



COMPARING TWO MODES OF EXERCISE TRAINING WITH DIFFERENT INTENSITY ON BODY COMPOSITION IN OBESE YOUNG GIRLS

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Abstract

Purpose. Obesity is currently a serious, worldwide public health problem and a lifelong disease requiring early intervention before adulthood. This study compares the effects of high intensity aerobic training (HIAT) and Moderate intensity aerobic training (MIAT) after four and eight weeks on body composition in girls' obese students.

Methods. The present study includes 21 obese female students (fat percent 36% and BMI: 29.6%) randomly placed in three same groups, HIAT (n =7), MIAT (n =7) and control (n =6). Body composition (weight, body mass index, fat percentage, body fat mass, lean body mass and waist to hip ratio) in the students was measured using Bio-impedance before, in the middle and after 8 weeks of exercise. The exercises were done three days a week with interval high intensity (85-95% HR peak) and continuous moderate intensity (50 -70 % HR peak) respectively for 33 and 41 minutes with the same energy expenditure on the treadmill. To data analysis, parametric methods were used (*t* - paired and ANOVA) at significance level of $\alpha=0.05$.

Results. Results showed that although HIAT reduced the mentioned items in body composition in each of the testing processes, but this reduction was not significant, while the MIAT significantly decreased fat percentage, fat mass and WHR after 8 weeks. It also reduced other items except body lean mass but, they were non-significant. The significant difference was observed in body fat mass and fat percentage after 8 weeks between MIAT and HIAT. Comparing MIAT and control groups showed that significant difference in fat mass after 4 and 8 weeks and in fat percentage after 8 weeks.

Conclusions. Research results indicates that the MIAT causes further changes in body composition compared to the HIAT, although, during activity, HIAT fat oxidation rate was significantly improved after 8 weeks.

Key words. Aerobic training, Body composition, Intensity, Obesity

Introduction

Today, obesity and overweight have drawn world research's' attentions as a problem. As it has been cleared, sedentary and obesity are risk factors for many common diseases of the world including diabetes type 2, cardiovascular diseases, blood pressure, high blood lipid, arthritis, asthma, and recently cancer.

On the other hand, body activities especially along with diets have been considered as a strategy for weight loss. Regular activities are followed by metabolic changes in muscles and adipose tissues; therefore they increase using of fats as energy instead of storing them. Some research also mentioned that exercises can improve appetite (Bilski et al, 2009; Bay et al, 2009). However weight loss is not the only benefit of exercise and some other desired effects such as improving cardiovascular risk factors, decreasing harmful blood lipid, decreasing blood pressure, decreasing glucose level in blood, decreasing depression, improving muscle strength and preventing osteoporosis are attributed to exercise.

Researchers conducted extensive researches on the best method of exercise which help with body weight management. Endurance exercises with low to moderate

intensity have been usually considered as a desired method for fat and weight loss from so long.

Due to time shortage in modern human life and as these kinds of exercises take lots of time; scholars have dealt with more modern methods of weight loss. They have newly shown that higher intensity exercises lead

to weight loss and fat-flush increase. Some studies have shown that high intensity exercises by healthy people, obese women before menopause, overweight male soldiers and cardiac patients improve blood lipid profile, body composition, fat oxidation, weight loss and maximum oxygen consumption. Burgomaster et al (2005) and Talanian et al. (2006) showed that short time exercises, i.e. 6 sessions, with high intensity increase fat oxidation in healthy active or sedentary people. Mara et al. (2007) also showed that exercises with high intensity decrease higher percentage of fat among overweight male soldiers. However, Van Ajel Ligsen et al., (2002), did not find any differences between fat percentages during two exercises of high and low intensity. Therefore, we do not yet know what exercise intensity and how long exercising has the most influence on body composition. In this case, this research was conducted aiming to study the influence of exercise intensity during a 4-week and 8-week exercise on body composition of young obese girls. High intensity exercises were done constantly so that obese girls obtain the ability to do them. Exercises with

Method

After primitive screening, 21 volunteer obese young girls (age 22.1 ± 0.49 years, weight 77 ± 2.40 kg, height 161.5 ± 1.43 cm, fat $36.1 \pm 0.57\%$, BMI 29.6 ± 0.93 kg/m²) exercised with treadmill 3 days a week for 8 weeks. The limitations of the research were non-participation in any kinds of physical activity at least for 6 months, not catching any diseases and having at least 35% fat. Consent form was completed

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by all samples. All samples cooperated eagerly up to the end of research. Samples were randomly divided into 3 groups with high exercise intensity (VO_{2peak} 80-90%), moderate exercise intensity (VO_{2peak} 50-60%) and control group. There were not any significant differences among the three groups before conducting the research (Table 1). Samples were asked to keep their diet constantly during the whole study. For this purpose, 7-day diet reminding questionnaire was used. Research protocol was surveyed by Ethics Committee of Islamic Azad University.

Physiological assessments

Height of the samples was measured by digital height gauge (Satrap, Iran); weight, fat percentage, fat mass and lean body mass also measured by bio-impedance (Olympia, Korea).

Maximum oxygen consumption was measured by modified Bruce treadmill test (hp-cosmus, Germany) and through collecting respiratory gases (Ganshorn, Germany) using direct calorimetric method. Heart beat was measured constantly through Polar heart rate monitor.

The Exercise program

Having assessed body compositions, VO_{2peak} , and diving patients into two groups of high intensity interval training (HIIT) and moderate intensity continual training (MICT), all of patients participated in an exercise program of three times per week in an 8-week duration. The HIIT group was walking on the treadmill to warm up for 5 minutes specified by 50–60% of VO_{2peak} (50–70% of HR_{peak}), then they were exercising for four intervals of 4- min at 80–90% of VO_{2peak} (85–95% of HR_{peak}), and three intervals of 3-min at 50–60% of VO_{2peak} (50–70% of HR_{peak}). Each training session terminated by a 3-min cooling down period at 50–70% of VO_{2peak} . Therefore total exercise time in each session was 33 minutes. The subjects of continual training group were walking on the treadmill for 41 minutes with 50-70% of HR_{peak} . The first and the last 3-5 minutes of each session was dedicated to warm-up and cool-down and its intensity was less than the one in the main program. To equate the total work performed by the two groups in each session, the following formula was used (3-5):

$$\text{Time spent in MCIT} = (60\% \text{ of mean } v_{O_{2peak}} \text{ of all subjects}) \times 3 \times 3 + (90\% \text{ of mean } v_{O_{2peak}} \text{ of all subjects}) \times 4 \times 4$$

$$\text{Intensity of MCIT (60\% of mean } v_{O_{2peak}})$$

Table 1. Physical characteristics of subjects in each group

Parameter	HIAT	MIAT	Control	<i>p</i>
Number	7	7	6	NS
Age(years)	22.29±0.89	21.37±0.5	23±1.15	0.35
Height(Cm)	162.4±1.4	160±0.03	162±0.03	0.84
Weight(Kg)	77.13±2.7	78.68±5.9	74.63±1.72	0.81
Waist to hip ratio	0.89±0.01	0.89±0.02	0.87±0.013	0.66
Fat Percent (%)	35.96±0.56	36.90±1.23	35.47±1.01	0.60
BMI(kg/m ²)	29.2±0.8	30.65±2.25	28.6±1.16	0.67
VO_{2peak} (ml/kg ⁻¹ .min ⁻¹)	20.40±1.6	19.65±2.51	19.35±2.67	0.23

P value less than 0.05

through Kolmogorov-Smirnov test, parametric one-way analysis of variance (ANOVA) was used through post hoc test LSD and Paired T test along with Bonferroni correction to survey research hypothesis at the meaningful level of ($05/0 \geq \alpha$). Data were analyzed through computer software spss version 17.

Result

Results showed that fat percentage ($P=0.014$), fat mass ($P=0.015$) and waist-hip ratio ($P=0.007$) had

Also fat mass was significant in the group with moderate exercise intensity in compare with control group ($P=0.029$) after 4 weeks and with the group by high exercise intensity ($P=0.027$) and control group ($P=0.011$) after 8 weeks. Percentage of fat was significant only after 8 weeks in the group with moderate exercise intensity in compare with the group by high exercise intensity ($P=0.02$) and control group ($P=0.03$). (Table 2).

Table 2. Metabolic data of two groups before and after training

Parameter	HIAT		MIAT		Control	
	After 4 week	After 8 week	After 4 week	After 8 week	After 4 week	After 8 week
Weight(Kg)	76.87±2.88	76.64±2.84	77.66±5.87	77.59±6.18	75.63±2.47	75.67±2.76
FP (%)	35.61±0.81	35.81±0.73	35.12±1.35	35.17±1.34δ*	34.98±1.17	35.23±0.92
BFM (Kg)	27.50±1.58	27.57±1.51	27.45±2.61§	27.11±2.58§δ*	26.62±1.35	26.75±1.54
BMI(kg/m ²)	29.09±0.81	29.01±0.84	30.24±2.22	30.19±2.32§	28.98±1.32	29±1.32
LBM (Kg)	49.37±1.36	49.07±1.38	50.21±3.6	50.42±3.93	49.25±1.75	48.92±1.36
WHR	0.88±0.007	0.88±0.009	0.87±0.02	0.87±0.02*	0.87±0.009	0.87±0.009

FP: Fat Percent; BFM: Body Fat Mass; BMI: Body Mass Index; LBM: Lean Body Mass; WHR: Waist to hip ratio

*Different from baseline, P<0.05; δDifferent from HIAT, P<0.05; §Different from Control, P<0.05

Discussion and conclusion

Results showed that fat percentage, fat mass and waist-hip ratio had significant decrease in the group with alternative moderate exercise intensity before and after 8 weeks. Also fat mass was significant in the group with moderate exercise intensity in compare with control group after 4 weeks and with the group by high exercise intensity and control group after 8 weeks. Percentage of fat was significant only after 8 weeks in the group with moderate exercise intensity in compare with the group by high exercise intensity and control group.

Duration of the exercises was considered 8 weeks in the present research. Exercises with high intensity (HR_{peak}85-95%) were done alternatively with decreasing the intensity in some period so that sample being able to exercise for 31 minutes as some researchers have recently shown that exercises with high intensity can decrease weight and fat percentage or increase fat oxidation (Trojan et al, 2009; Davidz et al., 2008; Adel et al., 2010; Pari et al., 2008). As exercise with moderate intensity (HR_{peak}65-75%) is the common exercise in researches about weight loss and as it is a suitable exercise for health, it was selected for comparison. Exercises with high intensity were previously studied among diabetics, cardiac patients, patients with metabolic syndrome and even healthy active people and military men. Results showed that exercise with high intensity can improve factors such as weight loss, fat percentage and increase capacity of fat oxidation (Mara et al., 2007; Zilaei et al, 2012; Burgomaster et al, 2005).

Talanian et al, showed that alternative short time exercises, i.e. 6 sessions, with high intensity will increase fat oxidation. In the present research, 2 exercise programs were isocaloric so that exercise intensity being as an effective factor on body composition. Exercises with moderate intensity for 41 minutes had more effect on fat lose. It also decreased fat mass and percentage significantly in 4th and 8th

weeks while exercises with high intensity could not significantly effect on any body composition factors.

At the beginning of the research, in addition of group integrating with regard to physiologic characters, all samples were asked to keep their received calories fixed through recording their food consumption using 7-day diet reminding questionnaire before of the research, among the weeks of exercises and at the final week of exercises. Although there was no significant difference in received calorie from before to after the research, but in the group with high exercise intensity, received calorie showed more increase in compare with the group by moderate exercise intensity. Also in the group with high exercise intensity fat free mass increased a little which was not significant. This is while there was not significant decrease in weight in both groups. The study by Mara et al. (2007) conducted in the same intensity rate with the present research, showed significant decrease in fat percentage in the group by high exercise intensity. This is while that in the present research, male soldiers was overweight who exercised for 14 weeks. In this research, samples run or walked fast 30 km for the first 5 weeks and 4 km for the remained 9 weeks with intensity HR_{max} 60-70% in group with moderate exercise intensity and HR_{max} 75-90% in group with high exercise intensity. In the present research, only changes of fat percentage were surveyed in advance and after exercise. Irving et al. (2008) also surveyed the effect of 16 weeks exercise on 27 obese women suffering from metabolic syndrome in three groups, i.e. control, exercise with high intensity (higher than lactate threshold for 3 days and less than lactate threshold for 2 days a week) and exercise with moderate intensity (less than lactate threshold for 5 days a week). The results mentioned that exercise with high intensity decrease abdominal fat, abdominal subcutaneous fat, total percent of body fat, body weight and BMI significantly while there was not any significant changes in any factors in group with moderate exercise intensity and in control group.



Exercises were coordinated based on consuming calories and the group by high exercise intensity showed significant decrease in abdominal fat and abdominal subcutaneous fat in compare with the group by moderate exercise intensity. Scholars reported factors which stimulate effect of exercises with high intensity on body fat decrease including more lipolytic hormone secretion (growth hormone and epinephrine) in exercises with high intensity which facilitate more fat oxidation. The other factor is that under isocaloric condition, exercises with high intensity cause more balance in negative energy in compare with exercises with low intensity. Researchers of this study did not mentioned that why exercise with moderate intensity for 5 days a week which burned 350 to 400 calories could not change amounts of body compositions. In another research by Santez et al. (2004), different amount of exercises on body composition and weight of overweight sedentary and women were compared. Results showed that all exercises with low volume/moderate intensity (19.2 km with VO_{2peak} 40-55%), low volume/high intensity (19.2 km with VO_{2peak} 65-80%) and high volume/high intensity (32 km with VO_{2peak} 65-80%) for about 3-4 days a week during 5 to 8 months significantly decrease weight, fat mass and body fat percentage. Of course amount of decrease was more in group with high volume/high intensity. Therefore scholars suggested that when there is lack of change in diet, more activity is required to keep weight. Also observed positive balance of energy is little in overweight people which could be inversed through moderate volume of exercise (30 minutes for all days of a week). In compare with the mentioned researches, Gootin et al. (2002) surveyed effects of exercise intensity on body composition and abdominal obesity in obese adults. They found that although exercises with high intensity improve cardiovascular preparedness but they are not superior to exercises with less intensity to decrease body fat percentage. In this research eighty 13-16 years old adults exercised for 8 months and had the same consuming calories in two groups with high exercise intensity and moderate exercise intensity. In a research by Geradgin et al. (1995), 12 unexercised women with extra fat mass were divided into two groups of high exercise intensity (VO_{2max} 80 %) and low exercise intensity (VO_{2max} 50%). After 12 weeks exercise (4 days a week) body composition did not show any significant difference in both groups, although fat-free mass increased in the group with high exercise intensity and fat mass decreased in both groups. Researchers suggested that it is also the reason of absolute decrease of weight in the group with low exercise intensity. They also suggested that if fat decrease is the goal and if there is not enough time, then exercises with high intensity could be more effective. In another research by Domortyer et al. (2002), it was showed that 2 month exercise with low intensity (in a level with maximum fat oxidation) decreased body fat percentage, body weight, circumference of the waist and the hips and improved

fat oxidation normally in 17 patients suffering from metabolic syndrome. Researchers mentioned that this level of exercises is more delight for sedentary people so that it cause more fat-flush. In addition strength against insulin was decreased in these people. Extensiveness and variety of applied intensities in different researches lead to different results. It is believed that what is happened after the duration of exercise (recovery) is more important than the time of exercise for fat decrease. These beliefs in researches show that if two methods of exercise are coordinated regarding consuming calories, usually exercises with high intensity, low intensity, below the maximum and alternative exercises do not show significant differences regarding fat decrease. In fact, during more studies which amount of burning calories measured after exercises, it was cleared that exercises with high intensity much more increase burning calories (Tremblay et al., 1994). In fact in exercises with high intensity, consuming calories after exercise applied more fat in compare with exercises with low and moderate intensity due to increase in extra consuming oxygen (Seldak et al. 1989; Mac Ardel, 1996). More studies have dealt with comparing exercises of low and high intensity due to effect of exercises with low intensity on more fat oxidation and a few studies have dealt with comparing exercises with moderate and low intensity; however they mentioned inconsistent results which are due to difference in selecting samples and their particulars, time of exercise or kind of diet control.

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