

Original Research Article

Lipid profile analysis of type 2 diabetic patients in Bengaluru population, India

Shyamala K. Venkatesh*, Sudheer K. M. V., Mohana Krishna T.

Department of Biological Sciences, School of Basic and Applied Sciences, Dayananda Sagar University, Bangalore-78, Karnataka, India

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***Correspondence:**

Dr. Shyamala K. Venkatesh,
E-mail: shyamala@dsu.edu.in

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ABSTRACT

Background: Prevalence of Diabetes in India is 69.2 million, among which type 2 diabetes mellitus (T2DM), constitutes for 90% of all the diabetic populations. Previous studies have proved the association of T2DM, with increasing risk of cardiovascular diseases (CVDs) and the level of risk varies among males and females. The present study aims to analyze the lipid profile of T2DM patients and compare the lipid profile of T2DM males and females in Karnataka, Bengaluru population.

Methods: The study included 171 T2DM patients, 59 females and 112 males aged 21 years and above. Total cholesterol (TC), low density lipoprotein cholesterol (LDL-C), high density lipoprotein cholesterol (HDL-C), very low density lipoprotein cholesterol (VLDL-C) and triglycerides (TG) concentrations values were analyzed for each group. Paired students t test was applied to identify the differences in lipid profile values of males and females with T2D.

Results: The mean value of TC, VLDL-C and LDL-C were higher in overall T2DM patients than the normal range and HDL-C was lower in T2DM patients. Comparison between males and females showed significantly higher LDL-C in females with T2DM than males. Other lipid parameters TC, TG and HDL-C did not show any significant differences between females and males with T2DM.

Conclusions: This study demonstrated the existence of dyslipidemia in T2DM population which is major risk factor for CVD. Greater LDL-C was observed in T2DM females compared to T2DM males suggests higher risk for CVD in females compared to males.

Keywords: CVD, Type 2 diabetes mellitus, dyslipidemia

INTRODUCTION

Diabetes mellitus is a metabolic disease characterized by the increase in blood glucose level as a result of insulin deficiency or insulin resistance.¹ Insulin-dependent diabetes mellitus is referred as Type 1 diabetes mellitus (T1DM) and non-insulin-dependent diabetes mellitus as Type 2 diabetes mellitus (T2DM).² According to diabetes Atlas data, 415 million adults have been identified with diabetes worldwide that accounts for one in every 11 and in India prevalence of diabetes has reached 69.2 million.³

Frequency of T2DM is higher than T1DM which accounts for more than 90% of all diabetic patients.² Prevalence and incidences of T2DM are rapidly increasing both high and low-income countries.⁴ Preliminary studies from The National Urban Survey conducted across the metropolitan cities of India reported prevalence rate ranging from 6.1% to 16.6% in different states of India.⁵

The potential factors contributing to increase in the incidences of T2DM are ageing, ethnicity, obesity, less

healthy diets, physical inactivity etc.⁶⁻⁸ The risk of development of Cardiovascular Disease (CVD) is more in people with T2DM compared to non-diabetic subjects.⁹ Dyslipidemia is one of the major risk factors for CVD in T2DM patients.¹⁰ Diabetic dyslipidemia is characterized by increased Low Density Lipoprotein Cholesterol (LDL-C), Very Low Density Lipoprotein Cholesterol (VLDL-C), Triglycerides (TG) concentrations and decreased High Density Lipoprotein Cholesterol (HDL-C) concentration in diabetes patients.^{10,11} Dyslipidemia associated with diabetes has more atherogenic effect than other types of dyslipidemia.¹² Impaired lipid metabolism is commonly observed in T2DM patients due to insulin resistance which affects the enzymes activity and lipid metabolism.¹³

Lipid profile analysis studies have been conducted both internationally and nationally to identify the risk of dyslipidemia in T2DM and non-diabetic population. A study conducted in Chinese population showed strong correlation of TC/HDL-C with T2DM.¹⁴ Lipid analysis study on T2DM patients and hypertensive T2DM patients of Jamaica population showed higher rate of TG/HDL and LDL/HDL ratios in T2DM and hypertensive T2DM patients compared with non-diabetic, and hypertensive non-diabetic control subjects.¹⁵

These studies have demonstrated the existence of dyslipidemia in T2DM patients.^{14,15} In India lipid profile analysis has been conducted in Punjabi populations showed high LDL-C, TC and low HDL-C, which is the most common pattern of dyslipidemia. Increased LDL-C level was very commonly observed compare to other types.¹⁶ Growing body of evidence also suggests that, rate of dyslipidemia and atherogenic incidences are more in T2DM females compare to T2DM males.^{15,17}

In Jamaica population greater TC was observed in hypertensive T2DM females compared with hypertensive T2DM males.¹⁵ In Saudi Arabia also female patients showed higher serum TC and lower HDL-C in comparison with male patients, whereas LDL-C and TG values were significantly increased in females compared with male T2D patients. Atherogenic incidences were also higher in female than those for males with T2DM.¹⁷ Present study was conducted to identify the risk of dyslipidemia in T2D patients and to analyze the effect sex on lipid abnormalities in T2D patients in Bengaluru, Karnataka population.

METHODS

Data was collected for the retrospective study from Karnataka Institute of Diabetology, Bangalore, Karnataka, India on patients diagnosed with T2D. A total 171 T2D patients were involved in the study, out of which 59 were female participants and 112 were male participants as represented in Table 1. The subjects

included for the study were aged between 21 and 80 years. Ethical approval and informed consent are not required for the retrospective study.

Data collection

A retrospective study was conducted in September 2016. All the participants were diagnosed for T2D at Karnataka Institute of Diabetology. Clinical data on fasting blood glucose, postprandial blood glucose level, HbA1c, lipid profile TC, HDL-C, LDL-C, VLDL-C, and TG-C were collected from Karnataka Institute of Diabetology and presented in Table 2. Figure 1 shows the mean value of lipid profile concentration of overall patients was calculated and compared with the normal range. Further, mean of lipid profile concentration of male and female T2D patients were calculated and compared.

Statistical analysis

All the values for the continuous variables are presented as mean \pm SD. Paired Students t-test was used to compare the lipid profile values of males and females with T2D and p value below 0.05 was considered as statistically significant.

RESULTS

Mean age of the participants included in the study was 52 ± 12 , males 54 ± 12 and females 50 ± 11 years (Table 1). In overall participants the mean value of LDL-C, TG and VLDL-C (113.62 ± 39.26 , 163.53 ± 87.6 , 32.76 ± 17.49) were higher than the normal range and mean value of HDL-C (38 ± 9.9) was lower than the normal range (Table 3).

Comparison of lipid profile between male and female participants showed mean TC and HDL-C concentrations higher in T2DM females (169.22 ± 37.75 and 40.86 ± 9.96) than T2D males (164.79 ± 34.82 and 37.50 ± 9.7) but the difference was statistically non-significant ($p = 0.4435$ and 0.0815). LDL-C concentration was also higher in the females (121.96 ± 42.65) than males (109.18 ± 36.76) with T2DM and the difference was statistically significant ($p = 0.0426$). Whereas, TG concentration was higher in T2D males than females with no statistical significance ($p = 0.8687$). The concentration of VLDL-C remains equal in both males and female (32.76 ± 17.6 and 32.76 ± 17.35) as represented in Table 3.

Table 1: Gender distribution and age of patients with type 2 diabetes.

Gender	No. of patients	Age
Male	112	54 ± 12
Female	59	50 ± 11
Total	171	52 ± 12

Table 2: The concentration of fasting blood glucose and postprandial blood glucose in diabetic patients.

	Normal range	Study group range	Mean
Glucose (FBG)*			
Male	70-100	77-257	151±63
Female	70-100	82-421	167±72
Overall	70-100	77-421	156±67
Postprandial glucose*			
Male	<140	68-495	224±94
Female	<140	90-571	238±101
Overall	<140	68-571	229±96
HbA1c#			
Male	< 5.7	5.3 -14.5	8.49±2.11
Female	< 5.7	5.6 - 13.4	8.59±2.18
Overall	< 5.7	5.3 - 13.4	8.51±2.12

*Representation in mg/dl and #Representation in percentage for HbA1c.

Table 3: Comparison of results of TC, HDL-C, LDL-C, VLDL-C, and TG concentrations in type 2 diabetic males and females.

Lipid profile	Normal range	Total T2DM patients	Male with T2DM		Female with T2DM		P value
			Study group	Mean	Study group	Mean	
TC *	<200 mg/dl	166.3±35.79	101 – 253	164.79±34.82	101- 253	169.22±37.75	0.4435
HDL-C *	>40 mg/dl	38.66±9.91	22-62.2	37.50±9.7	20-69	40.86±9.96	0.0815
LDL-C *	<100 mg/dl	113.62±39.26	42 -199	109.18±36.76	42-201	121.96±42.65	0.0426
Triglyceride	<150 mg/dl	163.53±87.6	11-456	164.34±87.23	11-456	162±89.02	0.8687
VLDL	<30 mg/dl	32.76±17.49	12-91	32.76±17.6	11-91	32.76±17.35	1.0000

p value < 0.05 is significant and * represents mg/dl

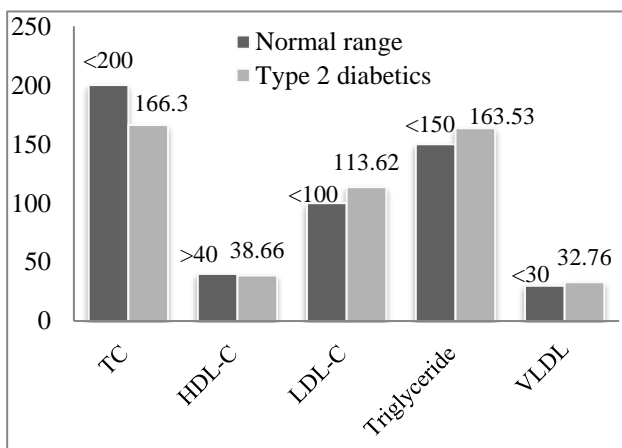


Figure 1: Concentrations of TC, HDL-C, LDL-C, VLDL-C, and TG in type 2 diabetic patients and normal range.

DISCUSSION

Individual with long term hyperglycemia due to T2DM are at high risk for CVD and mortality rate of T2DM patients with CVD is more than 70%.¹⁸ T2D associated with metabolic abnormalities like dyslipidemia further increases the risk for the development of CVD.¹⁹ Appearance of dyslipidemia is highly common in T2DM

patients and the most common lipid abnormalities found in T2DM patients are increased TG and small dense LDL-C and decreased HDL-C cholesterol which is a major risk factor for CVD.^{19,20} The primary cause for atherosclerosis is accumulation of LDL-C. Increased LDL-C concentration in T2D patients or normal individual is likely to enhance atherogenicity and CVD.²¹

Insulin resistance in T2DM increases the free fatty acid flux to the liver which increases the TG synthesis in hepatic cells in turn causes the elevation of VLDL-C concentration²². Increased VLDL-C results in change of lipoproteins and causes elevation of small dense LDL-C and decreases HDL-C and apolipoprotein A-I.^{18,21} Reduction in the concentration of HDL-C and apolipoprotein A-I results in the accumulation of the cholesterol in blood vessels which increases the risk of atherosclerosis.²¹ Increase in the small dense LDL-C further increases the apolipoprotein B and are more tending to transfer into the arterial wall in T2DM patients.²³

In our study, mean concentration of LDL-C, TG and VLDL-C in overall T2D patients was higher and concentration of HDL-C was lower in T2D patients, which indicates the association of dyslipidemia in diabetic patients. Since higher LDL-C and lower HDL-C were mainly found to be associated CVD and

atherosclerosis in T2DM patients, the present study suggest the presence of CVD risk in T2DM patients in Bengaluru population. Further comparison of lipid profiles of male and female T2D groups showed non-significant difference between TC, TG, VLDL-C and HDL-C values. Whereas, LDL-C concentration was significantly higher in T2DM females than males. This study supports the variation in occurrence of dyslipidemia among males and females by LDL-C value whereas, rest all remain same among both groups. Since increase LDL-C is a major risk factor for CVD, significant higher LDL-C value in female T2DM group indicates the higher risk of CVD in females compare to males with T2DM.

CONCLUSION

This study demonstrated the existence of dyslipidemia in T2DM patients of Bengaluru population. Overall greater LDL-C, TG and VLDL-C and lower HDL-C indicate the risk for CVD in T2D patients. Whereas, in males and females different CVD risk patterns was observed. In females increased LDL-C which is significantly higher than males. Since higher LDL-C was linked with severe CVD, in females risk of CVD will be expected more than the males. Since, dyslipidemia was found to be associated with T2DM which is a major risk factor for CVD it is advised to take preventive measure for controlling the lipid concentration and to improve HDL-C by life style modification and healthy diet pattern. Regular monitoring of blood glucose level and serum lipid profile in T2DM patients with proper medication and changing the lifestyle is necessary to decrease the risk of CVD.

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