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The effect of 8 weeks' moderate intensity interval training on body composition and cardio-respiratory endurance in obese teenage girl students

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Extended Abstract

Introduction

Teenage girls are prone to gaining weight in the abdomen, thighs, and buttocks. Other factors that lead to abdominal obesity include unhealthy diet, inactivity, hormonal changes, genetic disorders, diseases, and stress. Overweight and obesity are associated with various diseases and reduce quality of life and self-confidence, especially in adolescent girls; Therefore, it is important to introduce a solution that can encourage adolescent girls to engage in regular and fun physical activity. Research results showed that during exercise, fat-burning hormones are secreted, which play a very important role in weight control and health and are the important factor for maintaining health and wellness. Previous studies have shown that aerobic exercise has a positive effect on body fat percentage and body mass index in different individuals. One of the best aerobic exercise methods that has a great impact on modifying body composition is moderate and high intensity interval training. Moderate-intensity interval training improved aerobic capacity and reduced weight and body mass index in obese adolescent girls. Also, four weeks of intense interval training improved aerobic capacity and body composition. Additionally, eight weeks of intense interval training reduced %BF and BMI and increased muscle mass. Most previous research has studied the effects of high-intensity interval training, and there is little research on the effectiveness of moderate-intensity interval training. The aim of this study was to determine the effects of eight weeks of moderate-intensity interval training on body composition and cardiorespiratory endurance in obese adolescent girls.

Method

This semi-experimental study was conducted with a two-group research design with a control group and with pre and post-test in obese adolescent girls (BMI $\geq$ 30 kg/m^2) volunteers. The samples were 20 people who were randomly divided into two equal groups (control and training). The training program consisted of eight weeks of moderate-intensity interval training with a frequency of three sessions per week. In this training program, each training session consisted of two phases. From weeks one to four, the first phase consisted of 6 repetitions of 30-second running (70% of maximum heart rate) with 30 seconds of active rest (50% of maximum heart rate) between 6 repetitions. After a 4-minute inactive rest, the second phase was performed similarly to the first phase. From the fifth to the eighth week, the exercise intensity increased from 70 to 75% of maximum heart rate. The exercise intensity for each subject was calculated based on the Karvonen target heart rate formula. A body composition analyzer and a wall-mounted height scale were used to measure weight, body fat percentage, and body mass index. To estimate the subjects' maximal oxygen consumption, a one-mile walk and run test for adolescents was used. The Shapiro-Wilk test was used to determine the normality of the data distribution, and the analysis of covariance test was used to determine the significant difference between each variable between the training and control groups. For the assumption of the covariance test, homogeneity of variances test (Levine test) were used. The significance level for all statistical tests was $p \leq 0.05$.

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Results
The results showed that the exercise intervention significantly reduced the fat percentage and increased the lean body mass and aerobic capacity of the subjects. Fat percentage, lean body mass, body mass index, and maximal oxygen consumption were significantly different in the training group compared to the control group ($p \leq 0.001$). Fat percentage and body mass index decreased significantly, and aerobic capacity and muscle mass increased significantly.

Discussion and Conclusion
Moderate-intensity interval training reduced BMI, %BF, and increased lean body mass and aerobic capacity in obese adolescent girls. These results were consistent with the results of some previous studies, but were also inconsistent with some results. The difference in the exercise protocol is probably the main reason for these differences, as those studies used resistance training as the exercise intervention.
Moderate-intensity interval training reduced %BF and BMI. Physical activity and exercise lead to the activation of the sympathetic nervous system, and both the hormones epinephrine and norepinephrine are rapidly released, causing lipolysis. Previous research has shown that levels of these hormones remain high for several hours after interval exercise and that lipolysis continues even after exercise. In addition, interval training causes a negative calorie balance and increases daily energy expenditure in subjects, thereby improving body composition. Also, interval training may activate adipokines such as leptin and irisin, thereby altering body composition.
Moderate-intensity interval training improved aerobic capacity in obese adolescent girls. These results are consistent with the results of some previous studies, but are also inconsistent with some results. Previous studies have observed that interval training at different intensities can improve aerobic power and capacity; however, some of them have indicated that intense interval training did not make a difference in aerobic power in young obese women. In a study of high-intensity interval training in professional male soccer players, it was found that an 8% improvement in aerobic power was possible after two consecutive 10-week periods of 12 to 15 running bouts at 120% of maximal aerobic speed, alternating for 15 seconds with 15 seconds of active rest. The reasons for improving aerobic capacity include central adaptations, including increased cardiac output and stroke volume, as well as improved environmental factors, such as capillary adaptations, increased angiogenesis, increased hemoglobin and blood fluidity, and increased mitochondrial function. However, some studies have found an inverse relationship between weight loss and increased aerobic capacity. It is possible that increased lean body mass and decreased %BF were independent factors in this finding.
One of the important issues in prescribing an interval training program is determining the intensity of the exercise. It seems that due to the subjects' obesity and inactivity, moderate-intensity interval training is better than high-intensity. According to the results of this study, it is suggested that moderate-intensity interval training programs be used in physical education classes and sports programs for obese adolescent girls.

Keywords: Aerobic Capacity, Body Composition, Interval Training, Obesity, Adolescent Girls.

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