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The effect of aerobic intermittent training on resting level of serum vascular cell adhesion molecules in sedentary young woman

Emanzade Reza[1], Soori Rahman[2], Sohaily Shahram[1], Shakeri Nader[3]

[1]*Department of Physical Education and Sport Science, Shahre - e - Qods Branch, Islamic Azad University, Iran*
[2]*Exercise Physiology Department Faculty of Physical Education and Sport Science. University of Tehran. Tehran. Iran*
[3]*Department of Physical Education and Sport Science, Science and Research Branch, Islamic Azad University, Tehran, Iran*

ABSTRACT

Cardiovascular diseases in particular atherosclerosis are among main causes of disability and fatality in the world. There is a great deal of evidence suggesting that vascular adhesion molecules is one of the new inflammatory factors prognostic of cardiovascular disease, particularly atherosclerosis. This research aims to explore the impact of intermittent exercise on serum concentration of vascular cell adhesion molecules-1 (VCAM-1) in sedentary young woman. For this purpose, 30 female overweight volunteer students (BMI ≥ 26) of Azad University Shahre Qods Campus were selected and randomly divided into two groups: intermittent training group and control group. Training groups exercised for 12 weeks, three sessions a week with definite intensity and distance. VCAM, body weight, fat percentage, BMI And maximum oxygen consumption were measured both before and after the 12-week exercise. Using Independent T-test, the results showed that interval training had significant effect on VCAM, body weight, fat percentage, BMI and maximum oxygen consumption ($p \leq 0.05$). Our findings showed that with significant reduction of adhesion molecules levels and decreasing inflammation intermittent exercise may perhaps play an effective role in prevention, control and mitigation of atherosclerosis.

Keywords: Intermittent Exercise - Vascular Cell Adhesion Molecules - Sedentary Young Woman

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INTRODUCTION

Among diseases threatening human are cardiovascular diseases and according to available reports every year 12 Million lose their lives due to cardiovascular diseases [1]. Classical and traditional risk factors of cardiovascular diseases include high blood pressure, elevated blood lipids and lipoproteins, smoking, inactivity and diabetes have traditionally been considered indicators of cardiovascular disease. Reports, however, indicate that some individuals suffer from cardiovascular diseases without traditional risk factors [2]. Recently, the relationship between inflammation and atherosclerosis has been established by numerous studies. Development of cardiovascular disease has an inflammatory background and general inflammation plays a central role in the development and progression of atherosclerosis [3, 4, and 5]. Therefore researchers are constantly looking for indicators to predict cardiovascular disease risk with greater accuracy and sensitivity. For this purpose many researchers have introduced VCAM-1 as one of the new factors and inflammatory markers predictive of cardiovascular disease, particularly atherosclerosis [5, 6, 7 and 8]. Any factor that reduces inflammatory markers may reduce atherosclerosis. In this respect other sciences, such as sports science have also acted to identify the relationship of disease and physical activity thereby

helping to prevent it. Recent studies suggest that endurance exercise significantly reduces levels of adhesive molecule [9, 10, 11 and 12]. Also, Tatjana et al (2007) Showed that aerobic exercise leads to decreased VCAM-1 without loss of body weight and visceral obesity in patients with coronary heart disease [12].

In contrast Sabatier et al (2008) reported no significant change after 14 weeks of 50-minute aerobic exercise (Each session includes two-minute frequencies of 75 to 90 percent intense aerobic exercise at 55 to 65 percent reserve heart rate) in 13 healthy woman in plasma VCAM-1 and ICAM-1 [13]. Moreover no changes have been reported in the values of VCAM-1 after exercise in patients with peripheral artery disease, but in healthy animals with high cholesterol, VCAM-1 decreased significantly after prolonged exercise [14 And 15].

On the one hand the results of previous studies on the effects of exercise on VCAM-1 are contradictory, and on the other hand, exercise reduces the risk of cardiovascular disease and overall mortality [16], so it is possible that exercise can bring about these beneficial effects by improving such inflammatory markers as VCAM-1. Thus our aim of this study is to evaluate the effect 12 Weeks of intermittent aerobic exercise on VCAM-1.

MATERIALS AND METHODS

Subjects: First of all call notices were posted in Azad University Shahre Qods Campus in which the researcher invited to identify overweight and obese individuals who were willing to run exercise for weight adjustment and improvement of their physiological conditions. In the next stage the candidates were invited for the purpose of the Initial assessments and from among them, at least 30 individuals with BMI $\geq$ 26 whose being overweight or obese was not associated with thyroid under-activity and did not have a history of exercise or calorie restriction diet were selected. After obtaining consent letters from the participants, they were asked to avoid rigorous physical activity 48 hours before the test and attend the pathobiology laboratory for blood sampling after 12 hours of fasting. The anthropometric measurements and maximal oxygen consumption of the subjects were done in the gym. The subjects were then divided randomly into two exercise and control groups.

Anthropometric and Physiologic Measurements: The height was measured using a medical height meter; weight and body composition were measured using a body composition monitor (OMRON, Finland). The maximum oxygen consumption of all the subjects was measured twice using the Cooper test; once before the test and once after the test. The subjects ran for 12 minutes at their maximum speed. The mileage was then placed in this formula:

$$\mathbf{Vo2max} = \text{Mileage (M)} - \frac{504/9}{44/73}$$

The aerobic capacity of the subjects was calculated milliliters of oxygen for each kilogram of the body weight per minute. The amount of calories intake of the subjects was determined by data collection method using a three-day questionnaire, at the beginning, at the end and every fortnight during the exercise period [17]. The subjects were advised to keep up their usual diet during the research period.

Exercise Protocol: Over 12 weeks the subjects exercised 3 time a week with a specific intensity and distance. Karvonen heart rate reserve formula was used to determine the exercise intensity. The exercise intensity was controlled using a heartbeat monitor (Polar, made in Finland). A session of training program included a ten-minute warm-up with and stretching exercises. The subjects then continued with running a distance of 1600 to 3200 meters with the intensity of 80 to 95% of their maximum heart rate reserve with the work to rest ratio of one to three (Table 1). They cooled off for five minutes.

Table 1 - Intermittent training programs

Week	1	2	3	4	5	6	7	8	9	10	11	12
Target heartbeat (percentage)	70-75%	70-75%	70-75%	70-75%	75-80%	75-80%	75-80%	75-80%	80-85%	80-85%	80-85%	80-85%
Distance (meter)	8× 200	8× 200	9× 200	9× 200	12× 200	12× 200	14× 200	14× 200	15× 200	15× 200	16× 200	16× 200

Blood sampling: 5 ml of blood was taken from each subject after 12 hours of fasting from the brachial vein and was reserved degrees by test time. Blood sampling in both phases was done between 8 and 9 AM of every subject. Biovendor kits were used accordingly to measure serum VCAM using ELISA method.

Statistical analysis: All values are represented as mean ± SD. As to the inferential statistics, first the Kolmogorov–Smirnov test was used for normal distribution Leuven test was used for data homogeneity. Then independent t test was used for testing significance between groups. All the statistical operations were performed by spss software and significance level of tests was considered $p \leq 0.05$.

RESULTS AND DISCUSSION

The descriptive profile of the groups in variables of age, height, weight, body mass index, body fat percentage and vascular cell adhesion molecules-1 as well as the independent t-test are presented in the table 2. After 12 weeks of Intermittent training VCAM level (p= 0.000) (Diagram 1) showed a significant decrease. Also the difference of measurements of variables of the two groups including Body weight (p= 0.036), Body mass index (p= 0.039), Body fat percentage (p= 0.000), Maximum oxygen consumption (p= 0.000) was significant (0.05≥ P) (Table 2).

Table 2- Pre-and post-test physical, physiological and biochemical variables and t test in the two groups

Group	Intermittent		Control		P
Index	Pre test	Pos test	Pre test	Pos test	-
Age (year)	22.2 ± 1.68	-	22.77 ± 1.63	-	-
Height (cm)	159 ± 1.88	-	158.80 ± 3.99	-	-
Weight (kg)	75.21 ± 2.86	72.72 ± 2.28	75.18 ± 2.49	75.20 ± 2.46	0.036
Body mass index (kg/m^2)	29.8 ± 1.31	28.89 ± 1.22	30.17 ± 1.58	30.29 ± 1.74	0.039
Fat percentage (%)	30.92 ± 1.48	28.06 ± 0.84	31.80 ± 1.57	31.96 ± 1.65	0.000
Vo_2max (ml/kg/min)	23.64 ± 1.24	29.83 ± 1.28	23.13 ± 1.49	23.03 ± 1.50	0.000
VCAM (ng/ml)	501.10 ± 26.53	393.30 ± 24.45	503.20 ± 22.98	510 ± 23.16	0.000

Data are expressed as mean and standard deviation

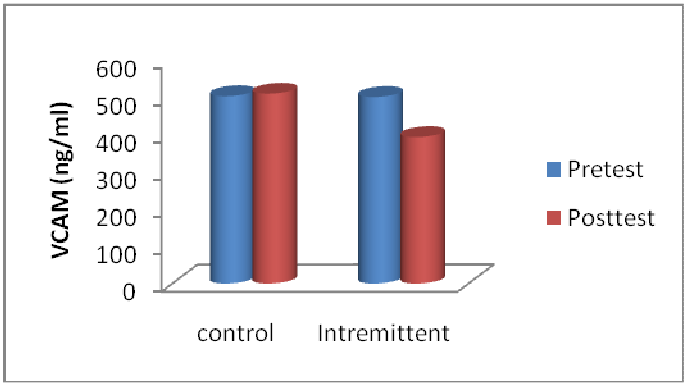

Diagram 1: The pattern of changes in VCAM levels before and after 12 weeks in intermittent exercise and control groups

Cell adhesion molecules are proteins expressed on the surface of a variety of cells and mediate the leukocyte response to inflammation. Some of these molecules are released to the plasma as soluble forms, whose presence indicates the degree of vascular endothelial activation or dysfunction. Increased concentrations of soluble adhesion molecules are thought to hamper the immune response and mediate the atherosclerotic inflammatory process. [9, 11, 13 and 18]. The results of this study showed that VCAM□1concentrations significantly decreased due to intermittent exercise.

Previous investigations examining the effects of aerobic exercise training interventions on adhesion molecules have demonstrated favorable results in both animal [15] and human subjects [14].

Adamopoulos et al [6]. Found that 12 weeks of aerobic exercise training significantly reduced both sICAM-1 and sVCAM-1 in heart failure patients. Althought some authors did not registred changing in VCAM-1 molecules serum concentration after physical exercise [14], in animal models long-term exercise training significantly reduced expresion of P-selectin, VCAM-1, MCP-1 and iNOS in healthy as well as hypercholesterolemic animals [15].

By contrast, there are reports of increased concentrations of circulating cell adhesion molecules after endurance exercise in healthy adults. Nielsen and Lyberg (2004) reported increased plasma concentrations of VCAM-1, ICAM-1, E-selectin, P-selectin and L-selectin after marathon and half-marathon running. A common characteristic of these studies is the high exercise volume [19].

Brevetti et al (2001) found no significant changes in the plasma concentrations of VCAM-1, ICAM-1, E-selectin and P-selectin after 30 min of maximal exercise in healthy subjects, but VCAM-1 and ICAM-1 increased in claudicants [20]. Similarly, Mizia-Stec et al (2002) found no changes in the serum concentrations of VCAM-1, ICAM-1, E-selectin and P-selectin after treadmill electrocardiogram stress testing in healthy volunteers, but found considerable increases in VCAM-1 and E-selectin in patients with stable coronary artery disease [21]. Finally, Wang et al (2005) found no significant changes in VCAM-1, ICAM-1, E-selectin and L-selectin immediately after exercise of light (40% maximal oxygen consumption (VO2 max), moderate (60% VO2max) or high intensity (80% VO2max) [22].

A close association between adipose tissue synthesis and secretion of inflammatory cytokines, and subsequent upregulation of adhesion molecules has previously been demonstrated [23]. The results of the present study suggest that 12 week of intermittent training contributes to improvements in the vascular cell adhesion molecules in overweight women. The subtle changes in the inflammatory markers seen in the present study may be reflective of the relatively minor changes in body composition demonstrated between the groups. Specifically, the intermittent training group demonstrated a reduction in body fat.

CONCLUSION

Intermittent training during 12 weeks induces significant reduction of inflammatory markers VCAM, with significant reduction of percent body fat. All these effects of physical training are beneficial regarding the reduction of cardiovascular risk for subsequent coronary events. The results of this study suggest that regular physical activity is clinically desirable in primary and secondary prevention of coronary heart diseases.

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