e-ISSN: 0975-1556, p-ISSN:2820-2643
Available online on www.ijpcr.com
International Journal of Pharmaceutical and Clinical Research 2024; 16(4); 1172-1176

Original Research Article

Correlation of Lipid Profile with Period of Diabetes and Hba1c Levels in Type2 Diabetes Mellitus Patients: A Descriptive Cross-Sectional Study.

S.M. Mumtazul Haque[1], Vinay Kumar[2], Rakesh Kumar[3], Usha Kumari[4]

[1]PG Student, Department of Biochemistry, B.M.I.M.S., Pawapuri, Nalanda, Bihar, India
[2]PG Student, Department of Biochemistry, B.M.I.M.S., Pawapuri, Nalanda, Bihar, India
[3]PG Student, Department of Biochemistry, B.M.I.M.S., Pawapuri, Nalanda, Bihar, India
[4]Professor, Department of Biochemistry, B.M.I.M.S., Pawapuri, Nalanda, Bihar, India

Received: 25-01-2024 / Revised: 23-02-2024 / Accepted: 25-03-2024
Corresponding Author: Usha Kumari
Conflict of interest: Nil

Abstract:

Background: Type 2 Diabetes Mellitus (T2DM) is a widespread condition that significantly impacts lipid metabolism, leading to dyslipidemia and increasing the risk of cardiovascular diseases. The correlation between the lipid profile, the period of diabetes, and HbA1c levels, which reflect long-term glycemic control, is critical for managing and preventing complications in T2DM.

Methods: The study involved 50 participants diagnosed with T2DM and aimed to analyze the association between lipid profile parameters, the period of diabetes, and HbA1c levels. Data were collected through clinical examination and blood tests, analyzed using SPSS version 20.

Results: The study found significant correlations between the period of diabetes and HbA1c levels ($r = 0.64$, $p < 0.001$). Total Cholesterol (TC) and Low-Density Lipoprotein (LDL) cholesterol showed positive correlations with both the period of diabetes and HbA1c levels, indicating worsening lipid profiles over time with poor glycemic control.

Conclusion: The study highlights a significant association between lipid profile disturbances and both the period of diabetes and HbA1c levels. This underscores the importance of monitoring these parameters closely in patients with T2DM to prevent cardiovascular complications.

Recommendations: Regular monitoring and management of lipid profiles and glycemic levels are recommended to mitigate the risks associated with prolonged dyslipidemia in T2DM patients. Future studies should focus on longitudinal assessments to better understand the impact of sustained glycemic control on lipid metabolism.

Keywords: Type 2 Diabetes Mellitus, Lipid Profile, HbA1c, Dyslipidemia, Cardiovascular Diseases.

Introduction

Type 2 Diabetes Mellitus (T2DM) is a complex global health issue, impacting numerous individuals and affecting various metabolic pathways, including lipid metabolism. A critical aspect of managing T2DM involves comprehending and monitoring the link between the lipid profile, the period of diabetes, and HbA1c levels, which reflect long-term glycemic control. This understanding is crucial because dyslipidemia, a common diabetes complication, is a significant risk factor for cardiovascular diseases. [1]

Recent studies highlight a notable association between HbA1c levels and lipid profiles. For instance, one study discovered a positive correlation between HbA1c levels and cholesterol, LDL, VLDL, and triglycerides in diabetic patients. This finding suggests that HbA1c could serve as a predictor for dyslipidemia risks and assist in complication prevention. Similarly, another study noted that diabetic patients with well-controlled HbA1c levels exhibited substantially lower cholesterol and LDL levels, indicating better lipid profiles. [2]

Moreover, the period of diabetes also plays a crucial role in lipid metabolism. As diabetes progresses, lipid metabolism becomes increasingly altered, suggesting a need for stringent monitoring and management of lipid levels to prevent cardiovascular complications [3].

Monitoring and managing lipid profiles in patients with T2DM is essential, particularly as HbA1c levels and the period of diabetes provide significant insights into the risk of dyslipidemia. This correlation aids healthcare providers in strategizing preventative measures for cardiovascular diseases, highlighting the importance of comprehensive diabetic care.

The study aimed to explore the relationship between lipid profile parameters, diabetes duration, and HbA1c levels in individuals diagnosed with Type 2 Diabetes Mellitus.

Methodology

Study Design: A descriptive cross-sectional design.

Study Setting: The study was conducted over the course of one year, from 2022 to 2023, within Bhagwan Mahavir Institute of Medical Sciences, Pawapuri, Bihar, India.

Participants: A total of 50 individuals were enrolled for the study.

Inclusion and Exclusion Criteria: The study enrolled individuals diagnosed with Type 2 Diabetes Mellitus (T2DM) who were over 40 years old and had micro- and macrovascular complications. Exclusion criteria included individuals taking statins or fibrates, oral contraceptives, steroids, those with hypothyroidism, nephrotic syndrome, chronic kidney disease, or familial hyperlipoproteinemia.

Bias: Efforts were made to minimize bias by ensuring consecutive sampling and obtaining informed consent from participants. The study was conducted following institutional ethical committee approval.

Variables: Variables of interest included lipid profile parameters, period of diabetes, and HbA1c levels.

Data Collection and Procedure: Data were gathered using a standardized questionnaire and clinical assessment. Venous blood samples were taken from participants after an overnight fast to measure fasting blood sugar and lipid profiles. Lipid profiles were evaluated according to the National Cholesterol Education Program (NCEP-ATP III) classification. Furthermore, participants underwent other blood tests including complete blood count, renal function tests, thyroid function tests, and urine analysis.

Statistical Analysis: The data were inputted into Microsoft Excel and analyzed using SPSS version 20. Categorical variables like gender, treatment type, and medical history were assessed using frequencies and percentages, supported by visualizations. For numerical variables such as age, lipid profile parameters, diabetes duration, Hb, and HbA1c levels, measures of central tendency and dispersion were employed. A p-value below 0.05 was deemed statistically significant.

Ethical Considerations: The study protocol was approved by the Ethics Committee and written informed consent was received from all the participants.

Result

Table 1: Participant Characteristics

Characteristic	Values
Mean Age (SD), years	58.5 (6.2)
Gender	
- Male	30
- Females	20

Fifty participants diagnosed with T2DM were comprised in the study. The mean age was 58.5 years (± 6.2). Among them, 60% were male and 40% were female.

Table 2: Lipid Profile Parameters

Lipid Parameter	Mean (SD)	Range
Total Cholesterol (mg/dL)	195.3 (25.6)	160 - 240
HDL Cholesterol (mg/dL)	42.8 (7.4)	35 - 55
LDL Cholesterol (mg/dL)	120.5 (15.9)	95 - 150
VLDL Cholesterol (mg/dL)	35.2 (5.8)	25 - 45
Triglycerides (mg/dL)	176.2 (28.4)	140 - 220

The mean levels of lipid profile parameters were as follows: total cholesterol (TC) 195.3 mg/dL (± 25.6), HDL cholesterol 42.8 mg/dL (± 7.4), LDL cholesterol 120.5 mg/dL (± 15.9), VLDL cholesterol 35.2 mg/dL (± 5.8), and triglycerides (TGL) 176.2 mg/dL (± 28.4).

Table 3: Clinical study

Clinical Detail	Frequency
Microvascular Complications	25
Macrovascular Complications	20
No Complications	5

The mean period of diabetes among the participants was 8.7 years (± 3.4), ranging from 5 to 15 years.The mean HbA1c level observed among the participants was 8.2% (± 1.1).

Table 4: Correlation Analysis of Lipid Profile with HbA1c Levels and Diabetes Duration

Parameter	Pearson Correlation (r)	p-value
Total Cholesterol	0.42	0.003
HDL Cholesterol	-0.15	0.254
LDL Cholesterol	0.38	0.008
VLDL Cholesterol	0.21	0.147
Triglycerides	0.31	0.034

Pearson correlation coefficients were calculated to explore the connections between lipid profile parameters, diabetes duration, and HbA1c levels. The findings indicated a significant positive correlation between diabetes duration and HbA1c levels ($r = 0.64$, $p < 0.001$), suggesting that a longer duration of diabetes was linked to elevated HbA1c levels.

Table 5: Correlation Analysis of Age, HbA1c, and Hemoglobin with Diabetes Duration

Parameter	Pearson Correlation (r)	p-value
Age	0.25	0.076
HbA1c Levels	0.64	<0.001
Hemoglobin	-0.12	0.31

Additionally, there were notable correlations found between HbA1c levels and specific lipid profile parameters: Total Cholesterol (TC) ($r = 0.42$, $p = 0.003$), LDL cholesterol ($r = 0.38$, $p = 0.008$), and triglycerides ($r = 0.31$, $p = 0.034$). However, no substantial associations were observed between HbA1c levels and HDL cholesterol ($r = -0.15$, $p = 0.254$) or VLDL cholesterol ($r = 0.21$, $p = 0.147$).
Additionally, there were significant correlations between period of diabetes and certain lipid profile parameters: TC ($r = 0.29$, $p = 0.049$) and LDL cholesterol ($r = 0.36$, $p = 0.012$), suggesting that longer period of diabetes was related with higher levels of these lipid parameters.

Discussion

The study enrolled 50 participants diagnosed with T2DM, with a mean age of 58.5 years (± 6.2). Among them, 60% were male and 40% were female. This demographic distribution reflects a relatively balanced representation of gender within the sample, although males were slightly more predominant. These participants were middle-aged to older adults, consistent with the typical age range for individuals diagnosed with T2DM.

The analysis of lipid profile parameters revealed mean levels within typical ranges for individuals with T2DM. Specifically, the mean total cholesterol was 195.3 mg/dL (± 25.6), HDL cholesterol was 42.8 mg/dL (± 7.4), LDL cholesterol was 120.5 mg/dL (± 15.9), VLDL cholesterol was 35.2 mg/dL (± 5.8), and triglycerides were 176.2 mg/dL (± 28.4). These lipid profile parameters provide insights into the metabolic health status of the participants, reflecting their cardiovascular risk profile.

Regarding clinical details, microvascular complications were observed in 25 participants, while macrovascular complications were present in 20 participants. A smaller subset of participants (5 individuals) had no documented complications. These complications include conditions such as retinopathy, neuropathy, nephropathy (microvascular), and cardiovascular disease (macrovascular). The presence of both microvascular and macrovascular complications underscores the multifaceted nature of diabetes-related complications among the study population.

The mean period of diabetes among the participants was 8.7 years (± 3.4), indicating a substantial period of living with the condition. This prolonged duration highlights the chronic nature of T2DM and the importance of long-term management strategies in mitigating associated risks. Additionally, the mean HbA1c level was 8.2% (± 1.1), indicating suboptimal glycemic control among the participants. Elevated HbA1c levels suggest a higher risk of diabetes-related complications and underscore the importance of optimizing blood sugar management.

Correlation analysis revealed significant positive relationships between diabetes duration and HbA1c levels, as well as between certain lipid profile parameters (total cholesterol, LDL cholesterol, and triglycerides) and HbA1c levels. These findings suggest that longer diabetes duration and dyslipidemia are linked to poorer glycemic control, emphasizing the importance of comprehensive management strategies addressing both blood sugar and lipid levels in individuals with T2DM.

Studies examining the correlation between lipid profiles, HbA1c levels, and diabetes duration in T2DM patients provide valuable insights into the interaction between glycemic control and lipid metabolism. Priya and Begum (2020) identified a significant positive correlation between lipid profile components such as total cholesterol, LDL, VLDL, and triglycerides with HbA1c levels, indicating that HbA1c can act as a predictor of dyslipidemia [4].

Similarly, Amer and Haridas (2017) demonstrated that HbA1c levels positively correlate with

cholesterol, triglycerides, and LDL, and negatively with HDL, supporting the use of HbA1c as a predictor for the development of diabetic complications [5]. Handayani et al. (2023) also found significant differences in lipid profiles between patients with controlled and uncontrolled glycemic levels, further underscoring the importance of glycemic control in managing lipid abnormalities [6].

Bhaskar et al. (2021) extended this understanding by correlating HbA1c not only with lipid profiles but also with C-reactive protein (CRP), suggesting that HbA1c could serve as an additional marker for assessing inflammation and dyslipidemia risk in diabetic patients [7]. The study by Begum et al. (2019) in Bangladeshi patients highlighted significant correlations between HbA1c values and the levels of cholesterol, triglycerides, and HDL-C, reinforcing the predictive value of HbA1c in lipid profile disturbances in diabetes mellitus [8].

These findings collectively emphasize the role of HbA1c in predicting dyslipidemia, suggesting that both lipid profile and glycemic control should be regularly monitored in Type 2 Diabetes Mellitus patients to mitigate the risk of complications.

Conclusion

The study elucidates the intricate relationship between lipid profile parameters, glycemic control, and the period of diabetes among individuals with T2DM. Significant correlations were observed between longer diabetes duration and higher HbA1c levels, emphasizing the imperative of sustained management strategies to uphold optimal blood sugar control. Furthermore, certain lipid profile parameters, notably total cholesterol, LDL cholesterol, and triglycerides, exhibited positive correlations with HbA1c levels, highlighting the necessity for comprehensive management approaches addressing both glycemic and lipid control to mitigate the risk of diabetes-related complications. These findings underscore the significance of early intervention and ongoing monitoring to optimize outcomes in T2DM.

Limitations: The limitations of this study include a small sample population who were included in this study. Furthermore, the lack of comparison group also poses a limitation for this study's findings.

Recommendation: Regular monitoring and management of lipid profiles and glycemic levels are recommended to mitigate the risks associated with prolonged dyslipidemia in T2DM patients. Future studies should focus on longitudinal assessments to better understand the impact of sustained glycemic control on lipid metabolism.

Acknowledgement: We are thankful to the patients; without them the study could not have been done. We are thankful to the supporting staff of our hospital who were involved in patient care of the study group.

List of Abbreviations:

T2DM: Type 2 Diabetes Mellitus

HbA1c: Glycated Hemoglobin

LDL: Low-Density Lipoprotein

VLDL: Very Low-Density Lipoprotein

NCEP-ATP III: National Cholesterol Education Program-Adult Treatment Panel III

SD: Standard Deviation

TC: Total Cholesterol

HDL: High-Density Lipoprotein

TGL: Triglycerides

CRP: C-Reactive Protein

Source of Funding: No funding received.

Conflict of Interest: The authors have no competing interests to declare.

References

1. Kumar, S. Profile of type 2 diabetes mellitus patients attending family medicine clinic in a rural tribal locality in India. Journal of Family Medicine and Primary Care. 2023.
2. Jha, A., Nigoskar, S., & Mourya, SCorrelation between hemoglobin a1c and serum lipid profile with type 2 diabetes: a cross-sectional study. International Journal of Advanced Research. 2021.
3. Khan, M., Mubeen, M., Chohan, H., Jawed, S., Jamal, A., Qamar, J., Chohan, M., Siddiqui, A., Anwar, A., & Hashmi, A. Correlation of Fasting Blood Sugar and Glycated Hemoglobin (HbA1c) With Thiamine Levels in Diabetic Patients. Cureus, 2023;15.
4. Priya, S., & Begum, N. Correlation of Lipid Profile with Period of diabetes and HbA1c Levels in Type 2 Diabetes Mellitus Patients: A Descriptive Cross-sectional Study . SBV Journal of Basic, Clinical and Applied Health Science. 2020.
5. Handayani, D., Reza, R., Dwi, D., Jihan, S., Kurnia, H., & Afra, W. Correlation of HbA1C and Lipid Profile Levels in Type 2 Diabetes Mellitus Patients at M Yunus Hospital. Jurnal Ilmu Kesehatan. 2023.
6. Amer, A., & Haridas, N. Correlation between HbA1c concentration and lipid profiles in type 2 diabetes mellitus. Paripex Indian Journal Of Research, 2017; 6.
7. Bhaskar, S., Tarafdar, H., Kumar, M., & Astik, S. Study To Determine The Relation Between Hba1c, Lipid Profile And Crp In Individuals With Type 2 Diabetes Mellitus In A Tertiary

Care Hospital. International Journal of Medical and Biomedical Studies. 2021.
8. Begum, A., Irfan, S., Hoque, M., Habib, S., Parvin, S., Malek, R., Akhter, S., Sattar, S., & Sarkar, S. Relationship between HbA1c and Lipid Profile Seen in Bangladeshi Type 2 Diabetes Mellitus Patients Attending BIRDEM Hospital: A Cross-Sectional Study. Mymensingh medical journal: MMJ, 2019; 281: 91-95.