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The Effect of Intermittent Training on C-reactive Protein in Young Women

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ABSTRACT: Inflammation is an important factor in the cardiovascular events. C-reactive protein (CRP) is a marker of inflammation that directly involved in atherogenesis. The aim of the present study is to analyze the effects of the intermittent training on serum concentration of CRP in young women. For this purpose, 20 female voluntarily participated in our study. Subjects were randomly assigned to one of two groups: aerobic training and control. Training group exercised for 12 weeks, three sessions a week with definite intensity and distance. CRP, fat percentage, BMI And maximum oxygen consumption were measured both before and after the 12-week exercise. By means of the statistical test of T, the results showed that the aerobic training had significant effect on body weight, body fat percentage, BMI, VO2max, and CRP ($p \leq 0.05$). Our findings showed that with significant reduction of CRP levels and decreasing inflammation, aerobic intermittent training may perhaps play an effective role in atherosclerosis.

Keywords: Intermittent Training - CRP- Young Women

INTRODUCTION

Development of cardiovascular disease has an inflammatory background and general inflammation plays a central role in the development and progression of atherosclerosis [1-3]. Therefore researchers are constantly looking for indicators to predict cardiovascular disease risk with greater accuracy and sensitivity. For this purpose many researchers have introduced CRP as one of the new factors and inflammatory markers predictive of cardiovascular disease, particularly atherosclerosis [4-7]. 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. Physical activity to reduce one's risk for cardiovascular disease is strongly recommended in the consensus statement from the Centers for Disease Control and Prevention and the American College of Sports Medicine [8]. In addition, general population studies have reported an inverse association between levels of WBC, fibrinogen, and CRP and self-reported physical activity [1, 9] or physical fitness [10, 11], and nonrandomized prospective trials have suggested that short periods of exercise training may lower markers such as CRP. Mattusch *et al* (2000), contrary to the above mentioned findings, reported increase in CRP, respectively after 2-week training with 55% of Vo2max, 12-week endurance training on the work-assay bicycle and 9-month regular running [12].

On the one hand the results of previous studies on the effects of exercise on CRP are contradictory, and on the other hand, exercise reduces the risk of cardiovascular disease and overall mortality [13], so it is possible that exercise can bring about these beneficial effects by improving such inflammatory markers as CRP. Thus our aim of this study is to evaluate the effect intermittent training on CRP.

METHOD AND SUBJECTS

Subjects: Thirty women with BMI ≥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.

A. 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:

$$\mathbf{Vo2max} = \frac{504/9}{44/73}$$

The aerobic capacity of the subjects was calculated milliliters of oxygen for each kilogram of the body weight per minute.

B. 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 heart beat 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 70 to 85% 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: Exercise 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

C. 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. Pars Azmon kits were used accordingly to measure serum CRP using ELISA method.

D. 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 ? 0.05.

RESULTS

The descriptive profile of the groups in variables of age, height, weight, body mass index, body fat percentage, Vo2max and CRP as well as the independent t-test are presented in the table 2. After 12 weeks of Exercise training CRP level (p= 0.000) (Fig 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 (P ? 0.05P) (Table 2).

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

Groups	**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
CRP (mg/l)	2.65 ± 0.23	2.16 ± 0.08	2.70 ± 0.12	2.77 ± 0.13	0.000

Data are expressed as mean and standard deviation

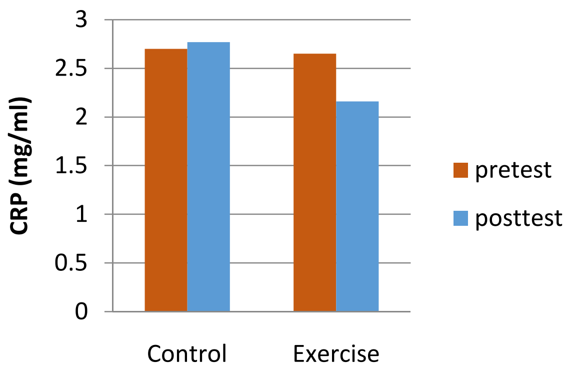

Fig. 1. The pattern of changes in CRP levels before and after 12 weeks in exercise training and control groups.

DISCUSSION

The results show that exercise training include aerobic intermittent program significantly has decreased CRP level in sedentary young woman. These results are coincided with Gutin et al (1999) [14], and Stewart et al (2007) [15] findings, but opposed to Mattusch et al (2000) [12], Reviewing CRP level in the studies coincided with present research showed that there is a reversed relation between physical activity, physical fitness and CRP quantity [16]. Although the relation between sports activities and reduction of CRP is not clear and above mentioned solution were presented upon existing assumptions, but significant increase in Vo2 max of these study cases and decrease in CRP level, probably could be explained by compatibility resulted from exercise training and cardiovascular strengthening of the study cases. This process through increasing endothelial nitric oxide directly improves endothelial function and increases antioxidants which result is lower systemic and local inflammation and reduced inflammatory cytokines production from smooth muscles of endothelial wall and their final effect is lower hepato-production of inflammatory predictive [3]. On the other hand, cardiovascular strengthening resulted from intermittent training, metabolism changes and amplified lipolysis which appeared in this research as significant decrease of body mass, specially reduced lipid percentage, have resulted in reduced adipose tissue which is one of the main producers of inflammatory cytokines and hepato-production of CRP is the consequence of this direct or indirect reduction [17, 18, 19].

Inconsistency of the above findings can be attributed to different fitness levels and age of participants of these researches, continuity of long term activities in one session training program (Stauffer et al., 2004), a variety of study cases, sectional test and self-expression [14, 20].

CONCLUSION

Result of the present study indicated that intermittent training induces significant reduction of CRP, with significant reduction of body weight and percent body fat. All these effects of exercise training are beneficial regarding the reduction of cardiovascular risk for subsequent coronary events.

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