

# Evaluation of Diabetic Dyslipidemia in Patients with Type 2 Diabetes Mellitus

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## Abstract

**Introduction:** Type 2 diabetes mellitus (DM) is the most common metabolic disorder in the world. Patients with diabetic dyslipidemia are more prone for developing macrovascular complications compared to subjects without DM. Hence, morbidity and mortality are high among patients with DM.

**Aim:** The aim of this study was to study the prevalence and pattern of diabetic dyslipidemia in the study population so as to intensify treatment to achieve optimum glycemetic and lipid control.

**Materials and Methods:** The study was carried out on 50 patients with type 2 DM who attended the Department of General Medicine, KIMSH and research center, Bangalore between the period of January 1 to March 1, 2022, it was a cross-sectional study. Statistical analysis was done using Epi Info software. Chi-square test was done to see the statistical significance of difference between males and females,  $P < 0.05$  was considered significant in this study.

**Results:** Among the study population, 46% were male and 54% were female, mean age of the study population was  $53 \pm 7$  years. About 44% ( $n = 22$ ) of the patients had higher triglyceride (TG) levels and 54% ( $n = 38$ ) had optimum TG levels of  $<150$  mg/dl. About 60% ( $n = 30$ ) had high low-density lipoprotein cholesterol (LDL-C) levels, whereas 40% ( $n = 20$ ) had optimum LDL-C levels of  $<100$  mg/dl. About 98% ( $n = 49$ ) had low high-density lipoprotein cholesterol (HDL-C) values of  $<40$  mg/dl. About 44% ( $n = 32$ ) had Non-HDL (NON-HDL) levels of  $>130$  mg/dl, whereas 56% ( $n = 28$ ) had optimum levels of  $<130$  mg/dl. The mean TG level was  $173.76 \pm 97.68$  mg/dl, mean LDL-C was  $103.18 \pm 38.03$  mg/dl, mean HDL-C was  $31.54 \pm 9.91$  mg/dl, and mean NON-HDL level was  $123.44 \pm 42.41$  mg/dl. The mean fasting blood sugar was  $164.66 \pm 71.37$  mg/dl and mean postprandial blood sugar was  $242.54 \pm 86.09$  mg/dl.

**Conclusion:** The pattern of diabetic dyslipidemia high TG, high LDL-C, and low HDL-C is still prevalent among patients with type 2 DM which requires early screening and intense glycemetic and lipid control to prevent macrovascular complications.

**Key words:** Diabetes mellitus, Dyslipidemia, Triglyceride

## INTRODUCTION

Diabetes mellitus (DM) is the most common metabolic disorder in the world. According to the IDF, 537 million people in the world live with diabetes as of 2021.<sup>[1,2]</sup> In most countries, the number of individuals with diabetes is steadily increasing. China has the largest number of people with diabetes in the world (140.8 million), followed

by India with 74.1 million.<sup>[1,2]</sup> DM is characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both leading to microvascular and macrovascular complications.<sup>[1,2]</sup> Among the macrovascular complications, cardiovascular diseases (CVDs) contribute to significant morbidity and mortality in patients with type 2 DM. Dyslipidemia is found to be one of the major risk factors for atherosclerotic CVD in type 2 DM. A triad of high Triglyceride (TG), low high-density lipoprotein (HDL), and high low-density lipoprotein (LDL) particles is observed in patients with type 2 DM which is referred to as "Atherogenic Diabetic Dyslipidemia (ADD)," as shown in Figure 1. Insulin resistance at the level of adipocyte causing increased free fatty acid efflux is thought

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to be central to the pathogenesis of ADD.<sup>[3]</sup> American Diabetes Association (ADA)<sup>[4]</sup> guidelines recommend maintaining serum TG below 150 mg/dl, LDL cholesterol below 100 mg/dl, and HDL cholesterol of more than 40 mg/dl in males and 50 mg/dl in females. This study evaluates the prevalence and pattern of dyslipidemia in patients with type 2 DM to achieve better treatment goals that may reduce risk of CVD in this population.

## MATERIALS AND METHODS

The present cross-sectional study was conducted at the department of General Medicine, Kempegowda Institute of Medical Sciences And Research Center, Bangalore from January 1 to March 1, 2022, over a period of 2 months. The study was carried out on 50 patients with type 2 diabetes. Informed consent was taken from all the patients.

### Inclusion Criteria

Known case of type 2 diabetes, including recently diagnosed cases.

### Exclusion Criteria

Patients with the following conditions were excluded from the study:

- Type 1 diabetes on insulin
- Hypothyroid patients
- Obesity
- Diabetic patients with chronic kidney disease
- Nephrotic syndrome
- Patients on lipid lowering agents.

The diagnosis of diabetes was made by ADA criteria<sup>[4]</sup>

Both fasting and postprandial blood sugars were estimated using hexokinase method. HBA1C was measured by immunoturbidometry method. Lipid profile panel was considered as follows as per our hospital laboratory protocol.

Total cholesterol:

- <200 mg/dl desirable
- 200–239 borderline high
- >240 high.

Measured by CHOD-PAP method.

TG:

- <150 mg/dl normal
- 150–199 borderline high
- 200–449 high
- >500 very high.

Measured by GPO-PAP method.

HDL

- <40 mg/dl low
- >60 mg/dl high.

LDL

- <100 mg/dl optimal
- 100–129 mg/dl above optimal
- 130–159 borderline high
- 160–189 high
- >190 very high.

HDL and LDL both measured by DIRECT method.

### Statistical Analysis

The data were analyzed using various statistical methods such as percentage, proportion, and tables using Epi Info software. Chi-square test was used to see the statistical significance of difference between males and females,  $P < 0.05$  was considered significant for the purpose of this study.

## RESULTS

The study population comprised 50 patients of type 2 diabetes with 23 (46%) males and 27 (54%) females. The mean values of biochemical parameters are as shown below.

Twenty-two patients have TG level >150 mg/dl which comprise 44% of the total study population.

Thirty patients have LDL-C level >100mg/dl which comprise 60% of the total study population.

## DISCUSSION

Our research reveals information on the prevalence and pattern of dyslipidemia in the diabetic population seen by us in our day-to-day clinical practice. The mean values of the biochemical parameters taken for our study are shown in Table 1. Our study shows that only 40% ( $n = 20$ )

**Table 1: Mean biochemical values**

Mean values	Total patients n=50	Male n=23	Female n=27
FBS	164.66±71.37	161.43	167.40
PPBS	242.54±86.09	237.86	246.51
TC	154.26±41.64	141.82	164.85
TG	173.76±97.68	152.26	192.07
HDL-C	31.54±9.91	30.69	32.25
LDL-C	103.18±38.03	96.47	111.42
NON-HDL	123.44±42.41	112.69	132.59

FBS: Fasting blood sugar, PPBS: Postprandial blood sugar, TC: Total cholesterol, TG: Triglyceride, HDL-C: High-density lipoprotein cholesterol, LDL-C: Low-density lipoprotein cholesterol, NON-HDL: Non-high-density lipoprotein

of the patients had their LDL-C levels within the target range and 60% ( $n = 30$ ) of the study population had LDL-C levels beyond the target range, as shown in Table 2. These results are comparable to the data from Kennady *et al.*<sup>[5]</sup> who found that only 45% of those with diabetic dyslipidemia are at LDL-C goal; similarly, Jayaram *et al.*<sup>[6]</sup> have shown that only 43.91% patients achieved

**Table 2: LDL-C levels**

LDL-C in mg/dl	TP $n=50$ (%)	Male $n=23$	Female $n=27$
<100	20 (40)	11	9
100–129	15 (30)	4	11
130–159	10 (20)	7	3
160–189	4 (8)	1	3
>190	1 (2)	0	1

LDL-C: Low-density lipoprotein cholesterol

**Table 3: Serum triglyceride levels in DM**

Serum TG in mg/dl	TP $n=50$ (%)	Male $n=23$	Female $n=27$
<150	28 (56)	15	13
150–199	4 (8)	1	3
200–499	18 (36)	7	11
>500	0	0	0

TG: Triglyceride, DM: Diabetes mellitus

**Table 4: HDL-C levels**

HDL-C in mg/dl	TP $n=50$	Male $n=23$	Female $n=27$
<40	49 (98%)	22	27
>60	1 (2%)	1	0

HDL-C: High-density lipoprotein cholesterol

**Table 5: NON-HDL levels**

NON-HDL in mg/dl	TP $n=50$ (%)	Male $n=23$	Female $n=27$
<130	28 (56)	14	14
>130	22 (44)	9	13

NON-HDL: Non-high-density lipoprotein

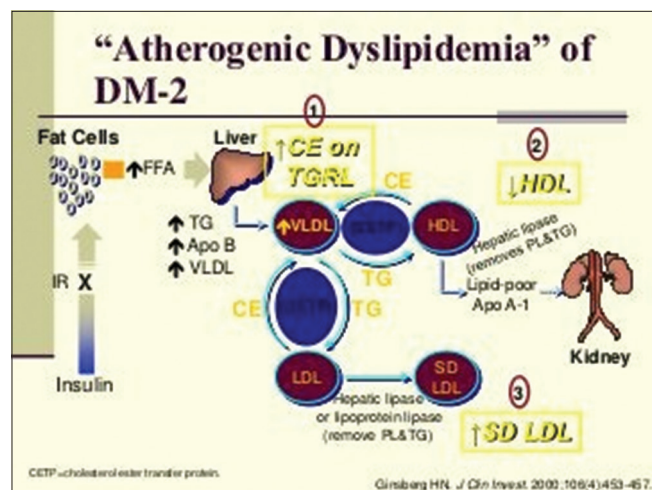
LDL-C goal in a study from India. Control of other lipid parameters such as serum TG and HDL-C levels were also found to be inadequate with only 56% ( $n = 28$ ) of the patients achieving target TG levels and 44% ( $n = 22$ ) of the patients had TG levels >150 mg/dl, respectively, as shown in Table 3. About 98% of the patients have HDL-C level <40 mg/dl and 2% had >60 mg/dl, as shown in Table 4; HDL-C levels have been found to be significantly lower in our study population.<sup>[7-10]</sup> We also evaluated the non-HDL levels in our study population, 44% ( $n = 22$ ) had HDL-C >130 mg/dl, as shown in Table 5, because non-HDL cholesterol measures the apo B containing lipoproteins, it can serve as an additional tool to assess cardiovascular risk.<sup>[11]</sup> As mentioned earlier, a triad of high TG, low HDL, and high LDL is referred to as atherogenic diabetic dyslipidemia; our study correlates with the above findings hence putting our study population under significant cardiovascular risk.<sup>[7-10,12,13]</sup> In our study, there no was significant differences between the lipid parameters among male and female gender,  $P > 0.05$ ; hence, both males and females were at an equal risk of acquiring CVD.

## CONCLUSION

Our present study concludes that there was significantly higher levels of serum LDL-C level, serum TG and non-HDL levels in our study diabetic population and low levels of serum HDL-C levels which contribute to increased cardiovascular, cerebrovascular, and peripheral arterial morbidity and mortality. Hence, efforts should be intensified in the area of glycemic control, lipid lowering, and lifestyle modification to reduce the risk of morbidity and mortality in diabetic patients.

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**Figure 1: Atherogenic diabetic dyslipidemia mechanism**

## Gowda: Diabetic Dyslipidemia Prevalence and Pattern

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