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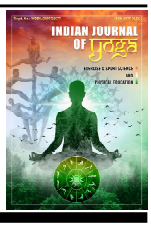

Experiment

# Effect of Regular Exercise on Low-Density Lipoprotein Level

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ABSTRACT

Low-density lipoprotein (LDL) is called bad cholesterol. High LDL level leads to a build-up of cholesterol in arteries, which may elicit heart disease. Therefore, it is necessary to keep under controlled LDL levels for the safety of life. The researchers in this study investigate whether exercise may lead to decreasing the LDL level. A total of sixty undergraduate willing female students, with a mean age (of 22+1 years), were conveniently selected from two populations and divided into two groups: the exercise group (n=30) and the wait-for-list control group (n=30). A total of four hours per day and six days per week of exercise and games were practiced for twelve weeks by the exercise group. The Hitachi 704 analyzer conducted a lipid profile test during pre and post-intervention. The level of LDL was decreased by 32.48% after twelve weeks in the exercise group. It can be explained that the physiological process of fat loss occurs when fats are liberated from adipocytes and other areas into circulation to supply the needed energy during exercise.

## INTRODUCTION:

The state of active operation is termed exercise, a fundamental aspect of overall health. Cholesterol, a fatty, waxy-like substance present in every cell in our body, is essential for hormone production, vitamin D synthesis, and aiding in digestion. While the human body naturally produces all the necessary cholesterols, it is also found in animal-based foods like egg yolks, meat, and cheese. Excessive cholesterol in the bloodstream can combine with other substances to form plaque, which adheres to artery walls, resulting in the build-up of plaque known as atherosclerosis. This condition can lead to coronary artery disease, narrowing or blocking the coronary arteries. LDL, HDL, and VLDL, classified as lipoproteins, are a combination of fat (lipid) and protein. LDL, or low-density lipoprotein, is sometimes referred to as "bad" cholesterol, as elevated LDL levels lead to plaque build-up in the arteries.

Cholesterol levels tend to increase with age, and although less common, younger individuals, including children and teenagers, can also experience high LDL levels due to modern lifestyles. High blood cholesterol may have a hereditary component and can be associated with being overweight or obese. Certain races may be at an increased risk of high cholesterol. In cases where large plaque deposits are present in the arteries, the rupture of an area of plaque can cause a blood clot on the plaque's surface. If the clot becomes sufficiently large, it can partially or entirely block blood flow in a coronary artery, leading to reduced or blocked oxygen-rich blood flow to the heart muscle, resulting in angina or a heart attack. Plaque can also accumulate in other arteries, including those supplying oxygen-rich blood to the brain and limbs, leading to conditions such as carotid artery disease, stroke, and peripheral arterial disease. Therefore, it is imperative to maintain cholesterol levels within standard limits.

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The researcher aims to investigate whether regular exercise could reduce LDL levels in this study. Xiong et al. (2021) asserted that aerobic exercises could significantly decrease low-density lipoprotein levels in patients with non-alcoholic fatty liver. Junga et al. (2021) demonstrated that aerobic exercise, resistance exercise, and combined exercise may reduce LDL by 46.2%, 54.4%, and 81%, respectively. Chris Kite et al. (2019) concluded that exercise and diet control effectively lowered LDL cholesterol. In contrast, Liang et al. (2021) reported no significant change in LDL levels with aerobic exercise in children and adolescents. Therefore, there is room for further research in this area.

**Methods:** In this study, thirty residential (n-30) Bachelor in Physical Education (BPEd) and non-residential(n-30) general Bachelor degree (B.A.) willing female students, mean age (22$\pm$1 years) were conveniently selected. Students from the BPEd group (most of them have non-regular exercise habits) and the B.A. student's waitlist control group (B.A.) were chosen for the exercise group. Exercise groups practiced as per their routine for two hours in the morning (from 6:30 AM to 8:30 AM) and two hours in the evening (from 3:30 PM to 5:30 PM) six days per week for twelve weeks. (Table:01)

**Table 1**
**Exercise and games Schedule:**

| **Morning** | | **Afternoon** | |
|---|---|---|---|
| **6:30 to 7:30 AM** | **7:30 to 8:30 AM** | **3:30 to 4:30 PM** | **4:30 to 5:30 PM** |
| Warm-up and conditioning exercises | Football/Basketball | Kho-Kho/Kabbadi | Volleyball/Handball |

The intensity of exercises and games was maintained at 60 to 80 % for safety and throughout the year of practice without any injury. The level of LDL is measured pre and post-intervention through a blood test using "Hitachi 704 Analyzer," which is serviced by Roche Diagnostics (formerly Boehringer- Mannheim Diagnostics), Indianapolis.

**Results:** In the pre-test result, it was found that the mean LDL in the experimental group was more than the control group, which may be due to the age factor, that is, the age of B.P.Ed. Students were more than B.A. students. In the experimental group, the pre-test mean was 78.20 mg./dl. Moreover, the post-test mean was 52.20 mg./dl. This implies that the LDL level decreased by 32.48% (0.05 level of significance). The pre-test mean of the wait list control group was 73.35 mg./dl. Moreover, the post-test mean was 77.48 mg./dl. This implies 0.0148% increase in LDL, and no significant change in the control group was found (Fig:01 and Table:02))

**Figure – 1: Mean LDL (mg/dl) of Pre and Post-intervention**

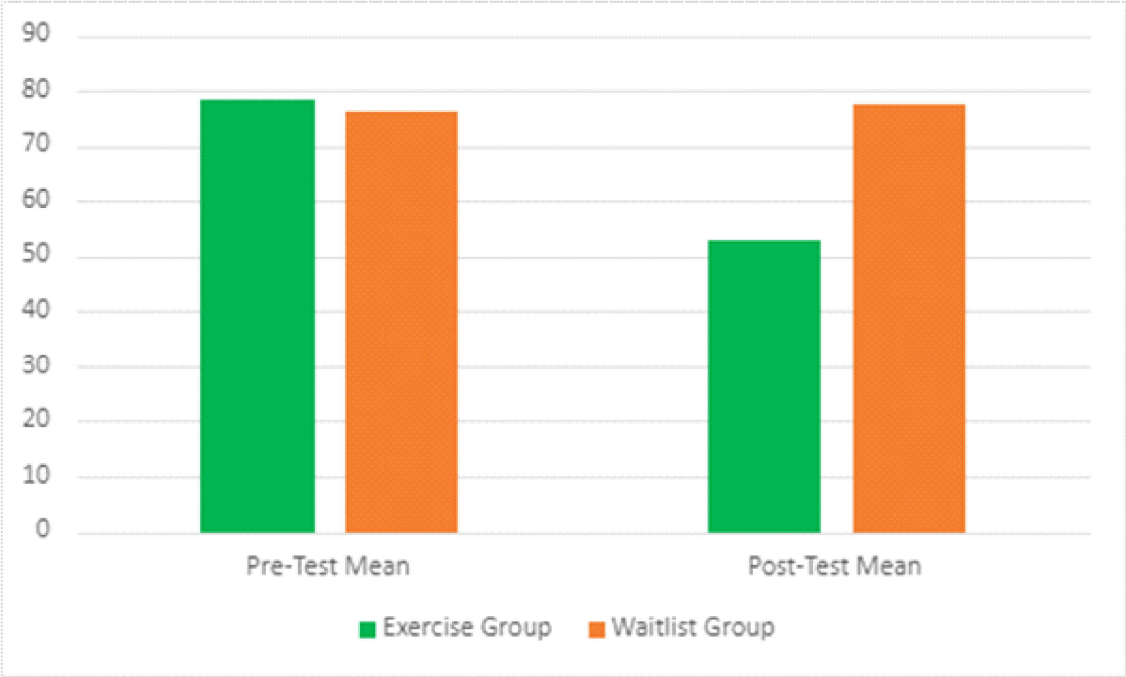


**Table no. – 2**
**Mean and S.D. of LDL of pre- and Post-intervention.**

| Group | Pre-test Mean and S.D. in mg./dl. | Post-test Mean and S.D. in mg./dl. | t-value and p-value |
|---|---|---|---|
| **Experimental Group** | 78.20 ± 16.90 | 52.80 ± 9.76 | t = 4.711404<br>p = 0.000333913 |
| **Waitlist Control Group** | 76.35 ± 15.88 | 77.48 ± 16.11 | t = 0.193500<br>p = 0.848000 |

Exercise that's repetitive and works multiple muscle groups is the best to reduce cholesterol. The American Heart Association recommends exercising for at least 30 minutes five to seven times weekly. In the present study, students practiced one-hour conditioning and three games, such as football, kabaddi, basketball, etc., for one hour, respectively. These are high-intensity exercises, games, and vigorous muscle movements that may be the main reason for decreased LDL levels. Exercise can reduce plasma LDL-C levels, and proteinase/ subtilisin/ kexin 9 (PCSK9) regulates LDL receptors. Therefore, the investigators have considered that exercise will likely affect LDL-C by modulating PCSK9. Kamani et al. (2015) found a significant decrease in mean PCSK9 levels and mean LDL-C levels in volunteers after three months of exercise and concluded that daily exercise is independently associated with a decrease in PCSK9 levels over time. High-intensity exercise for a long duration may significantly decrease LDL levels by decreasing proteinase/ subtilisin/ kexin 9, which makes more LDL absorbed and excreted by the liver.

**Conclusion**:
From this study, regular exercise could reduce blood LDL levels in adult female subjects.

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