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ORIGINAL ARTICLE

PREVALENCE AND PREDICTORS OF ANAEMIA IN PREGNANCY AMONG CHILD-BEARING WOMEN ATTENDING AN ANTENATAL CLINIC IN A TERTIARY HOSPITAL, SOUTHWEST NIGERIA.

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ABSTRACT

BACKGROUND

Pregnancy-related anaemia raises the risk of morbidity and death for both the mother and the unborn child. This study aimed to determine the prevalence and predictors of anaemia in pregnancy among women attending the antenatal clinic (ANC) in a tertiary hospital located in the southwest, of Nigeria.

METHODS

A hospital-based descriptive cross-sectional study that utilized a semi-structured interviewer-administered questionnaire. The study was conducted between August and October 2023 and included all pregnant women attending the ANC at Federal Teaching Hospital Ido-Ekiti (FETHI). A total sample size of 277 was calculated using Leslie Fischer's formula. Participants were selected through systematic random sampling. Venous blood samples were taken for packed cell volume (PCV) analysis. IBM Statistical Package for the Social Sciences (SPSS) version 21 was used for data analysis, and the level of statistical significance was set at $p < 0.05$.

RESULTS

The majority (63.0%) were in the 25-34 age group. The prevalence of anaemia based on packed cell volume values, is 64.8%. Age group, spouse occupation ($\chi^2 = 37.741$, $p < 0.001$), respondents' occupation ($\chi^2 = 48.888$, $p < 0.001$), and family monthly income ($\chi^2 = 18.417$, $p < 0.001$) were associated with anaemia in pregnancy. Younger maternal age (15 -24years) is an independent predictor of anaemia in pregnancy.

CONCLUSION

Anaemia remains common among pregnant women receiving antenatal care. It is significantly associated with younger maternal age, low educational attainment, and poor household income. Context-specific strategies, with a strong focus on improving maternal nutrition and reinforcing social protection measures are required in low resource settings.

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INTRODUCTION

Anaemia is often formally diagnosed when the haemoglobin concentration drops below a certain threshold for age and sex. Anaemia arises when the red blood cell mass is insufficient to meet physiological oxygen-carrying demands, seen among pregnant women in many African societies.¹ Anaemia during pregnancy is defined as a haemoglobin concentration of less than 11.0 g/dL in the first trimester and less than 10.5 or 11.0 g/dL in the second or third trimester, depending on the protocol.² During pregnancy, anaemia is the most prevalent haematologic disorder, and maternal anaemia is linked to poor health outcomes for the foetus, newborn, and child.² In the tropics, a pregnant woman is considered anaemic if her PCV is less than 30% or her haemoglobin concentration is less than 10 g/dL.³ A good haemoglobin concentration during pregnancy is important to cater for increased physiological maternal oxygen demand and as a driving force for foetal growth and development.⁴ Pregnancy-related anaemia raises the risk of morbidity and death for both the mother and the unborn child.⁵ Premature birth, low birth weight, and foetal abnormalities are among the risks associated with anaemia during pregnancy, which can also have a negative impact on families and society.⁶

The incidence of anaemia among pregnant women participating in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) increased by 13% in the United States from 2008 (10.1%) to 2018 (11.4%), affecting approximately half of the WIC population.⁵

Anaemia was a moderate public health concern in 2018 for both pregnant non-Hispanic Black or African American women in general and those evaluated in the third trimester.⁵ According to a study on the global burden of anaemia in pregnancy, pregnant women in developing nations have much higher rates of anaemia than those in developed nations because of economic, social, and health factors. It also confirmed that the highest

prevalence of anaemia in pregnant women was found in Africa, where it was 41.7% (95% CI 32.3–49.4).⁶ Socio-economic conditions are known to affect maternal health outcomes, and they may also dictate the degree to which specific groups or tribes can withstand competing environmental and cultural influences.⁷ A study conducted in Kano and Lagos States, Nigeria, reported that iron deficiency anaemia accounted for 41% of cases of moderate to severe anaemia among women, with prevalence increasing as gestational age advanced.⁸ Another study at Federal Medical Center (FMC) in Keffi, Nigeria, reported that 42.5% of women attending the antenatal clinic (ANC) were anaemic, and most common blood film findings were consistent with microcytic anaemia.⁹

Despite the global and local prevalence of anaemia in pregnancy, identifying specific values among pregnant women attending antenatal clinics (ANC) in time and place is vital for clinical practice and policy-making, with the underlying goal of demystifying its complexity in any setting. Strengthening the alignment between clinical management and laboratory evidence is essential for enhancing clinical practice and reducing complications of pregnancy-related anaemia, especially in women from low- to middle-socioeconomic status. Existing research in Nigeria has not sufficiently examined how low- to middle-income socioeconomic status influences anaemia prevalence, severity, and outcomes. This study aimed to determine the prevalence of anaemia in pregnancy, and identify the predictors of anaemia in pregnancy among pregnant women attending the antenatal clinic (ANC) in a tertiary hospital located in the southwest of Nigeria

METHODS

The study is a hospital-based, descriptive, cross-sectional study conducted at a federal government-owned tertiary hospital in Ido-Ekiti, Ekiti State, southwest Nigeria. Ekiti State is entirely located in the tropics, with a total land Area of 5887.890sq km.¹⁰

Table 1a: Socio-demographic Characteristics of Respondents

Variable	Frequency N = 270	Percentage (%)
Age Group (in years)		
15 – 24	45	16.7
25 – 34	170	63.0
35 – 44	55	20.4
<i>Mean age ± SD</i>	<i>29.8 ± 5.7</i>	
<i>Range</i>	<i>18 – 44</i>	
Tribe		
Yoruba	197	73.0
Igbo	35	13.0
Hausa	28	10.4
Others	10	3.7
Level of Education		
No Formal Education	28	10.4
Primary	22	8.1
Secondary	56	20.7
Tertiary	164	60.7
Occupation of respondents		
Trading	150	55.6
Non-Governmental/Private Organization	43	15.9
Governmental Employer	71	26.3
Unemployed	6	2.2

There are sixteen Local Government Councils in Ekiti State, one of which is Ido-Osi Local Government, where the study took place from August to October, year 2023.¹⁰ Ido-Ekiti is a town in Ido-Osi Local Government Area, with an estimated population of approximately 200,000, of whom 91,000 are female (49.1%).¹¹

Study Population

The study population comprised 277 pregnant women who attended antenatal care services at the Federal Teaching Hospital, Ido-Ekiti, from August to October 2023. Inclusion criteria include all pregnant women aged 15-49 years attending ANC at the same hospital during the first, second, and third trimesters, irrespective of parity or booking status. Twice weekly, on Tuesdays and Thursdays, the Department of Obstetrics and Gynaecology operates the ANC, one of its service units, under the specialized medical supervision of qualified professionals. The clinic offers services such as health education, dietary guidance, immunization, screening (including HIV, Hepatitis B and C,

proteinuria, high blood pressure, high blood sugar, and venereal diseases), and treatment of common pregnancy-related illnesses. On average, the clinic sees 20-30 pregnant women per day. The study excluded women who were extremely ill or who tested positive for HIV, Hepatitis B, or Hepatitis C.

Sample Size Determination: The sample size was calculated using Leslie Fischer's formula for cross-sectional studies.¹²

$$n = \frac{Z^2 \times PQ}{d^2}$$

n = minimum sample size required

Z is the appropriate value for the standard normal deviation for the desired confidence =1.96

d = the level of significance or sampling error (0.05)

p = proportion of women with anemia in pregnancy based on a previous study conducted at a teaching hospital in Benin, Nigeria.¹³

Table 1b: Socio-demographic Characteristics of Respondents (continued)

Variable	Frequency N = 270	Percentage (%)
Occupation of spouse		
Trading	131	48.5
Non-Governmental/Private Organization	42	15.6
Governmental Employer	97	35.9
Religion		
Islam	67	24.8
Christianity	199	73.7
Others	4	1.5
Marital Status		
Single	11	4.1
Married	247	91.5
Divorced	5	1.9
Widowed	7	2.6
Number of Children		
Primigravida	64	23.7
1 – 3	178	65.9
>3	28	10.4
Approximate monthly family income		
<N50,000	73	27.0
N50,000 – N100,000	109	40.4
>N100,000 – 150,000	39	14.4
>N150,000	49	18.1

$q = 1-p$, proportion of women without anemia

$$n = 277.2 \approx 277.0$$

P is the estimated prevalence of 20.7%¹³

q is the probability which is $1 - P$,

Hence, the Final sample size is 277.

Substituting the above figures,

$$n = \frac{Z^2 \times PQ}{d^2}$$

$$n = \frac{1.96^2 \times 0.207 \times (1 - 0.207)}{0.050^2}$$

$$n = 252.0$$

Assuming a non-response of 10% among the required minimum sample size.¹²

$$10\% \times 252 = 25.2$$

$$\text{Therefore, } n = 252 + 25.2$$

Sampling Technique

The Federal Teaching Hospital, Ido-Ekiti, was purposively selected from the three teaching hospitals in the state for convenience. Study participants were recruited using systematic sampling on each clinic day, with a sampling interval of two, based on clinic attendance and the calculated sample size. Recruitment continued for eight weeks until the required sample size was reached.

Data Collection

Data were collected using a semi-structured interview administered by final-year medical students.

Table 2: Assessment of Anaemia in Pregnancy

Variable	Frequency N = 270	Percentage (%)
Aware of your previous packed cell volume (PCV)		
Yes	126	46.7
No	144	53.3
Conjunctiva pallor		
Not pale	202	74.8
Pale	67	24.8
Very pale	1	0.4
Buccal mucosa pallor		
Not pale	219	81.1
Pale	49	18.1
Very pale	2	0.7
Palmar pallor		
Not pale	217	80.4
Pale	52	19.3
Very pale	1	0.4
Severity of anaemia (PCV)		
Severe (<19%)	3	1.1
Moderate (19 – 26%)	31	11.5
Mild (27 – 33%)	141	52.2
Normal (>33%)	95	35.2
Mean PCV $\pm$ SD	29.8 $\pm$ 5.7	
Prevalence of anaemia		
Yes	175	64.8
No	95	35.2

The instrument was adapted from previously conducted studies on anaemia in pregnancy and tailored to incorporate relevant local contexts. The instrument has three sections: section A, which contains the socio-demographic characteristics of respondents such as age, tribe, education, religion, occupation, and income; section B, which focuses on questions related to some risk factors of anaemia in pregnancy; and finally, section C contains check boxes on clinical signs and symptoms of anaemia. The check boxes were completed appropriately by final-year medical students under the supervision of clinicians, following a general clinical examination of every participant in clean, safe, enclosed rooms with examination couches. The questionnaire was verbally translated from English into Yoruba (the local language in Ido-Ekiti) by Yoruba-speaking medical students, and subsequently translated back into English after interviewing some illiterate participants. These non-English-speaking respondents also thumb printed the consent form as

a means of giving consent to the study. Venous blood samples were collected from 270 participants (response rate = 97%) using a 2ml syringe with a sterile needle and an EDTA bottle. The blood samples were subsequently taken to the teaching hospital laboratory, where they were individually filled into 40mm capillary tubes, centrifuged at 5000 RPM (revolutions per minute) using a Lasany Hematocrit Centrifuge for 5 minutes, and then read using a Hawksley haematocrit reader at standard room temperature and pressure. The packed cell volume values for each numbered bottle were recorded and entered into the space provided in the corresponding questionnaire, which carried the same number.

Data Management

The collected data were sorted, coded, cleaned and entered into IBM Statistical Package for Social Sciences (SPSS) version 21.0 for analysis. The study's results were presented using tables and frequencies at the univariate level.

Table 3a: Socio-demographic and Obstetric Factors Associated with the Prevalence of Anaemia in Pregnancy.

Variable	Anaemia Yes (%)	No (%)	Chi square	p-value
Age Group (in years)				
15 – 24	36 (80.0)	9 (20.0)	7.130	0.028
25 – 34	109 (64.1)	61 (35.9)		
35 – 44	30 (54.5)	25 (45.5)		
Tribe				
Yoruba	130 (66.0)	67 (34.0)	5.654	0.130
Igbo	18 (51.4)	17 (48.6)		
Hausa	18 (64.3)	10 (35.7)		
Others	9 (90.0)	1 (10.0)		
Level of Education				
No Formal Education	25 (89.3)	3 (10.7)	26.435	<0.001
Primary	19 (86.4)	3 (13.6)		
Secondary	44 (78.6)	12 (21.4)		
Tertiary	87 (53.0)	77 (47.0)		
Occupation of respondents				
Trading	119 (79.3)	31 (20.7)	48.888	<0.001
Non-Governmental/Private Organization	10 (23.3)	33 (76.7)		
Governmental Employer	41 (57.7)	30 (42.3)		
Unemployed	5 (83.3)	1 (16.7)		
Occupation of spouse				
Trading	109 (83.2)	22 (16.8)	37.741	<0.001
Non-Governmental/Private Organization	20 (47.6)	22 (52.4)		
Governmental Employer	46 (47.4)	51 (52.6)		
Religion				
Islam	47 (75.8)	15 (24.2)	4.275	0.118
Christianity	122 (61.6)	76 (38.4)		
Others	6 (60.0)	4 (40.0)		
Marital Status				
Single	10 (90.9)	1 (9.1)	5.591	0.133
Married	155 (62.8)	92 (37.2)		
Divorced	4 (80.0)	1 (20.0)		
Widowed	6 (85.1)	1 (14.3)		
Number of Children				
None	46 (71.6)	18 (28.1)	2.997	0.223
1 – 3	114 (64.0)	64 (36.0)		
>3	15 (53.6)	13 (46.4)		

Chi-square and binary logistic regression were used in the bivariate and multivariate analyses, respectively. The level of statistical significance was set at $p < 0.05$.

Ethical considerations

Ethical approval was obtained from the Human Research and Ethics Review Committee of the Federal Teaching Hospital, Ido-Ekiti, before the commencement of the study. The clearance certificate bears the protocol number ERC/2023/07/31/1012B. Permission was obtained

from the head of the Department of Obstetrics and Gynaecology and the consultants responsible for various antenatal clinics to ensure a smooth data collection process. All study participants provided written informed consent by signing or thumb-printing the consent form. This was obtained after each pregnant woman had been given a complete explanation of the study and its purpose. Participants who declined to participate in the study or who were unwilling to allow venous blood

Table 3b: Socio-demographic and Obstetric Factors Associated with the Prevalence of Anaemia in Pregnancy (continued)

Variable	Anaemia Yes (%)	No (%)	Chi square	p-value
Approximate monthly family income				
<N50,000	51 (69.9)	22 (30.1)	18.417	<0.001
N50,000 – N100,000	82 (75.2)	27 (24.8)		
>N100,000 – 150,000	21 (53.8)	18 (57.1)		
>N150,000	21 (42.9)	28 (57.1)		
Gravidity				
Primigravida	32 (69.6)	14 (30.4)	0.549	0.459
Multigravida	143 (63.8)	81 (36.2)		
Gestational Age (months)				
1 – 3	15 (46.9)	17 (53.1)	6.751	0.034
4 – 6	110 (70.1)	47 (29.9)		
7 – 9	50 (61.7)	31 (38.3)		
History of bleeding during this pregnancy				
Yes	54 (68.4)	25 (31.6)	0.614	0.433
No	121 (63.4)	70 (36.6)		
Number of ANC visits during this pregnancy				
Once	42 (65.6)	22 (34.4)	8.463	0.037
2 times	62 (66.0)	32 (34.0)		
3 times	35 (79.5)	9 (20.5)		
> 4 times	36 (52.9)	32 (47.1)		

collection for PCV assessment were respectfully excluded. Confidentiality was ensured throughout the study. The principal researcher labeled the questionnaires with serial numbers anonymously and later matched them to the sample bottle numbers. Respondents' privacy was ensured during the administration of questionnaires, as interviews were conducted in confined areas and consulting rooms within the ANC building. The collected data was stored in a locked office and later on a laptop protected by a strong password.

RESULTS

Table 1 shows the socio-demographic characteristics of respondents. Most respondents (63.0%) were in the 25-34 age group, with an age range of 18-44 years and a mean of 29.8±5.7 years. The majority (73.0%) were Yoruba, and over two-thirds (60.7%) had attained tertiary education.

About 73.7% of respondents were Christians; 91.5% were in a marital union; approximately 66.0% had 1 - 3 children; and less than half (40.4%) had a monthly income between N50,000 and N100,000. Over half of the respondents (53.3%) were unaware of their PCV values following previous ANC visits, compared with 46.7% who were aware. The majority (74.7%) of the women did not have conjunctival pallor, whereas 18.0% and 19.0% had buccal mucosa pallor and palmar pallor, respectively. Regarding the severity of anemia, approximately 35.2% had a normal PCV (>33%). About half (52.2%) of the women had mild anemia with a PCV value below 33.0% (27-33%), while 11.5% had moderate anemia (19- 26%), and finally, a minority (1.0%) had severe anemia with a PCV value less than 19.0%. The prevalence of anemia was 64.8% based on packed cell volume

Table 4: Binary Logistic Regression for the Predictors of Anaemia in Pregnancy

Variable	AOR	95% CI for AOR		p-value
		Lower	Upper	
Age Group (in years)				
15 – 24	15.394	3.092	76.635	0.001
25 – 34	3.880	1.504	10.008	0.005
35 – 44	1.000			
Level of Education				
No Formal Education	10.469	2.191	50.021	0.003
Primary	7.331	1.357	29.528	0.019
Secondary	2.341	0.729	24.177	0.174
Tertiary				
Occupation of respondents				
Trading	5.919	0.403	17.043	0.136
Non-Governmental/Private Organization	0.604	0.035	10.555	0.247
Governmental Employer	5.068	0.736	19.126	0.396
Unemployed/Full housewife	1.000			
Occupation of spouse				
Trading	4.933	0.725	23.358	0.745
Non-Governmental/Private Organization	1.712	0.580	5.058	0.656
Governmental Employer	1.000			
Approximate monthly family income				
<N50,000	3.298	1.365	10.935	0.025
N50,000 – N100,000	1.608	0.533	4.852	0.652
>N100,000 – 150,000	2.813	0.781	10.140	0.347
>N150,000	1.000			
Gestational Age (months)				
1 – 3	1.225	0.325	4.610	0.765
4 – 6	1.346	0.564	3.211	0.503
7 – 9	1.00			
Number of ANC visits during this pregnancy				
Once	0.555	0.170	1.817	0.331
2 times	0.686	0.216	2.182	0.523
3 times	0.504	0.130	1.867	0.412
>3 times	1.000			

AOR: Adjusted Odd Ratio, p<0.05

(PCV) measurements from venous blood samples. Conversely, those who were not anaemic, having a normal PCV (>33%) constituted 35.2% of the participants (Table 2). Table 3 shows the relationship between socio-demographic characteristics, obstetric factors and prevalence of anaemia in pregnancy. Age group ($\chi^2= 7.130$, $p=0.028$), spouse occupation ($\chi^2= 37.741$, $p<0.001$), respondents' occupation ($\chi^2= 48.888$, $p<0.001$), and family monthly income ($\chi^2= 18.417$, $p<0.001$) were found to be associated with anaemia

in pregnancy and were all statistically significant. The predictors of anaemia in pregnancy among pregnant women attending ANC are shown in Table 4. Pregnant women in the age group 15 to 24 years were 15 times (AOR = 15.394, $p = 0.001$) more likely to be anaemic than their older counterparts. Education was an independent predictor, where those with no formal education were 10 times more likely to be susceptible to anaemia (AOR = 10.469, $p = 0.003$), and those with primary education were 7 times more likely to be

anaemia (AOR = 7.331, $p = 0.019$) compared to their peers with tertiary education who were not susceptible. In addition, pregnant women with an approximate monthly family income of less than 50,000 naira were 3 times more likely to develop anaemia in pregnancy than pregnant women whose families were earning over N150,000 per month.

DISCUSSION

The prevalence of anaemia in pregnancy in this study was high (64.8%), relatively higher than the global average value of 41.7%.⁶ Such a higher value seen in this study can be a reflection of low socio-economic living within the community, showing poor nutritional states of childbearing and pregnant mothers who need a balanced diet and iron supplements in sufficient quantities, along with the recommended dietary allowance. The higher prevalence can also be attributed to a lack of knowledge among Ido-Ekiti women about blood-building foods and fruits that are essential during pregnancy. Studies have demonstrated that social values and cultural norms significantly contribute to the occurrence of anaemia among pregnant women, particularly in low- and middle-income settings.^{15,16,17} These socio-cultural values can be systematically identified and constructively addressed during antenatal care (ANC) visits through culturally sensitive counselling and community-based interventions by healthcare providers. A study conducted in a teaching hospital in Calabar, South-South Nigeria, reported a significantly high prevalence of anaemia (59.6%) among first-time antenatal clinic attendees who also had asymptomatic malaria parasitaemia. The severity of anaemia was significantly associated with the use of antimalarials before booking.⁴ Another study done in the Tamale teaching hospital in Ghana, a country located in a similar West African region, found that about half (50.8%) of the Ghanaian respondents had anaemia in pregnancy, and women in their third trimester were four times more likely to be anaemic during pregnancy.¹⁸ A study in rural Malawi discovered that anaemia among pregnant women was unacceptably high

(72%), higher than the value identified in this research.¹⁸ Anaemia during pregnancy was confirmed as a public health issue in several nations in 2019, with prevalence rates ranging from 5.2 to 65.7% globally.²⁰ Such public health problems cannot be overlooked by clinicians, women of reproductive age, and policymakers via concerted efforts at all levels of care during pregnancy. Pregnant women aged 15 – 24 years were significantly more likely to be anaemic, as this younger age group is an independent predictor of anaemia in pregnancy. This finding is similar to the result of a study done among pregnant women in four primary health centers in Ogun State, where the frequency of anaemia in pregnancy was higher among the younger age group, 25 to 29 years.²¹ This younger age factor may be because many women in this age group may be pregnant for the first time and may not be adequately prepared or armed with knowledge on the importance of religious intake of iron supplements, foods and feeding patterns that may prepare the body against developing anaemia in pregnancy. Additionally, respondents with no formal education were twice as likely to develop anaemia in pregnancy as respondents with formal education. Similarly, a study in Ethiopia revealed that women with no education were twice as likely to be anaemic.^{20,21} In Mali, a cross-sectional study similarly found a high prevalence of anaemia to be 63.5% among pregnant women in all three trimesters, and many of the women with secondary education, and those who had access to mass media, were less likely to be anaemic.²⁴ Also, low family income was a significant predisposing factor for anaemia in pregnancy, as respondents earning less than 50,000 naira were more likely to develop anaemia. Similarly, anaemia was found to be significantly and independently associated with educational level and socio-economic class among women attending ANC in FMC Keffi, Nigeria.⁹ Limited income may restrict access to adequate food, preventing women and their families from achieving a balanced diet or meeting the Recommended Dietary Allowance (RDA)

necessary for the optimal health of both mother and fetus.¹⁴ Green leafy vegetable consumption among pregnant women in Kano and Lagos was found to be protective against iron deficiency anaemia, whereas consumption of soya bean and kaolin clay-based foods increased the odds of developing anaemia.⁸ Likewise, in the United States of America, anaemia remains a concern for low-income women, highlighting the significance of initiatives to ensure that these women have access to healthy, iron-rich diets both before and during pregnancy.⁵ A multicenter retrospective study in China, though with quite a lower overall prevalence value of 23%, also attests to this research finding that low per capita family income is a very potent determinant of anaemia in pregnancy among childbearing women.²⁵ Nigerian studies also highlight the importance of eating iron-rich foods during pregnancy as an essential approach to reducing anaemia, which mainly results from iron deficiency anaemia.^{8,9} Addressing anaemia in pregnancy effectively involves a comprehensive strategy that combines community health education, enhanced access to affordable healthcare services, and policy initiatives aimed at overcoming systemic barriers responsible for its high prevalence.²⁶

Hence, programmes targeted at improving maternal nutrition and socio-economic wellbeing of women in their childbearing age must be at the forefront as part of the public health solution mix against the chronically high prevalence of anaemia in pregnancy documented in many developing nations.

STRENGTHS AND LIMITATIONS

This cross-sectional study provides PCV values and comprehensive clinical assessments of childbearing women attending ANC at a tertiary healthcare institution in Ekiti State. The standardized procedures used are reproducible, allowing comparison with similar studies and supporting evidence-based public health interventions. However, the study design limits the generalizability of the findings. Illiteracy was

observed in 18% of respondents, requiring translation of the instrument and additional efforts to obtain informed consent.

CONCLUSION

The prevalence of anaemia is high among pregnant women attending ANC at the tertiary hospital. Younger age, lack of formal education, and low monthly household income were significant predictors of anaemia in pregnancy among women of reproductive age in a southwestern state of Nigeria. Clinicians, health sector stakeholders, and policymakers must prioritize strategies tailored to specific contexts to address anaemia in pregnancy. Emphasis should be placed on ensuring dietary adequacy and enhancing social safety nets as primary interventions in numerous developing nations.

DECLARATIONS

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the originality of the work reported in this paper.

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AUTHOR CONTRIBUTIONS

AOO- research conceptualization, study design, manuscript drafting, and final manuscript revision. OJO, AA- team coordination from start to finish, editing of manuscript. BSA, FEL, AEE, ABA, EBA, ECM, IAE, NEU, OVG, AA- manuscript writing, data gathering, data analysis, data protection, and proofreading.

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