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Association between Glycemic Control and Lipid Profile among Newly Diagnosed Type 2 Diabetes Mellitus Patients

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ABSTRACT

Background: The association between Type 2 diabetes mellitus (T2DM) and dyslipidemia has a long history of developing, but the latter has become one of the key factors of the development of cardiovascular-related illness. Therefore, early detection of lipid abnormalities in patients who were just diagnosed with the T2DM is crucial to the effective minimization of health risks.

Objective: This research aimed to determine the frequency and specific features of dyslipidemia in a cohort of newly-identified T2DM patients.

Methods: Cross-sectional and observational study was carried out on newly diagnosed the T2DM subjects aged 30 to 65 years in a specialized medical facility. The respondents were tested in terms of fasting blood sugar (FBS), post-meal glucose (PPBS), HbA1c and the complete lipid profile. The 2018 AHA Guidelines were used to define dyslipidemia. The data processing involved use of t-tests and correlation coefficients of Pearson.

Results: Higher prevalence of dyslipidemia was observed with study group, with mean triglyceride concentrations being significantly higher in diabetic men (217.7 mg/dL) than with diabetic women (187.3 mg/dL). The group identified as dyslipidemic was characterized by notably increased mean levels of HbA1c (7.86 ± 2.1), FBS (153.0 ± 33.4 mg/dL), and PPBS (261.4 ± 60.4). It was found that HbA1c was strongly positively correlated with FBS ($p < 0.001$), whereas moderate value of correlation was observed between FBS and total cholesterol, LDL cholesterol and between PPBS and triglycerides ($r = 0.664$).

Conclusion: The incidence of dyslipidemia is extremely high even at the first stage of the diagnosis of Type 2 diabetes and it is closely linked with hypertrophic control over blood sugar levels. It is strongly recommended that regular lipid screening should be part and parcel of the initial clinical examination on all patients with diabetes with the view of reducing the risk of developing heart related complications in the future.

KEYWORDS: *Hyperglycemia , Increased HbA1C ,Increased LDL , Triglycerides, VLDL*

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INTRODUCTION

Type 2 diabetes (T2DM) can be described as a chronic metabolic condition following insensitivity of insulin and relative insulin deficiency, which in turn leads to a state of persistent hyperglycemia. The rate of T2DM prevalence is growing at an unprecedented rate; it is estimated that, in 2021, about 537 million adults were living with T2DM, and this number is projected to increase to 643 million by the year 2030 (International Diabetes Federation [IDF], 2021). As the trend of changing demographics in India towards urban areas and physical inactivity is identified as a key contributor to the sharp increase in new cases of T2DM in the country (Anjana et al., 2017).

In most cases, T2DM is associated with dyslipidemia, which contributes significantly to the development of atherosclerosis and cardiovascular disease (CVD) which has been the major cause of death and functional disability among diabetics. Studies have shown that most lipid profile in a diabetic condition is characterized by increased serum triglyceride levels, lower levels of HDL cholesterol, and more small dense LDL particles (Goldberg, 2001). These lipid abnormalities can often be detected at an early age and in many cases coincide with the first case of the disease being diagnosed (Taskinen, 2005). Thus, it is crucially important that dyslipidemia can be identified at the early stages and effectively managed clinically in order to reduce the cardiovascular risk. Although numerous studies evaluated dyslipidemia rates in already diagnosed diabetic patients, there is growing need to research lipid changes at the point of the diagnosis, especially in regions,

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Table 1: Glycemic and Lipid Profile Parameters by Dyslipidemia Status

Group	HbA1c (Mean± SD)	FBS (Mean ± SD mg/dl)	PPBS (Mean ± SD mg/dl)
Dyslipidemic	7.86 ± 2.1	153.0 ± 33.4	261.4 ± 60.4
Non-Dyslipidemic	6.15 ± 1.9	107.4 ± 7.1	167.9 ± 10.4

which have limited medical resources where regular lipid testing by the diagnosis could be postponed or even overlooked (Ramachandran et al., 2010). Considering the lipid profiles of those diagnosed recently can provide a valuable insight into the underlying metabolic catastrophe that is associated with hyperglycemia and be used to guide the specific clinical interventions that should be made at the right time.

The aim of the research is to determine the prevalence and the variation of dyslipidemia in patients with new T2DM and to examine whether the blood sugar markers (HbA1c, fasting glucose and post meal glucose) correlate with the variables of the lipid profile. Such observations will play a significant role in enhancing the early cardiovascular risk assessment and interventions aimed at providing diabetic care.

METHODS

Cross-sectional, observational study design and population: In this study, we used a cross-sectional, observational study design and population, involving the patients of the Medicine Department at MSDASMC Medical College, Bahraich. We selected the subjects aged 30-65 years with the fresh diagnosis of T2DM according to ADA standards of 2018. The criteria of exclusion were either having Type 1 diabetes or using lipid-lowering drugs or had underlying conditions that can interfere with lipid results. The size of the sample was calculated based on the prevalence estimation formulas, i.e., a sample of 100 participants was obtained, and they were recruited one by one. 2016, American Diabetes Association. 2018).

Data Collection: Clinical history and physical measurement were captured in details. Fasting blood samples were collected to determine the levels of FBS, PPBS, HbA1c, and triglycerides by enzymatic colorimetry. Dyslipidemia classification was done based on the 2018 AHA Guidelines (Penumarthy, S et al. 2013).

Statistical analysis: The statistical analysis was done through the use of SPSS software, t-tests were used to compare groups, and the Pearon correlation was used to investigate a relationship. A p-value below 0.05 was regarded to indicate a statistical significance.

RESULTS

By dividing these 100 subjects into dyslipidemic and non-dyslipidemic groups, the results of these laboratory findings were determined. There were substantial differences in both glycemic and lipid indicators between these two groups.

Glycemic Profile by Dyslipidemia Status The data presented in Table 1 show that the group with dyslipidemia had significantly higher amounts of HbA1c, FBS, and PPBS in it.

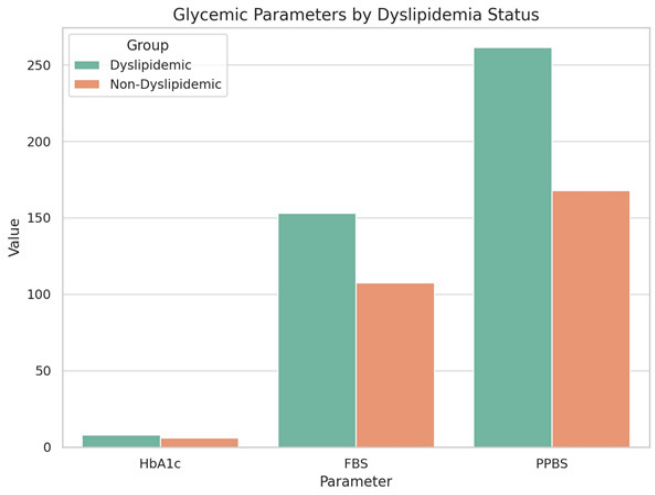

Figure 1: The comparison of glycemic parameters (HbA1c, FBS, and PPBS)between the dyslipidemic (greenish-blue bars) and the non-dyslipidemic (orange bars) group.

Participants with dyslipidemia showed an average HbA1c of 7.86 ± 2.1, a fasting sugar of 153.0 ± 33.4 mg/dl, and a post-meal sugar of 261.4 ± 60.4 mg/dl. On the other hand, the average values were considerably lower in the group that did not have dyslipidemia: 6.15 ± 1.9 in the case of the HbA1c, 107.4 ± 7.1 in the case of fasting sugar, and 167.9 ± 10.4 in the case of the post-meal sugar.

Gender-wise Dyslipidemia and Triglyceride Levels

Gender-wise Dyslipidemia and Triglyceride Levels Table 2 attributes the distributions of triglyceride levels with gender and diabetes status with those who are having dyslipidemia. There were highest average triglyceride levels in diabetic males (217.7 mg /dl), diabetic females next at 187.3mg/dl. The levels of triglycerides were also higher in the presence of dyslipidemia in non-diabetes individuals but was in the lower range compared with diabetic patients.

Correlations Between Glycemic and Lipid Parameters

Correlations Between Glycemic and Lipid Measures The analysis indicated there exists a significant positive correlation between HbA1c and FBS ($P < 0.001$), which implies that an inefficient management of blood sugar is always evident in both the short and long-term markers of glucose. Also, hyperglycemia after meals was found to be positively related with high levels of serum triglycerides as a pearson correlation of 0.664 was observed between PPBS and serum triglycerides. This signifies a moderate-strong positive relationship between these two determinants.

Table 2: Gender-wise Triglyceride Levels among Dyslipidemic Individuals

Group	Gender	Dyslipidemia	Mean Triglyceride (mg/dl)
Diabetic	Male	Yes	217.7
Diabetic	Female	Yes	187.3
Normal	Male	Yes	178.7
Normal	Female	Yes	178.3

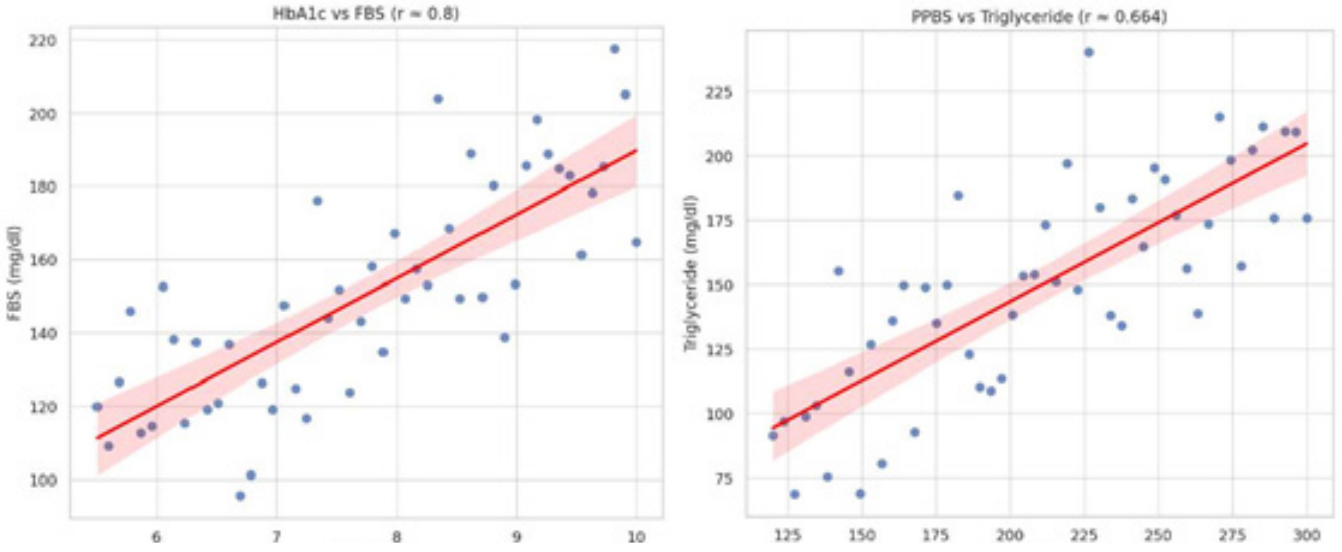

Figure 2: Correlation Analysis between Glycemic and Lipid Parameters A. HbA1c vs Fasting Blood Sugar (FBS), B. Postprandial Blood Sugar (PPBS) vs Serum Triglyceride

DISCUSSION

The current study indicates a high rate of dyslipidemia among patients with Type 2 diabetes in the first clinical visit, a fact that is in line with other studies that were conducted in India. Although, in this study, the materials of the dyslipidemic group were significantly higher in HbA1c, FBS and PPBS in comparison with the non-dyslipidemic group, which confirms that the disturbances of the glucose metabolism in the dyslipidemic group occur at an early stage and are closely interconnected with the lipid imbalances. The rates of dyslipidemia prevalence reported in previous Indian studies (60%-75% rates; Mohan et al., 2019; Prasad et al., 2012) are also consistent with our current findings. The rising triglycerides, especially among diabetic men, reflects the global trends in diabetic dyslipidemia (Goldberg, 2001) as well as national trends (Ramachandran et al., 2010). This particular dyslipidemic pattern, i.e., high triglycerides and low quantities of HDL, is highly atherogenous and is often missed when a diagnosis of diabetes is made.

The found level of relationships between FBS and total/LDL cholesterol was also moderate ($P < 0.001$). This follows the earlier studies that found out that a failure when it comes to control lipids is an unfortunate byproduct of hyperglycemia that ensues due to insulin resistance and an increase in hepatic VLDL production (Taskinen, 2005). The moderate-strong correlation between PPBS and triglycerides (r= 0.664) continues to underscore the effects of post-meal triglycerides level.

Screenings of dyslipidemia during a diagnosis of diabetes is of critical importance, especially in an Indian setting where there is an unequal high rate of the heart disease occurrence. Checking lipids and metabolic changes should also be prioritized to make sure that future complications will be prevented in the future.

CONCLUSION

Recently diagnosed patients with T2DM are at a far greater risk of dyslipidemia, which is closely connected with ineffective regulation of blood sugar levels. Due to the dominant connection between glycemic indicators and lipid anomalies, it is crucial that early screening and an in-depth metabolic assessment be undertaken during the diagnosis phase. In controlling the risk of development of long-term heart related complications, it is imperative to consider integrating lipid management in the initial stages of diabetic treatment, and this is so because of the high-risk groups like those in India.

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