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PREVALENCE OF DYSLIPIDAEMIA AND ITS ASSOCIATION WITH GLYCAEMIC CONTROL AMONG PATIENTS WITH NEWLY DIAGNOSED TYPE 2 DIABETES MELLITUS

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ABSTRACT

Background: Dyslipidaemia is a common metabolic abnormality associated with type 2 diabetes mellitus (T2DM) and contributes significantly to cardiovascular morbidity. Early identification of lipid abnormalities and their association with glycaemic control is essential for appropriate risk assessment and management. **Aim:** To determine the prevalence of dyslipidaemia and evaluate its association with glycaemic control among patients with newly diagnosed type 2 diabetes mellitus.

Materials and Methods: This hospital-based observational cross-sectional study included 98 patients with newly diagnosed T2DM at a tertiary care hospital. Demographic characteristics, anthropometric measurements, clinical parameters, glycaemic indices, and fasting lipid profiles were evaluated. Patients were categorized according to HbA1c levels (<7.0% and ≥7.0%). Statistical analysis was performed using SPSS version 27.0. A p-value <0.05 was considered statistically significant.

Results: Among 98 patients, 58.16% were males, with a mean age of 53.39 ± 10.96 years. The overall prevalence of dyslipidaemia was 71.43%. Elevated LDL-C (63.27%) was the most common abnormality, followed by hypertriglyceridaemia (52.04%), low HDL-C (25.51%), and hypercholesterolaemia (15.31%). Dyslipidaemia was significantly more prevalent among patients with HbA1c ≥7.0% compared with those having HbA1c <7.0% (81.82% versus 50.00%; p=0.001). Patients with higher HbA1c demonstrated significantly elevated triglycerides, LDL-C, and total cholesterol levels, with reduced HDL-C concentrations. Multivariable logistic regression identified HbA1c ≥7.0% (AOR=5.62; p=0.001) and increased BMI (AOR=1.18; p=0.034) as significant factors associated with dyslipidaemia.

Conclusion: Dyslipidaemia was highly prevalent among newly diagnosed T2DM patients and was significantly associated with higher HbA1c levels and increased BMI. Early lipid screening, glycaemic management, and cardiovascular risk assessment are essential for preventing long-term complications.

Keywords: Type 2 diabetes mellitus; Dyslipidaemia; Glycaemic control; HbA1c; Lipid profile.

INTRODUCTION

Type 2 diabetes mellitus (T2DM) is a major global public health concern and one of the leading causes of metabolic morbidity and premature mortality worldwide. It is a chronic metabolic disorder characterized by persistent hyperglycaemia resulting from insulin resistance, progressive pancreatic beta-cell dysfunction, and impaired insulin secretion. The increasing burden of T2DM is closely associated with rapid urbanization, sedentary lifestyles, unhealthy dietary habits, obesity, and population ageing. In

addition to disturbances in glucose metabolism, T2DM is frequently accompanied by abnormalities in lipid metabolism, hypertension, and other cardiovascular risk factors. These metabolic disturbances contribute significantly to the development of atherosclerotic cardiovascular disease and long-term diabetic complications. Early identification of associated metabolic abnormalities is therefore essential for comprehensive diabetes management and prevention of future cardiovascular events.[1] Newly diagnosed type 2 diabetes mellitus represents an important stage for identifying metabolic abnormalities and initiating appropriate preventive interventions. Although diabetes may be diagnosed for the first time, underlying insulin resistance and metabolic dysfunction may have been present for several years before clinical recognition. Consequently, many patients already demonstrate abnormalities in lipid metabolism at the time of diagnosis. Glycaemic status is commonly assessed through fasting plasma glucose, postprandial plasma glucose, and glycated haemoglobin (HbA1c). Among these parameters, HbA1c provides an estimate of average blood glucose concentrations over the preceding two to three months and serves as an important indicator of chronic glycaemic exposure. Assessment of HbA1c alongside lipid parameters may help identify patients with concurrent disturbances in glucose and lipid metabolism.[2] Dyslipidaemia is an important metabolic abnormality associated with type 2 diabetes mellitus and is characterized by disturbances in circulating lipoprotein concentrations and composition. The characteristic pattern of diabetic dyslipidaemia generally includes elevated triglycerides, reduced high-density lipoprotein cholesterol (HDL-C), increased concentrations of small dense low-density lipoprotein particles, and abnormalities in non-HDL cholesterol. These changes are primarily related to insulin resistance, increased adipose tissue lipolysis, excessive delivery of free fatty acids to the liver, and increased hepatic production of very-low-density lipoproteins. Impaired clearance of triglyceride-rich lipoproteins further contributes to altered lipid metabolism. Additionally, glycation and oxidative modification of lipoproteins may enhance their atherogenic properties. Such abnormalities can accelerate endothelial dysfunction, vascular inflammation, and atherosclerotic plaque formation, thereby increasing cardiovascular risk among diabetic patients.[3] The relationship between dyslipidaemia and glycaemic control is complex and influenced by multiple metabolic pathways. Persistent hyperglycaemia and insulin resistance can alter lipid synthesis, transport, and clearance, producing an unfavourable circulating lipid profile. Poor glycaemic regulation may contribute to increased triglyceride concentrations, reduced HDL-C, and abnormalities in LDL particle metabolism. Conversely, excess adiposity and lipid accumulation may aggravate insulin resistance and further impair glucose homeostasis. Thus, glucose and lipid metabolism are closely interconnected, and disturbances in either pathway can influence the other. Comprehensive evaluation of lipid fractions, including total cholesterol, triglycerides, LDL-C, HDL-C, and non-HDL-C, is important for identifying different dyslipidaemic patterns and guiding individualized cardiovascular risk management.[4] The prevalence and pattern of dyslipidaemia among patients with type 2 diabetes may vary according to age, gender, body mass index, dietary practices, physical activity, genetic predisposition, and associated metabolic disorders. Central obesity, hypertension, smoking, and family history of metabolic disease may further contribute to an unfavourable cardiometabolic profile. Newly diagnosed patients deserve particular attention because lipid abnormalities may remain clinically silent despite contributing to progressive vascular injury. Evaluating the distribution of individual lipid abnormalities, isolated dyslipidaemia, and mixed dyslipidaemia can provide a better understanding of the metabolic characteristics of the affected population. Such assessments are especially relevant in tertiary care settings, where patients frequently present with multiple metabolic risk factors requiring comprehensive evaluation.[5] Cardiovascular disease remains a major cause of morbidity and mortality among individuals with type 2 diabetes mellitus. Dyslipidaemia contributes to atherosclerosis and increases susceptibility to coronary artery disease, cerebrovascular events, and peripheral arterial disease. The coexistence of hyperglycaemia, obesity, hypertension, and abnormal lipid concentrations may further increase cardiovascular risk. Therefore, diabetes management should extend beyond glycaemic regulation and incorporate systematic assessment of modifiable cardiovascular risk factors. Early lipid screening, appropriate nutritional counselling, regular physical activity, weight management, smoking cessation, and evidence-based pharmacological interventions are important components of comprehensive care. Identifying the relationship between HbA1c and lipid abnormalities may also provide clinically useful information for cardiovascular risk assessment at the time of diabetes diagnosis.[6]

MATERIALS AND METHODS

The present study was designed as a hospital-based, observational cross-sectional study conducted at a tertiary care hospital to determine the prevalence of dyslipidaemia and evaluate its association with glycaemic control among patients with newly diagnosed type 2 diabetes mellitus (T2DM). A total of 98 patients with newly diagnosed T2DM were included in the study. Patients attending the General Medicine outpatient department and those admitted to the hospital were screened for eligibility. Participants were selected through consecutive sampling according to predefined inclusion and

exclusion criteria. Demographic, clinical, anthropometric, and biochemical parameters were systematically recorded using a structured study proforma.

Inclusion Criteria

Patients aged 18 years and above with newly diagnosed type 2 diabetes mellitus, diagnosed within the preceding three months according to established diagnostic criteria, were included. Patients willing to participate and undergo fasting blood glucose, glycated haemoglobin (HbA1c), and fasting lipid profile investigations were considered eligible. Both male and female patients were included irrespective of their glycaemic status.

Exclusion Criteria

Patients with previously diagnosed diabetes mellitus, type 1 diabetes mellitus, gestational diabetes, or a history of lipid-lowering therapy were excluded. Patients with known familial dyslipidaemia, untreated hypothyroidism, chronic liver disease, advanced chronic kidney disease, acute infections, malignancy, or other conditions significantly influencing lipid metabolism were excluded. Pregnant women and patients receiving medications affecting lipid or glucose metabolism, including long-term systemic corticosteroids, were also excluded.

Clinical Assessment and Data Collection

Detailed clinical histories were obtained, including age, gender, family history of diabetes, smoking status, alcohol consumption, dietary habits, physical activity, and associated comorbidities. Anthropometric measurements included height, weight, body mass index (BMI), and waist circumference. BMI was calculated as weight in kilograms divided by height in metres squared (kg/m^2). Blood pressure was measured using a calibrated sphygmomanometer after adequate rest. The presence of hypertension, obesity, and other cardiovascular risk factors was documented. Clinical and biochemical findings were recorded at the time of enrolment.

Biochemical Investigations

Venous blood samples were collected following an overnight fasting period of 8–12 hours under aseptic precautions. Fasting plasma glucose (FPG), postprandial plasma glucose (PPG), and HbA1c levels were assessed to determine glycaemic status. HbA1c was measured using a standardized laboratory method. The fasting lipid profile included total cholesterol (TC), triglycerides (TG), high-density lipoprotein cholesterol (HDL-C), and low-density lipoprotein cholesterol (LDL-C). Lipid parameters were estimated using standardized enzymatic methods. LDL-C was calculated using the Friedewald formula when triglyceride levels were below 400 mg/dL; direct LDL-C measurement was considered for higher triglyceride concentrations. Non-HDL cholesterol was calculated by subtracting HDL-C from total cholesterol.

Assessment of Dyslipidaemia

Dyslipidaemia was defined as the presence of one or more abnormal lipid parameters: total cholesterol ≥200 mg/dL, triglycerides ≥150 mg/dL, LDL-C ≥100 mg/dL, HDL-C <40 mg/dL in males, or HDL-C <50 mg/dL in females. Patients were categorized according to the presence or absence of dyslipidaemia. Individual lipid abnormalities, including hypercholesterolaemia, hypertriglyceridaemia, elevated LDL-C, low HDL-C, and mixed dyslipidaemia, were evaluated. The overall prevalence of dyslipidaemia and the frequency of individual lipid abnormalities were calculated as percentages.

Assessment of Glycaemic Control

Glycaemic control was primarily assessed using HbA1c levels. Patients were categorized into two groups: HbA1c <7.0% and HbA1c ≥7.0%, representing lower and higher glycaemic levels, respectively. Fasting and postprandial plasma glucose values were also recorded. Mean lipid parameters were compared between the HbA1c groups to determine the association between glycaemic status and dyslipidaemia. Correlations between HbA1c and individual lipid parameters were evaluated. Associations involving age, gender, BMI, waist circumference, and hypertension were additionally examined.

Statistical Analysis

Data were entered into Microsoft Excel and analysed using IBM SPSS Statistics version 27.0. Continuous variables were expressed as mean ± standard deviation or median with interquartile range, depending on data distribution, whereas categorical variables were presented as frequencies and percentages. Normality was assessed using the Shapiro–Wilk test. The independent-samples Student's t-test or Mann–Whitney U test was applied for comparisons of continuous variables. Categorical variables were compared using the Chi-square test or Fisher's exact test, as appropriate. Pearson's or Spearman's correlation coefficients were calculated to assess relationships between HbA1c and lipid parameters. Binary logistic regression analysis was used to evaluate the association between elevated HbA1c and dyslipidaemia after adjustment for relevant confounding variables. Results were expressed as odds ratios with 95% confidence intervals. A p-value <0.05 was considered statistically significant.

RESULTS

Table 1: Distribution of Study Participants According to Demographic and Clinical Characteristics (N=98)

Table 1 presents the demographic and clinical characteristics of 98 patients with newly diagnosed type 2 diabetes mellitus. The highest proportion of patients belonged to the 40–49 and 50–59 years age groups (30.61% each), followed by those aged ≥60

years (29.59%), while 9.18% were aged 18–39 years. Males constituted 58.16% of the study population, whereas females accounted for 41.84%. Regarding BMI, 42.86% of patients were overweight, 18.37% were obese, and 38.78% had a BMI below 25 kg/m². Hypertension was present in 36.73% of patients, while 28.57% reported a smoking history and 51.02% had a family history of diabetes. Based on glycaemic status, 67.35% of patients had HbA1c ≥7.0%, whereas 32.65% had HbA1c below 7.0%.

Table 2: Distribution of Anthropometric, Glycaemic and Lipid Profile Parameters Among Study Participants (N=98)

Table 2 summarizes the anthropometric, glycaemic, and lipid profile parameters of the study participants. The mean age was 53.39 ± 10.96 years, with a mean BMI of 26.61 ± 3.59 kg/m² and waist circumference of 90.94 ± 7.79 cm. The mean systolic and diastolic blood pressures were 116.62 ± 11.29 mmHg and 76.45 ± 7.28 mmHg, respectively. The mean HbA1c was 7.90 ± 1.11%, while fasting and postprandial plasma glucose levels were 177.96 ± 34.35 mg/dL and 256.16 ± 45.22 mg/dL, respectively. Regarding lipid parameters, mean total cholesterol and triglycerides were 182.36 ± 18.79 mg/dL and 147.22 ± 39.17 mg/dL, respectively. Mean LDL-C, HDL-C, and non-HDL-C levels were 104.04 ± 17.78 mg/dL, 48.88 ± 8.68 mg/dL, and 133.49 ± 24.37 mg/dL, respectively.

Table 3: Prevalence and Pattern of Dyslipidaemia Among Newly Diagnosed Type 2 Diabetes Mellitus Patients (N=98)

Table 3 demonstrates the prevalence and distribution of different lipid abnormalities among newly diagnosed type 2 diabetes mellitus patients. Overall, dyslipidaemia was identified in 70 patients (71.43%), whereas 28 patients (28.57%) had no lipid abnormalities. Isolated lipid abnormalities were observed in 18.37% of patients, while mixed dyslipidaemia involving two or more abnormal lipid parameters was present in 53.06%. Elevated LDL-C was the most common lipid abnormality, affecting 63.27% of patients, followed by hypertriglyceridaemia in 52.04%. Low HDL-C was detected in 25.51% of patients, whereas hypercholesterolaemia was observed in 15.31%. These findings indicate a high frequency of dyslipidaemia, particularly elevated LDL-C and triglyceride levels, among newly diagnosed diabetic patients.

Table 4: Comparison of Glycaemic and Lipid Profile Parameters According to HbA1c Levels

Table 4 compares glycaemic and lipid profile parameters between patients with HbA1c <7.0% and those with HbA1c ≥7.0%. Patients with HbA1c ≥7.0% demonstrated significantly higher fasting plasma glucose (192.62 ± 29.36 versus 147.73 ± 21.98 mg/dL) and postprandial plasma glucose (274.86 ± 39.72 versus 217.59 ± 28.50 mg/dL), with p<0.001 for both comparisons. Mean total cholesterol was significantly higher in the HbA1c ≥7.0% group (185.19 ± 18.37 versus 176.53 ± 18.56 mg/dL; p=0.032). Similarly, triglycerides (156.77 ± 37.35 versus 127.53 ± 35.80 mg/dL; p<0.001) and LDL-C (106.89 ± 17.80 versus 98.17 ± 16.49 mg/dL; p=0.022) were significantly elevated. Conversely, HDL-C was significantly lower in patients with higher HbA1c (46.95 ± 8.56 versus 52.86 ± 7.59 mg/dL; p=0.001). Non-HDL-C was also significantly higher in the HbA1c ≥7.0% group (138.24 ± 23.92 versus 123.68 ± 22.63 mg/dL; p=0.005), indicating an adverse lipid profile associated with higher glycaemic levels.

Table 5: Association Between Glycaemic Control and Prevalence of Dyslipidaemia Among Study Participants

Table 5 illustrates the association between HbA1c levels and the prevalence of different lipid abnormalities among the study participants. Overall dyslipidaemia was significantly more prevalent among patients with HbA1c ≥7.0% compared with those having HbA1c <7.0% (81.82% versus 50.00%; p=0.001). Hypertriglyceridaemia was observed in 62.12% of patients with higher HbA1c compared with 31.25% in the lower HbA1c group (p=0.004). Similarly, elevated LDL-C was significantly more common in the HbA1c ≥7.0% group (71.21% versus 46.88%; p=0.019), while low HDL-C was present in 34.85% versus 6.25% of patients (p=0.002). Mixed dyslipidaemia was also significantly higher among patients with HbA1c ≥7.0% (65.15% versus 28.12%; p<0.001). Although hypercholesterolaemia was more frequent in patients with higher HbA1c (18.18% versus 9.38%), the difference was not statistically significant (p=0.372).

Table 6: Multivariable Logistic Regression Analysis of Factors Associated with Dyslipidaemia Among Newly Diagnosed Type 2 Diabetes Mellitus Patients

Table 6 presents the multivariable logistic regression analysis evaluating factors associated with dyslipidaemia among newly diagnosed type 2 diabetes mellitus patients. HbA1c ≥7.0% was significantly associated with increased odds of dyslipidaemia, with an adjusted odds ratio (AOR) of 5.62 (95% CI: 2.04–15.47; p=0.001), after adjustment for other included variables. Body mass index also demonstrated a statistically significant positive association with dyslipidaemia (AOR=1.18; 95% CI: 1.01–1.38; p=0.034), indicating an 18% increase in the adjusted odds for each 1 kg/m² increase in BMI. However, age was not significantly associated with dyslipidaemia (AOR=0.99; p=0.826). Similarly, male gender (AOR=1.80; p=0.245) and hypertension (AOR=0.86; p=0.784) did not demonstrate statistically significant independent associations. These findings suggest that higher HbA1c levels and increased BMI were the principal factors associated with dyslipidaemia in the presented regression model.

Table 1: Distribution of Study Participants According to Demographic and Clinical Characteristics (N=98)

Parameters	Number of patients (n)	Percentage (%)
Age group (years)		
18–39	9	9.18
40–49	30	30.61
50–59	30	30.61
≥60	29	29.59
Gender		
Male	57	58.16
Female	41	41.84
BMI (kg/m²)		
<25	38	38.78
25–29.9	42	42.86
≥30	18	18.37
Hypertension		
Present	36	36.73
Absent	62	63.27
Smoking history		
Present	28	28.57
Absent	70	71.43
Family history of diabetes		
Present	50	51.02
Absent	48	48.98
HbA1c categories		
HbA1c <7.0%	32	32.65
HbA1c ≥7.0%	66	67.35

Table 2: Distribution of Anthropometric, Glycaemic and Lipid Profile Parameters Among Study Participants (N=98)

Parameters	Mean ± SD
Age (years)	53.39 ± 10.96
Body mass index (kg/m²)	26.61 ± 3.59
Waist circumference (cm)	90.94 ± 7.79
Systolic blood pressure (mmHg)	116.62 ± 11.29
Diastolic blood pressure (mmHg)	76.45 ± 7.28
HbA1c (%)	7.90 ± 1.11
Fasting plasma glucose (mg/dL)	177.96 ± 34.35
Postprandial plasma glucose (mg/dL)	256.16 ± 45.22
Total cholesterol (mg/dL)	182.36 ± 18.79
Triglycerides (mg/dL)	147.22 ± 39.17
LDL cholesterol (mg/dL)	104.04 ± 17.78
HDL cholesterol (mg/dL)	48.88 ± 8.68
Non-HDL cholesterol (mg/dL)	133.49 ± 24.37

Table 3: Prevalence and Pattern of Dyslipidaemia Among Newly Diagnosed Type 2 Diabetes Mellitus Patients (N=98)

Lipid abnormalities	Number of patients (n)	Percentage (%)
Overall dyslipidaemia	70	71.43
No dyslipidaemia	28	28.57
Isolated lipid abnormality	18	18.37
Mixed dyslipidaemia (≥2 abnormalities)	52	53.06
Hypercholesterolaemia (TC ≥200 mg/dL)	15	15.31
Hypertriglyceridaemia (TG ≥150 mg/dL)	51	52.04
Elevated LDL-C (≥100 mg/dL)	62	63.27
Low HDL-C (sex-specific cutoffs)	25	25.51

Table 4: Comparison of Glycaemic and Lipid Profile Parameters According to HbA1c Levels

Parameters	HbA1c <7.0% (n=32) Mean ± SD	HbA1c ≥7.0% (n=66) Mean ± SD	p-value
Fasting plasma glucose (mg/dL)	147.73 ± 21.98	192.62 ± 29.36	<0.001
Postprandial plasma glucose (mg/dL)	217.59 ± 28.50	274.86 ± 39.72	<0.001
Total cholesterol (mg/dL)	176.53 ± 18.56	185.19 ± 18.37	0.032
Triglycerides (mg/dL)	127.53 ± 35.80	156.77 ± 37.35	<0.001
LDL-C (mg/dL)	98.17 ± 16.49	106.89 ± 17.80	0.022
HDL-C (mg/dL)	52.86 ± 7.59	46.95 ± 8.56	0.001
Non-HDL-C (mg/dL)	123.68 ± 22.63	138.24 ± 23.92	0.005

Table 5: Association Between Glycaemic Control and Prevalence of Dyslipidaemia Among Study Participants

Lipid abnormalities	HbA1c <7.0% (n=32), n (%)	HbA1c ≥7.0% (n=66), n (%)	p-value
Overall dyslipidaemia	16 (50.00)	54 (81.82)	0.001
Hypercholesterolaemia	3 (9.38)	12 (18.18)	0.372
Hypertriglyceridaemia	10 (31.25)	41 (62.12)	0.004
Elevated LDL-C	15 (46.88)	47 (71.21)	0.019
Low HDL-C	2 (6.25)	23 (34.85)	0.002

Mixed dyslipidaemia	9 (28.12)	43 (65.15)	<0.001

Table 6: Multivariable Logistic Regression Analysis of Factors Associated with Dyslipidaemia Among Newly Diagnosed Type 2 Diabetes Mellitus Patients

Variables	Adjusted odds ratio (AOR)	95% confidence interval	p-value
HbA1c ≥7.0%	5.62	2.04–15.47	0.001
Age (per year)	0.99	0.95–1.04	0.826
BMI (per kg/m²)	1.18	1.01–1.38	0.034
Male gender	1.80	0.67–4.87	0.245
Hypertension	0.86	0.30–2.50	0.784

DISCUSSION

The present study included 98 patients with newly diagnosed type 2 diabetes mellitus, with a mean age of 53.39 ± 10.96 years. The majority of patients were males (58.16%), while 61.22% had a BMI ≥25 kg/m². Hypertension was present in 36.73%, and 28.57% reported a smoking history. Comparable findings were reported by Sosale et al. (2016), who conducted a multicentric study involving 1,500 patients with newly diagnosed young-onset type 2 diabetes mellitus in India. They reported a mean age of 34.7 ± 4.2 years and mean BMI of 26.8 ± 4.7 kg/m², while hypertension and smoking were present in 27.60% and 24.00% of patients, respectively. Dyslipidaemia was identified in 62.40% of their patients compared with 71.43% in the present study. Although their participants were considerably younger, the findings suggest that abnormal lipid metabolism and associated cardiovascular risk factors may already be present at diabetes diagnosis.[7] In the present study, the mean BMI was 26.61 ± 3.59 kg/m², while the mean HbA1c, fasting plasma glucose, and postprandial plasma glucose levels were 7.90 ± 1.11%, 177.96 ± 34.35 mg/dL, and 256.16 ± 45.22 mg/dL, respectively. These findings were comparable with those reported by Unnikrishnan et al. (2022), who evaluated 5,080 newly diagnosed type 2 diabetes mellitus patients across India. Their study demonstrated a mean age of 48.3 ± 12.8 years, mean BMI of 27.2 ± 4.6 kg/m², and mean HbA1c of 8.1 ± 2.2%. Hypertension was identified in 42.10% of their participants compared with 36.73% in the present study. Furthermore, 82.50% of their patients had at least one cholesterol abnormality, while 55.60% had low HDL-C. The comparable glycaemic and anthropometric profiles indicate the importance of evaluating lipid abnormalities and cardiovascular risk factors during the initial assessment of newly diagnosed diabetes.[8] The present study demonstrated a high prevalence of dyslipidaemia, affecting 70 of 98 patients (71.43%), while only 28.57% had no lipid abnormality. Elevated LDL-C was the most common abnormality (63.27%), followed by hypertriglyceridaemia (52.04%), low HDL-C (25.51%), and hypercholesterolaemia (15.31%). Similar findings were documented by Wassan et al. (2023) in a study involving 125 patients with newly diagnosed type 2 diabetes mellitus at a tertiary care hospital in Islamabad. They reported hypercholesterolaemia in 55.20%, hypertriglyceridaemia in 58.40%, elevated LDL-C in 50.40%, and reduced HDL-C in 72.00% of patients. Compared with their findings, the present study demonstrated a higher frequency of elevated LDL-C but lower frequencies of hypercholesterolaemia and reduced HDL-C. These differences may reflect variations in patient characteristics, lipid cutoff values, and metabolic status. Both studies nevertheless demonstrate that multiple lipid abnormalities are common among patients with newly diagnosed type 2 diabetes mellitus.[9]

In the present study, mixed dyslipidaemia involving two or more abnormal lipid parameters was observed in 53.06% of patients, whereas isolated lipid abnormalities were detected in 18.37%. Elevated LDL-C was the predominant abnormality, affecting 63.27% of participants. These findings can be compared with those of Jayakumari et al. (2020), who evaluated the lipid profiles of 971 Indian patients with type 2 diabetes mellitus. Their study reported a prevalence of hyperlipidaemia of 40.00%, with elevated LDL-C representing the most common lipid abnormality. They also observed an association between higher HbA1c and fasting blood glucose levels and increased LDL-C concentrations. Although the reported prevalence was lower than the 71.43% observed in the present study, both investigations identified LDL-C abnormalities as an important component of diabetic dyslipidaemia. Differences in dyslipidaemia definitions and the inclusion of patients with established diabetes in the previous study may explain some variation in prevalence.[10] The relationship between glycaemic control and lipid parameters was an important finding of the present study. Patients with HbA1c ≥7.0% demonstrated significantly higher LDL-C levels than those with HbA1c <7.0% (106.89 ± 17.80 versus 98.17 ± 16.49 mg/dL; p=0.022). Similarly, mean triglyceride levels were significantly higher in patients with elevated HbA1c (156.77 ± 37.35 versus 127.53 ± 35.80 mg/dL; p<0.001). These observations were partly consistent with Yan et al. (2012), who investigated 128 patients with type 2 diabetes mellitus, categorized into HbA1c <7% (31 patients), 7–10% (48 patients), and >10% (49 patients). They observed a significant increasing trend in LDL-C with increasing HbA1c (p<0.05), whereas triglycerides and HDL-C did not demonstrate significant correlations with HbA1c. Therefore, both studies support an association between higher HbA1c and LDL-C, although the present study demonstrated a stronger relationship involving triglycerides and

HDL-C.[11] The present study also demonstrated that patients with HbA1c ≥7.0% had significantly higher mean total cholesterol (185.19 ± 18.37 versus 176.53 ± 18.56 mg/dL; p=0.032) and non-HDL-C (138.24 ± 23.92 versus 123.68 ± 22.63 mg/dL; p=0.005). Conversely, mean HDL-C was significantly lower in patients with higher HbA1c levels (46.95 ± 8.56 versus 52.86 ± 7.59 mg/dL; p=0.001). Alzahrani et al. (2019) conducted a retrospective study involving 206 patients with type 2 diabetes mellitus and reported a significant positive correlation between HbA1c and triglyceride levels (r=0.164; p=0.020). They also demonstrated a significant difference in triglyceride levels between patients with good and poor glycaemic control (p=0.020), whereas total cholesterol, LDL-C, and HDL-C were not significantly associated with HbA1c. In contrast, the present study demonstrated statistically significant differences across multiple lipid parameters, suggesting a broader association between glycaemic status and lipid abnormalities in the study population.[12] The association between glycaemic status and the prevalence of individual lipid abnormalities was further demonstrated in the present study. Hypertriglyceridaemia was significantly more prevalent in patients with HbA1c ≥7.0% than in those with HbA1c <7.0% (62.12% versus 31.25%; p=0.004). Similarly, elevated LDL-C was observed in 71.21% versus 46.88% (p=0.019), while mixed dyslipidaemia was detected in 65.15% versus 28.12% (p<0.001). These findings were supported by Naqvi et al. (2017), who studied 509 patients with type 2 diabetes mellitus and reported hypertriglyceridaemia in 58.20% and elevated LDL-C in 66.00%. They also found that 67.80% of patients had HbA1c >7%, closely resembling the 67.35% with HbA1c ≥7.0% in the present study. Their analysis demonstrated a significant association between elevated HbA1c and hypertriglyceridaemia, with an odds ratio of 2.038 (95% CI: 1.397–2.972; p<0.001). These observations support the relationship between higher HbA1c levels and an increased frequency of abnormal lipid profiles.[13] The present study showed that dyslipidaemia was significantly more common among patients with HbA1c ≥7.0% than among those with HbA1c <7.0% (81.82% versus 50.00%; p=0.001). Elevated triglycerides, increased LDL-C, and reduced HDL-C were significantly associated with higher HbA1c, although the difference in hypercholesterolaemia prevalence did not reach statistical significance (18.18% versus 9.38%; p=0.372). These findings were broadly consistent with Khan et al. (2007), who examined 1,011 patients with type 2 diabetes mellitus, with a mean age of 59.76 years. They demonstrated direct correlations between HbA1c and total cholesterol, triglycerides, and LDL-C, together with an inverse correlation between HbA1c and HDL-C. Their study also reported significantly higher total cholesterol and triglyceride concentrations and lower HDL-C levels among patients with poorer glycaemic control. The similarity in the direction of lipid changes supports an association between elevated HbA1c and adverse lipid metabolism, although a cross-sectional association cannot establish causality.[14] Multivariable logistic regression analysis in the present study demonstrated that HbA1c ≥7.0% was significantly associated with dyslipidaemia (AOR=5.62; 95% CI: 2.04–15.47; p=0.001). Increased BMI was another significant associated factor (AOR=1.18 per kg/m²; 95% CI: 1.01–1.38; p=0.034), whereas age, male gender, and hypertension showed no statistically significant independent associations. Comparable findings regarding obesity were reported by Ahmmed et al. (2021), who investigated 132 newly diagnosed type 2 diabetes mellitus patients in Bangladesh. Their study demonstrated dyslipidaemia in 72.60% of males and 75.70% of females. Obesity was significantly associated with increased odds of dyslipidaemia (OR=2.63; 95% CI: 2.27–2.90; p<0.001). Female gender was also associated with higher odds of dyslipidaemia (OR=1.74; p<0.001), whereas gender was not significant in the present study. Although the BMI estimates are not directly comparable because different exposure definitions were used, both studies identify increased adiposity as an important associated factor. These findings emphasize the relevance of assessing glycaemic status, BMI, and lipid abnormalities at diabetes diagnosis, while the limited sample size and cross-sectional design of the present study restrict causal interpretation.[15]

CONCLUSION

The present study demonstrated a high prevalence of dyslipidaemia (71.43%) among patients with newly diagnosed type 2 diabetes mellitus, with elevated LDL-C and hypertriglyceridaemia being the most common lipid abnormalities. Patients with HbA1c ≥7.0% exhibited a significantly higher prevalence of dyslipidaemia and an unfavourable lipid profile compared with those having lower HbA1c levels. Elevated HbA1c and increased BMI were significantly associated with dyslipidaemia. These findings emphasize the importance of early lipid screening, glycaemic management, and modification of cardiovascular risk factors in newly diagnosed diabetic patients to reduce future cardiovascular complications.

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