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Effect of Short-Term Aerobic Exercise on Lipid Profile

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Abstract

Background: Dyslipidemia and a sedentary lifestyle are well-recognized risk factors for atherosclerotic heart disease.

Objective: The aim of this study was to ascertain the effect of short-term aerobic exercise on the lipid profile of individuals engaged in regular exercise for 8 weeks.

Methods: The lipid profile of 50 apparently healthy female students practiced regular aerobic exercise (mean age 20.5 ± 1 year) was analyzed using enzymatic and colorimetric methods.

Results: There was a significant decrease ($p<0.05$) in serum level of Low-Density Lipoprotein-Cholesterol (LDL-C), in females practice regular aerobic exercise for 8 weeks, and there was a significant difference in serum level of Total Cholesterol (TC), Triglyceride (TG) and High-Density Lipoprotein (HDL) ($p<0.05$) when comparing pre and post exercises levels of lipid profiles, regular participants showed a significant decrease in TC, TG, and LDL. TC, TG, LDL, VLDL, significantly decrease while HDL-C significantly increases.

Conclusion: Short term aerobic exercise improves HDL-C and decreases TG, TC, LDL, VLDL, so decrease the risk of Coronary Heart Disease (CHD).

Keywords: Aerobic Exercise; Dyslipidemia; CHD; TG; TC; LDL

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Introduction

Lipids are small hydrophobic molecules that have a wide range of a function; they act as structural elements in biological membranes, they store energy and they function as signaling molecules in cellular response pathways. Although lipids are highly essential its abnormal levels contribute to the progression of many diseases such as atherosclerosis. The abnormalities in lipids can be noticed *via* lipid profile panel which is a panel of blood tests that serves as an initial broad medical screening tool for abnormalities in lipids such as cholesterol and triglycerides [1].

Hypercholesterolemia is an important risk factor for the development of atherosclerosis, ischemic heart disease, and stroke. According to the American Heart Association, 54% of adult Europeans aged >25 years suffer from increased cholesterol levels higher than 5.17 mmol/L. Decreasing of Low-Density Lipoprotein (LDL) levels over a lifetime for 1 mmol/L is associated with a 55% lower risk for cardiovascular diseases [2]. Aerobic exercise is a physical activity which increases the heart rate and respiratory volume to supply the activated muscles by a sufficient amount of oxygen, aerobic exercise is easy to perform and has little side effects compared to medicines. Aerobic exercise has a useful effect on cardiovascular disease and makes a better prognosis for these patients [3].

Examination of multiple meta-analyses shows a relation between exercise and lipid profile, as the exercise positively affects the symptoms and physical health [3]. Exercise at moderate-intensity for 30 min, five days/week either with resistance or combination. It has an effect on the cardiovascular risk profile in overweight and obese individuals; however, combination exercise has more effects than other training modalities. However, fasting levels of triglycerides, cholesterol, glucose, and insulin were not affected in the short-term [4]. The addition of resistance training to aerobic exercise possibly will enhance the effects on the lipid profile; the researches confirm the beneficial effects of regular physical activity on cholesterol levels [5]. The aim of our study is to assess the effect of short-

Table 1: Lipid profile of pre and post exercise.

	Pre (Mean ± SD)	Post (Mean ± SD)	Significance
Cholesterol (mg/dl)	162.9 ± 15.9	143.8 ± 13.8	0.001*
Triglycerides (mg/dl)	156.9 ± 22.4	136.4 ± 23.82	0.001*
HDL (mg/dl)	46.3 ± 4.5	50.9 ±8.5	0.001*
LDL (mg/dl)	85.2 ± 15.7	65.6 ± 11.3	0.001*

term aerobic exercise on lipid profile.

Materials and Methods

Cohort prospective study was conducted on 50 female students of collage of applied medical sciences (mean age 20.5 ± 1 year) who were followed up for 2 months starting from January 2019 till March 2019. The inclusion criteria of the participated subjects in this study were, i- they have a normal cognitive, physical, and mental condition, ii- they did not suffer from any chronic disease, and iii- their body mass index was within normal. Subjects were excluded if they had any of the following i- any medical condition that prevents independent weight-bearing or severely affects balance, ii- continuous symptoms of vertigo, or dizziness. iii- neurological, orthopedic, cardiovascular, and metabolic disorders, iv- if they were using medications that could influence research results or had a family history of cardiovascular and metabolic disorders. Blood samples were collected from volunteer participants before entering the study and after 8 weeks of aerobic exercise. Lipid profile was tested using kits and spectrophotometer for measuring. Serum Total Cholesterol (TC) was determined by enzymatic (CHOD-PAP) colorimetric method as described by McGowan et al. [6]. The enzymatic method as described by Tietz NW [7] was adopted in the estimation of TG. The estimation of HDL was performed using the method described by Burstein et al. [8], while the method of Assman et al. [9] was adopted in the determination of LDL was estimated using the method described by Friedwald et al. [10].

Blood Sample Collection

After overnight fasting of about 10 h to 12 h, about 5 ml of blood was collected aseptically by vein puncture from all the subjects between 8 am to 10 am. The samples were allowed to coagulate and centrifuged to obtain the serum which was stored at -20°C.

Calculation of exercise intensity

Martti Karvonen formula to calculate heart rate zone was used. At first, calculate resting Heart Rate (rest-HR) for each participant by asking her to lie in a supine position in a noiseless room to avoid any distractions for 10 min while wearing a heart rate monitor. Then the maximum Heart Rate (max-HR) was calculated using the formula: Maximum heart rate = 220 - age [11]. After that the Heart Rate Reserve (HRR) will be calculated using the formula: HRR = max-HR - rest-HR. Finally, the target Heart Rate (target-HR) was calculated using the formula: Target-HR = HRR × intensity% + rest-HR. The used intensity in this study was 60% (moderate intensity) so the used formula was target-HR = HRR × 60% + rest-HR [12].

The subject started to walk on the treadmill at speed of 2 km/h zero inclination under supervision of the researcher then the speed increased gradually until she reached the target heart rate which was calculated before the exercise session. The heart rate was monitored to maintain the target heart rate while the subject walking for 30 min. The subjects received a program of treadmill training three sessions/ week for eight weeks. Before starting each session, the target heart rate was calculated to determine the target-HR for this session.

Table 2: Correlation between cholesterol and triglyceride, HDL, and LDL after exercise.

	Cholesterol and triglyceride after exercise	Cholesterol and HDL after exercise	Cholesterol and LDL after exercise
Pearson Correlation	0.409**	0.476**	0.688**
Significance (2-tailed)	0.003	0.001	0.001
N	50	50	50

Data analysis

The obtained data were analyzed by using the Statistical Package for Social Science (SPSS version 22.0). MANOVA was used and the results were statistically significant if P value <0.05 and highly significant if P value <0.001.

Results

The results of our study showed that moderate aerobic exercise using treadmill training significantly improves the lipid profile. MANOVA test was highly significant (0.000) at an F value of 112.55. Cholesterol (mg/dl) Triglycerides (mg/dl) and LDL (mg/dl) were significantly reduced while HDL (mg/dl) was significantly increased after the exercise program. Table 1 shows, the mean and standard deviation for the study variables in addition to pair-wise comparisons.

Pearson correlation showed moderate correlation between cholesterol and triglyceride after exercise program. This moderate correlation also found between cholesterol and HDL after the exercise program while the correlation between cholesterol and LDL was strong. This is indicated by Table 2 and Figures 1-3.

Discussion

Dyslipidemia is an important risk factor for the development of atherosclerosis, ischemic heart disease, and stroke [13,14]. Regular physical activity has a number of positive effects on the blood lipids profile [15].

The short term regular aerobic exercise causes a statistically significant decrease in the mean values of LDL (Table 1). This is in agreement with the work done by Ikekpeazu et al. [16]. Aristomenis et al. [17] who showed a significant decrease in LDL in subjects involved in regular exercise.

Also, this study showed that there was a statistically significant difference in the mean serum level of TC, TG, and HDL of regularly exercised students. This is in agreement with the work done by Sondergaard et al. [18]. Which shows a significant decrease in TG. This may be due to the fact that the decrease in LDL levels could be attributed to the increases in the activity of hepatic triglyceride lipase enzyme during short term physical exercise [19].

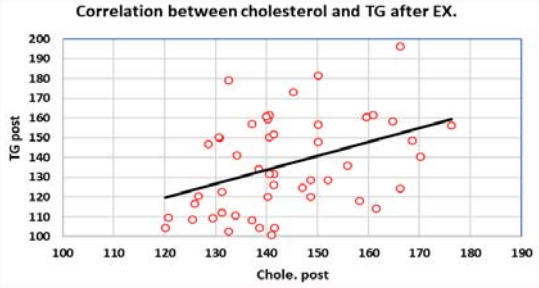

Figure 1: Correlation between cholesterol and triglyceride after exercise.

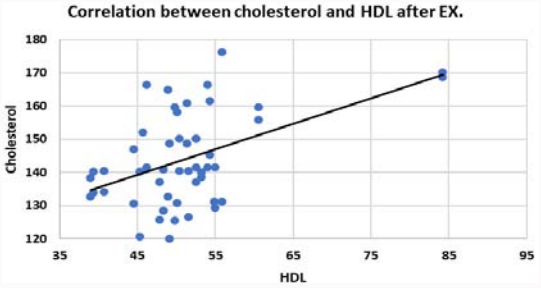

Figure 2: Correlation between cholesterol and HDL after exercise.

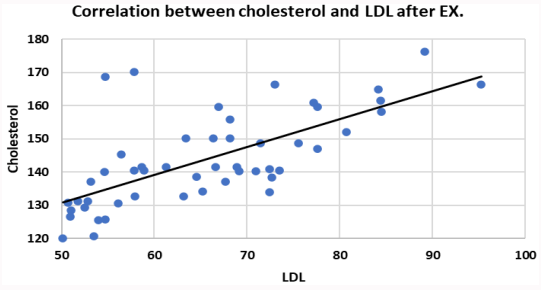

Figure 3: Correlation between cholesterol and LDL after exercise.

Frequent and regular aerobic exercise has been shown to prevent chronic heart diseases as our study revealed that there was a significant decrease ($p<0.05$) in serum level of Low-Density Lipoprotein-Cholesterol (LDL–C), in females practice regular aerobic exercise for 8 weeks, and there was a significant difference in serum level of Total Cholesterol (TC), Triglyceride (TG) and High-Density Lipoprotein (HDL) ($p<0.05$) when comparing pre and post exercises levels of lipid profiles, regular participants showed a significant decrease in TC, TG, and LDL. TC, TG, LDL, VLDL, significantly decrease while HDL-C significantly increases (Table 1 & 2) (Figures 1-3). Several mechanisms have been suggested to explain as exercise induces an acute increase in post heparin lipoprotein lipase which in turn leads to enhanced triglyceride clearance and decreases plasma clearance of high-density lipoprotein constituents. Lipoprotein lipase activity is the major enzyme involved in the catabolism of plasma triglyceride and has been found to be increased in the skeletal muscle and adipose tissue as well as in the plasma of people engaged in exercise [20]. It could be seen from this study that regular exercise has a beneficial effect on lipid profile and could reduce the incidence of coronary heart disease, obesity, and high blood pressure.

Conclusion

The short-term aerobic exercise improves HDL-C and decreases TG, TC, LDL, VLDL, SBP, and DBP which does not predispose one to the risk of Coronary Heart Disease (CHD).

Ethical Concerns

Ethical approval for this study was obtained from the Ethics Review Committee of the College of Applied Medical Sciences at Al-Taif University. Moreover, all students included in the study were informed of the study objectives and each one of them signed written consent. Each of them had the right to withdraw from the study at any time she wants.

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