**Original Research Article**

# PREVALENCE OF DYSLIPIDEMIA AMONG TYPE 2 DIABETIC PATIENTS IN SOUTHERN ASSAM, INDIA:A CROSS-SECTIONAL STUDY

*Jayanta Bhattacharjee[1], Pragyan Prakash Gogoi[1], Kanika K Baruah[2]*

[1]Assistant Professor, Department of Community Medicine, Silchar Medical College and Hospital, Silchar, Assam, India.
[2]Professor & HOD, Department of Community Medicine, Silchar Medical College and Hospital, Silchar, Assam, India.

**ABSTRACT**

**Background:** There is marked increase in the prevalence of diabetes not only in India but around the world. Both glucotoxicity and lipotoxicity is believed to play a major role in the pathophysiology of diabetes progression and development of complication. Dyslipidaemia has been recognized as a major cardiovascular risk factor. The objective of the study was to study prevalence and pattern of dyslipidaemia in type 2 diabetes mellitus patients attending outpatient department of Non-Communicable Disease clinic of civil hospital, Silchar, Assam.

**Materials and Methods:** This was a cross-sectional study carried out among 100 Type 2 diabetic mellitus patients attending outpatient department of Non-Communicable Disease clinic of civil hospital, Silchar, Assam. Study population included known as well as newly diagnosed type 2 diabetic patients more than 20 years of age.

**Results:** The prevalence of dyslipidaemia among type 2 diabetic individuals was 90% among males and 87.5% among females. Proportion of mixed dyslipidaemia, combined dyslipidaemia and isolated single parameter dyslipidaemia among males were 16.7%, 48.3% and 25% respectively. Among females the figure for the same stands out to be 20%, 45% and 22.5% respectively. The most common combined dyslipidaemia among males was high TG and low HDL (26.7%) whereas in females it was high TG and high LDL affecting 20% of females. Low HDL with 13.3% was the common single parameter dyslipidaemia in males and in females it was high LDL contributing to 12.5%.

**Conclusion:** The high prevalence of dyslipidaemia among type 2 diabetes mellitus study subjects remarks the need for early screening with complete lipid profile and not just individual lipid fraction. For better treatment outcome the use of anti-diabetic drug and lipid lowering drug should go hand-in-hand.

**Keywords:** Type 2 Diabetes Mellitus, Dyslipidaemia, Prevalence.

## INTRODUCTION

The South Asian countries, especially India have witnessed a marked escalation in the prevalence of type 2 diabetes mellitus (T2DM). The recent data from International Diabetes Federation reports that 74.2 million people have T2DM in India and this number is predicted to rise to 124.9 million by 2045.[1]
Chronic hyperglycemia due to defect in insulin secretion and action is the hallmark of T2DM leading to deleterious effect on β-cell function and survival – a concept referred to as glucotoxicity. In parallel to glucotoxicity, lipotoxicity is believed to be a co-contributor in pathophysiology of diabetes progression and development of complication.[2] In diabetes the characteristic lipid abnormalities is referred to as "atherogenic dyslipidaemia" where the low density lipoprotein-cholesterol (LDL-C) is comparable to general population as evident from Framingham study,[3] and United States National Health and Nutritional Examination Survey,[4] but the number and density of LDL particle (small dense LDL) is increased in diabetic individual along

with high triglyceride level and reduced high density lipoprotein-cholesterol (HDL-C) which correlated strongly with major occlusive events.[5] The Asian Indian not only has a distinct "thin outside fat inside" characteristic phenotype that predisposes to visceral obesity and T2DM at relatively lower Body Mass Index but also have a distinct lipophenotype with raised LDL-C which is not much different from Caucasian and other population but hypertriglyceridemia (TG) and low HDL-C seems to be more common in Asian Indian Phenotype.[6]

Although few large studies have reported prevalence of dyslipidaemia among diabetic patients in some major cities in India but such data on prevalence and pattern of dyslipidaemia is relatively insufficient in southern part of Assam and therefore in view with these objectives the present study was conducted in the Non-Communicable Disease (NCD) clinic of Civil Hospital, Silchar.

## MATERIALS AND METHODS

**Study design and subjects**: A cross-sectional study conducted from June 2024 to February 2025. Type 2 diabetic individuals both known and newly diagnosed as per criteria of American Diabetic Association [7] and aged more than 20 years attending NCD clinic of district hospital, Silchar were included in the study. Individuals on beta blocker, diuretics, lipid lowering drugs, renal and liver disorder, hypothyroidism, acute metabolic complication, acute illness and pregnant women were excluded.

**Sample size and sampling technique**: Sample size was estimated using formula of n = 4p (1-p)/d$^2$ and considering anticipated prevalence of dyslipidaemia among type 2 diabetic individual (p) as 50% (as previous data on prevalence were unavailable in target population in the northeastern state of India), 95% level of confidence, 10% absolute precision (d). The sample size of 100 was considered. Convenience sampling technique was used to enrolled to study participants.

**Data collection tool**: In accordance with the objective of the study a draft questionnaire was prepared which was subsequently pre-tested in the study setting. Based on the experience gathered from pre-testing the questionnaire was modified and rearranged. Questions related to personal details (age, gender, religion), presenting complains, past medical history and treatment were included in the questionnaire. Informed consent was obtained from each participant after explaining them the objective of the study.

Maintaining all aseptic condition, 8 hour fasting and 2 hour of post meal blood sample was obtained from the study subject using disposable needle and syringe and were subjected to lipid profile, fasting and post prandial blood sugar estimation using semi auto analyser.

Dyslipidaemia was defined when one or more parameter (TG, HDL-C or LDL-C) is outside the target range recommended by the national cholesterol education programme (NCEP) adult treatment panel III (ATP III) guidelines [8]. Dyslipidaemia was further subdivided into mixed dyslipidaemia (all parameters are outside the recommended target), combined dyslipidaemia (two parameters outside and one parameter within target range) and isolated single parameter dyslipidaemia (TG, LDL-C, or HDL-C). Further, among the individuals with combined dyslipidaemias proportion of individuals with different patterns (high TG and low HDL; high TG and high LDL, high LDL and low HDL) was obtained [9].

**Statistical Analysis**: Microsoft Excel and SPSS 17.0 (trial version) software packages were used for data entry and analysis. Unpaired "t" test was applied for the significance of the association and p-value < 0.05 was taken as statistically significant difference.

**Ethical considerations**: The study was approved by the institutional ethics committee of Silchar Medical College, Silchar. The study participants were briefed about the purpose and nature of the study, and written informed consent was obtained before data collection.

## RESULTS

To find out the prevalence and pattern of dyslipidaemia among type 2 diabetic patients, 100 study subjects were enrolled in the study among which 60 were male with a mean age of 49.6 ± 12.3 years and 40 were female with mean age of 47.1 ± 11.8 years with no statistically significant difference observed between them. Lipid profile parameters including total cholesterol, triglyceride, LDL-C and HDL-C with their mean and standard deviation is shown in Table 1. Although statistically insignificant, females were having slightly higher values of lipid profile parameters except for triglyceride which is slightly higher in males. Similarly, no statistically significant difference was observed in the blood glucose level between males and females with mean fasting blood glucose of 220.8 ± 95.8 mg/dl in males and 226.8± 96.4 in females. While post prandial blood glucose values for males and females were 326.5 ± 144.6 and 334.4 ± 147.3 mg/dl respectively.

**Table 1: Distribution of clinical parameters among the study subjects**

| Variable | Males | | Females | | p value |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| Age | 49.6 | 12.7 | 47.1 | 11.8 | 0.31 |
| Fasting blood sugar (mg/dl) | 220.8 | 95.8 | 226.8 | 96.4 | 0.76 |

| | | | | | |
|---|---|---|---|---|---|
| Post prandial blood sugar (mg/dl) | 326.5 | 144.6 | 334.4 | 147.3 | 0.79 |
| Total Cholesterol (mg/dl) | 181.5 | 41.8 | 194.1 | 42.2 | 0.15 |
| Triglycerides (mg/dl) | 220.1 | 138.3 | 187.3 | 86.9 | 0.15 |
| LDL-C (mg/dl) | 101.7 | 33.4 | 111.9 | 30.3 | 0.12 |
| HDL-C (mg/dl) | 38.2 | 7.7 | 42.0 | 10.9 | 0.06 |

According to ATP III guidelines specific prevalence association of dyslipidaemia are presented in Table 2 and pattern of dyslipidaemia is depicted in Table 3.

In males, hypercholesterolemia was seen in 21 (35.0%), 38 (63.3%) had hypertriglyceridemia. Low HDL-C was identified in 40 (66.7%) while 27 (45.0%) had high LDL-C. Proportion of mixed dyslipidaemia was 10 (16.7%), isolated single parameter dyslipidaemia was seen in 15 (25%) and combined two parameter dyslipidaemias was highest affecting 29 (48.3%) males. Sub-analysis of the combined dyslipidaemia revealed high TG and low HDL-C was the most common pattern affecting 16 (26.7%) individuals followed by high TG and high LDL-C in 8 (13.3%) and 5 (8.3%) individuals had high LDL-C and low HDL-C among males. Among individuals with isolated single parameter dyslipidaemia isolated low HDL-C was most common involving 8 (13.3%) individuals followed by isolated hypertriglyceridemia 4 (6.7%) individuals and 3 (5%) had isolated high LDL-C out of the total males.

Even among females the distribution of lipid profile and pattern of dyslipidaemia was comparable with that of the males with hypercholesterolemia affecting in 14 (35.0%) individuals, 24 (60.0%) had hypertriglyceridemia and high LDL-C and 21 (52.5%) had low HDL-C. Combined dyslipidaemia was more common affecting 18 (45%) females. Proportion of mixed dyslipidaemia and isolated single parameter dyslipidaemia being 8 (20%) and 9 (22.5%) respectively. Unlike males the most common pattern of combined dyslipidaemia in females was high TG and high LDL-C involving 8 (20%) individuals followed by high TG and low HDL-C (17.5%) while only 3 (7.5%) had high LDL-C and low HDL-C. The most common isolated single parameter dyslipidaemia in females was high LDL-C involving 5 (12.5%) individuals followed by low HDL-C affecting 3 (7.5%) and only 1 (2.5%) had hypertriglyceridemia out of the total females.

Overall, the prevalence of dyslipidaemia in females was 35 out of 40 (87.5%) and was slightly higher in males affecting 54 out of 60 (90.0%) individuals.

**Table 2: Distribution of lipid profile parameters according to NCEP ATP III classification**

| Lipid Parameter | Males (n=60) | Females (n=40) |
|---|---|---|
| **Total Cholesterol** | | |
| < 200 | 39 (65.0 %) | 26 (65.0%) |
| 200 – 239 | 17 (28.3%) | 9 (22.5%) |
| > 240 | 4 (6.7%) | 5 (12.5%) |
| **Triglyceride** | | |
| <150 | 22 (36.7%) | 16 (40.0%) |
| 150 – 199 | 9 (15.0%) | 8 (20.0%) |
| 200 – 499 | 27 (45.0%) | 16 (40.0%) |
| >500 | 2 (3.3%) | 0 (0.0%) |
| **LDL – Cholesterol** | | |
| < 100 | 33 (55.0%) | 16 (40.0%) |
| 100 – 129 | 11 (18.3%) | 15 (37.5%) |
| 130 – 159 | 12 (20.0%) | 7 (17.5%) |
| 160 – 189 | 4 (6.7%) | 1 (2.5%) |
| >190 | 0 (0.0%) | 1 (2.5%) |
| **HDL – Cholesterol** | | |
| <40 | 40 (66.7%) | 21 (52.5%) |
| 40 – 60 | 19 (31.7%) | 17 (42.5%) |
| >60 | 1 (1.7%) | 2 (5.0%) |

**Table 3: Pattern of dyslipidaemia among study subjects**

| Pattern of dyslipidaemia | Males (n=60) | Females (n=40) |
|---|---|---|
| **Mixed dyslipidaemia** (LDL≥100, TG≥150 & HDL < 40) | 10 (16.7%) | 8 (20.0%) |
| **Combined two parameters dyslipidaemia** | | |
| a. (LDL≥100, TG≥150, HDL>40) | 8 (13.3%) | 8 (20.0%) |
| b. (LDL<100, TG≥150, HDL<40) | 16 (26.7%) | 7 (17.5%) |
| c. (LDL≥100, TG<150, HDL<40) | 5 (8.3%) | 3 (7.5%) |
| **Isolated single parameter dyslipidaemia** | | |
| a. (LDL≥100, TG<150, HDL>40) | 3 (5.0%) | 5 (12.5%) |
| b. (LDL<100, TG≥150, HDL>40) | 4 (6.7%) | 1 (2.5%) |
| c. (LDL<100, TG<150, HDL <40) | 8 (13.3%) | 3 (7.5%) |
| **Total** | 54 (90.0%) | 35(87.5%) |

Distribution of lipid profile parameters according to sex is graphically represented using box and whiskers plot in Figure 1 which shows that the maximum value of triglyceride extends much

beyond the upper outlier limit in both the sex
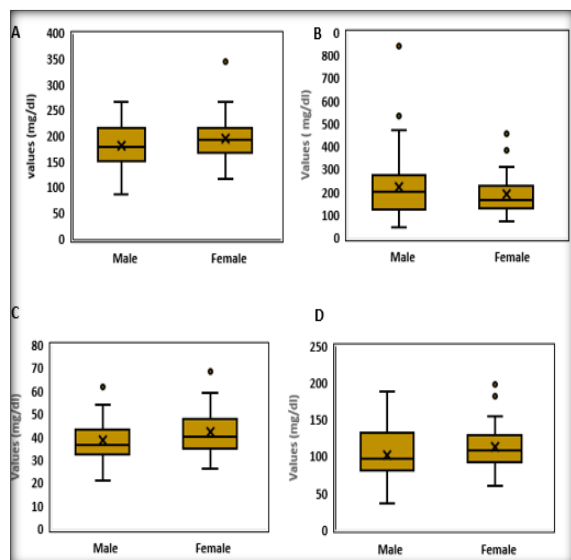


**Figure 1: Box and whiskers plot showing distribution of lipid profile parameters according to sex**
**A Cholesterol, B Triglyceride, C HDL, D LDL**

## DISCUSSIONS

The hallmark of South Asian phenotype is the combination of dysglycemia and specific dyslipidaemia.[6] Therefore, the present study was carried out to assess the prevalence of dyslipidaemia among the Type 2 diabetic patient and which is first of its kind in the southern part of Assam. The higher value of fasting and post prandial blood glucose among the study participant reflects their poor glycaemic status.

In the present study, although statistically insignificant the lipid profile parameters were slightly higher in females except for triglyceride which is slightly higher in males. These finding were in slight variation to those observed by Borle et al in Madhya Pradesh.[10]

The most common specific dyslipidaemia that was observed in the present study is hypertriglyceridemia (62.0%) and reduced HDL- C (61.0%). The first phase of the ICMR-INDIAB (Indian council of Medical Research – India Diabetes) study which was restricted to four states in India reported hypertriglyceridemia as second most common dyslipidaemia after low HDL-C.[11] The present study also reflects a high total cholesterol of 35% and increased LDL-C of 51% of the study subject. The finding that agrees with those from the observation of Borle et al,[10] and Bali K et al,[12] respectively.

Apart from looking into the specific dyslipidaemia, the present study also focused on the pattern of dyslipidaemia among the type 2 diabetic patients. Among the dyslipidemic individual the most common pattern was combined dyslipidaemia (53.7% in males versus 51.4% in females). Similar pattern of dyslipidaemia was observed by Parikh

specially in males.
R.M. et al.[9] Among the combined dyslipidaemia high TG and low HDL-C was the most common pattern that was observed in 16 out of 54 dyslipidemic males. Although it is well established fact that elevated LDL –C is associated with increased risk of atherosclerotic cardiovascular disease, however in Asian population elevated triglyceride and low HDL – cholesterol also play a major role in the development of cardiovascular (CV) risk.[6] The overall prevalence of dyslipidaemia in females and males in the present study is found to be 87.5% and 90.0% respectively which was comparable to the study by Borle et al,[10] and Parikh R.M. et al.[9] Landmark prospective study like the Framingham Heart study clearly demonstrate dyslipidaemia to be one of the major modifiable CV risks factors.[13] Therefore, every effort should be made to screen for lipid abnormalities in diabetic patient in the initial visit and if found abnormal, lipid lowering treatment should be initiated and re-check at regular interval.

## CONCLUSION

This study brings into focus the high prevalence of dyslipidaemia among the type 2 diabetic patients and therefore remarks the need for early screening for lipid abnormalities and treatment initiation to prevent the development of macro and microvascular complication. Routine monitoring of blood glucose and complete lipid profile should be the mainstay of treatment plan for optimum care. The use of anti-diabetic drug along with lipid lowering drug should go hand-in-hand to achieve a better outcome.

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