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Regular aerobic training in absence diet can not affect cardiovascular risk factors

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ABSTRACT: Obesity is a major health problem in developed or developing country and is associated with metabolic disorders. The objective of this investigation was to evaluate the effect of regular aerobic training on cardiovascular risk factors in obese subjects. For this purpose, twenty six males aged 36 ± 5 year and body weight 100 ± 14 kg were assigned to participate in study and divided into exercise or control groups by randomly. All subjects was non-trained and non-smoker. Pre and post-training of fasting levels of total serum cholesterol (TC), triglycerides (TG), high-density lipoprotein cholesterol (HDL), low-density lipoprotein cholesterol (LDL) and anthropometrical markers were measured in two groups. Student's paired 't' test was applied to compare the pre and post training values. Based on statistical data, triglyceride concentration ($p = 0.019$) was decreased significantly with aerobic training program whereas concentrations of TC ($p = 0.91$), HDL cholesterol ($p = 0.61$), and LDL cholesterol ($p = 0.36$) did not change. A significant decrease was also observed in TG/HDL by exercise training ($p = 0.019$). All variables did not change in control group. Despite improved TG, it seems that regular aerobic program in absence diet control is not associated with all anthropometrical risk factor even in presence weight reduction.

Keywords: Obesity, Cardiovascular risk factors, Exercise training

INTRODUCTION

The growing trend toward mechanical life, the uncontrolled use of nutritious and high calorie foodstuff especially fatty foods and genetic traits and heredity, together with a sedentary lifestyle and no sporting activities, have increased the propensity to positive energy balance in most healthy or sick populations both in developed and in developing countries. Growing trends in incidence of obesity, rising body fat percentage, increasing incidence of some chronic diseases such as type 2 diabetes, hypertension, and various types of cancer, are always observed as consequences of obesity. The World Health Organization refers to the rapid increase in the prevalence of obesity as an epidemic and calls obesity and its complications one of the major world health problems [1].

The increased prevalence of high body fat percentage and of obesity-related risk factors are accompanied by prevalence of cardiovascular diseases and type 2 diabetes [2, 3]. Scientific sources have confirmed the increased risk for cardiovascular diseases in healthy or sick obese populations compared to people with normal weight [4,5], and have pointed to increased levels of total cholesterol (TC), triglycerides (TG), and low density lipoproteins (LDL) and also to reduced high density lipoproteins (HDL) in obese people compared to people with normal weight [5]. Nevertheless, increased levels of body fat, especially visceral abdominal fat, raise the propensity to cardiovascular diseases because they increase risk factors for such diseases. Therefore, developing suitable strategies such as diet corrections and other internal and external interventions with the purpose of controlling and improving risk factors for cardiovascular diseases, especially in obese populations, has become the focus of attention for researchers in health sciences and welfare. Physical activity and regular training programs have been introduced as a correcting agent of risk factors for obesity such as LDL, HDL, TC, and TG and as an effective treatment method for improving inflammation and for controlling risk factors for cardiovascular diseases. In this relation, researchers have reported that regular anti-inflammatory exercise results in reduced levels of inflammatory factors and improved lipid profile indices (HDL, TC, TG, and LDL) [6]. Moreover, in another study, 3-and 6-month intensive aerobic endurance exercise led to significant increases in HDL and reductions in TG and TC in cardiovascular patients [7]. However, some researchers reported in a number of recent studies that these indices (HDL, LDL, TC, and TG) did not significantly change after a 12-week sports exercise [8]. Therefore, considering the contradictory existing evidence, this study was conducted with the purpose of determining the effects of a relatively long-term aerobic training program on the levels of risk factors for cardiovascular diseases in non-sporting obese men.

METHOD AND SUBJECTS

In this study, the effect of regular training program on cardiovascular risk factors was investigated in obese men. Twenty six non-trained healthy obese men aged 36 ± 5 yrs, BMI 32 ± 3 kg/m2 were matched according to bodyweight and BMI were enrolled to participate in this study. The subjects selected into exercise (n=13) or control (n=13) groups. The subject of exercise group were completed an aerobic training program for three months and control subjects were instructed to maintain their habitual activities. The subjects were given an oral and written description of the study and the possible risks and discomfort involved before giving their voluntary oral and written content to participate.

A. Anthropometric measures: Each subject's anthropometrical markers were measured by the same researcher. Height (Ht) and weight (Wt) were measured twice to ±0.2 cm and to ±0.2 kg, respectively, with subjects being barefoot and lightly dressed; the averages of these measurements were recorded. BMI was calculated by dividing body mass (kg) by height in meters squared (m2). Waist-hip ratio (WHR) was calculated. The abdominal circumference was measured to the nearest 0.1 cm, using a non-extendable flexible tape applied above the iliac crest and parallel to the ground; with the subject standing erect with abdomen relaxed, arms along the body, and feet together. Hip circumference was measured at the maximum circumference between the iliac crest and the crotch while the participant was standing and was recorded to the nearest 0.1 cm. Percentage of body fat was estimated by bioelectrical impedance method (Omron Body Fat Analyzer, Finland). Each of these measurements was conducted two times and the average was reported.

B. Inclusion and exclusion criteria: Obesity was defined as BMI and body fat (%). Participants were included if they had not been involved in regular physical activity in the previous 6 months. None of the subjects used drugs or therapies for obesity, and none had a past history of disease or injury that would prevent daily exercise. The exclusion criteria were as follows: a history of acute or chronic respiratory infections, neuromuscular disease, and cardiopulmonary disease. Furthermore patients with overt diabetic were also excluded from the study. In addition, exclusion criteria included inability to exercise and supplementations that alter carbohydrate-fat metabolism.

C. Blood analysis: Pre training of metabolic markers were measured in all subjects of two groups and repeated 48 hours after lasted session of exercise program. All subjects were asked to attend hematology lab after an overnight fast. All blood samples were taken in the morning after an overnight fast between 8:00 and 9:00 a.m. After sampling in ETDA- or serum-tubes, blood was immediately chilled on ice, centrifuged in order to measure metabolic variables. Fasting blood total cholesterol, triglycerides, HDL and LDL cholesterol were measured enzymatically using commercially available kits (Pars Azmun Co. Tehran, Iran).

D.Training protocol: The exercise program involved 1 h of exercise training, three times per week for 12 weeks. Each exercise session was supervised by an exercise physiologist or one of the study physicians. Each exercise test started by warm up, then main exercise and cool up at the end. The main part of each exercise sessions was performed in running at moderate intensity (60-75% HRmax; increasing 5% each 3 weeks) for 25-40 minutes (increasing 5 minutes each 3 weeks). The last training session with low intensity was allowed to be performed 48 hours before blood samples were taken.

E. Statistical analyses: Normal distribution of data was analyzed by the Kolmogorov-Smirnov normality test. Statistical analysis was performed with the SPSS software version 15.0. Baseline characteristics between two groups were compared by using independent t-tests. Student's t-tests for paired samples were performed to determine significance of changes in variables by exercise training intervention in exercise group as well as control subjects. Significance was accepted at $P < 0.05$.

RESULTS AND DISCUSSION

Regular training program lasted 3 months and cardiovascular risk factors were compared between pre and post training program. Baseline and post training anthropometrical markers and cardiovascular risk of two groups are shown in Table 1. Data were expressed as individual values or the mean ± SD.

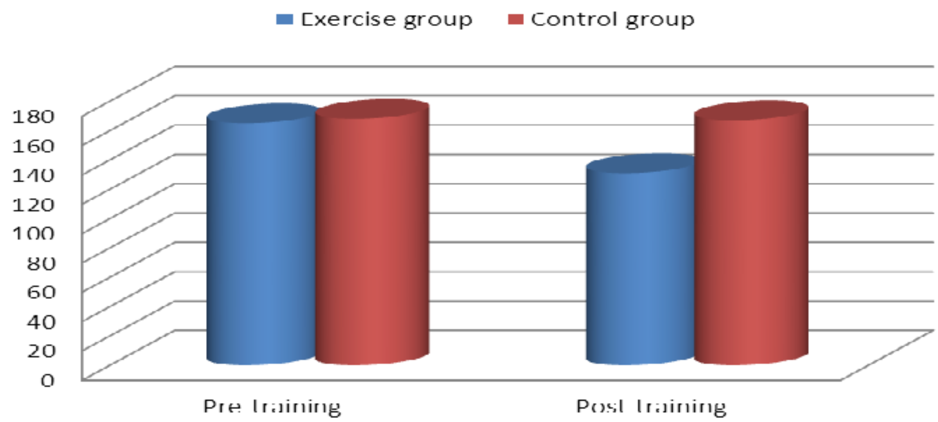
At baseline, there were no differences in the age, body weight and other anthropometrical indexes between the two groups. No significant differences were also observed in cardiovascular risk factors between two groups at baseline.

Based on data of paired T test, Serum HDL cholesterol did not change by exercise program when compared with pre test ($p = 0.61$). In addition, there were no significant changes in TC ($p = 0.912$) and LDL cholesterol ($p = 0.36$) by exercise training. Triglyceride concentration was decreased 26% with exercise training ($p = 0.019$, Fig. 1). Exercise program results in significant decrease in TG/HDL compared to pretest ($p = 0.019$, Fig. 2). All anthropometrical markers decrease significantly by exercise program in exercise group ($p < 0.05$).

All variables did not change in control subjects ($p \geq 0.05$).

Table 1: Baseline and post training levels of anthropometrical and metabolic indexes of two group.

Variables	Exercise group		Control group	
	Pretest	post-test	Pretest	post-test
Age (year)	**35.7** (4.7)	-----	**38.8** (2)	-----
Height (cm)	**177** (4.4)	-----	**175** (3.4)	-----
Weight (kg)	**100** (14)	**95** (15)	**99** (7)	**99** (8)
Waist circumference (cm)	**107** (10)	**102** (10)	**103** (6.9)	**103** (6.7)
Hip circumference (cm)	**107** (9)	**103** (9)	**102** (5.9)	**102** (5.4)
Waist to hip ratio	**0.99** (0.03)	**0.99** (0.03)	**1.01** (0.22)	**1.02** (0.28)
BMI (kg/m2)	**32.1** (3.39)	**30.3** (3.58)	**32.2** (1.77)	**32.2** (1.86)
Body fat (%)	**32.1** (3.42)	**27.8** (2.32)	**31.6** (1.3)	**31.5** (1.06)
Total cholesterol (mg/dl)	**178** (28)	**176** (45)	**174** (24)	**176** (21)
Triglyceride (mg/dl)	**165** (51)	**131** (42)	**168** (28)	**167** (21)
LDL cholesterol (mg/dl)	**108** (27)	**116** (32)	**112** (16)	**114** (20)
HDL cholesterol (mg/dl)	**43** (3.9)	**44** (5.5)	**43** (1.9)	**42** (3.2)
TG/HDL cholesterol	**3.79** (1.12)	**2.98** (0.98)	**3.88** (0.66)	**3.97** (0.65)



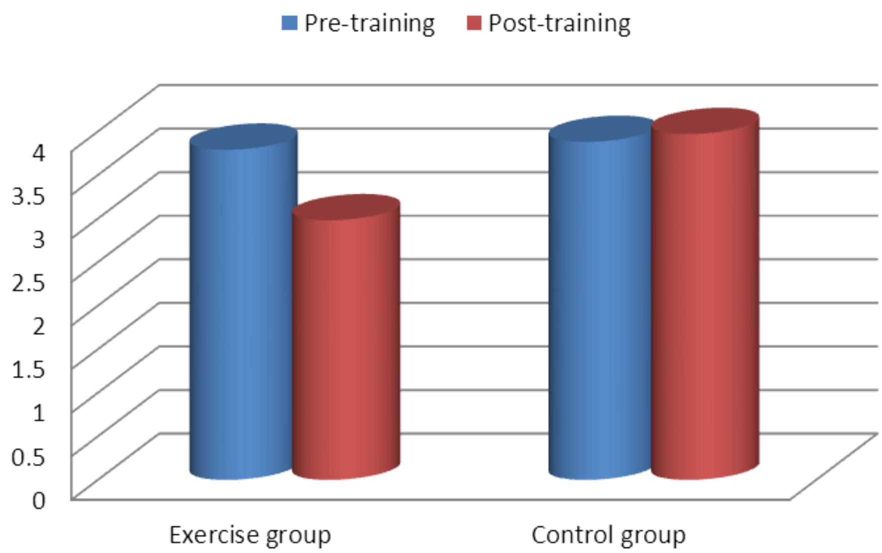


Fig 1: Pre and post training TG/HDL in two groups: significant decrease by exercise program.

Although TC, LDL, and HDL levels did not change in response to a 3-month aerobic exercise program, serum TG levels significantly declined. In other words, three sessions of aerobic exercise per week for the duration of 3 months significantly reduced TG levels in obese men compared to their levels before the exercise program. Nevertheless, lack of changes in the levels of other variables such as HDL, even with weight loss resulting from the exercise program, is somewhat contentious. On the other hand, recent studies reported risk factors for cardiovascular diseases did not change in response to exercise training [9, 10, 11]. Some researchers have reported that exercise training is sometimes accompanied by slight changes, and in most cases is not accompanied by any changes, in blood HDL levels [12, 13, 14]. Some recent studies have also reported that levels of HDL and of other lipid profile indices do not change in response to exercise training [15].

Molecular mechanisms responsible for changes in other risk factors for cardiovascular diseases such as TC have not yet been clearly defined either. Although it is generally assumed that sports exercise is accompanied by lower blood cholesterol, this hypothesis does not always hold and, as observed in some studies, exercise training does not necessarily reduce blood cholesterol [16]. However, some research has pointed out that levels of risk factors for cardiovascular diseases improve when the exercise program is accompanied by significant reduction in body weight [17, 18]. Nevertheless, in this research, despite a significant reduction in weight and in body fat percentage following the training program for obese people, levels of the mentioned risk factors remained unchanged, which contradicts the mentioned hypothesis.

The considerable improvement in HDL in response to long-term training programs for obese populations suffering from obesity-related diseases was already reported in some studies. These studies pointed to significant increases in HDL levels following training programs [7, 19]. However, contrary to the findings in these studies, serum HDL levels did not change in a recent study on patients with type 2 diabetes [20]. In that study, although the researchers somehow attributed the lack of changes in HDL levels to the small number of studied subjects, their findings showed that the TG/HDL and TC/HDL ratios, that are other important factors indicating cardiovascular health, significantly decreased in response to the training exercise [20]. These researchers also mentioned that reductions in both TG/HDL and TC/HDL somehow supported the opinion that the cardiovascular risk profile decreased in response to training programs for diabetic subjects because scientific sources pointed to increased incidence of cardiovascular diseases when the ratios of triglycerides or bad cholesterol to HDL increased. In this study also, although HDL levels did not significantly change in response to aerobic exercise, the findings show that the TG to HDL ratio (TG/HDL) significantly declined, which is clinically noteworthy. Despite the lack of changes in other risk factors, the reduction in the ratio of risk factors for cardiovascular diseases to HDL may have its roots in reduced body weight. A recent study confirms this because it found a positive and significant correlation between BMI and TG/HDL after the training program [20]. On the other hand, researchers have pointed out that blood cholesterol will decline if sports exercise is accompanied by corrected diets [16]. Therefore, the lack of changes in risk factors for cardiovascular diseases in this study, even when body weight declined, may be attributed to the fact that diets were not controlled during the training program.

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