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A RESEARCH ARTICLE

Evaluation of High and Low Serum Triglyceride and Cholesterol Levels Among the Population of El-Wahat, Libya

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Abstract

Evaluation of both cholesterol, Triglyceride TG, high-density lipoproteins (HDL), and low-density lipoproteins (LDL) were studied in the Al Wahat region. A total of 1060 samples, 426 samples of cholesterol, 419 samples of TG, 325 samples of HDL, and 316 samples of LDL were collected. A statistical analysis of these samples revealed that the highest incidence of elevation in all these types occurred between the ages of 50 and 60, with the mean 53 years and a standard deviation (SD) ranging from 2 to 9.5. The coefficient of variation (CV) ranged from 4 to 18, and increasing incidence with age. The incidence rate of cholesterol was about 19.5%, TG about 28%, HDL about 20%, and LDL about 37%. The incidence rate for individuals aged 50-60 among men was cholesterol 44%, TG 40%, HDL 51%, and LDL 66%, while among women it was cholesterol 47%, TG 46%, HDL 50%, and LDL 58%. These results confirm that there is a problem with food consumption and the nature of the foods consumed. Therefore, dietary factors must be taken into account, and how these foods are consumed must be regulated, or they must be replaced with substances that have fewer effects, or with natural substances that contribute to keeping these levels within the normal range.

1. Introduction

Elevated triglyceride (TG) and cholesterol (C) levels are associated with an increased risk of angina pectoris and cardiovascular disease due to lipid accumulation within blood vessels, leading to narrowing and impaired blood flow. Multiple factors, including genetic predisposition, unhealthy lifestyle, obesity, physical inactivity, hypertension, and hyperglycemia, contribute to dyslipidemia. Reducing blood lipid levels through lifestyle modification and pharmacological treatment can lower cardiovascular risk. Additionally, the triglyceride to high-density lipoprotein (TG/HDL) ratio is a reliable surrogate marker of insulin resistance and related metabolic disorders, demonstrating prognostic value comparable to fasting blood glucose and supporting its role as an early indicator for cardiovascular and metabolic risk assessment. [1]. The TG/HDL-C ratio is an established biomarker of IR and metabolic syndrome [2]. Low HDL levels combined with elevated TG may contribute to persistent disturbances in insulin secretion characteristic of the prediabetic state [3]. Liquid fructose intake is associated with the development of type 2 diabetes and obesity, particularly within the context of an unhealthy diet that already promotes visceral fat accumulation, fatty liver disease, and obesity. It further increases hepatic lipid burden, impairs hepatic insulin signaling, and reduces whole-body insulin sensitivity without altering energy intake [4]. Abdominal obesity is linked to increased risk of insulin resistance, which is most pronounced in postprandial states [5].

The TG/HDL-C ratio is also considered a novel surrogate marker for insulin resistance and an indicator of atherosclerosis. Elevated TG/HDL-C levels may independently predict a higher risk of cardiovascular diseases (CVD) [6]. High TG and total cholesterol (TC) levels are established risk factors for type 2 diabetes mellitus (T2DM); however, no predictive ability has been found for these two factors in determining T2DM onset in men and women. Therefore, TG and TC levels can be used in both genders to reduce the incidence of T2DM [7]. Plasma lipid profiles naturally fluctuate due to

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physiological atherosclerotic changes during pregnancy. Gestational diabetes mellitus (GDM) may exacerbate metabolic alterations, and the TG/HDL-based Atherogenic Index of Plasma (AIP) can serve as a marker for plasma atherosclerosis. AIP is considered a valuable indicator for identifying pregnant women at low risk of developing GDM before the 24th week of gestation [8]. Additionally, associations of lipoproteins with the Hemoglobin Glycation Index (HGI) and the Triglyceride-Glucose Index (TyG), as well as correlations of apolipoprotein A1 (ApoA1) and HDL-C with HGI and TyG, have been noted in the diagnosis of coronary artery disease (CAD) patients [9]. There is also a documented relationship between triglyceride-rich lipoprotein cholesterol (TRL-C) and the risk of recurrent cardiovascular events (RCVEs). Elevated TRL-C levels are associated with a higher risk of RCVEs in statin-treated patients with CAD, independently of systemic inflammation [10].

Moreover, small dense LDL cholesterol (sd-LDL-C) and triglyceride-rich lipoproteins (TRLs) influence outcomes in patients with ST-segment elevation myocardial infarction (STEMI) [11]. Non-HDL-C and apolipoprotein B (ApoB) are particularly important among patients with obesity, diabetes, hypertriglyceridemia, or hypertension for the prevention of cardiovascular diseases (CVD) [12]. Dyslipidemia is also implicated in CVD complications and in kidney transplant (RT) recipients, or in most related cases as a secondary effect of immunosuppression [13]. Elevated TG and HDL-C levels define a specific lipid profile associated with CAD risk, independent of total cholesterol and LDL-C levels [14]. Compared with TG alone, the TG/HDL-C ratio has been found to be positively and independently associated with CVD risk [15]. In examining the effect of daily walnut consumption on lipid profiles and glycemic levels among adults at risk for CVD, it was found that regular walnut intake improves postprandial lipid ratios in individuals predisposed to CVD [16].

While low HDL-C concentrations represent a well-established CVD risk factor, extremely high HDL-C levels are paradoxically associated with elevated CVD risk, forming a U-shaped relationship [17]. Coffee products containing cafamide-I/-II have been shown to influence metabolic factors associated with obesity (body weight, LDL, HDL, TC, TG, adiponectin, and leptin) in non-obese individuals, though they may not have substantial effects on metabolic, inflammatory, or CVD risk factors [18]. Patients with severe COVID-19 complications often present with comorbid CVD, hypertension, and T2DM—clinical conditions that share metabolic alterations characterized by insulin resistance and dyslipidemia. Elevated TG and TG/HDL-C ratios are associated with reduced insulin sensitivity, metabolic syndrome, and adverse cardiovascular events, and may serve as early biochemical indicators of severe COVID-19 disease [19].

Concentrations of HDL, LDL, and TG are genetic risk factors for vascular disease and contribute to the development of chronic kidney disease (CKD) [20]. Routine measurement of both LDL cholesterol and ApoB is essential for accurately assessing global cardiovascular risk [21]. The TG/HDL-C ratio is positively associated with the risk of atherosclerotic cardiovascular disease (ASCVD) and stroke [22]. High inflammation combined with atherogenic lipid levels is linked to increased CAD risk. Inflammation increases CAD risk among both White and Black populations, whereas dyslipidemia alone is associated with increased CAD risk only among White adults. High-sensitivity C-reactive protein (hsCRP) testing should therefore be a standard component of CAD risk assessment, particularly in Black patients [23]. Elevated TG levels and the TG/HDL-C ratio are associated with CVD and may serve as early surrogate markers for future T2DM [24]. Lowering LDL-C is among the most effective strategies for CAD prevention [25]. Unhealthy lipid levels remain key modifiable risk factors for CAD [26]. Elevated TG and TG/HDL-C ratios have been used as predictors of adverse cardiometabolic outcomes. A high TG/HDL-C ratio is an independent predictor of long-term all-cause mortality and is strongly associated with major adverse cardiac events (MACE) [27]. LDL-C levels are linked to worse outcomes in patients with chronic heart failure (HF) and predict in-hospital mortality [28].

Increased TG and ApoB levels and reduced HDL-C concentrations are risk factors for CVD [29]. In the liver, mitochondria-associated ER membranes (MAMs) may play an important regulatory role in lipid metabolism, influencing the progression or prevention of fatty liver disease [30]. Bempedoic acid may serve as a potential therapeutic agent for metabolic syndrome and alcoholic steatohepatitis (NASH) [31]. Sodium–glucose cotransporter-2 (SGLT2) inhibition increases total cholesterol, LDL, and HDL levels while reducing TG; effect size varies slightly by dosage and ethnicity but remains consistent across drug classes [32]. Smaller LDL particle size is the most atherogenic lipoprotein parameter [33]. Widespread environmental pollutants such as per- and polyfluoroalkyl substances (PFAS) are repeatedly associated with elevated serum cholesterol in humans, and PFAS exposure influences triglyceride metabolism through effects on long-chain glycerophospholipid pathways [34].

A significant positive association has been identified between the TG/HDL-C ratio and the risk of severe complications in COVID-19 patients; the TG/HDL-C ratio can therefore serve as an early biochemical indicator of severe COVID-19 outcomes [35,36]. A pyrrole- and pyrazole-derived compound, (E)-labda-8(17),12-diene-15,16-dial, has been found to inhibit cholesterol and TG synthesis [37]. Hypercholesterolemia is a major CVD risk factor, and oat consumption significantly reduces TC, VLDL, and LDL-C more effectively than TG. Including oats in calorie-restricted diets may produce further reductions in TG [38]. Pemafibrate, a novel selective peroxisome proliferator-activated receptor-α modulator, has been shown to reduce plasma TG levels with few adverse drug reactions and is associated with reductions in TG/HDL-C and CVD events [39]. Pectin, whether extracted from apples or found as a major component of mango pulp, affects plasma lipid profiles and bile acids (BA). Both forms demonstrate prebiotic properties, including significant increases in therapeutic BA such as ursodeoxycholic acid (UDCA) [40].

The primary limiting factor in TG synthesis is the utilization of fatty acids for cholesterol esterification [41]. Sweet basil contains phenolic compounds capable of lowering blood lipid levels and preventing atherosclerosis [42].

Double-null genotypes of GSTM1 and GSTT1 genes are associated with elevated TG and decreased HDL levels in humans, representing a novel link between lipid metabolism and glutathione S-transferase (GST)-related redox balance [43]. Catecholamines stimulate glucose production and inhibit hepatic secretion of very low-density lipoproteins (VLDL). Hepatic denervation increases circulating TG and cholesterol by enhancing VLDL secretion, indicating a regulatory role of liver innervation in lipid and carbohydrate metabolism [44]. Multiple genetic variants of the haptoglobin (HP) and haptoglobin-related protein (HPR) genes are associated not only with HP levels but also with total cholesterol and/or non-HDL and/or LDL concentrations. Obesity significantly modifies the relationships between circulating HP levels, genetic factors, anthropometric measures, and metabolic markers, underscoring the need to consider obesity degree when using HP polymorphisms as predictive biomarkers in clinical conditions [45].

Bile acid resins (BAR) improve glycemic control at least partly by downregulating hepatic cholesterol pathways [46]. Transplant vasculopathy (TV) is a major contributor to chronic graft failure in kidney transplant recipients (RTR), and evidence shows that the TG/HDL-C ratio has predictive potential as a clinical biomarker in this context [47]. An elevated TG/HDL-C ratio is an important risk factor for nephropathy in patients with type 2 diabetes [48]. Maternal physiological dyslipidemia (MPD) supports fetal growth during pregnancy; however, some women develop maternal supraphysiological dyslipidemia (MSPD), characterized by elevated TC and TG levels. MSPD occurs in both normal and gestational diabetes mellitus (GDM) pregnancies and is associated with fetal endothelial dysfunction, contributing to alterations in the nitric oxide (NO)–L-arginine/arginase metabolic axis [49]. Altered lipid metabolism is a hallmark of systemic autoimmune diseases, and dyslipidemia correlates with disease activity and progression in multiple sclerosis (MS) patients [50]. Diet: Food affects different types of blood lipids. The most important nutrients that increase blood cholesterol levels are saturated fatty acids, followed by dietary cholesterol. Triglycerides increase with high-calorie foods that lead to obesity. Consuming saturated fats in the diet leads to increased levels of LDL (bad) cholesterol.

Obesity: Obesity is a disease characterized by excessive accumulation of fat in the body. A 7.3% increase in body weight leads to a 2.5-3% increase in total cholesterol and an 18.2% increase in triglycerides, while HDL (good) cholesterol decreases by 4.9%. It's worth noting that when an obese person begins to lose weight, triglycerides usually decrease significantly (by about 40%), along with a 10% decrease in total cholesterol and a 10% increase in HDL cholesterol. Smoking: Smoking leads to a 3% increase in total cholesterol, a 1.7% increase in LDL cholesterol, and a 10.4% increase in triglycerides, while HDL cholesterol decreases by 13%. Medium-chain triglyceride (MCT) oil does not affect TC, LDL, or HDL levels but induces a mild increase in TG [51]. There are also associations between cholesterol and TG levels in lipoprotein subclasses isolated from healthy adults and menopausal status [52]. Moderate elevations in TG, cholesterol, and fasting glucose are linked with an increased risk of acute pancreatitis [53]. Elevated TG and reduced HDL levels may also be associated with major depressive disorder (MDD) [54].

2. Materials and Methods

2.1. Research Objectives

- To identify the factors influencing elevated levels of TG and cholesterol and to assess their role in the development of angina pectoris.
- To determine the prevalence of this disease in the Al-Wahat region.
- To identify the age group most at risk of developing the condition.
- To assess the prevalence of the disease among both sexes.
- 5-To highlight the importance of cholesterol and its functions in the human body.
- 6-To identify the diagnostic methods and tests used to determine the total lipid profile in the study area.
- 7-To examine the therapeutic approaches used in the treatment of hypercholesterolemia.
- 8-To analyze the genetic factors contributing to the development of triglyceride and cholesterol disorders and angina pectoris.
- 9-To determine dietary recommendations and healthy lifestyle practices that help reduce triglyceride and cholesterol levels and prevent angina pectoris.

2.2. Research Problem

- Due to the high global prevalence of cardiovascular diseases, this study aims to determine the extent of their spread in the Al-Wahat region and to identify factors contributing to elevated triglyceride and cholesterol levels and their role in the development of angina pectoris.
- The relationship between angina pectoris and elevated cholesterol and triglyceride levels.

2.2.1. Study Delimitations

Spatial delimitations: This study was conducted in the Jalu area.
Temporal delimitations: The study was carried out from October 2022 to October 2023.

2.2.2. Research Questions

Is there a relationship between dietary habits, smoking, and the incidence of heart disease? Additionally, is there a strong association between gender, obesity, elevated blood lipid levels, and the incidence of heart disease?

2.2.3. Research Methodology

This study employs a descriptive content analysis methodology, also known as laboratory data analysis, for triglyceride and cholesterol levels. This methodology involves a systematic process of reading, classifying, and analyzing results. A descriptive analytical field/laboratory approach (a descriptive cross-sectional laboratory study)It was chosen for the following reasons:

- The availability of the necessary laboratory results for the study.
- Its reliance on collecting statistical data without the need for questionnaires or interviews.
- Its ability to examine results containing information about triglycerides and cholesterol, analyze these results, and classify their relationship to angina.

2.3. Blood Sample Preparation

The sample used is serum, obtained by placing a blood specimen in tubes without anticoagulants, allowing it to clot. The sample is then centrifuged at 4000 rpm for 5 minutes. The upper layer represents the serum, which normally appears yellow in color.

2.4. Lipid Profile Analysis and Instruments Used

A device called the Mispa Viva Biochemistry Analyzer is used to measure cholesterol and triglyceride levels in the patient’s blood.

2.5. Procedure: Steps for Cholesterol Analysis

- Prepare three small tubes (AQUIVET).
- Label the tubes as Blank, Standard, and Test with the corresponding sample number.

- Add 1000 µL of the cholesterol reagent to all three tubes.
- Add 10 µL of the Standard solution to the tube labeled Standard.
- Add 10 µL of serum from the sample to be tested into the Test tube, ensuring the sample number is verified.
- Mix the contents using an automatic pipette and incubate the tubes for 5 minutes at 37°C.
- Open the analyzer, select the cholesterol program, and after incubation insert the tubes in the following order: Blank → Standard → Test, then record the result.
- Measure absorbance using a colorimetric spectrophotometer at a wavelength of 510 nm.

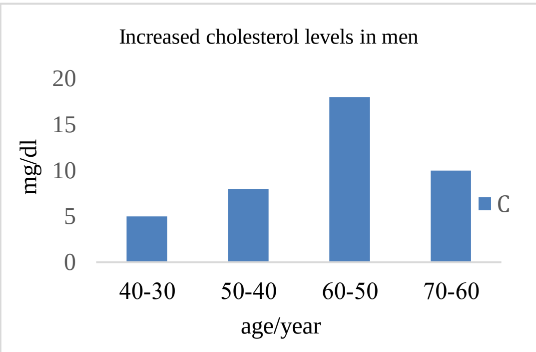
2.6. Procedure for TG Analysis

- Prepare three small tubes (AQUIVET).
- Label the tubes as Blank, Standard, and Test with the corresponding sample number.
- Add 1000 µL of the triglyceride reagent to all three tubes.
- Add 10 µL of the Standard solution to the tube labeled Standard.
- Add 10 µL of serum from the sample to be tested into the Test tube, after verifying the sample number.
- Mix the tubes using an automatic pipette and incubate them for 5 minutes at 37°C.
- Open the analyzer, select the triglyceride program, and after incubation insert the tubes in the following sequence: Blank → Standard → Test, then record the result.
- Measure absorbance using a spectrophotometer at a wavelength of 505 nm.

3. Results and Discussion

3.1. Cholesterol

The cholesterol levels in men and women aged 50-60 were 31% ,32% respectively During this period, characterized by reduced physical activity and decreased energy consumption, and in the absence of specific dietary programs, cholesterol levels tend to rise compared to previous age periods. This is slightly higher in women due to hormonal changes, sedentary lifestyles, and reduced physical activity, and the percentage increase in cholesterol in both sexes was 16%.



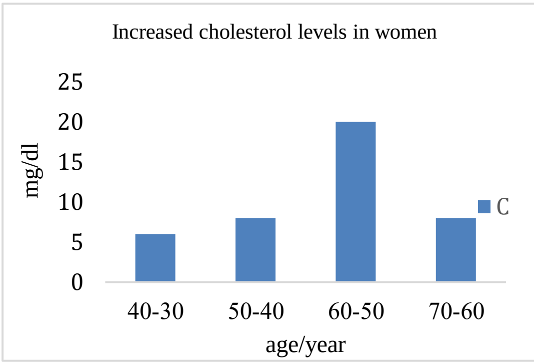


Figure 1. shows the percentage of increased cholesterol in men/ women

3.2. Triglycerides Test

The triglycerides levels in men and women aged 50-60 were 29% ,32% respectively. During this period, characterized by reduced physical activity and decreased energy consumption, and in the absence of specific dietary programs, cholesterol levels tend to rise compared to previous age periods. This is slightly higher in women due to hormonal changes, sedentary lifestyles, and reduced physical activity, and the percentage increase in cholesterol in both sexes was 22%.

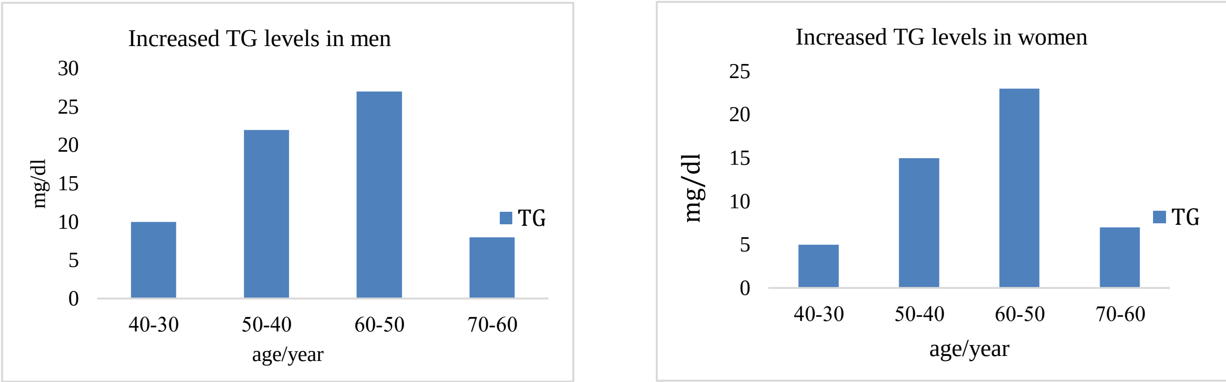


Figure 2. shows the percentage increase in TG in men/women

3.3. High-density lipoproteins:

High-density lipoproteins levels in men and women aged 50-60 were 34% ,33% respectively. High-density lipoprotein (HDL), also known as "good cholesterol," is considered a good indicator of heart health and protection against angina. However, these levels are relatively low compared to global values and also compared to low-density lipoprotein (LDL) cholesterol levels. The overall percentage is 17%, a small percentage that indicates a potential risk of heart disease and angina.

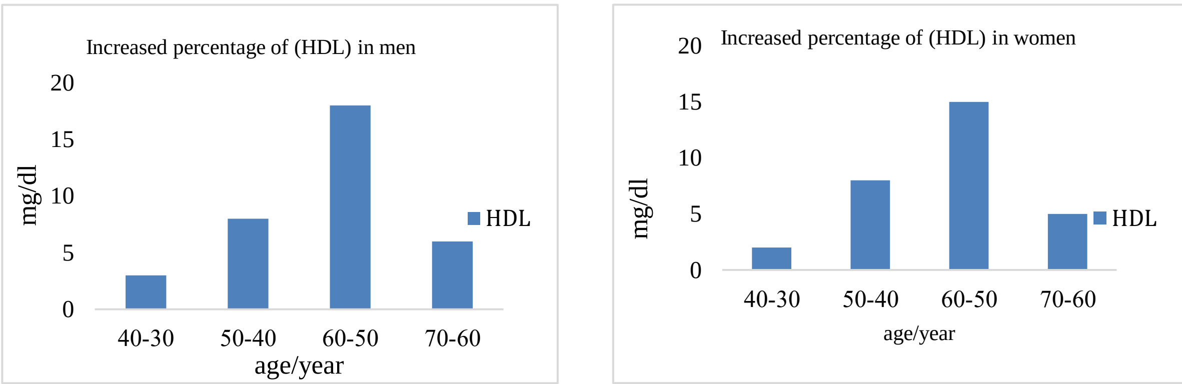


Figure 3. shows the increased percentage of (HDL) fat in men/women

3.4. Low-density lipoproteins (LDL)

Low-density lipoproteins (LDL) levels in men and women aged 50-60 were 40% ,37% respectively. Low-density lipoprotein (LDL) cholesterol, often called "bad cholesterol," is a strong indicator of heart disease and angina. However, these levels are relatively high (40% and 37%, respectively) compared to global values, indicating a high risk of developing heart disease and angina. The overall LDL cholesterol level of 27% is also high, suggesting an increased risk of angina, and is higher than the global average of no more than 20%.

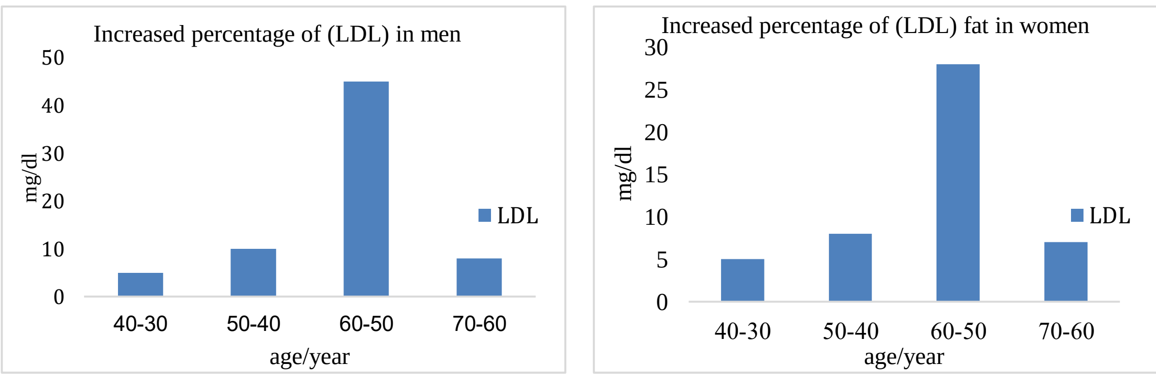


Figure 4. shows an increased percentage of (LDL) fat in men/ women

The preceding graphical representations of cholesterol, TG, (HDL), and (LDL) indicate that the highest prevalence of abnormal lipid levels occurs among individuals over the age of fifty. This makes this age group among both males and females more susceptible to developing angina pectoris, cardiovascular diseases, hypertension, cardiac arrest, and other obesity-related disorders.

3.5. Statistical Procedures

From Table 1, the mean age of individuals with elevated cholesterol, TG, (HDL), and (LDL) ranges between 50 and 60 years, which is consistent with both the mode and median. The SD of the values ranges from 2 to 9, with CV between 4% and 18%, and a slightly negative SK1 and SK2 means the values are higher at higher age) A negative skewness coefficient indicates that the data distribution is slightly skewed to the left, with the tail extending towards the lower values, while the majority of observations are concentrated at the higher values (. This indicates a relatively higher exposure and risk of dyslipidemia among individuals younger than 50 years, suggesting that prevalence rates in this age group may be even higher.

Table 1. Shows the statistical operations such as the mean, (X) mode, median, standard deviation, (S. D) coefficient of variation, (C.V) skewness using the mode, (SK1) and skewness using the median, (SK1).

Lipids	Sex	X	Mod.	Med.	S. D	C.V	SK_1	SK_2
(C)	M	53	55	53	9.5	18	-0.2	-0.07
	F	52	55	53	9.4	18	-0.3	-0.16
(TG)	M	48	53	51	5	10.4	-0.92	-0.77
	F	51	53	52	2.7	5.2	-0.6	-0.66
(HDL)	M	53	54	53	2.2	4.1	-0.6	-0.4
	F	53	54	52	2.3	4.3	-0.5	-0.5
(LDL)	M	53	55	54	2.1	3.9	-0.64	-0.5
	F	53	55	54	2.3	4.3	-0.82	-0.56

4. Conclusions

The prevalence of elevated cholesterol, TG, (HDL), and (LDL) was assessed in the Al-Wahat region for the year 2023. A total of 426 cholesterol samples, 419 triglyceride samples, 325 HDL samples, and 316 LDL samples were collected. Statistical analysis of these samples showed that the highest incidence of elevation in all lipid types occurred among individuals aged 50 to 60 years, with a mean age of approximately 53 years, SD ranging from 2 to 9.5, a CV between 4 and 18, and increases with age.The prevalence rates were approximately 19.5% for cholesterol, 28% for TG, 20% for HDL, and 37% for LDL. Among men aged 50–60 years, the prevalence of elevated lipid levels was as follows: Cholesterol: 44%, TG: 40%, (HDL): 51%, and (LDL): 66%. Among women aged 50–60 years, the prevalence rates were: Cholesterol: 47%, TG: 46%, (HDL): 50%, and (LDL): 58%.

5. Recommendations

- Reduce your intake of all types of fats, especially saturated and trans fats.
- Read food labels. Food labels help you choose foods that are low in saturated fat, trans fat, cholesterol, and calories.
- Replace saturated fats such as lard, butter, ghee, margarine, palm oil, and coconut oil with unsaturated fats (in small amounts) such as olive oil, corn oil, and sunflower oil.
- Reduce your intake of simple sugars (added sugar, juices, sweets and candies, chocolate, soft drinks, alcoholic beverages, energy drinks, and sweetened hot drinks).
- Limit your consumption of sweets, as they contain high amounts of sugar and fat. 6. Avoid excessive consumption of refined carbohydrates, such as white bread, pasta, rice, and pastries of all kinds. It is preferable to obtain carbohydrates from whole grains and their products.
- Consume sufficient amounts of foods rich in dietary fiber, including vegetables, fruits, and legumes.

- Replace full-fat dairy products with low-fat or fat-free alternatives.
- Ensure that meats are lean and poultry is skinless.
- Avoid fried foods and follow healthy cooking methods such as grilling, boiling, and steaming.
- Avoid fast food due to its high content of harmful saturated fats.
- Include foods rich in omega-3 fatty acids in your diet, such as fish at least three times a week, and small quantities of unsalted nuts.
- Avoid processed meats such as mortadella, sausages, salami, bacon, and canned meats. 1.
- Dedicate some time each day to exercise, at least 30 minutes daily.
- Refrain from smoking.
- Avoid all processed and fast foods such as frozen foods, samosas, etc.
- Maintain a healthy weight.

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تقييم مستويات الدهون الثلاثية والكوليسترول المرتفعة والمنخفضة في مصل الدم لدى سكان الواحات، ليبيا

الملخص
أُجريت دراسة لتقييم مستويات الكوليسترول والدهون الثلاثية والبروتينات الدهنية عالية الكثافة (HDL) والبروتينات الدهنية منخفضة الكثافة (LDL) في منطقة الواحات. جُمع ما مجموعه 1060 عينة، منها 426 عينة للكوليسترول، و419 عينة للدهون الثلاثية، و325 عينة للبروتينات الدهنية عالية الكثافة، و316 عينة للبروتينات الدهنية منخفضة الكثافة. أظهر التحليل الإحصائي لهذه العينات أن أعلى نسبة ارتفاع في جميع هذه المستويات كانت بين سن 50 و60 عامًا، بمتوسط 53 عامًا وانحراف معياري يتراوح بين 2 و9.5. تراوح معامل التباين بين 4 و18، مع ازدياد نسبة الارتفاع مع التقدم في العمر. بلغت نسبة الإصابة بارتفاع الكوليسترول حوالي 19.5%، والدهون الثلاثية حوالي 28%، والكوليسترول عالي الكثافة (HDL) حوالي 20%، والكوليسترول منخفض الكثافة (LDL) حوالي 37%. أما نسبة الإصابة لدى الأفراد الذين تتراوح أعمارهم بين 50 و60 عامًا فكانت 44% للكوليسترول، و40% للدهون الثلاثية، و51% للكوليسترول عالي الكثافة، و66% للكوليسترول منخفض الكثافة، بينما كانت لدى النساء 47% للكوليسترول، و46% للدهون الثلاثية، و50% للكوليسترول عالي الكثافة، و58% للكوليسترول منخفض الكثافة. تؤكد هذه النتائج وجود مشكلة في استهلاك الغذاء ونوعية الأطعمة المستهلكة. لذا، يجب مراعاة العوامل الغذائية، وتنظيم كيفية استهلاك هذه الأطعمة، أو استبدالها بمواد ذات تأثيرات أقل، أو بمواد طبيعية تُسهم في الحفاظ على هذه المستويات ضمن المعدل الطبيعي.

الكلمات المفتاحية: الدهون الثلاثية، الكوليسترول عالي الكثافة، الكوليسترول منخفض الكثافة، التحليل الإحصائي