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Original Article

# EVALUATION OF GESTATIONAL DIABETES AND HYPERLIPIDEMIA AMONG PREGNANT WOMEN ATTENDING ANTE-NATAL CLINIC AT NIGERIAN CUSTOMS MEDICAL CENTRE KARU, FCT ABUJA, NIGERIA.

**Abriba S. P.[*1], Terungwa G. V. [1], Osadolor H.B.[2]**

[1]Department of Medical Laboratory Science, Faculty of Allied Health Sciences, Bingham University, Karu
[2]Department of Medical Laboratory Science, College of Health Sciences University of Benin.

ARTICLEINFO

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ABSTRACT

BACKGROUNG: Gestational diabetes and hyperlipidemia have been on the increase globally, and approximately 16% of pregnant women has been affected. This metabolic disease conditions needs to be assessed to determine its prevalence and to prevent its incidence and attended complications in pregnant women and the new born. METHODS:This is a cross=sectional study involving a total of 150 pregnant women whowere recruited into the study; the pregnant women were grouped into three according to their trimester, 50 in each trimester. Fasting blood sugar (FBS), Triglycerides, Total cholesterol and HDL-C were carried out in all the subjects using enzymatic methodsfor FBS and Triglycerides; while Liebermann Burchard method was used for the estimation of T. Cholesterol and Phosphotungstic acid/ Magnesium methods for HDL-C. RESULTS: The fasting blood sugar(FBS), Triglycerides, T. Cholesterol, and HDL-C in the first trimester are 6.54±3.20, 140.50±70.05, 200.50±40.70, 77.30±16.50 respectively, second trimester FBS, Triglycerides, T. Cholesterol, HDL-C are 7.56± 3.40, 165.30± 68.10, 240.52± 30.80, 67.20±30.10 respectively; third trimesters FBS, Triglycerides, T. Cholesterol, HDL-C are 9.50± 6.90, 350.60± 30.70, 270.74± 52.50, 69.16± 20.30 respectively. There is a statistically significant difference $p<0.001$ in all the parameter in the three trimesters, except in HDL-C that show no significant difference $p>0.001$. CONCLUSION:The study shows very low prevalence rate of gestational diabetes and increasing hyperlipidemias in the pregnant women who attend ante-natal clinic in Customs Medical Center, Karu FCT Abuja Nigeria.

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## Introduction

Gestational diabetes (GD) is a significant and increasing global health issue, affecting about 16% of pregnant women worldwide. According to the International Diabetes Federation (IDF), the prevalence of diabetes keeps rising globally with 537 million people with the condition in 2021, and it's expected to rise to 783 million by 2045 [1].

The greatest increase in incidence, predicted to be 129%, is projected to occur in the African region, meaning that the current 24 million individuals with the illness between the ages of 20 and 79 would climb to 55 million by 2045. Furthermore, the area still has the greatest proportion of misdiagnosed instances of the illness worldwide (53.6%).[1]

In Nigeria, GD is estimated to affect 10% of pregnant women, with higher rates observed in urban areas [2]. However, GD frequently remains undetected and untreated, particularly in nations with limited resources like Nigeria, where it continues to be a serious concern.

Corresponding author:

**Dr Simon Peter Abriba**
Department of Medical Laboratory Science, Faculty of Allied Health Sciences, Bingham University, Karu
**Email:** abriba.simon-peter@binghamuni.edu.ng
ORCID: http/ORCID.org/0000-0002-8858-8456

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For the benefit of both the mother and the fetus, maternal adaptation occurs early in pregnancy. The pregnancy allows the mother to store more energy in anticipation of labor since these physiological changes happen throughout the body at varying rates. One of the most basic systemic alterations in a typical pregnancy is fluid retention and lipid accumulation, which contributes 8–10 kg of the 11–13 kg average maternal weight gain. Protein anabolism occurs, blood glucose levels increase and about 3-4 kg of fat is deposited in the maternal body, and thus increases blood lipid level [3, 4].

During pregnancy, estimation of maternal lipid profile is recommended, due to the association of dyslipidemia with gestational diabetes [5]. The concentration of some lipids such as T. Cholesterol, Triglycerides, and LDL-C increases from the first trimester to the third trimester. The increase in Triglycerides right from beginning of pregnancy seems to be associated with insulin resistance and implicitly with gestational diabetes, one of the important complications of pregnancy [6].

An elevation in blood cholesterol levels hinders the insulin-driven uptake of glucose into cells, leading to varying degrees of hyperglycemia.
As a result of the actions of some pregnancy-related hormones, notably cortisol and human chorionic somatomammotropin, pregnancy frequently results in a diabetic-like state. As a result, gestational diabetes affects 1–16% of pregnant women [2].

Gestational diabetes may develop as a consequence of elevated blood sugar levels, primarily influenced by pregnancy hormones and adipose tissue. Gestational diabetes is associated with a range of maternal perinatal morbidities and mortality including fetal macrosomia (20%), hyperinsulinemia and hypoglycemia, but may also program childhood obesity and adult onset of cardiovascular disease and diabetes [6, 7].

Insulin resistance (IR), an independent risk factor for the development of type 2 diabetes mellitus (T2DM) and other metabolic syndromes, is a pathological state characterized by failure of the insulin system [ 8]. It

refers to a reduced sensitivity of insulin-sensitive cells to the effects of insulin. Since type 2 diabetes mellitus (T2DM) makes up more than 90% of diabetes cases worldwide, it is vital to examine the factors that contribute to the onset of insulin resistance, which occurs before the full development of T2DM. [7].

Due to the potential long-term pathogenic effects on the mother and the unborn child, the incidence of gestational diabetes is still rising[8, 9]. Elevated blood sugar levels during pregnancy, caused by gestational diabetes (GD), or by preexisting type 1 (T1DM) or type 2 diabetes mellitus (T2DM), have been linked to negative maternal and perinatal outcomes, such as macrosomia (large birth weight), shoulder dystocia and birth injury, high levels of bilirubin in the blood, preterm delivery and primary caesarean delivery, preeclampsia, and increased neonatal mortality.[8].

High blood sugar levels during pregnancy can result in increased insulin resistance and hyperglycemia in the fetus, potentially increasing the risk of obesity and diabetes later in life. The increasing incidence of pregnant women with GD and T2DM as part of the on-going epidemic of obesity highlights the importance of managing hyperglycemia during pregnancy from a clinical and public health perspective [10]. In addition to smoking, a history of GD, stillbirths or newborns with congenital abnormalities, overweight or obesity, excessive weight gain during pregnancy, polycystic ovarian syndrome, and advanced age, GD predisposes the afflicted to the development of T2DM in the future. [8].

This study is aimed at evaluating the Gestational Diabetes and lipidaemia in pregnancy, and determine its prevalence in the given population and bring about reduction of maternal and fetal complications associated with GD and lipidemia in Nigeria; and improve the overall health outcomes of pregnant women and their newborns.

## METHODS

**Subject and Sample:** A cross-sectional study was carried out on pregnant women between February, 2024 to October, 2024, in Nigerian Customs Medical Center Karu, FCT Abuja. One hundred and fifty participants were randomly selected and included in the study; they were grouped into fifty in each of the trimesters.

Five milliliters of blood sample was drawn from each of the subject from the articular vein on their clinic visit days; the sample were put into a fluoride oxalate container, to prevent glycolysis for glucose determination and heparin container for the lipids determination, after which, it was spin at 3000 rpm for 5 minutes; plasma and serum sampleswere then extracted from the whole sample and then analyzed using enzymatic method for glucose and Triglyceride estimation while Cholesterol was estimated using the modified Leiberman Buchard reaction, and Phosphotungstic acid/ Magnesium methods for HDL-C.

Ethical approval: Ethical approval was sought and obtained from the ethical clearance committee of Customs Medical Centre health research ethics committee Abuja with reference number CMREC/2024/01/97/21-03-24 dated March 21, 2024.

**Inclusion and exclusion criteria:**

Pregnant women aged 18 and 45 years were included for the study, while the women with other serious health conditions, who also agree to alcohol consumption and smoking were excluded.

**Informed consent:** The purpose and protocol of the study were clearly explained to each patient and all participants were requested to voluntarily sign the consent forms in their own hand writing as proof of willingness to provide samples for the research work.

**Data collection:** Prior to specimen collection, demographic information of the participants was obtained through administration of prepared questionnaires. Interpreter was provided for translation where it was necessary. Each questionnaire had a unique participant identification number (PIDN). The first part of the questionnaires contained the bio data of the patients e.g. sex, age etc. The second part consisted of duration of the pregnancy. For reason of privacy, all data were kept confidential in accordance with World Medical Association declaration of Helsinki (WMA, 2008). For each participant, only the PIDN was recorded on the laboratory forms (no names). All the filled questionnaires were destroyed after data entry had been completed.

**Statistical analysis:**The demographic characteristics of the participants were expressed as mean values and standard deviation (SD). Differences in fasting blood sugar (FBS), Total Cholesterol, HDL-C, and Triglycerideslevels between the study group and the control group were tested by student t-test;P value < 0.001 were considered statistically significant. The statistical package of social science (SPSS) window version 20.0 was used for all calculation and data analysis.

## RESULTS

Table 4.1 and Figure 1 presents the Fasting blood sugar (FBS), Triglycerides,Total cholesterol, and HDL-C levels of pregnant women in their first trimester attending antenatal care at Nigeria Customs Service Hospital, Karu.The Triglycerides, Cholesterol, and HDL-C values shows statistically significant difference among the first trimesters with p-values <0.001, while the FBS show no significant difference.

Table 4.1 and Figure 1presents the Fasting blood sugar, Triglycerides, Total Cholesterol and HDL-C of the pregnant women attending antenatal care at the Hospital, in the second trimester. The FBS, Triglycerides, T. Cholesterol, and HDL-C values shows statistically significant difference among the second trimester with p-value<0.001.

Table 4.1 shows the Comparison of Fasting Blood Glucose and Fasting Lipid Profile

| Parameters | First Trimester(n=50) | Second Trimester(n=50) | Third Trimester(n=50) | P-value |
|---|---|---|---|---|
| FBG (mg/dL) | 72.13 ± 10.11 | 87.37 ± 10.49 | 86.36 ± 12.25 | < 0.001* |
| Triglyceride (mg/dL) | 128.20 ± 28.189 | 190.01 ± 32.90 | 204.81 ± 31.83 | < 0.001* |
| Total Cholesterol (mg/dL) | 186.37 ± 22.93 | 209.56 ± 16.70 | 215.70 ± 16.85 | < 0.001* |
| HDL-Cholesterol (mg/dL) | 57.54 ± 8.34 | 59.30 ± 6.34 | 57.56 ± 6.12 | 0.050* |
| POST-HOC ANALYSIS | | | | |
| FBG | I vs II < 0.001 | I vs III < 0.001 | | |
| Triglyceride | I vs II < 0.001 | I vs III < 0.001 | II vs III < 0.001 | |
| Total Cholesterol | I vs III < 0.001 | I vs III < 0.001 | I vs III = 0.018 | |

Table 4.1 and Figure1 presents the Fasting blood sugar, Triglycerides, T. Cholesterol, and HDL-C of pregnant women attending antenatal care at the Hospital, in the third trimester. The FBS, Triglycerides, T. Cholesterol, and HDL-C values show statistically significant difference among the thirst trimester with p-value <0.001.

Figure 2 to Figure 10 shows the linear relationship between Fasting Blood Sugar and the lipids in gestational diabetes across the three trimesters.
Table 4.2 and Figure 4.2 shows Prevalence of Gestational Diabetes in Pregnant Women attending Ante Natal Clinic in Customs Hospital, Karu FCT Abuja.

Table 4,3 and Figure 4.3 presents the association between gestational age and weight with glucose.

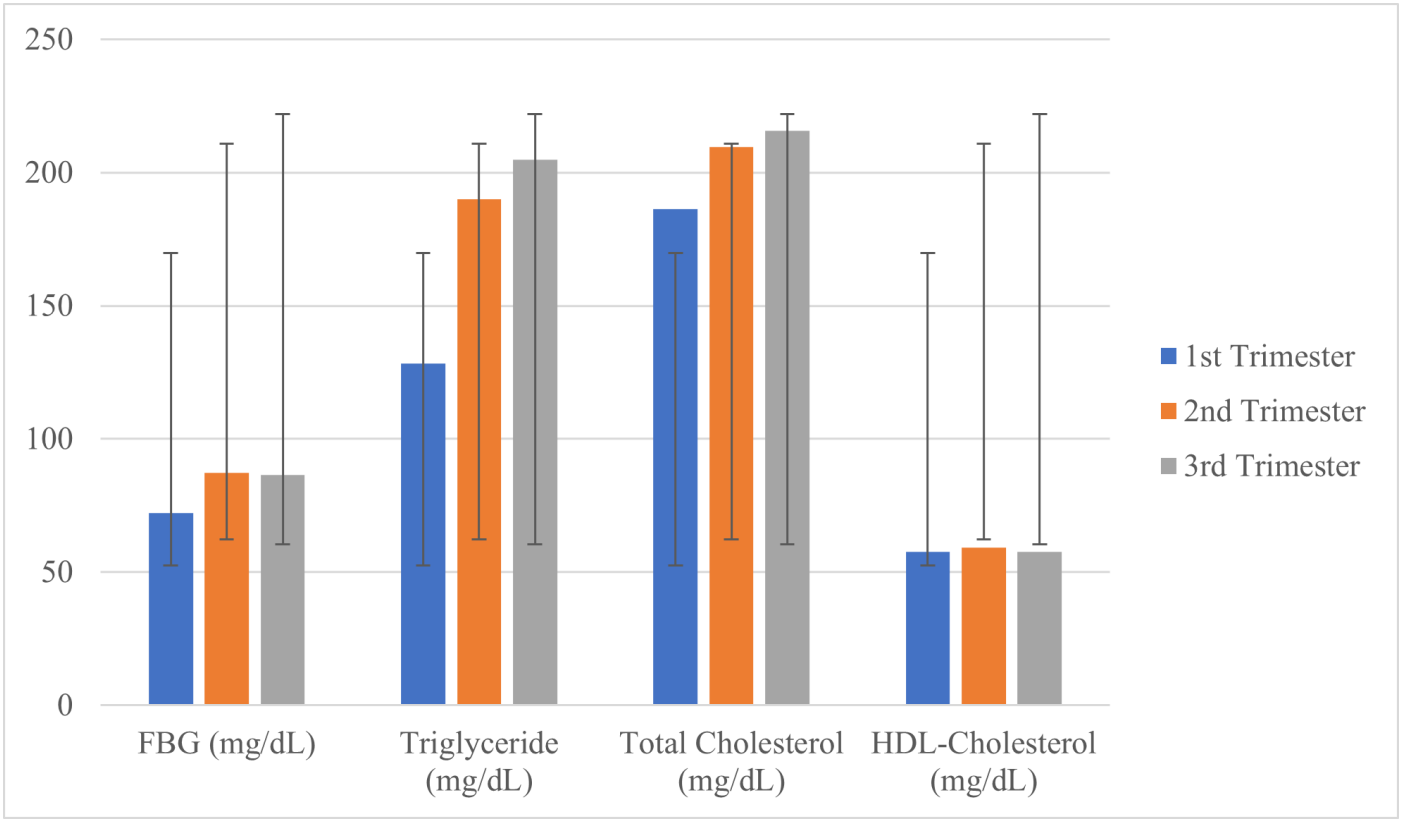



Fig. 1 shows Mean and SD of Fasting Blood Glucose and some Fasting Lipid Profile of First, Second and Third Trimesters Subjects.

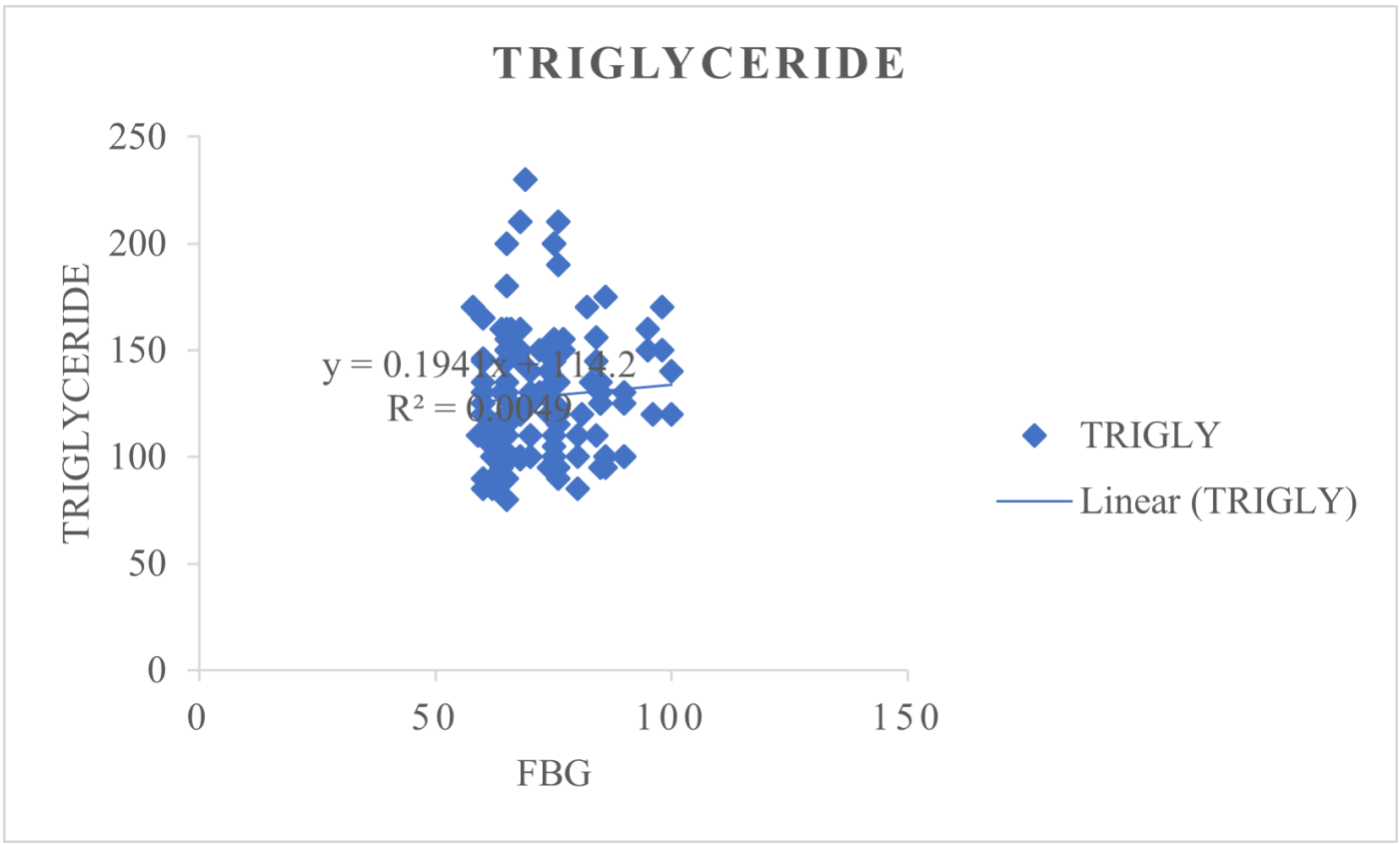



Fig. 2. Scatter graph of FBG and Triglyceride of First Trimester

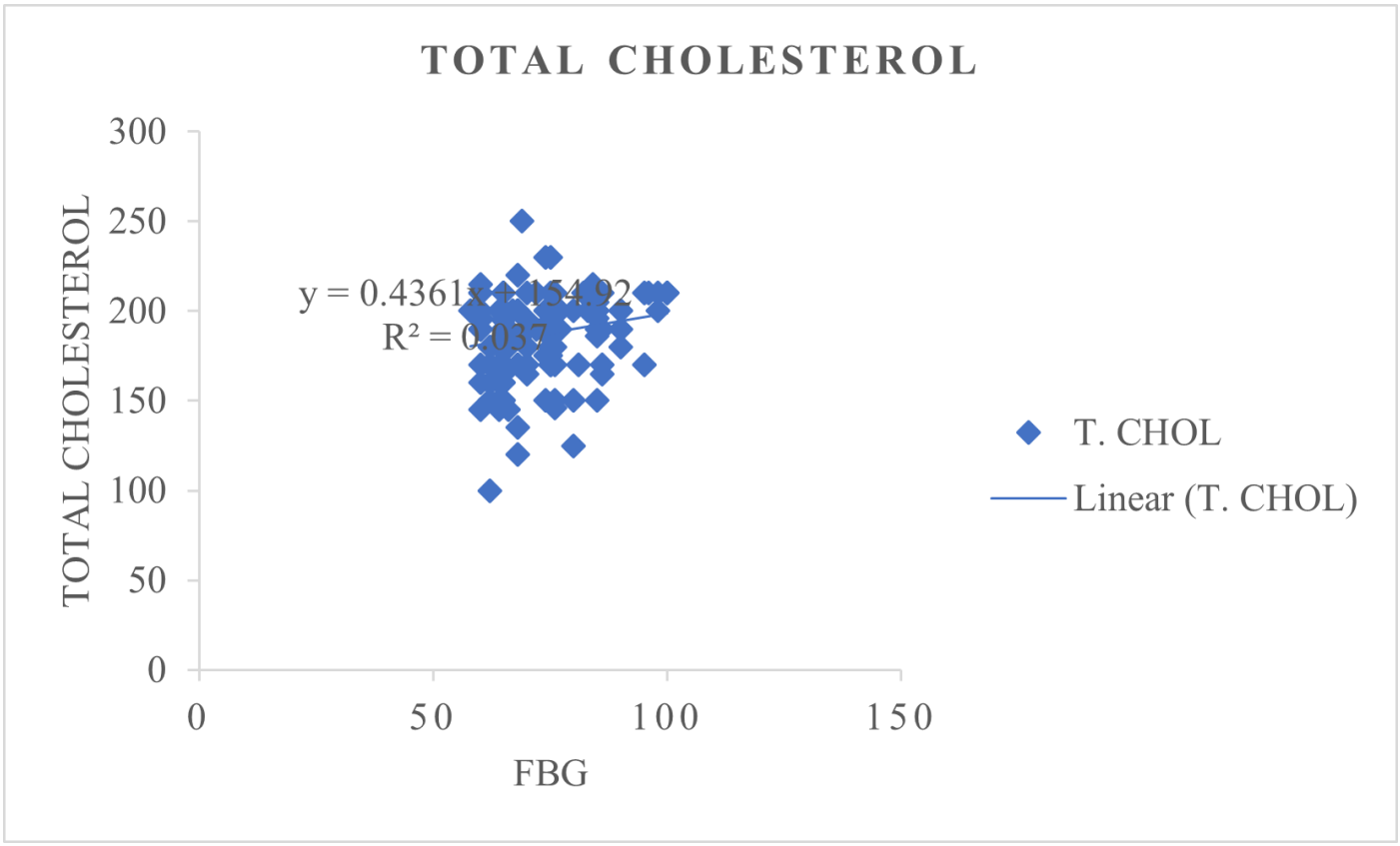



Fig. 3. Scatter graph of FBG and Total Cholesterol of First Trimester

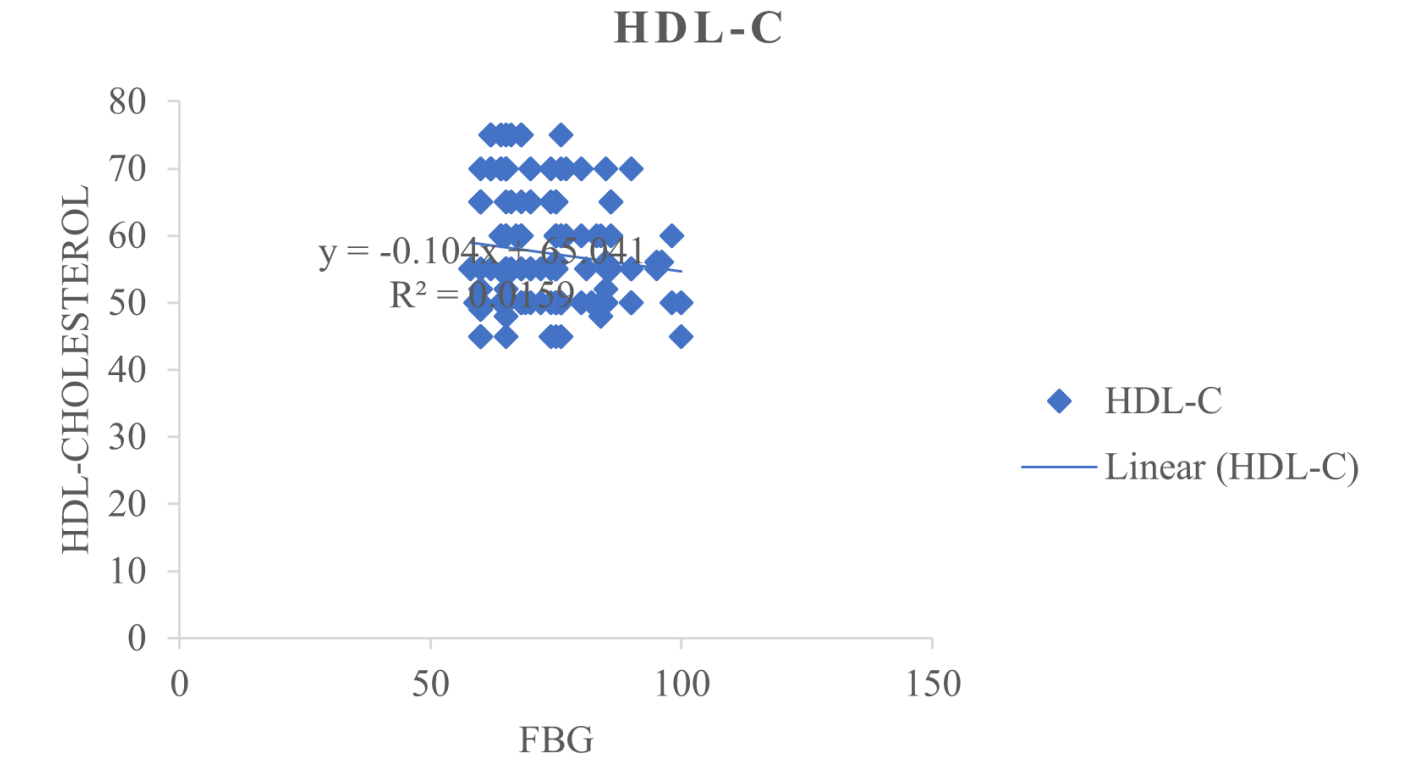



Fig. 4. Scatter graph of FBG and HDL-Cholesterol of First Trimester

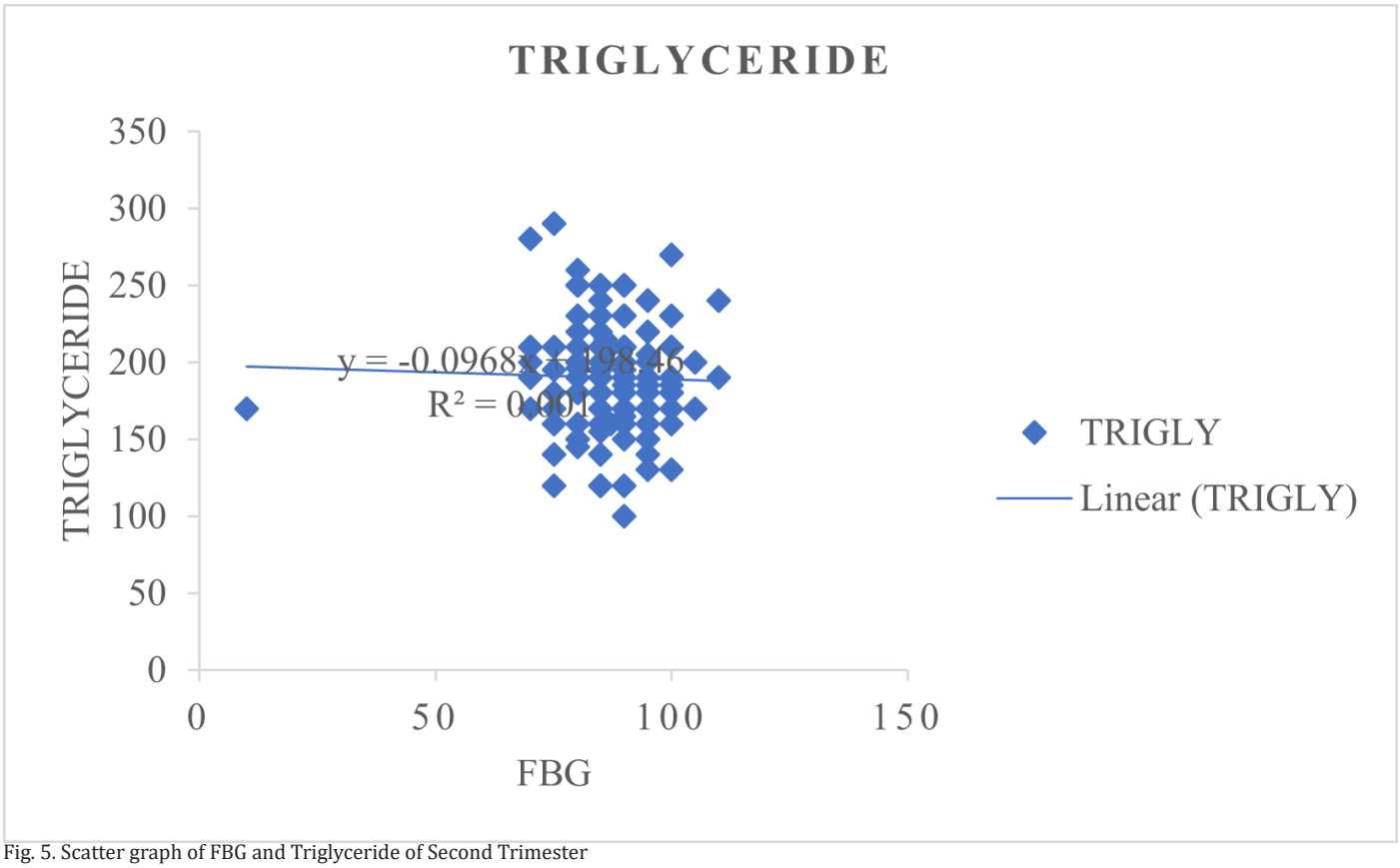



Fig. 5. Scatter graph of FBG and Triglyceride of Second Trimester

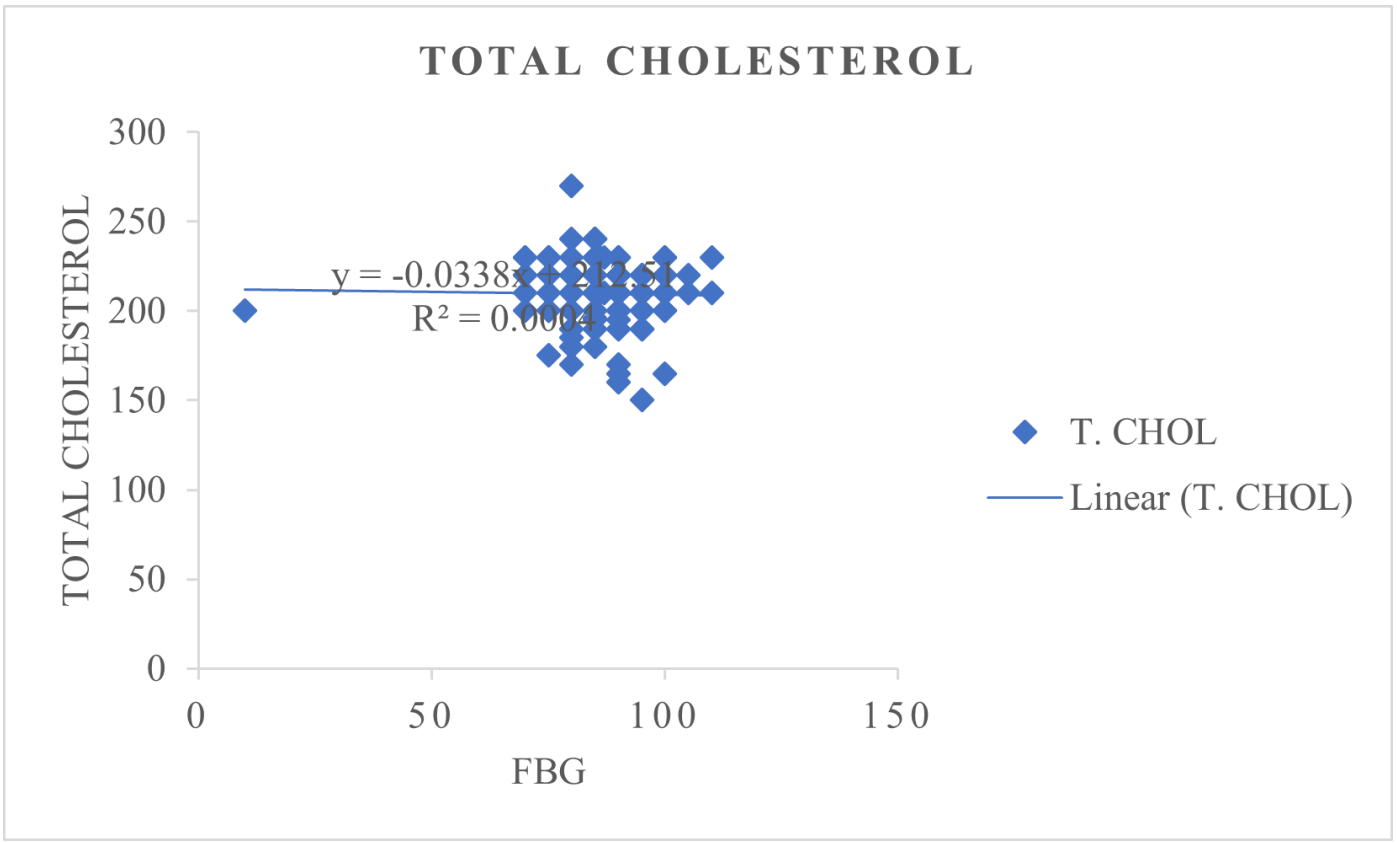



Fig. 6. Scatter graph of FBG and Total Cholesterol of Second Trimester

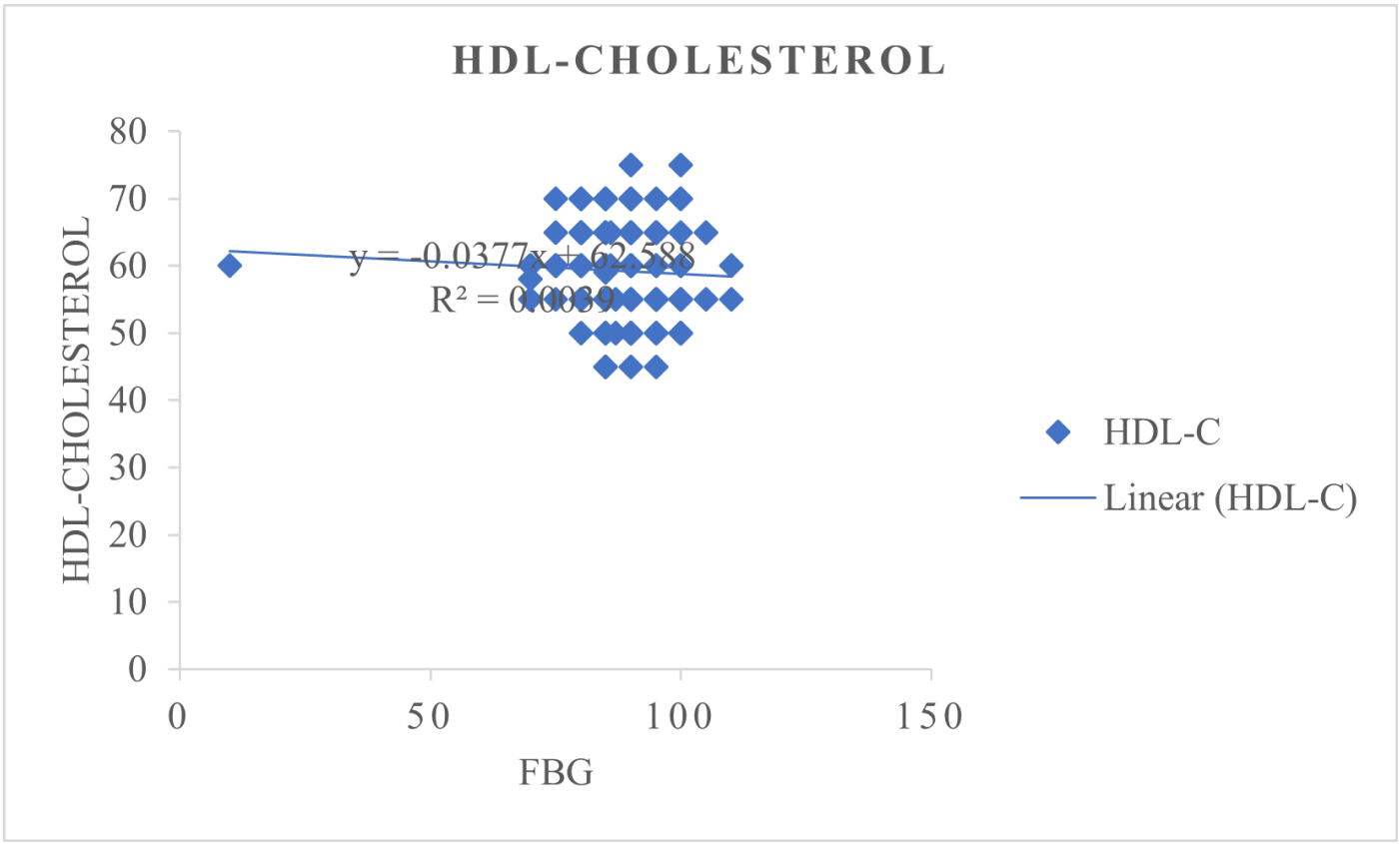



Fig. 7. Scatter graph of FBG and Total Cholesterol of Second Trimester

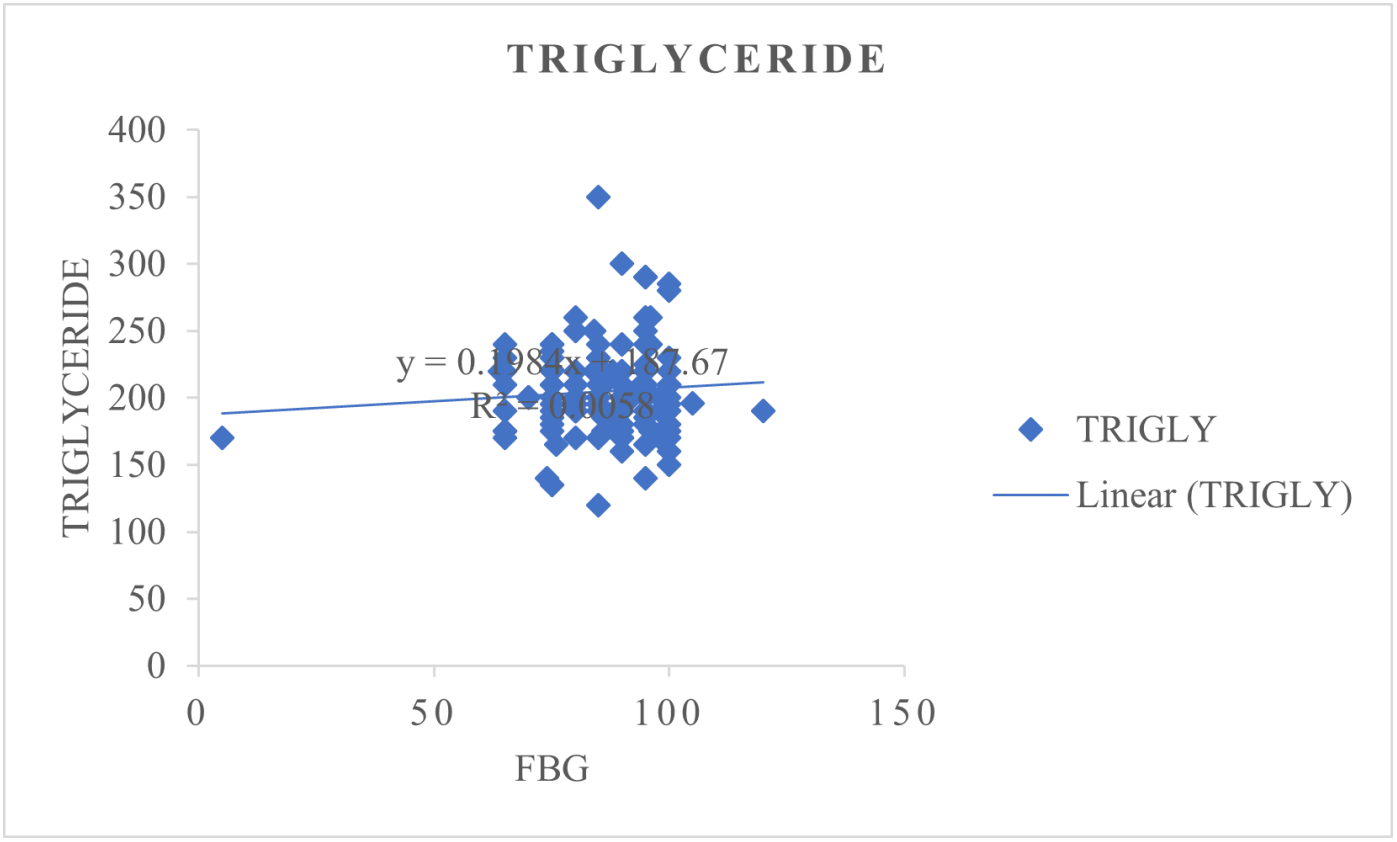



Fig. 8. Scatter graph of FBG and Triglyceride of Third Trimester

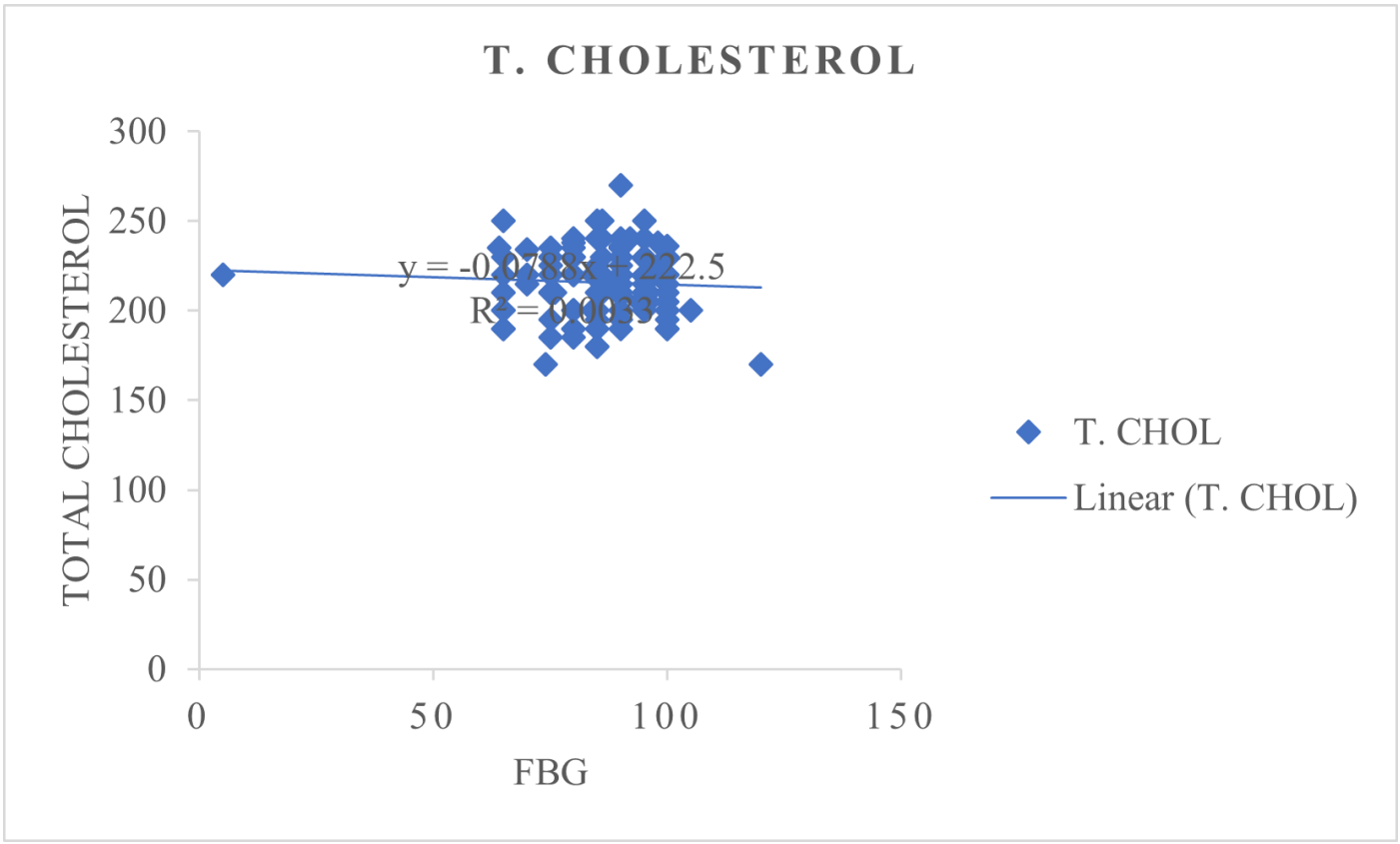



Fig. 9. Scatter graph of FBG and Total Cholesterol of Third Trimester

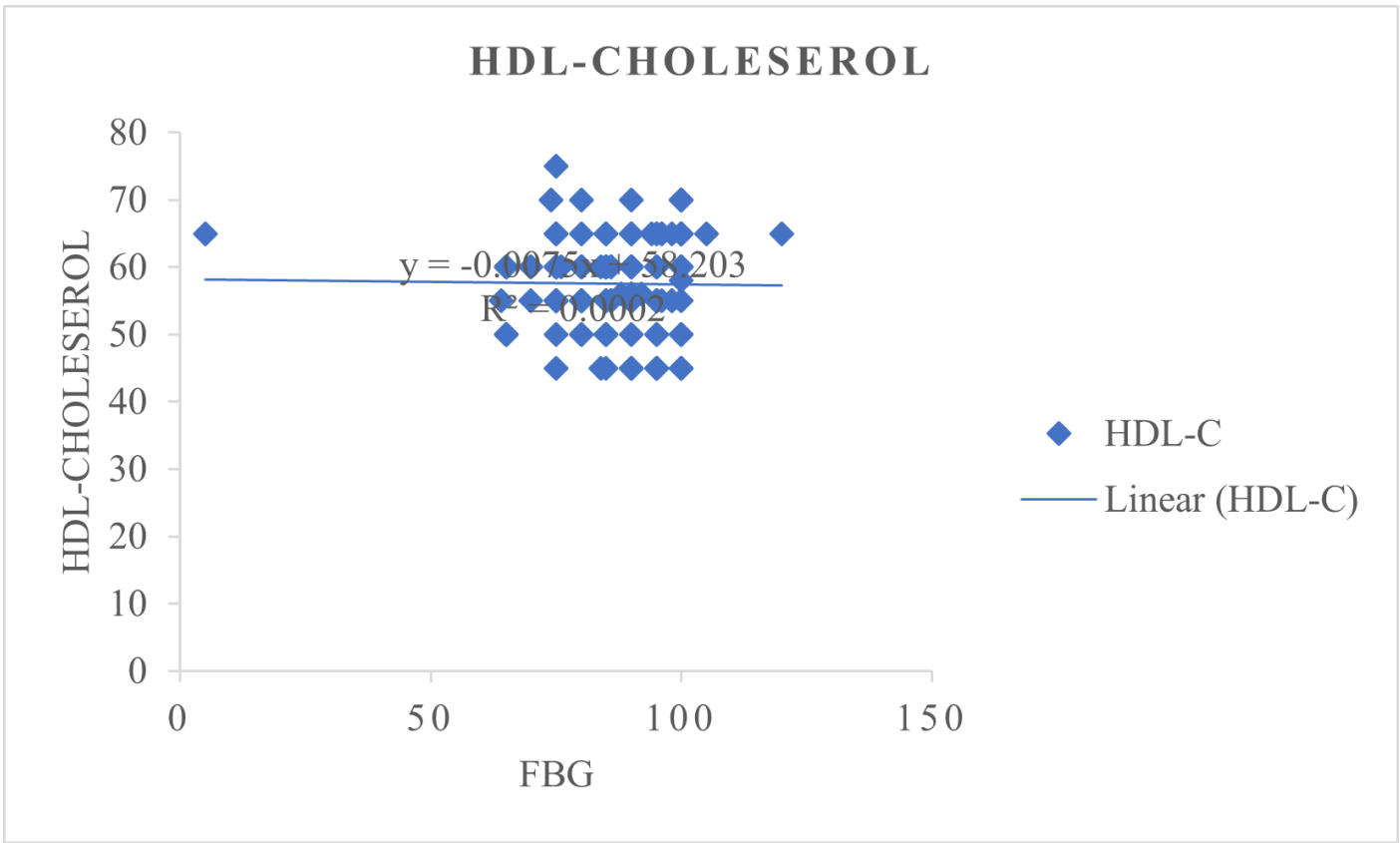



Fig. 10. Scatter graph of FBG and HDL-Cholesterol of Third Trimester

Table 4.2. Prevalence of Gestational Diabetes in Pregnant Women attending Ante Natal Clinic in Customs Hospital, Karu FCT Abuja.

| Gestational Diabetes | Frequency (%) | Mean SD(mg/dl) |
|---|---|---|
| Yes | 3 (8.3) | 125.23± 2.34 |
| No | 147 (91.7) | 87.10± 1.30 |

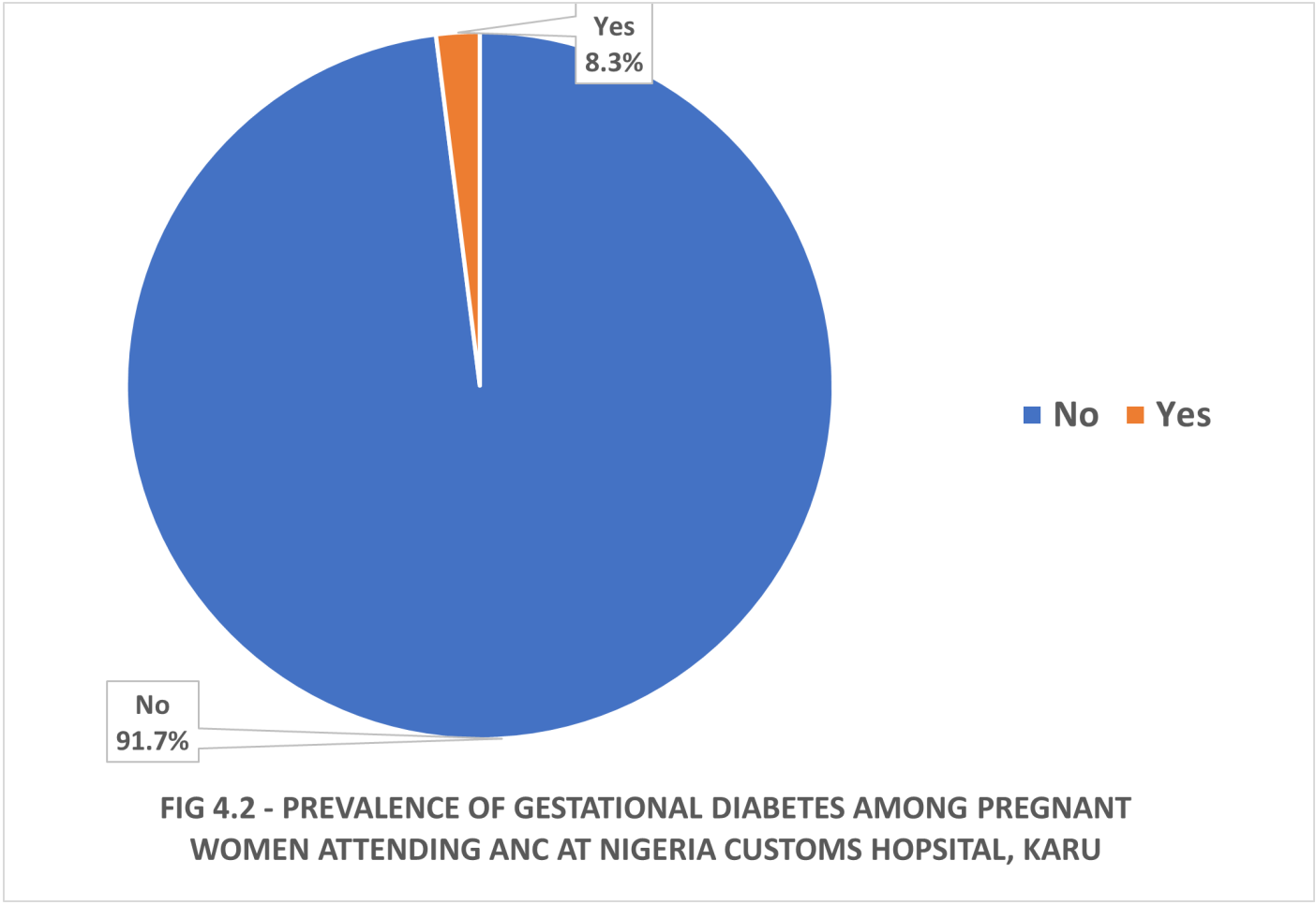



FIG 4.2 - PREVALENCE OF GESTATIONAL DIABETES AMONG PREGNANT WOMEN ATTENDING ANC AT NIGERIA CUSTOMS HOPSITAL, KARU

| Variables | Mean ± S.D. | Correlation coefficient (r) | p-value |
|---|---|---|---|
| Gestational age | 24.05 ± 5.63 (weeks) | -0.074 | 0.364 |
| Weights | 75.82 ± 16 (kg) | -0.082 | 0.318 |

Table 4.3 and figures 4.3 and 4.4below presents the relationship between gestational age, weight, and glucose levels in pregnant women attending antenatal care. The mean gestational age of the participants was 24.05 weeks (±5.63), while the mean weight was 75.82 kg (±16). The correlation coefficient (r) values for both gestational age and weight are negative, indicating an inverse relationship with glucose levels. However, these relationships are weak, with gestational age showing an r value of -0.074 and weight showing an r value of -0.082.

The p-values for both gestational age (0.364), FBS (0.321) and weight (0.318) are greater than 0.05, meaning that these relationships are not statistically significant.

Table 4.3. Present the association between gestational age and weight with glucose level.

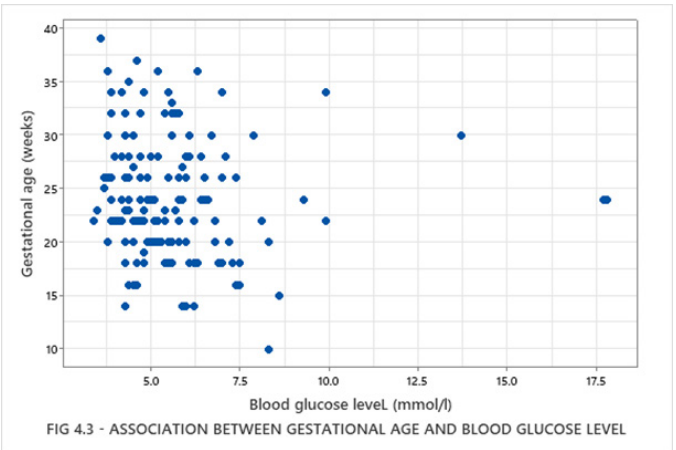



FIG 4.3 - ASSOCIATION BETWEEN GESTATIONAL AGE AND BLOOD GLUCOSE LEVEL

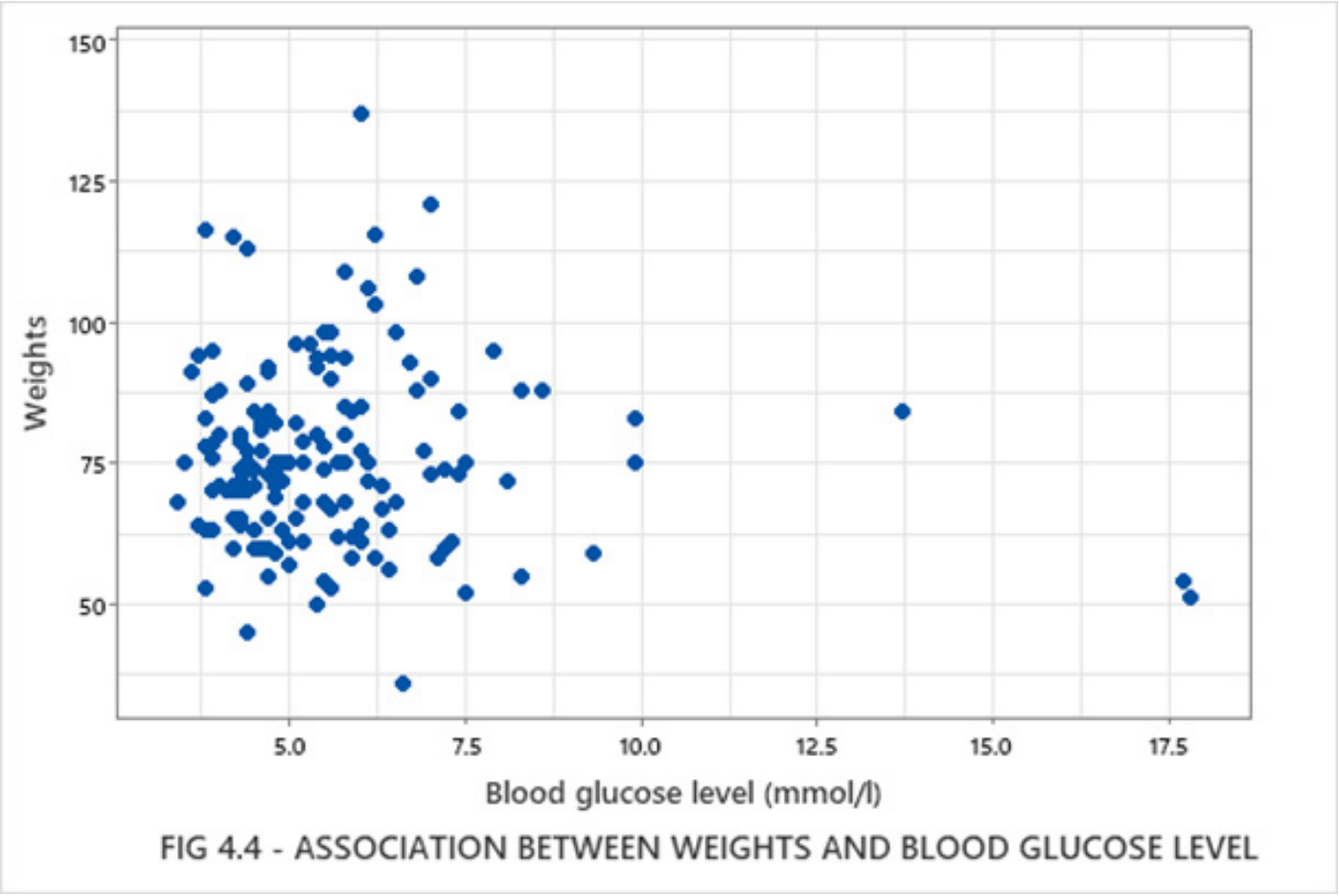



FIG 4.4 - ASSOCIATION BETWEEN WEIGHTS AND BLOOD GLUCOSE LEVEL

**DISCUSSION**

The implications of gestational diabetes and lipidemia are its consequences and complications in the maternal life of pregnant women and fetus. This study investigated the relationship between gestational age, weight, some lipids and blood glucose levels in pregnant women attending antenatal care at the Nigeria Customs Service Hospital, Karu, to ascertained the prevalence of gestational diabetes and lipidemia in pregnant women. It has been found that in early pregnancy, the lipid levels are slightly increased, and in a late pregnancy some lipid increases significantly [11]. Obesity and increased fasting blood sugar in the first trimester of pregnancy is independently associated with the further development of gestational diabetes [12].

The finding of the results reveals that there are significant increases in blood glucose levels among pregnant women within the normal range. The p-value <0.001 indicate a statistically significant difference across the three trimesters, this is in tandem with studies by Covali et al,[13], which observed that pregnant women may experience elevated blood glucose levels due to biological and socioeconomic factors. The study revealed that there is a gradual increase inTriglycerides, and T. Cholesterol in first to third trimester of pregnancy, with gradual decrease in HDL-C in the third trimester of pregnancy; this finding is in tandem with the work of Carman et al, who reported elevated Triglycerides and T. Cholesterol in pregnant women in their second and third trimesters, but normal HDL-C values [17].

In contrast, the subjects in this study showed glucose levels within the upper limits of normal range, reflecting patterns observed in other studies, though some researchers observed that while age-related differences in glucose levels are observed, they generally remain within normal limits for healthy pregnant women across all age[14]. The finding of Shen et al. shows that lipidlevels, Triglycerides, T. Cholesterol, and LDL-C, gradually increases during pregnancy in their trimesters and peaked before birth, while HDL-C level increases from the first trimester to the second trimester, then shows a slight decrease in the third trimester [7]; this report corroborates our findings.

The study shows that gestational diabetes affects a small proportion of the women in the sample, with only 8.7% of the participants diagnosed with the condition. However, those diagnosed with gestational diabetes had significantly elevated blood glucose levels, underscoring the evidence and incidence of the condition. The remaining 91.3% of the pregnant women had slight increases in glucose levels in all the three trimesters, with elevated values of some lipids. This suggests that gestational diabetes may not be widespread in this population, though the increasing glucose levels in the pregnant women across the trimesters highlight the need for effectivesurveillance and management.

Although, the prevalence of GD varies across populations, with one study reporting 24.2% in high-risk pregnancies [15]. Another study conducted reported that the frequency of gestational diabetes mellitus varies substantially across centers, with an overall frequency of 17.8% [16], this study however, obtained a prevalence rate of 8.7% which is low as compared to some authors.

This study examines the relationship between gestational age, blood glucose, Triglycerides, T. Cholesterol, and HDL-C levels. This study also confirms a high level of some lipids, such as Triglycerides,and T. Cholesterol, but normal HDL-C values in the women who are pregnant in their various trimesters; this is in tandem with Carmen et al who recorded high lipidemia in pregnant women at the second and third trimesters, but had normal HDL-C values [17].

**CONCLUSION**

This study shows low prevalence of GD in this given population. Despite the low prevalence of gestational diabetes in these subjects, the affected women showed markedly elevated glucose levels, stressing the importance of screening and managing the condition. While no significant associations were found between gestational age, weight, and glucose levels, there are significant association of some lipids and gestational diabetes in various trimesters; this research underscores the complexity of gestational diabetes and the need for comprehensive approaches to its management, treatment and prevention. Further studies are recommended to explore other potential factors influencing glucose and lipids regulation during pregnancy in similar populations.

**AUTHORS INVOLMENT:** ASP, involved in the conception of the topic, collation of data and writing of manuscript. GVT, involved in analysis of samples and collation of data. OHB, involved in analysis of data. All authors have read the manuscript and have agreed to the publication of the manuscript.

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**CONFLICT OF INTEREST**: None.

**FUNDING:** None.

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