

Original Research Article

Pattern of serum lipid profile of type 2 diabetes patients in a tertiary hospital in Nigeria

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ABSTRACT

Background: Diabetes mellitus is a metabolic disorder characterised by chronic hyperglycemia and disturbances of carbohydrate, lipid and protein metabolism. Diabetic patients have an increased risk of developing dyslipidemia with various lipid abnormalities which makes them prone to develop cardiovascular disease. The aim of the study is to determine the patterns of lipid profile in patients with Type 2 diabetes mellitus.

Methods: Lipid profile data for a total of 104 known type 2 DM patients from the medical outpatient clinic were collected. The profile of the study sample was analysed for dyslipidemia using the ATP III classification. Data obtained were analysed using Analyse-it v3.0 statistical software for Microsoft Excel.

Results: This study showed that there were more females 53.8% than males 46.2% with type 2 diabetes mellitus with the mean age of 52.5 ± 11.9 years. The pattern of dyslipidaemia revealed elevated LDL 51.9%, TG 37.5%, TC 36.5% and low HDL 27.9%. We had more patients who were overweight 33.7% than obese 32.7%.

Conclusions: It was observed from the study that a significant number of diabetic patients have dyslipidaemia and most common lipid abnormalities are elevated LDL, triglyceride and low HDL.

Keywords: Diabetes mellitus, Dyslipidemia, Glycated haemoglobin

INTRODUCTION

Diabetes mellitus is characterized by chronic hyperglycaemia with disturbances in carbohydrate, lipid and protein metabolism resulting from defects in insulin action or both.¹ Approximately 463 adults are currently living with diabetes; by 2045 this will rise to 700 million with 79% of adults with diabetes living in low-and middle-income countries.² Dyslipidemia is known to be a major risk factor for macrovascular complications in type 2 Diabetic patients and affects 10-73% of this population.^{3,4} Diabetic dyslipidemia consist of reduced high density lipoprotein (HDL), raised triglycerides (TG) and excess of small dense low density lipoprotein (LDL) particles. Lipid abnormalities are common in patients with diabetes

mellitus because insulin resistance or deficiency affects key enzymes and pathways of lipid metabolism.⁵ Microvascular and macro-vascular complications, including cardiovascular disease (CVD), retinopathy, nephropathy, and neuropathy, occur due to chronic uncontrolled hyperglycaemia in diabetics.^{6,7} Glycated haemoglobin (HbA1c) is used to monitor long term glycaemic control routinely, predict the risk of complications development, and also function as the indicator for the mean blood glucose level.⁸

This study aimed to find out the lipid profile pattern in patients with type 2 diabetes mellitus attending the Endocrine and diabetes division of medical outpatient clinic.

METHODS

Study location and data collection

The study was carried out at the University of Abuja Teaching Hospital, a tertiary health centre, between June 2018 and October 2020. It is a retrospective study. A total of one hundred and four lipid profile data with Type 2 diabetes were accessed from the medical records of the Endocrine unit of Department of Medicine, University of Abuja Teaching Hospital, Gwagwalada.

Diabetes mellitus was confirmed using fasting blood glucose and glycated haemoglobin.

All patients had full clinical assessment and investigations done including fasting lipid profile. One hundred and four patients had complete data in terms of fasting blood glucose, fasting lipid profile and glycated haemoglobin for analysis.

As part of routine in the Endocrine unit, patient is advised to fast for at least 12-14 hours overnight and the 5ml venous blood sample were collected in a disposable syringe on next morning (before breakfast) for the serum lipid profile and fasting blood sugar.

Inclusion criteria

A hundred and four patients between 30 to 100 years of age who were seen at the clinic with complete records where included. All patients who had full clinical assessment and laboratory investigation for diabetes and lipid profile from June 2018 to October 2020 were included in the study.

Exclusion criteria

Patients who had normal blood glucose and impaired fasting glucose.

Statistical analysis

Statistical analysis of data collected was performed using Analyse-it v3.0 statistical software for Microsoft Excel. Data collected was analysed by frequency, mean, standard deviation and chi-square test. For all statistical tests, the threshold of significance is fixed at 5%.

$P > 0.05$ indicates non-significant results. $P < 0.05$ indicates significant results. The frequency of dyslipidemia was evaluated while the pattern was determined by serum level for cholesterol, high density lipoprotein HDL-C, low density lipoprotein LDL-C and triglyceride.

RESULTS

Table 1 critical values of lipid profile and other parameters in patients with Type 2 diabetes Mellitus. The general characteristics of the study population are shown in Table 2.

There were more females 56 (53.8%) with type 2 diabetes than males 48 (46.2%) out of the 104 participants. Majority 66 (63.5%) were between 40 and 60 years of age. The overall mean age of the patients is 52.0 ± 11.9 years but mean age for male is 52.7 ± 10.8 years, while female is 52.3 ± 12.8 years.

Table 1: Critical values of lipid profile and other parameters in patients with Type 2 DM.

Parameters	Critical values (mmol/L)	Remark
TC	>5.18	Abnormal
LDL	>2.59	Abnormal
HDL	<1.04	Abnormal
TRIG	>1.5	Abnormal
FBS	>7.00	Diabetes
HBAIC	$(> 6.5\%)$	Poor DM control

Table 2: Demographic and anthropometric characteristics of patient stratified by gender.

Variables	Sex of patients (n, %)		Total (104,100)
	Female (56, 53.8)	Male (48, 46.2)	
Age group (years)			
<40	10 (9.6)	4 (3.8)	14 (13.5)
40-60	34 (32.7)	32 (30.8)	66 (63.5)
>61	12 (11.5)	12 (11.5)	23 (23.1)
BMI			
Underweight	2 (1.9)	0 (0.0)	2 (1.9)
Normal weight	12 (11.5)	21 (20.2)	33 (31.7)
Overweight	18 (17.3)	17 (16.3)	35 (33.7)
Obese	24 (23.1)	10 (9.6)	34 (32.7)

Table 3: Lipid profile parameters in patients with Type 2 DM (n =104).

Parameter	Mean	SE	SD	Min	Median	Max	IQR
LDL	2.90	0.13	1.29	0.18	2.71	6.99	1.63
HDL	1.33	0.06	0.58	0.47	1.20	3.91	0.53
TRIG	1.38	0.06	0.60	0.25	1.22	3.09	0.75
TC	4.80	0.14	1.48	1.43	4.80	9.80	2.02

TC = Total cholesterol, LDL = Low density lipid, HDL = High density lipid, TRIG = Triglyceride

There were 35 (33.7%) overweight patients (male-17.3%, female-16.3%) while obese patient accounted for 34 (32.7%) with 24 (23.1%) in females compared with 10(9.6%) in males.

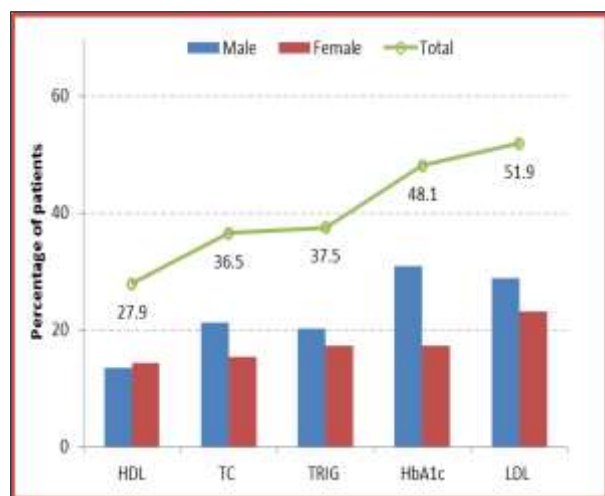


Figure 1: Percentages of overall DM patients with critical levels of lipid profile and HbA1c.

Figure 1 shows the percentage of overall diabetic patients with critical values of lipid profile as HDL 29 (27.9%), TC 38 (36.5%), TRIG39 (37.5%) LDL54 (51.9%) and HbA1c 50 (48.1%). The mean concentration of the lipid profile parameters are LDL 2.90 ± 1.29 mmol/l, HDL 1.33 ± 0.58 mmol/l, TG 1.38 ± 0.60 mmol/l and TC 4.8 ± 1.48 mmol/l as shown in Table 3. There was no significant correlation seen between HbA1c and TG, TC, LDL, TG and HDL as shown in Table 4.

Table 4: Correlation between HbA1c and lipid profile.

Lipid parameters	Correlation	P value (t-test)
TRIG	-0.01	0.93
TC	0.15	0.13
LDL	0.13	0.20
HDL	0.02	0.88

The cut off values for HbA1c according to American association of clinical endocrinologist (AACE) is:

4-5.6%=Normal range, 5.7- 6.4%=increased risk of DM, 6.5% and higher=DM.

Critical values of lipid profile and HbA1c: TC >5.18 mmol/l, LDL >2.59 mmol/l, HDL >1.04 mmol/l, TRIG >1.5 mmol/l, HbA1c >6.5%.

DISCUSSION

Abnormalities of lipid metabolism have been reported in patients with diabetes mellitus accompanied by the risk of cardiovascular arteriosclerosis.⁹ Many factors may affect

blood lipid levels in diabetes because of interrelationship between carbohydrates and lipid metabolism and vice versa. Dyslipidaemia as a metabolic abnormality is frequently associated with diabetes mellitus.

This study revealed that there were more females 53.8% than males 46.2% with type 2 diabetes mellitus with the mean age of 52.5 ± 11.9 years. These findings are similar to the findings of Ozder who reported more female preponderance.¹⁰ Several studies reported that the cluster of lipid abnormalities associated with type 2 DM is defined by a high concentration TG and small dense LDL and a low concentration of HDL.^{10,11} The pattern of dyslipidaemia in our study revealed LDL 51.9%, TG 37.5%, TC 36.5% and HDL 27.9% which compares with other studies that demonstrates the typical diabetic dyslipidaemia.^{12,13} Although obesity and type 2 diabetes commonly co-exist.¹⁴ We had more patients who were overweight 33.7% than obese 32.7% which is comparable with other findings, increased physical activity and dietary modifications were discussed and re-emphasised to our patients early at diagnosis of T2M and this could contribute to why our patients were overweight than obese which still buttress the need for more lifestyle modification.^{10,15}

Dyslipidemia is a common feature of diabetes.¹⁶ The risk of cardiovascular disease is greater at any given level of serum cholesterol in patients with diabetes and its association with hypertriglyceridemia is stronger than in the general population.¹⁷ Numerous factors are related to diabetic dyslipidaemia including insulin effects on liver apoprotein production, regulation of apoprotein lipase, action of cholesteryl ester transfer protein (CETP), and peripheral actions of insulin on adipose tissue and muscle.¹⁸ The process for the development of the cardiac complication is based on the dyslipidaemia-insulin resistance (IR)-hyperinsulinemia cycle, well known as the "vicious cycle hypothesis".¹⁹ In an insulin-resistant state, hypertriglyceridemia is primarily due to an increased hepatic production of very low lipoprotein lipase (VLDL) particles, postprandial hyperlipidaemia, and low lipoprotein lipase (LPL) levels. This hypertriglyceridaemia enhances the CETP mediated interchange of Tg from Tg-rich lipoprotein lipoproteins to HDL-L/HDL-VL and the subsequent Tg-enrichment of the HDL-C. Hepatic lipase has greater activity against Tg and will thus, convert large HDL particles to small HDL particles, which are also cleared more rapidly from the circulation by the kidney, consequently reducing the concentration of HDL particles (HDL-P).^{20,21}

Abnormal glucose control accompanied by elevated LDL, hypertriglyceridaemia, hypercholesterolaemia and low HDL is the commonest metabolic abnormality in T2DM Patients. Thus, improving glycaemic control will significantly cause an improvement in dyslipidaemia and lowers the risk of cardiovascular events in patients with T2M.²²⁻²⁴ Coronary artery calcification in asymptomatic patients with newly diagnosed T2DM has been

demonstrated to a larger extent.²⁵ Dyslipidaemia is not only an important risk factor in macrovascular complications; studies have also shown the association of dyslipidaemia with microvascular complications related to T2DM namely diabetic retinopathy, diabetic nephropathy and diabetic neuropathy.²⁶⁻²⁹ Our study demonstrated that lipid profiles are abnormal in diabetic patients and is very essential for proper monitoring of the patient's glycaemic and lipid control to prevent Cardiovascular and cerebrovascular complications.

CONCLUSION

We acknowledge the limitations in our study with a relatively small sample size and being single-centered hospital-based retrospective study, but despite these limitations, it still highlight risk of dyslipidemia in T2DM. The risk of atherosclerosis in type 2 diabetic patients is associated with clusters of inter-related plasma lipids and lipoprotein abnormalities with alterations in VLDL metabolism with insulin resistance playing a role in the development of diabetic dyslipidaemia. This study showed that a significant number of diabetic patients have dyslipidaemia and the most common lipid abnormalities are elevated LDL, triglyceride and low HDL. Periodic check of Fasting Plasma lipids in diabetic patients, coupled with optimum treatment of plasma glucose with lifestyle intervention should go along side with lipid lowering drugs.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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