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EFFECT OF WEIGHT LOSS INDUCED BY AEROBIC TRAINING ON CRP AND OTHER CARDIOMETABOLIC RISK FACTORS

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ABSTRACT
Obesity is a major health problem and is associated with a high risk of coronary artery disease morbidity and mortality. This study aimed to assess effects of regular training with moderate training on some cardiovascular risk factors in obese women. To achieve this outcome, fasting blood samples were obtained before and after an aerobic training program in middle-aged women. Subjects were twenty six non-trained obese women that participated in study by voluntary and divided into exercise or control groups by randomly. Training program was three months at 55-70 (%) of maximal heart rate. Blood samples used to measure some cardiovascular risk factors such as C-reactive protein (CRP), triglyceride (TG), total cholesterol (TC), LDL-cholesterol and HDL-cholesterol. Data analyzed by statistical Package for Social Sciences (SPSS) for Windows, version 15.0. The exercise intervention improved anthropometric and metabolic parameters (TG, LDL, HDL and CRP of all subjects. Concentrations of TG, LDL and HDL were decreased with long-term exercise training whereas concentrations of TC did not change. CRP levels were significantly decreased by training program in exercise group but not in control subjects. Since the diet in both groups was similar before the study and all participants were asked to remain their diet during the study, so improve in cardiovascular risk factors can be attributed to exercise training intervention.

KEYWORDS: C-reactive protein, Lipid profile, Obesity, Aerobic training

INTRODUCTION

Obesity or increased body fat, which is often associated with increased visceral fat, has been introduced as one of the health problems in the past century threatening the lives of children and adults. Most of chronic diseases associated with metabolic disorders such as cardiovascular and respiratory diseases, metabolic syndrome and type 2 diabetes are the consequences of obesity (Gregg *et al*., 2005). In a recent study, it was found that nearly 30 percent of Iranian women suffer from overweight and 11 percent of them are obese (Hosseini *et al*., 2011). Apart from social and psychological problems, increased levels of blood lipids or the impairment of cardiovascular risk factors follow obesity and increase in body fat (Huang *et al*., 1998). There has been reported a close relationship between the incidence of coronary artery diseases and increasing levels of blood lipid (Indu *et al*., 2013; Nagaf, 2007). From among the cardio - vascular risk factors, Triglyceride (TG) and Total cholesterol (TC) along with decreased levels of high density lipoprotein cholesterol (HDL) are the most major risk factors of cardiovascular diseases (Expert Panel on Detection, 2001).

According to the World Health Organization in 2006, sedentary life style is among the most major factors affecting the deaths from chronic diseases. Accordingly, lack of exercise and lack of participation in regular physical activities are accounted as risk factors leading to cardiovascular diseases (Burton *et al*., 2000). Researchers have found that exercise programs in the form of fitness activities significantly affect the levels of factors involved in fat metabolism (Kamal. 2007). However, in a recent study, 8 weeks of aerobic exercise did not affect the levels of lipid profile in obese patients (Hosseini *et al*., 2011). It is assumed that weight loss improves cardiovascular risk factors, blood glucose, insulin, and blood lipids (Dow *et al*., 2013). However, few studies have examined the effects of long-term weight loss interventions, especially exercise-induced weight loss, on these variables, especially in obese women. Although several studies have been conducted on the impact of physical activities and exercise on the levels of most biochemical markers, there is little study that merely investigates long-term effects of exercise in the absence of dietary control on cardiovascular risk factors. Therefore, the present study was carried out to evaluate the effect of aerobic training on these variables and serum C - reactive protein (CRP) in obese adult sedentary women.

MATERIALS AND METHODS

This study involved twenty six diabetic women aged 39 ± 3 years and body mass index 33±3 kg/m2 that voluntarily participated in the study. Participants were randomly assigned to either an experimental group (n = 13) that performed

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aerobic training for 3 months or a control group (n = 12) that rested. Participants were non-athletes and non-smokers. 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. Neither the control or exercise subjects had participated in regular exercise for the preceding 6 months, nor did all subjects have stable body weight. The Study Protocol was approved by the Ethics Committee of Islamic Azad University, Iran. After the nature of the study was explained in detail, informed consent was obtained from all participants.

Anthropometrical and clinical measurements: Before and after the aerobic training program, anthropometrical markers and cardiovascular risk factor were measured of two exercise and control groups. Anthropometric measurements (body height and weight, waist and hip circumference) were performed with the subjects wearing light underwear and without shoes. Weight and height were measured in the morning, in fasting condition. Depending on the height and weight, body mass index (kg/m2) was calculated. Abdominal circumference and hip circumference were measured in the most condensed part using a non-elastic cloth meter.
Fasting blood samples were collected before and after aerobic training program. Serum separate immediately and stored at −80°C until analysis. Blood samples were analyzed for serum CRP, cholesterol, LDL cholesterol, HDL cholesterol, triglycerides. Serum CRP was determined by ELISA method. Triglyceride, TC, HDL and LDL-cholesterol was measured directly with enzymatic methods (Randox direct kits).

Training protocol: The aerobic exercise program was planned to incorporate 45-60 minutes of activity 3 days/wk mostly walking or running on treadmill. Participants were encouraged to train 3 times per week, consisting of a brief warm-up (5-10 min), followed by approximately 35-45 min per session of aerobic exercise at an intensity of 55% to 70% of age-predicted maximum heart rate, followed by a brief cool-down. The last training session with low intensity was allowed to be performed 48 hours before blood samples were taken. The control group was asked to continue their usual daily routines during the three months experimental period.

Data analysis: All analyses were performed using SPSS (version 16.0; SPSS Inc, Chicago, IL, USA). After assessment of the normal distribution by the Kolmogorov-Smirnov test, within group changes were compared by the paired t-test for those variables with normal distribution. Means and standard deviations were calculated for all variables. A P-value <0.05 was considered statistically signigcant.

RESULTS

In this study, we assessed the effect of regular aerobic training on serum CRP and other cardiovascular risk factor in obese women. Baseline and post training ghrelin levels, anthropometrical indexes and clinical characteristics of two groups are shown in Table 1.

Table 1: Anthropometrical and metabolic characteristics at before and after aerobic program of two groups

Variables	Exercise subjects		Control subjects	
	Pretest	post-test	Pretest	post-test
Age (year)	39.3 ± 3.4	39.3 ± 3.4	38.6 ± 2.18	**38.6 ± 2.18**
Height (cm)	160 ± 5.8	160 ± 5.8	159 ± 5.25	**159 ± 5.25**
Weight (kg)	84 ± 7.1	81.5 ± 7.9	83.8 ± 5.2	**84 ± 5.1**
Waist circumference (cm)	112 ± 7.7	109.5 ± 7	111 ± 6.1	**111 ± 5.8**
Hip circumference (cm)	115 ± 5.4	111 ± 4.9	113 ± 5.4	**113 ± 5.2**
Waist to hip ratio	0.98 ± 0.06	0.98 ± 0.05	0.98 ± 0.05	**0.98 ± 0.04**
BMI (kg/m2)	32.8 ± 2.39	31.8 ± 2.68	33.1 ± 2.24	**33.1 ± 2.20**
Body fat (%)	46.2 ± 3.8	44.7 ± 3.6	44.6 ± 3.13	**44.6 ± 2.99**
CRP (pg/ml)	6748 ± 2770	5236 ± 2543	6577 ± 2174	**6634 ± 1803**
TG (mg/dl)	151 ± 85	115 ± 51	149 ± 51	**156 ± 48**
TC (mg/dl)	165 ± 31	169 ± 28	160 ± 33	**163 ± 42**
LDL-cholesterol (mg/dl)	118 ± 24	103 ± 24	124 ± 15	**125 ± 19**
HDL-cholesterol (mg/dl)	40.8 ± 10.2	45.8 ± 10.3	41.2 ± 4.3	**41.3 ± 4.3**

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Significant differences were not found in body weight, BMI and other anthropometrical markers between two groups at baseline ($p > 0.05$). Baseline characteristics of CRP and other cardiovascular risk factors were not difference between two groups at baseline ($p > 0.05$). Serum CRP concentration decreased 22% in exercise group after 12 wk of aerobic exercise training ($p = 0.01$, Fig 1) but not in control subjects (Fig 1). Compared to pre-training, fasting concentrations of TG ($p = 0.03$, Fig 2), LDL ($p = 0.000$) and HDL cholesterol ($p = 0.01$) were also improved significantly after exercise program but these clinical variables was not changed in control subjects. In contact, no significant change was observed in TC by exercise program in exercise group ($p = 0.33$). We also found a significant decrease in body weight, body fat percentage, abdominal circumference and other anthropometrical markers in exercise subjects ($p < 0.05$).

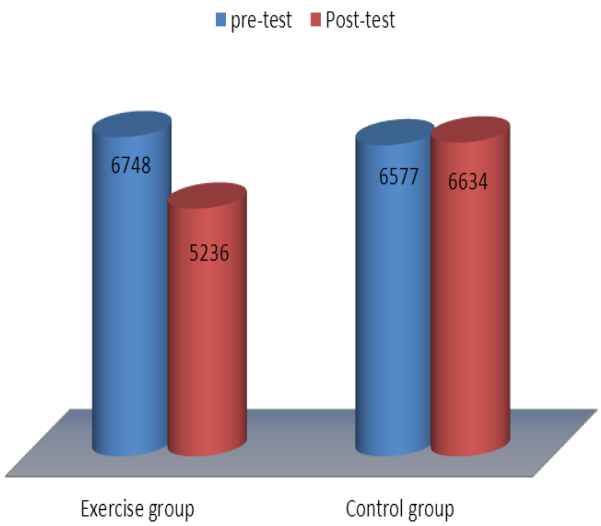

Fig 1: Pre and post training of serum TNF-α of two groups

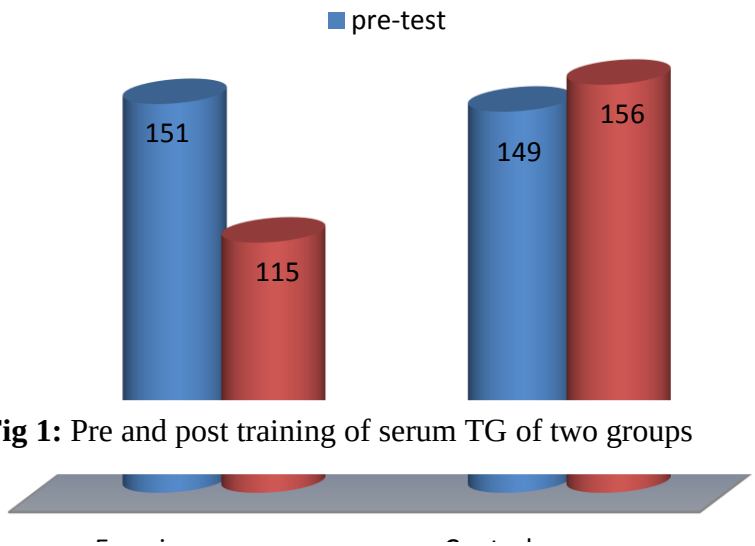

Fig 1: Pre and post training of serum TG of two groups

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DISCUSSION

The significant reduction of triglycerides and LDL and also significant increase of HDL are the main findings of this study. In a sense, a three-month aerobic training leads to significant reduction of TG, LDL and significant increase of HDL in obese women. Although TC levels tended to be reduced, this reduction was not statistically significant. Deceased serum CRP by training program was anther main result of present study. Obesity was introduced a major risk factor associated with mortality and various diseases including type 2 diabetes, coronary artery disease, and heart failure (Gregg *et al*., 2005). Increased prevalence of fatty tissue, particularly visceral fat and obesity-related risk factors play a major role in the abovementioned diseases and the impairment in vascular risk factors also predicts metabolic syndrome in most cases (Ford *et al*., 2005; Yusuf *et al*., 2005). Obese people often have increased levels of fasting glucose, lipids, insulin resistance and inflammatory markers (Gregg *et al*., 2005; Lumeng *et al*., 2011; Taylor *et al*., 2008). It is known that even with a relatively modest weight loss, significant improvements can be observed in metabolic risk factors for obesity-related diseases, particularly cardio - vascular diseases and type 2 diabetes (Gregg *et al*., 2005; Layman *et al*., 2009; Harvie *et al*., 2011). Also, it is known that a ten percent weight loss in obese people, even with preserving BMI, causes a significant reduction in glucose, insulin and markers representing blood lipids such as cardio - vascular risk factors (Johnson *et al*., 2011). None the less, some studies have mentioned the absence of any change in the levels of cardio - vascular risk factors (TG, TC, HDL and LDL) even after a 12 and 14-month weight loss course (Rock *et al*., 2010). In another study, though a 12-week training program three times a week for 40 to 50 minutes caused significant diminution of waist circumference, BMI and body weight in metabolic syndrome patients, no significant change was observed in TG, TC and LDL. Nevertheless, HDL levels increased significantly (Colombo *et al*., 2013). The absence of any change in cardiovascular risk factors was also observed after 12 weeks of aerobic exercise on a treadmill in a separate study (Januszek *et al*., 2014).

On the other hand, to support our finding, 12-week aerobic, resistance and combined training significantly improved blood glucose, blood pressure, CRP and cardiovascular risk factors in patients with type 2 diabetes (Jorge *et al*., 2011). The beneficial effects of long-term training programs on cardiovascular risk factors have also been reported in other studies (Di Raimondo *et al*., 2013; Stavropoulos-Kalinoglou *et al*., 2013; Eizadi *et al*., 2013). These findings indicate that each of the risk factors responds differently to different cardio - vascular training programs and different populations. The TG latent in the body are among the main sources of energy during long-term exercise activities. Increased release and breakdown of TG depends on the presence of lipoprotein lipase. However, it should be noted that short-term or long-term effects of exercise on TG levels and other cardiovascular risk factors depends also on their initial levels before training program (Van Loon *et al*., 2004). In support of these findings, long-term weight loss intervention reduced TG and LDL in type 2 diabetes (Wing *et al*., 2010). In another study, 5-month weight loss program led to weight loss and waist circumference with an improvement of TG and LDL (Muzio *et al*., 2007). Scientific sources have also reported that in addition to the improvement of cardiovascular risk factors induced by weight loss; even a moderate weight loss is maintained long after the cessation of exercise (Dow *et al*., 2013). In general and regardless of the absence of a change in some variables, the findings of this study indicate that three months of aerobic training improves cardiovascular risk factors in obese women who had a sedentary lifestyle. The strength of this study is that the beneficial effects of training program were achieved in the absence of any dietary control during the exercise course. However, the absence of any change in TC levels in this study may be due to the lack of dietary control or a low number of study samples.

REFERENCES

Burton N.W. and Turrell G. (2000). Occupation, hours worked, and leisure time of physical activity. *Rre. Med*. 31(6): 673-681.

Colombo C.M., de Macedo R.M., Fernandes-Silva M.M., Caporal A.M., Stinghen A.E., Costantini C.R., Baena CP., Guarita-Souza L.C. and Faria-Neto J.R. (2013). Short-term effects of moderate intensity physical activity in patients with metabolic syndrome. *Einstein (Sao Paulo).* 11(3): 324-30.

Di Raimondo D., Tuttolomondo A., Buttà C., Casuccio A., Giarrusso L., Miceli G., Licata G. and Pinto A. (2013). Metabolic and anti-inflammatory effects of a home-based programme of aerobic physical exercise. *Int. J. Clin. Pract.* 67(12): 1247-53.

Dow C.A., Thomson C.A., Flatt SW., Sherwood N.E., Pakiz B. and Rock CL. (2013). Predictors of Improvement in Cardiometabolic Risk Factors With Weight Loss in Women. *J. Am. Heart. Assoc.* 2(6): 152.

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Eizadi M., Bagheri G., Kasbparast M.J., Zahedmanesh F. and Afsharmand Z. (2013). Effects of training on body composition, blood lipids, and glucose homeostasis assessed by the homeostasis model assessment. *Sci. sports*. 28(2): 75-80.

Ford E.S. (2005). Prevalence of the metabolic syndrome defined by the International Diabetes Federation among adults in the U.S. *Diabetes Care.* 28: 2745–2749.

Gregg E.W., Cheng Y.J., Cadwell B.L., Imperatore G., Williams DE., Flegal K.M., Narayan K.M. and Williamson D.F. (2005). Secular trends in cardiovascular disease risk factors according to body mass index in US adults. *JAMA.* 29: 1868–1874.

Harvie M.N., Pegington M., Mattson M.P., Frystyk J., Dillon B. and Evans G. (2011). The effects of intermittent or continuous energy restriction on weight loss and metabolic disease risk markers: a randomized trial in young overweight women. *Int J Obes (Lond).* 35: 714–727.

Hosseini K.S., Amiri P.T., Azarnive M. and Hamedinia M. (2011). The Effect of Resistance Training, Aerobic Training and Detraining on the Lipid Profile and CRP in Obese Girls. *Sabzevar University of medical sciences.*18 (3): 188-197

Huang Z., Willett W.C., Manson JE., Rosner B , Stampfer M.J. and Speizer F.E. (1998). Body weight, weightchange, and risk for hypertension in women.Ann Intern Med.128(2): 81-88.

Indu L., Pulani W. and Rajitha A. (2013). Sedentary behavior and Physical Activity in South Asian Woman :*Time to Review Current Recommendations? PLoS One.* 18(3): 138-144.

Januszek R., Mika P., Konik A., Petriczek T., Nowobilski R. and Niżankowski R. (2014). The effect of treadmill training on endothelial function and walking abilities in patients with peripheral arterial disease. *J Cardiol.* 5087(13): 393-6.

Johnson WD., Brashear MM., Gupta AK., Rood JC. and Ryan DH. (2011). Incremental weight loss improves cardiometabolic risk in extremely obese adults. *Am. J. Med.* **124:** 931–938.

Jorge ML., de Oliveira VN., Resende NM., Paraiso LF., Calixto A. and Diniz AL. (2011). The effects of aerobic, resistance, and combined exercise on metabolic control, inflammatory markers, adipocytokines, and muscle insulin signaling in patients with type 2 diabetes mellitus. *Metabolism.* 60(9): 1244-52.

Kamal MSM. (2007). Study the Effects of Ramadan Fasting on the Serum Glucose and Lipid Profile among Healthy Jordanian Students. *Am. J. Applied Sci.* 4 (8): 565-569.

Layman DK., Evans EM., Erickson D., Seyler J., Weber J., Bagshaw D., Griel A., Psota T. and Kris-Etherton P. (2009). A moderate-protein diet produces sustained weight loss and long-term changes in body composition and blood lipids in obese adults. *J Nutr.* 139: 514–521.

Lumeng CN. and Saltiel AR. (2011). Inflammatory links between obesity and metabolic disease. *J Clin Invest.* 121: 2111–2117.

Muzio F., Mondazzi L., Harris W.S., Sommariva D. and Branchi A. (2007). Effects of moderate variations in the macronutrient content of the diet on cardiovascular disease risk factors in obese patients with the metabolic syndrome. *Am J Clin Nutr.* 86: 946–951.

Nagaf A. (2007). Investigatiopn of risk factors, obesity in woman. *Tabib Shargh*. **9(2):** 133-138.

Rock C.L., Flatt S.W., Sherwood N.E., Karanja N., Pakiz B. and Thomson CA. (2010). Effect of a free prepared meal and incentivized weight loss program on weight loss and weight loss maintenance in obese and overweight women: a randomized controlled trial. *JAMA.* 304: 1803–1810.

Stavropoulos-Kalinoglou A., Metsios GS., Veldhuijzen van Zanten J.J., Nightingale P., Kitas G.D. and Koutedakis Y. (2013). Individualised aerobic and resistance exercise training improves cardiorespiratory fitness and reduces cardiovascular risk in patients with rheumatoid arthritis. *Ann Rheum Dis.* 72(11): 1819-25.

Taylor R. (2008). Pathogenesis of type 2 diabetes: tracing the reverse route from cure to cause. D*iabetologia*. 51: 1781–1789.

Van Loon L.J. (2004). Use of intramusculartriacylglycerol as a substrate source duringexercise in humans. *J. Appl. Physiol.* 97(4): 1170-87.

Wing R.R. (2010). Long-term effects of a lifestyle intervention on weight and cardiovascular risk factors in individuals with type 2 diabetes mellitus: fouryear results of the Look AHEAD trial. *Arch. Intern. Med.* 170: 1566–1575.

Yusuf S., Hawken S., Ounpuu S., Bautista L., Franzosi M.G., Commerford P. and Lang C.C. (2005). Study Investigators. Obesity and the risk of myocardial infarction in 27,000 participants from 52 countries: a case-control study. *Lancet.* 366: 1640–1649.

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