Effects of Eight Weeks of Aerobic Exercise on Visfatin, Homocystein, C - reactive protein and Lipid Profile in Sedentary Men

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ABSTRACT

Background and objectives: Visfatin is a newly characterized adipokine, which is highly expressed in visceral adipose tissue. The aim of this study was to evaluate effects of aerobic exercise training on visfatin, homocystein, C-reactive protein and lipid profile in sedentary men.

Methods: In this quasi-experimental study, 27 sedentary men were selected by convenience sampling method. The subjects were divided into a control group (n=13) and an aerobic training group (n=14). The subjects in the experimental group performed 60 minutes of aerobic exercise at 75-85% of maximum heart rate, three sessions per week for eight weeks. Data were analyzed in SPSS 16.0 (SPSS Inc., Chicago, IL, USA) using paired and independent sample t-test for comparison of means within and between groups, respectively. A P-value of less than 0.05 was considered statistically significant.

Results: The eight-week aerobic exercise training significantly reduced body weight (P=0.02), body mass index (P=0.01) and low-density lipoprotein-cholesterol (P=0.03) levels. It also caused a significant increase in the high-density-lipoprotein-cholesterol (P=0.00) and a significant decrease in visfatin levels (P=0.005). Serum homocysteine and C-reactive protein levels decreased by the end of the training program, but these changes were not statistically significant (P>0.05).

Conclusion: The eight-week aerobic exercise program could effectively improve lipid profile and visfatin levels. Therefore, this type of exercise could be recommended for prevention of cardiovascular disease and improvement of its risk factors.

Keywords: Aerobic, C-reactive protein, Exercise, Homocysteine.

INTRODUCTION

Cardiovascular disease (CVD) is one of the major causes of death worldwide and the leading cause of death in Iran (1). Several highly specific and sensitive new markers such as visfatin, C-reactive protein (CRP), homocysteine, insulin, and insulin resistance have been proposed to predict CVD (2-7).

Visfatin is a 52-kDa protein expressed in lymphocytes identified as pre-B-cell colony-enhancing factor (8), which can regulate immunity as a cytokine. It also helps regulate glucose hemostasis (2). Visfatin has been detected in human atherosclerosis plaques and elevated serum visfatin levels increase inflammatory cytokines, such as tumor necrosis factor alpha and interleukin-6 (IL-6) in human monocytes (3). Another stable potent marker of inflammation and CVD is homocysteine and CRP produced in response to IL-6 and the alpha-receptor-positive factor (lipoproteins) in the liver (9). In this regard, lowered CRP level is associated with reduced risk of CVD and other chronic obesity-related diseases including diabetes and cancer (10). Homocysteine is a small sulfur-containing amino acid and its metabolism requires certain vitamins, such as B12, B6, and folate. It can cause peroxide and hydrogen superoxide production in the inner stratum of the arteries, platelet aggregation, and change the amount of coagulation factors that facilitates clot formation (11).

Aerobic activity has beneficial effects on CVD risk factors and complications associated with obesity. It improves glucose tolerance and insulin sensitivity, which are dependent on visfatin concentrations (12). In this regard, Kargarfard et al. reported that serum visfatin levels decrease significantly after eight weeks of resistance training and combined aerobic and resistance training (13). Dehghanpisheh et al. reported that that the level of plasma visfatin decrease significantly in women following trice weekly training at 60% maximal oxygen uptake (12).

According to Khanna et al., diet (45% protein, 30% fat) and circuit resistance exercise (4 days a week) with walking (10,000 steps a day, 3 days a week) for 11 weeks can significantly decrease visfatin levels and insulin resistance (14). In contrast, Abdolali et al. reported that 12 weeks of aerobic training has significant beneficial effects on body composition but has no significant effect on visfatin level in obese women (15). The contradiction in the results could be due to various factors such as the amount of fat and its distribution, inflammatory conditions, hormones, and exercise type and intensity. Therefore, more research is needed to better understand the role of visfatin and factors controlling its synthesis and release. Considering the important role of physical activity in the prevention and treatment of various diseases, this study aimed to determine the effect of eight weeks of aerobic training on level of visfatin, CRP, homocysteine and lipid profile of inactive men.

MATERIAL AND METHODS

This quasi-experimental study with a pretest and posttest design was carried out in Mashhad, Iran. Subjects included 27 healthy inactive men (age range: 20 to 25 years) with body mass index (BMI) of 20 to 22 Kg/m^2 who were selected through selective and targeted sampling. In the first stage, the subjects became familiar with the nature and manner of cooperation with the implementation of the study.

The inclusion criteria consisted of being healthy according to a Health Questionnaire, no drug use, no smoking, and no participation in any training program at least two months prior to participation in this study. After obtaining written consent, the subjects were divided into an experimental (n=14) and a control (n=13) group. The following equation was used to determine sample size:

$$n = \frac{2\sigma^2 (Z_{1-\alpha/2} + Z_{1-\beta})^2}{d^2} = \frac{2(2.5)^2 (2+1.28)^2}{3.5^2} = 10.97 \cong 11$$

In this equation, power of the test was 0.8, a=0.05 and variation of means was 2.5 unit. Based on the estimated equation, a sample size of 10.97 was obtained. Physical activity level of the subjects before and after the eight-week aerobic training was studied using the Kaiser physical activity survey. The reliability of the questionnaire is 0.87 (16). The control group did not perform any exercise during the study period. The study protocol received approval from the Ethics Committee of Medical Research under IRCT code number (IRCT20120129008863N7).

In order to evaluate body composition, bioimpedance parameters including body fat percentage, weight and height were measured

using Inbody 720 body composition analyzer (Biospace, Dogok-dong, South Korea). BMI was calculated by dividing body weight (Kg) by height squared (m^2). The subjects were instructed to refrain from eating and drinking for four hours before the tests (17).

Bruce protocol treadmill test was used to estimate the maximum energy consumption. The test was carried out in 10 three-minute stages. The treadmill started at 2.74 Km/h at a gradient of 10%. The speed and gradient of the device were increased gradually. Maximum energy consumption based on the Bruce protocol was calculated using the following equation:

Maximum energy consumption (ml/kg/min) = $14.8 - (1.379 \times T) + (0.451 \times T^2) - (0.012 \times T^3)$

Blood samples were also collected 48 hours before the first training session and 24 hours after the last session. All samples were taken between 8 and 10 AM after a 15-min rest in supine position. All participants were asked to avoid any intense physical activity such as cycling, running and walking for longer than 15 minutes before sampling (17). Serum visfatin level was measured by ELISA and using Zelbaye kits (Germany). Serum CRP levels were measured by nephelometric method and using MININEPH kits (Binding Site Group Ltd., UK). Amount of homocysteine was measured using Axis-shield ELISA kits (UK). The lipid profile was assessed using commercial kits (Pars Azmoon Co., Iran). The subjects performed 60 minutes of aerobic exercise at 75-85% of maximum heart rate trice a week for eight weeks. The exercise protocol included warm-up for 10 minutes (walking, slow running, stretching and jumping). The exercise session lasted 30 minutes at first and was increased to 45 minutes at the end of the study. The exercise intensity was controlled during the training sessions with a heart rate monitor (Polar, Finland). At the end of each session, all participants were examined and the exercise intensity was adjusted accordingly (17). After eight weeks, all measurements were repeated similar to the pre-test conditions. In all stages, the exercise intensity was controlled by the Borg rating of perceived exertion (18).

Results were analysed using SPSS 16.0 (SPSS Inc., Chicago, IL, USA). Data are expressed as mean ± standard deviation (SD). Normal distribution of the data was assessed using the Shapiro–Wilk test and the homogeneity of variances was tested by the Levene's test. Comparison of means within and between the groups was made using paired and independent sample t-test, respectively. P-value of less than 0.05 was considered statistically significant.

RESULTS

The characteristics of the subjects in the experimental and control group are shown in table 1. The eight-week aerobic training caused a significant decrease in body weight, BMI and in low-density lipoprotein (LDL) level. However, the high-density lipoprotein cholesterol (HDL-C) increased significantly after the exercise program (Table 2).

As shown in table 3, visfatin values decreased significantly after the eight-week training exercise. The exercise program also caused a decrease in serum homocysteine and CRP levels, but these changes were not statistically significant (P>0.05). There was a statistically significant difference between the mean BMI, HDL and serum visfatin levels in the experimental group and in the control group.

Table 1- The characteristics of the subjects in the two study groups

Groups	Age (years)	Height (cm)	Weight (Kg)	BMI (Kg/m^2)
Experimental (n=14)	22.57±1.55	176.64±5.37	69.85±7.77	21.36±2.74
Control (n=13)	22.61±1.93	174.92±3.75	71.12±5.06	22.35±1.99

Data are shown as mean ± SD

Table 2- Changes in the serum lipid profile of subjects in response to aerobic exercise training

Variables	Groups	Stages		Variation	
		*Pretest	*Posttest	P-value**	P-value***
Weight (Kg)	Exercise	69.85±7.77	69.49±7.79	0.001†	0.06
	Control	71.12±5.06	70.96±4.96	0.33	
BMI (Kg/m²)	Exercise	21.36±2.74	21.22±2.75	0.01†	0.05†
	Control	22.35±1.99	22.36±1.98	0.93	
LDL-C (mg/dl)	Exercise	112.35±29.67	101.57±20.87	0.03†	0.84
	Control	98.23±23.34	88.76±20.19	0.06	
HDL-C (mg/dl)	Exercise	44.85±8.51	54.21±1.03	0.001†	0.001†
	Control	53.38±5.57	50.84±7.30	0.21	
TG (mg/dl)	Exercise	118.92±58.07	117.35±59.14	0.74	0.63
	Control	99.61±34.45	101.61±29.24	0.73	
TC (mg/dl)	Exercise	176.42±32.91	177.21±33.49	0.86	0.94
	Control	164.38±27.91	165.76±26.49	0.84	

† A significant difference (P<0.05), *Data presented as mean ± SD, ** P-value within group   *** P-value between group

† A significant difference (P<0.05), *Data presented as mean ± SD, ** P-value within group   *** P-value between group

Table 3- Changes in the serum visfatin, homocystein and CRP levels of subjects in response to aerobic exercise training

Variables	Groups	Stages		Variation	
		Pre-test (M±SD)*	Post-test (M±SD)*	P-Value**	P-Value***
Visfatin (mg/ml)	Exercise	98.09±35.90	90.92±34.79	0.005†	0.005†
	Control	103.58±41.56	104.54±41.09	0.55	
Homocystein (mm/l)	Exercise	12.82±5.40	12.01±4.73	0.07	0.79
	Control	15.47±11.15	14.21±7.39	0.48	
CRP (mg/ml)	Exercise	1.98±2.60	1.56±1.94	0.25	0.45
	Control	1.67±1.29	1.64±1.23	0.93	

† A significant difference (P<0.05), *Data presented as mean ± SD, ** P-value within group   *** P-value between group

DISCUSSION

The aim of this study was to investigate the effect of eight weeks aerobic training on the level of visfatin, hemocytine, CRP, and lipid profile of inactive men. Based on the results of this study, serum visfatin levels decreased significantly at the end of the training period. These findings are consistent with the results of Seifi et al. and Seo et al. (8, 19) but inconsistent with the findings of Giti et al. and Taghian et al. (20, 21). Visfatin is thought to be involved in the autocrine/paracrine function that facilitates differentiation and placement of adipocytes in visceral adipose tissue, and also in the endocrine function and sensitivity to insulin (22). Studies have shown that plasma visfatin level has a significant relationship with visceral fat mass, body weight and BMI (23). In the present study, body weight and BMI decreased following aerobic activity. Reduction in serum visfatin level may be attributed to the improving effect of endurance training on all anthropometric indices such as body weight, BMI, body fat percentage and waist-to-hip ratio (19).

The eight weeks of aerobic training also caused a significant reduction in levels of homocysteine and CRP. This results are in line (25, 26) but inconsistent (9, 24) with the results of other studies. The difference in the results of studies could be attributed to the difference in the protocol, duration, severity and type of exercise, as well as the subjects' fitness level (27). Decreased availability of methionine increases methionine production and leads to accumulation of homocysteine. During intense and long-term exercise (28), the mechanism of protein transport increases the concentration of homocysteine (29). Choubineh et al. reported a decrease in homocysteine level after regular exercise (30). Lowering body fat mass is a determinative factor for reducing CRP level. It has been suggested that at least 3.5 pounds weight loss is necessary to produce anti-inflammatory effects. In our study, weight loss and decreased CRP level were only observed in the

experimental group. Reduced CRP is associated with improvement in symptoms of metabolic syndrome, including half-life of blood lipids, insulin resistance and abdominal fat (31).

The eight-week aerobic training caused a significant decrease in LDL-C level and a significant increase in HDL-C level of subjects. These findings are in line with findings of Monazamnezhad et al. and Nowak et al. (32, 33) but inconsistent with findings of Aggarwala et al. and Kazemi et al. (34, 35). Monazamnezhad et al. examined the effect of eight weeks of trice weekly aerobic training at 50-70% of maximum heart rate on 28 subjects aged 20 to 45 years and reported a significant decrease in the level of VLDL, triglyceride (TG), total cholesterol and body fat percentage (33).

Increasing the number of training sessions or the duration of each session could cause more favorable effects on serum HDL and LDL levels. Low intensity exercise may not affect the levels of these variables, but it can lower body fat percentage and blood pressure and increase aerobic capacity (36). In addition to physical activity, levels of thyroid and sex hormones affect blood cholesterol and lipoprotein levels (37). Therefore, it is possible that factors other than exercise could be responsible for the change in the lipid profile. Physical activity and exercise, especially aerobic exercise, significantly increase HDL levels, which is due to increased activity of lipoprotein lipase and lecithin cholesterol acyltransferase and decreased activity of hepatic lipase (37). In addition, regular endurance training increases expression of lipolytic enzymes (38). Lipoprotein lipase is a TG-degrading enzyme that releases free fatty acids from TG to provide energy during aerobic activity. Therefore, it can be concluded that the increased lipoprotein lipase activity during aerobic activity is responsible for reduced TG levels (37). Measurement of visfatin-associated inflammatory markers such as alpha-induced tumor necrosis factor and IL-6 could provide more information on the beneficial effects of exercise.

CONCLUSION

Our results indicate that regular aerobic exercise significantly decreases serum visfatin and improves lipid profile of men. Considering these effects and other effects of exercise on weight and body composition, regular aerobic exercise could be recommended for prevention of CVD and improvement of its risk factors.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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