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PREVALENCE AND PATTERN OF DYSLIPIDEMIA IN NEWLY DIAGNOSED TYPE 2 DIABETES MELLITUS PATIENTS

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A B S T R A C T

Background: Type 2 Diabetes Mellitus (T2DM) is a prevalent metabolic disorder associated with significant cardiovascular risk, partly due to dyslipidemia. Dyslipidemia, characterized by abnormal lipid levels, is a common complication in T2DM patients and can contribute to the development of cardiovascular and cerebrovascular diseases.

Aim & Objective: To determine the prevalence of dyslipidemia in newly diagnosed type 2 diabetes mellitus patients.

Methodology: This cross-sectional study included 140 patients with newly diagnosed T2DM. Lipid profiles were measured, including total cholesterol, LDL-C, HDL-C, and triglycerides. Glycemic control was assessed via HbA1c levels. Demographic data such as age, gender, and Body Mass Index (BMI) categories were recorded. The prevalence of dyslipidemia and its association with these factors were analyzed using appropriate statistical tests.

Results: The study found that 71.40% of patients had dyslipidemia. Elevated triglycerides were present in 57.10% of patients, low HDL-C in 50%, elevated LDL-C in 42.90%, and elevated total cholesterol in 35.70%. Dyslipidemia was more prevalent in males (78.6%) compared to females (64.3%) and increased with age and higher BMI. Poor glycemic control (HbA1c $\geq$ 7%) was significantly associated with a higher prevalence of dyslipidemia (80% vs. 50% with HbA1c < 7%, p=0.02).

Conclusion: The study highlights a high prevalence of dyslipidemia among newly diagnosed T2DM patients, particularly in males, older individuals, those who are overweight or obese, and those with poor glycemic control. These findings underscore the need for integrated management strategies to address both glycemic and lipid abnormalities to improve cardiovascular health in T2DM patients. Routine monitoring of blood glucose and lipid profiles is essential for early detection and intervention.

Key Words: *Type 2 Diabetes Mellitus, Dyslipidemia, Glycemic Control, Lipid Profile, Cardiovascular Risk, HbA1c, Body Mass Index.*

INTRODUCTION:-

Diabetes mellitus (DM) comprises a range of metabolic disorders marked by elevated blood glucose levels due to deficiencies in insulin secretion, insulin action, or both [1] . The global incidence of diabetes is escalating significantly [2] . Presently, over 190 million individuals worldwide are affected by the disease, and projections suggest this number could rise to 324 million by 2025. This makes diabetes mellitus a pressing public health concern of the century.Diabetes mellitus is increasingly prevalent in India, affecting about 20% of urban populations and around 10% of rural populations [3]. It is a metabolic disorder characterized by elevated blood glucose levels, impaired cellular glucose uptake and metabolism, and abnormalities in lipid and protein metabolism [4].

Persistent high levels of blood sugar in diabetes can cause severe damage and dysfunction in multiple organs, particularly affecting the eyes, kidneys, nerves, heart, and blood vessels, potentially leading to organ failure over time [5].In type 2 diabetes, there is a significant association between hyperglycemia and atherosclerosis [6]. Elevated blood glucose levels lead to glycosylation of various proteins, particularly collagen and matrix proteins within the arterial wall. Over time, this process contributes to endothelial dysfunction, further exacerbating the progression of atherosclerosis. Dyslipidemia is highly prevalent, affecting approximately 95% of individuals with diabetes mellitus [7].

Dyslipidemia refers to an imbalance in lipid levels, encompassing fats, triglycerides, cholesterol, phospholipids, and lipoproteins in the bloodstream. It is a major risk factor for atherosclerotic cardiovascular diseases (ASCVD) such as coronary artery disease, cerebrovascular disease, and peripheral artery disease [8,9].Coronary heart disease is widely recognized as the foremost cause of mortality among both men and women in developed nations [10-12].
In developed countries, hyperlipidemia, marked by elevated lipid levels in the bloodstream, is the predominant type of dyslipidemia, often linked to dietary patterns and lifestyle choices. Similarly, its prevalence is rising in developing countries, where it is increasingly contributing to mortality rates.Prolonged insulin resistance also plays a crucial role in contributing to dyslipidemia. Furthermore, heightened levels of O-GlcNActransferase (OGT) have been implicated in the development of dyslipidemia. Characteristic features of diabetic dyslipidemia include elevated levels of triglycerides (TG) and low-density lipoproteins (LDL), along with reduced levels of high-density lipoproteins (HDL). These lipid abnormalities are commonly observed in individuals with diabetes and significantly increase the risk of cardiovascular complications associated with the disease [8].
Managing dyslipidemia not only aids in preventing associated co-morbidities but also enhances their control. Identifying and treating dyslipidemia can significantly improve quality of life by addressing its impact on morbidity and mortality and its influence on the management of associated conditions.

AIMS AND OBJECTIVES:-
To determine the prevalence of dyslipidemia in newly diagnosed type 2 diabetes mellitus patients.

MATERIALS AND METHODS:-

Study Design - Cross-Sectional Study.
Study Area - Tertiary Care Center.
Study Population - Patients with Type 2 Diabetes Mellitus.
Sample Size - All patients fulfilling the inclusion and exclusion criteria.
The study includes individuals aged 20 years and above, of any gender, occupation, socioeconomic status, religion, and marital status, who are presenting at a tertiary care center. Specifically, the study focuses on newly diagnosed cases of Type 2 Diabetes Mellitus (T2DM) who meet the American Diabetes Association (ADA) criteria: HbA1c > 6.5%, fasting blood sugar (FBS) > 126 mg/dl, or postprandial blood sugar (PPBS) > 200 mg/dl with symptoms of diabetes for the first time. Exclusion criteria involve known T2DM patients already on insulin therapy, those with acute metabolic complications such as diabetic ketoacidosis or hyperosmolar syndrome, and individuals with acute illnesses or infections, acute myocardial infarctions, cerebrovascular accidents, thyroid disorders, liver or renal disease. Additionally, patients with known inherited lipid disorders, secondary dyslipidemia, or those currently on lipid-lowering medications are excluded.
Data collection involved informed consent from patients and volunteers, ensuring confidentiality. A structured proforma gathered demographic details and clinical history, including diabetes specifics, duration, hypertension, surgical history, and family medical history. Physical examinations assessed height, weight, blood pressure, heart rate, pulse rate, and waist-hip ratio for abdominal obesity. Cardiovascular assessments included 12-lead ECG and echocardiogram to evaluate cardiovascular health and risk factors, defined by specific waist-hip ratio thresholds.

STATISTICAL ANALYSIS
Data is systematically entered into an Excel spreadsheet, where it is then analyzed and formatted into tables and graphs. Appropriate statistical tests are applied, with a p-value of less than 0.05 being considered significant.

RESULT & OBSERVATIONS

Table 1 – Age Distribution Study

Age Groups	Frequency (N)	Percentage (%)
20-30	10	7.10
31-40	20	14.30
41-50	40	28.60
>50	70	50.00
Total	**140**	**100**

Table 1summarizes the age distribution among the newly diagnosed type 2 diabetes mellitus (T2DM). The 20-30 age group comprises of 10 (7,10%) participants. In the 31-40 age group includes 20 (14.30 %) participants. In the 41-50 age

group has 40 (28.60%) participants of the study population & the largest age group is over 50 years old, with 70 (50%) participants.

Figure 1- Age distribution study

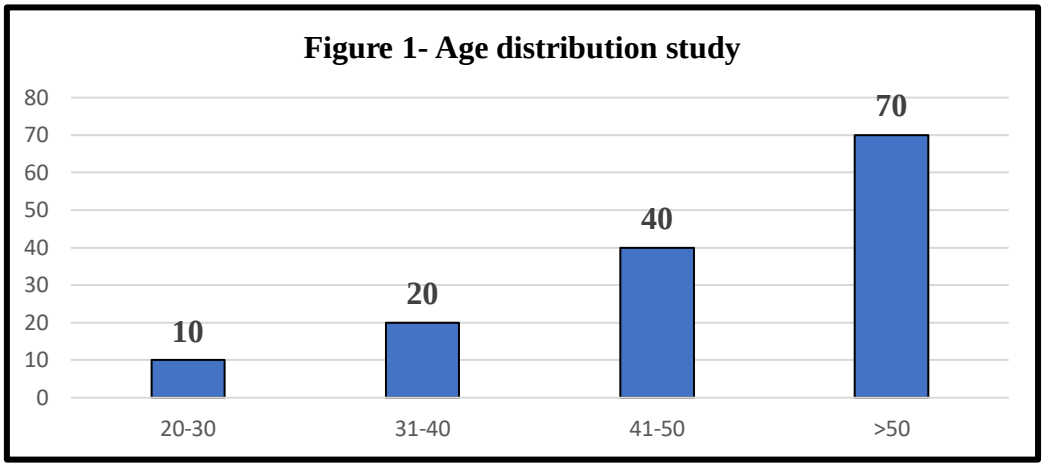


Table 2 – Demographic data

Gender	Frequency (N)	Percentage (%)
Male	90	64.29
Female	50	35.71
BMI Categories		
Normal weight	30	21.40%
Overweight	60	42.90%
Obese	50	35.70%

Table 2 presents the distribution of gender and body mass index (BMI). 90 (64.29%) participants are male, while 50 (35.71%) participants are female, In terms of BMI categories, 30 participants (21.40%) have a normal weight. 60 (42.90%) participants are overweight, and 50 (37.50%) participants are obese.

Table 3 – Study of Prevalence of Dyslipidemia

Lipid Profile	Number (n)	Percentage (%)
Dyslipidemia Overall	**100**	**71.40%**
Elevated Triglycerides	**80**	**57.10%**
Low HDL-C	**70**	**50%**
Elevated LDL-C	**60**	**42.90%**
Elevated Total Cholesterol	**50**	**35.70%**

Table 3 details the lipid profile abnormalities among the newly diagnosed type 2 diabetes mellitus (T2DM) patients. 71.40% of the participants have some form of dyslipidemia. 57.10% have elevated triglyceride levels. 50% of the participants have low HDL-C levels. 42.90% have elevated LDL-C levels. 35.70% of the participants have elevated total cholesterol levels, which includes LDL-C, HDL-C, and other lipid components, indicating an overall imbalance in lipid levels.

Figure 3 – Study of Prevalence of Dyslipidemia

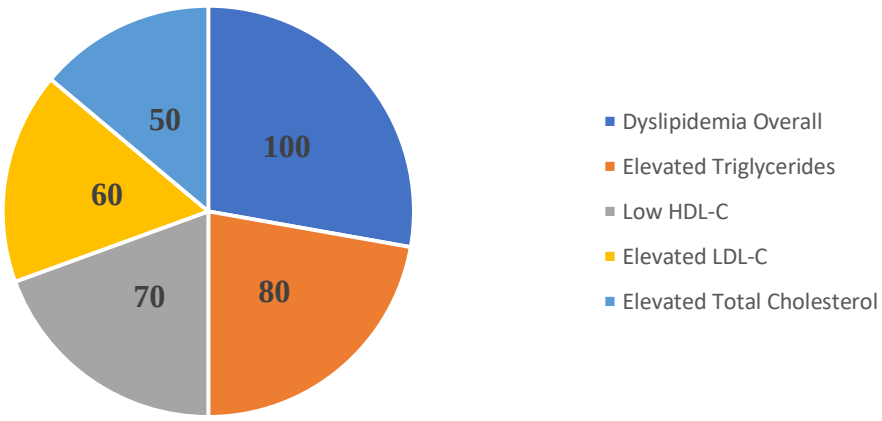


Table 4 - Lipid Profile Distribution Table

Lipid Parameter	Mean ± SD	Median (IQR)	Range
Total Cholesterol (mg/dL)	200 ± 40	198 (180-220)	150-300
LDL-C (mg/dL)	130 ± 35	128 (110-150)	80-200
HDL-C (mg/dL)	45 ± 10	44 (40-50)	30-70
Triglycerides (mg/dL)	180 ± 60	175 (140-210)	100-300

Table 4 summarizes the lipid profile parameters diagnosed type 2 diabetes mellitus (T2DM) patients. The mean total cholesterol level is 200 ± 40 mg/dL, with a median of 198 mg/dL (IQR: 180-220) and a range of 150-300 mg/dL. The mean LDL-C (low-density lipoprotein cholesterol) level is 130 ± 35 mg/dL, with a median of 128 mg/dL (IQR: 110-150) and a range of 80-200 mg/dL. The mean HDL-C (high-density lipoprotein cholesterol) level is 45 ± 10 mg/dL, with a median of 44 mg/dL (IQR: 40-50) and a range of 30-70 mg/dL. The mean triglyceride level is 180 ± 60 mg/dL, with a median of 175 mg/dL (IQR: 140-210) and a range of 100-300 mg/dL.

Table 5 –Correlation of Dyslipidemia by Demographic Characteristics Table

Characteristic	Dyslipidemia (n, %)	No Dyslipidemia (n, %)	P-value
Gender			
Male	55 (78.6%)	15 (21.4%)	0.03
Female	45 (64.3%)	25 (35.7%)	
Age Groups			
20-30	5 (50%)	5 (50%)	0.04
31-40	12 (60%)	8 (40%)	
41-50	28 (70%)	12 (30%)	

>50	55 (78.6%)	15 (21.4%)	
BMI Categories			
Normal weight	15 (50%)	15 (50%)	0.01
Overweight	45 (75%)	15 (25%)	
Obese	40 (80%)	10 (20%)	

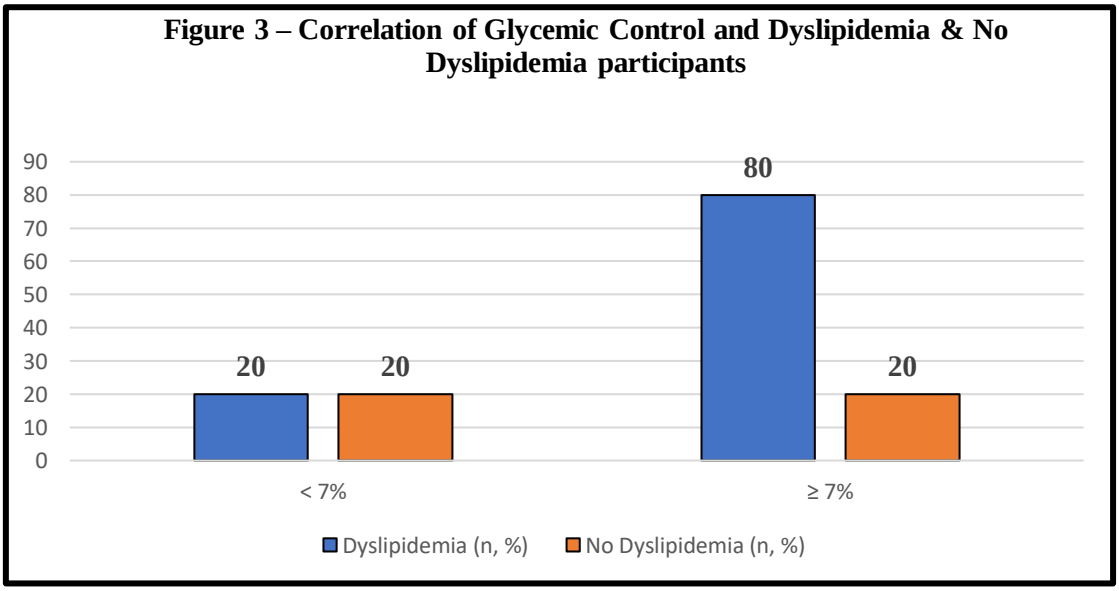
Table 5 examines the prevalence of dyslipidemia among newly diagnosed type 2 diabetes mellitus (T2DM) patients comparing those with and without dyslipidemia across different demographic and BMI categories. Among males, 78.6% have dyslipidemia compared to 21.4% without dyslipidemia. while among females, 64.3% have dyslipidemia compared to 35.7% without dyslipidemia. P-value 0.03 states a significant association between gender and dyslipidemia. Regarding age groups, 50% of the 20-30 age group have dyslipidemia, and 50% do not In the 31-40 age group, 60% have dyslipidemia, and 40% do not. In the 41-50 age group, 70% have dyslipidemia, and 30% do not. For those over 50, 78.6% have dyslipidemia compared to 21.4% without. P-value 0.04 3 states a significant association between age and dyslipidemia. BMI categories, 50% of those with normal weight have dyslipidemia and 50% do not Among overweight individuals, 75% have dyslipidemia, and 25% do not. Among obese individuals, 80% have dyslipidemia, and 20% do not. P-value 0.01 states a significant association between BMI and dyslipidemia.

Table 6 – Correlation of Glycemic Control and Dyslipidemia&No Dyslipidemia participants

Glycaemic Control	Dyslipidemia (n, %)	No Dyslipidemia (n, %)	P-value
HbA1c (%)			
< 7%	20 (50%)	20 (50%)	0.02
≥ 7%	80 (80%)	20 (20%)	

Table 6 analyzes the relationship between glycemic control, measured by HbA1c level among newly diagnosed type 2 diabetes mellitus (T2DM) patients. For patients with HbA1c levels less than 7%, 50% have dyslipidemia and 50% do not. In contrast, among patients with HbA1c levels equal to or greater than 7%, 80% have dyslipidemia, while only 20% do not. The p-value for this comparison is 0.02, indicating a statistically significant association between glycemic control.

Figure 3 – Correlation of Glycemic Control and Dyslipidemia & No Dyslipidemia participants



DISCUSSION:-

Patients with Type 2 Diabetes Mellitus (T2DM) typically exhibit a characteristic lipid profile, which includes normal or slightly elevated LDL cholesterol, low HDL cholesterol, and mildly elevated triglyceride concentrations[13]. Focusing solely on LDL measurements may thus underestimate the risk associated with the concentration of atherogenic lipoprotein particles in diabetes[14].Type 2 diabetes mellitus constitutes over 90% of all diabetes cases, posing a significant public health challenge. One of the key metabolic issues associated with diabetes mellitus is dyslipidemia. This study was conducted to evaluate the prevalence and patterns of dyslipidemia in patients with newly diagnosed type 2 diabetes mellitus.

The present study included 140 patients with newly diagnosed Type 2 Diabetes Mellitus (T2DM). Among them, 10 patients (7.10%) were aged 20-30 years, 20 patients (14.30%) were aged 31-40 years, 40 patients (28.60%) were aged 41-50 years, and the majority, 70 patients (50.00%), were over 50 years old. In terms of gender distribution, there were 90 males (64.29%) and 50 females (35.71%), indicating a higher prevalence of T2DM among males in this sample. Regarding Body Mass Index (BMI) categories, 30 patients (21.40%) were of normal weight, 60 patients (42.90%) were overweight, and 50 patients (35.70%) were obese, highlighting a significant presence of elevated BMI among the patients.In comparison, the study by **Borle Aet al** also found a higher proportion of males with T2DM and observed that most patients were in the higher age group[15]. Both studies indicate a high prevalence of overweight and obesity among the participants, emphasizing the importance of addressing these factors in managing T2DM. The present study findings are also identical with the study conducted by **Sosale A et al**[16].

In the present study, the prevalence of dyslipidemia among 140 patients with newly diagnosed Type 2 Diabetes Mellitus (T2DM) was found to be 71.40%, with specific abnormalities in the lipid profile. Elevated triglycerides were observed in 80 patients (57.10%), low HDL-C in 70 patients (50%), elevated LDL-C in 60 patients (42.90%), and elevated total cholesterol in 50 patients (35.70%). These findings indicate that dyslipidemia is a common metabolic disturbance in newly diagnosed T2DM patients, contributing to increased cardiovascular risk. Comparatively, other studies have reported similar high prevalence rates of dyslipidemia among T2DM patients. **Agarwal Y et al., Pandya H et al., Jayrama N et al., and Dixit et al.** found dyslipidemia prevalence rate with in the same range, aligning closely with our study's findings. These studies collectively highlight the widespread issue of dyslipidemia in T2DM patients[17-19].

The present study showed a mean total cholesterol level of 200 ± 40 mg/dL, LDL-C of 130 ± 35 mg/dL, HDL-C of 45 ± 10 mg/dL, and triglycerides of 180 ± 60 mg/dL. The median values and interquartile ranges (IQR) for these parameters were 198 (180-220) mg/dL for total cholesterol, 128 (110-150) mg/dL for LDL-C, 44 (40-50) mg/dL for HDL-C, and 175 (140-210) mg/dL for triglycerides. The observed ranges were 150-300 mg/dL for total cholesterol, 80-200 mg/dL for LDL-C, 30-70 mg/dL for HDL-C, and 100-300 mg/dL for triglycerides. In comparison, **Borle A et al** reported that hypercholesterolemia was present in 36% of their study subjects, increased LDL-C was observed in 66%, elevated triglycerides in 64%, and low HDL-C in 52%[15]. Both studies indicate a high prevalence of dyslipidemia among T2DM patients, with the present study showing slightly lower rates of elevated LDL-C and triglycerides compared to **Borle A et al**[15].

The present study Dyslipidemia was found in 78.6% of males and 64.3% of females, with a significant gender difference (p=0.03). Age-wise, dyslipidemia prevalence was 50% in the 20-30 age group, 60% in the 31-40 age group, 70% in the 41-50 age group, and 78.6% in those over 50, showing a significant trend (p=0.04). Regarding BMI, 50% of normal-weight patients, 75% of overweight patients, and 80% of obese patients had dyslipidemia, with a significant correlation (p=0.01). These findings highlight the high prevalence of dyslipidemia in older and overweight/obese T2DM patients, particularly among males.

In the present study, glycemic control was assessed in relation to dyslipidemia among patients with newly diagnosed Type 2 Diabetes Mellitus (T2DM). The results showed that 50% of patients with HbA1c levels below 7% had dyslipidemia, compared to 80% of patients with HbA1c levels of 7% or higher. This significant difference (p=0.02) underscores a clear association between poorer glycemic control and a higher prevalence of dyslipidemia in T2DM patients. Maintaining good glycemic control is crucial for managing dyslipidemia in T2DM patients. Elevated HbA1c levels are associated with a higher risk of developing lipid abnormalities, which can exacerbate the cardiovascular risks inherent in T2DM[20]. Therefore, effective management of blood glucose levels could be a key strategy in reducing the prevalence and severity of dyslipidemia among T2DM patients, highlighting the importance of comprehensive diabetes care that includes both glycemic and lipid management.

CONCLUSION:-

The present study reported the 71.40% prevalence of dyslipidemia among type 2 diabetes mellitus study participants. This study underscores the significant prevalence of dyslipidemia among newly diagnosed Type 2 Diabetes Mellitus (T2DM) patients, with a notable impact on males, older individuals, those who are overweight or obese, and those with poor glycemic control. These results highlight the need for comprehensive management strategies that address both blood sugar levels and lipid abnormalities to enhance cardiovascular health in T2DM patients. Dyslipidemia is particularly concerning as it may contribute to the development of cardiovascular and cerebrovascular diseases. Therefore, routine monitoring of blood glucose and lipid profiles in T2DM patients is essential for early detection of abnormalities and timely initiation of preventive measures and interventions.

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