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*Review Article*

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# Impact of Aerobic Exercise on Lipid Profile and Cardiovascular Health in University Graduates

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**ABSTRACT**

Dyslipidemia and a sedentary lifestyle are well-known risk factors for cardiovascular illnesses (CVD). Exercise-induced modifications to the blood lipid profile (total cholesterol (TC), triglycerides, high-density lipoprotein (HDL), and low-density lipoprotein (LDL)) may help to reduce CVD-related events. In this study, we tried to see how aerobic exercise affected various lipid profile parameters in students of various ages and health statuses. All trials including males and females' students, however, showed effective improvement. Healthy people, overweight people, those with obesity, and male participants were shown to have benefited more from the activity, regardless of their health status or gender. A non-significant improvement in lipid profiles was seen in individuals with low physical activity. In the case of cardiovascular health, jogging demonstrated to be more effective than exercise alone. Exercise is helpful in terms of lowering cholesterol levels, but younger people, people with higher cholesterol, and CVD patients require additional preparations made under the guidance of professionals in the fields of sports medicine. Serum Cholesterol improved from 105 mm/dl to166 mm/dl, Serum Triglycerides 124 mm/dl to 90 mm/dl, HDL Cholesterol 37 mm/dl to 44 mm/dl, and LDL Cholesterol 140 mm/dl to 104 mm/dl with positive improvements. Additional research is required for these populations with heart patients, hypercholesterolemia in order to further elaborate the outcomes of this study.

**Keywords:** Aerobic Exercise, CVD, Cholesterol, HDL

## Introduction

Aerobic exercise is an engaging and non-competitive movement, which has turned out to be extremely well known lately. Investments in aerobics exercise add the change of cardio-respiratory stamina and anticipation of cardio-vascular sicknesses in individuals of any age. Change in mood is an essential favorable position gotten from aerobics without requiring a long investment. In any case aerobic exercises support to enhance physical wellness, self-perception, fulfillment, self-viability and reduction the feeling of anxiety. Physical activities and exercise influence perspective and strain and an exceptional number of studies depict a relationship of physical activity and general flourishing, attitude and nervousness. Exercise is frequently the initial phase in way of life alterations for the avoidance and administration of endless diseases. Individuals who work out frequently show slower rates of age-related memory and subjective decrease in examination to the individuals who are more stationary [1,2].

The benefits of aerobic exercise in reversing and preventing CV disease have been demonstrated in several researches. They used adult female Sprague-Dawley rats for their investigation, and they divided the animals into groups according to whether they had been subjected to induced myocardial infarctions (MI) with exercise or not as well as controls. According to their findings, aerobic exercise reduced left ventricular (LV) enlargement by 15% and myocyte length and breadth by 12% and 20%, respectively, post-infarction. Furthermore, in MI patients allocated to the training group, myocardial contractility showed a 60% improvement, indicating increased myocardial Ca2+

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sensitivity. According to this study they were able to draw the conclusion that aerobic exercise had positive effects on cardiac remodeling and myocardial contractility [3].

Five years later, released another research that included people with post-MI heart failure and verified the effects of aerobic exercise in human participants. Aerobic interval training (AIT), moderate continuous training (MCT), or a control group was offered to the participants. Peak VO2 increased by 46% in the AIT group, while the maximum rate of Ca2+ absorption in the sarcoplasmic reticulum of the skeletal muscles increased by 60%. Additionally, LV diameters decreased and LV volumes rose in both the diastolic and systolic phases, demonstrating cardiac remodeling similar to that shown in the rat individuals of the prior study. Furthermore, it was shown that the AIT group's systolic function had increased by 35% increasing the benefits of aerobic exercise even further [4].

According to the World Health Organization, cardiovascular disease (CVD) is to blame for 30% of all fatalities that have been officially reported and causes 17 million deaths worldwide each year. Furthermore, CVD is known to cause significant morbidity and death in both men and women. This is why the American Heart Association and European Atherosclerosis Society specifically targeted women when making their most recent guidelines. Furthermore, despite the prevalence of hypercholesterolemia in girls being comparable to that in males, hyperlipidemia is mostly untreated in the female population, according to literature statistics. More active intervention is advised in populations with numerous risk factors and/or monogenic dyslipidemias, such as lipoprotein apheresis in the case of familial hypercholesterolemia in the homozygous and compound types.

This is why the American Heart Association and European Atherosclerosis Society specifically targeted women when making their most recent guidelines. Furthermore, despite the prevalence of hypercholesterolemia in girls being comparable to that in males, hyperlipidemia is mostly untreated in the female population, according to literature statistics. The most prevalent non-communicable epidemic in China and the rest of the globe is CVD. Nearly 20% of the population has some form of cardiovascular disease, and China has 290 million cardiovascular patients. In India as well as the rest of the world, cardiovascular diseases (CVDs) are the main cause of mortality. Over the past few decades, numerous nationwide studies have revealed an increasing incidence of key CVD risk factors in the Asian Indian community. CVDs are mostly made up of coronary heart disease (CHD), heart failure, cardiac arrest, ventricular arrhythmias, sudden cardiac death, rheumatic heart disease, transient ischemic attack (TIA), ischemic stroke, and subarachnoid hemorrhage [5-8].

## Materials and Method

All the volunteers were taken from Govt. College University Faisalabad. The volunteer's age was ranged from 18 to 25 years. Human trial, 40 subjects; ten in each groups were distributed randomly. In this trial, aerobic exercise was performed. The analysis was performed from Lahore Allied Lab Pindi Bhattian using commercial kits.

### Demographic Information

Participants of this study both sexes males and females were from Department of Nutritional Science Government College University Faisalabad. Students were mostly from Faisalabad city and others were different cities of Punjab.

### Bio-Evaluation

In bio-evaluation trial (40 days), Four groups were studied. At termination, the blood samples from subjects were with-drawn followed by centrifugation using rotator machine to collect sera.

### Blood Sampling

For biochemical assessment the blood samples were drawn through the vein typically from inside of elbow or back of hand. The SOPs for drawing blood samples are given below:

1. The skin was cleaned with antiseptic swab.
2. The elastic band or tourniquet was placed around the upper arm to make the vein swell with blood.
3. The needle was inserted in the vein and the elastic band or tourniquet was removed and the blood sample was drawn in one or more vials.
4. 3.2% sodium citrate as anticoagulant was added in each blood sample.
5. The sampled area was covered antiseptic bandage to stop bleeding.
6. The sample was labeled for necessary documentation and record keeping the lab.
7. The vials containing samples were stored at 4-25°C (39-77°F) till used for laboratory analysis.

To assess the subjects for biochemical status following routine analysis were employed.

The parameters studied were; cholesterol, LDL, HDL, triglycerides levels. The elimination of HDL from circulation is the effect of several mechanisms.

**Table 1: Groups on the Basis of Exercise Duration**

| No of Volunteers | Group 1 | Group 2 | Group 3 | Group 4 |
|---|---|---|---|---|
| | 15 (minutes) | 25 (minutes) | 35 (minutes) | 45 (minutes) |
| 40 | Aerobic exercise | Aerobic exercise | Aerobic exercise | Aerobic exercise |

Recommendations for cholesterol testing come from the Adult Treatment Panel (ATP) III guidelines, and are based on many large clinical studies, such as the Framingham Heart Study [9] The following parameters were analyzed;

### Body Weight

Each subject of the study was assessed for the weight gain on weekly interval [10].

### Lipid Profile

Changes in the lipid levels were measured to find the effect of respective treatments [11].

### Cholesterol

Procedure of was followed to find cholesterol levels [11].

**Low- & High-Density Lipoproteins**
LDL were assessed by procedure of while, HDL of serum was determined by HDL-precipitant method as described by [11].

**Triglycerides**
Samples were tested to find triglycerides following the method of [11].

**Metabolic Pathway**
Lipids and TG are transported by serum chylomicrons between the liver, gut, and extrahepatic tissue. These actions are performed through two different paths. An increased cholesterol profile and increased risk of CVD occur when these systems are genetically or environmentally disturbed. The stages in the LDL receptor mechanism lead to the transport of cholesterol to extrahepatic tissue. The transportation of lipoprotein from hepatocellular tissue to the liver is known as inverse lipid transport.

This test is performed on Biochemistry analyzer Mindray BA-88A from Shenzhen Mindray Bio-Medical Electronics Co. Ltd. China.

**Analysis Technique**
The blood is collected in a vial. Upon collection of your blood sample, it will be analysed in the laboratory, where the level of triglycerides, HDL cholesterol and LDL cholesterol are measured. The procedure lasts only for a few minutes. There are no risks associated with lipid profile test.

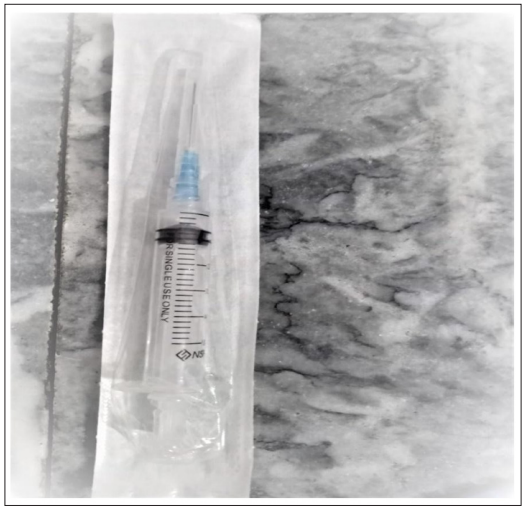

**Figure 1.1:** For Withdrawing Blood Samples from Veins

The BA-88A is a semi-automatic chemistry analyzer with large touch-screen and easy-to-use operation software. The Clinical Biochemistry Analyzer is an instrument that uses the pale-yellow supernatant portion (serum) of centrifuged blood sample or a urine sample, and induces reactions using reagents to measure various components, such as sugar, cholesterol, protein, enzyme, etc.

**Statistical Analysis**
- The study data were collected all the data were subjected to Paired T test
- All the data were measured for analytical means and standard error
- Analysis were carried out by using SPSS software

The results obtained for each parameter were analyzed statistically to draw a conclusion.


**Figure 1.2:** K3EDTA was Used to Obtain Whole Blood Plasma


**Figure 1.3:** For Disinfection Purpose Lifeline Health Care Made Alcohol Pads Were Used

**Result and Discussion**
The figure 3.1 showed that all four groups give significant results at ($p<0.05$) for total cholesterol level in serum against respective time intervals of 15min, 25 min, 35 min, 45 min cardiac workout. Group 1, 2 and 4 give highly significant results at $p<0.01$. the group 4 with 45 min exercise gave the best results by lowering maximum level of total cholesterol as compared to baseline data without any exercise. The graph for total cholesterol level before and after workout showed the direct relation of decreasing serum cholesterol with increased exercise interval. The same findings were drawn from other studies, which showed that various types of physical activity were useful in enhancing blood cholesterol components (LDL, VLDL, HDL, Triglycerides).

However, more research is required to determine the most effective course of action for young people who are obese,

overweight, or have chronic kidney disease. Cardiovascular patients and those at higher risk of developing CVD found that cardiac rehabilitation, particularly comprehensive cardiac restoration, was more helpful than exercise. The results mentioned above are in line with the findings of who found that cardio /aerobic activity result in increasing HDL and lowering the bad cholesterol i.e LDL, furthermore it was observed that the physical activity also improved the fatty acid metabolism. Long-term aerobic exercise improved lipid profiles, decreased insulin sensitivity, and raised risk of type 2 diabetes in obese individuals, according to, Additionally, utilized a walking fitness routine for 15 Patients with Hiv infection and discovered that cardio activity lower body fats and enhanced insulin sensitivity. Active muscle contraction causes membrane depolarization, which increases cytoplasmic calcium concentration and activates 5′-adenosine monophosphate-activated protein kinase, which results in the translocation of glucose transporter protein-4 (GLUT-4) to the plasma membrane. This is one possible mechanism by which exercise can improve insulin sensitivity [12-15].

Additionally, the altered expression of several lipogenic and glycolytic enzymes in the liver brought on by activity of 5′-Adenosine physiologically protein kinase has beneficial impacts on lipid metabolism (Rutter et al., 2003). Numerous other research has shown that aerobic activity affects blood lipid levels, which are similar to our findings. Adults' HDL-c levels considerably increased after 8 weeks of aerobic exercise training, according to conceptual analysis [16].

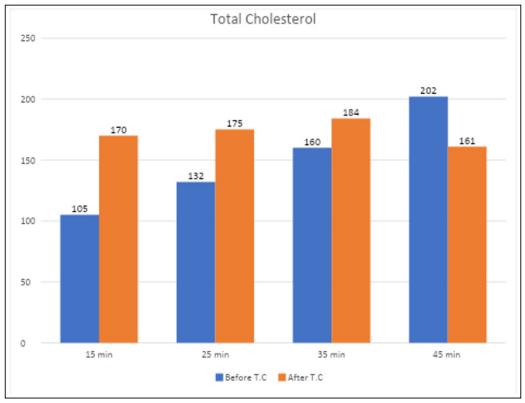


**Figure 2.1:** Mean and Standard deviation of Total cholesterol

Data was analyzed by using paired T-Test through SPSS software.

$G_{15}$: 15min exercise, $G_{25}$: 25 min exercise, $G_{35}$: 35 min exercise, $G_{45}$: 45 min exercise

The figure 3.2. showed that all four groups give significant results ($p<0.05$) for total triglycerides level in blood against respective time interval of 15 min, 25 min, 35 min, and 45 min cardiac workout. The group 1,2 and 4 gave a significant result in which group 4 showed the best results by lowering the total triglyceride level in blood after 45 min cardio workout as compared to baseline readings in which subjects have zero workout routine. The graph showed the inverse relation with total triglyceride which might be decreased by increasing exercise time interval. Similar findings were made in a different research that claimed that following aerobic exercise, cholesterol profiles significantly improved in all studies of aged and mid- persons. Students who participated, those with type 2 diabetes and obesity, those in excellent condition, and those who were overweight all benefited more from the activity [12].

A system demonstrating the essential function of the livcr in preserving serum low-density lipoprotein cholesterol (LDL-C) levels and net cholesterol control both in both humans and animals. The straight lines are intended to illustrate in a statistically valid way the levels of lipoprotein production in the three tissue categories, the rate of gastrointestinal lipid uptake, the flow of this cholesterol to the liver, and the exit of this cholesterol from the body through the feces. The rate of conversion of very low-density lipoprotein-cholesterol (eVLDL-C) to LDL-C and the subsequent disposal of this atom from the plasma via the action of LDL receptors, which are primarily found in the liver, also significantly influence the fairly constant saturation of lipid performed by LDL [17].

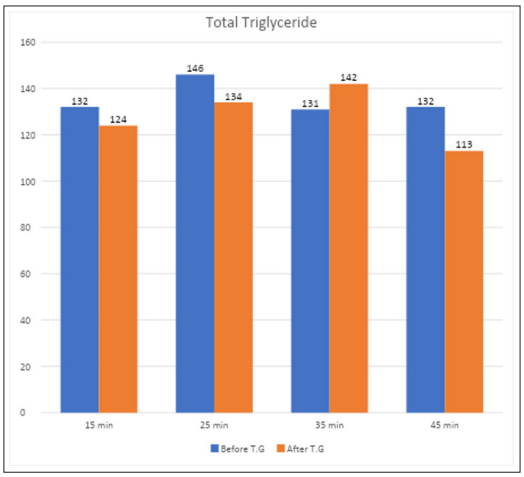


**Figure 2.2:** Mean ± Standard Deviation of Total triglycerides

Data was analyzed by using paired T-Test through SPSS software.

$G_{15}$: 15min exercise, $G_{25}$: 25 min exercise, $G_{35}$: 35 min exercise, $G_{45}$: 45 min exercise

The figure 3.3 showed that all four groups give significant results at ($p<0.05$) for total HDL level in serum against respective time intervals of 15min, 25 min, 35 min, 45 min cardiac workout. Group 1, 2 and 3 give highly significant results at $p<0.01$. The group 3 with 35 min exercise gave the best results by increasing maximum level of total HDL as compared to baseline data without any exercise. The graph for HDL level before and after workout showed the direct relation of increasing serum HDL level with increased exercise interval. Same results were obtained from other studies in which Doewes et al, claimed to, several forms of physical exercise have been successful in improving the components of lipid profiles; however, additional research is needed to determine the most beneficial approach for young people who are obese, overweight, or who have chronic renal disease. Cardio patients and those at higher risk of developing CVD found that cardiac rehabilitation, work perfectly cardiac restoration, was more helpful than activity [12].

In our study the changes in High density lipoproteins are good. Those who were below the optimum range after aerobic activity showed in between optimum range. Even though the mechanisms but behind exercise's impact on the plasma lipids are yet unknown, it appears that exercise increases the ability of skeletal muscles to use lipids rather than glycogen, resulting in a decrease in plasma lipid levels. The processes may also include raises in fatty acid enzyme production and emulsifier acyltrans (LCAT), the lipase that transfers ester to High - density lipoprotein and has been demonstrated to significantly boost after aerobic training, even though the data in this case are inconsistent and may depend on the energy expenditure that is provoked. Ferguson et al said that Increases in HDL cholesterol and large increases in lipoprotein lipase activity need 1,100 kcal of energy expenditure. Reverse cholesterol transport is the term for the method of removing cholesterol. As a result of increases in LCAT and decreases in cholesterol ester transfer protein (CETP), the enzyme that transfers HDL cholesterol to other lipoproteins after both acute and long-term exercise, this mechanism removes cholesterol from circulation for disposal. The LDL receptor (LDL-R) appears to play a role in the blood's direct uptake of some of these residues, whereas the remaining amount is metabolized to LDL [18].

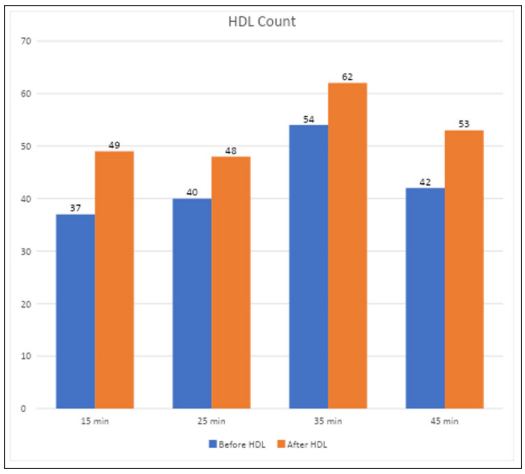


**Figure 2.3:** Mean ± Standard deviation of HDL

Data was analyzed by using paired T-Test through SPSS software.

$G_{15}$: 15min exercise, $G_{25}$: 25 min exercise, $G_{35}$: 35 min exercise, $G_{45}$: 45 min exercise

The figure 3.4. showed that all four groups give significant results ($p<0.05$) for low density lipoprotein in blood against respective time interval of 15 min, 25 min,35 min, and 45 min cardiac workout. The group 1,3 and 4 gave a significant result in which group 4 showed the best results by lowering the low-density lipoprotein level in blood after 45 min cardio workout as compared to baseline readings in which subjects have zero workout routine. The graph showed the inverse relation with low density lipoprotein which might be decreased by increasing exercise time interval. Same results were found in another study in which Doewes et al, stated that in all investigations of older and middle-aged people, considerable improvements were seen in lipid profile after physical activity. Healthy people, overweight people, those with type-2 diabetes and obesity, and male participants all benefited more from the exercise [12].

Although moderate exercising alone can also be used to reduce LDL levels therapeutically, its impacts should not be disregarded because staying active is linked to improves blood circulation, overall endurance, maximal aerobic capacity, body composition, physical activity, and muscle mass. LDL levels and the consequences of low- to moderate-intensity exercise. The analysis revealed that the included studies' findings on how workout affects blood LDL levels solely after low- and moderate-intensity exercise were inconsistent. With the exception of a few trials, low-intensity exercise did not significantly reduce LDL levels in the majority of individuals [19].

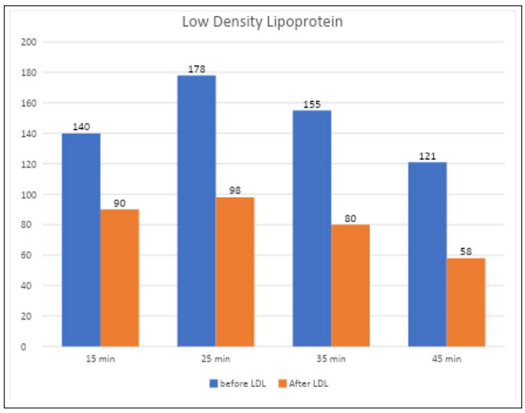


**Figure 2.4:** Mean ± Standard Deviation of Low-Density Lipoprotein LDL

Data was analyzed by using paired T-Test through SPSS software.

$G_{15}$: 15min exercise, $G_{25}$: 25 min exercise, $G_{35}$: 35 min exercise, $G_{45}$: 45 min exercise

The capacity of muscle fibers to oxidise fatty acids from plasma, VLDL cholesterol, or triglycerides is boosted by this increased enzymatic activity. Latest research supports the notion that the liver plays a similar role in the metabolism of LDL-C, as seen in table 3.1 as well. The liver produces the very low-density lipoprotein (VLDL) molecule to transport triacylglycerol from the hepatocyte to the peripheral organs of use (muscle) or storage (adipose tissue) A remnant is also created while this particle undergoes metabolism in the peripheral tissue [18].

Managing CVD risk factors with physical exercise may be a main preventative strategy. Training increased plasma High density lipoprotein levels and the ratio of High-density lipoprotein to Low density lipoprotein (High density lipoprotein), while decreasing plasma Low density lipoprotein and triglyceride (TG) concentrations. Cardiovascular endurance (AE) was shown to have a favorable impact on blood pressure, total cholesterol, and TG but not High-density lipoprotein. A meta-analysis that largely involved western patients and studies conducted before 2010 found that AE changed the levels of High-density lipoprotein, Low density lipoprotein, TC, and TG1, but had no effect on the level of TG. The effect of consistent AE on the serum lipid profile was examined in a meta-analysis of East Asian individuals in 2019 and shown improvement in all lipid components, including High density lipoprotein and TG [20].

**Table 2: Mean and Standard Deviation of Very Low-Density Lipoprotein**

| Groups | Parameter Very Low-Density Lipoprotein | | Group mean |
|---|---|---|---|
| | Baseline VLDL | End line VLDL | |
| $G_{15}$ | 181±1.52 | 42±2.00 | 139.3±0.57 |
| $G_{25}$ | 177±2.00 | 36±1.52 | 140±0.57 |
| $G_{35}$ | 114.3±2.51 | 25±2.00 | 89±4.5 |
| $G_{45}$ | 95±5.00 | 17.33±2.51 | 77±2.51 |

Data was analyzed by using paired T-Test through SPSS software.

$G_{15}$: 15min exercise, $G_{25}$: 25 min exercise, $G_{35}$: 35 min exercise, $G_{45}$: 45 min exercise.

In graphs and tables, I discussed how each lipoprotein responded to the aerobic exercise and showed positive improvements.

**Conclusion and Recommendation**

This study concluded that aerobic exercise has significant impact on lipid profile as the bad lipids effects the vessels health especially coronary and in this way moderate aerobic exercise improves the heart health. All the lipoproteins effect the heart health if these should have maintained in optimum range then a person enjoy good health socially, physically, emotionally and mentally. A moderate aerobic exercise is good for health on daily basis 30 to 45 minutes or 2 hours on weekly basis. Especially the morning brisk walk and jogging also good for health [21].

As in morning and evening aerobic exercise improve the heart health also improve brain health reduce your stress levels. Moreover, result shows that the people with low BMI have greater effects of aerobic exercise with 15 Minutes of activity.

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