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Prevalence of Gestational Diabetes among Pregnant Women Resident in Jalingo, Taraba State, Nigeria using Binary Logistic Regression

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Abstract: This research investigated how common Gestational Diabetes Mellitus (GDM) is and examined the contributing risk factors among expectant mothers receiving antenatal care at the Federal Medical Centre and Specialist Hospital in Jalingo.250 medical records of pregnant women were reviewed. The prevalence was 18%, with 45 women diagnosed with GDM. Socio-demographic, clinical, and lifestyle characteristics were examined using chi-square analysis and binary logistic regression. The analysis revealed that age, Body Mass Index (BMI), a family history of diabetes, and a previous diagnosis of GDM were significantly linked to the risk of developing GDM. In particular, women between the ages of 26 and 35 had 3.33 times greater odds of developing GDM compared to those aged 18 to 25 (OR = 3.33, p = 0.009). Overweight and obese women had 6.51- and 9.22-times higher odds, respectively. A family history of diabetes was associated with 2.52 times increased odds of developing GDM among women, though this finding did not reach statistical significance (OR = 2.52, p = 0.058). Previous GDM history was the strongest predictor, with women who had a previous GDM diagnosis being 10.09 times more likely to develop GDM in subsequent pregnancies (OR = 10.09, p = 0.001). The findings of this study highlight GDM as a public health concern in Jalingo.

Keywords: Diabetes, Gestational, Variable, mellitus

1. Introduction

Gestational Diabetes Mellitus (GDM) poses significant health risks for both mothers and infants, and its prevalence is rising globally, including in Nigeria. Numerous studies have demonstrated the adverse effects of GDM on maternal and fetal health, including increased risk of preterm birth, macrosomia, and persistent metabolic disturbances in offsprings (Vounzoulaki et al., 2021; HAPO Study Cooperative Research Group, 2008). In Nigeria, the burden of GDM is compounded by challenges related to healthcare infrastructure, access to well-structured prenatal support, and cultural beliefs about pregnancy and diabetes management (Iliodromiti et al., 2019). Despite the growing recognition of GDM's adverse effects, there is a paucity of research specifically focused on GDM control in the Nigerian context. Existing studies have highlighted disparities in GDM prevalence and management practices between urban and rural areas of Nigeria, with limited robust evidence on the effectiveness of GDM management strategies tailored to the Nigerian population (Oguntunde *et al., 2020; O'Sullivan* et al., 2016).

GDM refers to a form of diabetes first identified during pregnancy, posing health risks to both the expectant mother and the unborn baby. Potential complications associated with GDM include unfavorable outcomes like excessive fetal growth (macrosomia), delivery-related injuries, low blood sugar in newborns, and a heightened likelihood of developing diabetes later in life for both mother and child (American Diabetes Association, 2018).

Diabetes mellitus is a long-term metabolic condition marked by high blood glucose levels, resulting from inadequate insulin secretion or the body's reduced capacity to utilize insulin efficiently (Aideyan & Efuwape, 2022). The condition has become a major global health concern, particularly among pregnant women. The widespread nature of diabetes mellitus in pregnancy is multiplying and posing significant risks to both maternal and fetal health. According to Bakari et al. (2017), the occurrence of GDM varies between 4.9% and 54.8% in Nigeria and reflects its widespread nature.

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This high prevalence is alarming due to the potential risks of diabetes-related complications in pregnancy. Adedeji and Caesin (2018) reported 14.6% prevalence of GDM among Nigerians, highlighting the need for comprehensive research to further illuminate the influence of diabetes mellitus among pregnant women in Nigeria. Complications of diabetes mellitus in pregnancy can have serious implications for both maternal and fetal health. Inadequately managed diabetes may result in negative outcomes such as gestational hypertension, pre-eclampsia, premature delivery, excessive fetal growth (macrosomia), and low blood sugar in newborns (Ugege et al., 2019). The heightened risk of these complications emphasizes the need to address the effects of diabetes mellitus among pregnant women in Nigeria.

Furthermore, the control of diabetes mellitus in pregnant women is crucial for improving maternal and fetal health. Ganiyu et al. (2018) highlighted the challenges in diabetes management in resource-constrained settings, including inadequate availability of essential diabetes care supplies in healthcare facilities in Nigeria. This issue underscores the need for research to explore the current management practices for diabetes mellitus in pregnant women in Nigeria.

Despite increasing rates, comprehensive research on prevalence, complications, management, and outcomes of diabetes in pregnancy in Nigeria is lacking, hindering tailored interventions and healthcare policies (Timothy et al., 2023). Insufficient data on diabetes prevalence among pregnant women in Nigeria complicates accurate assessment and limits evidence-based guidelines for healthcare providers. Additionally, challenges in healthcare resource availability and accessibility exacerbate the effects of diabetes on mothers and their unborn children's health in Nigeria. They necessitate urgent research to guide targeted strategies and improve outcomes within the country's healthcare system. This study aims to assess the prevalence of GDM among pregnant women attending antenatal care in the selected area, examine patterns of glucose tolerance and associated risk factors, and suggest preventive strategies to reduce the occurrence of GDM in this population. This research project has the potential to significantly impact public health strategies, influence policy decisions, improve healthcare practices, and empower pregnant women in Taraba state to manage their diabetes effectively for better maternal and fetal health outcomes.

2. Methods

This research employed both descriptive and inferential statistical methods. Descriptive statistics are commonly utilized to summarize the characteristics of the study sample and key variables by presenting data through frequency distributions. They entail techniques for organizing, summarizing, and presenting data through tables and percentage distributions. Inferential statistics, on the other hand, help in making generalizations about the larger population based on the sample. In this study, inferential methods. such as the chi-square test and logistic regression, were employed.

2.1 Model Specification

Dependent Variable:

Gestational Diabetes Mellitus (GDM): This is a binary outcome variable indicating whether a pregnant woman has been diagnosed with gestational diabetes (yes/no).

Independent Variables

i. Age: The age of the pregnant woman
ii. Body Mass Index (BMI): A calculation that evaluates body fat percentage using height and weight measurements
iii. Family History of Diabetes: Presence or absence of a family history of diabetes (Yes/No)
iv. Ethnicity: The ethnic background of the participant
v. Previous Gestational Diabetes: Whether the woman had GDM in previous pregnancies (yes/no)
vi. Lifestyle Factors include variables such as physical activity level, dietary habits, and smoking status.
vii. Pregnancy Complications: Any other complications in the current pregnancy (e.g., hypertension)

Dependent Variable:

Y = GDM (1 if diagnosed with gestational diabetes; 0 otherwise)

Independent Variables:

X_1 = Age (in years)

X_2 = BMI (in kg/m^2)

X_3 = Family History of Diabetes (1 if yes; 0 if no)

X_4 = Ethnicity (categorical variable; to be dummy coded)

X_5 = Previous GDM (1 if yes; 0 if no)

X_6 = Physical Activity Level (categorical variable; to be dummy coded)

X_7 = Dietary Habits (categorical variable; to be dummy coded)

X_8 = Pregnancy Complications (1 if yes; 0 if no)

Logistic Regression Model

The logistic regression model can be specified as follows:

$$\log\left(\frac{P(Y=1)}{P(Y=0)}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots, + \beta_8 X_8$$

Where:

P(Y=1) is the probability of being diagnosed with gestational diabetes.

β_0 = is the intercept.

$\beta_1,\beta_2,\ldots,\beta_8$ = are the coefficients for each independent variable.

2.2 Chi-Square Test of Independence

The chi-square test is suitable for assessing whether a significant relationship exists between two variables. It is a non-parametric statistical method used to evaluate the independence of the variables represented in the rows and columns of a contingency table , based on the test's degrees of freedom. The test statistic is expressed as

$$\chi^2 = \sum_{i=1}^{n} \frac{(O_{i-}\ell_i)^2}{\ell_i} \quad (1)$$

Where:
O_i : The observed values or frequency
ℓ_i : The expected values or frequency

3. Results

3.1 Demographic Characteristics of Respondents

250 medical records were randomly selected from the antenatal clinic files at the Federal Medical Centre and Specialist Hospital in Jalingo. Table 1 presents a summary of the respondents' demographic and clinical profiles.

The participants' ages ranged between 26 and 35 years (48%) and had a normal BMI (40%). A significant proportion (32%) of the participants had a family history of diabetes, and 18% had a previous history of GDM.

Table 1: Demographic Characteristics of Respondents (N = 250)

Characteristic	Frequency (n)	Percentage (%)
Age		
18–25 years	50	20.0
26–35 years	120	48.0
36–45 years	60	24.0
46 years and above	20	8.0
BMI		
Underweight (< 18.5 kg/m^2)	30	12.0
Normal weight (18.5-24.9 kg/m^2)	100	40.0
Overweight (25-29.9 kg/m^2)	70	28.0
Obese (≥ 30.0 kg/m^2)	50	20.0
Family History of Diabetes		
Yes	80	32.0
No	170	68.0
Ethnicity		
Jukun	80	32.0
Fulani	60	24.0
Mumuye	50	20.0
Other Ethnic Groups	60	24.0
Previous GDM History		
Yes	45	18.0
No	205	82.0

3.2 Prevalence of Gestational Diabetes Mellitus (GDM)

Table 2: Prevalence of GDM in the Study Population

Gestational Diabetes Mellitus (GDM)	Frequency (n)	Percentage (%)
Yes	45	18.0
No	205	82.0

GDM was identified in 18% of the study population, signifying that nearly one in five pregnant women receiving antenatal care at the Federal Medical Centre and Specialist Hospital in Jalingo were diagnosed with the condition.

3.3 The Relationship Between Risk Factors and the Prevalence of GDM

This section examines the connection between selected socio-demographic, clinical, and lifestyle variables and the occurrence of GDM through chi-square statistical analysis.

From the Chi-Square results in Table 3, a significant relationship was found between age and GDM diagnosis (χ^2 = 13.48, p = 0.04). Women in the 26-35 years age group had a higher prevalence of GDM (25%).

From the Chi-Square Results (Table 4). A significant relationship was observed between Body Mass Index (BMI) and Gestational Diabetes Mellitus (GDM) diagnosis (χ^2 = 22.13, p = 0.01). The prevalence of GDM was higher among women classified as overweight or obese.

3.5 Logistic Regression Analysis

To determine the individual risk factors linked to the likelihood of developing GDM, binary logistic regression was performed using the significant variables in the chi-square tests (age, BMI, family history of diabetes, and prior GDM history). The model estimated these risk factors' odds ratios.

In the logistic regression analysis in Table 5, women aged 26-35 years had 3.33 times chances of developing GDM compared to women in the 18-25 years age group (OR = 3.33, p = 0.009). BMI (Overweight) increased the odds of developing GDM by 6.51 times (OR = 6.51, p < 0.001), while BMI (Obese) increased the odds by 9.22 times (OR = 9.22, p < 0.001). Family history of diabetes showed a trend toward increased odds (OR = 2.52, p = 0.058), though the result was marginally not significant. Previous GDM significantly increased the odds of developing GDM by a factor of 10.09 (OR = 10.09, p = 0.001).

Table 3: Chi-Square Test for Association Between Age and GDM

Age Group	GDM Diagnosis	No GDM	Total	Chi-Square (χ^2)	p-value
18–25 years	5 (10%)	45 (90%)	50	13.48	0.04
26–35 years	30 (25%)	90 (75%)	120		
36–45 years	8 (13.33%)	52 (86.67%)	60		
46 years and above	2 (10%)	18 (90%)	20		

Table 4: Chi-Square Test for Association Between BMI and GDM

BMI Category	GDM Diagnosis	No GDM	Total	Chi-Square (χ^2)	p-value
Underweight (< 18.5 kg/m^2)	2 (6.67%)	28 (93.33%)	30	22.13	0.01
Normal weight (18.5–24.9 kg/m^2)	10 (10%)	90 (90%)	100		
Overweight (25-29.9 kg/m^2)	18 (25.71%)	52 (74.29%)	70		
Obese (≥ 30.0 kg/m^2)	15 (30%)	35 (70%)	50		

Table 5: Binary Logistic Regression Analysis

Variable	B (Coefficient)	Standard Error	Wald	p-value	Odds Ratio (OR)
Age (26-35 years)	1.201	0.456	6.872	0.009	3.33
BMI (Overweight)	1.872	0.526	12.235	0.000	6.51
BMI (Obese)	2.220	0.501	19.121	0.000	9.22
Family History of Diabetes (Yes)	0.925	0.487	3.607	0.058	2.52
Previous GDM (Yes)	2.314	0.694	11.236	0.001	10.09

4.0 Discussion

This study examined how common GDM is among pregnant women in Jalingo, Taraba State, Nigeria, and explored the related risk factors through the application of binary logistic regression analysis. The research investigated the demographic profile and occurrence of gestational diabetes mellitus (GDM) among 250 pregnant women receiving antenatal care at the Federal Medical Centre and the Specialist Hospital in Jalingo. Most of the respondents (48%) were between 26 and 35 years old. In terms of body mass index (BMI), 40% had normal weight, whereas 28% were classified as overweight and 20% as obese. Approximately 32% of the participants reported a family history of diabetes, while 18% had experienced gestational diabetes in a prior pregnancy. The overall prevalence of GDM in the study population was 18%, reflecting a moderate level of occurrence among the respondents.

The analysis revealed several significant risk factors for developing GDM. Chi-square tests showed a strong association between age and GDM diagnosis, with women aged 26–35 years showing the highest prevalence of 25%. The chi-square analysis revealed a significant association between body mass index (BMI) and the incidence of GDM, with overweight and obese participants showing higher prevalence rates than those with a normal BMI. Further analysis using binary logistic regression identified the key independent risk factors for GDM. Women between the ages of 26 and 35 were more than three times as likely to develop gestational diabetes mellitus (GDM) as those aged 18 to 25. he likelihood of developing GDM was markedly elevated among overweight and obese women, with the odds rising by over six times for those overweight and more than nine times for those classified as obese. A Familial history of diabetes was associated with increased odds of GDM, though the association was marginally non-significant. The most substantial predictor of GDM was a previous history of GDM, with women having a tenfold increased risk of developing the condition in subsequent pregnancies. These results highlight the significance of controlling age, body weight, and medical history to reduce the likelihood of GDM in expectant mothers.

5.0 Conclusion

This study has offered valuable insights into the prevalence and risk factors associated with Gestational Diabetes Mellitus (GDM) among pregnant women in Jalingo, Taraba State.The prevalence rate of 18% found in this study is concerning, and it highlights the need for urgent action to tackle this issue. The study has confirmed that age, BMI, previous GDM history, and family records of diabetes are significant risk factors for the development of GDM in the selected population.

According to the results of this study, the following measures should be implemented to lower the prevalence of GDM and enhance maternal health outcomes in Jalingo:

i. All pregnant women in Jalingo should be examined for Gestational Diabetes Mellitus (GDM) as part of routine antenatal care. Early detection is crucial in managing the condition and preventing complications.
ii. Public health campaigns should be launched to educate the general population, especially pregnant women, on the risks and prevention of GDM. These campaigns should emphasize the significance of conducting early testing, maintaining a healthy weight, engaging in physical activities, and taking proper nutrition to prevent GDM.
iii. Programs aimed at managing weight among pregnant women, especially those who are overweight or obese, should be introduced. These programs should provide guidance on healthy eating, physical exercise, and behavioral changes that can help women achieve and maintain a healthy weight before and during pregnancy.
iv. Women aged 26–35 years, women with a history of GDM, and women with a family history of diabetes should receive targeted care and counseling. These women should be monitored more closely during pregnancy for signs of GDM.
v. Women with a history of GDM in a prior pregnancy should undergo regular postnatal monitoring to detect the onset of type 2 diabetes. Ongoing medical follow-up is essential to help prevent the transition from GDM to type 2 diabetes.
vi. A multidisciplinary care approach should be adopted, involving obstetricians, dietitians, and physical activity experts to manage women susceptible to gestational diabetes.
vii. GDM education should be integrated into the routine prenatal care curriculum. Healthcare providers should educate pregnant women on how to reduce their likelihood of developing GDM and the critical role of early diagnosis.
viii. Healthcare infrastructure should be improved in rural and underserved areas of Jalingo to ensure all pregnant women have access to antenatal screening for GDM.
ix. The government should invest in maternal health services and allocate more resources for GDM prevention and management programs.

Authors' Contributions

Aideyan contribution includes the provision and analysis of the data using R- Software with reference to

some existing literature. Efuwape is responsible for the interpretation of the results of the analysis in relation to the variables used in the article.

Declaration of Competing Interest

The authors declare no competing interests.

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