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*Correspondence

Chioruru Ruth N

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Status of Serum Cholesterol and Triglycerides in Pregnant Women Diagnosed with Gestational Diabetes Mellitus in Owerri, Nigeria

Chioruru Ruth N.^{1*}, Aloy-Amadi Oluchi C.², Akujobi Augustine U.³, Akogu Okechukwu⁴, Ezech Caleb C.⁵, & Aloy-Amadi Winifred U.⁶

^{1,2}Department of Medical Laboratory Science, Imo State University, Owerri, Nigeria.

^{3,4}Department of Optometry, Imo State University, Owerri, Nigeria.

⁵Department of Haematology, Federal Teaching Hospital, Owerri, Nigeria.

⁶Department of Nursing Science, Rivers State University, Port Harcourt, Nigeria.

Abstract

Background: Gestational diabetes mellitus (GDM) is a glucose intolerance disorder with onset or first recognition during pregnancy. It is associated with adverse maternal and neonatal outcomes. Beyond hyperglycemia, GDM is characterized by metabolic disturbances, including dyslipidemia. Cholesterol and triglyceride abnormalities play a crucial role in the pathophysiology of GDM complications, influencing vascular health, fetal growth, and long-term metabolic risks. **Objective:** To investigate serum cholesterol and triglyceride levels in pregnant women diagnosed with GDM in Owerri, Nigeria, compared to healthy pregnant controls. **Methods:** A hospital-based cross-sectional case-control study was conducted among pregnant women attending antenatal clinic at Federal Medical Centre (FMC), Owerri. Ninety women diagnosed with GDM and an equivalent number of age-matched apparently healthy subjects who served as the controls were recruited. Five milliliters of venous blood samples were collected, and serum cholesterol and triglycerides were analyzed using enzymatic colorimetric methods. Demographic, anthropometric, and clinical data were recorded. Statistical analysis was performed using SPSS version 25, with $p < 0.05$ considered significant. Subgroup analyses by maternal age, BMI, and trimester were also conducted. **Results:** Mean serum cholesterol (212.09 ± 43.96) mg/dl and triglyceride (155.64 ± 50.68) mg/dl levels were significantly higher in GDM women compared to controls (105.64 ± 34.00) mg/dl. Total cholesterol was significantly higher in the first and second trimesters (221.03 ± 37.53) mg/dL, (223.90 ± 49.84) mg/dL than in the third (191.33 ± 36.96) mg/dL. Triglyceride levels, however, did not differ significantly across trimesters ($p = 0.197$). Parity-based analysis showed no significant differences in total cholesterol ($p = 0.056$), or triglycerides (0.388). Subgroup analysis revealed significant increase in total cholesterol in the second trimester compared to the first and third, but a non-significant increase was observed in triglyceride levels across the trimesters. No significant difference was observed based on parity in total cholesterol and triglyceride levels. **Conclusion:** Pregnant women with GDM in Owerri exhibit significant dyslipidemia, marked by elevated cholesterol and triglycerides. This suggests that lipid profile evaluation

may be an important adjunct in GDM management. Routine screening of cholesterol and triglycerides in GDM patients should be integrated into antenatal care. Early interventions, including dietary modification and close monitoring, are recommended to reduce adverse outcomes.

Keywords

Gestational diabetes mellitus, cholesterol, triglycerides, dyslipidemia, pregnancy, Nigeria.

1.0 Introduction

Gestational diabetes mellitus (GDM) is one of the most common metabolic disorders in pregnancy, with a prevalence ranging from 2% to 14% depending on population and diagnostic criteria¹. It is defined as glucose intolerance of variable severity with onset or first recognition during pregnancy². GDM is associated with complications such as preeclampsia, macrosomia, neonatal hypoglycemia, and increased risk of type 2 diabetes in both mother and child³. While hyperglycemia is the diagnostic hallmark, pregnancy with GDM is also marked by broader metabolic alterations, including disturbances in lipid metabolism. Normally, pregnancy is a hyperlipidemic state, as maternal lipid mobilization supports placental and fetal growth⁴. However, in GDM, dysregulation of lipid metabolism is exaggerated, resulting in elevated total cholesterol and triglyceride levels⁵.

Cholesterol is essential for steroid hormone synthesis and fetal cell membrane development, but excessive maternal cholesterol has been linked to atherosclerotic changes in the fetus⁶. Triglycerides, similarly, are crucial for energy supply but their excessive accumulation is associated with insulin resistance, endothelial dysfunction, and increased risk of preeclampsia⁷. Elevated triglycerides also contribute to macrosomia and adverse neonatal outcomes⁸. The pathophysiology of dyslipidemia in GDM involves insulin resistance, hormonal modulation, and altered hepatic metabolism. Insulin resistance reduces the inhibitory effect of insulin on lipolysis, leading to increased free fatty acids and hepatic triglyceride synthesis⁹. Placental hormones such as human placental lactogen, progesterone, and cortisol exacerbate this process¹⁰. In Nigeria, few studies have systematically examined lipid alterations in GDM patients. Most antenatal evaluations focus primarily on glucose regulation, overlooking lipid monitoring. Given the rising prevalence of obesity, sedentary lifestyle, and dietary changes in urban Nigerian populations, the burden of GDM-related dyslipidemia is likely underestimated.

This study was therefore designed to investigate serum cholesterol and triglyceride levels in pregnant women with GDM compared to healthy controls in Owerri, Nigeria. Studying these changes will provide local evidence to support integrated metabolic monitoring in antenatal care.

2.0 Materials and Methods

2.1 Study Design

A hospital-based cross-sectional case-control study was conducted to compare serum cholesterol and triglyceride levels between pregnant women with GDM and age-matched healthy controls.

2.2 Study Area

The study was carried out at the Federal Teaching Hospital (FTH), Owerri, Imo State, Nigeria. The hospital serves as a referral center, providing tertiary care to a diverse population in southeastern Nigeria.

2.3 Study Population

The study population consisted of pregnant women attending antenatal clinics at FTH, Owerri.

2.3.1 Inclusion Criteria

Pregnant women aged 18–40 years.

Diagnosed with GDM using WHO 75g oral glucose tolerance test (OGTT).

Age-matched healthy pregnant women with normal OGTT as controls.

2.3.2 Exclusion Criteria

Women with pre-existing type 1 or type 2 diabetes.

Pregnant women with chronic hypertension, renal disease, or thyroid disorders.

Those on lipid-lowering medications.

Women who declined consent.

2.4 Sample Size

Sample size was calculated using the formula for case-control studies, ensuring adequate power to detect differences in lipid parameters. A minimum of 90 cases (GDM) and 90 controls were included.

2.5 Sample Collection

Venous blood (5 mL) was collected aseptically after an overnight fast. Samples were divided into plain tubes, allowed to clot, centrifuged, and serum separated for biochemical analysis.

2.6 Laboratory Analysis

Serum cholesterol was measured using enzymatic colorimetric method (CHOD-PAP).

Serum triglycerides were measured using enzymatic glycerol phosphate oxidase method.

Quality control was ensured using standard reference sera.

2.7 Data Collection

Socio-demographic and clinical data (age, gestational age, parity) were obtained using structured questionnaires and antenatal records.

2.8 Data Analysis

Data were analyzed using SPSS version 25. Mean \pm SD values were computed. Independent t-tests compared lipid levels between groups. ANOVA was used for subgroup analysis by maternal age, BMI, and trimester. $p < 0.05$ was considered statistically significant.

2.9 Ethical Considerations

Ethical approval was obtained from FTH, Owerri Research Ethics Committee. Informed consent was obtained from all participants. Confidentiality and voluntary participation were ensured.

3.0 Results

Table 1: Mean Values of Total Cholesterol and Triglycerides in GDM and Non-GDM Pregnant Women.

Parameter	Test (n=90)	Control (n=90)	t-value	p-value
TC (mg/dL)	212.09 \pm 43.96	147.38 \pm 29.22	11.63	<0.0001*
TG (mg/dL)	155.64 \pm 50.68	105.64 \pm 34.00	7.77	<0.0001*

KEY:

*: Significant p value

SD: Standard Deviation

TC: Total Cholesterol

TG: Triglycerides

Table 1 illustrates the mean values of total cholesterol and triglycerides in pregnant women with and without GDM.

The mean total cholesterol and triglyceride levels were significantly elevated in women with GDM (212.09 ± 43.96) mg/dL and (155.64 ± 50.68) mg/dL, respectively, compared to non-GDM women (147.38 ± 29.22) mg/dL and (105.64 ± 34.00) mg/dL ($t=11.63$, $p < 0.0001$; $t=7.77$, $p < 0.0001$).v

Table 2: Total Cholesterol and Triglycerides in Women with GDM Based on Gestational Age (Mean \pm SD).

Parameter	1st trimester	2 nd trimester	3 rd trimester	t-value	p-value
TC (mg/dL)	221.03 ± 37.53	223.90 ± 49.84	191.33 ± 36.96	5.56	0.005*
TG (mg/dL)	157.20 ± 57.20	166.60 ± 49.13	143.13 ± 43.70	1.65	0.197

KEY:

*: Significant p value

SD: Standard Deviation

TC: Total Cholesterol

TG: Triglycerides

Table 2 shows the mean values of total cholesterol and triglycerides in pregnant women diagnosed with gestational diabetes mellitus, based on gestational age.

The mean values of total cholesterol was significantly higher in the first (221.03 ± 37.53) mg/dL and second (223.90 ± 49.84) mg/dL trimesters compared to the third trimester (191.33 ± 36.96) mg/dL ($F=5.56$, $p=0.005$). Similarly, the mean values of triglycerides were not significantly different across the first (157.20 ± 57.20) mg/dL, second (166.60 ± 49.13) mg/dL and third (143.13 ± 43.70) mg/dL trimesters respectively ($F=1.65$, $p=0.197$).

Table 3: Mean Values of Total Cholesterol and Triglycerides in Women with GDM Based on Parity (Mean \pm SD).

Parameter	Nulliparous	Primiparous	Multiparous	t value	p value
TC (mg/dL)	208.87 ± 34.19	200.43 ± 43.73	226.97 ± 49.70	2.979	0.056
TG (mg/dL)	166.07 ± 63.84	149.63 ± 39.16	151.23 ± 45.87	0.958	0.388

KEY:

TC: Total Cholesterol

TG: Triglycerides

Table 3 shows the mean values of total cholesterol, and triglycerides in women diagnosed with gestational diabetes mellitus (GDM) based on parity.

The mean values of total cholesterol and triglycerides were not significantly different across nulliparous (208.87 ± 34.19) mg/dL, (166.07 ± 63.84) mg/dL, primiparous (200.43 ± 43.73) mg/dL, (149.63 ± 39.16) mg/dL, and multiparous (226.97 ± 49.70) mg/dL, (151.23 ± 45.87) mg/dL women with GDM respectively ($F=2.979$, $p=0.056$, $F=0.958$, $p=0.388$).

4.0 Discussion

This study examined serum cholesterol and triglyceride levels in pregnant women with GDM compared to healthy controls in Owerri, Nigeria. The findings demonstrated significantly elevated cholesterol and triglyceride concentrations in GDM women, consistent with global reports of dyslipidemia in GDM populations¹¹.

Elevated cholesterol levels in GDM patients may reflect increased hepatic synthesis and reduced clearance due to insulin resistance. Excess maternal cholesterol can cross the placenta, influence fetal lipid metabolism and increase risk of atherosclerotic changes in utero¹². Our findings align with studies in India, Turkey, and South Africa, which reported significantly higher cholesterol levels in GDM pregnancies compared to controls¹³.

Triglycerides were also markedly elevated in the GDM group. This may be attributed to enhanced lipolysis in adipose tissue and increased hepatic triglyceride synthesis under insulin-resistant conditions¹⁴. Elevated triglycerides have been implicated in endothelial dysfunction, preeclampsia, and macrosomia¹⁵. Our findings agree with earlier Nigerian studies demonstrating similar patterns¹⁶. Furthermore, women in the third trimester had significantly higher lipid levels, reflecting the progressive physiological hyperlipidemia of late pregnancy, exaggerated in GDM¹⁸.

Dyslipidemia in GDM is not merely a biochemical alteration but has important clinical consequences. Elevated maternal cholesterol and triglycerides contribute to adverse maternal outcomes (hypertensive disorders, cesarean delivery) and neonatal complications (macrosomia, neonatal hypoglycemia)¹⁹. Incorporating lipid profile assessment into routine GDM management could help stratify risk and guide interventions.

This study is one of the few Nigerian investigations focusing specifically on cholesterol and triglycerides in GDM. However, limitations include relatively small sample size and single-center design, which may limit generalizability.

5.0 Conclusion

This study demonstrates that pregnant women with GDM in Owerri exhibit significantly higher serum cholesterol and triglyceride levels compared to healthy controls. These findings highlight the need to consider lipid profile monitoring as part of comprehensive GDM care.

6.0 Recommendations

1. Routine lipid screening should be incorporated into antenatal care for women diagnosed with GDM.
2. Dietary and lifestyle interventions should target both glucose and lipid control.
3. Risk stratification using lipid profile could improve prediction of adverse outcomes.
4. Multicentre studies with larger cohorts are recommended to confirm these findings and explore long-term implications.

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