

Cardiovascular Risk Factors among Pregnant Women attending Antenatal Care at Primary Health Care Centres in Sokoto Metropolis

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Abstract

Background: Cardiovascular disease risk factors in pregnancy, including hypertension, obesity, and gestational diabetes, substantially increase the risk of maternal and fetal complications such as pre-eclampsia and preterm birth. Understanding their burden in antenatal populations is crucial for early detection and targeted interventions. **Objectives:** This study determined the prevalence of hypertension and obesity among pregnant women in Sokoto Metropolis and examined their associations with key socio-demographic factors. **Methods:** A cross-sectional study was conducted in nine randomly selected Primary Health Care facilities in Sokoto Metropolis using the WHO STEPS approach. Through multistage stratified sampling, 205 pregnant women were enrolled. Data were collected via structured questionnaires and physical measurements. Analysis was done using IBM SPSS version 25. **Results:** Of the 205 participating pregnant women, the mean age was 26 years. The prevalence of hypertension was 21 (10.2%). The prevalence of obesity (BMI ≥ 30 kg/m²) was 12 (5.9%), and an additional 58 (28.3%) were overweight. Cigarette smoking and alcohol consumption were reported by 2 (1%) and 4 (2%) of respondents, respectively. Educational level and occupational status showed significant associations with elevated blood pressure ($p = 0.026$ and $p = 0.012$, respectively). No significant association was observed between ethnicity and cardiovascular risk factors. **Conclusion:** This study found notable hypertension and obesity prevalence among pregnant women in Sokoto PHC antenatal clinics, highlighting the need for routine screening, strengthened health education, and targeted interventions to reduce cardiovascular risks during pregnancy

Keywords; Cardiovascular risk factors; pregnancy; hypertension; obesity; Sokoto

Introduction

Cardiovascular disease (CVD) complicates approximately 1-4% of pregnancies globally, with an increasing trend attributed to advancing maternal age, improved survival of women with congenital heart disease, and a rising burden of noncommunicable disease risk factors such as hypertension and obesity.^[1,2] Heart disease is now a leading cause of non-obstetric maternal mortality worldwide.^[3-5]

CVD encompasses disorders of the heart and circulatory system, including hypertension and

stroke.^[6] Established risk factors include physical inactivity, unhealthy diet, smoking, alcohol use, obesity, diabetes, dyslipidaemia, advancing age, and socioeconomic factors.^[7,8] These risk factors are increasingly prevalent among women of reproductive age, raising concerns about pregnancy outcomes.

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Poor maternal cardiovascular health has intergenerational consequences.^[9] Impaired vascular adaptation during pregnancy can affect placental development and fetal growth, increasing the risk of adverse outcomes such as pre-eclampsia, fetal growth restriction, preterm birth, and stillbirth.^[10-12] Pregnancy, therefore provides a critical window for identifying women at increased cardiovascular risk and initiating preventive interventions.

Primary health care settings offer an equitable platform for early detection and management of cardiovascular risk factors, particularly in low- and middle-income countries. In Nigeria, limited data exist on cardiovascular risk factors among pregnant women at the PHC level, especially in northwestern regions such as Sokoto State.^[13,14] This study addresses this gap by assessing the prevalence and socio-demographic correlates of selected cardiovascular risk factors among pregnant women attending PHC antenatal clinics in Sokoto Metropolis.

Materials and Methods

Study Area

The study was carried out among pregnant women attending antenatal care (ANC) services at selected Primary Health Care (PHC) centers in Sokoto Metropolis, Sokoto State, northwestern Nigeria. Sokoto Metropolis comprises urban areas within Sokoto North, Sokoto South, and Wamakko Local Government Areas (LGAs), covering approximately 259 km² with an estimated population exceeding 800,000. The metropolis has 63 PHCs distributed across the three LGAs (Sokoto North: 10, Sokoto South: 9, Wamakko: 44). The population is predominantly Hausa and Fulani, with livelihoods centered on commerce, agriculture, and public service. Although tertiary facilities such as UDUTH and Specialist Hospital Sokoto exist, PHCs remain the primary entry point for antenatal care, despite challenges related to human resource shortages and limited noncommunicable disease (NCD) services.^[15]

Study Design

A population-based cross-sectional study design was employed, utilizing the World Health

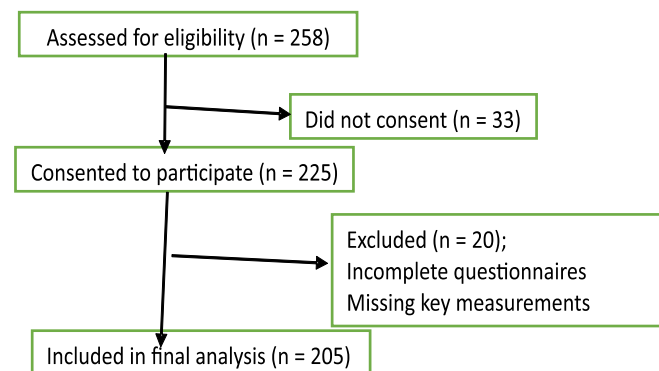
Organization (WHO) STEP wise approach to surveillance (STEPS) to assess cardiovascular risk factors among pregnant women.^[16] STEP 1 involved collection of socio-demographic characteristics, behavioral risk factors, and medical history using a structured questionnaire. STEP 2 comprised physical measurements including blood pressure, height, and weight. This design provided a snapshot of cardiovascular risk factor prevalence and was suitable for the resource-limited setting.

Study Population

The study population consisted of pregnant women attending ANC at selected PHCs within Sokoto Metropolis.

Inclusion criteria were pregnant women aged 18 years and above, residents of Sokoto Metropolis for at least six months, and those who provided written informed consent.

Exclusion criteria included transient visitors, women with severe medical conditions that could compromise participation (e.g., severe anemia or infections), and those unable to understand or communicate effectively in English or the local languages used for data collection.



Study Flow Chart

Sample Size Estimation

The sample size was determined using the Cochran formula, based on a 17% prevalence of hypertension among pregnant women from a previous study conducted at UDUTH. Using a 95% confidence level ($Z = 1.96$) and a margin of error of 5%, a minimum sample size of 217 was calculated. After adjusting for an anticipated non-response rate, the final sample size was increased to 258 participants. However, 205 eligible participants were enrolled due to non-response during data collection. This limitation is acknowledged.

Sampling Technique

A multistage stratified random sampling technique was applied. In the first stage, the three LGAs were treated as strata, and proportional allocation was based on the number of PHCs in each LGA. Accordingly, 41 participants were selected from Sokoto North, 37 from Sokoto South, and 180 from Wamakko. In the second stage, PHCs within each LGA were selected using simple random sampling. In the third stage, systematic random sampling was employed to select eligible pregnant women at each PHC, with the first participant chosen by balloting and subsequent participants selected at a fixed interval.

Data Collection Tools and Methods

Data were collected using a pretested, structured, interviewer-administered questionnaire adapted from the WHO STEPS instrument. The tool was reviewed for clarity and relevance and pretested before use. Physical measurements followed standard WHO procedures. Pretesting was conducted among pregnant women attending ANC at UDUTH to ensure clarity, reliability, and validity, with necessary modifications made before final deployment. Data collection was facilitated using Google Forms at selected PHCs.

Operational Definitions

Hypertension was defined as systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg. Body mass index (BMI) was calculated as weight in kilograms divided by height in metres squared and categorised using standard WHO criteria. Smoking and alcohol use were based on self-report.

Data Analysis

Data were exported from Google Forms into Microsoft Excel and analyzed using IBM SPSS Statistics version 25. Descriptive statistics (means, standard deviations, frequencies, and percentages) were used to summarize variables. Associations between variables were assessed using chi-square tests. Statistical significance was set at $p < 0.05$ with a 95% confidence interval.

Research Ethics Considerations

Ethical approval was obtained from the Health Research Ethics Committee of Usmanu Danfodiyo University Teaching Hospital (UDUTH), Sokoto (UDUTH/HREC/2025/1529/V1). Participation was entirely voluntary with informed consent.

Results

Socio-demographic characteristics

The study included 205 pregnant women attending antenatal care in Sokoto Metropolis, most of whom were young, with a mean age of about 26 years. The majority were within the younger reproductive age group, while women aged 35 years and above made up less than one-tenth of the participants. Nearly half of the respondents (45.4%) had no formal education, while about one-quarter (26.3%) completed secondary school and 14.6% attained primary education.

Table 1: Socio-demographic characteristics of respondents

Variable	Category	Frequency (n)	Percentage (%)
Age group	≤ 19 years	7	3.4
	20–29 years	146	71.2
	30–39 years	49	23.9
	≥ 40 years	3	1.5
Education	No formal education	93	45.4
	Primary	38	18.5
	Secondary	54	26.3
	Tertiary	20	9.8
Marital status	Married	200	97.5
	divorced	3	1.5
	widowed	2	1.0
Level of Education	No formal schooling	93	45.4
	Less than primary school	8	3.9
	Primary school completed	30	14.6
	Secondary school completed	54	26.3
	College/University completed	20	9.8
Total		205	100.0

Ethnic Background

The study population was predominantly Hausa, accounting for 91.2% of respondents, while other ethnic groups such as Fulani, Yoruba, and a few minority groups were represented in much smaller proportions. This distribution reflects the ethnic composition of Sokoto Metropolis.

Table 2: Ethnic Background of Respondents (n = 205)

Ethnic Group	Frequency (n)	Percentage (%)
Hausa	187	91.2
Fulani	8	3.9
Yoruba	3	1.5
Others	7	3.4
Total	205	100.0

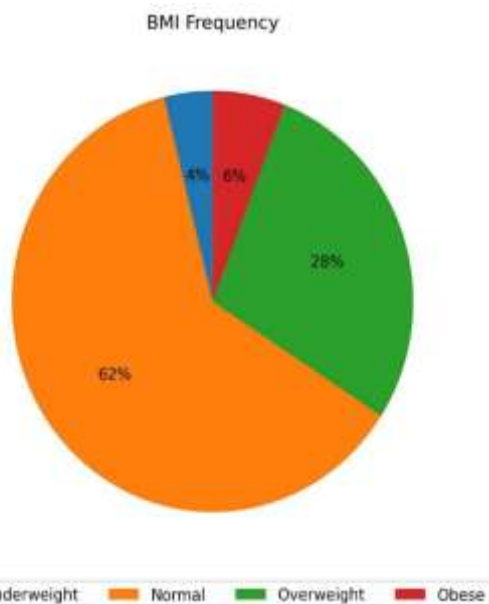


Figure 1: Prevalence of obesity (defined by BMI ≥ 30 kg/m²) among pregnant women attending primary health care centers in Sokoto Metropolis

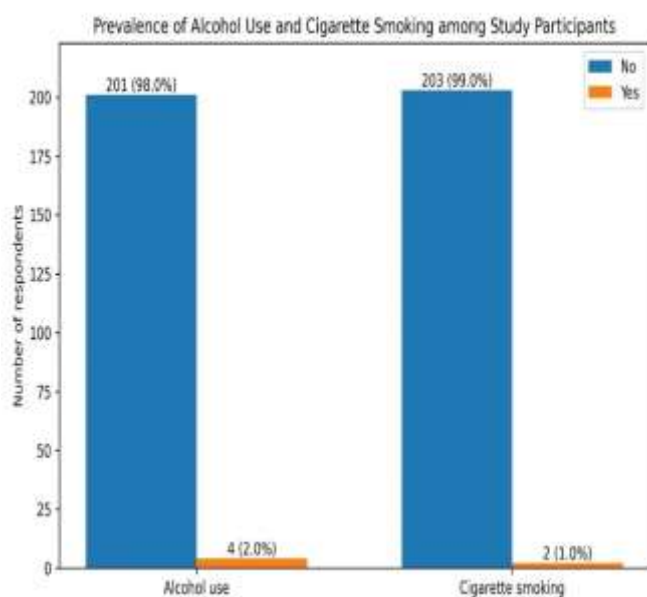


Figure 2: Prevalence of Alcohol Use and Cigarette Smoking

Occupational Status

More than half of the respondents (52.7%) were self-employed, while 39.5% were unemployed. Only a small proportion were in formal employment or were students, indicating that most pregnant women were engaged in informal work or not employed.

Table 3: Occupational Status of Respondents (n = 205)

Work Status	Frequency (n)	Percentage (%)
Government employee	10	4.9
Private organization employee	4	2.0
Self-employed	108	52.7
Student	2	0.9
Unemployed	81	39.5
Total	205	100.0

Prevalence of hypertension among pregnant women attending primary health care centers in Sokoto Metropolis.

Most respondents (71.2%) had normal blood pressure, while 18.5% had elevated readings. Stage 1 and stage 2 hypertension were observed in 6.3% and 3.4% of participants, respectively, with 0.5% presenting with hypertensive urgency. Overall, the prevalence of hypertension was 10.2%, indicating that a notable minority of pregnant women had elevated blood pressure during pregnancy.

Table 4: Blood Pressure Categories of Respondents (n = 205)

Blood Pressure Category (mm Hg)	Frequency (n)	Percentage (%)
< 120/80	146	71.2
120–129 / < 80	38	18.5
130–139 / 80–89	13	6.4
$\geq 140 / 90$	7	3.4
$\geq 180 / 120$	1	0.5
Total	205	100.0

Prevalence of obesity (defined by BMI ≥ 30 kg/m²), Alcohol Use and Cigarette Smoking among pregnant women attending primary health care centers in Sokoto Metropolis using frequency and proportion (n=205). Most respondents (62.0%) had normal BMI, while 28.3% were overweight and 5.9% were obese; 3.9% were underweight. Overall, the prevalence of obesity among pregnant women was 5.9%, with nearly one-third (34.2%) either overweight or obese, indicating a substantial burden of excess body weight with potential cardiovascular and obstetric risks. Among the 205 pregnant women surveyed, only 4(2%) reported alcohol consumption, while the vast majority 201(98%) denied ever taking alcohol. This indicates that alcohol use was very uncommon among the study

participants. Cigarette smoking was almost absent in the study population. Only 2(1%) reported cigarette use, whereas 203(99%) of the respondents did not smoke. This demonstrates that cigarette smoking was an extremely rare behavior among pregnant women attending antenatal care in Sokoto Metropolis.

Associations between cardiovascular risk factors and socio-demographic characteristics

Table 5 shows that age was significantly associated with BMI ($p = 0.001$), while educational level and work status were significantly associated with blood pressure ($p = 0.026$ and $p = 0.012$, respectively). No significant associations were observed between ethnicity and either BMI or blood pressure, nor between age and blood pressure or BMI and education or work status.

Table 5: Associations between cardiovascular risk factors and socio-demographic characteristics.

Socio-demographic Variable	Risk Factor	χ^2 Value	df	p -value
Age	BMI	126.6	81	0.001*
	Blood pressure	93.6	108	0.836
Education	BMI	13.7	12	0.321
	Blood pressure	28.7	16	0.026*
Ethnicity	BMI	26	21	0.208
	Blood pressure	19.2	28	0.891
Work status	BMI	4.6	12	0.969
	Blood pressure	31.4	16	0.012*

*Significant at $p < 0.05$.

Discussion

This study provides evidence of a measurable burden of hypertension and excess body weight among pregnant women attending PHC antenatal clinics in Sokoto Metropolis. Although behavioural risk factors such as smoking and alcohol use were rare, medical risk factors were present in a notable proportion of respondents

The mean age of respondents was 26 years, with the majority aged between 20 and 30 years. This age distribution reflects the typical reproductive pattern in Nigeria and is consistent with the 2018 Nigeria Demographic and Health Survey, which reported that most Nigerian women begin childbearing in their twenties.^[17] Nearly half of the respondents had no formal education, while fewer than 10% attained

tertiary education. Educational status is a well-recognized determinant of maternal and cardiovascular health, influencing health literacy, dietary choices, health-seeking behavior, and adherence to antenatal care recommendations.^[18] Ethnically, the study population was predominantly Hausa (91.2%), mirroring the sociocultural composition of Sokoto State.

The prevalence of hypertension in this study was 10.2%, which is lower than figures reported in other Nigerian studies. For example, a prevalence of 17% was reported among pregnant women at Usmanu Danfodiyo University Teaching Hospital, Sokoto,^[19] while a higher prevalence of 25.8% was documented in Katsina State.^[20] This prevalence is also lower than the national estimate of hypertension among Nigerian women, reported at 25.0%.^[21] Differences in study design, population characteristics, diagnostic criteria, and healthcare access may explain these variations. The lower prevalence observed in this study may also reflect earlier detection and management at the PHC level or differences in sociodemographic profiles.

Obesity prevalence was 5.9%, with 34.2% of respondents classified as overweight or obese. This finding is lower than the obesity prevalence reported in Southeast Nigeria (10.7%),^[22] but approximates national estimates, indicating that about one-quarter of Nigerian adults are overweight or obese.^[23] The relatively low obesity prevalence observed may be partly due to the limitations of BMI as a measure of adiposity during pregnancy, particularly in the second and third trimesters. Additionally, inclusion of pregnant women across all gestational ages may have influenced BMI-based estimates.

The prevalence of cigarette smoking in this study was very low (1%). This aligns with the global trend, where smoking during pregnancy ranges from less than 1% in many African countries (approximately 0.8–0.9% in studies from 2018 and 2024) to much higher figures such as 4.5% in Enugu,^[24] Nigeria, 7.2% in the United States (2016),^[25] and as high as 38.4% in Ireland (2018).^[26] Alcohol consumption during pregnancy was also low (1.95%) compared with reports from Ibadan, Nigeria (12.7%),^[27] and the pooled prevalence of 15.7% across sub-Saharan Africa.^[28] Much higher rates have been reported in Geneva,

Switzerland,^[29] Addis Ababa, Ethiopia,^[30] and South-South Nigeria.^[31] These differences likely reflect sociocultural, religious, and methodological variations across settings. In Sokoto, strong religious and cultural norms discouraging alcohol and tobacco use among women likely contributed to the low prevalence observed.^[32] Nevertheless, even minimal exposure to tobacco or alcohol during pregnancy is clinically important, as it has been associated with adverse perinatal outcomes and increased long-term cardiovascular risk in offspring.^[33]

Significant associations were observed between certain sociodemographic factors and cardiovascular risk markers. Obesity was significantly associated with advanced maternal age ($p = 0.001$), consistent with findings from Abia State, Nigeria, linking increasing age to metabolic changes and lifestyle factors.^[34] Hypertension was significantly associated with lower educational attainment ($p = 0.026$), supporting evidence that limited health literacy increases the risk of hypertensive disorders in pregnancy.^[35] A significant association was also observed between hypertension and work status ($p = 0.012$), aligning with studies from Kenya that highlight the role of socioeconomic disadvantage in adverse antenatal outcomes.^[36] The absence of gestational diabetes data limited comprehensive cardiovascular risk assessment, underscoring the need for future studies incorporating biochemical screening to better characterize cardiovascular risk among pregnant women.

Conclusion

Hypertension and excess body weight are present among pregnant women attending PHC facilities in Sokoto Metropolis, despite low levels of smoking and alcohol use. Strengthening routine cardiovascular risk screening and health education within antenatal care is crucial for improving maternal and fetal outcomes.

Limitations

The cross-sectional design may limit causal inference. The reduced sample size of 205 was due to non-response, incomplete questionnaires, and missing key measurements, which may affect statistical power. Use of BMI alone may not accurately reflect adiposity during pregnancy, and the absence of biochemical measurements could

have led to underestimation of cardiovascular risk. Self-reported behavioural data may be subject to reporting bias, and findings from selected PHC facilities may not be generalizable to other settings.

Recommendation

Routine screening for blood pressure and body mass index should be integrated into antenatal care at the PHC level, alongside targeted health education on nutrition, physical activity, and early ANC booking. Future studies should incorporate biochemical screening, larger sample sizes, and longitudinal designs to better characterise cardiovascular risk during and after pregnancy.

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