

Research Article

Determinants of Diabetes-hypertension Comorbidity Among Pregnant Women Attending Primary Healthcare Centres in Urban Rivers State, Nigeria

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Abstract

The coexistence of diabetes mellitus and hypertension during pregnancy represents an important public health concern in low- and middle-income countries, including Nigeria. This study determined the prevalence and factors associated with comorbid diabetes and hypertension among pregnant women attending primary healthcare centres in an urban area of Rivers State, Nigeria. A facility-based cross-sectional study was conducted among 306 pregnant women selected using multistage and systematic random sampling from nine primary healthcare centres between December 2024 and January 2025. Data were collected using a structured questionnaire and standardized measurements of fasting blood glucose and blood pressure. Descriptive statistics were used to summarize participants' characteristics and prevalence estimates, and binary logistic regression was used to identify factors associated with comorbidity at the $p < 0.05$ significance level. The prevalence of diabetes-hypertension comorbidity was 4.9% (95% CI: 2.5–7.3). The prevalence of diabetes was 34.6% (95% CI: 26.1–38.8), and hypertension was 8.8% (95% CI: 5.6–12.0). The higher prevalence of diabetes compared with comorbidity reflects the fact that many women had hyperglycaemia without concurrent hypertension. Increasing age, occupation, marital status, genotype and limited social support were significantly associated with comorbidity. Although the prevalence of comorbidity was relatively low, the presence of overlapping cardiometabolic conditions during pregnancy highlights the need for strengthened routine screening for blood glucose and blood pressure and integration of non-communicable disease management into antenatal care services at the primary healthcare level.

Keywords

Comorbidity, Diabetes Mellitus, Hypertension, Pregnant Women Attending Antenatal Care, Primary Healthcare, Rivers State

1. Introduction

Diabetes mellitus and Hypertension are significant public health challenges, both as individual conditions and as comorbidities [1]. These chronic diseases are among the leading causes of morbidity and mortality worldwide, with profound implications

for healthcare systems and patient outcomes [2]. According to the World Health Organization (WHO), approximately 1.28 billion adults globally suffer from hypertension, and around 422 million people live with diabetes mellitus, accounting for over 70% of

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deaths worldwide [3, 4]. The growing burden of non-communicable diseases (NCDs) threatens progress toward Sustainable Development Goal (SDG) 3, particularly Target 3.4, which aims to reduce premature mortality from NCDs, and Target 3.1, which focuses on reducing maternal mortality [5]. Their coexistence during pregnancy presents a complex public health challenge, heightening the risks of preeclampsia, preterm birth, stillbirth, long-term cardiovascular and metabolic complications for both mothers and infants [6, 7]. The comorbidity of Diabetes Mellitus and Hypertension (DHC) is highly prevalent, with estimates indicating that 50-80% of individuals diagnosed with diabetes also present with hypertension [8].

Globally, about 16.7% of pregnancies are affected by hyperglycaemia, both pre-existing and gestational diabetes, with nine out of ten cases occurring in less developed countries [9] and hypertensive disorders complicate up to 10% of pregnancies [10]. This trend is particularly pronounced in sub-Saharan Africa, where inadequate healthcare infrastructure and limited access to screening programs exacerbate the impact of these conditions on maternal and fetal health [11]. Studies show that women with pre-existing type 2 diabetes have a likelihood of developing hypertensive disorders, compounding the risk of maternal and neonatal complications [12]. Both conditions also independently contribute to significant maternal mortality, with pre-eclampsia or eclampsia alone accounting for 24% of maternal deaths in certain regions [13]. In response, global NCD control strategies emphasize early detection, integrated management, and strengthening primary healthcare systems as cost-effective approaches to reducing complications [14].

In Sub-Saharan Africa, the prevalence of diabetes and hypertension in pregnancy is rising due to obesity, physical inactivity, poor dietary habits, and urbanization and limited access to quality healthcare resources [14, 15]. A meta-analysis by [16] found that 58% of individuals with diabetes in Africa also had hypertension, emphasizing the high burden of comorbidity. Hypertensive and diabetes disorders remain among the leading causes of maternal mortality in the region, often worsened by poor screening and delayed management [17].

In Nigeria, diabetes and hypertension are among the most frequent medical complications during pregnancy. Hypertensive disorders account for about 17% of maternal deaths [18], while gestational diabetes affects up to 0.5% to 38% of pregnancies [19]. When these two conditions coexist, they exacerbate maternal risk and increase neonatal complications. Despite the substantial health implications associated with diabetes and hypertension comorbidity, there remains a paucity of data on the prevalence and determinants of this comorbidity within Primary Healthcare Centres (PHC) in an urban Local Government Area of Rivers State, Nigeria, where most women seek routine antenatal care. The lifestyle transition, which includes increased consumption of processed foods, reduced physical activity, and rising overweight, increases the risk of metabolic disorders [20].

Despite the growing burden of cardiometabolic disorders during pregnancy, evidence on the coexistence of diabetes and

hypertension among pregnant women remains limited, particularly within primary healthcare settings where most antenatal care services are delivered. In a study conducted among antenatal care attendees, gaps were identified in the knowledge and management practices of diabetes mellitus and hypertension among pregnant women [21]. However, the study focused primarily on awareness and management practices without examining the co-occurrence of diabetes-hypertension, highlighting the need for further investigation into prevalence and determinants of comorbidity among pregnant women attending primary healthcare centres. This is an important gap, especially in low-resource primary care settings where early identification and coordinated management are crucial for improving maternal outcomes [22].

This study therefore provides context-specific evidence on the prevalence and determinants of diabetes-hypertension comorbidity among pregnant women attending antenatal care at primary healthcare centres in an urban Local Government Area of Rivers State. By identifying the factors associated with this comorbidity, the study seeks to inform early detection strategies, improve risk assessment, and support more targeted maternal health interventions within the primary healthcare system.

This study aimed to determine the prevalence and determinants of diabetes-hypertension comorbidity among pregnant women attending antenatal care at primary healthcare centres in an urban Local Government Area of Rivers State, Nigeria.

2. Methods

2.1. Study Area

The study was conducted in selected Primary Health Care centres (PHC) providing antenatal services in Obio/Akpor Local Government Area (LGA), Rivers State, Nigeria. Obio/Akpor is an urban LGA in the south-southern region of Nigeria and serves as a major economic hub within the state. The area has experienced rapid urbanization characterized by sedentary occupations, increased consumption of processed foods, and reduced physical activity. These lifestyle patterns are relevant to the growing burden of non-communicable diseases, including diabetes and hypertension, in the population.

2.2. Study Design and Study Population

This was a facility-based cross-sectional study conducted among pregnant women attending antenatal care at the Primary Healthcare Centres in an urban LGA, Rivers State, Nigeria. Women aged 18–49 years who were pregnant and provided consent were included in the study, while pregnant women attending antenatal care who were not available at the time of the study and those who were critically ill, unable to provide consent, or with incomplete clinical records were excluded.

2.3. Sampling Size and Sampling Techniques

A minimum sample size of 306 was calculated using Fisher's formula, based on a previously reported prevalence of 6.9% [23], a 95% confidence level, a 3% margin of error, and an additional 10% to account for non-response. Participants were selected on ANC days through multistage sampling: Primary Healthcare Centres were stratified into the 17 political wards, and 9 PHCs were chosen randomly through balloting; thereafter, systematic random sampling with a calculated sampling interval (k) was used to recruit eligible respondents from the ANC register. The first respondent was randomly selected, after which every 3rd woman was recruited until the allocated sample size was reached. To minimize selection bias, the sampling interval was determined using the average ANC attendance register, and recruitment was conducted across multiple clinic days. Non-response was minimal, and the calculated 10% adjustment accounted for potential attrition; however, no significant dropout occurred after enrollment, as data were collected during routine clinic visits.

2.4. Data Collection Procedure and Instrument

Data were collected using a semi-structured questionnaire from December 4th 2024, to January 25th 2025. The questionnaire was developed based on previously validated instruments used in maternal health and NCD research and adapted to the local context. It comprised sections on socio-demographic characteristics (age, marital status, education, occupation, income), obstetric history (gravidity, parity, gestational age, trimester, birth order), clinical history, social support, and lifestyle factors. The questionnaire was administered to participants during antenatal clinic visits by trained research assistants who were healthcare personnel at the selected facilities.

Fasting blood glucose (FBG) was measured using a standardised glucometer after participants had fasted for at least 8 hours, and blood pressure was measured with a digital sphygmomanometer in accordance with WHO guidelines. All measurements were taken by trained nurses under standardized procedures to ensure consistency. Diabetes mellitus was defined as FBG ≥ 126 mg/dL, in accordance with WHO diagnostic criteria. For this study, diabetes included both previously diagnosed (pre-existing) diabetes documented in medical records and hyperglycaemia first detected during the current pregnancy based on FBG measurement. Oral glucose tolerance testing (OGTT) was not performed due to limited laboratory resources. Hypertension was defined as systolic ≥ 140 mmHg and/or diastolic ≥ 90 mmHg on two separate readings. If the difference between the initial two readings exceeded 10mm Hg for either systolic or diastolic pressure, a third reading was immediately taken, and the average of the two closest values was used for analysis. The questionnaire was administered to the study population during their visits to the healthcare centres on antenatal care (ANC) days.

The instrument's validity was evaluated through a pretest

administered to 31 pregnant women attending antenatal care, and corrections were made to improve instrument quality. Cronbach's Alpha (CA) was greater than 0.70 for all the sections of the questionnaire, indicating acceptable internal consistency.

2.5. Consent and Ethical Consideration

Ethical clearance was obtained from the Rivers State Ministry of Health Ethics Committee (RSU/FBMS/REC/24.095). Ethical approval was granted by the Rivers State Primary Health Care Management Board to ensure access to the respective healthcare facilities. Written informed consent was obtained from all participants. Confidentiality was maintained throughout the study.

2.6. Data Analysis

Data were entered and analysed using Stata 16. Quantitative variables were assessed for normality using the Shapiro-Wilk test and visual inspection. Normally distributed variables were summarized using means and standard deviations, while categorical variables were presented as frequencies and percentages. Binary logistic regression analyses were performed to determine associations between independent variables and comorbidity. Variables with $p < 0.20$ at the bivariate level were included in the multivariate logistic regression model. Multicollinearity among independent variables was assessed using the variance inflation factor (VIF) before model fitting. Adjusted Odds ratios (AOR) with 95% confidence intervals not crossing unity (1.0) were used to assess the strength of association, and statistical significance was set at $p \leq 0.05$.

3. Results

3.1. Characteristics of the Pregnant Women at Primary Healthcare Centres

A total of 306 pregnant women attending antenatal care participated in the study (Table 1). The mean age of respondents was 28.9 ± 4.1 years, with the majority aged between 20 and 39 years (85.6%). Most respondents had two or fewer children (71.6%). The majority were married (79.7%), while 20.3% were not married.

Similarly, 51.6% had more than secondary education, while 49.4% had secondary education or less. Traders constituted the largest occupational group (45.8%), followed by civil/public servants (17.6%), unemployed respondents (15.7%), private sector workers (12.4%), and artisans (8.5%). Most respondents (83.3%) reported no history of domestic violence, while 14.4% reported having experienced domestic violence. In terms of monthly income, 33.7% earned between ₦51,000 and ₦100,000, 22.2% earned between ₦30,000 and ₦50,000, and equal proportions (20.9%) earned either less than ₦30,000

or above ₦100,000.

With respect to obstetric characteristics, 40.5% of respondents were in their second trimester, 35.3% in their third trimester, and 23.2% in their first trimester. Slightly more than half (54.6%) reported that it was not their first pregnancy. Regarding birth order, 44.1% were expecting their first child, 27.5% their second, and 28.4% their third child or higher.

Work-related stress was reported with varying frequency: 28.8% experienced stress daily, 23.2% weekly, 21.6% rarely, 13.1% never, and 11.4% monthly. Additionally, 63.7% reported having a support system to assist in managing their health.

3.2. Prevalence of Diabetes and Hypertension Comorbidity

The data in Table 2 shows that the prevalence of diabetes and hypertension comorbidity is 4.9%, diabetes alone is 34.6%, and 8% had hypertension alone, while 49.0% were classified as normal.

Women aged 40 years and above had the highest comorbidity (40%), and the lowest were among those between 20-29 years. Diabetes alone was most prevalent among women aged 20-29 years (54.4%), whereas hypertension had (40.7%) in the same age group.

Parity showed a consistent pattern in which women with ≤2 children recorded the highest prevalence across all categories while women with more than 2 children had the lowest prevalence. Married women had a higher prevalence across all categories than not married women. Educational attainment revealed that women with higher than secondary education recorded higher prevalence of DHC (2.9%) and diabetes (19.6%), while those with secondary education or less showed slightly lower values. Genotype analysis indicated that AA genotype had the highest prevalence across normal, diabetes, hypertension, and comorbidity categories, whereas AC genotype consistently recorded the lowest values, including a 0% prevalence for diabetes and DHC. For blood group, respondents with O blood type had the highest prevalence of normal status

(20.8%) and diabetes (17.3%), while blood group AB recorded the lowest across categories. Gestational age findings showed that women in the second trimester had the highest proportions across all health status categories, whereas the first trimester had the lowest for both diabetes and DHC.

Figure 1 shows the distribution of respondents according to family history of diabetes and hypertension. The majority of the respondents reported no family history of these outcomes, with 46.1% indicating no history under the normal category, 3.9% in DHC, 34.6% in diabetes, and 8.5% in hypertension. Only a smaller proportion of participants reported a family history of diabetes and hypertension, accounting for 2.9%, 0.9%, and 0.3% respectively.

3.3. Factors Influencing Diabetes Mellitus and Hypertension Comorbidity

The data in Table 3 shows that those aged 20–29 years had lower odds of DHC (AOR = 0.91; 95% CI: 0.81–0.98), while those aged ≥40 years had significantly higher odds (AOR = 2.71; 95% CI: 1.20–6.08) compared with respondents aged <20 years. Similarly, marital status was significantly associated with comorbidity and hypertension, with married respondents having markedly lower odds compared with those not married (AOR = 0.03; 95% CI: 0.01–0.15). Civil/public servants had higher odds of DHC (AOR = 3.11; 95% CI: 1.09–8.91) compared with the unemployed, while artisans had reduced odds of diabetes (AOR = 0.20; 95% CI: 0.11–0.90). Traders had substantially increased odds of hypertension (AOR = 13.56; 95% CI: 1.83–50.30). Furthermore, women with genotype AS were over seven times more likely to develop comorbidity DHC (AOR = 7.25; 95% CI: 2.02–26.10), than women with genotype AC (AOR = 0.56; 95% CI: 0.15–0.90). Blood group O was associated with higher odds of diabetes (AOR = 2.35; 95% CI: 1.08–5.13) but lower odds of hypertension (AOR = 0.13; 95% CI: 0.02–0.84). Additionally, having a support system was associated with reduced odds of diabetes (AOR = 0.38; 95% CI: 0.19–0.74). Other variables were not statistically significant after adjustment.

Table 1. Characteristics of the Pregnant Women attending antenatal care at Primary Healthcare Centres in Obio/Akpor.

Variables	Frequency (n)	Percentage (%)
Age		
Less than 20 years	14	4.6
20-29 years	146	47.7
30-39 years	116	37.9
40 years and above	30	9.8
Mean 28.9 ± 4.1		
No of Children		
≤ 2 Children	219	71.6

Variables	Frequency (n)	Percentage (%)
≥ 2 Children	87	28.4
Marital Status		
Not married	62	20.3
Married	244	79.7
Educational Background		
≤ Secondary education	148	49.4
≥ Secondary education	158	51.6
Occupation		
Artisan	26	8.5
Civil/Public Servant	54	17.6
Private Sector	38	12.4
Trader	140	45.8
Unemployed	48	15.7
Experienced domestic violence		
No	255	83.3
Yes	44	14.4
Average monthly Income, in naira (N):		
Less than 30,000	64	20.9
30,000 – 50,000	68	22.2
51,000 – 100,000	103	33.7
Above 100,000	64	20.9
Genotype		
AA	206	67.3
AC	5	1.6
AS	75	24.5
Blood Group		
A	90	29.5
AB	19	6.2
B	41	13.4
O	134	43.8
Gestational Age		
First trimester	71	23.2
Second trimester	124	40.5
Third trimester	108	35.3
First Pregnancy		
No	167	54.6
Yes	135	44.1
First child	135	44.1
Second child	84	27.5

Variables	Frequency (n)	Percentage (%)
Third child or more	87	28.4
Experience work related stress		
Never	40	13.1
Rarely	66	21.6
Daily	88	28.8
Weekly	71	23.2
Monthly	35	11.4
Support System		
No	109	35.6
Yes	195	63.7

Table 2. Prevalence of Diabetes Mellitus and Hypertension Comorbidity (DHC) by socio-demographic factor.

Characteristic	Normal BMI % (95% CI)	DHC% (95% CI)	Diabetes% (95% CI)	Hypertension% (95% CI)
Overall	49.0 (43.4–54.6)	4.9 (2.5–7.3)	34.6 (26.1–38.8)	8.8 (5.6–12.0)
Age (years)				
<20	52.3 (46.8–57.8)	1.2 (0.1–3.4)	18.7 (14.2–23.2)	1.5 (0.3–3.6)
20–29	50.1 (44.6–55.6)	4.1 (2.2–6.0)	32.4 (27.5–37.3)	5.2 (3.1–7.3)
30–39	44.8 (39.3–50.3)	5.6 (3.4–7.8)	41.3 (35.8–46.8)	10.8 (7.6–14.0)
≥40	39.5 (33.0–46.0)	8.2 (4.9–11.5)	46.9 (39.8–54.0)	18.4 (13.1–23.7)
Number of Children				
≤2	50.8 (46.2–55.4)	4.3 (2.8–5.8)	30.9 (26.6–35.2)	6.5 (4.3–8.7)
≥2	42.9 (37.1–48.7)	7.1 (4.6–9.6)	40.7 (34.8–46.6)	14.2 (9.7–18.7)
Marital Status				
Not married	46.2 (39.1–53.3)	3.1 (1.0–5.2)	29.4 (22.8–36.0)	6.1 (3.0–9.2)
Married	49.8 (44.9–54.7)	5.0 (3.0–7.0)	35.6 (30.8–40.4)	9.3 (6.7–11.9)
Educational Background				
≤Secondary education	43.7 (38.2–49.2)	6.1 (3.8–8.4)	39.8 (34.5–45.1)	12.4 (8.7–16.1)
≥Secondary education	53.4 (48.5–58.3)	3.8 (2.1–5.5)	28.9 (24.5–33.3)	5.9 (3.7–8.1)
Occupation				
Artisan	47.5 (39.2–55.8)	3.2 (0.9–5.5)	30.6 (23.0–38.2)	6.4 (2.8–10.0)
Civil/Public servant	51.8 (43.6–60.0)	4.0 (1.5–6.5)	32.7 (25.1–40.3)	7.2 (3.8–10.6)
Private sector	49.1 (41.0–57.2)	4.7 (2.0–7.4)	34.2 (27.0–41.4)	8.0 (4.3–11.7)
Trader	44.3 (38.0–50.6)	6.0 (3.7–8.3)	40.5 (34.5–46.5)	11.3 (7.5–15.1)
Unemployed	50.6 (43.1–58.1)	4.3 (1.8–6.8)	31.8 (25.1–38.5)	7.5 (4.1–10.9)
Average Monthly Income (Naira)				
<30,000	46.9 (40.7–53.1)	5.7 (3.3–8.1)	38.5 (32.6–44.4)	11.2 (7.3–15.1)

Characteristic	Normal BMI % (95% CI)	DHC% (95% CI)	Diabetes% (95% CI)	Hypertension% (95% CI)
30,000–50,000	48.6 (42.1–55.1)	4.9 (2.6–7.2)	35.4 (29.5–41.3)	9.1 (5.7–12.5)
51,000–100,000	50.8 (44.4–57.2)	4.2 (2.0–6.4)	31.6 (26.0–37.2)	7.3 (4.2–10.4)
>100,000	53.1 (45.8–60.4)	3.6 (1.2–6.0)	27.8 (21.9–33.7)	5.8 (2.9–8.7)

Table 2. Prevalence of Diabetes Mellitus and Hypertension Comorbidity (DHC) by obstetric factors (continued).

Characteristic	Normal % (95% CI)	DHC% (95% CI)	Diabetes% (95% CI)	Hypertension% (95% CI)
Genotype				
AA	48.9 (43.9–53.9)	5.0 (3.0–7.0)	34.8 (29.9–39.7)	8.7 (6.1–11.3)
AC	50.0 (35.0–65.0)	2.0 (0.0–6.0)	28.0 (15.0–41.0)	6.0 (0.0–13.0)
AS	46.7 (39.8–53.6)	4.5 (2.3–6.7)	33.2 (26.8–39.6)	9.5 (5.8–13.2)
Blood Group				
A	47.6 (41.0–54.2)	4.9 (2.6–7.2)	33.8 (27.7–39.9)	8.4 (5.2–11.6)
AB	45.2 (33.1–57.3)	3.5 (0.4–6.6)	31.0 (19.8–42.2)	7.2 (1.9–12.5)
B	49.8 (41.9–57.7)	5.2 (2.6–7.8)	35.4 (28.2–42.6)	9.1 (4.8–13.4)
O	50.1 (44.8–55.4)	4.6 (2.7–6.5)	34.0 (29.0–39.0)	8.9 (6.0–11.8)
Gestational Age				
First trimester	50.8 (44.1–57.5)	4.0 (1.8–6.2)	30.6 (24.7–36.5)	7.1 (3.8–10.4)
Second trimester	48.3 (42.3–54.3)	5.3 (2.9–7.7)	36.4 (30.8–42.0)	9.4 (6.2–12.6)
Third trimester	47.9 (41.8–54.0)	5.1 (2.7–7.5)	37.2 (31.6–42.8)	9.8 (6.4–13.2)
First Pregnancy				
No	46.8 (41.5–52.1)	5.6 (3.3–7.9)	38.4 (33.2–43.6)	10.6 (7.3–13.9)
Yes	51.2 (45.8–56.6)	4.0 (1.9–6.1)	30.2 (25.2–35.2)	7.1 (4.2–10.0)
Birth Order of Current Pregnancy				
First child	51.0 (45.6–56.4)	4.0 (1.9–6.1)	30.1 (25.2–35.0)	7.0 (4.1–9.9)
Second child	47.5 (41.1–53.9)	5.0 (2.6–7.4)	35.8 (30.1–41.5)	9.4 (6.0–12.8)
Third child or more	43.9 (37.4–50.4)	6.8 (3.9–9.7)	41.2 (35.1–47.3)	13.6 (8.9–18.3)
Work-Related Stress				
Never	52.1 (45.3–58.9)	3.5 (1.4–5.6)	28.7 (23.0–34.4)	6.0 (3.0–9.0)
Rarely	49.4 (43.1–55.7)	4.2 (2.0–6.4)	33.6 (28.0–39.2)	8.4 (5.0–11.8)
Daily	44.0 (37.8–50.2)	6.1 (3.6–8.6)	40.5 (34.5–46.5)	12.1 (8.0–16.2)
Weekly	46.7 (40.5–52.9)	5.0 (2.6–7.4)	36.2 (30.4–42.0)	9.5 (5.9–13.1)
Monthly	48.9 (41.7–56.1)	4.4 (1.8–7.0)	34.0 (27.5–40.5)	8.2 (4.6–11.8)
Support System				
No	41.6 (36.0–47.2)	6.3 (3.9–8.7)	39.2 (33.8–44.6)	12.1 (8.5–15.7)
Yes	52.8 (47.7–57.9)	4.2 (2.3–6.1)	30.4 (25.8–35.0)	6.7 (4.3–9.1)

Characteristic	Normal % (95% CI)	DHC% (95% CI)	Diabetes% (95% CI)	Hypertension% (95% CI)
Experienced Domestic Violence				
No	50.9 (46.1–55.7)	4.4 (2.6–6.2)	33.1 (28.6–37.6)	8.0 (5.5–10.5)
Yes	38.5 (32.0–45.0)	7.8 (4.6–11.0)	41.0 (34.8–47.2)	14.6 (9.8–19.4)

Abbreviations: CI = Confidence Interval

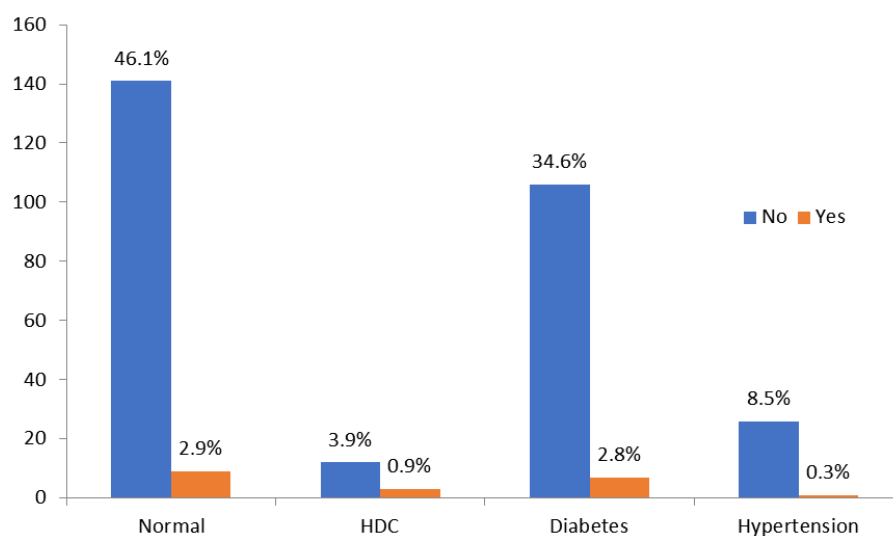


Figure 1. Distribution of respondents by family history of Diabetes Mellitus and Hypertension among pregnant women attending primary healthcare centres in Obio/Akpor LGA.

Table 3. Factors Influencing Diabetes Mellitus and Hypertension Comorbidity (DHC).

Variables	DHC AOR (95% CI)	Diabetes AOR (95% CI)	Hypertension AOR (95% CI)
Age			
<20 years	1.00	1.00	1.00
20–29 years	0.91 (0.81–0.98)*	1.12 (1.02–2.29)*	2.23 (0.37–7.67)
30–39 years	0.95 (0.45–3.62)	1.45 (0.83–4.24)	2.10 (1.68–3.22)*
≥40 years	2.71 (1.20–6.08)*	1.37 (1.17–4.71)*	1.21 (0.26–4.72)
Marital Status			
Not married	1.00	1.00	1.00
Married	0.42 (0.20–0.90)*	2.98 (0.94–9.43)	0.03 (0.01–0.15)*
Educational Background			
≤Secondary	1.00	1.00	1.00
≥Secondary	0.73 (0.37–1.63)	0.15 (0.03–7.40)	0.02 (0.01–6.40)
Occupation	S		
Unemployed	1.00	1.00	1.00
Artisan	0.84 (0.24–2.95)	0.20 (0.11–0.90)*	2.04 (0.34–7.20)

Variables	DHC AOR (95% CI)	Diabetes AOR (95% CI)	Hypertension AOR (95% CI)
Civil/Public Servant	3.11 (1.09–8.91)*	1.40 (0.12–15.21)	9.53 (0.87–13.93)
Private Sector	1.70 (0.49–5.99)	1.60 (0.12–22.71)	5.52 (0.58–22.24)
Trader	1.01 (0.21–4.94)	1.10 (0.12–9.90)	13.56 (1.83–50.30)*
Experienced Domestic Violence			
No	1.00	1.00	1.00
Yes	3.12 (0.70–13.91)	0.80 (0.30–2.18)	0.50 (0.12–2.07)
Genotype			
AA	1.00	1.00	1.00
AC	2.47 (0.16–19.46)	0.56 (0.15–0.90)*	1.02 (0.17–5.11)
AS	7.25 (2.02–26.10)*	0.51 (0.24–1.11)	1.69 (0.37–7.67)
Blood Group			
A	1.00	1.00	1.00
AB	0.80 (0.05–11.85)	0.36 (0.04–3.35)	4.86 (0.61–39.12)
B	2.13 (0.26–17.56)	2.02 (0.66–6.18)	1.24 (0.17–9.27)
O	0.88 (0.16–4.77)	2.35 (1.08–5.13)*	0.13 (0.02–0.84)*
Support System			
No	1.00	1.00	1.00
Yes	0.56 (0.50–2.32)	0.38 (0.19–0.74)*	1.87 (0.51–6.83)

* $p < 0.05$

4. Discussion

This study is among the first to contribute to the limited body of evidence on diabetes–hypertension comorbidity in primary healthcare in Rivers State. Unlike many previous studies conducted in tertiary settings or examining single conditions, this research provides integrated evidence on overlapping cardiometabolic risk among pregnant women in routine PHC services.

This study assessed the prevalence and factors associated with diabetes–hypertension comorbidity among pregnant women attending primary health care (PHC) centres in Obio/Akpor Local Government Area of Rivers State, Nigeria. The prevalence of comorbid diabetes and hypertension observed in this study indicates that one in twenty antenatal care attendees in this population had overlapping metabolic disorders. This prevalence in this study was lower than that documented by [24] in a tertiary hospital in Southwest Nigeria. This variation may be due to tertiary hospitals serving as referral sites and often managing more complex cases. This study's findings are higher than those observed by [11, 25]. Although most pregnancy studies rarely assess these conditions simultaneously, evidence from reproductive-age

populations supports the co-existence of diabetes and hypertension. For instance, [26] reported a comorbid prevalence among US women of reproductive age that is lower than the prevalence observed in this study. Similarly, [6] demonstrated that hypertensive disorders and gestational diabetes frequently co-exist and increase the risk of preeclampsia, preterm birth, macrosomia, and long-term maternal cardiovascular disease. A similar prevalence has been reported in the general population; for instance, a population-based study in Punjab, North India, reported comorbidity prevalence among adults that aligns with that of the study [27], whereas a study in Ethiopia documented a lower prevalence [20]. In contrast, [28] reported a pooled prevalence higher than that reported in this study. However, the prevalence observed in this study is lower than that reported in high-risk groups [29, 16]. The difference could be due to variation in study facility, geographical location, race/ethnicity, sample size, sample population and screening methods used. Therefore, the prevalence observed in this study represents an important maternal health burden requiring integrated screening strategies and public health interventions.

The prevalence of diabetes in this study reported far higher rates than studies in Tanzania, Cameroon, and Nigeria. A previous study reported a slightly lower prevalence in Tanzania [30], while [31] also reported a prevalence lower than this

study. [19] reported a pooled prevalence of gestational diabetes substantially lower than the figure observed in this study. Similarly, [32-34] found a prevalence lower than that of this study. Inclusion of both pre-existing diabetes and gestational diabetes in this study, variations in diagnostic thresholds may account for these differences. The relatively high prevalence of diabetes observed in this study may partly reflect methodological and contextual factors. Diabetes diagnosis was based on a single fasting blood glucose measurement without confirmatory oral glucose tolerance testing due to limited laboratory resources at the primary healthcare level. This approach may have led to some overestimation of hyperglycaemia. In addition, the urban setting is characterized by lifestyle changes, including increased consumption of processed foods, sedentary occupations, and reduced physical activity. The prevalence of hypertension aligns with regional pregnancy data in Sub-Saharan Africa, including Nigeria. [35] reported similar rates of hypertensive disorders in Nigerian tertiary facilities. Likewise, [36] documented comparable prevalence among antenatal attendees in Ethiopia. [37, 13] reported a slightly higher prevalence, whereas [24] documented a much higher prevalence than that observed in this study. In contrast, [25] reported a prevalence lower than that observed in this study. The differences in prevalence across studies may reflect variations in study setting, population characteristics, diagnostic criteria, and level of care. Estimates derived from tertiary hospitals often involve referral populations with more severe or complicated cases, which may inflate prevalence rates compared with PHC-based studies such as ours. In contrast, PHC facilities typically serve broader community populations and may capture earlier or less severe presentations. Differences in screening protocols and laboratory capacity may also contribute to observed variations. This finding reinforces the importance of strengthening screening at the primary healthcare level, where early detection may prevent progression to more severe disease.

Age was significantly associated with diabetes-hypertension comorbidity and with the individual outcomes of diabetes and hypertension. Older women, particularly those aged 40 years and above, had higher odds of comorbidity. This pattern is consistent with the accumulation of cardiometabolic risk with advancing age, including progressive insulin resistance, vascular stiffness, and longer exposure to behavioural risk factors. Similar age-related associations have been documented in Nigerian and international studies [18, 35, 33]. These findings highlight the need for age-sensitive risk stratification during antenatal care. Marital status was significantly associated with comorbidity and hypertension, with married women showing lower odds compared with those not married. This finding may reflect differences in emotional support, economic stability, and shared decision-making, which can influence stress levels and healthcare-seeking behaviour. In our context, marital status may serve as a proxy indicator of social support and financial security, both of which are relevant to chronic disease management during pregnancy. However,

given the cross-sectional design, this association should be interpreted cautiously.

Occupational differences were also observed. Civil/public servants had higher odds of diabetes-hypertension comorbidity, while traders had higher odds of hypertension. These associations may be related to sedentary work patterns, occupational stress, irregular schedules, and dietary behaviours associated with certain professions. Occupation may therefore represent an important socio-economic determinant of cardiometabolic risk during pregnancy, reflecting both lifestyle and structural factors. Conversely, artisans had lower odds of diabetes, possibly reflecting higher levels of physical activity inherent in manual occupations.

Genotype was another factor associated with the outcomes, with individuals carrying genotype AS demonstrating over seven times stronger likelihood of experiencing adverse cardiometabolic outcomes compared with those with genotype AA. Although sickle cell trait (AS) is often considered relatively benign, emerging evidence suggests that it may be associated with subtle vascular and metabolic changes that could influence pregnancy outcomes. However, the relatively small number of participants in certain genotype categories in this study may have contributed to wider confidence intervals for some estimates. Further studies with larger samples are therefore required to better understand the relationship between genotype and cardiometabolic risk during pregnancy.

Social support emerged as an important factor associated with maternal health outcomes in this study. Social support during pregnancy plays a crucial role in buffering psychological stress, improving health-seeking behaviours, and facilitating adherence to medical advice. Studies have shown that pregnant women with higher perceived social support are more likely to engage in positive health behaviours and experience fewer pregnancy complications. For example, a study by [38] reported that higher levels of social support were associated with lower odds of gestational hypertension and improved health-promoting behaviours among pregnant women. Similarly, research has demonstrated that low social support during pregnancy is associated with poorer maternal well-being and increased risk of adverse pregnancy outcomes, including higher rates of complications and reduced quality of life [39]. Emerging evidence also suggests that social support may influence metabolic health during pregnancy [40]. Poor emotional support has been linked with increased stress responses and hormonal changes that can contribute to insulin resistance and the development of gestational diabetes.

Therefore, the association observed in the present study may reflect the protective role of strong family and community support systems in improving maternal coping capacity, encouraging regular antenatal attendance, and promoting healthy lifestyle behaviours during pregnancy.

5. Limitations

The cross-sectional design limits the ability to establish

temporal or causal relationships between the variables and diabetes–hypertension comorbidity. Diabetes diagnosis was based on a single fasting blood glucose measurement without repeat confirmatory testing or oral glucose tolerance testing, which may have introduced misclassification bias. Some subgroups, particularly genotype categories, had relatively small sample sizes, resulting in wide confidence intervals for certain estimates. Some variables, including social support and experience of domestic violence, were self-reported and may be subject to recall or social desirability bias.

6. Conclusion

Diabetes–hypertension comorbidity affects a notable proportion of pregnant women attending antenatal care at PHC centres in an Urban Local Government Area of Nigeria. Age, marital status, occupation, genotype and social support were significantly associated with one or more of the outcomes examined. These findings highlight the importance of integrated cardiometabolic risk assessment within routine antenatal care at the primary healthcare level. Based on the study findings, routine screening for blood glucose and blood pressure should be conducted at every antenatal care visit, particularly among older pregnant women and those in high-risk occupational groups. Targeted screening and monitoring should be prioritized for pregnant women aged 40 years and older and for those in occupations associated with sedentary work. PHC facilities should integrate structured NCD risk assessment tools into maternal health services. Health education programmes targeting lifestyle modification and social support mechanisms should be incorporated into routine antenatal counseling. Strengthening PHC capacity for integrated NCD management will improve early detection and coordinated care in similar urban settings.

Abbreviations

AOR	Adjusted Odds Ratio
ANC	Antenatal Care
CA	Cronbach Alpha
CI	Confidence Interval
DHC	Diabetes-Hypertension Comorbidity
FBG	Fasting Blood Glucose
LGA	Local Government Area
NCD	Non-Communicable Disease
OGTT	Oral Glucose Tolerance Test
PHC	Primary Healthcare Centre
SDGs	Sustainable Development Goals
VIF	Variance Inflation Factor
WHO	World Health Organization

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Author Contributions

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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