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The Effect of Aerobic Training with difference Periods on Lipid Profile in Obese Women

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ABSTRACT: Cardiovascular diseases is one of the most important causes of mortality in the world obesity is one of the causes. Increase in blood lipid and triglyceride cholestrole is significant in over weights. The aim of this study was assessing the effect of periodic aerobic exercises on lipid profile of obese woman. This study which was a semi – experimental research, 30 volunter obese woman (age 35-45 year, body mass index (BMI>30 kg/m$^{2)}$ were randomly divided into two equal groups experimental and control of each with 15 individuals. The subject in experimental group had an aerobic training program for 12 week (3 sessions in week, each session 45-60 minutes, the intensity of exercise was 60 to 80 minutes ,the intensity of exercise was 60 to 80 percent of maximum heart rate)Whereas control group had no regular physical activity. Blood samples (5cc) were taken from the participants to the beginning of the period, week 6 and end of week 12 in order to measure factors such as (TG, TC, HDL, LDL, VLDL, TG/HDL, LDL/HDL and BMI, WHR, BMI, WHR, Body fat Percent). Then Data for inter group comparison, between group independent test was used and inter group comparison of repeated measures (significance level p≤0.05). The obtained result showed that 6 week aerobic training decrease in fat percentage, BMI, weight and TG/HDL,LDL/HDL and increase HDL also 12 week aerobic training decreased fat percentage, BMI, weight and TG, LDL, TG/HDL, LDL/HDL and increase HDL. Aerobic exercises by itself and without special diet was efficient in improving serum lipid concentrations, and metabolic syndrome factors in obese woman further more, with increasing the length of exercise course better conclusions were achieved.

Keywords: Aerobic Exercise, Obesity, Lipid profile

INTRODUCTION

Obesity or increased body fat percentage in one health problem in the twenty-first century. Epidemic obesity threatens health of children and adults. Obesity negatively affects health and longevity of the population. Obesity is associated with many diseases and health problems such as cardiovascular disease, metabolic syndrome, diabetes, hypertension, hyperlipidemia, etc [1, 2]. It seems that one reason for the association between obesity and cardiovascular because lies in the fact that obesity is associated with a number of health-threatening factors such as increased triglycerides levels, low levels of lipoprotein cholesterol with high-density HDL-c, high levels lipoprotein cholesterol with low-density LDL-c and hypertension. On the other hand, increased LDL-C and decreased HDL-C with hypertension underlies development of atherosclerosis [3].

In addition, high TG and low HDL-C are main causes of insulin resistance and metabolic syndrome, which can intensively lead to CHD. The TG / HDL-C ratio is a relatively new lipoprotein index and indicates presence of small and dense LDL particles. This can properly predict CHD [4, 5]. Metabolic syndrome refers to a group of cardiovascular risk factors such as obesity, hypertension, diabetes, high blood triglyceride, low levels of high-density lipoprotein and high blood cholesterol [6]. This syndrome is considerably important in diagnosis of people who are substantially at high risk of cardiovascular disease (CVD). In addition to genetic factors, such environmental factors as smoking, menopausal status, lack of exercise and inactive lifestyle, alcohol abuse and progressive increase in weight significantly contribute to development of cardiovascular disease [7].

Regular aerobic physical activity as a desirable lifestyle may improve lipid and lipoprotein concentrations in women [8]. Examining the effects of regular aerobic exercise on lipid profile parameters with regard to optimized duration and intensity is a practical and convenient solution to identify and reduce cardiovascular disease. For this purpose, the effect of aerobic exercise with different periods was examined on lipid profile in obese women in this study.

METHODOLOGY

This was a quasi-experimental study with pre-test and post-test. The statistical population consisted of 30 obese pre-menopausal women in Tehran who were between 35 and 45 years old. The subjects with overweight and obesity with a body mass index of 36> BMI> 30 kg/m^2 who voluntarily participated in the research were selected. Volunteer subjects visited the doctor at first. They were examined in terms of health status, history of disease and cardiorespiratory fitness in order to participate in the training program. The subjects should have not had any disease, smoking problem, and drug abuse. They should not also have done regular exercise at least in the past year. They should not have been menopausal too.

Furthermore, the subjects who have volunteered to participate in the study were given medical history questionnaire and the questionnaire to start physical activities and consent form. After these steps, 30 subjects were selected among the eligible ones. The selected subjects were randomly divided into two control and experimental groups consisting of 15 subjects. After briefing, wall mounted stadiometer and tape were used to measure standing height and waist and hip circumference in centimeters with 0.1 cm precision. Moreover, BMI was calculated by dividing weight (kg) to square of height (m). Body fat percentage was calculated using OMRON analyzer device. The weight was measured using a Seka digital scale made in Germany with 1.0 kg precision.

In order to examine blood biochemical variables, bloodletting was performed three stages prior to exercises (week zero), the sixth week and the twelfth week. In the first phase, the subjects were asked to not to do any exercise two days before the test and maintain their usual diet. Then, 5 mL blood was taken after twelve hours of fasting from the left antecubital vein in sitting position and 5 mL blood was taken from the workout group in rest position at 8 am. Biochemical variables were cholesterol (TC), triglyceride (TG), low density lipoprotein (LDL), very low density lipoprotein (VLDL), high density lipoprotein (HDL), low density lipoproteins to high density lipoprotein ratio (LDL / HDL), triglycerides to high density lipoprotein ratio (TG / HDL). Enzymatic method with auto analyzer alpha x device was used for measuring lipid with (E2HL-100) kits and 0.1 (mmol/d) sensitivity.

A. The Exercise Protocol

Before the exercise, maximum heartbeats were measured using (age × 0.7)-208 formula for each individual and was declared [9]. In this study, the experimental group performed aerobic exercises for 12 weeks, three sessions per week with predetermined duration and intensity.

Each exercise session was conducted in three stages including:

(i) Warm-up phase: This phase includes a ten-minute warm-up as stretching, jogging, fast walking with 45-55% of maximum heartbeats.

(ii) Main basic exercise: the main exercise of the experimental group consisted of running (by controlling the intensity, speed, distance and time in which injury is low). Running was intended as the main exercise. Training program initially started with 60% maximum heartbeats (MHR) and increased to 80% maximum heartbeats. Running exercise lasted for 45 minutes in the first session. In following session, one minute was added to running time until the time of running was increased to 60 minutes (end of the twelfth week) and was maintained in the remaining exercise sessions. Intensity of exercise was controlled using a stethoscope belt (pollar) during exercise. Stethoscope belt was kept after warming up and before the main workout.

(iii) Cooling phase: at the end of the session, cooling was performed by soft and slow running and stretching.

During three preliminary, intermediate and final stages, information about each subject (including anthropometric indices and lipid profile) was recorded and statistically analyzed with regard to the above-mentioned methods.

B. Statistical Methods

Research findings were analyzed in two parts. In the first part, individual characteristics were analyzed using descriptive statistics. In inferential statistics, Kolmogorov - Smirnov test was used to test normal data distribution. Independent t-test was used to compare the means between the groups. Analysis of variance with repeated measures was used to determine changes within the groups. In order to test hypotheses and interpret the results, $P \leq 0.05$ was considered. All statistical operations were done using SPSS Version 15.

RESULTS

The findings showed that six-week aerobic exercise significantly decreased body weight (p<0.0), body fat percentage (p<0.01), body mass index (p<0.01) and the ratio of triglycerides to serum HDL (p=0.019) and the ratio of LDL to HDL (p=0.001) while concentration of high-density lipoprotein (p=0.001) increased compared with the control group. Moreover, twelve weeks of aerobic exercise significantly decreased body weight (p<0.0), body fat percentage (p<0.01), body mass index (p<0.01), serum triglyceride concentration (0.014), concentration of low-density lipoprotein (p=0.032), very low-density lipoprotein levels (p=0.023), ratio of triglycerides to HDL (p=0.005), the ratio of LDL to HDL (p=0.001) while high-density lipoprotein levels (p=0.000) increased compared with the control group. The effect of exercise after twelve weeks was examined with an intermediate test (six weeks). The results showed a significant decrease in body weight (p≤0.01), body mass index (p≤0.01), body fat percentage (p≤0.01), waist-to-hip ratio (p≤0.05), ratio of triglycerides to serum HDL (p≤0.01), the ratio of LDL to HDL (p≤0.01) significantly increased the concentration of high-density lipoprotein (p≤0.001).

No significant decrease was observed in total cholesterol within the groups in none of the control and experimental groups. Moreover, 6 and 12 weeks without training did not change levels of anthropometric variables and lipid profile in the control group (p≤0.05).

Table 1: Pre, mid and post training of anthropometrical and metabolical markers of studied groups.

Variables	**Control group**			**Exercise group**		
	Pre-test	**Mid-test**	**Post-test**	**Pre-test**	**Mid-test**	**Post-test**
Age (year)	37 ± 3.8	----	----	38 ± 5.4	----	----
Height (cm)	160 ± 4.6	----	----	160 ± 4.8	----	----
Weight (kg)	80 ± 6.6	79.7 ± 6.5	79.9 ± 6.7	8. ± 7.4	79.4 ± 7.6	78.1 ± 7.7
Abdominal (cm)	108 ± 10	111 ± 16	111 ± 17	108 ± 9.9	108 ± 9.7	106± 8.7
Hip (cm)	113 ± 9	114 ± 9	113 ± 9	113 ± 9	111 ± 8	108 ± 8
AHR	0.96 ± 0.08	0.98 ± 0.13	0.99 ± 0.13	0.96 ± 0.08	0.97 ± 0.08	0.98 ± 0.08
BMI (kg/m2)	31.2 ± 2.79	31.3 ± 2.68	31.4 ± 2.64	31.5 ± 3.3	31.1 ± 3.4	30.6 ± 3.5
Body fat (%)	44.9 ± 3.78	44.9 ± 3.37	45 ± 3.12	45.2 ± 4.8	44.5 ± 4.7	43.5 ± 4.9
TG (mg/dl)	110 ± 32	117 ± 34	122 ± 40	108 ± 39	103 ± 37	99 ± 34
TC (mg/dl)	163 ± 22	160 ± 14	157 ± 27	167 ± 23	165 ± 25	170 ± 24
LDL (mg/dl)	106 ± 23	110 ± 15	113 ± 9	109 ± 22	110 ± 23	102 ± 19
HDL (mg/dl)	40 ± 4	40 ± 5	40 ± 6	39 ± 8	45 ± 7	49 ± 7
vLDL (mg/dl)	43.3 ± 5.6	42.2 ± 5.3	42.4 ± 5.2	42.3 ± 7.4	40.5 ± 7.6	37.1 ± 6.11
TG/HDL	2.76 ± 1	3.01 ± 0.99	3.12 ± 1.07	2.94 ± 1.53	2.36 ± 0.69	2.05 ± 0.79
TC/HDL	2.63 ± 0.49	2.8 ± 0.44	2.89 ± 0.54	2.86 ± 0.8	2.38 ± 0.69	2.13 ± 0.54

DISCUSSION

The results showed that HDL levels after both 6 and 12 weeks of aerobic exercise significantly increased. In addition, HDL levels significantly increases after 12 weeks compared to 6 weeks of exercise training. Mechanism of changes in HDL-C is complex after training exercises. Increase in HDL-C may be due to increased enzymatic activity (LPL) of lipoprotein lipase. LPL enzyme effectively converted VLDL to HDL. Increased activity of LPL enzyme increased levels of HDL-C. Furthermore, Lecithin cholesterol acyltransferase (LCAT) converts LDL cholesterol to HDL particles. Increasing this enzyme may be responsible for increasing HDL as a result of exercise. Another possible reason for the increase in HDL may be due to increased HDL production by the liver followed by a change in (LPL) enzymatic activity and decrease in hepatic lipase followed by physical activity [10].

The effect of exercise on LDLV, and LDL and TG concentrations led to similar results. These variables did not change significantly after 6 weeks of aerobic exercise; however, these variables significantly decreased after 12 weeks compared to baseline levels. Olson *et al.* (2007) argued that low-density lipoprotein and cholesterol are strongly affected by exercise unless accompanied by weight loss or body fat weight loss [11]. Changes in body composition, increased muscle mass and decreased fat mass can considerably decrease LDL [12]. A number of studies showed that aerobic exercise is associated with reduced serum levels of LDL-C. In aerobic exercise, fat is used as the main source of energy.

Thus, decrease in LDL-C levels in aerobic exercise group can be due to the effects of these exercises on fat because fat is used as a source of energy. Furthermore, studies showed that sports activities increase lipoprotein lipase (LPL) and Lecithin Cholesterol acyltransferase (LCAT) enzymatic activities. These two enzymes decrease triglyceride, LDL-C, and cholesterol while increase HDL-C [6]. In addition, aerobic exercise absorbs cholesterol, decrease LDL, and subsequently prevent cardiovascular disease [13].

Moreover, VLDL levels significantly decreased after 12 weeks of aerobic exercise. This may be due to the fact that lipoprotein lipase activity increases due to aerobic activity. The main substrates for lipoprotein lipase are VLDL and shilo micron. Therefore, VLDL uptake leads to increased oxidation in muscle [14]. Lipoprotein lipase enzyme increases catabolism of VLDL and LDL levels after exercise [13].

Furthermore, triglyceride levels significantly decreased after 12 weeks compared to baseline levels. Triglycerides are the main source of energy during aerobic exercise. Lipoprotein lipase (LPL) regulates lipoprotein enzyme and triglyceride breakdown in triglyceride-rich lipoproteins. Thus, there is a strong relationship between (LPL) enzymatic activity and blood TG uptake. [15, 16]. Increased (LPL) lipoprotein lipase enzymatic activity a result of aerobic exercise decreases triglyceride in the experimental group after 12 weeks. In general, the major long-term effects of exercise on lipid profile continuously and significantly decreased triglyceride. Therefore, insignificant effect of exercise at 6 weeks on triglycerides and no significant decrease in triglycerides between 6 and 12 weeks may be due to the intensity and duration of training sessions in this study. In addition, the effect of exercise on plasma triglyceride concentration also depends on triglyceride concentration before exercise activity. Triglyceride level did not change significantly in people with lower triglyceride concentrations while triglyceride level significantly decreased in those people with high levels of plasma triglycerides [16]. In this study, triglyceride levels in subjects before exercise was not so high and short-term training for 6 weeks did not significantly decrease triglyceride levels.

Cholesterol levels in aerobic exercise compared to baseline levels were not significantly changed. In this study, aerobic exercise slightly decreased cholesterol levels. This has been clinically valuable but was not statistically significant. Hence, it seems that longer duration of exercise significantly changed this variable. Small sample size decreased statistical power. Another reason for lack of change in cholesterol may be due to intensity [17], duration of exercise [18] and diet simultaneously [19].

Evaluating the ratio of triglycerides to HDL as a relatively new lipoproteins index can be used as an indicator to predict the risk of heart disease [20]. Akhir Al-Hossein (2008) et al. addressed that a TG / HDL- C ratio greater or equal to 3 is consistent with clinical criteria defined for metabolic syndrome in women with premenopausal status [21]. Kim et al. studied two groups of exercise at 50% VO2max and 85% VO2max for 6 to 12 months and showed that HDL significantly increased while (TG / HDL-C) decreased. Katz Marzyk et al. reported a significant relationship between physical activity and lipoprotein protein and TG / HDL ratio [22].

A number of other studies also showed a direct relationship between physical activity and HDL. In other words, an increase in intensity of physical activity can increase HDL levels [23]. The ratio of TG / HDL is known as a risk factor for cardiovascular disease. This ratio depends on HDL and cholesterol levels. Thus, cholesterol levels can be decreased and HDL levels can be increased with proper exercise. It helps to decrease TG / HDL ratio. The ratio of TG / HDL represents the relative size of LDL particles and predicts athrogenicity. Low TG / HDL ratio represents large-sized and non-atherogenic LDL while high TG / HDL ratio represents small sized, dense and atherogenic LDL particles. Dubiasava et al. demonstrated that TG / HDL-C logarithm as an atherogenic index indicates the actual balance between concentration of plasma TG and HDL-C, which represents the path of transferring cholesterol in arteries [24].

Higher ratio of TG / HDL-C decreases HDL particle sizes. Thus, high TG/HDL-C ratio may stop HDL-C maturity and weakens reverse cholesterol transport [25]. In the present study, TG/HDL-C ratio after 6 and 12 weeks respectively declined to 0.58 and 0.89. TG/HDL-C ratio decreased 0.31 from the sixth week to the twelfth weeks. Thus, it seems that regular training programs with the intensity and duration in this study created favorable conditions to decrease this ratio. The ratio of LDL to HDL after both 6 and 12 weeks of aerobic exercise significantly decreased compared to baseline levels. The ratio of LDL to HDL also predicts cardiovascular events. The highest ratio of LDL to HDL increases the risk of cardiovascular events and threatens individual health [26]. In fact, diagnosis factors of the ratio of LDL to HDL are considerably important. This ratio should be less than 3. Those individuals with a ratio between 3 and 6 are in moderate risk group. Those individual with a ratio greater than 6 are at high risk of heart disease.

Changes in the ratio of LDL to HDL depend on concentrations of LDL and HDL levels. The ratio of LDL to HDL changes optimally by increasing HDL and lowering LDL. Therefore, effective factors in LDL and HDL levels can also be effective in LDL to HDL ratio. Moreover, regular exercise program with intensity and time in this study provides the context for decreasing this factor. Other factors that could possibly affect the outcome of the investigation are not measured in this study. Nutrition and the food taken by the subjects may be one of these factors. Thus, consuming more carbohydrates than other foods increases triglyceride level. It is possible that the subjects consumed more carbohydrates in the first 6 weeks compared to the second 6 weeks [27, 28].

Hormones are an important factor in the escalating consumption of fat for energy production. Growth hormone specifically increases release of fatty acids and their concentrations. In addition, this hormone converts fatty acids to acetyl coenzyme A and uses the latter for energy production. In addition, insulin-like adiponectin hormone secreted from adipose tissue absorbs glucose, increases oxidation of fatty acids, and prevent the development of insulin resistance and metabolic disorders. This activity is decreased in obese individuals. This leads to increased fat storage and increases the risk of heart disease [29]. Despite the fact that growth hormone and adiponectin were not measured in this study, these variables may be involved in this research. Apart from the factors mentioned, psychological factors should be considered, particularly stress. In times of stress and physical activity, cortisol increased fat calls simultaneously with increased fat oxidation in cells and shifts metabolic systems from glucose to fat for energy consumption. This hormone is not measured in the present study, which might have affected the results.

CONCLUSION

In general, it can be stated that aerobic exercise alone without specific diet has a significant effect on weight, body mass index, body fat profile, fat percentage, triglycerides, total cholesterol, low-density lipoprotein, high-density lipoprotein in obese women. Improving lipid profile and risk factors of metabolic syndrome with aerobic exercise can decrease the prevalence of cardiovascular disease in untrained obese women. Studies have shown that the prevalence of obesity and relevant complications have increased in Iran, especially in women. Therefore, identifying ways to reduce risk factors and complications in obese individuals may have important clinical implications. Thereby, adopting a healthy lifestyle that includes maintaining a normal weight, engaging in regular exercise is a major step in the longevity and health of obese society.

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