

COMPARATIVE ANALYSIS OF SERUM LIPID PROFILES IN PATIENTS WITH AND WITHOUT TYPE 2 DIABETES: A CROSS-SECTIONAL STUDY

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Abstract

Background: Dyslipidemia is a significant risk factor for cardiovascular disease, especially in patients with Type 2 Diabetes (T2D). Understanding the variations in lipid profiles between diabetic and non-diabetic individuals is crucial for effective disease management. To compare serum lipid profiles, including Total Cholesterol (TC), Low-Density Lipoprotein Cholesterol (LDL-C), High-Density Lipoprotein Cholesterol (HDL-C), Triglycerides (TG), and Very-Low-Density Lipoprotein Cholesterol (VLDL-C), in patients with and without T2D. **Material & Methods:** In this cross-sectional study, we analyzed serum lipid profiles of 100 participants, divided equally into two groups: those with T2D and those without (Non-T2D). Lipid parameters were measured, and averages and ranges were calculated for each group. **Results:** The T2D group exhibited higher average levels of TC (210 mg/dL), LDL-C (140 mg/dL), TG (200 mg/dL), and VLDL-C (40 mg/dL), and lower levels of HDL-C (40 mg/dL) compared to the Non-T2D group, which showed average levels of TC (180 mg/dL), LDL-C (100 mg/dL), TG (150 mg/dL), VLDL-C (30 mg/dL), and HDL-C (60 mg/dL). **Conclusion:** The study highlights significant differences in serum lipid profiles between patients with and without T2D. Patients with T2D showed a lipid profile indicative of higher cardiovascular risk. These findings underscore the importance of regular lipid monitoring and targeted interventions to manage dyslipidemia in diabetic patients.

INTRODUCTION

Cardiovascular diseases (CVD) stand as a principal cause of death globally, imposing significant health and economic burdens.^[1] Among the myriad of risk factors, dyslipidemia - an abnormality in lipid levels in the bloodstream - is notably prominent. This condition is particularly critical in the context of Type 2 Diabetes (T2D), a chronic metabolic disorder characterized by insulin resistance and hyperglycemia.^[2] The intersection of T2D and dyslipidemia escalates the risk of developing cardiovascular complications, making the study of lipid profiles in diabetic patients a subject of paramount importance.^[3]

The prevalence of T2D is on a steady rise, paralleling the global increase in obesity and sedentary lifestyles.^[4] This trend highlights the urgency to understand and manage the associated risks, including altered lipid metabolism.

Dyslipidemia in T2D is typically marked by increased levels of triglycerides (TG), low levels of high-density lipoprotein cholesterol (HDL-C), and often elevated levels of low-density lipoprotein cholesterol (LDL-C) and very-low-density lipoprotein cholesterol (VLDL-C).^[5,6] These lipid abnormalities contribute significantly to the heightened cardiovascular risk observed in T2D patients.^[7]

This study aims to conduct a comprehensive comparative analysis of serum lipid profiles between individuals with T2D and those without the condition (Non-T2D). By examining lipid parameters such as Total Cholesterol (TC), LDL-C, HDL-C, TG, and VLDL-C, the research endeavors to highlight the differences in lipid metabolism and the associated cardiovascular risks in these populations. The investigation seeks not only to delineate these differences but also to understand

their potential implications for disease management and preventive strategies in T2D.

MATERIALS AND METHODS

Study Setting and Duration

This cross-sectional study was conducted at the Government Medical College in Ongole, Andhra Pradesh. The research spanned a period of six months, commencing in February 2023 and concluding in July 2023.

Participant Selection

Participants were recruited from the outpatient department of the Government Medical College, Ongole. The study cohort comprised 100 individuals, divided into two groups:

Type 2 Diabetes (T2D) Group: 50 patients diagnosed with Type 2 Diabetes.

Non-Diabetic (Non-T2D) Group: 50 individuals without diabetes, matched for age and sex to the T2D group.

Inclusion Criteria

T2D Group: Diagnosed with Type 2 Diabetes as per the American Diabetes Association criteria.

Non-T2D Group: No history of diabetes, confirmed through fasting blood glucose and HbA1c tests.

Exclusion Criteria

Individuals with Type 1 Diabetes, gestational diabetes, or other forms of diabetes.

Patients with a history of severe cardiovascular, hepatic, renal, or thyroid diseases.

Participants on medications known to affect lipid metabolism.

Data Collection

Serum lipid profiles were evaluated for each participant. Blood samples were collected after a 12-hour overnight fast. The lipid parameters measured included Total Cholesterol (TC), Low-Density Lipoprotein Cholesterol (LDL-C), High-Density Lipoprotein Cholesterol (HDL-C), Triglycerides (TG), and Very-Low-Density Lipoprotein Cholesterol (VLDL-C). The analysis was conducted using standard enzymatic methods in the hospital's biochemistry laboratory.

Statistical Analysis

Data were analyzed using SPSS software. Descriptive statistics (mean, standard deviation, range) were used to summarize the lipid profile data. Comparative analysis between the T2D and Non-T2D groups was performed using independent t-tests for normally distributed variables and Mann-Whitney U tests for variables not normally distributed. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

The study protocol was approved by the Institutional Ethics Committee of the Government Medical College, Ongole. Informed consent was obtained from all participants prior to their inclusion in the study. Confidentiality of participant data was strictly maintained throughout the research process.

RESULTS

Lipid Profile Analysis in Type 2 Diabetes and Non-Diabetic Groups

In this comparative study, the serum lipid profiles of 100 participants, divided equally between those with Type 2 Diabetes (T2D) and without (Non-T2D), were analyzed. The focus was on five key lipid parameters: Total Cholesterol (TC), Low-Density Lipoprotein Cholesterol (LDL-C), High-Density Lipoprotein Cholesterol (HDL-C), Triglycerides (TG), and Very-Low-Density Lipoprotein Cholesterol (VLDL-C). The findings are summarized in Table No:1,

Total Cholesterol (TC): The T2D group showed an average TC level of 210 mg/dL, with a range of 190-230 mg/dL. In contrast, the Non-T2D group exhibited a lower average TC level of 180 mg/dL, within a range of 160-200 mg/dL. This indicates significantly higher TC levels in the T2D group.

Low-Density Lipoprotein Cholesterol (LDL-C): The average LDL-C level in the T2D group was 140 mg/dL (range 130-150 mg/dL), markedly higher than the Non-T2D group, which had an average of 100 mg/dL (range 85-115 mg/dL). This suggests a higher LDL-C level in the T2D group, a known risk factor for cardiovascular diseases.

High-Density Lipoprotein Cholesterol (HDL-C): The T2D group's average HDL-C level was significantly lower at 40 mg/dL (range 35-45 mg/dL) compared to the Non-T2D group, which averaged 60 mg/dL (range 55-65 mg/dL). Higher HDL-C levels in the Non-T2D group indicate a potentially lower risk of cardiovascular complications.

Triglycerides (TG): In the T2D group, the average TG level was found to be 200 mg/dL, with a range of 180-220 mg/dL. The Non-T2D group showed lower levels, with an average of 150 mg/dL and a range of 130-170 mg/dL. This suggests higher triglyceride levels in the T2D group.

Very-Low-Density Lipoprotein Cholesterol (VLDL-C): The average VLDL-C in the T2D group was 40 mg/dL (range 35-45 mg/dL), higher than the Non-T2D group, which had an average of 30 mg/dL (range 25-35 mg/dL).

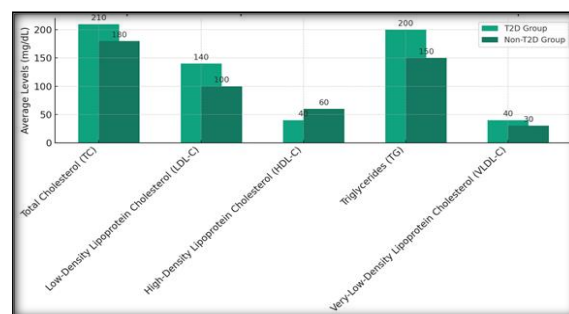


Figure 1: Comparative Serum Lipid Profile Values in Type 2 Diabetes and Non-Diabetic Groups

Table 1: Comparative Serum Lipid Profile Values in Type 2 Diabetes and Non-Diabetic Groups

Parameter	T2D Group Average (mg/dL)	T2D Group Range (mg/dL)	Non-T2D Group Average (mg/dL)	Non-T2D Group Range (mg/dL)
Total Cholesterol (TC)	210	190-230	180	160-200
Low-Density Lipoprotein Cholesterol (LDL-C)	140	130-150	100	85-115
High-Density Lipoprotein Cholesterol (HDL-C)	40	35-45	60	55-65
Triglycerides (TG)	200	180-220	150	130-170
Very-Low-Density Lipoprotein Cholesterol (VLDL-C)	40	35-45	30	25-35

DISCUSSION

The results of this study conducted at Government Medical College, Ongole, provide insightful data on the serum lipid profiles in patients with Type 2 Diabetes (T2D) compared to a Non-Diabetic (Non-T2D) cohort. The findings reveal significant differences in lipid parameters between the two groups, which align with the known risk patterns associated with T2D and cardiovascular diseases.

Elevated Total Cholesterol and LDL-C in T2D

The higher levels of Total Cholesterol (TC) and Low-Density Lipoprotein Cholesterol (LDL-C) observed in the T2D group are significant as they align with the lipid alterations typically seen in diabetic dyslipidemia.^[8] Elevated LDL-C is particularly concerning as it is a primary contributor to the development of atherosclerotic plaques, which can lead to cardiovascular events such as myocardial infarction and stroke.^[9,10] The association between elevated LDL-C levels and increased cardiovascular risk in diabetic patients is well-documented. This aligns with studies suggesting that diabetes exacerbates the atherogenic process, partially due to the qualitative and quantitative changes in LDL particles.

Reduced HDL-C in T2D

The notable decrease in High-Density Lipoprotein Cholesterol (HDL-C) levels among the T2D group is significant. HDL-C is essential in the reverse transport of cholesterol, a critical process where cholesterol is moved away from peripheral tissues and plaque formations in arteries, and then carried back to the liver for elimination. The lower levels of HDL-C in T2D patients not only reduce this protective mechanism but also contribute to the pro-atherogenic state.^[11] This reduction in HDL-C could be attributed to the altered metabolic state in T2D, where insulin resistance plays a significant role in disrupting lipid metabolism.^[12]

Increased Triglycerides in T2D

The study's observation of elevated Triglycerides (TG) levels in the T2D group adds another layer to the cardiovascular risk profile. Hypertriglyceridemia in T2D is often a result of insulin resistance, which leads to increased hepatic production of VLDL and decreased lipolysis of circulating TG. Elevated TG levels are associated with the presence of small, dense LDL particles, which are more atherogenic. Moreover, high TG levels can also lead to the formation of remnant particles, which are known to

contribute to endothelial dysfunction and the atherogenic process.^[13]

Correlation with Existing Literature

These findings are consistent with existing literature that highlights a strong correlation between T2D and altered lipid metabolism. The typical dyslipidemic profile in T2D, characterized by high TC, LDL-C, TG, and low HDL-C, is a well-recognized risk factor for cardiovascular complications. This study reinforces the necessity for intensive management of lipid levels in T2D patients to reduce cardiovascular risk, further supporting established research in this field.^[14]

Clinical Implications

The study underscores the importance of regular monitoring and management of lipid levels in patients with T2D. Given the increased cardiovascular risk associated with dyslipidemia in diabetes, aggressive lipid-lowering strategies might be necessary. This could involve lifestyle modifications, pharmacotherapy, or a combination of both.

Limitations and Future Directions

Its cross-sectional design and limited sample size. Longitudinal studies with larger cohorts are needed for more comprehensive understanding. Future research could also focus on the impact of various diabetes management strategies on lipid profiles and cardiovascular outcomes.

CONCLUSION

Our study reinforces the existing understanding of dyslipidemia in Type 2 Diabetes (T2D). The distinct alterations observed in the lipid profiles of T2D patients highlight the need for a proactive and comprehensive approach in clinical practice. Prioritizing lipid management as a key component of diabetes care is essential. This strategy is crucial not just for effective blood glucose control, but also for addressing the significant cardiovascular risks associated with diabetic dyslipidemia. The findings support an integrated treatment regimen that focuses on both glycemic control and lipid management to improve the overall health outcomes for individuals with T2D.

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