The effect of 6-weeks aerobic training on serum levels of lipoprotein changes in non-athlete females

Masoumeh Azizi
Department of Sport Science
Islamic Azad University, Abadan Branch, Abadan, Iran.

Research Article

Corresponding Author:

Masoumeh Azizi
Department of Sport Science, Islamic Azad University, Abadan Branch, Abadan, Iran.
Telephone: 0098-631 44 60 113-4
Fax: +98-631 44 60 110
Email: science.sport@yahoo.com

Abstract

Objectives: Having serum levels of high cholesterol can cause life-threatening disease specially cardiovascular problems. However, it is believed aerobic training can reduce the risk of cardiovascular disease, but this effect varies considerably among exercise intervention studies. Therefore, the present study was designed to evaluate the effects of aerobic training on serum levels such as cholesterol, high density lipoprotein, Low density lipoprotein, triglycerides and anthropometric parameters of inactive women.

Methods: This study was performed as an experimental study, in which 20 healthy non-athlete females(age 27.50 ± 4.11 yr, height 163.55 ± 4.22 cm, body weight 62.81 ± 4.66 kg) randomly divided in two groups(Control group, n=10 and Experimental group, n=10). Blood samples were taken 48 h before starting the aerobic training program. Then, experimental group performed a selected aerobic training program with 65-85% of individual maximum heart rate for 3 session per week, 60 minutes per session and 6 consecutive weeks. Then another blood sample was taken following the training period. Serum levels of lipoproteins of all subjects before and after the training period were measured using standard biochemical methods. Differences between post test and pre test were evaluated using a Student's t-test for paired samples. A P-value < 0.05 was considered to be statistically significant.

Results: Our results showed that the aerobic training caused significant changes(p<0.05) in HDL-cholesterol(pre-test:38.53±1.34 *vs* post-test:42.65±1.6, p=0.000), LDL-cholesterol(pre-test:134.61±4.82 *vs* post-test:127.72±4.82, p=0.001), VLDL-cholesterol(pre-test:131.98±1.93 *vs* post-test:127.53±1.43, p=0.000), TG(pre-test:117.05±3.21 *vs* post-test:92.37±7.61, p=0.001) and TC(pre-test:195.98±4.30 *vs* post-test:186.49±4.48, p=0.000) in experimental group but not in control group.

Conclusions: The result of the present study revealed that regular aerobic training can lead to reduce cardiovascular risk factors with changing in the lipid profiles.

Keywords: Heart risk factors, Aerobic fitness, Serum lipids, Inactive females

Introduction

The association of high serum cholesterol levels with the incidence and severity of coronary heart disease (CHD) is so pronounced in epidemiological studies that the National Heart, Lung, and Blood Institute recognizes this association as causal (11).

Recent studies have shown that a 1% reduction in a person's total serum cholesterol level caused a 2 to 3% reduction in the risk of coronary heart disease(CHD) (14) . Aerobic exercise programs such as walking, jogging, and aerobics have been encouraged as a means to decline total cholesterol, low-density lipoprotein cholesterol (LDL-C), and triglycerides while elevating the "good" high-density lipoprotein cholesterol (HDL-C).

The primary transport is LDL-c that carrier of cholesterol in the circulation. About 50-60% of cholesterol is delivered to the cells by LDL-c. Evidence suggests that LDL-c may directly contribute to the cellular alterations of the inner walls of arteries which may ultimately lead to the development of atherosclerotic plaque (17). Thus, LDL-C is proposed to be more highly associated with CHD than total cholesterol (14). On the other hand, HDL-c has an inverse relationship with coronary heart disease, offering a protecting mechanism against the development of CHD (7).

HDL-C is considered to be the most powerful lipid parameter for predicting CHD in people of all ages (6).The primary function of HDL-C is to transport cholesterol from the tissues and blood to the liver for excretion from the body or synthesis into bile acids. HDL-C also prevents the uptake of LDL-C at receptor sites in the body and participates in the metabolism of other lipoproteins. Several long-term, or longitudinal, studies have been conducted with healthy individuals to measure the effect of increased physical activity on serum lipoprotein concentrations. The most recent studies revealed Moderate to high intensity aerobic training results in an improvement in the blood lipid profile(15). But, results of aerobic exercise studies vary considerably, depending on the exercise program (eg, duration, intensity, or frequency) and characteristics of subjects at baseline(2).

This paper will attempt to clarify the association between physical activity and blood lipoproteins. The main objective of the present study was to assess the efficacy of aerobic training in improving blood lipid profile (such as high density lipoprotein (HDL), cholesterol and triglycerides) in inactive women. The hypothesis of the

study is weather aerobic exercise training with 65-85% of individual maximum heart rate improve lipid profiles of non-athlete women?

Methodlogy:

This study was performed as an experimental study, in which subjects were randomly selected. There were twenty inactive women, aged 22-33 years, recruited from GhaemShahr, Mazandaran(Iran). Only healthy subjects without any history of pathologic or orthopedic limitation were included in the study. No subject was currently engaged in any of the other exercise programs. They were familiarized with the training program and were informed about the possible risks and benefits involved with the study both verbally and in writing before obtaining written informed consent.

Subjects

The study protocol was approved by the Islamic Azad University Abadan Branch(Iran). Subjects were grouped into control (n=10) and aerobic training (n=10).

Methods

48 h before starting the aerobic training program Weight, Height and Blood samples were taken from all the subjects using proper devices/methods: weight by scale, height by measuring-tape and Blood sample was drawn from the ante cubital vein. Then, experimental group performed the aerobic training program included running with 65-85% of individual maximum heart rate on treadmill for 3 session per week, 45 minutes per session for 6 consecutive weeks. Then another Weight and Blood sample was taken in the end of the training period. Lipid profiles of all subjects were measured using standard biochemical methods from all the subjects in both groups again.

Statistical analysis

All values are reported as Means ±SE. Differences between exercise-induced changes in Lipid profiles included HDL-cholesterol, LDL-cholesterol, VLDL-cholesterol, TG and TC before and after exercise protocol were evaluated using a Student's t-test for paired samples. A P-value < 0.05 was considered to be statistically significant.

Results

Mean ± standard deviation(SD) of variables including HDL-cholesterol, LDL-cholesterol, VLDL-cholesterol, TG and TC levels for each subject of control group (Post-test and Pre-test) are shown in table.1.and for each subject of experimental group (Post-test and Pre-test) in table.2. shows the comparison of measurements between two groups after 6 weeks training.

The pre to post training results of paired t-test for Lipid profiles (according table.2) showed a statistically significant difference in aerobic training group after six weeks(p<0.05) in which HDL-c [pre-exercise:38.53±1.34 mean ±SD, post-exercise: 42.65±1.60, t= -7.476 *p=0.000*]

Table.1. *Control Groups' Pre- and Post-Experiment Measurements, HDL-cholesterol, LDL-cholesterol, VLDL-cholesterol, TG and TC levels*

Control Group	Pre-Test Mean ±SD	Post-Test Mean ±SD	P Value
HDL-c(mg/dL)	39.06±1.06	38.75±1.79	0.492
LDL-c(mg/dL)	134.95±1.05	133.02±3.74	0.161
VLDL-c(mg/dL)	131.54±1.35	131.07±2.70	0.699
TC(mg/dL)	199.98±6.41	202.68±5.88	0.126
TG(mg/dL)	117.39±5.50	116.85±5.12	0.495

in comparison with control group [pre-exercise: 39.06±1.06, post-exercise: 38.75±1.79, t=0.717, *P*=0.492], LDL-c [pre-exercise: 134±4.82 mean ±SD, post-exercise: 127.72±1.43, t= 4.869,*p=0.001*] in comparison with control group [pre-exercise: 134.95±1.05, post-exercise: 133.02±3.74, t=1.526, *P*=0.161],VLDL-c[pre-exercise: 131.98±1.93 mean ±SD, post-exercise: 127.53±1.00, t=5.671,*p=0.000*] in comparison with control group [pre-exercise: 131.54±1.35, post-exercise: 131.07±2.70, t=1.526, *P*=0.699], TC [pre-exercise:195.98±4.30 mean ±SD, post-exercise: 186.49±4.48, t=7.995, *p=0.000*] in comparison with control group [pre-exercise: 199.98±6.41, post-exercise: 202.68±5.88, t= -1.686, *P*=0.126] and TG [pre-exercise: 117.05±3.21 mean ±SD, post-exercise: 92.37±7.61, t=9.023, *p=0.000*] in comparison with control group [pre-exercise: 117.39±5.50, post-exercise: 116.85±5.12, t= 0.711, *P*=0.495] .

Table.2. *Experimental Groups' Pre- and Post-Experiment Measurements, HDL-cholesterol, LDL-cholesterol, VLDL-cholesterol, TG and TC levels*

Experimental Group	Pre-Test Mean ±SD	Post-Test Mean ±SD	P Value
HDL-c(mg/dL)	38.53±1.34	42.65±1.60	0.000*
LDL-c(mg/dL)	134±4.82	127.72±1.43	0.001*
VLDL-c(mg/dL)	131.98±1.93	127.53±1.00	0.000*
TC(mg/dL)	195.98±4.30	186.49±4.48	0.000*
TG(mg/dL)	117.05±3.21	92.37±7.61	0.000*

*Note: *Significant improvement, p < 0.05.*

Discussion

This study evaluated the effects of aerobic exercise on serum levels of lipoproteins such as HDL-c, LDL-c, VLDL-c, TC and TG in inactive females. In the present study, aerobic exercise resulted in reduction in cholesterol and low and very low density lipid concentrations(LDL-c and VLDL-c) and improvement in high density lipid concentrations (HDL) levels. Several studies have confirmed the results of the present study(2).

In the present study HDL-c concentration of aerobic group increased that most of researches agreement with this statement. The concentration of HDL is inversely related with the risk of coronary heart disease. Low intensity aerobic training may improve the profile of HDL-C and its sub fractions in healthy subjects(19). Although the mechanism of more HDL-c proceeding has not yet clearly

identified but it is accepted exercise training may enhance the production of the enzymes that facilitate HDL transportation of cholesterol back into the liver to be broken down and ultimately reduce the incidence of heart disease.

The results of this study showed that six weeks of aerobic exercise reduced LDL-c and VLDL-c of experimental group. However, several researchers, Sunami et al(1999) and Leon et al(2002), reported these finding(13,19), others did not show significant change in LDL-c and VLDL-c following aerobic training(3). The conflicting results between studies could be attributed to differences in the amount of intensity and duration of aerobic training program and also subject's gender and ability.

In the present study, TG concentration also showed a statistically significant reduction in aerobic training group. More research confirm aerobic training reduces triglyceride concentration(8,12,16,19). They state the greater utilization of free fatty acid in the trained state is fueled by increased lipolysis of muscle triglyceride and the

findings of the present study support the aforementioned statement. Indeed the relationship between lipoprotein lipase and triglycerides can be affected by appropriate amount of exercise. The more activity of lipoprotein lipase lead to increase of protein dissimilation and enhances the plasma triglycerides levels. That might be a reasonable explanation why triglycerides reduction following aerobic training. However, several researcher have not reported this result(9,13,19, 3).

In the present study, total cholesterol(TC) concentration also observed a statistically significant reduction in aerobic training group. This finding reported by Leon et al(2002), Dimitriou et. al (2007) but Kim and Lee(2006), Crouse et al(1997) and Damirchi et al(2008) do not confirm these results that might be due to the duration of study, the kind of training and also the subject's gender and ability. Plasma values of TC is a major factor for heart disease and epidemiological research has decisively demonstrated that low concentrations of total cholesterol and low-density lipoprotein cholesterol (LDL-C) and high levels of high-density lipoprotein cholesterol (HDL-C) are associated with decreased coronary heart disease(10).

Conclusion

The results of the present study indicate that aerobic training is beneficial in improving serum levels of lipoproteins and can be used as a preventive measure in patients who are at risk of developing cardiovascular diseases due to obesity. However, more research is needed to be done in future, to determine the effect of aerobic training on serum levels of lipoproteins in inactive females.
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Acknowledgement

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AUTHORS' CONTRIBUTIONS
Authors contributed equally to all aspects of the study.

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CONFLICTS OF INTEREST
The authors declare that they have no competing interests