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Effects of Endurance Training On Inflammatory Markers Predictor of Cardiovascular Disease in Aging Men

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Abstract—**Context:There is increasing evidence that inflammation contributes to the atherosclerotic process. Physical activity has recently been established as a potential modifier of the inflammatory process, suggesting that it mitigates inflammation and consequently reduces the incidence of several chronic diseases, such as cardiovascular events.**

Objective:Our objective was to evaluate the effects of endurance training on Inflammatory Markers Predictor of Cardiovascular Disease risk in aging men.

Subjects and methods:twenty male subjects (age 60-70) voluntarily participated in our study. Subjects were randomly assigned to one of the two groups: Endurance training or control group. The endurance training program included continuous running (in gymnasium) with an intensity of 60-70% maximal heart rate reserve for 8 weeks, 3 sessions per week. Pre and post 8 weeks of Endurance training blood samples were taken (5cc) in fasting state from all subjects. Data was analyzed via independent test ($p \leq 0.05$).

Results:Endurance training caused a significant decrease in the serum CRP and plasma fibrinogen levels of the aging men ($\alpha = 0.05$).

Conclusions:This study demonstrates that Endurance training causes a decrease in the inflammatory markers and probably decreases future cardiovascular risks in aging men.

Keywords-Endurance Training, Inflammatory Markers, Aging Men

I. INTRODUCTION

Increasing trend toward industrialization along with irregular accomplishment of different industrial programs has resulted in stressful life, preoccupations and specially immobility in the urban life (1). This situation is accompanied with different diseases including high blood pressure, blood disorders, decrease in physical strength and work ability, and specially increases in cardiovascular diseases including atherosclerosis, angina pectoris, heart attack resulting from unsuitable nutrition, non-observance of environment health and immobility (2). Cardiovascular diseases and importantly coronary disorders are among the main causes of mortality in today industrial world and so it has been predicted that in future, this disease would be the prevailing disease of human communities (3). Pathologic changes of atherosclerosis begin from childhood and appear in adulthood in multiple steps (4, 5, 6).

Recognizing the main causes of cardiovascular disease can have an important role in preventing from the disease progression. The most well-known factors are age, gender, high LDL-C (Low – Density Lipoprotein Cholesterol), smoking, high blood pressure, diabetes, and immobility. Although these reasons are not the only ones in all of cardiovascular diseases (7, 8), researches are looking for indicators that predict cardiovascular disease risks with more accuracy and high sensitivity.

In the previous studies, the specialists had mostly emphasized on lipid quantity as an indicator of individuals exposed to cardiovascular disorders. This point cannot be forgotten that this indicator is still used in some communities to diagnose cardiovascular disease. In 1998, the work grounds of inflammatory Atherogensis and important role of inflammation and plasma index of inflammation to predict cardiovascular disorders risks have been introduced in the Heart Conference of America (9). Serum C - reactive protein (hs- CRP) as a high sensitive and independent inflammatory predictive of cardiovascular events has drawn researches attention because its increase was accompanied with cardiovascular events (10). So any interference which causes to decrease in this inflammatory predictive is followed by decrease in cardiovascular diseases (11).

As inflammation role in pathogenesis of cardiovascular diseases might be one of reducing factors of cardiovascular diseases, so that focus on helpful effects of sport activities and exercises on prophylaxis and decrease in inflammatory predictive have led sports specialists specially sport physiology and sport medicine to this practical methods in order to decrease and prevent cardiovascular diseases. Therefore the observations showed a reversed relation between inflammatory predictive, CRP, and cardio-respiratory fitness of women and men (12). For example, Gutin and Owens in their studies on the effect of four-month exercise (5 sessions a week for 40 min.) with 158 heartbeat per minute on risk factors of coronary cardiovascular diseases in 81 children, ranging from 7 to 11 years old, showed that 4-month controlled exercise without nutritional interfere, has decreased CRP level in children (13).

Coinciding with the above mentioned results, Laura et al reported reduction in CRP after 12-week aerobic activities in untrained men, ranging from 18-38 years old (14). Hagubian et al (5) and Mattusch et al (15), 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.

These studies have been taken as evidence of a direct anti-inflammatory action of regular exercise. Anyway, if physical activity proves to decrease inflammation, more researches will be required to determine the mechanism of the decrease and the type of the activity causing decrease of inflammation. The purpose of this study was to determine whether endurance training alters resting CRP variables and fibrinogen in aging men.

II. Material And Methods

The research was semi-experimental. Twenty healthy aging men (age 60-70) were voluntarily selected from Shahre Ghods Old People's Home. They signed a written informed consent form after approval by the committee of Medical ethics, Shahre Gods University. All subjects completed a medical questionnaire to ensure that they were not talking any medication, and were free from cardiac, respiratory and renal diseases. The age, height, weight, body fat percentage and maximal aerobic capacity of all subjects were measured in sport physiology laboratory. The subjects were divided randomly into two groups of endurance training (12 members) and control (12 members). The endurance training program included continuous running (in gymnasium) with an intensity of 60-70% maximal heart rate reserve and duration 16- 28 minutes per session, 3 sessions per week for 8 weeks. Warm up and cool down was ten minutes per session.

A. Blood samples and biochemical markers:

To examine the biochemical variables, blood samples were gathered after 12 to 14 hours of fasting. First, the subjects were required not to perform any physical activity two days before the test. 5 cc of blood was obtained from each subject's left-hand vein in sitting and resting statuses. 2.5 cc was used to determine fibrinogen. The serum from the remaining 2.5 cc was kept at -80°C, so that it could be used later to measure CRP. Then, the experimental performed 8 weeks of endurance training. 48 hours after the last training session, the blood samples were obtained from the experimental and control groups like the first stage. Clauss method was used to measure fibrinogen and an especial kit with Elisa method to measure CRP.

B. Endurance Training:

Endurance training consisted of 8 weeks and 3 sessions per week. Each session included 10-minute warm-up. Then, a continuous running with a stable trend and an intensity of 60-70% maximal heart rate was performed. The running took 15 minutes in the first session. One minute was added to the running time each two sessions. Maximal heart rate was measured by the 220-age formula and the intensity of training measured by heart rate monitoring belt. At the end of each session, cool-down was performed for 10 minutes.

C. VO2Max:

To measure this marker, YMCA (Young Man Christian Association) sub-maximal cycle ergo meter test was used.

D. Body fat percentage:

Subjects' hypodermic fat was measured using calipers in three parts of chest, stomach and thigh by Jackson and Pollack (27).

E. Statistical methods:

Data collected from descriptive statistics was applied to estimate central indicators, distribution and to draw tables and for deductive statistics, Smirnov-Colmegrov test was used to distribute natural data and Levin test was used to harmonize them. Independent T test was applied to consider significant differences of means pre- and post-training of the two groups. All statistical operations were done by SPSS/14 at $\alpha \leq 0.05$.

III. Results

Table I shows physical, physiological and biochemistry variables of the study cases. There was no significant difference in variables between control and resistance groups in pre test which is indicated their random and harmonious distribution in the two groups. The variables were assessed again after 8-week endurance training. Table I shows statistical findings and significant differences of these properties from pre-training through post-training of the two groups in variable body fat percent, CRP and fibrinogen.

TABLE I. Physical, Physiological And Biochemistry Variables In Two Groups

Group / Index	Endurance		Control		P
	Pre test	Pos test	Pre test	Pos test	-
Age (year)	66.60 ± 3.77	-	64.50 ± 4.06	-	-
Height (cm)	171.40 ± 4.57	-	170.80 ± 3.99	-	-
Weight (kg)	76.20 ± 4.07	75.15 ± 4.99	76.90 ± 5.25	77.10 ± 5.73	0.428
Body mass index (kg/m^2)	25.96 ± 1.66	25.60 ± 1.78	26.40 ± 2.28	26.48 ± 2.50	0.375

Fat percentage (%)	24.65 ± 2.88	22.85 ± 2.61	24.90 ± 1.77	25.10 ± 1.82	0.039
CRP (l/mg)	4.25 ± 1.28	3.40 ± 0.96	4.53 ± 0.96	4.80 ± 0.67	0.001
Fibrinogen (dl/kg)	354.00± 36.72	285.00 ± 38.36	344.50 ± 56.19	361.50 ± 51.69	0.001

IV. DISCUSSION

The results show that endurance training significantly has decreased CRP and fibrinogen level in ageing men. These results are coincided with Gutin and Owens (13), Hildebrandt et al (16) and Laura et al (14) findings, but opposed to Hilier et al (17) and Mattusch et al (15). 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 (18).

Although the relation between sports activities and reduction of CRP and fibrinogen is not clear and above mentioned solution is presented upon existing assumptions, significant increase in Vo2 max of these study cases and decrease in CRP level, probably could be explained by compatibility resulted from endurance training and cardiovascular strengthening of the study cases. This process through increasing endothelial nitric oxide, directly improves endothelial function and increases antioxidants which will result in 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 (19, 20, 21, 22). On the other hand, cardiovascular strengthening resulted from endurance training, metabolism changes and amplified lipolysis which appeared in this research as significant decrease of body mass, specially reduced lipid percentage, and they have resulted in reduced adipose tissue which is one of the main producers of inflammatory cytokines and hepato-production of CRP; and fibrinogen is the consequence of this direct or indirect reduction (11, 23, 24).

Furthermore, 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 (25), one session triathlon training of 2.4-mile swimming, 112 mile bicycling and 62.2 mile running all resulted in inflammation increase in these sports because of pre-exercise (17), a variety of study cases, sectional test and self- expression (13). In Mattusch studies (17), 2 cases of 12 participants have suffered from knee infection at the time of blood gathering which this problem could be explained as a kind of bias and interference variable which increases inflammation and inflammatory predictive, such as CRP.

Altogether, the present results are consistent with most of studies performed on the effect of regular exercise training on CRP and fibrinogen and had no consistency with some others. Non-random methods of research, ill participants with special occupations, non-use of control group and non harmonious study cases in regard to age and gender, are considered as some inconsistency factors. Generally, according to the present constraints including genetic differences and having no control on participants out of training hours, there are more research needs to release these constraints and using the present training protocol for both genders at lower ages is suggested in this study. According to the results based on exercise training effect on significant decrease in serum CRP, fibrinogen as an inflammatory predictive in cardiovascular diseases, and the fact that any factor reducing this indicator; directly or indirectly reduces cardiovascular diseases risks.

V. CONCLUSIONS

This study demonstrates that endurance training caused a decrease in the inflammatory markers (CRP, Fibrinogen) and probably is decreased future cardiovascular risks in aging men. So, endurance training according to age and fitness of people is suggested to health care centers, talent-finding centers, instructors, and common people as a helpful way to sustain general health and a long life.

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