

1 **Original research article**

2 **Anaemia in pregnancy: Prevalence and**
3 **associated factors in Azare, north-east Nigeria**

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Aims: Anaemia in pregnancy is a common health problem in poor-resource countries like Nigeria and is associated with both maternal and perinatal complications. It is multifactorial in origin; the relative contribution of these factors may differ from one region to the other. Anaemia is a preventable condition through interventions that are potentially feasible and cost effective. The objective of this study was to determine the magnitude of anaemia in pregnancy and its associated factors In Azare, north-eastern Nigeria.

Study design: Cross-sectional study

Place and Duration of Study: Department of Obstetrics &Gynaecology, Federal Medical Centre, Azare Bauchi State, between January 2010 and June 2010.

Methodology: Four hundred women who presented to the antenatal clinic for their booking visit were studied. Anaemia was defined as a haematocrit of 33%. Demographic and obstetric characteristics as well as blood, urine and stool samples were taken from the enrolled participants. Estimation of haematocrit, malaria parasite, urine microscopy and stool microscopy were done. The data was analysed with Epi info 3.3.4. (CDC Atlanta)

Results: Prevalence of anaemia was 71.3% and severe anaemia was 1.4%. The majority (79%) of the women booked in the second trimester. Multiple logistic regression model revealed malaria parasitaemia (AOR 5.45CI 2.59-11.45), low socioeconomic status (AOR 4.90 CI 2.09-11.49) and bacteriuria (AOR 4.74CI 1.99-11.32) as significant associated factors of anaemia in pregnancy.

Conclusion: The prevalence of anaemia in pregnancy in this community is high and it is an established problem at booking visit. Girl-child education, economic empowerment of women, antenatal care, treatment of infestations and provision of safe water supply should be promoted.

7
8 *Keywords: [Anaemia, pregnancy, Prevalence, factors, Nigeria]*
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11 1. INTRODUCTION

12

13 Anaemia in pregnancy is a major public health problem in poor-resource countries (1-4). It is
14 responsible for an estimated 20% of maternal deaths in West Africa and contributes to still
15 more deaths through obstetric haemorrhage (5). Studies reveal a strong association
16 between severe anaemia and adverse perinatal and maternal outcome (3). Nutritional
17 problems such as iron and folate dietary deficiencies are major causes of anaemia in
18 pregnancy. Others include secondary effects of malaria and hookworm infestations,
19 infections such as human immunodeficiency virus, and hemoglobinopathies (2,6,7).

20 It was estimated that up to 56% of all non-pregnant women living in developing countries
21 were anaemic by WHO standard (Hb < 11g/dl), compared with 18% in industrialised
22 countries (1,2). Asia and Africa have the highest prevalence of anaemia where it is
23 estimated that 60% and 52% of women, respectively, are anaemic, and between 1% and 5%
24 are severely anaemic (Hb < 7g/dl) (5-7).

25 In Nigeria, various rates have been reported from parts of the country. In Abeokuta,
26 south-west Nigeria, a prevalence rate of 76.5%, a high percentage of the women booked in
27 the second trimester. The rate was higher among primigravidae than multigravidae (8). In
28 Enugu south-eastern Nigeria, a prevalence rate of 64.1% with 1.1% of cases being severe
29 anaemia recorded at a University Hospital and the rate was higher among those that booked
30 in the third trimester (9). In a tertiary centre in north-eastern Nigeria found a prevalence rate
31 of 72% was reported (10). From the south of Nigeria, a prevalence of 56.1% was found at
32 antenatal booking clinic, of which 6.7% were severely anaemic (11). All these studies used
33 the WHO cut-off point of the haematocrit of 33%. A study in Gombe North-eastern Nigeria
34 recorded 51.8% with 2.1% having severe anaemia (12). This study used haematocrit of 30%
35 as the cut off point. Other studies using this criterion reported a prevalence of 33.3% and
36 35.5% in Port Harcourt and Nnewi respectively (13, 14).

37 Availability of baseline data on this important morbidity is necessary to be able to estimate
38 the burden and for monitoring of progress in its management. There is no existing data on
39 this common condition in Bauchi, north-east Nigeria. It is the aim of this study to generate
40 data on anaemia in pregnancy at booking in this area. The information on this condition and
41 its correlates will help maternal health policy makers to apply appropriate interventions

42

43 2. MATERIAL AND METHODS

44

45 This was a prospective study of 400 pregnant women who presented for booking at the
46 Federal Medical Centre Azare, north-east Nigeria between January 2010 and June 2010.
47 The hospital provides care to the population of Bauchi and its neighbouring states of Yobe
48 and Jigawa.

49 Verbal consent was obtained from the pregnant women and those who give consent were
50 consecutively enrolled into the study. Those excluded were pregnant women on follow-up
51 visits, who had a blood transfusion in the index pregnancy, those with sickle cell disease and
52 who decline to give consent. Ethical approval was obtained from the hospital ethics
53 committee.

54 The demographic and obstetric characteristics of the participants such as
55 age, education, occupation, gestational age, parity, inter-pregnancy interval as well as history of
56 Pica ingestion were obtained from each participant by the interviewer. The information was
57 entered into a data form. Socioeconomic status was determined taking cognisance of local

58 situations using husband occupation and educational level of the wife as done by Olusanya
59 et al (15).

60 For this study, anaemia was defined according to the WHO criteria of haematocrit below
61 33% (1). Anaemia was further categorised into three levels; mild 28-32%, moderate 21-27 %
62 and severe <21%.

63 LABORATORY METHODS

64 The packed cell volume was determined by the microhaematocrit method. Two millilitres of
65 blood was taken from each participant. The sample was centrifuged and then read with the
66 haemocytometer.

67 Thick films were made and stained with Giemsa stain and read. Parasite densities were
68 estimated by counting the number of trophozoites per 200 white blood cells. A thick film was
69 considered negative if 100 microscopic fields showed no parasites. Determination of HIV
70 status was done using two rapid tests (Determine^R and Unigold^R). It is regarded as positive
71 when two are in agreement. Where there is disagreement, a tie breaker is then utilised.

72 Mid-stream urine specimens were collected from the participants and processed by
73 inoculation on a blood agar plate using calibrated wire loop to determine bacteriuria.
74 Streaking on Cysteine-Lactose-Electrolyte (CLED) agar plate was done to obtain discrete
75 colonies for identification. A gram microscopy of the discrete colonies was performed
76 followed by biochemical identification and subsequent antimicrobial susceptibility testing.

77 The stool samples were examined within 24 hours of collection. They were first examined
78 macroscopically for blood or mucus staining and the form described as formed, loose or
79 watery. A wet preparation was then done. The 10x objective was used to examine each slide
80 thoroughly and where ova or larvae of any parasite were suspected, the 40x objective was
81 used to identify the parasite.

82 Data management and the statistical analysis was done with Epi Info 3.4.3 (Centre for
83 Disease Control and Prevention, Atlanta, GA, USA). This included univariate and
84 multivariate analyses. Variables known to be associated with anaemia factors and those
85 found to be significant in bivariate analysis were entered into a logistic regression model to
86 determine predictors of anaemia. A p value of less than 0.05 was considered statistically
87 significant

88

89 3. RESULTS

90

91 A total of 400 women were studied. The mean age was 25.3±5.9 years. Their median parity
92 was 2 with a range of 0-9. Mean gestational age at booking was 23± 4.8 weeks while mean
93 haematocrit was 30.8 ± 3.8 %.

94 Of the 400 women, 285 (71.3%) were anaemic using the WHO criteria. It was 46 % when
95 the haematocrit of less than 30% was used. Severe anaemia (<21%) was 1.4% while mild
96 anaemia was 81.4% (table 1).

97 Three hundred and two (75.5%) booked in the second trimester while 10 (2.5%) had their
98 booking visit in the first trimester. Of the 10 that booked in the first trimester only 2 (20%)
99 were anaemic compared to 78% of those that booked in the third trimester (p<0.001).

100 Multiparous women constituted 52% of the study population. Subgroup analysis revealed
101 that anaemia was more common among women with grand-multiparity than those with parity
102 of 4 and below ($p<0.001$). Women with no education constituted 29% but anaemia was
103 found in 94% among them compared to 19% among those who had completed at least
104 secondary education. Housewives with no occupation were 277(69%) of the women.
105 Anaemia was found in 84% of them compared to 28% among women who were civil
106 servants. The distribution of anaemia by maternal characteristics is shown in Table 2.

107 Malaria parasitaemia was found in 145 (36.3%) of the women. It was seen more in
108 primigravidae compared to multigravidae. Of the 37 women infested with intestinal parasites,
109 all but one were anaemic. Hookworm was isolated in 20(54%) Ascaris in 10 (27%) and
110 7(19%) had trichuris trichuria.

111 Anaemia in pregnancy was significantly associated with the following variables: malaria
112 parasitaemia (8.41 CI 4.44-17.07), Bacteriuria (4.74 CI 1.99-11.32) and intestinal
113 helminths(16.55 CI 2.24-122.19) amongst others (table 3). However, in the multivariate
114 logistic regression model, only three factors were significantly associated with anaemia in
115 pregnancy at booking in the studied population. These included malaria parasitaemia
116 (5.45CI 2.59-11.45), low socioeconomic status (4.90 CI 2.09-11.49) and bacteriuria (4.74CI
117 1.99-11.32) (table 4).

118 Table 1 Distribution of anaemia according to severity

Severity	Anaemia (%)
Mild	232 (81.4%)
Moderate	49 (17.2%)
Severe	4 (1.4%)
Total	285 (100%)

127 Table 2 maternal characteristics and anaemia

	Characteristics	Number	Anaemic n (%)
128	Age (years)		
129	≤ 19	60	57(95)
130	20-24	131	93(71)
131	25-29	107	63(58.9)
132	30-34	66	45(68.2)
133	35-39	28	4(14.3)
134	40-44	8	2(25)
135	Parity		
136	0	122	82(67.2)
137	1-4	209	142(67.9)
138	≥ 5	69	61(88.4)
139	Gestational age		
140	1 st trimester	10	2(20)
141	2 nd trimester	302	215(71.2)
142	3 rd trimester	88	68(77.3)
143	Marital setting		
144	Monogamous	251	160(63.70)
145	Polygamous	149	125(83.9)
146	Socioeconomic group		
147	Low	261	224(85.8)
148	Middle	90	54(60)
149	High	49	7 (14.3)
150	Education		

151	No education	117	110 (94)
152	Completed primary	220	163(74.1)
153	Completed secondary	63	12(19)
154	Occupation		
155	House wives only	277	232(83.8)
156	Civil servants	32	9 (28.10)
157	Traders	21	8 (30.1)
158	Students	37	10 (27)
159	Others	33	25 (75.8)

160 Table 3 Relationship of associated factors with anaemia

	Factor	Number	anaemic n	Odds Ratio	p-value
161	Age (years)				
162	≤19 *	60	57		
163	≥20	340	228	0.11(0.03-0.35)	0.001
164	Parity				
165	Para 4 and below*	331	224		
166	Grandmultiparity	69	61	3.71 (1.62-8.51)	0.002
167					
168	Booking				
169	Early *	10	2		
170	Late	390	283	0.09(0.02-0.45)	0.001
171					
172	Inter-pregnancy interval				

173	>2years [*]	55	35		
174	≤ 2 years	221	166	1.72 (0.88-3.38)	0.08
175	Marital union				
176	Monogamous [*]	251	160		
177	Polygamous	149	125	2.94(1.77-4.88)	<0.001
178	Socioeconomic group				
179	High [*]	283	175		
180	Low	17	110	4.02(2.33-7.01)	<0.001
181	Malaria parasitaemia				
182	Yes	145	134	8.41(4.44-17.07)	<0.001
183	No [*]	255	150		
184	Bacteriuria				
185	Yes	65	59	4.74(1.99-11.32)	<0.001
186	No [*]	235	226		
187	Pica ingestion				
188	Yes	57	48	2.36(1.12-4.99)	0.02
189	No [*]	343	237		
190	Intestinal helminths				
191	Yes	37	36	16.55(2.24-122.20)	0.006
192	No [*]	363	248		

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198 Table 4 Multivariate analysis of associated factors for anaemia

	Factor	number	anaemic	OR	Adjusted OR
199	Age (years)				
200	≤19 *	60	57	1	
201	≥20	340	228	0.11(0.03-0.35)	0.18(0.05-0.66)
202	Parity				
203	Para 4 and below *	331	224	1	
204	Grandmultiparity	69	61	3.71 (1.62-8.51)	2.72(0.85-8.69)
205					
206	Booking				
207	Early *	390	283	1	
208	Late	10	2	0.09(0.02-0.45)	2.72 (0.23-12.66)
209	Marital setting				
210	Monogamous*	251	160	1	
211	Polygamous	149	125	2.94(1.77-4.88)	2.08(0.96-4.51)
212	Socioeconomic group				
213	High*	283	175	1	
214	Low	117	110	5.50 (2.42-12.49)	4.90 (2.09-11.49)
215	Malaria parasitaemia				
216	Yes	145	134	8.45 (4.34-16.40)	5.45(2.59-11.45)
217	No*	255	150	1	
218	Bacteriuria				
219	Yes	65	59	4.74(1.99-11.32)	3.74(1.39-10.05)
220	No*	235	226	1	

221 **Pica ingestion**

222 Yes 57 48 2.36(1.11-4.99) 1.48(0.46-4.74)

223 No* 343 237 1

224 **Intestinal helminths**

225 Yes 37 36 16.55(2.24-122.19) 7.28(0.75-11.10)

226 No* 363 248 1

*Reference group

OR-odds ratio

227

228

229 **DISCUSSION**

230 The principal finding of this study is the high prevalence of anaemia in pregnancy of
 231 71.3% and severe anaemia of 1.4%. This revealed that anaemia in pregnancy was an
 232 important public health problem in Azare. The rate was comparable to 72% of Nguru (north-
 233 eastern Nigeria), 76.5% of Abeokuta (south-western Nigeria), 66% of Bobo-Dialasso
 234 (Burkina Faso) and 72% noted in rural Malawi(8,10,16,17). These figures are in the upper
 235 limit of the reported range of 35-70% prevalence rate for developing countries (1). The rates
 236 are higher than the 56.1% from Delta (southern Nigeria), 35.3% from the commercial city of
 237 Lagos, 35% from Malaysia and 15% for Singapore, a country with rate comparable to
 238 Europe and America(11,14,18). The striking differences may be due to the different
 239 socioeconomic conditions, culture, health-seeking behaviour and availability or otherwise of
 240 maternal health services. The study area is rural in nature and is in the northeast region of
 241 Nigeria which has the worst figures in reproductive health indices and levels of education in
 242 Nigeria (19). Hence the high rates in comparison to places like Delta and Lagos where
 243 socioeconomic condition and availability of maternal health services were better (19). While
 244 studies from south-eastern Nigeria and South-western Nigeria had no case of severe
 245 anaemia (8,9), in this study 1.4% of the anaemic pregnant women were severely anaemic.
 246 Also, in Southern Malawi, 3.6% of anaemic pregnant women had the severe variety (17).

247 This study was done on women who attend the antenatal clinic of the medical centre in
 248 Azare. An estimated 60% of women attend at least one antenatal visit in Nigeria (19). We
 249 have no reason to believe that anaemic women in the town preferentially visit the antenatal
 250 clinics of the hospital. For this reason, the rate of prevalence may be a reasonable estimate
 251 for the population of pregnant women who visit the hospital.

252 Anaemia was commoner among grandmultipara compared to those with parity of 4 and
 253 below ($p<0.001$). This was similarly reported from Nnewi south-eastern Nigeria but is at
 254 variance with the Lagos study where no such difference was found (9,11). The finding here
 255 could be due to progressive depletion of iron stores with increasing parity and the
 256 proposition that the experience of previous pregnancies may not have led to increased
 257 utilisation of antenatal care early.

Those booking in second and third trimester had more cases of anaemia than the first trimester. This was similar to the findings from Lagos and Gombe studies (11,12). This high number may be because the majority of our women booked in the second trimester. The physiologic expansion of maternal plasma volume, increasing foetal demand, worsening of existing iron deficiency and deficient or absent antenatal care early in pregnancy may all be contributory to the high rate of anaemia in late trimesters (20). The results suggested that anaemia predates the pregnancy in the majority of cases. Hence, preconception care, including iron and folic acid supplementation, is advocated to reduce this problem.

Teenage pregnancy was found in 15% of the women in the study and 95% of them were anaemic. The rate of teenage pregnancy was lower than the National Demographic Health Survey (NDHS 2013) reported rate of 39% for north-east region (19). This may reflect the low utilisation of ANC by this group. The young pregnant women are more likely to have low iron stores because of their greater iron requirements and so will remain iron-depleted during pregnancy as it is difficult to replenish the stores when pregnancy sets in (6,7). Ninety-five percent of those 19 years and below were anaemic in the studied sample. Teenage pregnancy was found to be significantly associated with anaemia and pregnant adolescent were at risk of anaemia. This was in agreement with the findings reported in Benin, southern Nigeria(15) but the Delta and Malawi studies found that teenage pregnancy was not a risk factor(14,17).

The majority of the women in the lower socioeconomic class were anaemic. Of this group, 85% of them were anaemic and the low socioeconomic class was significantly associated with anaemia. This was similarly reported by the Lagos and Gombe studies (11, 12). Women in these classes are less likely to be educated. Educational attainment has a strong effect on health behaviour and a key determinant of life style (7). More than two-third of the women studied did not have a basic education. These women are less likely to consume diets rich in animal protein, vitamins and more of carbohydrates and have poor access to good health services. They are likely to commence pregnancy with the chronic iron deficit and the foetal demand may worsen it (7). Education will lead to an increased awareness and better utilisation of antenatal care services. Educated mothers are more likely to have their children immunised so that child survival will improve and child spacing becomes feasible.

The majority of the women had inter-pregnancy interval less than 2 years. This is illustrative of the low contraceptive usage in this community. The Nigeria Demographic Health Survey (NDHS 2013) reported a national contraceptive prevalence rate of 15% with 3.0% for the north-east region (19). There was no significant difference in anaemia prevalence between those with an interval of fewer than 2 years and those with more than 2 years ($p=0.08$).

All the women studied were married. In this community, pregnancy out of wedlock is highly stigmatised and may have legal implications for the mother hence such women may not present to the health facility. Women in polygamous marriages had more cases of anaemia than that in monogamous ones. This was also noted in the Gombe study (12). However, this was not found to be significant in multivariate analysis.

The majority (69%) of the women were housewives with no paid employment. This is in keeping with the cultural norm in this area. This is in contrast to the profile of the women studied in Abeokuta south-west Nigeria where the majority were traders and civil servants (8). The high frequency of anaemia in the housewives compared to the civil servants in this study may be due to the economic empowerment enjoyed by those with paid employment.

Parasitic infestation during pregnancy is a recognised cause of anaemia in Africa (7, 21). Factors responsible for the transmission of human parasites vary according to geographical

location. In this study, malaria parasitaemia was seen in 31.3% with higher frequency in the primigravida women. A similar observation was seen in western Kenya but the Nguru study found higher frequency among multipara (10, 22). The increased risk of malaria among primigravidae has been well described (5, 21). The studies utilised peripheral blood to determine parasitaemia. Malaria parasitaemia was significantly associated with anaemia in this study. This is not an unexpected finding, malaria being an endemic disease in this area. Malaria parasitaemia can directly cause haemolysis and elaboration of inflammatory cytokines that may lead to decrease release of iron from bone marrow, decrease red cell survival and inadequate response to erythropoietin response to anaemia (21).

Infestation with intestinal parasites was found in 9.8% of the women. This was higher than 0.6% reported from Nguru but lower than 38.8% reported among 2000 near-term pregnant women studied in three Nigerian towns over a year and 15.64% reported from Northern Ghana (10,23,24). The disparity could be as a result of the sampled population, period of the study and geography. The occurrence of helminthic infestation among pregnant women is indicative of faecal contamination of soil and domestic water supply (23). The Nigeria Demographic Health Survey (NDHS) reported that 32% of households have no toilet facilities and improved source of water supply was available to less than half (49%) of rural dwellers (19). Lack of these amenities makes control of these parasites difficult. Anaemia prevention can be improved when malaria and intestinal parasites are adequately addressed.

HIV infection was found in 2.6% of the women; this is lower than the national seroprevalence rate of 4.8% and no association with anaemia ($p=0.96$) was noted. HIV infection is known to predispose to anaemia; it is associated with lower serum folate and serum ferritin in pregnancy so also the antiretroviral drugs used by HIV-infected patients(17,25). This effect was not seen in this study probably due to the low number of infected women in the sample.

Bacteriuria was found in 16% of the pregnant women. Urinary tract infection has been associated with anaemia (7). Endotoxin-induced haemolysis of red cells is one of the ways the infection predisposes to anaemia. A significant association with anaemia was seen in this study.

Odd eating habits were elicited in 14.3% of the women. Of these, 84% were anaemic compared to 69% of those without a history of pica ingestion. This figure is lower than that reported from Islamabad (32.5%) where pica ingestion was identified as a risk factor for anaemia in pregnancy (26). This may be applicable to the study area where a type of clay of the kaolinite group (called "*farar kasa*" in Hausa language) is easily accessible in the markets, and some pregnant women crave it. Further studies are required to explain this craving and its effect on patients' nutrition and anaemia in pregnancy. It was not found to be a significant factor in this study. Items taken may include mud, bark of trees and kaolin. The mud and kaolin may be a source of geo-helminths infestation.

The factors associated with anaemia, particularly during pregnancy, are multiple and complex and their relative contributions vary by geographic areas and seasons (7, 21). Significant factors identified in the population studied include low socioeconomic status, malaria parasitaemia and bacteriuria.

This study was done mainly during the dry season with extension into the early part of the rainy season. The observed finding may perhaps vary if it were done during the rainy season. A study with enrolment throughout the year will be needed. Another is its cross-sectional design that does not allow for follow-up of the patients to see the outcome of the

351 care given to the women. Issues of recall bias of information, especially last menstrual
352 period was a challenge due to the low level of education of the participants.

353 Areas for further research include the causes of late booking as antenatal care is the
354 cornerstone in improving the maternal foetal outcome of pregnancy. A well designed
355 longitudinal cohort study on the aetiology and outcome of pregnancy is needed to look at the
356 causes and effects of anaemia in this population.

357

358

359 **4. CONCLUSION**

360 Anaemia in pregnancy is high and is found in 7 out of every 10 women studied. It is a well-
361 established problem at the time of first antenatal visit in Azare north-eastern Nigeria. While it
362 has been established that in the context of developing countries, nutritional iron deficiency is
363 the main cause of anaemia in pregnancy, it is however related to several social,
364 demographic and obstetrics factors. In this study, malaria parasitaemia, low socioeconomic
365 status and bacteriuria are the risk factors identified in this community. Strategies to improve
366 girl-child education, economic empowerment of women, antenatal care, prevention and
367 treatment of infestations are needed in the study area.

368 **AUTHORS' CONTRIBUTIONS**

369

370 DLM and DPH conceived, designed the study performed the statistical analysis. DLM and
371 UNI wrote the draft and interpreted the results. All authors read and approved the final
372 manuscript.

373

374 **ETHICAL APPROVAL**

375

376 All authors hereby declare that the work has been examined and approved by the
377 appropriate ethics committee and have therefore been performed in accordance with the
378 ethical standards laid down in the 1964 Declaration of Helsinki."

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