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Effect of Six Weeks of Aerobic Interval training on Serum Vaspin and Blood Glucose Levels in Obese Inactive Girls

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ABSTRACT

Background and objectives: The prevalence of obesity and overweight in women is increasing. Secretion of adipokines such as vaspin may affect insulin sensitivity. It has been suggested that physical activity can alter circulating vaspin levels. The purpose of this study was to investigate effects of six weeks of aerobic interval training on serum vaspin and blood glucose levels in obese inactive girls.

Methods: In this quasi-experimental study, 22 inactive overweight girls were selected from the Shahid Chamran University of Ahvaz, Iran. The mean age, weight and body mass index of the subjects were 24.22±1.35 years, 83.77±12.66 kg and 32.56±3.36 kg/m^2, respectively. The subjects were randomly divided into an experimental group (n=11) and a control group (n=11). The experimental group performed aerobic training on stationary bicycle at 65-80% of maximal strength, three sessions a week for six weeks. Serum levels of vaspin and glucose were measured using commercial kits. Data were analyzed using SPSS (version 23) and at significance of 0.05.

Results: The training intervention had no significant impact on the serum vaspin and glucose concentrations (P>0.05). In addition, the covariance analysis showed that serum vaspin and glucose levels did not differ significantly between the study groups (P>0.05).

Conclusion: Based on the results, the six-week aerobic interval training had no significant effect on vaspin and blood glucose levels of inactive obese girls. It is recommended to further examine the effect of this type of exercise at higher intensities and for longer durations.

Keywords: Blood Glucose, High-Intensity Interval Training, Women.

Obesity is associated with an increase in body fat mass, which increases the risk of several diseases including coronary heart disease, type 2 diabetes, stroke, hyperlipidemia and cancer (1). In addition, by imposing huge costs in the health sector, it will lead to an increase in premature death in the community (2). In addition to playing a role in energy storage, adipose tissue also contributes to controlling the body's metabolism. This is mainly mediated by adipokines, cytokines secreted by the adipose tissue (3). Plasma levels of most adipokines increase with increasing adipose tissue and adipocyte volume. Vaspin (47 kDa) belongs to the family of adipokines and is highly expressed in visceral adipose tissue. Increase in vaspin secretion often coincides with an increase in body fat percentage and blood insulin concentrations (4). Clinical studies have shown that increased level of vaspin in the blood is associated with obesity and insulin resistance (5). Moreover, increased secretion of vaspin causes weight loss and increases insulin sensitivity, which can be beneficial for people with type 2 diabetes (6). Vaspin could improve insulin sensitivity in the liver, skeletal muscle and adipose tissue by activating the IRS/PI3K/Akt/Glut signaling pathway and inhibiting the IκBα/NF-κB signaling pathway (7). Exercise is thought to affect the secretion of this adipokine (4). High-intensity interval training (HIIT) can be an effective alternative to traditional aerobic training. Compared to traditional aerobic exercise, HIIT can induce similar or even greater physiological and functional effects at lower intensities (8). Kadoglou et al. reported that six months of aerobic exercise with an intensity of 65 to 75% of maximum heart rate increases serum vaspin levels in patients with type 2 diabetes (9). Safarzadeh et al. observed that eight weeks of aerobic exercise could significantly increase weight loss in overweight women (10). The aim of this study was to investigate effects of six weeks of aerobic interval training on serum vaspin levels and blood glucose of obese girls.

MATERIALS AND METHODS

In this quasi-experimental study, 22 obese girls (mean age of 24.12± 1.35 years) with an average weight of 83.37±12.60 kg and mean body mass index (BMI) of 32.54 ± 3.36 kg/m^2 were randomly selected from Shahid Chamran University of Ahvaz, Iran. The subjects were randomly divided into an experimental group (n=11) and a control group (n=11). Data related to age, marital status, education, history of drug use, history of disease and physical activity status were collected via a researcher-made questionnaire. Height, VO_2max and weight of the subjects were also measured.

Blood Sampling

Fasting blood samples were taken before the first training session and 48 hours after the last training session. Serum was separated by centrifugation at 3,500 rpm and then kept at -20 ^oC for future analysis.

Serum vaspin levels were measured using a commercial kit (Bioassay Technology Laboratory, China). Glucose levels were measured using a kit made by Pars Azmoun Company, Iran.

Training protocol

The Storer-Davis cycle test was used to measure the subjects' aerobic power (VO_2max).

First, the subjects learned how to perform the test. After 5 to 10 minutes of light stretching and warm up, the subjects performed the test on the bicycle. The test consists of 25 one-minute steps and a total of 27 minutes in which the subject rides a monarch bicycle for 5 minutes in the warm up phase without workload, and at maximum power (50 watts) for 2 minutes at a speed of 40-50 rpm pedaling. After 2 minutes, 15 watts more load were added per minute until fatigue and exhaustion (11). Table 1 shows the details of the Storer-Davis test. The VO_2max of the subjects was calculated using the following formula:

VO_2max (ml.kg.min)=9.39(W)+7.7(kg)-5.88(years)+136.7(ml.min)weight(kg).

Table 1- Details of the Storer-Davis cycle test

Watt	Intensity	Watt	Intensity
1	50	17	250
4	65	18	300
7	80	19	340
9	95	20	375
11	110	21	400
12	125	22	415
13	140	23	430
14	155	24	440
15	170	25	445
16	205		

Aerobic interval training

Aerobic interval training protocol was designed according to previous studies and with intensity appropriate to the subjects' conditions. The subjects performed aerobic interval training three sessions a week for six weeks. Each session included warm-up, main exercise and cool down. The subjects rode for 5 minutes on the Monarch bicycle with an intensity of 30-40% of maximum foot power for 5 minutes. The workload increased from seven alternations in the first week to 11 alternations in the sixth week. Intensity of pedaling was considered as a percentage of the maximum power. The Storder-Davis test was also used to obtain maximum leg strength. In this case, the subjects cycled with 65% of maximum power in the main exercise stage and with 40-40% of maximum power in the rest phase. This intensity reached 80% of the maximum power in the main exercise phase during the sixth week. In addition, the duration of activity increased from 50 seconds in the first week to 70 seconds in the sixth week (Table 2). Each training session ended with a 5-minute cool down with 30-40% of maximum power. The exercise intensity increased from 65 to 80% of the maximum leg strength.

Statistical analysis

All data were analyzed using the SPSS software (version 23). Descriptive statistics including mean value and standard deviation were used to describe the anthropometric and physiological characteristics of the subjects. The Shapiro-Wilks test confirmed normal distribution of dataThe dependent t-test was used to analyze intragroup differences. Intergroup differences were evaluated by analysis of covariance.

RESULTS

The anthropometric and physiological characteristics of the subjects are presented in table 3.

Table 2- Protocol of the aerobic interval training using the Monarch's bicycle

Week	Repetitions	Rest / Work (seconds)	Exercise intensity (Maximum power percentage)	Round per minute
First	7	50/100	65	50-60
Second	8	50/100	70	50-60
Third	9	60/120	70	50-60
Fourth	10	60/120	75	50-60
Fifth	11	70/140	75	50-60
Sixth	11	70/140	80	50-60

Vaspin level increased slightly in the training group compared to pretest. Glucose levels did not change significantly after the training intervention. There was no significant difference in terms of glucose level between the study groups (Table 4).

Table 3- Mean anthropometric and physiological characteristics of the subjects in the study groups

Group	Age (years)	Height (cm)	Weight (kg)	VO_2max
Training	24.12±1.35	159.75±6.58	83.37±12.60	19.37±2.02
Control	23.62±1.59	157.12±6.93	83.10±10.19	19.05±1.48

Table 4-Between groups Results Vaspin Indicators and Blood Glucose

Variable	Group	Stage		Intragroup p-value	Intergroup p-value
		pretest	posttest		
Vaspin (pg/ml)	Training	3.56±0.79	4.14±1.31	0.059	0.072
	Control	3.71±0.52	3.55±0.69	0.55	
Blood glucose (mg/dl)	Training	103.21±7.01	91.22±4.01	0.24	0.33
	Control	102.40±3.25	99.29±7.61	0.78	

Vaspin level increased slightly in the training group compared to pretest. Glucose levels did not change significantly after the training intervention. There was no significant difference in terms of glucose level between the study groups (Table 4).

DISCUSSION

In the present study, six weeks of aerobic interval training did not significantly alter the level of vaspin, blood glucose and fat mass of obese girls compared to the control group. Increased serum vaspin concentrations following exercise have been reported by some studies (4, 12), while some other studies have reported a reduction in serum vaspin following exercise activity (13-15). Contrary to the results of our study, Montazerifar et al. reported that 10 weeks of endurance exercise resulted in weight loss and improved serum vaspin level in young men (14). Consistent with our findings, Kim et al. found no significant difference in serum vaspin levels after resistance training in obese girls (16). Oberbach et al. also observed no significant difference in serum vaspin levels after two training intervention programs and antacid supplementation (15). Youn et al. attributed the increase in vaspin levels after four weeks of training in diabetic patients to a decrease in BMI, improved aerobic fitness, altered body composition and increased insulin sensitivity (12). In general, serum vaspin changes are influenced by many factors, including diet, physical activity, hormonal status and environmental factors (17). In the present study, a minor increase was observed in serum vaspin levels following the six-week training intervention. Due to the anti-inflammatory role of vaspin, it seems that increasing vaspin levels through exercise can be a compensatory or protective mechanism against oxidative stress and vascular damage (4, 18). Mogharnasi et al. reported that eight weeks of endurance and resistance training reduced vaspin levels in overweight and obese women (13). Exercise interventions may have different effects depending on the baseline levels of vaspin. In other words, the health status of the subjects, weight and lack of physical activity can affect how vaspin responds to exercise (19).

Improved glucose metabolism and insulin sensitivity are strong predictors of increased vaspin concentration. In our study, aerobic interval training did not have a significant effect on the blood glucose level of obese girls. In a previous study by Fazeli et al., blood glucose and insulin parameters changed significantly after eight weeks of strenuous periodic exercise in overweight women (20). Similar to our findings, a previous study by Bello et al. showed no significant change in blood glucose following aerobic exercise (21). The lack of significant change in glucose concentration could be related to the low intensity and duration of exercise (21). Inconsistent with our findings, Kadoglou et al. reported a decrease in glucose following exercise (22). Exercise increases glucose uptake in the muscles, which is associated with functional changes in insulin signals associated with increased GLUT-4 protein content (23). Chang et al. reported a reduction in glucose concentration after 12 weeks of moderate-intensity exercise in type 2 diabetic patients (24). Youn et al. reported a significant increase in vaspin levels after four weeks of exercise in diabetic patients. They attributed this significant increase to decreased BMI, improved aerobic fitness and increased insulin sensitivity (12). Kazemi et al. claimed that 10 weeks of aerobic activity reduced serum vaspin levels in overweight women without affecting blood glucose levels (25).

CONCLUSION

According to the results of the present study, six weeks of aerobic interval training does not significantly alter serum vaspin and glucose levels in inactive obese girls. Difference in subjects' characteristics, duration of exercise, nutritional status and diet as well as other environmental factors could have affected the outcome of the training intervention.

CONFLICT OF INTEREST

The authors declare that there no conflict of interest.

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