

Study of frequency of dyslipidemia in type 2 diabetes mellitus in a tertiary care hospital

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Abstract

Objective: To Study the frequency and pattern of dyslipidemia in type 2 DM. **Methods:** This is an observational cross sectional study done in Yenepoya medical college mangalore, Karnataka. 50 patients with type 2 DM meeting the inclusion and exclusion criteria attending the medicine OPD and those admitted in the ward were include in the study. They were screened for diabetes mellitus and Dyslipidemia. **Results:** Out of 50 cases 60% of them were dyslipidemic. Majority of them had a diabetic dyslipidemia pattern followed by combined dyslipidemia, isolated hypertriglyceridemia, other pattern characterised by elevated levels of LDL with decreased HDL levels and isolated lower HDL level. Prevalence of dyslipidemia was more in males however prevalence of and mean TG, LDL, TC,TC/LDL levels more in females. Duration of diabetes mellitus had positive correlation with dyslipidemia.

Keywords: Dyslipidemia, Type 2 diabetes mellitus

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INTRODUCTION

1) To know the frequency of occurrence of dyslipidemia in type 2 diabetes mellitus patients. 2) To study the correlation between various fractions of lipids like total cholesterol, triglycerides, HDL, LDL, VLDL and the ratio of LDL is to HDL with type 2 diabetes mellitus. 3) To study dyslipidemia in patients with type 2 diabetes mellitus based on their sex. 4. To study dyslipidemia in patients depending on their glycemic control.

METHODS AND MATERIALS

Study population and design was a total 50 patients with type 2 diabetes mellitus also meeting the inclusion and exclusion criteria were considered for the study. Patients attending medicine OPD and those admitted in the ward were included for the study. They were screened for type

2 diabetes mellitus and dyslipidemia. Study period was 18 months. The study conducted in Yenepoya Medical College Hospital Mangalore, Karnataka. It was a cross – sectional study to find out the frequency of occurrence of dyslipidemia in type 2 Diabetes Mellitus.

Inclusion Criteria: Patients above the age of 40 years with type 2 diabetes mellitus.

Exclusion Criteria: Pregnant females, Patients with previous history of coronary artery disease, Patients on weight loss program (last 4 week), Patients on steroids more than 14 consecutive days, Patients undergoing surgery within 30 days of visit, Patient with active liver or gall bladder disease, Patients with history of pancreatitis and Patients on statins.

Investigations: Done for the study purpose includes: Fasting blood sugar, Fasting lipid profile (LDL cholesterol, Triglycerides, HDL cholesterol, VLDL) Total cholesterol, Post Prandial blood sugar and HbA1c.

Statistical tests of be employed: Continuous variables in terms of MEAN +/- SD and categorical variables in terms of frequency and percentage. Bar and pie diagrams will be used to represent the statistical data. Chi square test (2x2 table) to compare data between two groups. Criteria for the diagnosis of diabetes mellitus: Symptoms of diabetes plus random blood glucose concentration \geq 11.1mmol/L (200mg/dl) or Fasting plasma glucose \geq 6.9mmol/L(126mg/dl). Two hour plasma glucose $>$ =

11.1 mmol/L (200ml/dl) during an oral glucose tolerance test. HbA1C > = 6.5%. Random blood sugar is defined as without regard to time since the last meal. Fasting blood sugar is defined as no caloric intake for atleast 8 hours. (8 hours after a small meal and 12 hours of a large meal). The serum should also be tested in the fasting state for the lipid profile and glycosylated haemoglobin determination.

Table 1: Glycemic statuses of the patients are divided into:

HbA1c	Glycaemic status
≤ 8%	Good
>8%	Poor

Table 2: Cardiovascular risk status of patients according to their lipid levels are tabulated accordingly

Lipids	Plasma concentration	Cardiovascular status
LDL cholesterol	>3.5 mmol/1	High
	2.6 mmol/1 – 3.4 mmol/1	Borderline
	<2.6 mmol/1	Low
Triglycerides	>4.mmol/1	High
	2.2.mmol/1 – 4.5 mmol/1	Borderline
	<2.2mmol/1	Low
HDL	<0.9mmol/1	High
	1.2mmol/1 – 0.9 mmol/1	Borderline
	>1.2mmol/1	Low

Table 3: Lipid levels of patients according to their glycaemic status

HbA1C	Lipids	Recommended level for adults with diabetes
≤8%	LDL – Cholesterol	<2.6 mmol/1
	Triglycerides	<1.7 mmol/1
	HDL – Cholesterol	>1.0 mmol/l
>8%	LDL – Cholesterol	<2.6 mmol/1
	Triglycerides	<1.7 mmol/1
	HDL – Cholesterol	>1.0 mmol/l

RESULTS

Table 4: Age distribution of Patients Studied

Age in years	Number of patients	Percentage
40-50	13	27.0
50-60	16	32.0
60-70	18	34.0
>70	3	7.0
Total	50	100.0

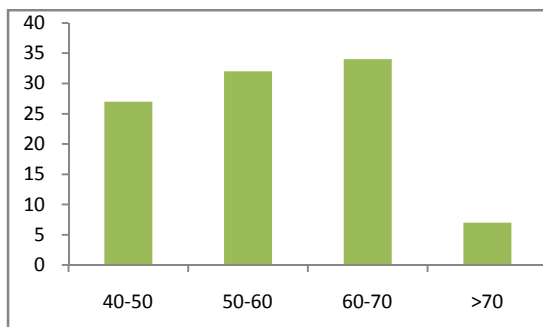


Figure 1: Age distribution of patients studied

Table 5: Gender distribution of patients studied

Gender	Number of patients	Percentage
Male	28	56
Female	22	44
Total	50	100

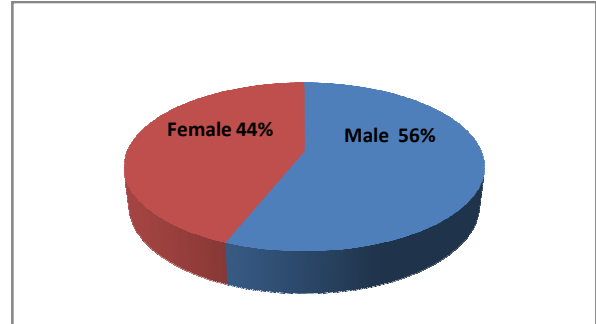


Figure 2: Gender Distribution

Table 6: Duration of Diabetes Mellitus

Duration	Number of patients	Percentage
1-2	10	20.0
3-5	10	20.0
5-10	16	32.0
10-20	12	24.0
>20	02	4.0
Total	50	100.0

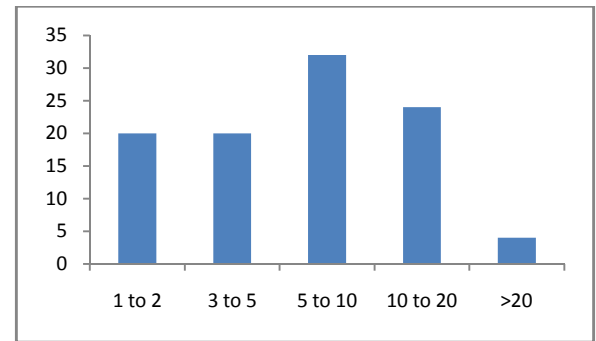


Figure 3: Duration of Diabetes with percentage

Table 7: Diet History

Diet history	Number of patients	Percentage
Vegetarian	21	42
Mixed	29	58

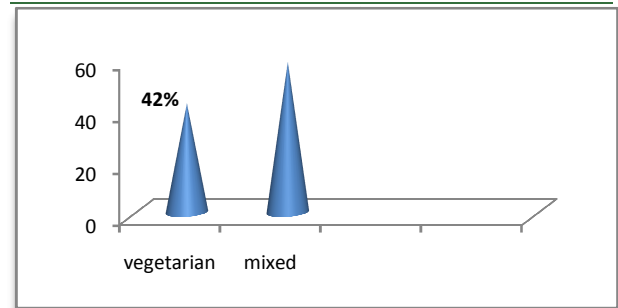


Figure 4: Diet History

Table 8: Family History

Family history	Number of patients	Percentage
No	28	56.0
Yes	22	44.0

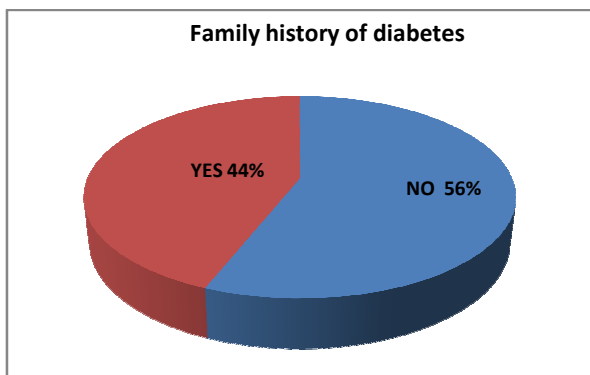


Figure 5: Family history of Diabetes in our study

Table 9: Sugar Parameters

Sugar parameters	Number of patients	Percentage
FBS (mg/dl)		
<110	10	10.0
110- 140	13	26.0
>140	32	64.0
PPBS(mg/dl)		
<140	02	4.0
140 – 200	12	25.0
>200	36	71.0
HbA1c%		
<7	02	4.0
7-8	8	16.0
8-9	16	32.0
9-10	9	18.0
>10	15	30.0

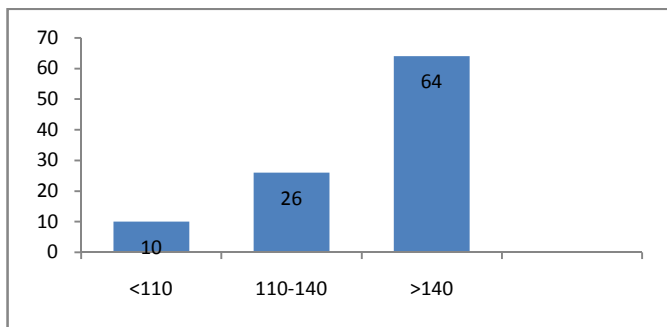


Figure 6: Fasting Blood Sugar

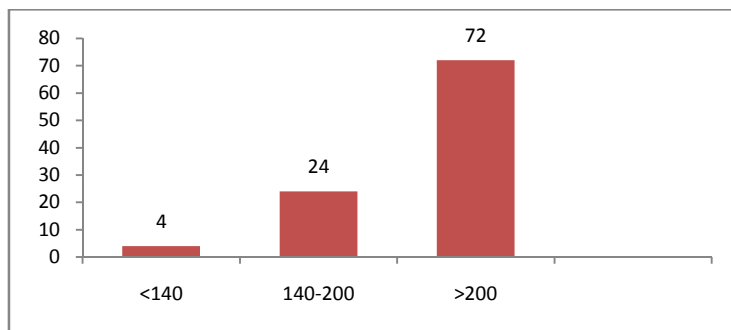


Figure 7: Post Prandial Blood Sugar(mg/dl)

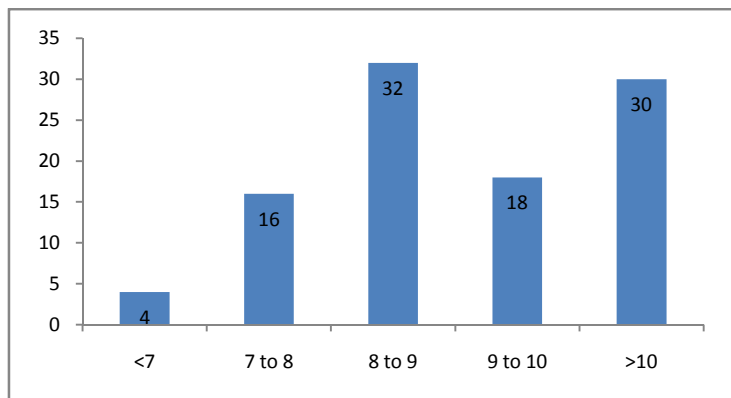


Figure 8: HbA1c with Percentage

Table 10: Lipid parameters of patients studied

Lipid parameters	Number of patients	Percentage
Total cholesterol(mg/dl)		
<200	34	68.0
200-240	10	20.0
>240	12	12.0
Total triglycerides(mg/dl)		
<150	26	52.0
150-199	12	24.0
200-499	07	14.0
>500	5	10.0
High Density Lipoprotein(mg/dl)		
<40	9	18.0
40-60	40	80.0
>60	1	2.0
Low Density Lipoprotein(mg/dl)		
<100	20	40.0
100-130	15	30.0
130-160	10	20.0
>160	05	10.0
Very low Density Lipoprotein(mg/dl)		
<30	25	50.0
>30	25	50.0
Total Chol/HDL ratio		
<4.5	23	46.0
>4.5	27	54.0

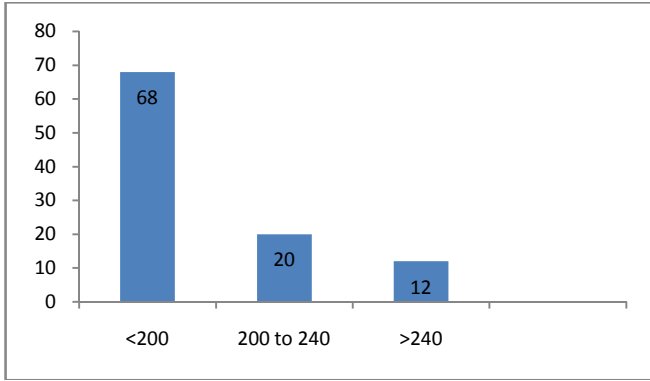


Figure 9: Total cholesterol (mg/dl)

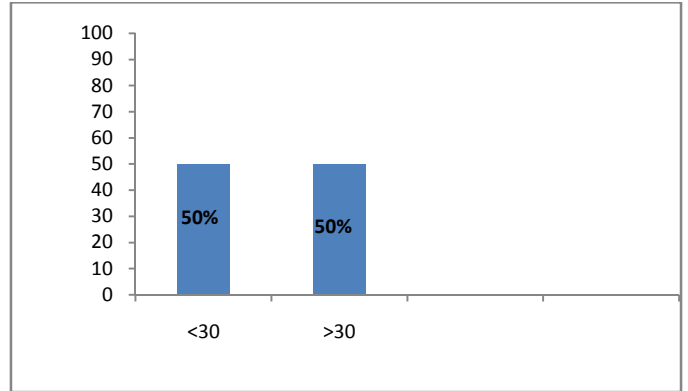


Figure 13: Very Low Density Lipoprotein (mg/dl)

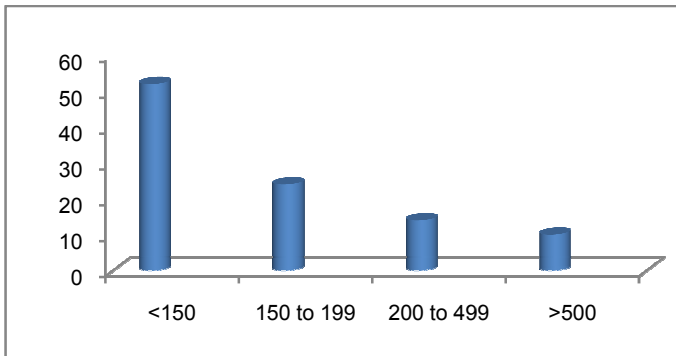


Figure 10: Triglycerides (mg/dl)

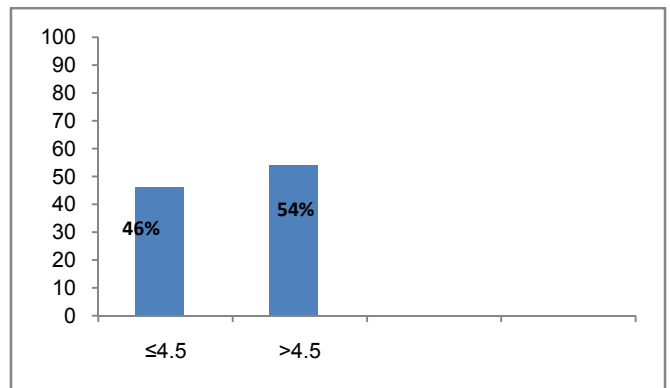


Figure 14: Total Cholesterol/HDL ratio

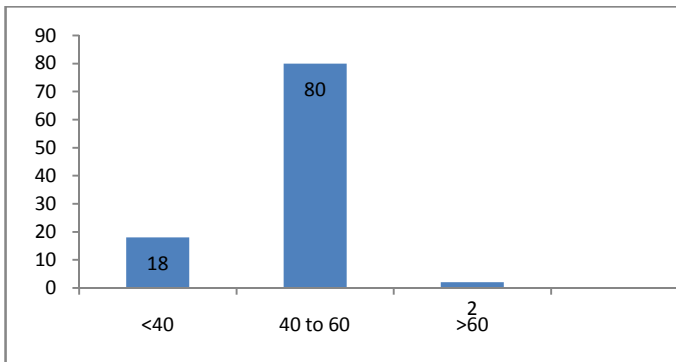


Figure 11: High Density Lipoprotein (mg/dl)

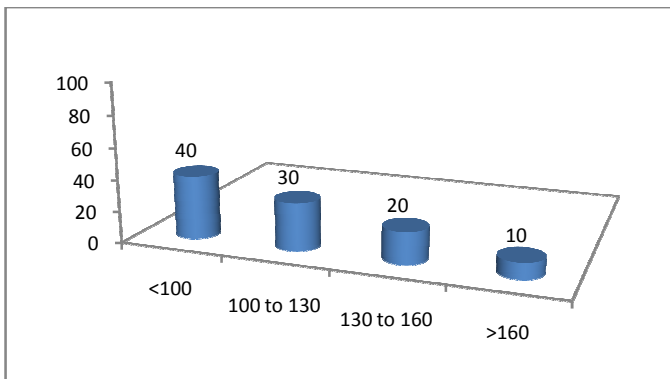


Figure 12: Low Density Lipoprotein (mg/dl)

Table 11: Prevalence of Dyslipidemia

Dyslipidemia	Number of patients	Percentage
Absent	20	40.0
Present	30	60.0
Total	50	100.0

Table 12: Correlation of prevalence dyslipidemia according to Age and Gender

Age	No: patients	Patients wit Dyslipidemia	% of dyslipidemia
40-50	13	10	76.92
50-60	16	10	62.50
60-70	18	07	38.90
>70	03	03	100.0
Gender			
Male	28	17	60.70
Female	22	13	59.09
Total	50	30	100

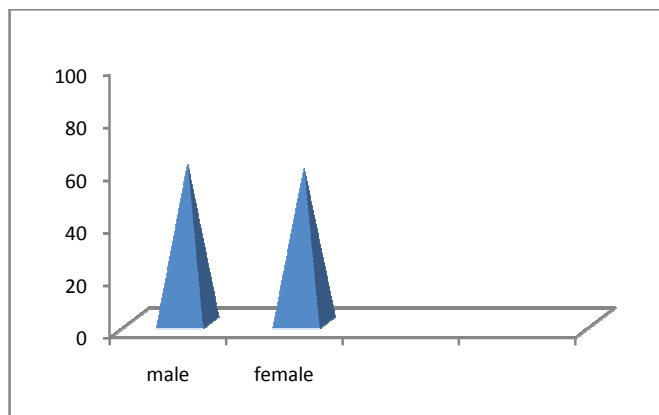


Figure 15: Prevalence of Dyslipidemia according to age and gender

Table 13: Prevalence of dyslipidemia according to duration

Duration of DM	No: patients	No: Patients with Dyslip	% of dyslipidemia
1-2	10	2	20.00
3-5	10	8	80.00
5-10	16	8	50.00
10-20	12	10	83.33
>20	2	2	100.0

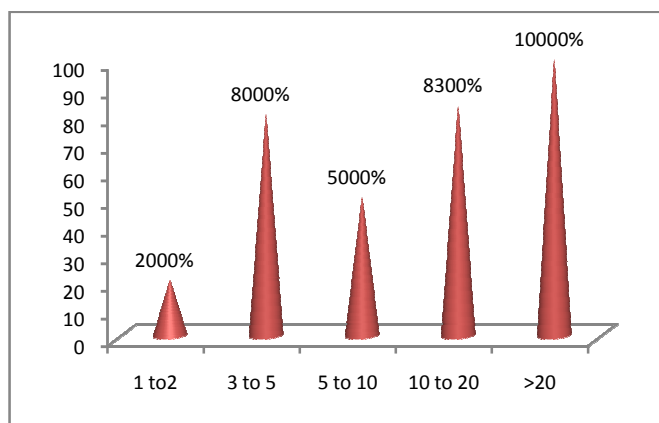


Figure 16: Correlation of prevalence of dyslipidemia according to duration of diabetes

Table 14: Lipid parameters according to HbA1c

Lipid parameters	<8.0%	>8.0%
Total cholesterol	181.70±40.38	187.40±47.36
Total triglycerides	129.15±49.50	169.40±62.22
HDL	41.90±8.92	37.46±6.21
LDL	116.90±33.32	116.05±39.49
VLDL	25.90±9.92	33.83±12.37
T.Chol / HDL Ratio	4.82±1.33	5.09±1.37

Table 15: Prevalence of various types of Dyslipidemia

Dyslipidemia	No Patients	Percentage
Diabetic dyslipidemia	7	25
Combined	6	20
Isolated HDL	2	4
Isolated triglycerademia	3	6

Table 16: Lipid parameters according to Gender

Lipid parameters	Male	Female
Total Cholesterol	28.1%	34.9%
Total triglycerides	43.9%	
HDL	35.08%	
LDL	57.9%	
VLDL	43.9%	

OBSERVATIONS

Patients Characteristics

Out of 50 patients included in the study, 28 were males and 22 were females. Age of the patients vary from 40 to 80 years. Maximum number (59%) of patients were seen in the age group of 40-60 years, rest of the patients in the 60-70 (34%) age group and remaining 7% was in > 70 age group. The duration of diabetes varied from 1 year to 29 years. 30 (30%) had 5-10 years duration, 25 (25%) had 10-20 years duration, 21 (21%) patients had duration of 1-2 years, 20 (20%) had duration of 3-5 years, and 4(4%) had diabetes mellitus for more than 20 years. The number of patients with a family history of type 2 diabetes mellitus was 22 (44%) and 28 (56%) did not have family history. 89 (89%) patients were taking oral hypoglycaemic agents for the control of diabetes and 34(34%) patients were on insulin. Among the 50 patients, 29 (58%) gave history of a mixed diet and 21 (42%) were vegetarian. 25 (50%) of the patients had normal BMI (18.5 – 25 kg/m²), 20 (40%) of the patients were in the overweight category (25-30 kg /m²), 3(6%) were in the obese category (>30 kg/m²) and 2 in the lean category (< 18.5 kg/m²). Mean value of fasting blood sugar of 50 patients was found to be 171. 29 +- 59. 8 mg/dl, 64 (64%) of the patients had fasting blood sugars above 140 mg/dl and only 11 (11%) of the patients had fasting blood sugars < 110 mg/dl while the mean value of post prandial blood sugar was 247. 32 +- 83.4 mg/dl, 71 (72%) of the patients were found to have post prandial blood sugars above 200mg/dl and only 2 (4%) of the patients had post prandial sugars less than 140 mg/dl. Number of patients with HBA1c > 9 were 24 (48%), only 2 (4%) of patients had HBA1VC < 7 while 8 (16%) had HBA1C between 7.8 and 16 (32%) had HBA 1 c in between 8 to 9%. The mean value of HbA1c in general was 9.08 +- 1.6%. Dyslipidemia was found to be present in 30 (60%) diabetics among 50 patients. Total cholesterol were found to be less than 200 mg/dl in 34 (68%) patients, 200 – 240 in 10 (20%) of patients and > 240 is 6 (12 %). Mean total cholesterol among males was 184.89 +- 49.97 and females was 188.09 +- 40.4 mg/dl. The number of patients with total triglycerides < 150 mg /dl as 26 (52%) 150 – 199 mg/dl was 12 (24%), 200-499 mg/dl was 07 (14%) and those with TG > 500 mg/dl was 05 (10%), mean TG levels in males was 160.28 +- 66.03 mg/dl and in females was 162.77+- 56.47mg/dl. High density

lipoprotein levels below 40 mg/dl seen in 09 (18%) patients, 40 patients have HDL between 40-60 mg/dl (80%). 20 patients had LDL < 100 mg/dl, 15 patients had between 100-130mg/dl, 10 had between 130-160 mg/dl and 05 had > 160 mg/dl. Very low density lipoprotein (VLDL) was found less than 30 mg /dl in 25 patients and more than 30 mg/dl in 25 of the 50 patients. The mean value of HDL, LDL, VLDL in males were 40.75 + - 7.54 mg/dl, 114.86 + - 41.33. mg/dl, 32.05 + - 13.21 respectively and in females HDL was 38.86 + - 5.78 mg/dl, LDL was 118.05 + - 33.94 mg/dl and VLDL was 32.53 + - 11.12 mg/dl. The number of patients with HbA1c less than 7% was 2. patients had 7-8% was 8, 8-9% was 16 and more than 9% in 24. In male patients, the mean values in mg/dl of TC, TG, HDL, LDL and VLDL were 181.70 + - 40.38, 129.15 + - 49.50, 38.90 + - 8.92, 116.90 = - 33.32, and 25.90 + - 9.92 respectively. In female patients it were 187.40 + - 47.36, 169.40 + - 62.22, 37.46+ - 6.21, 116.05 + - 39.49 and 33.83+ - 12.37 correspondingly.

DISCUSSION

Dyslipidemia remains an important association with type 2 diabetes mellitus. It is a well know fact that diabetes mellitus carries a high risk for accelerated atherosclerosis and is associated with increased morbidity and mortality. The prevalence of dyslipidemia in type 2 diabetes mellitus has been show to vary depending upon the ethnicity of the population. Afro- caribbean subjects in the UK have lower rates of CHD. Much of the difference in CHD incidence may be explained by the absence of the typical diabetic dyslipidaemia and ethnicity¹. Diabetic dyslipidemic pattern is highly atherogenic and is associated with coronary artery disease. In united Kingdom prospective diabetic study (UKPDS), increased LDL, decreased HDL and hyperglycemia emeged as a greater risk factor for coronary artery disease. It has been found that Asian Indians are predisposed to premature coronary artery disease. Certain unique clinical and biochemical abnormalities inindians which include increased insulin resistance, greater abdominal adiposity i.e., higher waist circumference despite lower body mass index, lower adiponectin and higher high sensitive C-reactive protein levels has lead to the term “Asian Indian Phenotype”. This particular phenotype makes Indians more prone to diabetes and premature coronary artery disease. In this study, the prevalence of dyslipidemia was 60% in 50 patients with type 2 diabetes mellitus. These patients were included in the study after excluding a wide variety of factors which can alter lipid profile of the diabetic patients. A national cross- sectional study of 2473 canadian patients with type 2 diabetes revealed a similar result with 55% of patients having dyslipidemia.

This proportion rose to 66% in patients with diabetes for 15 years². Kayoed *et al* studied 113 diabetic patients in a hospital based study conducted in Nigeria which revealed the prevalence of dyslipidemia (at least one abnormal lipid profile) to be 50.4%³. A hospital study conducted in Abbottabad, Pakistan showed prevalence of dyslipidemia to be 78% while another study conducted in Kolar, Karnataka showed the prevalence of dyslipidemia in type 2 DM to be 92.4%. the variation in prevalence can be attributed to the variation in glycaemic control along with ethnicity, diet and physical activity^{4,5}. The commonest type of dyslipidemia found in this study was diabetic dyslipidemia (25%) (increased triglyceride levels, increased levels of LDL and decreased HDL). it was followed by combined dyslipidemia (20%) (hyper triglyceridemia (6%) and other patterns which include increased LDL with decreased HDL (5%) and isolated decrease in HDL (4%). in a hospital based study in Malaysia involving 240 type 2 diabetic patients, 70% were dyslipidemic with diabetic dyslipidemic pattern was observed in 9.3% combined dyslipidemia 23.2, in another study conducted in COLar combined dyslipidemia dominated followed by isolated dyslipidemia with low HDL^{5,6}. Hypertriglyceridemia was seen in 48% of the total patients while isolated hypertriglyceridemia alone was seen in 6% of the diabetics. Prevalence of hypertriglyceridemia was more in females (48.8%) than in males (43.9%). The mean values of triglyceride levels in females (162.77 mg/dl) dslightly higher than in males (160.28mg/dl). In a study conducted in urban slums in Delhi, the prevalence of triglyceridemia in type 2 DM were 61%,while prevalence of hypertriglyceridemia was 78% in type 2 DM subjects was seen in a hospital based study in Abottabad, Pakistan^{5,7}. Prevalence of low HDL was noted in 34 % of the diabetics in the study with females to complete. Gupta *et al* has showed 24% of urban population has low HDL while Tai *et al* had demonstrated 34% of the subjects with low HDL in multi ethnic study in Singapore were Asian Indians. Misra *et al* showed a 15% male with low HDL and 16% females with low HDL in urban slums^{6,8}. Hypercholesterolemia was found to be present in 33% of diabetics with its prevalence higher in females (34.9%) than males (28.1%). The mean value in females was 88.09 mg/dl whereas in males it was 184 mg/dl. According to a study conducted in Malaysia, 73.2% patients had hypercholesterolemia among the 848 type 2 diabetes mellitus patients included in the study. Type 2 diabetic patients have a high frequency of atherogenic dyslipidemia especially for TC and LDL – C. A different study conducted in urban slum population in northern india in type 2 diabetes patients, hypercholesterolemia was found to be 26.8% in males and 27.5% in females. In

another study which was conducted in Saudi Arabia, 56.6% of the total patients had hypercholesterolemia^{9,6,10}. Majority of the diabetics in the study had poor glycaemic control. Mean value of fasting blood sugar of 50 patients was found to be 171.29 ± 59.8mg/dl, 32 (64% of the patients had fasting blood sugars above 140 mg/dl and only 05 (10%) of the patients had fasting blood sugars < 110 mg/dl while the mean value of post prandial blood sugar was 247.32 ± 83.4 mg/dl, 36(71%) of the patients were found to have post prandial blood sugars above 200 mg/dl and only 2 (4%) of the patients had post prandial sugars less than 140 mg/dl. Number of patients with HBA1C > 9 were 57%, only 4% of patients had HBA1c < 7 while 16% had HBA1C between 7-8 and 33% had HBA1c between 8-9%. This poor control may be attributed to the low rates of insulin therapy administered in the diabetics and failure oral hypoglycaemic therapy¹⁰. Triglycerides showed marked increase in their mean value along with other sub fractions of lipids in poor glycaemic control group except HDL which showed a decrease and LDL levels remained the same. The mean values of total cholesterol, TG, HDL, LDL, VLDL, TC/HDL ratio in HBA1C < 8% were 18.7 ± 40.38 mg/dl, 121.15 ± 49.5 mg/dl, 38.92 ± 8.92mg/dl, 116.9 ± 33.32mg/dl, 25.9 ± 9.92 mg/dl, 4.82 ± 1.33 respectively. While in HBA1c > 8% group TC, TG, HDL, LDL, VLDL, TC/HDL were 187.4 ± 47.36 mg/dl, 169.4 ± 62.22 mg/dl, 116.05 ± 39.49 mg/dl, 33.38 ± 12.37 mg/dl and 5.09 ± 1.3 respectively. A study by Chintamani Bodhe *et al* showed that severity of dyslipidemia increase in patients with higher HbA1c value. As elevated HbA1c and dyslipidemia are independent risk factors of cardiovascular disorders (CVD), diabetic patients with elevated HbA1c and dyslipidemia can be considered as very high risk group for CVD. Improving glycaemic control can substantially reduce the risk of cardiovascular events in diabetics¹¹. Ram Vind Mahto *et al* proved that HbA1c can be used as a potential biomarker for predicting dyslipidemia in type 2 diabetic patients in addition to glycemic control with his study. In a study done in Saudi Arabia, it was seen that there is a direct relation between glycemic status and lipid profile in both the genders¹². According to this study, the dyslipidemia in the male patients was found to be 61.4% and in females it was 58.13%. Jayarama *et al* studies showed that prevalence of dyslipidemia among diabetic males was 95.4% and 86.75% in females⁵ whereas a study conducted in Pakistan showed that 50.5% were females and 49.4% were males¹³. Another study done in Iran supports this with similar results¹⁴. Mean values of individual parameters like TG, TC, HDL, LDL and VLDL in females was 162.77mg/dl, 188.09mg/dl, 37.74mg/dl, 118.05mg/dl and 32.53 mg/dl respectively

which were higher than in males. The TG, TC, HDL, LDL and VLDL mean values in males were 160.28 mg/dl, 184.89mg/dl, 37.75 mg/dl, 114.86 mg/dl and 32.05mg/dl correspondingly. Almost all studies, including this, pointed to a higher prevalence of hypertriglyceridemia in females. Fontbonne *et al.* in a prospective cohort study showed that an elevated plasma level of TG in diabetic patients was positively and significantly correlated with CAD events and CAD mortality. Hypertriglyceridemia may be the best lipid predictor of CVD in type 2 diabetic patients¹⁴. Duration of diabetes and dyslipidemia has shown correlation with dyslipidemia where by prevalence of dyslipidemia was higher in the group with longer duration of diabetes. All the patients with more than 20 years of diabetes had dyslipidemia while patients with 10-20 years, 5-10 year and 1-2 years showed involvement of 80%, 50%, 23.8% respectively. According to a Canadian study, patients with type 2 DM for less than 2 years had dyslipidemia prevalence of 55% whereas in those with type 2 DM for more than 15 years, it rose to 66%¹⁵.

CONCLUSION

The study has shown the frequency of dyslipidemia in type 2 DM is 60%. Most prevalent pattern of dyslipidemia is diabetic Dyslipidemic pattern. Gender alters the lipid profile in type 2 DM and females are associated with higher non HDL fraction. Poor Glycemic control results results in worsening of dyslipidemic profile.

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