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Original Research Article

Sociodemographic determinants of anaemia in pregnant women at antenatal clinic booking

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ABSTRACT

Background: Anaemia is a common complication in pregnancy with adverse outcome. Early identification of women at risk and instituting prophylactic measures will help prevent its development. Objectives were to determine the prevalence and determinants of anaemia in pregnant women at antenatal booking.
Methods: A cross-sectional descriptive study was conducted. The participants were 410 pregnant women aged ≥18 years, booking for antenatal care at a gestational age (GA) ≤24 weeks. The recruitment spanned from January to July 2023. Information on maternal age, parity, GA at booking, marital status, religion, education and occupation of the woman and her spouse, and last birth interval, were collected. Data was analysed with statistical package for the social sciences (SPSS) version 25, using descriptive and inferential statistics. Multivariate logistics regression was used to determine adjusted odds ratios with 95% confidence intervals at a p value of <0.05.
Results: There were 410 participants, 136 (33.2%) were anaemic. Of these 130 (31.7%) had mild anaemia (Hb 9.0–10.9 g/dl), while 6 (1.5%) had moderate anaemia (Hb 7.0–8.9 g/dl). Factors associated with anaemia after multivariate analysis were Christian religion (aOR=5.49; p=0.028), lower socioeconomic status (aOR=1.77; p=0.009), late booking (aOR=2.76; p=0.003), and birth interval <2 years (aOR=2.12; p=0.003). The risk of anaemia was five-fold likely for a Christian than a Moslem, twice likely for lower socioeconomic status, about three-fold likely when booking late, and twice likely with short inter-pregnancy interval.
Conclusions: The prevalence of anaemia at booking was 33.2%. Determinants of anaemia at booking were Christian religion, lower socioeconomic status, late booking, and birth interval less than two years.

Keywords: Anaemia in pregnancy, Prevalence, Sociodemographic determinants

INTRODUCTION

Anaemia is a common complication in pregnancy globally and particularly in developing countries. Anaemia in pregnancy is associated with an increased incidence of both maternal and foetal morbidity and mortality.[1] Global estimates now show that anaemia in pregnancy in low- and middle-income countries can be as high as 56% with continental variations; sub-Saharan Africa shows 57% prevalence, South-East Asia 48%, and South America at 24.1%.[2,3] Because of the adverse maternal and perinatal outcomes associated with anaemia in pregnancy, the World Health Assembly set a target to reduce anaemia in reproductive age women by 50% by 2025, and this was endorsed as one of the sustainable development goals (SDGs) target for 2030.[4]

The World Health Organization (WHO) defined anaemia during pregnancy as haemoglobin concentration less than

11 g/dl. It is considered severe, when haemoglobin concentration is less than 7.0 g/dl, moderate when haemoglobin concentration is between 7.0 g/dl to 8.9 g/dl and mild when haemoglobin level is from 9.0 to 10.9 g/dl.[5] Pregnancy related fall in the haemoglobin concentration occurs across gestation and is mainly due to the increase in plasma volume exceeding the increase in red cell mass.[6] However, there are no WHO recommendations on the use of different haemoglobin cut off points for anaemia by trimester.

Multifactorial causes contribute to the development of anaemia in pregnancy in low-income countries and may include nutritional deficiencies of iron, folate, vitamins A and B12; parasitic infections (malaria and worm infestation) or chronic infections with tuberculosis and HIV.[7,8] There is a varying degree of contribution of these factors in the development and progress of anaemia in pregnancy but in sub-Saharan Africa, low iron intake is seen as the leading cause of anaemia in pregnancy.[8,9] According to the Nigerian National demographic health survey of 2018, 56-61% of pregnant women have iron deficiency anaemia.[10]

The sociodemographic factors contributing to anaemia in pregnancy and its severity are varied. Some of these include, but are not limited to, the age of the woman, parity, educational level, income, family type, religion and short birth interval.[11] It has also been noted that low socioeconomic status was a major contributor to the prevalence of anaemia in pregnancy.[12,13] Other factors include multiple gestation and heavy menstrual flow before pregnancy either due to fibroid or abnormal uterine bleeding. Women who do not practice family planning, education below junior high school, pregnancy induced hypertension and farming occupation were also found to have increased risk of developing anaemia in pregnancy.[14]

Anaemia is a major public health problem in developing countries, and the adverse outcome of anaemia in pregnancy can be ameliorated if adequate anaemia preventive measures are instituted. Investigating the sociodemographic determinants of anaemia in pregnancy would enable the early identification of women at risk and institution of proactive prophylactic measures to prevent the development of anaemia in pregnancy. The aim of the study, therefore, was to determine the prevalence of anaemia and identify the sociodemographic factors associated with anaemia among pregnant women at antenatal booking.

METHODS

Study site/area

This study was conducted at the antenatal clinic of the Rivers State University teaching hospital (RSUTH) Port Harcourt, a tertiary hospital owned and funded by the Government of Rivers State of Nigeria. The hospital provides obstetric services to women referred from other centers, as well as providing antenatal care and delivery services for low and high-risk pregnant women booked with the hospital. Port-Harcourt is a state capital, a metropolitan oil rich city, and made up of multi-ethnic and multicultural residents. Port Harcourt is predominately Christian, as is most of Southern Nigeria. The average daily attendance at the antenatal clinic is about 70 women including 20 newly booked mothers, and the clinic runs from Monday through Friday. Ethical approval (RSUTH/REC/2022205) was obtained from the Research and Ethics Committee of the RSUTH before commencement of the study and a written informed consent was obtained from each participant.

Study design and population

This was a hospital-based cross-sectional study. The participants were 410 consecutive and consenting pregnant women ≥18 years of age, booking for antenatal care at a gestational age (GA) ≤24 weeks. The recruitment spanned 29 weeks, from January to July 2023. Women who presented for booking at GA >24 weeks, having haemoglobinopathy, haemolytic anaemia, Chronic diseases (Retroviral disease, hypertensive disorders, liver and renal disease), multiple pregnancy, and women who refuse to give consent, were excluded.

Sample size determination

The sample size was calculated using the formula for cross-sectional studies.[15]

$$n = \frac{Z^2pq}{e^2}$$

Here, n is the sample size required for the study, Z is 95% confidence interval i.e. the desired level of significance set at 95% equivalent to 1.96, p is the working prevalence rate of anaemia of 60.3% as found in a previous study in RSUTH, Port Harcourt using 11 g/dl as cut-off for anaemia, hence p is 0.60, q is (1–p), which is 1–0.60=0.40, e is margin of sampling error tolerated; 95% confidence interval set at 5% in this study (0.05).[16]

$$n = \frac{1.96^2 \times 0.60 \times 0.40}{0.05^2} = 369$$

Non-response rate of 10% (37) was used to adjust the sample size.

$$369 + 37 = 406$$

Therefore, the minimum sample adopted for this study was 410 participants.

Data collection methods

On each antenatal day, the patients for booking were assembled at a section of the antenatal hall and they were informed and counselled about the study. Pregnant woman

who met the eligibility criteria and gave consent were recruited daily and consecutively until the sample size was reached. A purposively designed proforma was used to collect sociodemographic data and record the haemoglobin concentrations estimated at booking.

Information was collected on maternal age (≤25, 26–34, ≥35 years), parity (0, ≥1), GA at booking (≤13, 14–24 weeks), marital status, religion, highest educational level attained (tertiary, secondary, and primary/none) and occupation (fully employed, earning/self-employed, and unemployed) of the woman and her spouse, and last confinement to bed (last birth interval) for parous women.

The socioeconomic status of participants was determined, using a modification from the study by Ogunlesi et al, by awarding a score for the education (tertiary – 1, secondary – 2 , none/primary – 3) and occupation (fully employed – 1, earning/self-employed – 2, unemployed – 3) of each couple and the average score for both couple to the highest whole number was the socioeconomic status (2, 3, 4, 5, and 6) assigned, and they were further grouped for analysis into upper class (2 and 3) and lower class (4 to 6).[17] For example, a woman with tertiary education (1) and self-employed (2) will be scored 3, if her spouse has tertiary education (1) and is fully employed (1), their combined score is 5 and average of 2.5, approximated to a socioeconomic status of 3 (upper class). If the spouse of the same woman has tertiary education (1) but is unemployed (3), their combined score will be 7 and average of 3.5, approximated to a socioeconomic status of 4 (lower class).

The haemoglobin concentration of participants was measured using the HemoCue® system (HemoCue AB, Ängelholm, Sweden). The HemoCue system consists of a portable, battery-operated photometer and a supply of treated disposable cuvettes in which blood is collected. It uses capillary blood and gives satisfactory accuracy and precision when evaluated against standard laboratory methods.

Data analysis methods

Coded data was entered into Excel sheet and analyzed with statistical package for social sciences (SPSS) for Windows version 25 (SPSS Inc., Chicago, Illinois, USA). The data were presented in tables and figures as appropriate. Frequencies and proportions were used to present categorical variables. Summary statistics like mean, median, standard deviation and range were used in presenting numerical variables. The participants were dichotomised into anaemic and not-anaemic and differences in proportions of sociodemographic variables were compared for statistical significance using Pearson's Chi square, Fisher's exact, and Mann Whitney-U test, as appropriate. Bivariate and multivariate analyses were performed as appropriate. A p value <0.05 was considered statistically significant.

RESULTS

There were 410 participants, using haemoglobin concentration less than 11 g/dl as defined by WHO for anaemia in pregnancy, 136 (33.2%) of the participants at booking were anaemic. Of these 130 (31.7%) had mild anaemia (Hb 9.0 – 10.9 g/dl), while 6 (1.5%) had moderate anaemia (Hb 7.0 – 8.9g/dl). Two hundred and seventy-four (66.8%) were not anaemic, and the mean Hb concentration of the study population was 11.34±1.31, with median of 11.15 and range of 7.0–19 g/dl. Table 1 shows the distribution of the characteristics of the study population. Majority of the participants, 57.6% were aged 26–34 years, 98.0% were married, 77.3% had tertiary education, 95.6% were Christians and 61% were multiparous (para ≥1). Also, majority of the women 83.2% booked for ANC in the second trimester (≥14 weeks GA), 61.2% were classified as belonging to the upper socioeconomic class, and 99 (39.6%) of the multiparous participants had a previous birth interval less than 2 years.

Table 1: Socio-demographic and other characteristics of the study population.

Variables	Frequency	Percentage
Maternal age (years)		
≤25	47	11.5
26–34	236	57.6
≥35	127	31.0
Summary	Mean±SD= 31.98±5.03	Median=32, range=21–46
Marital status		
Single	8	2.0
Married	402	98.0
Educational level		
Secondary	93	22.7
Tertiary	317	77.3
Religion		
Christianity	392	95.6
Islam	18	4.4
Socio-economic status		
Upper class	251	61.2
Lower class	159	38.8
Parity		
Para 0	160	39.0
Para 1 or more	250	61.0
Summary	Median= para 1	Range= para 0–6
Gestational age at booking (weeks)		
≤13	69	16.8
≥14	341	83.2
Summary	Mean±SD=18.44± 4.84 weeks	Median=19 weeks; range= 6–25 weeks
Birth interval (n=250) (years)		
<2	99	39.6
2 or more	151	60.4

Table 2 shows a comparison of the sociodemographic and other characteristics between the anaemic and not-anaemic participants. There were significant differences in the proportion of anaemic versus not-anaemic participants in terms of Christianity (98.5% versus 94.2%; p=0.042), lower socioeconomic class (48.5% versus 33.9%; p=0.004), late (second trimester) booking (90.4% versus 79.6%; p=0.006), and birth interval <2 years (31.6% versus 20.4%; p=0.013). The differences in proportions were not significant when comparing for maternal age (p=0.433), marital status (p=0.793), maternal education alone (p=0.123) and parity (p=0.192). The variables with an association on bivariate analysis were fitted into a multivariate logistic regression analysis, to see significant factors associated with anaemia in pregnancy after excluding confounders, as shown in Table 3. Factors associated with anaemia after multivariate analysis were Christian religion (aOR=5.49; CI 1.20–5.03; p=0.028), lower socioeconomic status (aOR=1.77; CI 1.54–2.73; p=0.009), late (second trimester) booking (aOR=2.76; CI 1.42–5.35; p=0.003), and previous birth interval <2 years (aOR=2.12; CI 1.30–3.46; p=0.003). The risk of anaemia at booking was about five-fold likely for a Christian than a Moslem, twice likely for lower socioeconomic status women, about three-fold likely when booking late, and twice likely with short inter-pregnancy interval <2 years.

Table 2: Sociodemographic and other factors associated with anaemia in pregnancy (Hb conc. <11.0 g/dl) among the study population.

Variables	Anaemic n=136, N (%)	Not anaemic n=274, N (%)	Total n=410, N (%)	Crude odds ratio (95% CI)	Chi square (P value)
Maternal age (years)					
≤25	16 (11.8)	31 (11.3)	47 (11.5)	**	0.505
26–34	81 (59.6)	155 (56.6)	236 (57.6)		(0.777)
≥35	39 (28.7)	88 (32.1)	127 (31.0		
Mean±SD	31.70±4.74	32.11±5.17		t=-0.785	P=0.433
Marital status					
Single	3 (2.2)	5 (1.8)	8 (2.0)	1.214 (0.3–5.2)	0.069 F
Married	133 (97.8)	269 (98.2)	402 (98.0)	1	(0.793)
Educational level					
Secondary	37 (27.2)	56 (20.4)	93 (22.7)	1.45 (0.9–2.3)	2.374
Tertiary	99 (72.8)	218 (79.6)	317 (77.3)	1	(0.123)
Religion					
Christianity	134 (98.5)	258 (94.2)	392 (95.6)	4.155 (0.9–18.3)	4.133
Islam	2 (1.5)	16 (5.8)	18 (4.4)		(0.042*)
Socio-economic status					
Upper class	70 (51.5)	181 (66.1)	251 (61.2)	0.545 (0.4–0.8)	8.147
Lower class	66 (48.5)	93 (33.9)	159 (38.8)	1	(0.004*)
Parity					
Para 0	47 (34.6)	113 (41.2)	160 (39.0)	0.752 (0.5–1.2)	1.705
Para 1 or more	89 (65.4)	161 (58.8)	250 (61.0)	1	(0.192)
Parity (range)	1 (0–6)	1 (0–4)		Mann-Whitney U=16871.000	P=0.101
Gestational age at booking (weeks)					
≥14	123 (90.4)	218 (79.6)	341 (83.2)	2.430 (1.3–4.6)	7.685
≤13	13 (9.6)	56 (20.4)	69 (16.8)	1	(0.006*)
Mean±SD	19.32±4.25	18.01±5.05		t=2.613	P=0.009*
Birth interval (years)					
<2	43 (31.6)	56 (20.4)	99 (24.1)	1.800 (1.1–2.9)	6.202
None/≥2	93 (68.4)	218 (79.6)	311 (75.9)	1	(0.013*)

*Statistically significant (p<0.05); F–Fisher's exact test; CI–confidence interval; **odds ratio not computed because variable does not match a 2×2 table; Hb conc. – haemoglobin concentration

Table 3: Multiple logistic regression showing factors associated with anaemia in pregnancy (Hb conc. <11.0 g/dl) among the study population.

Factors (n=410)	Coefficient (B)	Adjusted odds ratio (OR)	95% CI	P value
Religion				
Christianity	1.703	5.491	1.20–5.03	0.028*
Islam[R]		1		

Continued.

Factors (n=410)	Coefficient (B)	Adjusted odds ratio (OR)	95% CI	P value
Socio-economic status				
Lower class	0.574	1.776	1.54–2.73	0.009*
Upper class[R]		1		
Gestational age at booking (weeks)				
≥14	1.015	2.759	1.42–5.35	0.003*
≤13 [R]		1		
Birth interval (years)				
<2	0.751	2.118	1.30–3.46	0.003*
None/≥2 [R]		1		

*Statistically significant (p<0.05); CI–confidence interval; Hb conc.–haemoglobin concentration

DISCUSSION

Using the WHO reference value for Hb of 11 g/dl as the cut off for anaemia in pregnancy, this study revealed a prevalence of anaemia at booking of 33.2%. This is comparable to the prevalence of 32.2% reported by Ikeanyi et al, 35.3% by Anorlu et al, and 37.6% by Omote et al.[18-20] Higher prevalences had earlier been reported in this study area of 60.2% by Awoyesuku et al and 69.6% by Okoh et al, and from other centers in Nigeria of 62.2% by Komolafe et al, 58.0% by Owolabi et al, 54.5% by Olatunbosun et al, and 41.7% by Nwizu et al.[12,16,21-24] Methodological differences (study design and target population), period of gestation when Hb estimation was done, socio-cultural differences and geographical variations among regions may be responsible for the variance in reported prevalences of anaemia in pregnant women.

The more recent studies are reporting lower prevalences indicating a general improvement in the burden of anaemia in pregnancy. Furthermore, the absence of severe anaemia among our study population, which is comparable to reports from Lagos, Kano, and Warri, but contrast with the findings of much older studies that reported severe anaemia of 1.1% in Enugu, 2% in Ilesha, and 11.8% in Ibadan, gives credence to such improvement.[12,19,20,22,25,26] An earlier WHO report had reported an expected range for severe anaemia of 1–5%.[27] The absence of severe anaemia in the recent studies might imply a general improvement of the nutritional status of women in Nigeria, and that anaemia and malaria prophylaxis programmes of antenatal care are perhaps yielding good results in Nigeria; or the change may just reflect differences in the study population of the various studies.

A previous study in our study area had established that our women book late for antenatal care.[28] The finding of this study that over 80% of the participants booked in the second trimester was therefore not surprising. However, late booking was significantly associated with anaemia in this study, which corroborates the finding of other studies, that the percentage of women with anaemia was lowest among women that booked in the first trimester.[12,19,22,24,29] This decline in Hb level could be explained by the dilutional effect of pregnancy and increased foetal demands, which are increased after the first trimester. Also, untreated anaemia in early pregnancy is likely to worsen as the pregnancy advances.

Lower socioeconomic status was found to be a major determinant of anaemia in pregnancy at booking, this was despite the high level of education attained by our study population. Many other studies have reported similar findings.[12,13,19,23,24,29] The low socioeconomic status may cause financial constraints that impact on their nutritional status and health seeking behaviour. This implies that socioeconomic empowerment of families would be a pre-requisite to reducing the prevalence of anaemia in pregnancy in our environment.

Another significant finding of this study was that anaemia occurred more in women who had a short birth interval of <2 years. Similar findings have been reported by previous studies.[12,19,24,29] A short interval between pregnancies means the mother's recovery from the previous one is incomplete and thus leaves her with a depleted iron store, which is made worse by active transport of iron to the foetus, leaving the mother anaemic. Adinma et al have shown that the exhausted maternal iron stores at the end of one pregnancy takes almost two years to be replenished.[30]

The relationship between parity and anaemia in pregnancy is still debatable. This study did not find a statistically significant association between parity and anaemia, as was reported by Omote et al.[20] While Nwizu et al reported higher prevalence of anaemia with increasing parity, attributing it to repeated drain on the iron stores with increasing parity, other studies have reported higher prevalence of anaemia in lower parity women, attributing the difference to increased susceptibility to malaria in primigravid women.[12,19,24,29]

Likewise, this study did not find a significant association between maternal age and prevalence of anaemia. Other studies have also reported that maternal age alone was not a significant determinant of anaemia in pregnancy.[12,19] The influence of age has often not been separated from the effect of parity and pre-pregnancy nutritional status.[12] However, some other studies have reported a higher occurrence of anaemia in younger mothers, attributing this to the lack of awareness, poor knowledge of antenatal services, and failure to book early for antenatal care.[20,22,24]

Limitations

The findings of the study cannot be generalized to the entire community, and therefore may be an underestimation of the burden of anaemia in pregnancy, as it was a facility-based study with selection bias limiting participation to only women registered with the facility, while a good number of women attend antenatal care at health centers or do not attend at all.

CONCLUSION

The prevalence of anaemia at booking was 33.2%. Determinants of anaemia at booking were Christian religion, lower socioeconomic status, late (second trimester) booking, and previous birth interval less than two years. Late booking can be reduced through appropriate health education. Effective child spacing should be encouraged among women. Improvement of the socioeconomic status of women and economic empowerment of the family on the long term will reduce the prevalence of anaemia in pregnancy.

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