

**THE EFFECT OF PHYSICAL EXERCISE ON TRIGLYCERIDES AND CHOLESTEROL
IN INDIVIDUALS WITH DOWN SYNDROME****Rihab Issa Al-Muzoghi*, Ibrahim Ali Azagha and Al-Bashir Mohamed Al-Bashir**

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ABSTRACT

This study aimed to investigate the effect of physical exercise on triglycerides and cholesterol levels in individuals with Down syndrome at the Suwani Bin Adam Disability Center in Tripoli. The sample included 17 individuals with Down syndrome, who were randomly divided into two groups (experimental and control). The experimental group engaged in physical exercise for 12 weeks, three times per week, for 30 minutes each session. Blood triglyceride and cholesterol levels were measured before and after the exercise program. Key results showed no statistically significant differences ($P > 0.05$) in triglyceride levels between pre- and post-tests, while significant differences ($P \leq 0.005$) were observed in cholesterol levels. The study recommends incorporating selected physical exercises into treatment and healthcare programs for individuals with Down syndrome to improve their overall health and reduce the risk of chronic diseases.

KEYWORDS: Down syndrome, physical exercise, triglycerides, cholesterol, obesity.**INTRODUCTION**

Down syndrome is a genetic condition that affects the development of the body and brain, leading to intellectual and physical disabilities. Individuals with Down syndrome are more prone to chronic diseases, particularly cardiovascular diseases, due to elevated levels of triglycerides and cholesterol in the blood. Triglycerides play a key role in supplying energy to the body and are a type of fat found in the blood. However, increased levels of triglycerides can raise the risk of chronic diseases. Cholesterol is another type of fat produced by the liver and transported to other tissues in the body, and elevated cholesterol levels can also increase the risk of cardiovascular diseases. One effective method for improving overall health and reducing chronic disease risk is regular physical exercise. Exercise enhances physical fitness, reduces triglyceride and cholesterol levels, and improves psychological well-being. However, individuals with Down syndrome are less likely to engage in regular exercise due to their physical and intellectual limitations. Some studies affirm the importance of exercise for people with Down syndrome and suggest that it can significantly improve health outcomes and reduce chronic disease risk. Hence, this research was conducted to investigate the effect of physical exercise on triglyceride and cholesterol levels in individuals with Down syndrome at the Suwani Bin Adam Center for Disability in Tripoli, Libya. This study was selected for several reasons: individuals with Down syndrome are at increased risk of cardiovascular diseases

due to high levels of triglycerides, cholesterol, and obesity. Furthermore, there is a shortage of research addressing the impact of physical exercise on these variables in this population.

Research Objectives and Hypotheses

To investigate the effect of physical exercise on triglyceride and cholesterol levels in the blood of individuals with Down syndrome, and to identify any significant differences in these variables between pre- and post-test measurements in the study samples.

Down Syndrome

Down syndrome (DS) is a genetic disorder caused by an error in cell division, resulting in a full or partial extra copy of chromosome 21, scientifically known as Trisomy 21. Children with Down syndrome are born with distinctive physical features, such as short stature and intellectual delay. These characteristics combine to cause brain and nervous system dysfunction, leading to mental disabilities and impaired cognitive and motor skills. The chromosomal abnormality is not due to malfunction in body systems or disease, nor is it necessarily inherited. It occurs during cell division at the early stages of fetal development. Individuals with Down syndrome have 47 chromosomes instead of 46, with an extra chromosome 21, forming a trisomy instead of a typical pair.

Obesity

Obesity is a significant health issue affecting individuals with disabilities at a higher rate than those without disabilities. According to McDonnell (2007), obesity prevalence among individuals with disabilities in the United States was 27.4%, compared to 16.5% in the general population.

Physical Exercise and Individuals with Down Syndrome

Exercise plays a crucial role in improving health and functionality in individuals with Down syndrome, who often experience low fitness levels, weak muscle strength, and motor coordination difficulties. Regular exercise programs, whether aerobic or resistance-based, have been shown to enhance muscle strength and endurance. Down syndrome is also linked to increased rates of obesity and metabolic disorders. Physical activity improves basal metabolic rate and reduces fat accumulation, aiding weight management and preventing complications such as cardiovascular disease and diabetes.

Triglycerides

Triglycerides are a form of fat circulating in the bloodstream. Most fat in the human body exists as triglycerides stored in adipose tissues, with a small portion present in the blood. While elevated triglyceride levels alone do not necessarily cause atherosclerosis, triglyceride-rich lipoproteins also contain cholesterol, which may contribute to arterial hardening in some individuals. Elevated triglycerides can indicate lipoprotein metabolism issues and are considered a risk factor for coronary heart disease. Exercise is an essential component in managing Down syndrome, helping improve cardiac and muscular fitness while lowering triglyceride levels. Studies show regular exercise improves cholesterol balance by lowering LDL and increasing HDL, thereby reducing the risk of cardiovascular disease and diabetes.

Cholesterol

Cholesterol is a fatty alcohol compound that is insoluble in water but dissolves in nonpolar solvents. It is present in all body cells, particularly in the brain, where it can

comprise up to 10%. Cholesterol is a soft, waxy, odorless substance found in the blood and throughout the body. About 80% of total cholesterol is synthesized in the liver, with the remaining 20% obtained from dietary sources, particularly animal-based foods. Cholesterol is transported from the liver to other tissues via special proteins called lipoproteins. Although it plays a role in brain function and hormone production, excessive cholesterol is a major contributor to atherosclerosis and heart attacks. Normal cholesterol levels vary with age, and aging tends to increase total cholesterol levels while HDL remains stable, and LDL increases.

MATERIALS AND METHODS

This study was conducted on 17 individuals with Down syndrome at the Suwani Bin Adam Disability Center in Tripoli. The participants did not suffer from any chronic diseases and were not taking medications related to weight loss. They were randomly divided into two groups: an experimental group and a control group.

The proposed exercise program was developed based on expert consultation in sports training, physical health, and physiotherapy. Its primary goal was to improve the blood lipid profile of the participants. The program lasted three months and included three sessions per week, each consisting of progressive exercises ranging from easy to moderate, including treadmill running.

Tools and devices used included: tourniquet, sterile cotton, 70% ethanol, adhesive tape, sterile disposable 5 ml syringes with 21G needles, plain 5 ml test tubes (no anticoagulants), gloves, semi-automatic pipettes, pipette tips, clean dry Eppendorf tubes, test tube racks, and measuring tape for waist and hip circumference. Exercise equipment included a treadmill, balls, and a whistle.

Blood samples (5 ml) were drawn using sterile syringes after cleaning the arm with alcohol. Samples were placed in clean dry tubes without anticoagulants and labeled. After 15 minutes at room temperature, samples were centrifuged at 3000 rpm for 10–15 minutes. The serum was extracted using a micropipette, stored in labeled Eppendorf tubes at -5°C, and later analyzed.

Table 1: Devices Used in Blood Analysis.

Test	Device Used	Manufacturer	Country
Cholesterol	MINDRAY BS-230	Shenzhen Mindray Bio-Medical	China
Triglycerides	MINDRAY BS-230	Shenzhen Mindray Bio-Medical	China

Blood lipid tests were conducted using the Mindray BS-230 device. 10 µL of blood serum was mixed with 1000 µL of the reagent, incubated for 5 minutes at 37°C, and read using the analyzer.

Table 2: Reference Values for Biochemical Variables.

Variable	Normal Range
Triglycerides (TG)	<150 mg/dL
Cholesterol	<200 mg/dL

All collected data were analyzed using SPSS Statistics software. Paired samples t-test was employed to determine the significance of differences between pre- and post-test measurements for triglycerides and cholesterol levels.

RESULTS AND DISCUSSION

Table 3.4: Effect of Physical Exercise on Triglycerides (Pre- and Post-Test).

Variable	Group	Mean \pm SD	T-test	P-value
TG	Pre	145.9 \pm 33.33	1.37	0.188
TG	Post	134.6 \pm 29.45		

Table 3.4 displays the results of the statistical analysis of triglyceride (TG) levels based on the Paired Samples T-Test. The p-value obtained was 0.188, which exceeds the threshold of 0.05, indicating the absence of statistically significant differences between pre- and post-exercise measurements. In other words, the physical exercise intervention did not produce a meaningful change in triglyceride levels among the participants with Down syndrome.

The lack of significant change observed in triglyceride concentration may be attributed to a variety of factors, particularly the unhealthy dietary habits commonly found in this population. These habits may be both acquired and physiological in nature. For example, emotional eating is frequently reinforced during early childhood, as parents often encourage excessive food intake in response to the naturally low appetite observed in young children with Down syndrome. This well-meaning behavior may unintentionally establish maladaptive eating patterns. Furthermore, parental emotional sensitivity may lead to lax dietary boundaries, such as permitting the consumption of sweets and high-

carbohydrate foods, which negatively impact lipid metabolism.

Another contributing factor may be hypothyroidism, a condition prevalent among individuals with Down syndrome, which is associated with chronic fatigue, muscle hypotonia, and reduced physical activity levels—thereby diminishing the effectiveness of exercise interventions.^[17]

Moreover, short-term training programs may be insufficient to elicit significant metabolic adaptations. This is supported by several previous studies^[18,19,20], which found that regular physical activity over extended periods, particularly when combined with structured dietary programs, is more likely to improve triglyceride levels. In contrast, a study conducted in Iraq reported significant reductions in triglyceride concentrations following a long-term intervention that integrated both exercise and a regulated nutritional plan, highlighting the synergistic effect of combining exercise with dietary modification.^[21]

Table 2.4: Effect of Physical Exercise on Cholesterol (Pre- and Post-Test).

Variable	Group	Mean \pm SD	T-test	P-value
Cholesterol	Pre	161.42 \pm 25.96	3.27	0.005
Cholesterol	Post	142.9 \pm 23.43		

Table 2.4 illustrates the results of the paired samples t-test for cholesterol levels before and after the intervention. The findings indicate a statistically significant difference ($p = 0.005 < 0.05$), suggesting that the physical exercise program had a positive impact on cholesterol concentrations.

This significant reduction in cholesterol levels may be attributed to the increase in regular physical activity, which stimulates the secretion of the hormone thyroxine. Thyroxine plays a critical role in lowering cholesterol by facilitating its excretion via bile and enhancing the activity of key enzymes involved in energy metabolism and protein synthesis.

These results are consistent with the findings of Margetic *et al.*^[22], who reported that physical activity contributes to improved lipid balance by decreasing low-density lipoprotein (LDL) cholesterol and promoting cardiovascular health. Similarly, a study conducted in Kuwait involving children aged 10 to 12 years demonstrated that exercise has a favorable effect on cholesterol levels and significantly enhances heart health.^[23]

CONCLUSION

The results indicate no significant impact of exercise on triglycerides, but a clear positive effect on cholesterol levels. This underscores the value of physical activity in health interventions for individuals with Down syndrome.

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