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Original Article

The Effect of Aerobic Exercise on Serum C - Reactive Protein and Leptin Levels in Untrained Middle-Aged Women

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Abstract

Background: Cardiovascular disease is the most common cause of death in the world. The aim of this study was to determine the effect of aerobic exercise on serum inflammatory markers in untrained middle-aged women.

Methods: Nineteen healthy female middle-aged were selected by convenience sampling method and were randomly divided into two experimental (n=11) and control (n=8) groups. The exercise protocol included aerobic exercise training lasted for 6 months and 3 sessions per week and every session lasted for 60 minutes and with intensity of 55-65 percent of maximum heart rate reserve (MHR). Blood samples were taken to measure serum leptin and C-Reactive Protein (CRP) before and after aerobic training period. General linear- Repeated measures (GL-RM) was used to comparing of within, Interactive and between means groups. The level of significance was set at $P< 0.05$.

Results: The level of serum leptin in middle-aged women did not change significant. However, the levels of CRP during this period did not change significantly.

Conclusion: Six months of aerobic exercise does not induce significant change in serum levels of CRP, while leptin levels reduced in middle-aged women. Regular physical activity probably causes decrease in serum leptin level if body mass index and body fat mass reduce simultaneously.

Keywords: Aerobic exercise, Heart disease, Untrained Middle-aged Women

Introduction

Atherosclerosis and its affiliated illnesses are the cause of death in many countries and finding out their root is very crucial (1). Atherosclerosis or arteriosclerotic vascular disease is caused by deposited fat in blood vessels such as cholesterol and other types of plasma fat. When there is a high deposit of fat in blood vessels, the risk of Atherosclerosis also increases, which has a direct connection with age, gender, exercising or not exercising, race, and diet (1). Research shows that the above-mentioned problems do not have a complete impact on causing cardiac-vascular diseases (2). Therefore, researchers are now paying closer attention to other possible patterns in order to predict cardiac-vascular diseases (3), some of which are IL-1, IL-6, CRP and leptin (4-6). CRP is a plasma component which is made in liver and its increase is a sign of infectious diseases or different tissue damage (7). Different research has shown that high CRP levels are closely related to obesity. It is assumed that secreted Interleukin from fat tissues plays an important role in CRP increase (8). It is also proved that CRP has a high positive connection with tissue measurement indexes such as body index measurement, waistline, and the waistline-hipline ratio (9). Another cardiac-vascular disease hormone is leptin. Leptin peptide, which is secreted from white fat, plays a key role in control-

ling central metabolism of the body and its weight. High levels of Leptin in obese subjects compared to thin ones can justify obesity issues and cardiac-vascular diseases with regard to leptin's role in regulating synthesis, secretion, and cytokines such as CRP, IL-6 and TNF-a. Higher levels of leptin in obese subjects compared with lean subjects could explain the inflammatory conditions associated with obesity and cardiovascular disease (10).

There is lots of research on the effects of physical exercise and the significant decrease it brings about for cardiac-vascular patterns, showing that aerobic exercise results in significant decrease in infectious items such as those in IL-6, HS-CRP, TNF-a in healthy people (11-12), cardiac-vascular patients (13), and diabetics (14). Having a two-year integrated aerobic-stamina exercise program for diabetic's results in a significant leptin decrease, and improving stamina has resulted in insulin production (15). A 16-week stamina program does not have a significant increase in leptin intensity and Plasma Adiponectin (16). CRP serum decreased within 12 days in young and elderly women who had completed 12 weeks of physical exercise (17). Hamedinia et al. reported a significant decrease in CRP level due to 12 weeks of aerobic exercise (18).

The conducted research on the effects of physical exercise on CRP level with limited leptin has conflicting results; moreover, there is little research on the effects of long aerobic physical exercise on the amount of serum gained from the above-mentioned agents–leptin and CRP; therefore, considering the importance of CRP and leptin on the diagnosis of arteriosclerosis, we have decided to research the effects of six months of aerobic exercise on the intensity of infectious CRP serum markers.

Materials and Methods

Subjects

This study was semi-experimental. Furthermore, it plan was confirmed by Research Assembly of Physical Education and Sport Sciences Faculty of Ferdowsi University of Mashhad. During first stage, the subjects of this study were nineteen healthy and inactive female who randomly assigned into the experimental (n=11) and control (n=8) groups. Before starting the program, written informed consents were taken from all subjects. The levels of health and physical activity of the subjects were determined using general practice physical activity questionnaire, physical activity readiness questionnaire and medical survey (including electrocardiogram and blood pressure tests) by a specialist physician (19). The subjects were nonsmokers, received no drugs and had no metabolic disease and physical impairment affecting their performance. During the second stage, their height was measured in centimeters using a height determiner and their weight was calculated using a digital scale produced by a German company called Beurer (PS07-PS06). The percent of body fat (PBF) was calculated using a body compound determiner (model In-body-720 made in Korea) and based on a method called bioelectrical impedance. All of these measurements were carried out while the volunteers had stopped eating or drinking 4 hours prior to their test, and their bladder, stomach, and bowels were empty.

Exercise protocol

The exercise protocol included aerobic exercise training lasted for 6 months and 3 sessions per week and every session lasted for 60 minutes and with intensity of 55-65 percent of maximum heart rate reserve (MHRR). According to the MHRR for every single athlete was respectively calculated based on Karvonen equation (1) and was also controlled during exercise by a heart rate monitor (made in Finland–Polar) (20).

Equation [1]: Target heart rate= [%60 or %70+ [(age-220) - (resting pulse]] + Resting heart rate

Blood sampling

Blood samples in all related studies were collected by venepunction from forearm vein after at least 15 minutes of sitting at rest or in the supine position. Blood sample were poured into a tube containing K2EDTA and mixed for 15 min before analysis. After centrifusing samples in plastic capillary tubes using Haemato Spin Centrifuge device. Serum CRP concentrations was determined

using an auto-analyzer spectrophotometer and different kits in various wavelengths as follows below. Serum CRP concentration was determined by using Pars-Azmun kits with Immunoturbidometric method. Serum leptin concentration was determined by using Bio Vendor GmbH, Human LIF Quantikine ELISA kit, DLF00with ELISA method.

Statistical analysis

All statistical analyses were performed with SPSS version 15. The average and standard deviation of data were calculated after checking the data distribution normalcy using Kolmogorov-Smirnov test and Homogeneity of variance method. The comparison of between means groups and Homogeneity of groups examined using Independent *t*-test. Repeated measure for comparison of variance within the group, interaction (groups × phases) and between group was used. The level of significance was set at $P< 0.05$.

Results

According to the (Table 1), before the onset of the exercise, there were no significant differences between groups in age, height and body composition variables including: weight, BMI, PBF and WHR.

Table 1: Mean ± standard deviation and Independent *t*-test for normality of two groups

	Group (s)	M±SD*	Independent t-test	
			t	*P*-value
Age (years)	Exercise	41.27±3.74	1.242	0.231
	Control	43.25±2.91		
Height (cm)	Exercise	155.36±5.48	-0.044	0.966
	Control	155.25±5.77		
Weight (kg)	Exercise	64.85±5.83	-1.34	0.191
	Control	61.37±7.84		
BMI (kg/m2)	Exercise	26.94±2.84	-1.25	0.232
	Control	25.44±2.69		
PBF (%)	Exercise	36.27±5.62	-0.404	0.706
	Control	35.31±6.14		
WHR (cm)	Exercise	0.84±6.50	-2.806	0.281
	Control	0.76±6.64		
CRP (mg/dL)	Exercise	1.00±0.00	-1.261	0.224
	Control	1.00±0.00		
Leptin (ng/mL)	Exercise	27.36±6.61	0.901	0.381
	Control	25.38±17.94		

†A significant level $P<0.05$ *Data presented as mean ± standard deviation

Table 2: Comparison of within group variance, interaction and between group of body composition, serum leptin and C-reactive protein (CRP) in Untrained Middle-Aged Women

Variables	Group (s)	Pre-test M±SD*	Post-test M±SD*	Within groups		Variations Interaction (group × phase)		Between groups	
				F	*P*-value	F	*P*-value	F	*P*-value
Weight (kg)	Exercise	64.85±5.83	64.70±5.76	1.25	0.27	1.25	0.27	1.70	0.20
	Control	61.37±7.84	61.36±7.84						
BMI (kg/m2)	Exercise	26.94±2.84	26.43±2.58	0.59	0.44	20.1	0.06	0.99	0.32
	Control	25.44±2.69	25.67±2.51						
PBF (%)	Exercise	36.27±5.62	36.02±5.54	0.05	0.82	9.72	0.00	0.09	0.76
	Control	35.31±6.14	35.52±6.20						
WHR (cm)	Exercise	0.84±6.50	0.83±7.86	1.70	0.20	0.00	0.99	6.96	0.01†
	Control	0.76±6.64	0.76±6.36						
CRP (mg/dL)	Exercise	1.00±0.00	1.18±0.40	1.65	0.20	1.65	0.20	1.72	0.25
	Control	1.00±0.00	1.00±0.00						
Leptin (ng/mL)	Exercise	21.45±5.81	27.36±6.61	0.98	0.32	11.68	0.07	0.43	0.51
	Control	25.38±17.94	28.62±15.99						

†A significant level $P<0.05$ *Data presented as mean ± standard deviation

Also, there were no significant differences between groups in the levels of CRP and leptin.
According to the (Table 2), our results show decrease in weight, BMI, body far percent, WHR, leptin in exercise group towards the end of period of the training, but this changes was not significantly. Interaction variance (groups × phases) was not significant. Results showed a variance between group WHR is significant ($P<0.05$). The levels of serum leptin did not change significantly. In addition, during the training, there was no significant change in serum CRP levels in both groups.

Discussion

In the present study, no statistically significant difference was observed in the body mass index of exercise group subjects' body weight, body mass index and body fat presented. This finding was supported by researchers (21-24). Pérusse et al. (21) did not find any significant changes in leptin levels by chronic and acute physical activity. Body weight and body mass index during the interval exercise were reduced (24). In this study, it appears that one of the main reasons for the decrease in body weight and body fat due to caloric restriction and exercise time has been changed. The results of the present study reveal that the level of leptin not changed significantly. The findings from the present study are consistent with those reported in the literature.
The leptin levels decreased after 48 h rather than insulin after treadmill testing is done (25). LDL-C and leptin levels were significantly in the exercise group after 12 weeks lower than the control group (26). The leptin concentration did not change immediately after exercising for 60 min at 70% VO2 max, but decreased by 18% and 40% at 24 and 48 h after exercise, respectively (27). Plasma leptin and cortisol levels did not changed significantly after eight weeks of combined endurance exercises - resistance in un-training subjects (28).
cotrizol production will increase during abdomen obesity. Not only does high cortisol result in the increase of leptin serum in blood, but it also helps leptin to resist in some obese individuals (28).
Regarding the positive connection between glucocorticoids and leptin, we may relate the stability of leptin level to the cotrizol consistency (29), It may be that the stability of the item in our research is the cause of internal cellular glucose metabolism productions which has neutralized leptin reduction by stimulating leptin mRNA and small glucose injection (30).
In this study, CRP level did not significantly change after the exercise program. This finding was supported by different studies (31,32).
Murtagh et al (31) showed no significant response of CRP following forty five minutes walking program with the intensity of sixty to seventy percents of heart rate maximum in overweight, healthy and inactive men. Tsao et al. (32). have reported different levels of exercise intensities (65%, 85% and 100% of VO2max) lead to no change in the levels of leptin and CRP. The findings of the present study are inconsistent with Kamal et al. (33). They concluded that exercise (3 times/week) for 12 weeks, showed reduced body weight, body mass index (BMI), and CRP level.
It is important to note that the intensity, type, and the length of the exercise along with muscular vulnerability, and the number of the used muscles are influential on CRP response to physical activities. In intense and short exercises, in which the use of different muscular tissues is almost rare, CRP response happens late (34). There are unknown mechanisms related to CRP response.

Conclusion

After aerobic exercise, leptin showed differences when compared to resting values. Besides, there were no significant differences in CRP levels after six months aerobic exercise. Furthermore, other cytokines and different types of subjects should be included in further studies.

Ethical considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc) have been completely observed by the authors.

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