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INCIDENCE AND PREDICTORS OF HYPOCALCAEMIA AMONG PREGNANT AND POSTPARTUM WOMEN ATTENDING SELECTED HOSPITALS IN KANO METROPOLIS, NIGERIA

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ABSTRACT

Hypocalcaemia during pregnancy is a significant public health concern in many developing countries and is associated with adverse maternal and fetal outcomes. This study assessed the incidence and predictors of hypocalcaemia among pregnant women attending antenatal care in some selected hospital in Kano Metropolis, Nigeria. A cross-sectional study design was adopted involving 400 women recruited from antenatal clinics. Data were collected using structured questionnaires covering socio-demographic characteristics, obstetric history, dietary practices, and clinical symptoms related to calcium deficiency. Descriptive statistics, chi-square tests, and logistic regression analysis were used to identify predictors of hypocalcaemia. The majority of respondents were aged 20–30 years (48.3%), and most attended antenatal care during the second trimester (55.2%). Clinical manifestations commonly associated with calcium deficiency were widely reported, including headache (53.5%), vomiting (47.0%), muscle cramps (42.3%), and dizziness (40.5%). Although dietary diversity among respondents was relatively high, the intake of calcium-rich foods such as milk and dairy products was inconsistent. Chi-square analysis showed no statistically significant association between hypocalcaemia and most socio-demographic variables, although occupation, calcium supplement use, and milk consumption showed marginal associations. Logistic regression analysis further indicated that none of the variables independently predicted hypocalcaemia at the 5% level of significance. The findings suggest that maternal hypocalcaemia in the study population may be primarily influenced by inadequate dietary calcium intake rather than demographic factors. Strengthening maternal nutrition education and improving access to calcium-rich foods and antenatal supplementation programs are therefore recommended.

Keywords: Hypocalcaemia, pregnancy, maternal nutrition, calcium intake, antenatal care

INTRODUCTION

Adequate calcium intake during pregnancy is essential for maintaining maternal health and supporting fetal skeletal development. Calcium plays an important role in neuromuscular function, blood clotting, and regulation of several metabolic processes in the body. During pregnancy, the demand for calcium increases significantly because of fetal growth and mineralization of the developing skeleton. When dietary calcium intake is inadequate, maternal calcium stores may become depleted, resulting in hypocalcaemia and associated complications (Prentice, 2013).

Hypocalcaemia during pregnancy has been associated with several adverse maternal and fetal outcomes including muscle cramps, neuromuscular irritability, hypertension, and increased risk of pre-eclampsia. Low maternal calcium intake may also negatively affect fetal skeletal development and pregnancy outcomes (Ajong *et al.*, 2022; Hofmeyr *et al.*, 2019; Hofmeyr *et al.*, 2014).

Globally, micronutrient deficiencies among pregnant women remain a major public health problem, particularly in low- and middle-income countries where dietary intake of nutrient-rich foods is limited. The World Health Organization recommends 1.5–2.0 g/day of elemental calcium supplementation for pregnant women in areas with low dietary calcium intake to prevent maternal complications such as preeclampsia and eclampsia. Despite this guideline, studies in Africa have reported persistently low calcium intake and poor adherence to supplementation among pregnant and postpartum women (Dwarkanath *et al.*, 2024; Gebreyohannes *et al.*, 2021).

Several studies in sub-Saharan Africa have documented varying prevalence rates of hypocalcaemia among pregnant women, ranging from 15% to 40% depending on the population, laboratory method, and gestational stage (Ajong *et al.*, 2022; Mlay *et al.*, 2025). In many parts of sub-Saharan Africa, diets are predominantly cereal-based and often lack adequate sources of bioavailable calcium such as dairy products and fish consumed with bones (FAO, 2019).

In Nigeria, maternal malnutrition continues to be a major public health concern despite improvements in antenatal care services. Studies have shown that many pregnant women consume diets that are inadequate in essential micronutrients including calcium (Olatona *et al.*, 2018). Poor maternal nutrition is often linked to poverty, inadequate nutrition education, and limited access to nutrient-dense foods. Additionally, calcium deficiency among women of the reproductive age has been linked to limited consumption of dairy products, low intake of fish and green leafy vegetables, and poor supplement adherence during antenatal care (Bako *et al.*, 2021; FAO, 2019). The nutritional transition in urban centers like Kano Metropolis, where the diet is dominated by

cereals and starchy foods, further increases the risk of inadequate calcium intake. Physiological factors such as parity, maternal age, vitamin D deficiency, and reduced sunlight exposure also influence calcium homeostasis, particularly during late pregnancy and the postpartum period (Morales-Suárez-Varela *et al.,* 2022).

Although several studies have examined micronutrient deficiencies among pregnant women in Nigeria, information regarding the incidence and predictors of hypocalcaemia among pregnant women in northern Nigeria remains limited. Despite the existence of WHO recommendations for calcium supplementation during pregnancy, hypocalcaemia continues to pose a significant health risk for women in developing countries, including Nigeria. Previous studies have reported high prevalence rates of hypocalcaemia in African settings due to low dietary calcium intake, limited access to supplements, and socioeconomic disparities (Ajong *et al.,* 2020; Gebreyohannes *et al.,* 2021). In Kano Metropolis, antenatal nutrition counseling and supplement distribution are often inconsistent across hospitals, leading to variable maternal nutritional outcomes. Understanding the determinants of maternal calcium deficiency is essential for designing effective nutrition interventions. This study therefore assessed the incidence and predictors of hypocalcaemia among pregnant and postpartum women attending selected hospitals in Kano Metropolis, Nigeria.

Materials and Methods

Study Design

A descriptive cross-sectional study design was used. This design was suitable because it enables the simultaneous collection of information on exposures (dietary intake, supplementation, socio-demographic and obstetric variables) and the outcome (serum calcium status) within the same period (Kirkwood and Sterne, 2020).

Study Area

The study was conducted among pregnant women attending some selected hospital in Kano Metropolis, Kano State, Nigeria. Kano is one of the most populous states in the country, with an estimated population of over 14 million people according to the National Bureau of Statistics (2022). Kano Metropolis comprises eight Local Government Areas (LGAs): Kano Municipal, Tarauni, Nassarawa, Dala, Fagge, Gwale, Kumbotso, and Ungogo.

Study Population

The target population was consisted of pregnant and postpartum women attending antenatal and postnatal clinics in the selected hospitals. Pregnant women in this research refers to those in any trimester of pregnancy and postpartum women are those within six months after delivery.

Sample Size Determination and Sampling Method

A total of 400 respondents participated in the study. The sample size was determined using the Cochran formula for cross-sectional studies (Cochran, 1963): $n = z^2 pq / d^2$ (Cochran, 1977; Naing *et al.,* 2006), with a confidence interval of 95% and precision of 5%. Estimated prevalence of 36.7% hypocalcaemia was use (Bako *et al.,* 2021).

A multistage sampling technique was employed. The sampling interval (k) was determined by dividing the average number of clinic attendees by the required daily sample. The first participant was chosed randomly, and subsequent participants then selected at every k^{th} interval until the sample is reached.

Data Collection

Data were collected using a structured questionnaire which obtained information on socio-demographic characteristics, obstetric history, antenatal care utilization, dietary practices and clinical symptoms related to calcium deficiency

Dietary Assessment

Dietary diversity was assessed using a modified dietary diversity scoring method based on commonly consumed food groups including cereals, legumes, vegetables, fruits, dairy products, meat, and fish.

Ethical Considerations

Ethical approval was obtained prior to data collection. Written informed consent was obtained from each participant after explaining the study's purpose, risks, and benefits. Participation was voluntary, and respondents may withdraw at any stage without penalty. Confidentiality was ensured by using coded identifiers rather than personal names. Participants diagnosed with hypocalcaemia was referred to attending physicians for proper treatment and counseling.

Statistical Analysis

Data were analysed using descriptive statistics and inferential statistical methods including frequency distribution, chi-square test and logistic regression analysis. A statistical significance was set at $p < 0.05$.

RESULTS AND DISCUSSION

Table 1: Demographic Characteristics of Respondents (n=400)

Variables	Categories	Frequency	Percentages
Age	<20 years	81	20.3
	20-30 years	193	48.3
	31 – 40 years	103	25.8
	> 40 years	23	5.8
Marital status	Married	392	98
	Not married	8	2
Education	Secondary	205	51.3
	Tertiary level	93	23.3
	Primary	81	20.3
	None	21	5.3
Occupation	Housewife	192	48
	Trader/self-employed	163	48.8
	Civil servants	45	11.2
Income	<100, 000	293	73.3

Variables	Categories	Frequency	Percentages
	100, 000 to 150, 000	90	22.5
	>150, 000	17	4.3

Table 2: Obstetric Characteristics and Antenatal Care Utilization

Variable	Categories	Frequency	Percentage
Gestational age	First trimester	83	20.8
	Second trimester	221	55.2
	Third trimester	96	24.0
Parity	1–2	231	57.8
	3–5	141	35.3
	≥6	28	7.0
ANC visits	1–3	286	71.5
	≥4	83	20.8
	None	31	7.8

Table 3: Incidence of Symptoms Associated with Hypocalcaemia

Symptom	Frequency	Percentage
Headache	214	53.5
Vomiting	188	47.0
Muscle cramps	169	42.3
Dizziness	162	40.5
Fatigue	137	34.3

Table 4: Association Between Hypocalcaemia and Selected Variables

Variable	χ^2	p-value
Age	2.41	0.299
Education	3.18	0.364
Occupation	5.64	0.060
ANC visits	1.75	0.416
Calcium supplement use	2.74	0.098
Milk intake	2.93	0.087

Table 5: Logistic Regression Analysis of Predictors

Variable	Odds Ratio	95% CI	p-value
Age	1.12	0.78–1.61	0.529
Education	0.91	0.66–1.27	0.612
Occupation	1.38	0.98–1.95	0.067
Parity	1.09	0.78–1.53	0.621
Calcium supplement use	0.79	0.55–1.13	0.194
Milk intake	0.83	0.58–1.19	0.311

Result Interpretation

The majority of respondents were aged 20–30 years (Table 1), representing the peak reproductive age group. Similar demographic patterns have been reported among antenatal populations in Nigeria (National Population Commission, 2019) Regarding occupation, 48% were housewives, 40.8% were traders or self-employed, and only 11.2% were civil servants, highlighting that formal employment is relatively low. The income distribution showed that 73.3% earned less than ₦100,000 monthly, which may constrain access to nutrient-rich foods and supplements.

Most respondents had fewer than four antenatal visits (Table 2), indicating inadequate utilization of recommended antenatal services. Similar findings have been reported in studies examining antenatal care utilization in Nigeria (Okedo-Alex *et al.,* 2019). There was high prevalence of muscle cramps and dizziness (Table 3), this may indicate possible underlying calcium deficiency. Similar symptoms have been reported in pregnant women with low calcium intake (Prentice, 2013). None of the variables showed statistically significant association with hypocalcaemia (Table 4). However, the regression model analysis showed that none of the variables independently predicted hypocalcaemia. This suggests that maternal calcium deficiency in the study population may be influenced by general dietary patterns rather than specific socio-demographic characteristics (Table 5).

Discussion

The findings of this study provide important insights into the incidence and determinants of hypocalcaemia among pregnant women attending antenatal care in Kano. The results indicate that the majority of respondents were within the age group of 20–30 years, which represents the peak reproductive age group in many developing countries. This pattern is consistent with demographic trends observed in antenatal clinic populations across Nigeria and other parts of sub-Saharan Africa where early marriage and childbearing are common (National Population Commission, 2019).

Most respondents in this study attended antenatal care during the second trimester of pregnancy. Similar patterns have been reported in previous studies where pregnant women tend to

initiate antenatal care relatively late due to cultural beliefs, lack of awareness, financial constraints, or limited access to health facilities (Okedo-Alex *et al.*, 2019). Late initiation of antenatal care may limit the opportunity for early detection and management of maternal nutritional deficiencies.

The study also revealed a relatively high occurrence of symptoms commonly associated with calcium deficiency, including headache, vomiting, muscle cramps, and dizziness. Muscle cramps and neuromuscular irritability are among the most frequently reported manifestations of hypocalcaemia during pregnancy. Previous studies have similarly reported high prevalence of these symptoms among pregnant women with inadequate dietary calcium intake (Prentice, 2013).

Although dietary diversity among respondents was relatively high, the frequency of consumption of calcium-rich foods such as milk and dairy products varied considerably. This finding suggests that dietary diversity alone may not guarantee adequate intake of specific micronutrients such as calcium. Similar observations have been reported in several nutrition studies where households consume a wide variety of foods but still experience micronutrient deficiencies due to low intake of nutrient-dense foods (FAO, 2019).

The analysis of potential predictors showed that most socio-demographic characteristics were not significantly associated with hypocalcaemia. However, occupation, calcium supplementation, and milk consumption showed marginal associations. These findings suggest that lifestyle and dietary factors may have a greater influence on maternal calcium status than basic socio-demographic characteristics. Previous research has shown that dietary habits, socioeconomic status, and access to nutrition education are important determinants of maternal micronutrient intake (Olatona *et al.*, 2018).

The logistic regression analysis further showed that none of the studied variables independently predicted hypocalcaemia at the 5% significance level. This may indicate that maternal calcium deficiency in the study population is influenced by broader dietary patterns affecting the entire population rather than specific individual-level characteristics. In communities where calcium-rich foods are generally under-consumed, the risk of hypocalcaemia may be widespread across different demographic groups.

CONCLUSION

This study revealed a high occurrence of symptoms associated with calcium deficiency among pregnant women attending antenatal clinics in Kano. Despite relatively high dietary diversity, consumption of calcium-rich foods was inconsistent. Socio-demographic variables were not strong predictors of hypocalcaemia, suggesting that maternal calcium deficiency may be influenced primarily by broader dietary patterns. Improving maternal nutrition education and promoting increased consumption of calcium-rich foods during pregnancy are therefore important strategies for improving maternal nutritional status and reducing pregnancy-related complications. The findings of this study highlight the importance of improving maternal nutrition through targeted nutrition education and promotion of calcium-rich foods during pregnancy. Strengthening antenatal care programs to include routine nutrition counseling and appropriate calcium supplementation may also help reduce the risk of hypocalcaemia and improve pregnancy outcomes.

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