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Comparative study of lipid profile among type 2 diabetics on treatment within Owo, metropolis, Nigeria.

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Abstract

The comparison of the lipid profiles of T2DM patients who are receiving treatment is the main objective of this study. Lipid abnormalities are typically present in T2DM, increasing the risk of cardiovascular diseases and other effects. The study examines the lipid profiles of T2DM patients and compares them to those of healthy individuals in order to identify parallels and differences. Since only subjects in group A who had recently been diagnosed with diabetes (within one month) had significantly lower total cholesterol levels, the findings of this study will advance understanding of lipid abnormalities in T2DM and may help in the development of targeted interventions for treating dyslipidemia in diabetic patients. Triglycerides were significantly ($p < 0.05$) high only in diabetes subjects whose diagnosis are greater than 1 month but not more than 3 months (group B). There were no significant differences in the HDL-C levels of all the groups. LDL-C was significantly ($p < 0.05$) reduced only among newly diagnosed ($\leq$ 1 month) diabetics subjects (group A) while HDL-C levels among the diabetics groups did not show any significant ($p > 0.05$) difference. The study highlights the necessity for dietary changes, lifestyle adjustments, and the use of suitable cholesterol-lowering medications to treat lipid abnormalities in T2DM patients. The results of this investigation confirm the conclusion from other studies which indicated that T2DM patients have a significant incidence of lipid abnormalities.

Keywords: Lipids, Diabetes Mellitus, Cholesterol, Cardiovascular disease, Triglycerides, Dyslipidemia.

Introduction

Diabetes mellitus (DM) is a major global health disease with an estimated incidence of 537 million people in 2021 and a projected incidence of 643 million by 2033. The increased incidence of DM has been attributed to reduced physical activity, changes in dietary patterns, and an increased population around the world . DM is the most common endocrine disorder of metabolic origin characterized by chronic hyperglycemia resulting from defects in insulin secretion (type 1), insulin action (type 2), or both with concomitant disturbance in carbohydrate, lipid, and protein metabolism . People living with diabetes are known to be predisposed to both macrovascular (cardiovascular, cerebrovascular, and peripheral vascular diseases), and microvascular (retinopathies, nephropathies, and neuropathies) complications. These complications promote premature mortalities, loss of productivity, and poor quality of life. The debilitating nature of DM disease has been a cause of excruciatingly costly burden to patients, caregivers, and healthcare systems across countries worldwide .

Type 2 diabetes mellitus (T2DM) is the commonest type of diabetes accounting for over 90% of all diabetes cases worldwide . Its development is primarily characterized by defective insulin secretion from the pancreatic β-cells and the inability of insulin-sensitive tissues of the body to respond to insulin . Insulin resistance has been implicated as the striking factor precipitating adverse effects on lipoprotein particle concentrations of VLDL,

LDL, and HDL. However, T2DM has been associated with clusters of interrelated plasma lipid and lipoprotein abnormalities, including reduced HDL cholesterol and elevated triglycerides despite normal LDL cholesterol levels .

Diabetes is an independent risk factor for accelerated atherosclerosis development via dyslipidemia. Atherosclerosis is characterized by lipid accumulation within the artery walls by narrowing of arteries due to the development intimal plaques (deposition of small cholesterol crystals in the intima and its underlying smooth muscle). Dyslipidemia is more common in diabetes patients because important enzymes and lipid metabolism pathways are affected in diabetes. Moreover, T2DM patients have been shown to have an increased risk of cardiovascular disease (CVD) associated with atherogenic abnormalities and dyslipidemia several folds, as over 50% of T2DM patients die of complications from coronary heart disease.

Early detection and treatment of hyperlipidemia in diabetic patients reduces the risk for cardiovascular and cerebrovascular diseases. Lifestyle changes such as diet and exercise are very important in improving diabetic dyslipidemia, but often pharmacological therapy is employed. The high-risk status of this group of patients and the need for more aggressive lipid-lowering therapy have been recognized and documented by the National Cholesterol Education Program, the American Diabetes Association, and the WHO.

Despite the high prevalence of DM and the associated complications of dyslipidemia, there is a dearth of information on the pattern of dyslipidemia among T2DM. Therefore, this study aims to detect lipid abnormalities among T2DM receiving treatment in a tertiary health care facility.

Materials and methods

This case control, cross-sectional study was carried out at the endocrinology clinic of a tertiary health institution (Federal Medical Center, Owo), in Nigeria. A total number of 80 subjects consisting of 20 newly diagnosed (diagnosis < 1 month) type 2 diabetics (Group A), 20 diagnosed (diagnosis greater than 1 month but not more than 3 months) type 2 diabetics (Group B), 20 diagnosed (diagnosis greater than 3 months) type 2 diabetics (Group C), and the other 20 apparently healthy subjects (Group D). Subjects were age (35-60 years) matched for all groups.

Participants were recruited consecutively using eligibility criteria by purposive sampling during the period (July 2021 to September 2021) of the study. T2DM was diagnosed in the hospital in accordance with standard WHO protocol . Data were collected in a semi-structured pretested questionnaire. Questions regarding socio-demographic data, and history of personal habits were asked from subjects. Physical examination was performed; height, weight, and blood pressure was also measured using standard protocols and recorded.

About 5 ml of venous blood was drawn from each participant in the fasting state, and distributed into lithium heparin and fluoride oxalate bottles for lipid profile and plasma glucose estimation respectively. Plasma was separated by centrifugation and transferred into another well labeled vial and stored at -20^{0}C until analysis. Plasma glucose, and lipid profile components such as total cholesterol (TC), high density lipoprotein (HDL), and triglycerides(TG) were measured using a commercially available (Randox©, UK) biochemical kit while, low density lipoprotein was calculated using Friedewald equation .

Statistical analysis

Statistical analysis of the results was obtained by using window based computer software devised with Statistical Packages for Social Sciences (SPSS-20). Data were expressed as frequencies or percentages for qualitative values and mean (±standard deviation) for quantitative values. T test or one way ANOVA was used appropriately to compare the mean values of measured parameters across different groups, p-value <0.05 was considered statistically significant.

Result

Table 1: Demographic data of the study population

variables	Frequency (n)	Percentage (%)
Sex		
Male (?)	59	73.75
Female (?)	21	26.25
Age(years)		
35-44	25	31.25
45-54	27	33.75
55-65	28	35.00
Body Mass Index(kg/m^2)		
18.50 - 24.90	57	71.25
25.00 - 29.90	16	20.00
>30.00 - 34.90	5	6.25
Smoking Status (1 stick/per day)		
Yes	3	3.75
No	77	96.25
Level of Exercise (minutes/per day)		
None	14	17.50
Moderate (=1 hour)	60	75.00
Intense (= 1 hour)	6	7.50
Alcohol Drinking Habit (bottle/day)		
None	63	78.75
Slight (1 bottle)	16	20.00
Regularly (= 1 bottle)	1	1.25

Table 2: Lipid profile of the study population

Variables **Groups**	T. Chl (mmol/L)	Trigs (mmol/L)	HDL-C (mmol/L)	LDL-C (mmol/L)
Group D	5.56 ± 1.54	1.16 ± 0.59	0.61 ± 0.16	4.42 ± 1.44
Vs				
Group A	4.08 ± 1.06	1.02 ± 0.44	0.63 ± 0.13	2.99 ± 1.01
p-value	*0.0011*	*0.4003*	*0.6668*	*0.0008*
Group D	5.56 ± 1.54	1.16 ± 0.59	0.61 ± 0.16	4.42 ± 1.44
Vs				
Group B	5.21 ± 1.22	3.30 ± 1.06	0.52 ± 0.22	4.21 ± 1.16
p-value	*0.4306*	*0.0000*	*0.1472*	*0.6145*
Group D	5.56 ± 1.54	1.16 ± 0.59	0.61 ± 0.16	4.42 ± 1.44
Vs				
Group C	6.55 ± 2.29	1.46 ± 0.81	0.61 ± 0.23	5.28 ± 1.96
p-value	*0.1169*	*0.18886*	*1.0000*	*0.1221*

T. Chl - Total Cholesterol
Trigs – Triglycerides
HDL-C – High density lipoprotein
LDL-C – Low density lipoprotein
p-value is = 0.05

Table 3: Lipid profile of the diabetes group

Groups	Variables T. Chl (mmol/L)	Trigs (mmol/L)	HDL-C (mmol/L)	LDL-C (mmol/L)
Group A	4.08 ± 1.06	1.02 ± 0.44	0.63 ± 0.13	2.99 ± 1.01
Vs				
Group B	5.21 ± 1.22	3.30 ± 1.06	0.52 ± 0.22	4.21 ± 1.16
p-value	*0.0034*	*0.0000*	*0.0617*	*0.0011*
Group A	4.08 ± 1.06	1.02 ± 0.44	0.63 ± 0.13	2.99 ± 1.01
Vs				
Group C	6.55 ± 2.29	1.46 ± 0.81	0.61 ± 0.23	5.28 ± 1.96
p-value	*0.0000*	*0.0393*	*0.7368*	*0.0000*
Group B	5.21 ± 1.22	3.30 ± 1.06	0.52 ± 0.22	4.21 ± 1.16
Vs				
Group C	6.55 ± 2.29	1.46 ± 0.81	0.61 ± 0.23	5.28 ± 1.96
p-value	*0.0264*	*0.0000*	*0.2137*	*0.0423*

T. Chl - Total Cholesterol
Trigs – Triglycerides
HDL-C – High density lipoprotein
LDL-C – Low density lipoprotein
p-value is ≤ 0.05

There were more males than females (ratio 2:1) in the study population but, no significant difference ($p<0.05$) in their age range. 71% of the study population were of the normal/healty weight range (BMI = 18.5 – 24.90), 20% were overweight (BMI = 25.0 – 29.9) while, 8.8% were obese (BMI >30.0). 3.75% of the population were smoking. Likewise, 75% do engaged in moderate ($\leq$ 1 hour per day) level of exercise daily while, only 1.3% drink alcohol ($\geq$ 1 bottle) regularly(Table 1).

Data from table 2 shows the level of lipid profile among the diabetes groups(A, B and C) as compared to the control subjects (group D). Total cholesterol was significantly ($p<0.05$) lowonly in subjects newly diagnosed ($\leq$ 1 month) with diabetes (group A). Triglycerides was significantly ($p<0.05$) highonly in diabetes subjects whose diagnosis is greater than 1 month but not more than 3 months (group B). There were no significant differences in the HDL-C levels of all the groups. LDL-C was significantly ($p<0.05$) reduced only among newly diagnosed ($\leq$1 month) diabetics subjects (group A).

Comparing the lipid profile among the diabetics, there were significant differences ($p<0.05$) in the total cholesterol levels [$p=0.0034$ (group A vs group B), $p<0.0000$ (group A vs group c), $p=0.0264$ (group B vs group C)], triglycerides levels [$p<0.0000$ (group A vs group B), $p=0.0393$

(group A vs group c), p<0.0000 (group B vs group C)], and LDL-C levels [p=0.0011 (group A vs group B), p<0.0000 (group A vs group c), p=0.0423 (group B vs group C)] of all the groups. HDL-C levels among the diabetics groups did not show any significant (p>0.05) difference (Table 3).

Discussion

T2DM is a chronic disease that requires lifelong treatment and care(Olaniyan and Osadolor, 2019). Drugs are being administered to manage this condition, and therefore it is of crucial importance to study the effect of these treatments on their lipid profile level as dyslipidemia, has been noted to play a role in the pathogenesis and progression of micro and macrovascular complication in diabetes mellitus patients and also been found to be highly prevalent among diabetics(Adinortey et al., 2011; Oguejiofor, Onwukwe and Odenigbo, 2012; Kiplagat et al., 2017; Ahmmed et al., 2021). In this study lipoproteins such as triglycerides (TG), total cholesterol (TC), high density lipoprotein (HDL), and low-density lipoprotein (LDL) were studied to know how oral hypoglycemics use among T2DM affect lipid level in such patients.

The results of this investigation confirm other studies' conclusions that T2DM patients have a significant incidence of lipid abnormalities (Bhambhani, Bhambhani and Thakor, 2015). According to Goel et al., 2016, the dyslipidemias seen in T2DM—including high TG levels and lower HDL-C levels—increase the risk of CVD and atherosclerosis progression. The study highlights the necessity for dietary changes, lifestyle adjustments, and the use of suitable cholesterol-lowering medications to treat lipid abnormalities in T2DM patients (Nadeem et al., 2022)

Conclusion

This research article provides a comprehensive comparative study of lipid profiles among individuals with T2DM who are undergoing treatment. The findings highlight the prevalence of lipid abnormalities in T2DM patients and their association with increased cardiovascular risk. Monitoring and managing lipid profiles in T2DM patients are crucial for preventing complications and improving overall health outcomes. Further research is needed to explore targeted interventions for managing dyslipidemia in T2DM patients.

Conflict of interest declaration: The authors declared that there is no conflict of interest in the experiment, reporting and publication of this article.

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