Research

Prevalence of Anaemia in pregnancy and its associated factors in Akwa Ibom state, Nigeria

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Abstract

Background: Anaemia in pregnancy affects over half of the pregnant women in low- and middle-income countries. It poses specific risks to both mother and foetus. This study set out to assess the prevalence of anaemia and its prevailing risk factors among pregnant women in rural and urban areas of Akwa Ibom state, Nigeria.

Methods: The study was a cross-sectional study. An interviewer-administered semi-structured questionnaire was used to obtain data. Descriptive statistics were presented in tables and figures. A haemoglobin level less than 11g/dl was classified as anaemia. Chi-square test and Fisher's exact were performed to examine the relationship between categorical variables. Statistical significance was set at a *p* value of 0.05.

Results: An equal number of urban and rural respondents (90) participated in this study. The average haemoglobin level was 10.80±1.25g/dl and 10.35±1.79g/dl for urban and rural respondents respectively. Majority of the respondents were anaemic (61.1%), with 49.1 of these having mild anaemia and 50.9% having moderate anaemia. The average daily dietary intake of iron was 17.7mg (6.1-37.8mg), and there was no significant difference between the iron intake of urban and rural respondents. Among the sociodemographic, obstetric and dietary factors evaluated, only pregnancy trimester was significantly associated with anaemia in pregnancy among urban respondents.

Conclusion: This study found alarmingly high prevalence of anaemia. This calls for promotion and implementation of proper nutrition education in pregnancy. These findings also support the need to strengthen policies on implementation of the continuous administration of iron and folic acid supplements as a routine ANC drug in health facilities.

Keywords

Anaemia, Pregnancy, Iron intake, Nutrient supplement, Rural, Urban, Nigeria

Introduction

Anaemia is one of the most intractable public health problems in developing countries and the commonest complication in pregnancy in sub-Saharan Africa[1]. Anaemia is present when blood haemoglobin is below the reference value for age, sex and location[2]. The WHO defines anaemia in pregnancy (AIP) as haemoglobin less than 11g/dl, and classifies it into mild, moderate and severe (10-10.9, 7-9.9 and <7g/dl respectively)[2]. Over 40% of pregnant women globally suffer from AIP.[3] Furthermore, it affects over half of the pregnant women in low- and middle-income countries, with the highest being in sub-Saharan Africa (57%), followed by South East Asia (48%)[1]. With recent estimates in Nigeria, the prevalence of AIP ranges from 12.3% to 45.6% [4–6].

The most common cause of anaemia in pregnancy is iron deficiency, followed by folate deficiency. Iron deficiency anaemia (IDA) may be caused by inadequate dietary intake of iron containing foods; inadequate child spacing or from blood loss during pregnancy[7]. The recommended iron intake is 27 mg per day for all pregnant women[8,9]. IDA is defined as anaemia accompanied by depleted iron stores and signs of a compromised supply of iron to the tissues[10]. Other causes of anaemia in pregnancy include nutritional deficiencies such as folate and vitamin B12 deficiencies, as well as chronic medical conditions such as sickle cell disease, chronic kidney disease, chronic liver disease and haematological malignancies[10].

In addition to the general consequences of anaemia, AIP poses specific risks to both mother and foetus such as intra-uterine growth retardation, premature birth, and higher risk for peripartum blood transfusion with its attending complications[6,11]. Furthermore, studies have shown that maternal IDA is associated with reduced foetal iron stores, and infants born to anaemic mothers usually have low iron stores with increased risk of developing anaemia in infancy[12]. Prenatal IDA has also been seen to impact child mental development[13].

Disparities in the prevalence of anaemia between rural and urban dwellers in developing countries exist due to their socioeconomic and sociocultural factors[14–16]. In Akwa Ibom state, the prevalence of anaemia among pregnant women was found to be as high as 54.5%[17]. Although no rural-urban comparison has been made previously in the state, the neighbouring state of Cross River reported a higher prevalence of anaemia among rural pregnant women when compared with their urban counterparts[16]. This study set out to assess the prevalence of anaemia in pregnancy and its prevailing risk factors among pregnant women in rural and urban areas of Akwa Ibom state, Nigeria. This will help to inform policies on preventive strategies and optimization of pregnancy outcomes among women in Nigeria.

Methodology

Study setting: The study was conducted in Uyo senatorial district, Akwa-Ibom State located in southern Nigeria. The State has a projected population of 6 million based on the National population commission census figures of 2006 and 85% live in the rural areas[18]. There are 31 Local Government Areas (LGAs) in Akwa Ibom, grouped into three senatorial districts: North East (Uyo senatorial District), North West (Ikot Ekpene Senatorial district) and South (Eket senatorial district). Uyo senatorial district comprises of nine LGAs. Uyo is the State capital, and is located between the coordinates 05^0 00N and $07^0$50E[18].

Study design and population: This study used a cross sectional, comparative study design.

Eligibility criteria: All pregnant women between 18 and 49 years of age, at any stage of gestation utilizing antenatal care services within the selected primary health centres, who gave consent to participate in the study were included. Participants had to have been resident in Akwa Ibom State for at least six months. All pregnant women with known diagnosis of haemoglobinopathies and other chronic infectious diseases that could result in anaemia such as HIV/AIDs, tuberculosis, chronic kidney diseases were excluded from this study.

Sample size:

The sample size for the study was determined using the formula for the comparison of two independent proportions[19].

$$N = \frac{2\times(Z_\alpha + Z_\beta)^2 \times [p_1(1-p_1) + p_2(1-p_2)]}{(p_1 - p_2)^2}$$

Where:

N = the sample size (for each group); Z_α = the standard normal deviate for the desired confidence level; Z_β = the standard normal deviate for the desired statistical power; p_1 and p_2 =the anticipated values of the proportions in the two populations; $(p_1 - p_2)$ = the minimum expected difference between the two proportions.

Z_α= 1.96 for α= 0.05 (two tailed); Z_β = 0.84 i.e., power of 80%; p_1 – Proportion of rural pregnant women with anaemia; p_2 – Proportion of urban pregnant women with anaemia

Therefore, using the prevalence of anaemia in rural pregnant women (48%) and urban pregnant women (20%) from a previous study in Calabar, Nigeria[16].

p_1= 0.48; p_2= 0.20

$$N = \frac{2\times(1.96+0.84)^2 \times [0.48(1-0.48) + 0.20(1-0.20)]}{(0.48-0.20)^2}$$

$$N = \frac{2\times 7.84\times[0.4096]}{0.0784}$$

$$N = \frac{6.3898}{0.0784}$$

N = 81.5

With a non-response rate of 10% added, the minimum sample size for the study was *89.6 ≈ 90*

Therefore, the minimum sample size of **90** participants was required for rural pregnant women and **90** participants for urban pregnant women. A total of 180 pregnant women were studied in all.

Sampling Technique: Multistage sampling was used for this study. The first stage involved selecting three LGAs out of the nine LGAs present in Uyo senatorial district by simple random sampling (balloting). This resulted in the selection of Uruan, Itu and Uyo LGAs. Three rural and urban PHCs respectively out of a total of 11 rural and 6 urban PHCs present in the three selected LGAs were then selected, also by simple random sampling (balloting). The selected PHCs were: Urban - PHC Base, Uyo; PHC Aka Offot; PHC West Itam, Itu. Rural - PHC Ndon Ebom, Uruan; PHC Ikot Otoinyie, Uruan; PHC Ntak Inyang Itam, Itu.

The third stage involved the selection of study participants. Respondents in each PHC were recruited consecutively into the study provided they met the inclusion criteria and consented to the study. For the urban facilities, two (2) ANC clinic days per facility was used with an average of twenty (20) respondents seen per ANC clinic day. Whereas, in the rural facilities, an average of four (4) ANC days per facility was used with an average of eight (8) respondents seen per ANC clinic day.

Study Instruments and Variables: A pre-tested, semi-structured and interviewer-administered questionnaire was used to obtain information on the sociodemographic characteristics and dietary intake of the respondents. The questionnaire was written in English language and communicated verbally in English and the local language where necessary by the trained interviewers. To estimate the 24-hour iron intake, the information on the approximate weight (grams) of every food consumed within 24 hours by the study participants was recorded by showcasing an approximated size of various food using premeasured and weighed food models during the data collection to enable the study participants quantify the size and weight of the different foods consumed within the 24 hours duration. The recommended nutrient intake for iron in pregnancy was taken as 27mg [8].
Haemoglobin level was assessed using an Omron Digital Hemoglobinometer. Finger prick method was used, whereby, participants first fingers were cleaned with methylated spirit, allowed to dry, and then pierced with a sterile lancet. About 2.5 millilitres of blood sample was collected into a capillary tube and haemoglobin values were read through a battery powered hemoglobinometer. This is the recommended method by WHO for assessing for anaemia in pregnant women in settings where full blood count cannot be done due to cost or lack of equipment[20]. Anaemia was taken as haemoglobin concentration of less than 11g/dl. It was classified as mild (10-10.9g/dl), moderate (7-9.9g/dl) and severe (<7g/dl).

Data Analysis: Data was coded and entered into IBM SPSS version 22.0. Descriptive statistics: Frequencies, proportions and means were calculated and presented as tables and charts and compared between the two groups. Inferential statistics: Fisher's exact and Chi-square test were used to test for association between categorical variable, while Mann-Whitney U test was used for comparison of median. Level of significance was placed at 0.05.

Ethical Concerns: Ethical approval was obtained from the Ministry of Health, Akwa Ibom (MH/PRS/99/VOL.V/641) and the Health Research and Ethics Committee of University of Uyo Teaching Hospital (UUTH/AD/S/96/VOL.XXI/282). Approval was also obtained in writing from the council authorities of the selected LGAs. Written informed consent was obtained from each participant with respect to voluntary participation and freedom to discontinue the interview at any stage. The rights, anonymity and confidentiality of the respondents were respected at all phases of the study by the interviewers, and no identifying information was obtained from the participants.

Result

A hundred and eighty pregnant women participated in this study (rural-90, urban-90). As shown in table 1, most respondents were below 30 years, with a mean age of 27.39 ± 4.69. Majority were married (93.9%), had obtained secondary level of education (61.7%) and were mostly business owners (48.9%). Similarly, majority of the spouses also attained secondary level of education (58.9%) and were business owners (48.3%). Most of the respondents reported an average monthly household income of less than ₦40,000 (70.6%). The result further reveals that pregnant women in the urban and rural areas were comparable in age, marital status, main occupation, and household income. However, they differed in educational status (p=0.004). About 31% of urban versus 13.1% of rural respondents had at least a tertiary education. Educational level and main occupation of the spouses were not significantly different across the two group

Table 1. Socio-demographic Characteristics of the Respondents by Place of Residence

Characteristics	Urban (N/%) N=90	Rural (N/%) N=90	Total (N/%) N=180	Test statistics/p value
Age (years)				
<30	58 (64.4)	64 (71.1)	122 (67.8)	χ^2= 0.900
≥30	32 (35.6)	26 (44.8)	58 (32.2)	P= 0.638
Mean (x)±SD	27.48±4.48	27.31±4.91	27.39±4.69	t=0.916; p=0.339
Marital status				
Single	6 (6.7)	5(5.6)	11(6.1)	χ^2= 0.097
Married	84(93.3)	85 (94.4)	169(93.9)	

Characteristics	Urban (N/%) N=90	Rural (N/%) N=90	Total (N/%) N=180	Test statistics/p value
				P= 0.756
Respondents' Level of education				
Primary or less	9 (10.0)	20 (22.2)	29 (16.1)	χ^2=8.229
Secondary	53 (58.9)	58 (64.4)	111 (61.7)	P=0.005*
Tertiary and above	28 (31.1)	12 (13.3)	40(22.2)	
Respondents' Main occupation				
Business owner	48 (53.3)	40 (44.4)	88 (48.9)	χ^2=3.304
Civil servant	9 (10.0)	7 (7.8)	16 (8.9)	p=0.347
Technician/Agric worker	21 (23.3)	32 (35.6)	53 (29.4)	
Unemployed	12 (13.3)	11 (12.2)	23 (12.8)	
Husbands' Level of education				
Primary or less	8 (8.9)	11 (12.2)	19 (10.6)	χ^2=3.168
Secondary	49 (54.4)	57 (63.3)	106 (58.9)	p=0.075
Tertiary and above	33 (36.7)	22 (24.4)	55 (30.6)	
Husbands' Main occupation				
Managers/Business owner	42 (46.7)	45 (50.0)	87 (48.3)	Fishers exact
Civil servant	21 (23.3)	11 (12.2)	32 (17.8)	p=0.053
Technician/Agric worker	21 (23.3)	32 (35.6)	53 (29.4)	
Unemployed	6 (6.7)	2 (2.2)	8 (4.4)	
Monthly household income (₦)				
<40,000	58 (64.4)	69 (76.7)	127 (70.6)	χ^2= 3.236
>40,000	32 (35.6)	21 (23.3)	53 (29.4)	p=0.072

*=statistically significant.

Majority of the urban respondents were in their second trimester (48.9%), while majority of rural respondents were in their third trimester (47.7%). Most respondents commenced antenatal clinic in their second trimester (45.0%) and had singleton pregnancies (78.3%). A higher proportion of rural (68.9%) versus 46.7% of urban respondents reported that they received nutritional education (p=0.003). Over three-quarters of the respondents (79.4%) had received any form of supplements and significantly more rural respondents (83.3%) reported receiving supplements compared to urban (75.6%), p=0.003. Most respondents reported that they received folic acid supplements (72.8%), multivitamins (68.3%) and iron supplement (58.9%). However, most did not know if they received de-worming medication (66.1%). A higher proportion of rural (83.3%) respondents affirmed that they received multivitamin tablets compared to urban (53.3%); p=0.000. Whereas more urban respondents (72.2%) reported that they received iron supplement compared to rural (46.5%); p=0.000 (table 2).

Table 2. Pregnancy Related Characteristics of Respondents by Place of Residence

Pregnancy related characteristics	Urban (N/%) N=90	Rural (N/%) N=90	Total (N/%) N=180	Test statistic/p value
Gestational age (months)				
1-3	9 (10.0)	14 (15.6)	23 (12.8)	
4-6	44 (48.9)	33 (36.7)	77 (42.8)	χ^2=3.108
7-9	37 (41.1)	43 (47.7)	80 (44.4)	p=0.211
Parity				
0	35 (38.9)	40 (44.4)	75 (41.7)	χ^2=0.895
1-3	45 (50.0)	39 (43.3)	84 (46.7)	p=0.667
4-6	10 (11.1)	11 (12.3)	21 (11.6)	
Gestational age at booking (month)				
1-3	44 (48.9)	35 (38.9)	79 (43.9)	χ^2=2.025
4-6	36 (40.0)	45 (50.0)	81 (45.0)	p=0.363
7-9	10 (11.1)	10 (11.1)	20 (11.1)	
Singleton or multiple pregnancy				

Pregnancy related characteristics	Urban (N/%) N=90	Rural (N/%) N=90	Total (N/%) N=180	Test statistic/p value
Singleton	71 (78.9)	70 (77.8)	141 (78.3)	χ^2=0.129
Multiple	19 (21.1)	20 (22.2)	39 (21.7)	p=0.720
Received nutrition education during current pregnancy.				
Yes	42 (46.7)	62 (68.9)	104 (57.8)	χ^2=9.109
Not sure	48 (53.3)	28 (31.1)	76 (42.2)	p=0.003*
Receive any Supplements during this Pregnancy				
Yes	68 (75.6)	75 (83.3)	143 (79.4)	χ^2=5.724
No	22 (24.4)	15 (16.7)	37 (20.6)	p=0.017*
Receive iron supplement.				
Yes	65 (72.2)	41 (46.5)	106 (58.9)	χ^2 =19.087
No	25 (27.8)	49 (54.4)	63 (41.1)	p=0.000*
Receive folic acid supplement.				
Yes	64 (71.1)	67 (74.4)	131 (72.8)	χ^2 =0.252
No	26 (28.9)	23 (25.6)	49 (27.2)	p=0.615
Receive multivitamin tablets.				
Yes	48 (53.3)	75 (83.3)	123 (68.3)	χ^2 =18.716
No	42 (46.7)	15 (16.7)	57 (31.7)	p=0.000*

*=statistically significant.

24-hour intake of dietary Iron

The average daily iron intake among all respondents was 17.7mg (6.1-37.8mg). There was no statistically significant difference between urban and rural respondents' iron intake (Mann-Whitney U-0.202; p=0.840). Urban respondents had an average daily iron intake of 18.1mg (7.8-35.3), while rural respondents had an intake of 17.2mg (6.1-37.8). Compared to the RNI of 27mg, urban and rural respondents consumed only 67.0% and 63.7% respectively of the RNI for iron in pregnancy.

Haemoglobin Concentration of Respondents

Respondents who attended antenatal care at urban primary health centres had a higher mean haemoglobin level (10.803±1.253g/dl) compared to those who attended antenatal care at rural primary health centres (10.353±1.79g/dl).

Majority of the respondents were anaemic (110, 61.1%), with 49 (54.4%) of urban respondents and 61 (67.8%) of rural respondents being anaemic. As illustrated in figure 1, 30% of rural and urban respondents respectively had mild anaemia, while a higher proportion of rural respondents were moderately anaemic (37.8%) compared to urban respondents (24.4%). There was no statistically significant difference in hemoglobin concentration between urban and rural respondents on bivariate analysis (χ^2=4.629; p=0.099).

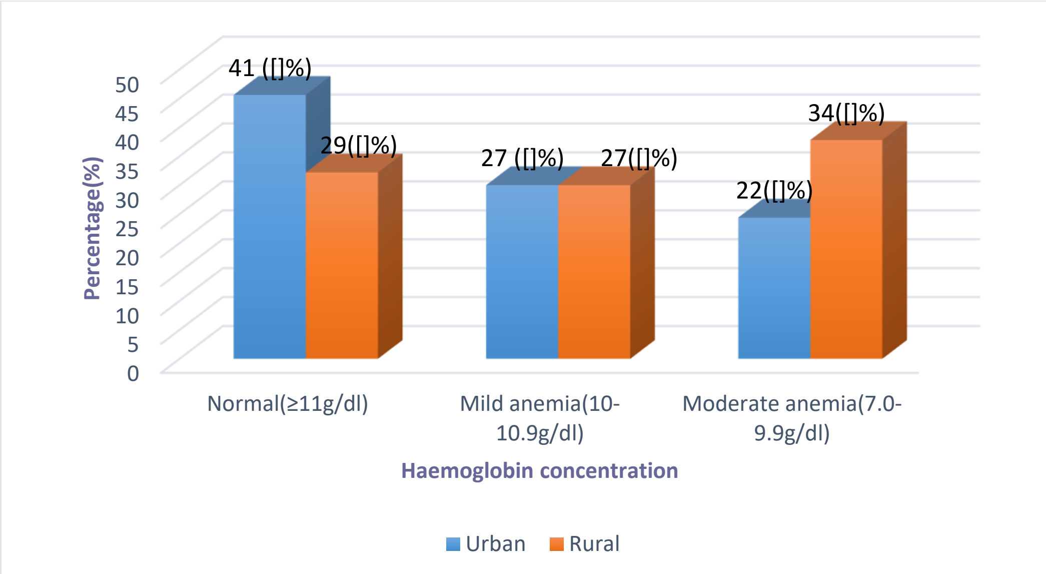

Fig 1. Haemoglobin concentration of rural and urban respondents

On bivariate analysis, no relationship between sociodemographic characteristics and haemoglobin concentration of both urban and rural respondents was statistically significant (Table 3).

Table 3. Haemoglobin Concentration by Sociodemographic Characteristics of Respondents

Characteristics	**Haemoglobin concentration (Urban)**			**Haemoglobin concentration (Rural)**		
	Normal n=41 (45.6%)	**Mild anaemia. n=27 (30.0%)**	**Moderate anaemia; n= 22 (24.4%)**	**Normal; n=29 (32.2%)**	**Mild anaemia; n=27(30.0%)**	**Moderate anaemia; n=34 (37.8%)**
Age (years)						
<30	27 (46.6)	15 (25.9)	16 (27.6)	20 (31.3)	18 (28.1)	26 (40.6)
>30	14 (43.8)	12 (37.5)	6 (18.8)	9 (34.6)	9 (34.6)	8 (30.8)
Test statistic/p value	x^2=1.625; P=0.444			x^2=0.800; P=0.670		
Respondents' Level of education						
Secondary or less	26 (41.9)	20 (32.3)	16 (25.8)	26 (33.3)	23 (29.5)	29 (37.2)
Tertiary	15 (53.6)	7 (25.0)	6 (21.4)	3 (25.0)	4 (33.3)	5 (41.7)
Test statistic/p value	x^2=1.063; P=0.616			Fisher's exact=0.206		
Respondents' Main occupation						
Managers/Business owner	20 (41.7)	16 (33.3)	12 (25.0)	14 (35.0)	11 (27.5)	15 (37.5)
Civil servant	2 (22.2)	3 (33.3)	4 (44.4)	2 (28.6)	2 (28.6)	3 (42.9)
Technician/Agric worker	12 (57.1)	5 (23.8)	4 (19.0)	8 (25.0)	11 (34.4)	13 (40.6)
Unemployed	7 (58.3)	3 (25.0)	2 (16.7)	5 (45.5)	3 (27.3)	3 (27.3)
Test statistic/p value	Fisher's exact=0.595			Fisher's exact=0.747		

Monthly household income (₦)						
<40,000	25 (43.1)	17 (29.3)	16 (27.6)	22 (31.9)	20 (29.0)	27 (39.1)
>40,000	16 (50.0)	10 (31.3)	6 (18.8)	7 (33.3)	7 (33.3)	7 (33.3)
Test statistic/p value	x^2=0.900; P=0.661			x^2=0.880; P=0.880		

Table 4 shows that among urban respondents, 37.8% of those with gestational age of 7-9 months had moderate anaemia compared to 13.6% of those with gestational age of 4-6 months and this was statistically significant (p=0.049). None of the relationships were significant for the rural participants.

Table 4. Haemoglobin Concentration by Selected Respondents' Characteristics

Characteristics	**Haemoglobin concentration (Urban)**			**Haemoglobin concentration (Rural)**		
	Normal; n=41 (45.6%)	**Mild anaemia; n=27 (30.0%)**	**Moderate anaemia; n= 22 (24.4%)**	**Normal; n=29 (32.2%)**	**Mild anaemia; n=27 (30.0%)**	**Moderate anaemia; n=34 (37.8%)**
Parity						
0	15 (42.9)	11 (31.4)	9 (25.7)	10 (25.0)	14 (35.0)	16 (40.0)
1-3	20 (44.4)	14 (31.1)	11 (24.4)	14 (35.9)	10 (25.6)	15 (38.5)
4-6	6 (60.0)	2 (20.0)	2 (20.0)	5 (50.0)	3 (25.0)	3 (25.0)
Test statistic/p value	Fisher's exact; p=0.939			Fisher's exact; p=0.567		
Gestational age(months)						
1-3	4 (44.4)	3 (33.3)	2 (22.2)	4 (28.6)	5 (35.7)	5 (35.7)
4-6	20 (45.5)	18 (40.9)	6 (13.6)	10 (30.3)	10 (30.3)	13 (39.4)
7-9	17 (45.9)	6 (16.2)	14 (37.8)	15 (34.9)	12 (27.9)	16 (37.2)
Test statistic/p value	Fisher's exact; p=0.049*			Fisher's exact; p=0.980		
Have you received nutrition education during this pregnancy?						
Yes	19 (45.2)	12 (28.6)	11 (26.2)	22 (35.5)	15 (24.2)	25 (40.3)
No	22 (45.8)	15 (31.3)	11 (22.9)	7 (25.0)	12 (42.9)	9 (32.1)
Test statistic/p value	Fisher's exact; p=0.927			χ^2=1.323; p=0.217		
Is your pregnancy singleton or multiple pregnancy?						
Singleton	31 (43.7)	22 (31.0)	18 (25.4)	20 (29.0)	23 (33.3)	26 (37.7)
Multiple	10 (52.6)	5 (26.3)	4 (21.1)	9 (42.9)	4 (19.0)	8 (38.1)
Test statistic/p value	Fisher's exact, p=0.843			Fisher's exact, p=0.400		
Did you receive iron supplements?						
Yes	28 (43.1)	21 (32.3)	16 (24.6)	16 (39.0)	12 (29.3)	13 (31.7)
No	13 (52.0)	6 (24.0)	6 (24.0)	13 (26.5)	15 (30.6)	21 (42.9)
Test statistic/p value	χ^2=0.734; p=0.655			χ^2=0.643; p=0.414		
Did you receive folic acid supplements?						
Yes	30 (46.9)	18 (28.1)	16 (25.0)	25 (37.3)	20 (29.9)	22 (32.8)
No	11 (42.3)	9 (34.6)	6 (23.1)	4 (17.4)	7 (30.4)	12 (52.2)
Test statistic/p value	χ^2= 0.372; P=0.832			Fisher's exact; p=0.153		
Did you receive multivitamin supplement?						
Yes	19 (39.6)	17 (35.4)	12 (25.0)	27 (36.0)	22 (29.3)	26 (34.7)
No	22 (52.4)	10 (23.8)	10 (23.8)	2 (13.3)	5 (33.3)	8 (53.3)
Test statistic/p value	χ^2=1.824; P=0.402			Fisher's exact; p=0.195		

Iron Intake						
Low	33(45.8)	22(30.6)	17(23.6)	23(31.1)	22(29.7)	29(39.2)
Adequate	8(44.4)	5(27.8)	5(27.8)	6(37.5)	5(31.3)	5(31.3)
Test statistic/p value	χ^2=0.145; p=0.930			χ^2=0.398; p=0.820		

*= statistically significant

Discussion

This study aimed to assess and compare the current prevalence of AIP and its associated factors among pregnant women in rural and urban areas of Uyo, Akwa Ibom state. Overall, the study found that most of the respondents were anaemic, with a higher proportion of rural respondents being anaemic compared to urban respondents. Mild anaemia was the commonest type of anaemia, followed by moderate anaemia. No respondent had severe anaemia. Among both urban and rural respondents, the average dietary intake of iron was low. However, while a high proportion of urban respondent took iron supplements, less than half of the rural respondents did. Regarding factors associated with anaemia in the study population, only trimester showed a significant association with the presence of anaemia.

The mean haemoglobin of both urban and rural respondents in the present study was below the normal haemoglobin levels in pregnancy, with urban respondents having higher hemoglobin levels. Similar result was seen in a hospital-based study in Kano state, where mean haemoglobin was 10.76g/dl±1.30[21]. A study in Ghana also reported a higher mean haemoglobin among urban respondents, (11.4g/dl±0.51 for urban and 10.44g/dl±0.10 for rural)[15]. Overall, over three-fifth of the study respondents were anaemic. This is similar to the WHO estimate for AIP in Nigeria (55.9%)[22], as well as to findings in a previous study in Akwa Ibom state, Nigeria (54.5%)[17]. However, it is higher than findings in other studies in Nigeria reporting prevalence of 25.0% to 34.5% [5,23], Uganda, 22.1% [24] and 33% in Ghana[25]. The high prevalence of AIP measured in our study population may be caused by low uptake or non-compliance with iron and folic acid supplementation, and low dietary iron intake. Furthermore, interventions employed to reduce anaemia in pregnancy in different locations may be responsible for the varied prevalence reported.

AIP has been linked with higher likelihood of maternal and perinatal deaths, preterm birth, preeclampsia, low birth weight, small-for-gestational-age, and operative delivery[26–28]. Low birth weight, a common complication of AIP accounts for a significant proportion of perinatal deaths, and for every 10mg increase in iron dose; birth weight increases by 15.1g and risk of low birth weight decreases by 3% [29]. In the present study, the respondents had a low intake of iron. This is no surprise as iron deficiency has been found to be the most prevalent nutrient deficiency worldwide, and up to half of these cases have been linked to poor intake in diet[30]. Olatunbosun *et al* reported that the most common blood picture found among women who were anaemic was microcytic hypochromia (89.9%), which is suggestive of iron deficiency anaemia[17]. This buttresses the fact that iron supplementation is crucial in prevention of anaemia in pregnancy. Urban and rural respondents in the present study who did not receive iron and folic acid supplementation had higher prevalence of mild and moderate anaemia.

A higher proportion of rural respondents were anaemic compared to urban respondents, although this was not statistically significant. This agrees with a study in North-West Ethiopia which found rural respondents were more than three times more likely to be anaemic compared to urban respondents[31]. An explanation for this finding may be that significantly more urban respondents reported that they received iron supplements and had higher intake of iron than rural respondents. The mean intake of iron among rural and urban respondents in this study was similar to findings by Gao *et al* who reported a mean intake of 19.7±10.4mg for urban and 16.8±8.3mg for rural respondents[32]. Other studies have reported low intakes of iron among pregnant women[15,33–35]. Hence, supplementation of iron and folic acid are very important interventions for reduction of perianal mortality due to anaemia[20]. Over half of the respondents in the present study took iron and folic acid supplements, however, rural respondents had a lower uptake of iron supplementation with less than half of them having received iron supplementation. This is similar to findings in a study in rural Ethiopia, where only 35.4% of the subjects were given iron supplementation during their pregnancy[36]. Folic acid supplementation on the other hand was received by majority of both urban and rural respondents. Lawal and Adeleye also reported a high uptake of folic acid supplementation in Southwestern Nigeria[37]. Folic acid is not only important for the prevention of anaemia, it is also crucial in preventing neural tube defects[38].

The use of one medication, which contains multiple micronutrients, including adequate amounts of iron and folic acid for micronutrient supplementation in pregnancy seems appealing, however, lack of enough evidence on its effectiveness, higher cost, and concerns about feasibility led to it not being recommended for routine ANC in 2016 [39]. In 2020, the guideline was updated with data mainly from low- and middle-income countries. The WHO now recommends the use of micronutrient supplements containing 13–15 micronutrients including at least 60mg of elemental iron and 0.4mg of folic acid for our environment[40]. Despite the fact that the guideline was only effected in 2020, majority of the respondents in this study took multivitamin supplements. This means that a good number took it with the individual nutrient supplements given at ANC visits. This could lead to an overdose, or increase in side effect of iron like diarrhoea, nausea, and vomiting, ultimately causing non-compliance[41].

Previous studies have reported that several factors were associated with prevalence of anaemia including occupation, level of education, socioeconomic class, age, high parity, trimester, short pregnancy interval, previous maternal illness, dietary intake of vegetables, hook worm infestation[23,31,42,43]. This study however did not show significant association between haemoglobin concentration and any of the studied factors except trimester. Among urban respondents in this study, a significantly higher proportion of respondents in their third trimester were moderately anaemic compared to other trimesters. In agreement to our finding, a systematic review conducted in sub-Saharan Africa showed that the prevalence of anaemia among pregnant women was higher during the third trimester[42]. This is particularly worrisome as hemoglobin levels are expected to increase during the third trimester compared to the second and first trimester. Also, this may have negative impacts during labour and childbirth[44].

Limitations

An important limitation is that a cross-sectional design was used, and this does not allow for the study of causation. Secondly, information on nutrient supplements was obtained from the pregnant women, and this may be subject to errors as some of them may not know the medications that they are taking. Furthermore, in the assessment of daily iron intake of the pregnant women, only one 24-h dietary recall was conducted, which may not be representative of the usual dietary pattern individually. Despite these limitations, this study provides some important insights into the burden of AIP and its risk factors in rural and urban areas in Akwa Ibom state. It highlights the fact that policies and guidelines surrounding micronutrient supplementation in pregnancy need to be further emphasized. Similarly, nutrition education and education on the need to be compliant with micronutrient supplements should be intensified at the different levels of healthcare. Future research should consider studying the compliance to micronutrient supplements and its effect on the prevalence of anaemia, as well as using more robust measures to assess the dietary intake of iron, so as to get a more accurate picture.

Conclusion

The prevalence of AIP among the study population was high with higher prevalence among the rural populace. Also, the average intake of iron for all respondents were low, with rural respondents having lower intakes. The prevalence of moderate anaemia increased with pregnancy trimester among urban respondents. Hence, anaemia in pregnancy is a serious public health issue in Akwa Ibom state. It calls for promotion and implementation of proper nutrition education on iron containing foods and to educate pregnant women on the importance of adequate nutrition and the consequences of anaemia in pregnancy. These findings also support and encourage the need to strengthen policies on implementation of the continuous administration of iron supplements as a routine ANC drug in health facilities.

Ethical conformity statement

All procedures performed this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments.

Conflict of Interest

The authors declare no conflict of interest

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