

Retrospective Analysis of Dyslipidemia in Type 2 Diabetes Mellitus Patients with Hypertension in Lahore, Pakistan

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Author's Contribution

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A B S T R A C T

Background: Type 2 Diabetes Mellitus (T2DM) is a common health problem in the world. According to the Global Diabetes League report, the number of individuals affected with diabetes was 416 million in 2015, projected to increase to 650 million by 2045. Hypertension is a major cause of heart disease and mortality, often accompanied by risk factors such as dyslipidemia, contributing to atherosclerosis in hypertensive individuals.

Objectives: The objective of this work was to investigate the pattern of lipid profiles and associated risk factors in local patients with both T2DM and hypertension.

Methodology: A comparative and analytical study was conducted on the 230 samples of males and females aged between 30 and 65 years, diagnosed with T2DM and hypertension. The work was done in the biochemistry section of Lahore University of Biological & Applied Sciences (UBAS), from October 2022 to April 2023. Participants meeting the inclusion criteria were selected, and their blood samples and medical histories were obtained with their informed consent. Blood samples were analyzed, and data analysis was performed using SPSS 22.

Results: The study findings showed that Type 2 diabetes mellitus was more prevalent in males (54%) compared to females (46%), with average age of 49.64 years. The mean HbA1c level was 8.06, while the average cholesterol level (in mg/dL) was approximately 209.91, and the average triglyceride (TG) level (in mg/dL) was around 213.89 in diabetic patient's p-value < 0.0001.

Conclusion: Diabetic dyslipidemia significantly contributes to morbidity. The duration of diabetes is concerned with a higher frequency of dyslipidemia, believed to be a significant risk factor for heart disease. In this study, elevated levels of total serum cholesterol, LDL-C, and low levels of HDL-C were observed. We recommend regular lipid profile examinations for patients and emphasize the importance of effective management of glucose and lipid levels in case of abnormalities.

Key words: Type 2 Diabetes Mellitus, hypertension, dyslipidemia, cardiovascular disease, HbA1c.

Introduction

Type 2 Diabetes mellitus (T2DM) is a central clinical problem around the globe. Survey done by an international federation of diabetes shows that the 387 million individuals are suffering with type 2 diabetes and the estimated count can cross to 592 million in 2035.¹ Diabetes account for 5% of all deaths globally every year.² For all intents and purposes 27% of Pakistanis developed 40 years or above have a coronary sickness.³ Patients having type 2 diabetes show an atherogenic lipid

profile, which significantly builds their chance of heart disease differed and individuals without diabetes. As per Worldwide Diabetes Association report, 415 million individuals in 2015 experienced diabetes and its consistency are reviewed to reach 642 million by 2040.⁴ One of the foremost serious medical conditions in the world, diabetes mellitus (DM) seriously impacts both the quality and longevity of life and leads to death.⁵

In diabetic individuals HbA1C is a reasonable parameter of long-term blood glucose control (an impression of glucose

management over the most recent three months) and is the highest quality level of glycemic control. Expanded HbA1C has been utilized as a prominent factor for diabetic patients with cardiovascular issues.⁶ To forestall the microvascular and macro vascular intricacies related with diabetes, it is crucial to concentrate on the two viewpoints due to a cozy connection between glycemic control and lipid profiles.⁷ LDL cholesterol is now a key component in controlling lipid profiles in patients with PC-guided plan factors for heart disease, such as diabetes, who should have serious LDL-C control less than 70 mg/dL, ever since the European Society of Cardiology proposed handling dyslipidemia.⁸

This indicates the important impact lipid profiles play in cardiovascular risk and the onset of diabetes. The lipid profiles (LDL-C, absolute cholesterol (TC), TG), lipid extents (TG/HDL, LDL/HDL), and HbA1c levels of patients with diabetes mellitus were significantly higher than those of people without the condition.⁹ These lipid parameters act as initial biochemical markers for glycemic record control in patients with type 2 diabetes mellitus in order to assess the relation among lipid profile and lipid percentage.¹⁰ Diabetic dyslipidemia is closely linked to glycemic management and is manifested by increase plasma levels of fatty substances (TG) and low-density lipoprotein, but low levels of high-density lipoprotein. The essential drivers are proinflammatory adipokines and cytokines from delayed fat tissue and amplified free unsaturated fat becoming discretionary to insulin resistance.¹¹ However, a number of research point to a prominent role for dyslipidemia in the development of type 2 diabetes. Although earlier studies focused on achieving good glycemic control with antihyperglycemic medication and showed that HbA1C can be used as a vital biomarker for observing serum lipid status in DM2 patients.¹² Despite the fact that multiple studies have linked lipid profiles to glycemic management in individuals with type 2 diabetes, the results are highly inconclusive.¹³

A few combinations of unusual lipid borders have been observed, but diabetic dyslipidemia is best described by the combination of elevated fatty substances, low high-density lipoprotein, apo-B, and three barely thick low-density lipoprotein particles.¹⁴ Different instances, including elevated TG and low HDL-C as well as a significant amount of quantitative dyslipidemia, especially with the aggregate and LDL cholesterol, have been observed in Kuwait and Nairobi separately. Lipid oddities in patients with diabetes named T-Chol), high TG, low HDL, and LDL particles are typical signs of diabetic dyslipidemia. Levels of LDL may be unobtrusively extended or average.¹⁵ There are frequently inappropriate lipids in persons with T2DM and prediabetes; nevertheless, the case of the several lipids may differ depending on ethnic social

gatherings, financial circumstances, and access to healthcare services.¹⁶

The rationale of this work was to observe the lipid profile pattern and its associated risk factors in type 2 diabetic and hypertensive patients in the local population. This study also emphasized on prevalence of dyslipidemia and assessed the impact of dyslipidemia on glycemic control in type 2 diabetes mellitus patients with co-existing hypertension.

Materials and Methods

A cross-sectional study was performed in biochemistry and hematology laboratory of Medical Laboratory Technology department, University of Biological and Applied Sciences. Total of 230 samples were added in the study after meeting the inclusion and exclusion parameters. The age range for controls and patients was 30-65 years including both males and females. Type 2 diabetes patients having any cardiac, kidney, liver and lipid metabolic disorder were excluded from the study. The study was approved by the Ethical board of University of Biological and Applied Sciences.

Estimation of TG, HDL, LDL, Cholesterol, and HbA1C

Blood samples (fasting) were collected from study group and CHO, TG, HDL, VLDL, LDL and HbA1C levels were estimated. Venous blood was collected using standard venous puncture technique. For lipid profile and blood glucose, samples were collected in plain tube without any anticoagulant and serum was obtained whereas, for HbA1C estimation fresh sample was taken into EDTA vials. Lipid profile was performed using Microlab 300 analyzer. A fully automatic protein analyzer PA120 was used to for HbA1C estimation. Non-parametric tests were applied using Version 21 of SPSS for the statistical evaluation. The mean as well as the standard deviation (SD) were used to express the continuous normal variables. The independent t-test was applied for the statistical analysis. P-value ≤ 0.05 was considered as statistically significant.

Results

Total of 230 individuals were included in this project, consisting of 54% males and 46% females with a mean age of 49.64 years. These findings showed that Type 2 diabetes mellitus was more prevalent in males as compared to females. Two study groups were included, one comprising of diabetic hypertensive patients defined as cases whereas, other include non-diabetic hypertensive participants defined as controls. The average HbA1c level in target group was 8.06. And in non-diabetic group HbA1c level was 4.7 (Figure 1). The comparative analysis of both groups depicted a significant difference i.e p value was 0.001 (Table 1).

The average cholesterol level in diabetic group was 202.91 mg/dL and significantly higher as compared to non-diabetic group having cholesterol level of 152.5 mg/dL (Table 1, Figure 2A). The average triglyceride level in cases was 213.89mg/dL whereas non-diabetic group mean TG level was 148.7mg/dL (Figure 2B). Triglyceride levels were markedly high in the diabetic and hypertensive group (p-value = 0.001) contrasted to non-diabetic hypertensive group (Table 1).

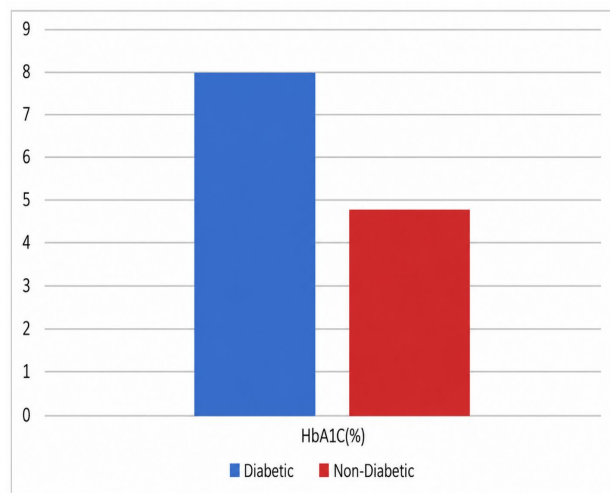


Figure 1: Percentage of HbA1C levels in diabetic cases and non-diabetic control group.

The HDL and LDL cholesterol levels in controls were 38.74mg/dL and 103.18mg/dL whereas 43.15 mg/dL and 86.5 mg/dL were reported in cases respectively (Figure 2C, D). HDL cholesterol levels were markedly low in diabetic hypertensive group of cases in contrast to the non-diabetic hypertensive control group (0.007) (Table 1). The average exceptionally low-density lipoprotein (VLDL) cholesterol level in patients and control group was 41.16mg/dL and 41.1 mg/dL respectively. The statistically significant p-value (0.056) suggested that in the present study, the lipid profiles of diabetic and hypertensive patients differ significantly from the non-diabetic hypertensive control group. Precisely, higher CHO and TG levels and lower HDL levels were observed in the diabetic and hypertensive group (Table 1).

Study Parameters	Diabetic hypertensive N=150 Mean ± SD	Non-Diabetic hypertensive N=80 Mean ± SD	P value*
Cho	202.91± 48	152.5± 37	0.0001
TG	213.89± 73	148.7±28.8	0.0001
HDL	38.35± 3.0	43.15± 3.0	0.007
VLDL	39.9± 13.6	41.1± 25.4	0.056

LDL	111.3± 41.8	86.6± 37.5	0.004
HbA1C	8.06±1.3	4.7±0.9	0.001

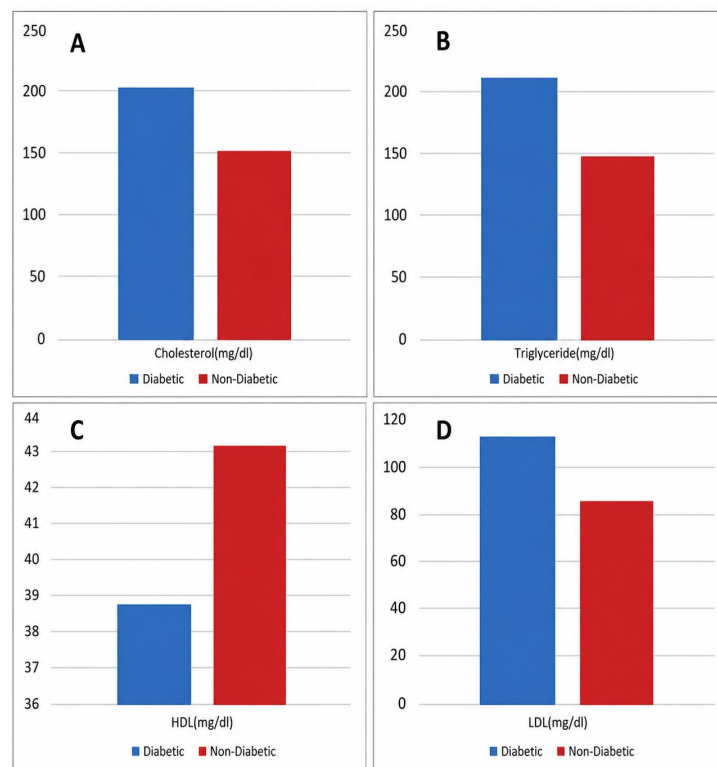


Figure 2: A) Levels of cholesterol, (B) triglycerides, (C) HDL and (D) LDL in Diabetic and non-diabetic study population.

*P value >0.05 was considered significant.

Discussion

In this study type-II diabetes mellitus was more prevalent in Males (54%) as compared to females (46%) and mean age was 49.64. The average HbA1c level in the target group was 8.06. The average cholesterol level and triglyceride levels were approximately 202.91mg/dL and 213.89mg/dL respectively. The average HDL cholesterol level was roughly 38.35mg/dL. The average LDL cholesterol level was approximately 111.3mg/dL. The low-density lipoprotein (VLDL) cholesterol was roughly 39.9 mg/dL.

A studied indicated a statistically insignificant P-value ($P > 0.05$), the average TC, TG, VLDL-C, HDL-C, and LDL-C concentrations, along with the TG/HDL and LDL/HDL ratios, were greater in type 2 diabetes and hypertensive type 2 diabetic patients as compared to nondiabetic and hypertensive non-diabetic control participants. Females with hypertensive type 2 diabetes had substantially higher serum TC (7.42 1.63 mmol/L) than males with hypertension (5.761.57 mmol/L; $P > 0.05$). Except for HDL-C, in comparison to type 2 diabetic and hypertensive

type 2 diabetic males, all other lipid and lipoprotein parameters in females with type 2 DM and those with hypertension and type 2 DM were non-significantly higher ($P > 0.05$).¹⁷ In comparison to above mentioned study this our present study indicated that cholesterol and triglycerides values were higher and the average HDL cholesterol level was 38.35mg/dL and has statistically significant importance in diabetic patients.

Hypercholesterolemia was observed in 76.2% of citizens. Whereas low HDL in 82.9%, high LDL in 90.5%, and hypertriglyceridemia in 82.1% were observed. Females had more anomalies in their lipid profiles as compared to males. In both combination and isolation, high LDL-cholesterol was the most frequent dyslipidemia (91.5%). More than 90% of type 2 diabetes patients had one or more kinds of dyslipidemia. The most frequent dyslipidemia in our study was high LDL cholesterol and high levels of triglycerides.¹⁸ Our present study concluded that almost all diabetic and hypertensive patients had Hypercholesterolemia and hypertriglyceridemia in both males and females and a significant relationship was observed.

A study investigated that HbA1C was the greatest marker of diabetic maintenance, there were few significant among glucose regulation and lipid levels. Evaluation the levels of fasting sugar level and lipid levels was performed and the relationship between FPG control and lipid profiles was demonstrated in order to guide the treatment of Type 2 diabetes (T2D). In this 5822-member cross-sectional survey FPG, TG, TC, LDL-C, VLDL-C, and HDL-L all fell within the metabolic control range of 27.4%, 73.11%, 28.11%, 64.21%, and 44.81%, respectively. The odds ratios (ORs) and 95% confidence intervals (CIs) for TG, TC, LDL-C, and HDL-C were 0.988 (0.934, 1.045), 0.863 (0.824, 0.904), 0.988 (0.921, 1.061), and 2.171 (1.760, 2.682), respectively. After considering the majority of elements, TG and LDL-C were not significantly raised, regardless the fact that TC and HDL-C were clearly significantly greater. FPG usually demonstrated significant associations with HDL and TC but not with LDL or TG. So, this shows strong relation among diabetes and dyslipidemia. The findings of our study showed that the mean HbA1c level was 8.06, while the average cholesterol level (in mg/dL) was approximately 209.91, and the average triglyceride (TG) level (in mg/dL) was around 213.89 in diabetic patient's p-value < 0.0001.

A study concluded that 42.4% of the 12255 subjects were females and 57.6% were males. There was dyslipidemia in 10230 (83.4%) of the individuals overall. Hypercholesterolemia, hypertriglyceridemia, dyslipidemia, high LDL, and low HDL were strongly linked with obesity, while hypercholesterolemia, hypertriglyceridemia, and other kinds of dyslipidemia were significantly connected with diabetes.¹⁹ The findings of the present study showed that Type 2 diabetes mellitus was more

prevalent in males (54%) compared to females (46%), with a mean age of 49.64 years. The mean HbA1c level was 8.06, while the average cholesterol level (in mg/dL) was approximately 209.91, and the average triglyceride (TG) level (in mg/dL) was around 213.89 in diabetic patient's p-value < 0.000s.

A study indicated that Only 21% of 100 Type 2 DM patients had good glycemic control, whereas 61% had dyslipidemia with greater Total Cholesterol (203.25), higher Triglycerides (167.25), and lower HDL-C (38.55) mg/dl, where p-value 0.001 is incredibly significant. HbA1C has a substantial positive connection with total cholesterol and triglycerides but a negative correlation with HDL.²⁰

Another study conducted based on patients' blood HbA1c readings, 135 individuals with type 2 diabetes mellitus were divided into two categories: those with excellent glucose control (Group I) and poor glucose control (Group II). Elevated serum triglyceride (191.45 mg/dl), total cholesterol (176.3 mg/dl), and LDL-cholesterol (108. mg/dl) levels observed in Group II. Both HbA1c and dyslipidemia, specifically serum TG ($r = 0.27$, $P0.05$), and HbA1c and total cholesterol ($r = 0.311$, $P0.05$), indicated significant associations.²¹ Our findings showed average cholesterol level (in mg/dL) was approximately 209.91, and the average triglyceride (TG) level (in mg/dL) was around 213.89 in diabetic patient's p-value < 0.0001.

Conclusion

Diabetic dyslipidemia significantly contributes to morbidity. The duration of diabetes is concerned with a higher frequency of dyslipidemia, believed to be a significant risk factor for heart disease. In this study, elevated levels of total serum cholesterol, LDL-C, and low levels of HDL-C were observed. We recommend regular lipid profile examinations for patients and emphasize the importance of effective management of glucose and lipid levels in case of abnormalities.

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