# Lipid Profile in Patients of Type 2 Diabetes Mellitus with and Without Hypertension at Rehman Medical Institute Peshawar

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## ARTICLE INFO

## ABSTRACT

**Introduction:** Type 2 diabetes Patients often causes dyslipidemia, which is marked by high triglycerides, low HDL cholesterol, and dense LDL particles. High triglycerides, free fatty acids, and HDL cholesterol promote dyslipidemia-related cardiovascular problems. **Objectives:** To determine the prevalence and relation of dyslipidemia with Type 2 diabetes Patients mellitus in patients with or without hypertension. **Materials & Methods:** This 400-person cross-sectional study was done at Rehman Medical Institute from December 2023 to June 2024. The study included both men and women with type 2 diabetes Patients for more than five years and aged 40 or older. Data were analyzed with SPSS v20. Categorical variables were calculated using frequencies and percentages, whereas quantitative variables were represented by mean and standard deviation. The difference between and within groups was assessed using an independent samples t-test. P-value less than 0.05 was statistically significant. **Results:** Among 400 patients, 240 were female and 160 males. Most patients, 140, were 51-60 years old, 35% of the total. The second biggest number of patients was 41-50 years old, while the fewest were 71-80 years old. The patients had an average age of 50.95 ±5.86. The cases had average cholesterol, triglycerides, and LDL values of 210.90, 308.05, and 116.04 mg/dL. The controls had average values of 159.08, 153.99, and 96.01 mg/dL. The serum cholesterol, triglyceride, and LDL levels were statistically significant (p < 0.05). **Conclusion:** Hyperlipidaemia is common in patients with type 2 diabetes Patients and hypertension. We identified significant differences in cholesterol, triglyceride, LDL, and HDL levels between the two groups. HDL differences were not significant.

## INTRODUCTION

Diabetes mellitus is a collection of several illnesses characterized by persistent high blood sugar levels and alterations in the metabolism of carbohydrates, lipids, and proteins due to inadequate secretion of insulin, impaired insulin function, or both. [1] Diabetes mellitus is characterized by a range of metabolic abnormalities that prevent the body from effectively regulating blood glucose levels. This occurs when the body either fails to produce enough insulin or is unable to utilize it properly, leading to elevated blood glucose levels and various systemic complications. [2] The primary factors contributing to the development of type-2 diabetes mellitus are obesity in individuals over the age of 40, a family history of diabetes, a history of prenatal diabetes, poor glucose metabolism, physical inactivity, and certain racial and ethnic backgrounds. [3] Glucose poisoning and lipotoxicity caused by dietary lipids are other variables that decrease islet function.. [4]

Diabetes mellitus affects 7% of the U.S. population, with an estimated 6.2 million people remaining undiagnosed. Recent research indicates that the prevalence of diabetes in Pakistan exceeds 14%. According to the National Diabetes Survey of Pakistan (NDSP) report from 2016-2017, diabetes is more common among females than males in the country. [5][6] Diabetes mellitus type 2 is the leading cause of mortality in the United States. Half of the adult patients with diabetes mellitus commonly experience hypertension and hypercholesterolemia, which increases the likelihood of developing issues in several organs of the body. [7]

Diabetes can be classified into two distinct forms. One is classified as type 1, while the other is classified as type 2. Type-1 diabetes, which constitutes less than 10% of all instances of diabetes mellitus, is characterized by a significant lack of insulin. As a result, individuals with this condition must administer insulin injections to regulate their blood glucose levels. [8] Insulin resistance is a

prominent feature of type-2 diabetes mellitus, affecting 60-80% of patients. It is most commonly observed in genetically predisposed and overweight individuals. Hyperinsulinaemia can also result in several cardiovascular conditions including coronary artery disorders and atherosclerosis. [9]

Dyslipidemia is characterized by the build-up of triglycerides and free fatty acids, along with a reduction in HDL cholesterol levels and their associated functions. LDL cholesterol levels may range from normal to slightly increased as a result of the accumulation of small, dense LDL particles. According to diabetes dyslipidemia, there is an increase in apolipoprotein B. Hepatic overproduction of VLDL lipoprotein, which contains apoB, causes an increase in apo lipoprotein levels. [10] Obesity is the primary contributor to cardiovascular problems. Elevated levels of free fatty acids in the liver, when glycogen stores are adequate, promote the synthesis of triglycerides. The synthesis of triglycerides naturally triggers the secretion of apolipoprotein B and the generation of very low-density lipoprotein cholesterol (VLDL). [11] The fundamental factor responsible for atherogenic dyslipidemia is the accumulation of free fatty acids from fat cells in the bloodstream, which is associated with insulin resistance. Insulin resistance in fat cells is thought to result in the accumulation of free fatty acids and elevation in the synthesis of hepatic VLDL cholesterol. In addition, there is an accumulation of hepatic fat. As a consequence of elevated VLDL and triglyceride levels, HDL levels decreased, while the concentration of tiny dense LDL increased. [12] Type 2 diabetes Patients is characterized by elevated triglyceride and reduced HDL levels. Nevertheless, it is imperative to examine the triglyceride concentration following a period of fasting. [13]

Diabetes can lead to acute and chronic complications. The acute consequences of diabetes mellitus mostly include diabetic ketoacidosis and hypoglycemia. [14] Diabetic retinopathy is a long-term consequence of diabetes. Diabetic neuropathy, coronary artery disease, myocardial infarction, congestive heart failure, and cerebrovascular accident (CVA). [15]

Studies have revealed that diabetics with continuous hyperglycemia develop fat and hypertension. The environment and diet also affect diabetes outcomes. These include anomalies in serum cholesterol and other lipids that cause cardiovascular events in patients with diabetes. Therefore, this study investigated whether dyslipidemia causes hypertension in patients with diabetes.

## MATERIALS AND METHOD

This 400-person cross-sectional study was conducted at Rehman Medical Institute from December 2023 to June 2024. Male and female patients with type 2 diabetes Patients aged > 40 years with a 5-year disease duration were included in the study. Patients with lipid-changing disease, nephritic syndrome, hepatobiliary disease, and hypothyroidism were excluded. Individuals with mental disabilities who used alcohol, contraceptives, lipid-lowering medicines, diuretics, or beta-blockers were excluded from the study.

**Data Collection Procedure**

The ethics review board of Rehman Medical Institute approved self-structured questionnaires for data collection. Each participant was informed of the study's goal and technique and promised that their information would be kept confidential and used exclusively for study purposes with informed consent. Outside RMI patients who were registered as eligible. Entering patient data on performance after a comprehensive history and clinical assessment. The questionnaire is two-part. Patient demographics included questions on diabetes, hypertension, and lipid profile.

**Sample Collection Procedure**

After a 12-to-14-hour overnight fast, admitted patients should have 3-5 ml of blood drawn in the morning, placed in lithium heparin vials, and centrifuged at 100 rpm for five minutes. The supernatant was split into analytical containers. The samples were evaluated within 72 hours. Ferric perchlorate total plasma cholesterol levels After precipitating LDL-cholesterol with phosphtungstate and magnesium, HDL cholesterol levels were measured. Enzymatic calorimetric triglyceride. The formula for measuring LDL cholesterol is as follows:

LDL cholesterol = Total cholesterol – HDL cholesterol – Triglyceride/5. [16]

**Statistical Analysis**

Data were entered and analyzed using SPSS v20. Categorical variables are expressed as frequencies and percentages, while quantitative variables are expressed as mean and standard deviation. The independent sample T-test was used to measure group differences. Statistical significance was set at $p \leq 0.05$.

## RESULTS

This study included a total of 400 patients. The study included 160 male and 240 female patients.

**Figure 1**
*Gender-wise Distribution of Participants*
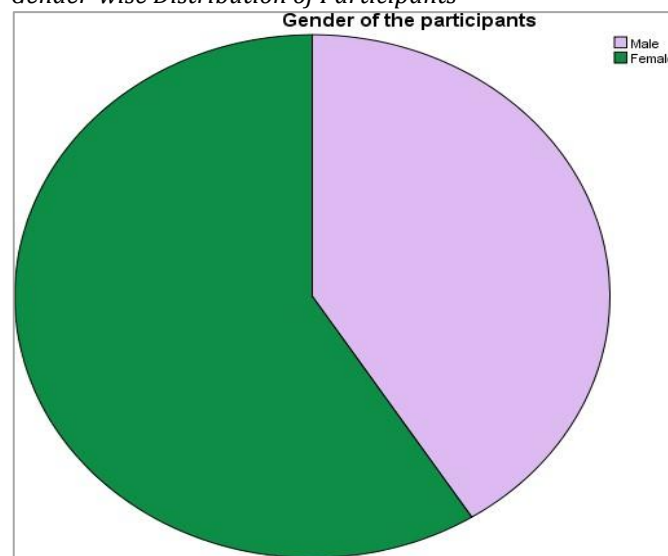


**Table 1**
*Demographic Data*

| S. No | Age (Years) | Frequency (n) (%) | Gender (n) | Mean Age (Years) |
|-------|-------------|-------------------|------------|------------------|
| 1. | 41-50 | 135 (33.75) | Male = 160 (40%) | 50..95 ±5.86 |
| 2. | 51-60 | 140 (35) | Female = 240 (60%) | |

| | | |
|---|---|---|
| 3. | 61-70 | 106 (26.5) |
| 4. | 71-80 | 19 (4.75) |

Table 1 displays the distribution of patients according to age and sex. Most of our patients were within the age range of 51-60 years. The average age of the patients was 50.95±5.86 years.

**Table 2**

*Mean comparison of lipid profiles in cases and controls.*

**Group Statistics**

| Patient's Demographics | | Number of Participants | Mean | Std. Deviation | *p*-value |
|---|---|---|---|---|---|
| Serum Cholesterol level of the participants | With Hypertension | 200 | 210.90 | ± 101.64 | <0.001 |
| | Without Hypertension | 200 | 159.08 | ± 32.14 | |
| The triglyceride level of the participants | With Hypertension | 200 | 308.05 | ± 166.11 | <0.001 |
| | Without Hypertension | 200 | 153.99 | ± 60.12 | |
| HDL (high-density lipoprotein) level of the participants | With Hypertension | 200 | 40.68 | ± 5.01 | 0.093 |
| | Without Hypertension | 200 | 44.23 | ± 7.41 | |
| LDL (low-density lipoprotein) level of the participants | With Hypertension | 200 | 116.04 | ± 82.25 | <0.002 |
| | Without Hypertension | 200 | 96.01 | ± 26.19 | |

In the table, our study showed serum cholesterol, triglycerides, HDL, and LDL levels with hypertension and without hypertension along with their means, SD, and statistical significance. Cases were defined as those with Type2DM with hypertension, while controls were defined as those with type type2DM without hypertension. The average blood cholesterol, triglycerides, and low-density lipoprotein (LDL) levels in the cases were 210.90 mg/dL, 308.05 mg/dL, and 116.04 mg/dL, respectively. In the controls, the average levels were 159.08 mg/dL, 153.99 mg/dL, and 96.01 mg/dL, respectively. The serum levels of cholesterol, triglycerides, and LDL were shown to be statistically significant (with a p-value less than 0.05).

**Table 3**

*Diabetes mellitus type 2 patients with hypertension and without hypertension*

| Diabetes mellitus type 2 patients with hypertension | | | |
|---|---|---|---|
| **Diastolic** | **Frequency (%)** | **Mean** | **SD** |
| 90-95 | 104 (52%) | | |
| 96-100 | 88 (44%) | 97.01 | 3.07 |
| > 100 | 8 (4%) | | |
| **Diabetes mellitus type 2 patients with hypertension** | | | |
| **Systolic** | **Frequency (%)** | **Mean** | **SD** |
| 145-150 | 54 (27%) | | |
| 151-155 | 74 (37%) | | |
| 156-160 | 37 (18.5%) | 156.03 | 6.02 |
| 161-165 | 34 (17%) | | |
| 166-170 | 1 (0.5%) | | |
| **Diabetes mellitus type 2 patients without hypertension** | | | |
| **Diastolic** | **Frequency (%)** | **Mean** | **SD** |
| 71-75 | 98 (49%) | | |
| 76-80 | 82 (41%) | 73 | 3.42 |
| 86-90 | 20 (10%) | | |
| 91-95 | 0 (0) | | |
| **Diabetes mellitus type 2 patients without hypertension** | | | |
| **Systolic** | **Frequency (%)** | **Mean** | **SD** |
| 100-110 | 12 (6%) | | |
| 111-120 | 78 (39%) | 123.03 | 6.96 |
| 121-130 | 88 (44%) | | |
| > 130 | 22 (11%) | | |

In this table Type2DM patients with systolic BP mean and SD were 97.01 and 3.07, respectively, while Type2DM patients with diastolic BP mean and SD were 156.03 and 6.02, respectively.

## DISCUSSION

Our study aimed to analyze and compare the variations in serum lipid levels between patients with diabetes with and without hypertension. The majority of patients in our study fell within the age range of 40–70 years. The majority of study participants were female, accounting for 60% of the total. This proportion is consistent with the findings of the National Diabetes Survey of Pakistan (NDSP) report from 2016-2017. [5]

Dyslipidaemia, a potent indicator of cardiovascular risk, induces endothelial injury and hypertension. Conversely, individuals with heart failure (HF) often have additional health conditions such as hypertension, diabetes, obesity, hyperlipidemia, and metabolic syndrome, which can adversely affect their clinical results. [17] Various cross-sectional studies have proposed a connection between abnormal lipid levels and hypertension. These studies examined the correlation between plasma lipids and the onset of hypertension and discovered a link between plasma lipids and the development of hypertension in susceptible individuals. [18] Johnson et al. reported that approximately 46.36% of individuals with diabetes had both dyslipidemia and hypertension.. [19] Our investigation revealed that the average serum cholesterol levels in the cases were higher than those in the control group. This finding is consistent with that of a Chinese study conducted by Ni et al., who also observed high cholesterol levels in diabetic patients with hypertension in the Chinese community. [20]

According to our research, the average level of triglycerides in the blood serum was higher in diabetic patients with hypertension than in diabetic patients without hypertension. Analysis of the data revealed a strong correlation between high triglyceride levels and high blood pressure in individuals with diabetes. Arshad et al. found that patients with diabetes in the northern region of Pakistan who had elevated levels of serum triglycerides had inadequate control of their blood pressure. . [21] The findings of our study align with those of Balint et al., who observed a notable reduction in HDL levels among hypertensive patients compared to healthy individuals. However, they also concluded that there was no substantial disparity in HDL levels within each group. [22]

The average LDL level in the cases was greater than that in the control samples, and this difference was statistically significant. There was a substantial disparity in LDL levels between patients in the case and control groups. The results of our investigation were similar to those of a study conducted by Alam et al., who observed a significantly elevated LDL level in diabetic individuals with hypertension. [23] Nevertheless, Gordon et al. discovered that diabetic individuals with hypertension had elevated blood LDL levels compared to non-diabetic hypertensive control subjects. However, this difference was not statistically significant, indicating that their study contradicts the findings of our investigation.. [24] The findings of our study align with those of Balint et al., who

observed a notable reduction in HDL levels among hypertensive patients compared with healthy individuals. However, they also concluded that there was no substantial disparity in HDL levels within each group. [22]

## CONCLUSION

Our study determined a notable disparity in the levels of blood cholesterol, triglycerides, LDL, and HDL between the two groups. The differences in serum cholesterol, triglycerides, and LDL levels were statistically significant, whereas the difference in HDL levels was not statistically significant. There was a high occurrence of dyslipidemia among patients with both diabetes mellitus and

hypertension in our population. It can be stated that dyslipidemia is a potential risk factor for the development of hypertension in individuals with diabetes.

## Limitations

Our study is the only investigation carried out in this area to establish a correlation between diabetes and dyslipidemia in patients with and without hypertension. Nevertheless, our study has many limitations, including our inability to establish a definitive association between dyslipidemia and the development of hypertension in vulnerable patients, due to the constraints imposed by our small sample size.

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