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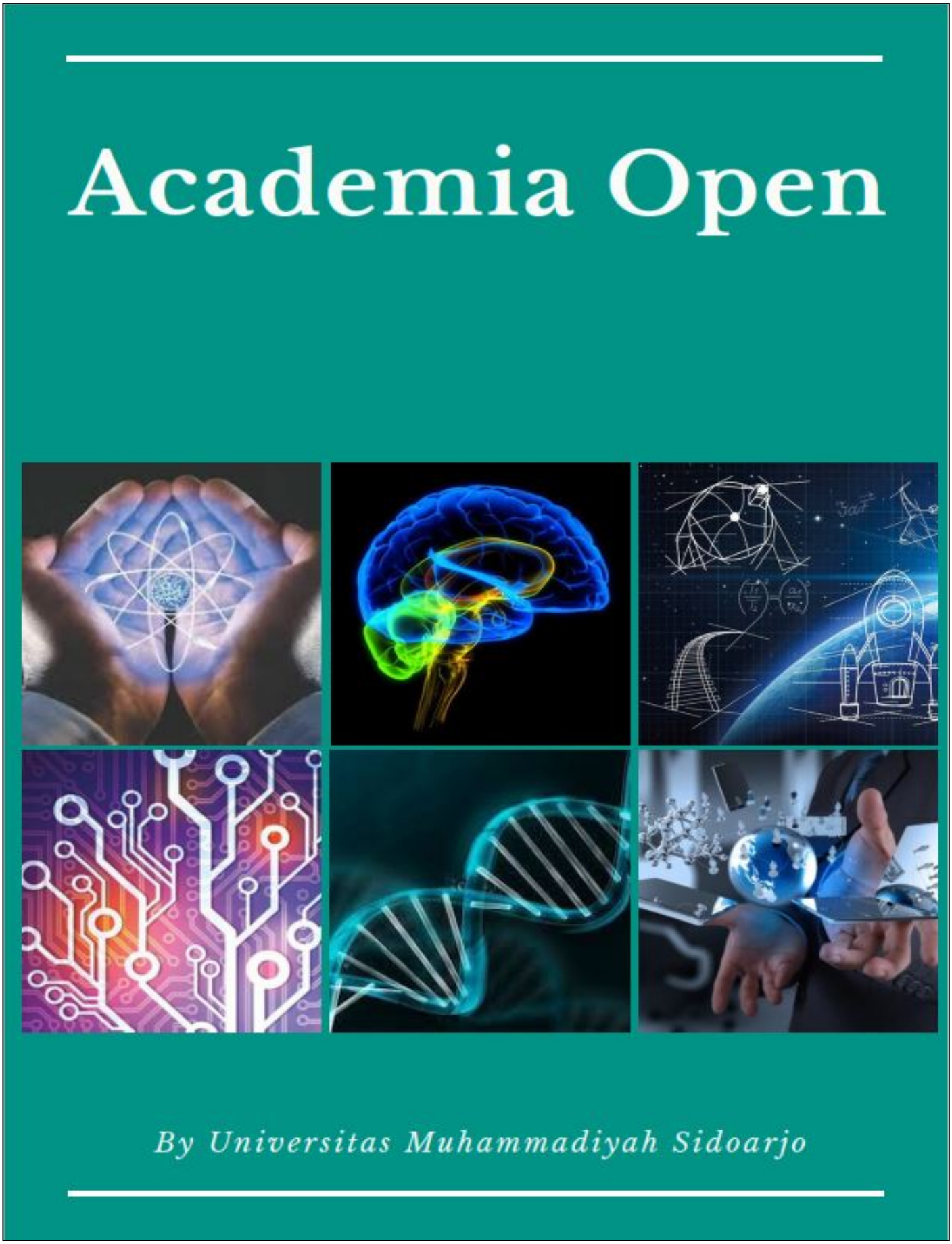


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# Hyperglycemia and Cholesterol Surge in Iraqi Diabetic Patients

## *Hiperglikemia dan Lonjakan Kolesterol pada Pasien Diabetes di Irak*

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**Abstract**

Diabetes mellitus, a metabolic disorder characterized by abnormal hyperglycemia, often correlates with dyslipidemia. This study examined the relationship between random blood sugar (RBS) levels and cholesterol types (HDL, LDL, and total cholesterol) in 350 patients from Diyala, collected between February and April 2023. Results showed higher blood sugar levels in females (22.3%) than males (19.7%) among the elderly (≥60 years). Type 2 diabetes was more prevalent than type 1 (77% vs. 5.4%). Cholesterol levels were elevated in 26% of patients. RBS was high in 82% of patients, and 49% had elevated total cholesterol. Both age groups 41-60 and ≥60 had high hyperglycemia incidence (32%), with higher prevalence in females (40.6%) compared to males (35.7%). These findings underscore the need for targeted interventions to manage blood sugar and cholesterol levels.

**Highlights:**

- Prevalence: Type 2 diabetes is significantly more common than type 1 among patients in Diyala.
- Gender Disparity: Females exhibit higher blood sugar and cholesterol levels compared to males.
- Age Impact: Elevated blood sugar is prevalent in both middle-aged and elderly populations, necessitating targeted interventions.

**Keywords:** Diabetes Mellitus, Hyperglycemia, Cholesterol, Insulin Resistance, Dyslipidemia

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# Introduction

According to its definition, diabetes is a metabolic disease marked by hyperglycemia brought on by insufficient insulin secretion, ineffective insulin action, or both. Due to inadequate insulin secretion or a weak tissue response to insulin in one or more complex pathways of hormone action, insulin does not act as it should on target tissues, which prevents diabetes patients from metabolizing carbohydrates, fats, and proteins normally [1]. Type 1 diabetes, also called childhood diabetes, is an autoimmune disease, meaning the body's immune system attacks and destroys pancreatic cells, leading to a severe lack of insulin secretion. There are two types of diabetics, Type 1 diabetics usually develop the disease in childhood, and need daily insulin. Type 1 diabetes patients constitute 10% of diabetes patients. While type 2 diabetes is the most common type, and is usually associated with obesity [2]. Type 2 diabetes occurs due to the body's resistance to the hormone insulin, and a disturbance in the cells' response to the hormone such that glucose accumulates in the blood [3].

Chronic hyperglycemia causes myocardial paralysis and weakening of the organs' ability to function, particularly the kidneys, eyes, nervous system, heart, and blood vessels [4]. In terms of cholesterol, total cholesterol is calculated to ascertain the type of lipids resulting from inadequate metabolism. Essential for life, cholesterol is also needed for the synthesis of cell membranes, vitamin D, and sex hormones. The liver produces about two thirds of the body's cholesterol, with the remaining one third coming from diet. But it causes atherosclerosis when its percentage increases [5].

Dyslipidemia is one of the risk factors for diabetes morbidity and mortality. It is one of the most important modifiable risk factors for cardiovascular disease (CVD) in Diabetics Mellitus (DM). Dyslipidemia in DM patients is caused by increased free fatty acid flux caused by insulin resistance, which results in an overproduction of triglyceride-rich lipoproteins from the liver, decreased clearance of triglyceride-rich lipoproteins, and, in some cases, atherosclerosis. Foods that are rich in fat, primary hypercholesterolemia, nephritic syndrome, hypothyroidism, primary biliary cirrhosis, and certain types of diabetes are associated with high cholesterol. while Malnutrition, malabsorption, severe liver disease, and polycythemia vera are associated with low cholesterol [6]. The types of foods consumed have an impact on blood sugar and cholesterol levels. Sugar consumption causes the liver to produce more LDL (Low-density Lipoprotein), a type of bad cholesterol, and less HDL (High-density Lipoprotein). Furthermore, the percentage of triglycerides rises with all forms of sugar and is directly correlated with cholesterol [7]. Additionally, engaging in sports or any other physical activity for at least half an hour a day, like walking, improves blood pressure and cholesterol levels whereas stimulating the heart and blood circulation. Consume a diet rich in vegetables, salads, fruits, grains, seafood, and poultry. Limit your intake of fats and sugars so that fat makes up no more than 30% of your diet. Less than 10% of daily calories come from saturated fats, while 50–60% of daily calories come from carbohydrates and a certain percentage of fiber must come from food. Additionally, one diabetes treatment (such as Glucophage) that helps prevent diabetes is the use of regulated grains [8].

Type 2 diabetes depends on age and weight, and even young children may have cholesterol rise to an unhealthy level, but it is more common in people over the age of forty. As we age, the liver becomes less able to get rid of low-density lipoprotein (LDL) cholesterol. High cholesterol can cause a dangerous buildup of cholesterol and other deposits on the walls of your arteries (atherosclerosis). These deposits (plaques) can reduce blood flow through the arteries, which may cause complications [9].

# Methods

## A. Collection of Samples

1. This study was conducted in the period from February 2023 to April 2023, when 350 blood samples were collected from patients with diabetes, after diagnosis by the specialist doctor in the laboratories of the teaching hospitals in Baqubah / Diyala.

2. Samples were collected by drawing blood through a finger prick in diabetes, but in cholesterol, the blood sample was drawn from a vein or from a finger prick as well.

## B. Assessing Cholesterol and Sugar Levels

### 1. Diagnosis of Diabetes

a. Hands were cleaned and patted dry.

b. A glucose meter was fitted with a measuring tape.

c. Using the needle (prick) that came with the measuring kit, the fingertip's side was pricked.

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d. The measuring tape's edge was touched to the blood drop and held there.

e. A few seconds later, the patient's blood sugar level was read and shown on the glucometer screen.

f. The outcome was noted and contrasted with the standard blood sugar value listed in Table No. (1)

**2. Measure Cholesterol**

Patients with diabetes gave two to three milliliters of blood, and details about each patient including age and gender were gathered. The following procedures were followed when taking blood samples from the patients:

a. By applying pressure and limiting movement, the vein in the arm area was located. The skin was then cleansed with alcohol, and before drawing, we let the alcohol dry to prevent the destruction of red blood cells.

b. We fastened the tunica to the patient's arm from seven to ten meters above the withdrawal site.

c. We used a needle to take blood from varicose veins.

d. After the blood was drawn, we took the syringe out and used sterile medical cotton to apply direct pressure to the puncture site while lifting the patient's arm just above the support.

e. After designating the tube, giving it a name, and providing the patient's information, a portion of the sample was then put in ordinary tubes that is, without additives until the sample coagulated.

f. The sample was then put into the centrifuge, which has a high-speed rotating section with 12 holes that can each hold a test tube with a capacity of 0.5 milliliters. The centrifuge was then set to rotate for five minutes at a maximum speed of 16,000 rpm.

**3. High Density Lipoproteins ( HDL ) Measurement Techniques**

Analysis method is based on the Spanish liner kit, according to the manufacturer’s instructions, as shown in the following steps:

a. A tube was taken and 400 microliters of HDL (R1) from the Spanish company Linear was placed in it, as in Table 3-2.

b. Then add 200 microliters of the sample (serum) to the tube above.

c. Then mix well and leave at room temperature for 10 minutes.

d. Then it was placed in the centrifuge for 10 minutes at high speed

e. A sediment and sediment appeared, and the sediment was collected in a tube, while the sediment was destroyed.

f. 50 microliters of the liquid were withdrawn and placed in another clean tube containing 1 each of cholesterol (R1 Cholesterol from the Spanish company).

g. The tube was mixed well and left at room temperature for 10 minutes

h. It was read on the device as 500 nm

**4. Low-Destiny Lipoprotein LDL-Cholesterol Measurement Techniques**

Methods for Measurement of LDL is the same as for HDL, only the added solution will be changed, which is (R2 for the German company), as in Table 3-2.

As for the Try method, it was completed with the following steps

a. 1000ml of R3 was added to a test tube from the German company, and the tube was cleaned before adding.

b. Then 10 ml of standard cholesterol was added to the standard tube

c. 10 micro of the patient’s serum was added to the sample tube, mixing the R3 solution of the German company as in Table (3-2) well.

d. A third tube was taken, which is the blanks test tube, to zero the Bector device, empty without adding anything.

e. Wait for 15 minutes at room temperature 37

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f. The LB link device was zeroed with a wave phase of 500 mm, and then the results appeared on the meter screen.

g. The result was recorded and compared with the normal cholesterol levels mentioned in Table (1)

| Sugar and Cholesterol | Normal mg/dL | Rising mg/dL | Down mg/dL |
|---|---|---|---|
| Sugar | 100 -125 | ≥126 | ≤ 100 |
| Cholesterol | 70-200 | 201- 500 | ≤ 70 |
| HDL | 35-65 | 66 ≤ | ≤ 34 |
| LDL | 70-135 | 135≤ | ≤ 70 |
| Tri.g | 160-40 | 160≤ | ≤ 40 |

**Table 1.** ***Normal Levels of Sugar and Cholesterol by Type s***

# Results and Discussion

## A. Result

The results of the current study to measure the level of sugar and cholesterol in Diyala Governorate, which included 350 samples for both sexes, male and female, and the number of males was 161 (46%) and females 189 (54%). The results showed that blood sugar was higher in females 78 (22.3%) than males 69 (19.7%) among the elderly 60 ≥. As shown in the table 2

| Gender Age | Males | Females |
|---|---|---|
| 1-20 | 11 (3.2%) | 12 (3.4%) |
| 21-40 | 25 (7.1%) | 35 (10.0 %) |
| 41-60 | 56 (16.0 %) | 64 (18.3 %) |
| ≥ 60 | 69 (19.7%) | 78 (22.3 %) |
| Total | 161 (46.0%) | 189 (54%) |

**Table 2.** ***Distribution of blood sugar level ( Randomly ) according on age groups and gander***

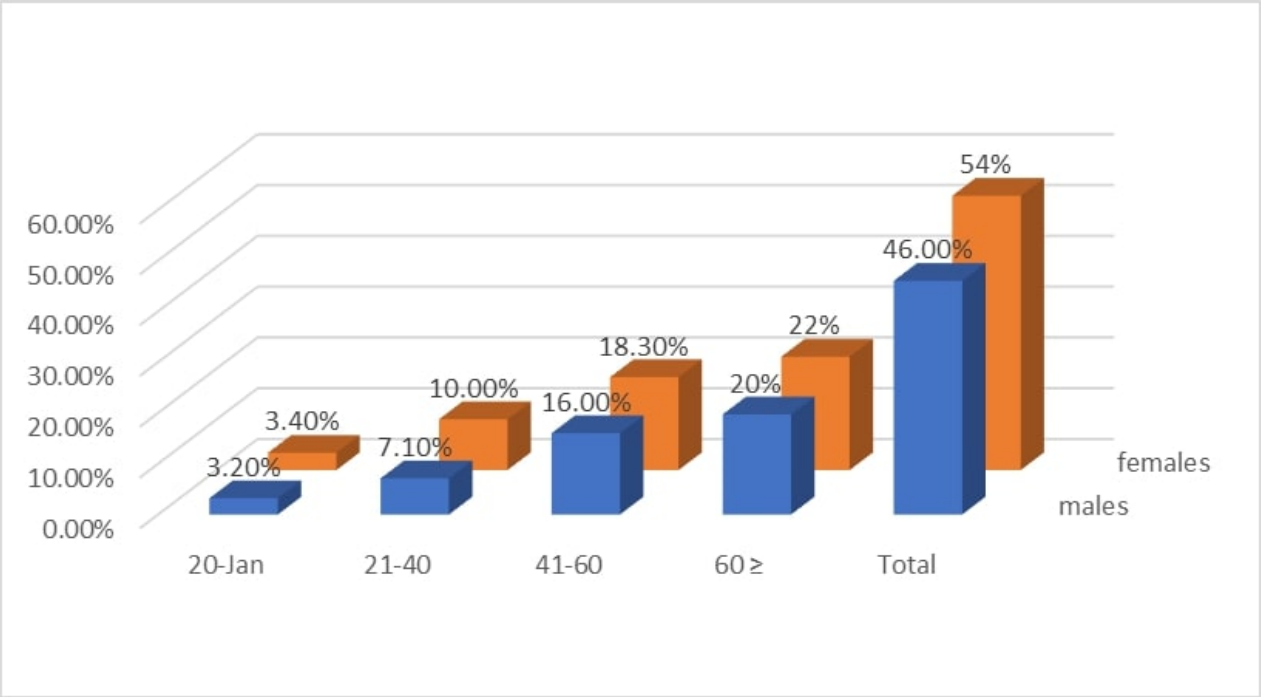


**Figure 1.** ***Distribution of blood sugar level (Randomly) according on age groups and Gender***

In the table 3 showed that the percentage of blood sugar levels was in rising 287 (82%) and down 21 (6%) and

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natural 42 (12%). It turns out that the blood sugar level according on type of diabetes, type 2 diabetes is more common than type 1, in rising 269 (77%), in naturel 39 (11%), and down 19 (5.4%) as in the Table (3) and figure (2).

| Type of Diabetes | Natural | Down | Rising |
|---|---|---|---|
| Type1 | 3 (1%) | 2 (0.6%) | 18 (5 %) |
| Type2 | 39 (11%) | 19 (5.4 %) | 269 (77 %) |
| Total | 42 (12 %) | 21 (6%) | 287 (82%) |

**Table 3.** ***Distribution of blood sugar level according on type of diabetes***

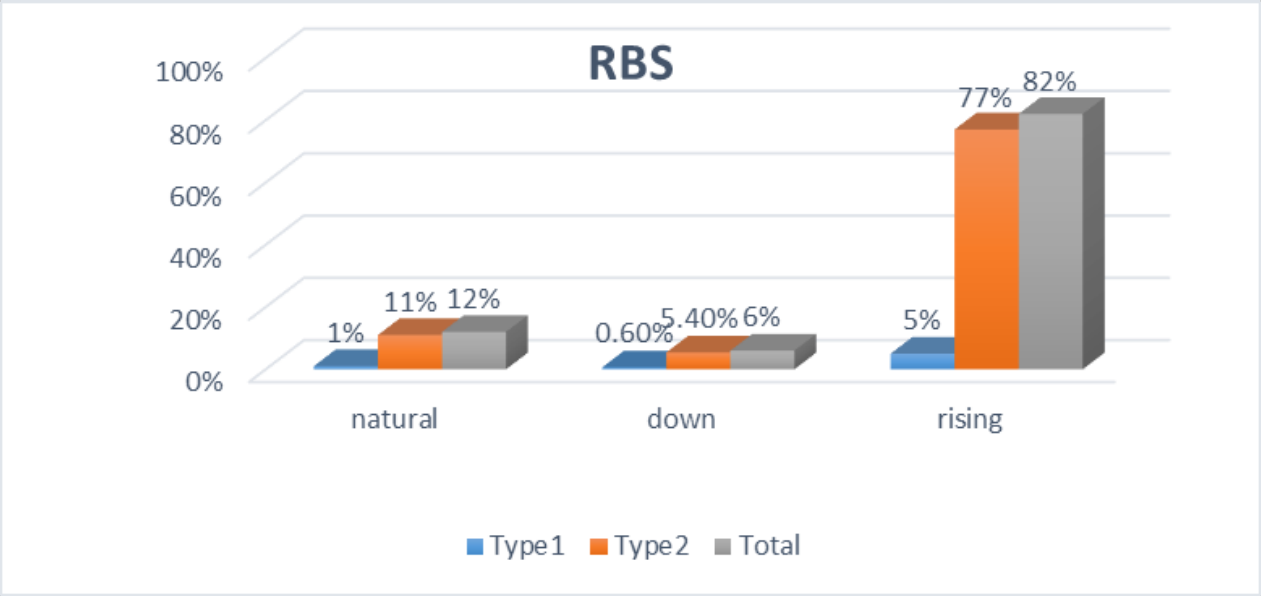


**Figure 2.** ***Distribution of blood sugar level according on type of diabetes***

The relationship between sugar levels and different types of cholesterol was also studied in a random blood sugar test, and the results were total cholesterol (49%), LDL (22%), HDL (76%), and triglyceride (47%), as in Figure 3.

| Cholesterol | Natural | Down | Rising |
|---|---|---|---|
| HDL | 25 (7%) | 18 (5 %) | 32 (9%) |
| LDL | 35 (10%) | 35 (10 %) | 49 (14%) |
| Tri.g | 42 (12 %) | 24 (7 %) | 91 (26%) |
| Total Cholesterol | 102 (29 %) | 77 (22%) | 172 (49%) |

**Table 4.** ***D ifferent types of cholesterol in a random blood sugar test***

* High-density lipoprotein (HDL), Low-density lipoprotein (LDL), triglyceride (Tri.g)

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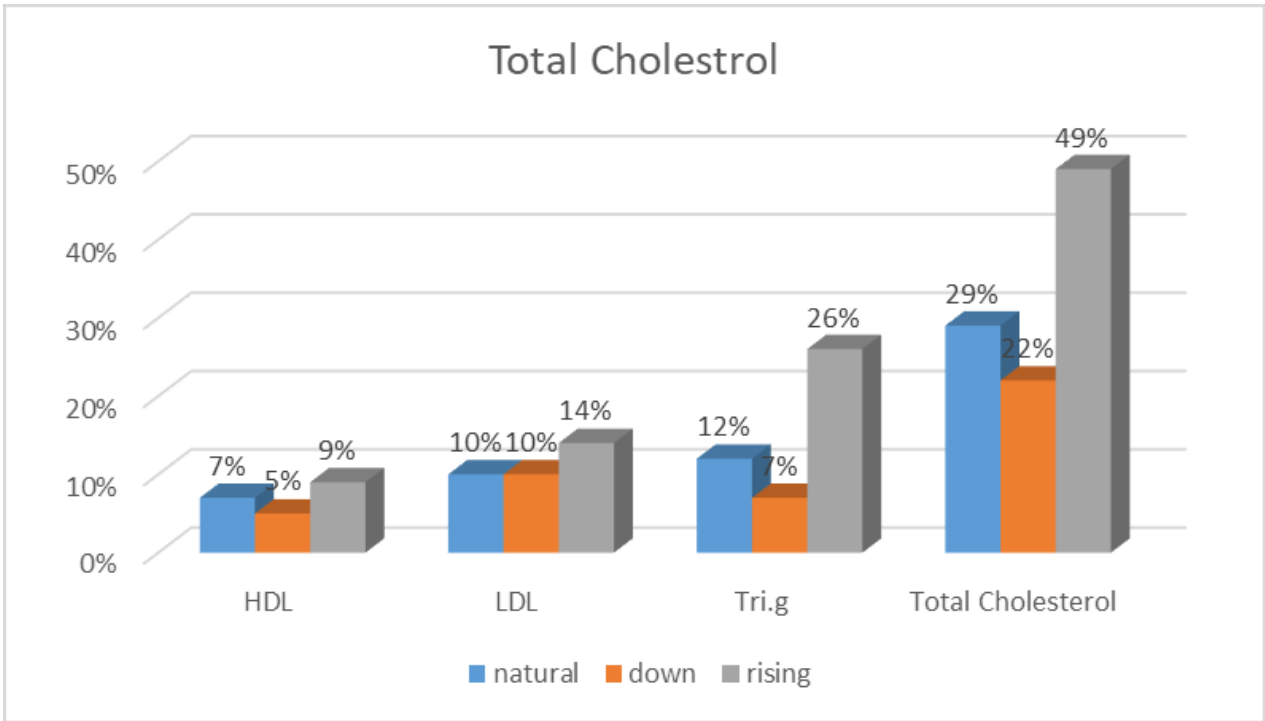


**Figure 3.** ***Different types of cholesterol in a random blood sugar test***

To study the relationship between sugar and cholesterol levels in a random blood sugar test, the result was (rising, natural, down) for RBS 287 (82%) , 42 (12%) , 21 (6%), while ( rising , natural, down) for Total Cholesterol was 172 (49%) , 102 (29 %) ,77 (22%) , respectively . as in Table (5) and Figure (4)

| Cholesterol | Natural | Down | Rising |
|---|---|---|---|
| RBS | 42 (12%) | 21 (6%) | 287 (82%) |
| Total Cholesterol | 102 (29 %) | 77 (22%) | 172 (49%) |

**Table 5.** ***Relationship between sugar and cholesterol levels in a random blood sugar test***

* RBS. random blood sugar

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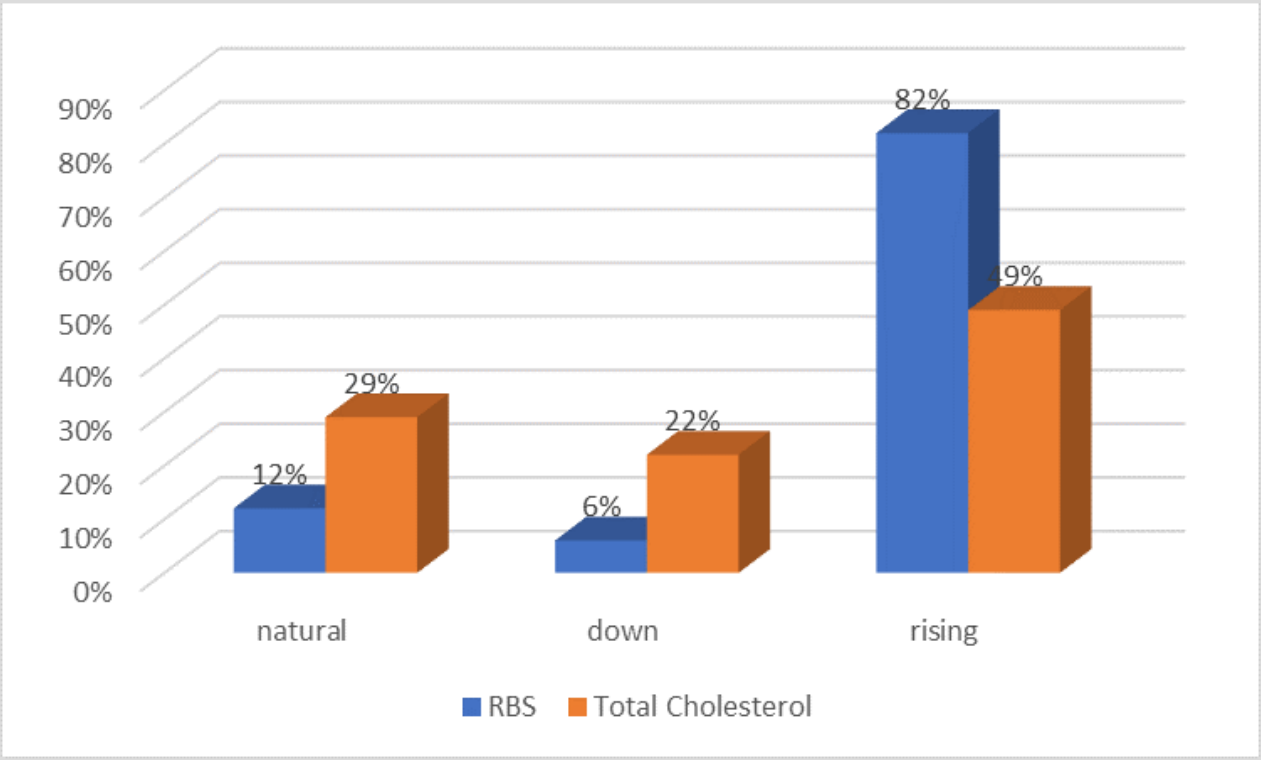


**Figure 4.** ***Relationship between sugar and cholesterol levels in a random blood sugar test***

## B. Discussion

The current study included 350 people who were randomly selected. Some of them had diabetes, others had high cholesterol, and some of them were healthy. It was shown from the results of the study that diabetes levels varied according to age groups, and the highest group with diabetes was those over 60 years old. It included males and females in similar proportions. There was no clear significant difference. The high incidence of diabetes in all age groups and for both sexes is due to non-adherence to the diet or lack of good health for the person, so he is vulnerable to the disease. This not agree with what was stated in a study Apoorva *etal*., as the highest rates of DM T1 were in diabetic patients. From the age of (0-14) years, and no differences appeared between the sexes. As for people between the ages of (41-60) years, it was found that the incidence of infection in males shows somewhat equal rates between males and females, as the reason for the high incidence is the hormonal effect, with peripheral insulin resistance being higher among females in youth and adults [10].

This study agrees with Wandell etal., regarding age from 40 years and above fewer studies were found, and with a much lower number of subjects with type 1 diabetes. Incidence rates in children 0–14 years of age show no gender differences, but in subjects aged 15–39 years a male preponderance up to twofold is found [11].

Younger and middle-aged, according to a study (Faselis et al., 2020) that T1DM is one of the most common chronic diseases with a rate of no less than 10%. However, it is considered one of the diseases that threatens health and puts life at risk and results in It has consequences on the physical and emotional development of the child and adolescent, as the average total reported by children and adolescents reached (82.17 ± 12.65), statistically significant for ($P < 0.001$) [12].

In this research we notice, the relationship between sugar levels and different types of cholesterol was in a random blood sugar test [13], and the results were total cholesterol172 (49%) in rising level, in which (49%) LDL, (22%) HDL, (76%), and triglyceride (47%), [14]

A cholesterol study (in the general internal medicine clinic at a community hospital) showed that total and HDL cholesterol levels were measured e in each patient, statistically significant but not clinically significant differences in the results total cholesterol [15]. HDL cholesterol levels were lower than LDL levels, and triglyceride. However, we notice an increase in rising 172 (49%) cholesterol, as for natural cholesterol 102 (29 %), down cholesterol 77 (22%)

High levels of blood sugar are associated with many health complications, including insulin resistance, diabetes, and cholesterol issues [16]. Chronic high blood sugar levels can also lead to a condition known as insulin resistance, which occurs when cells become unresponsive to insulin secretion and prevent the body from using

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glucose for energy. This condition is a precursor for diabetes; however, it's also been found to affect cholesterol levels, and can lower HDL cholesterol and increase LDL cholesterol levels [17].

# Conclusion

One study is frequently cited as proving the effects of sugar on cholesterol levels. Researchers found that sugar consumption raised several markers for cardiovascular disease. They determined that people who consumed more added sugars had lower "good" cholesterol, or high-density lipoprotein (HDL). HDL actually works to take up extra "bad" cholesterol, or low-density lipoprotein (LDL), and transport it to the liver. So, HDL levels should be high in the healthy people. They also found that these people had higher levels of triglycerides. Either one of these factors can increase your risks of heart disease.

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