chose to observe the effects of high-intensity interval training (HIIT) and moderate-intensity continuous training (MICT) on the body mass index (BMI) and cardiopulmonary function of obese college students.

The research results indicate that, compared to before intervention, both groups showed a significant decrease in average body mass index (BMI) ($P < 0.05$). Additionally, post-intervention comparison between the groups revealed that the average BMI of the MICT group was significantly lower than that of the HIIT group ($P < 0.05$). These findings suggest that both types of training were effective in significantly improving the BMI of college students, enhancing their physical appearance, with the MICT group showing more pronounced effects. Regarding cardiopulmonary function, the study results show that after intervention, both groups exhibited a significant increase in average lung capacity and a notable decrease in average resting heart rate compared to pre-intervention levels ($P < 0.05$). Furthermore, when comparing the groups post-intervention, the MICT group displayed a significantly lower average resting heart rate than the HIIT group ($P < 0.05$). This outcome demonstrates that obese college students participating in both high-intensity interval training (HIIT) and moderate-intensity continuous training (MICT) can significantly improve their cardiopulmonary function. Moreover, MICT shows a certain advantage in improving resting heart rate. HIIT is characterized by alternating between high-intensity and low-intensity exercises in short intervals, which effectively enhances fat burning and cardiovascular function [7]. This training method is effective in burning calories, improving fat burning efficiency, and consequently aiding in reducing body mass index. Additionally, interval training enhances cardiovascular function, increases endurance, and improves oxygen utilization efficiency, further promoting overall health. In comparison, moderate-intensity continuous training is a gentler exercise regimen typically involving moderate-intensity aerobic activities performed over a longer duration, such as jogging or brisk walking [8]. Although this training method may produce slower results, consistent adherence over the long term can effectively improve cardiovascular function, reduce blood pressure, and lower blood lipid levels, thereby exerting comprehensive positive effects on overall health [9]. Overall, both high-intensity interval training and moderate-intensity continuous training have positively impacted the body composition and cardiovascular function of obese university students. Moderate-intensity continuous training holds certain advantages. To achieve better results, it is recommended that obese university students undergo training under the guidance of professional coaches, select appropriate training methods based on their individual circumstances, and pay attention to maintaining a balanced diet.

In conclusion, for obese college students, both HIIT and MICT can improve their BMI and cardiopulmonary function, with MICT achieving better results in improving body composition and reducing resting heart rate.

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