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Original Research Article

# COMPARATIVE STUDY OF DYSLIPIDEMIA IN TYPE II DIABETES MELLITUS PATIENTS WITH AND WITHOUT ASSOCIATED HYPOTHYROIDISM

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## Abstract

**Background:** Dyslipidemia is defined as high plasma triacylglycerols and cholesteryl esters levels. Increased hepatic lipogenesis and adipose tissue fatty acid metabolism in response to elevated blood sugar and insulin resistance contribute to dyslipidemia in type 2 diabetes. Lipid abnormalities of T2DM can be further influenced by presence or absence of other endocrinopathies like hypothyroidism. **Materials and Methods:** The study was conducted on 256 patients with type 2 diabetes mellitus, out of these 48 patients had hypothyroidism (Group A) and 208 patients without hypothyroidism (Group B). Then, both groups were compared for lipid profile. **Result:** In group A we found mean values of total cholesterol, triglyceride, LDL-C, HDL-C, VLDL-C levels were found 217.4±297.7mg/dl, 191.50±80.49mg/dl, 86.48±42.36mg/dl, 50.48±16.65mg/dl, 50.98±50.46mg/dl, while in Group B parameters were 158.2±57.10mg/dl, 177.47±101.17mg/dl, 83.77±40.11mg/dl, 48.47±16.35mg/dl, 42.69±33.38mg/dl respectively. The mean levels of triglyceride, LDL-C, HDL-C, VLDL-C were not significantly different but the mean level of total cholesterol was significantly different in both groups. Group A subjects (62.5%) have high VLDL-C level whereas Group B subjects (57.69%) have normal VLDL-C (P value <0.05). Similarly, 60.42% subjects of group A and 54.33% subjects of group B have high and normal triglyceride levels, respectively (P value=0.09). **Conclusion:** We found that dyslipidemia in the form of total cholesterol, VLDL cholesterol and triglyceride level was more prevalent in type 2 diabetes patients associated with hypothyroidism.

## INTRODUCTION

Diabetes is currently affecting over 425 million people globally and still being a reason for major public ill health.[1] Diabetes is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action or both and associated with long-term damage, dysfunction and failure of different organs.[2,3] HbA1c is an important measure of control of diabetes over the last 3 months and remains unaffected by the short-term fluctuation in blood sugar levels as important in diagnosis of DM.

Dyslipidemia is defined as high plasma triacylglycerols and cholesteryl esters levels, part of LDL-cholesterol and HDL-cholesterol. Increased hepatic lipogenesis and adipose tissue fatty acid metabolism in response to elevated blood glucose and insulin resistance contribute to dyslipidemia in both type 1 and type 2 diabetes.[4,5]

Thyroid diseases and diabetes mellitus are the two most common endocrine disorders encountered in clinical practice and have been shown to mutually influence each other.[6-9] Hypothyroidism is one of the most common causes of secondary dyslipidemia. Subclinical hypothyroidism is described as the elevated level of serum TSH levels with normal levels of fT4 and fT3, is being more common disorder than overt hypothyroidism. Hypothyroidism is correlated with hyperlipidemia through interference in lipid synthesis, absorption, circulation and metabolism. Thyroid hormones increase cholesterol synthesis by increasing the expression of HMG-CoA reductase in the liver.[10] However, additional concomitant mechanisms like an increase in gastrointestinal cholesterol absorption,[11] decrease in cell surface LDL-cholesterol receptors,[12]


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decreases cholesterol excretion and plasma triglyceride clearance because of decrease in lipoprotein lipase levels outweighed this effect.[13]
An association between lipids, thyroid function and T2DM has been observed.[14] The analysis of a subgroup from the Fremantle Diabetes Study (FDS) explored the significant association between TSH levels and lipid profile mainly in the presence of T2DM. The thyroid hormone is an insulin antagonist physiologically. Increase glycemic level in T2DM, decreases thyroid activity that causes increased level of serum TSH level. Thus, Hyperglycemia can be positively associated with serum TSH and may cause thyroid dysfunction. Lipid abnormalities of T2DM can be further influenced by presence or absence of hypothyroidism.

## MATERIALS AND METHODS

A hospital based observational cross sectional comparative study was performed in the department of medicine, SMS Medical College, Jaipur. A total 256 consecutive cases of known or newly diagnosed cases of T2DM were included in this study with age >18 years after application of inclusion and exclusion criteria. Depending on presence or absence of hypothyroidism they were categorized into group A (Type 2 DM patients with Hypothyroidism) (48 subjects) and group B (Type 2 DM patients without Hypothyroidism) (208 subjects). The both groups were compared for anthropometric and biochemical parameters like BMI (weight/height3), abdominal girth, HbA1c, fT3, fT4, TSH, Total Cholesterol, Triglyceride, LDL Cholesterol, HDL Cholesterol and VLDL Cholesterol levels.
Patients having history of chronic liver, renal illness or known case of HIV, malignancy, type 1DM and on antipsychotics or antidepressants were excluded from our study.
The data was collected and compiled on M.S. Excel 2020 and data was analyzed using SPSS 20.0 version and statistically evaluated using Statistical Package for Social sciences (SPSS)-PC-20 software (version 20, SPSS, Inc, Chicago, IL, USA). Data were presented as mean and standard deviation (SD) for normally distributed continuous variables and as frequencies for categorical variables. Comparisons were made for means of two samples using by chi-square ($\chi 2$) analysis for continuous and categorical variables. Multiple regression analyses were performed with TSH and HbA1c concentrations as the dependent variable, and significant parameters (TG, cholesterol, HDL, LDL and VLDL) as the independent variables. All statistical analyses were performed taking level of significance.

## RESULTS

Overall, 256 T2DM subjects were included in this study; out of these 48 (18.75%) patients with hypothyroidism were included in Group A while 208 patients without hypothyroidism were included in Group B. Male female ration in Group A was 1:1.53 while in Group B it was 1:1.08, indicating female preponderance in Group A. Clinical and demographic data of the studied population are presented in [Table 1].
Among group A and group B mean ages was found to be matched i.e. 56.1years and 57.9 years, respectively ($p>0.05$). Differences in other clinical parameters like BMI, abdominal girth, blood pressure between two groups were not statistically significant. Mean TSH in Group A was 22.24uIU/ml while it was 2.36uIU/ml in Group B ($p<0.05$). We found significant differences between diabetes subjects of group A and group B in terms of total cholesterol level among lipid parameters ($p<0.05$) while other parameters like triglyceride, LDL-C, HDL-C, VLDL-C levels were statistically not significant between two groups.
When distribution of patients was done for VLDL-cholesterol, Group A subjects (62.5%) have high VLDL- cholesterol level while Group B participants (57.69%) have normal VLDL- cholesterol level ($p<0.05$). Group A participants (60.42%) have high Triglyceride level while Group B participants (54.33%) have normal Triglyceride level ($p =0.093$). Thus, the high triglyceride level in Group A was more but statistically not significant [Table 2].

**Table 1: Mean levels of various parameters**

| Parameters | Group A (n=48) | Group B (n=208) | P-value |
|---|---|---|---|
| | Mean±SD | Mean±SD | |
| Age (years) | 56.1 ±14.1 | 57.9±14.7 | 0.439 |
| BMI (kg/m2) | 27.42±2.70 | 27.58±2.60 | 0.703 |
| Abdominal girth (cm) | 99.35±11.38 | 100.28±11.73 | 0.616 |
| SBP (mmHg) | 119.2±11.8 | 123.7±16.9 | 0.079 |
| DBP (mmHg) | 75.0±9.47 | 77.56±11.45 | 0.147 |
| FBS (mg/dl) | 252.2±115 | 232.5±96.77 | 0.371 |
| HbA1c (%) | 8.82±2.65 | 9.31±2.51 | 0.226 |
| fT3 (Pg/ml) | 2.92±0.85 | 2.86±0.62 | 0.576 |
| fT4 (Pg/ml) | 1.12±0.61 | 1.16±0.80 | 0.745 |
| TSH (uIU/ml) | 22.24±40.28 | 2.36±1.25 | <0.001 |
| TG (mg/dl) | 191.5±80.49 | 177.47±101.17 | 0.365 |
| Total Cholesterol (mg/dl) | 217.4±297.7 | 158.2±57.1 | 0.004 |
| HDL-C (mg/dl) | 50.48±16.65 | 48.47±16.35 | 0.437 |
| LDL-C (mg/dl) | 86.48±42.36 | 83.77±40.11 | 0.671 |


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|---|---|---|---|
| VLDL-C (mg/dl) | 50.98±50.46 | 42.69±33.38 | 0.152 |

**Table 2: Distribution of hypothyroidism with VLDL- cholesterol and triglyceride levels in diabetics**

| Mg/dl | | Group A (Diabetes with hypothyroidism) | | Group B (Diabetes without hypothyroidism) | | P value |
|---|---|---|---|---|---|---|
| | | N | % | N | % | |
| Normal VLDL-C | <35 | 18 | 37.50 | 120 | 57.69 | 0.018 |
| High VLDL-C | ≥35 | 30 | 62.50 | 88 | 42.31 | |
| Low triglyceride | <36 | 0 | 0 | 0 | 0.00 | 0.093 |
| Normal triglyceride | 36-165 | 19 | 39.58 | 113 | 54.33 | |
| High triglyceride | >165 | 29 | 60.42 | 95 | 45.67 | |
| Total | | 48 | 100.00 | 208 | 100.00 | |

## DISCUSSION

Hypothyroidism and diabetes mellitus are the two most common endocrine disorders encountered in clinical practice and have been shown to mutually influence each other.[6-9] The prevalence of hypothyroidism in type 2 diabetes mellitus patients in our study was 18.75% with higher prevalence of subclinical hypothyroidism of about 64.58%. According to study by S Srikanth et al,[15] hypothyroidism among Type 2 DM patients was found 14% with subclinical hypothyroidism being most common. A similar study by Amare Desalegn Wolide et al,[16] found that the burden of hypothyroidism was 17.03% in diabetic patients. Jiffri EH et al,[17] also reported significantly higher TSH levels among T2DM than non-diabetic subjects (P<0.05), which was consistent with this study.

We observed mean age in diabetic participants with hypothyroidism was 56.1±14.1 years in our study. Our study results were in concordance with study conducted by Pangajam P et al,[18] who found mean age of 51.8±12.4 years. Amrita Gosh et al,[19] also suggested the risk for dyslipidaemia was high in age groups more than 50 years.

In our study, the mean total cholesterol level was found significantly higher (217.4±297.7mg/dl) in hypothyroid subjects among diabetics when compared with euthyroid diabetic subjects in whom mean total cholesterol level was 158.2±57.1mg/dl. We also observed in our study that VLDL-cholesterol levels were more with hypothyroidism in diabetic patients i.e. 62.50%. We had also observed that levels of triglyceride were also higher in subjects of Group A (60.42%) as compared with Group B (45.67%). These results were similar to many studies conducted in past. Jiffri EH et al,[17] also found that there was significant positive correlations between TSH and TC, LDL-C and TG in T2DM study subjects and non-diabetic subjects. In a study by Yun Zhang et al,[20] in a multiple linear regression analysis (stepwise), TSH was positively associated with TC. An association between dyslipidaemia, thyroid function and T2DM has been observed.[14] The analysis of a subgroup from the Fremantle Diabetes Study (FDS) showed that the association of TSH levels and lipid profile was significant mainly in the presence of T2DM.[14] We observed LDL- cholesterol level was non-significant among study diabetic population i.e. 86.48±42.36mg/dl in T2DM with hypothyroidism and 83.77±40.11mg/dl in type 2 diabetic subjects without hypothyroidism.

The relationship between thyroid function and lipid profile has been documented in T2DM subjects.[14,21-23] Moreover, hypothyroid T2DM subjects had higher TC and VLDL-C than euthyroid T2DM. Thus, analysis of thyroid function in diabetics and further assessment of lipid profile parameters and intervention accordingly should be essential to prevent or timely manage cardiovascular risk.

**Limitations**

1. The present observational comparative cross-sectional study was conducted to limited sample size. In this study diabetic subjects were categorized into 2 groups according to presence or absence of hypothyroidism. So, sample size was different in both groups which create disproportionately high p value.
2. The present study was limited to patients belonging to a specific region of India, which might prejudice any comment on its efficacy and reliability among other ethnic groups.

## CONCLUSION

To summarise, dyslipidaemia was more prevalent in type 2 diabetes patients associated with hypothyroidism in form of increased total cholesterol, VLDL- cholesterol and triglycerides. Mean HDL-cholesterol and LDL-cholesterol levels were more among subjects with hypothyroidism and diabetes. Real world studies suggest that cardiovascular risks like coronary artery disease, peripheral vascular disease as well as cerebrovascular accident are more in hypothyroidism with type 2 diabetes mellitus as in our study. With proper intervention and follow up we can timely reduce the complications and this may also reduce the morbidity occurring in patients of hypothyroidism with diabetic patients.

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