

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

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Aims: Anaemia in pregnancy is a common health problem in developing countries like Nigeria and is associated with both maternal and perinatal consequences. 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. 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.

9 *Keywords: [Anaemia, pregnancy, Prevalence, factors, Nigeria]*
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12 **1. INTRODUCTION**

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

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

26 In Nigeria, various rates have been reported from parts of the country. In Abeokuta,
27 south-west Nigeria, a prevalence rate of 76.5%, a high percentage of the women booked in
28 the second trimester. The rate was higher among primigravidae than multigravidae (8). In
29 Enugu south-eastern Nigeria, a prevalence rate of 64.1% with 1.1% of cases being severe
30 anaemia recorded at a University Hospital and the rate was higher among those that booked
31 in the third trimester (9). In a tertiary centre in north-eastern Nigeria found a prevalence rate
32 of 72% was reported (10). From the south of Nigeria, a prevalence of 56.1% was found at
33 antenatal booking clinic, of which 6.7% were severely anaemic (11). All these studies used
34 the WHO cut-off point of the haematocrit of 33%. A study in Gombe North-eastern Nigeria
35 recorded 51.8% with 2.1% having severe anaemia (12). This study used haematocrit of 30%
36 as the cut off point. Other studies using this criterion reported a prevalence of 33.3% and
37 35.5% in Port Harcourt and Nnewi respectively (13, 14).

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

43 44 **2. MATERIAL AND METHODS**

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

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

55 The demographic and obstetric characteristics of the participants were entered into a data
56 form. Socioeconomic status was determined taking cognisance of local situations using
57 husband occupation and educational level of the wife as done by Olusanya, Okpere and
58 Ezimokhai (15).

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

62 **LABORATORY METHODS**

63 The packed cell volume was determined by the microhaematocrit method. The sample was
64 centrifuged and then read with the haemocytometer.

65 Thick films were made and stained with Giemsa stain and read. Parasite densities were
66 estimated by counting the number of trophozoites per 200 white blood cells. A thick film was
67 considered negative if 100 microscopic fields showed no parasites.

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

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

79

80 **3. RESULTS**

81

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

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

88 Three hundred and sixteen (79%) booked in the second trimester while 2.5% had their
89 booking visit in the first trimester. Of the 10 that booked in the first trimester only 2 (20%)
90 were anaemic compared to 78% of those that booked in the third trimester (p<0.001).

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

98 Malaria parasitaemia was found in 36.3% of the women. It was seen more in
99 primigravidae compared to multigravidae. Of the 37 women infested with intestinal parasites,
100 all but one were anaemic. Hookworm was isolated in 20(54%) Ascaris in 10 (27%) and
101 7(19%) had trichuris trichuria.

102 Anaemia in pregnancy was significantly associated with the following variables: malaria
103 parasitaemia(8.41 CI 4.44-17.07), Bacteriuria (4.74 CI 1.99-11.32) and intestinal
104 helminths(16.55 CI 2.24-122.19) amongst others (table 3). However, in the multivariate
105 logistic regression model, only three factors were significantly associated with anaemia in
106 pregnancy at booking in the studied population. These include malaria parasitaemia (5.45CI
107 2.59-11.45), low socioeconomic status (4.90 CI 2.09-11.49) and bacteriuria (4.74CI 1.99-
108 11.32) (table 4).

109 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%)

111

112 Table 2 maternal characteristics and anaemia

Characteristics	Number	Anaemic n (%)
Age (years)		
≤ 19	60	57(95)
20-24	131	93(71)
25-29	107	63(58.9)
30-34	66	45(68.2)
35-39	28	4(14.3)

119	40-44	8	2(25)
120	Parity		
121	0	122	82(67.2)
122	1-4	209	142(67.9)
123	≥ 5	69	61(88.4)
124	Gestational age		
125	1 st trimester	10	2(20)
126	2 nd trimester	302	215(71.2)
127	3 rd trimester	88	68(77.3)
128	Marital setting		
129	Monogamous	251	160(63.70)
130	Polygamous	149	125(83.9)
131	Socioeconomic group		
132	Low	261	224(85.8)
133	Middle	90	54(60)
134	High	49	7 (14.3)
135	Education		
136	No education	117	110 (94)
137	Completed primary	220	163(74.1)
138	Completed secondary	63	12(19)
139	Occupation		
140	House wives only	277	232(83.8)
141	Civil servants	32	9 (28.10)
142	Traders	21	8 (30.1)
143	Students	37	10 (27)
144	Others	33	25 (75.8)

145 Table 3 Relationship of associated factors with anaemia

	Factor	Number	anaemic n	Odds Ratio	p-value
146	Age (years)				
147	≤19 [*]	60	57		
148	≥20	340	228	0.11(0.03-0.35)	0.001
149	Parity				
150	Para 4 and below	331	224		
151	Grandmultiparity [*]	69	61	3.71 (1.62-8.51)	0.002
152					
153	Booking				
154	Early [*]	10	2		
155	Late	390	283	0.09(0.02-0.45)	0.001
156					
157	Inter-pregnancy interval				
158	>2years	55	35		
159	≤ 2 years [*]	221	166	1.72 (0.88-3.38)	0.08
160	Marital union				
161	Monogamous [*]	251	160		
162	Polygamous	149	125	2.94(1.77-4.88)	<0.001
163	Socioeconomic group				
164	High [*]	283	175		
165	Low	17	110	4.02(2.33-7.01)	<0.001
166	Malaria parasitaemia				

167	Yes	145	134	8.41(4.44-17.07)	<0.001
168	No [*]	255	150		
169	Bacteriuria				
170	Yes	65	59	4.74(1.99-11.32)	<0.001
171	No [*]	235	226		
172	Pica ingestion				
173	Yes	57	48	2.36(1.12-4.99)	0.02
174	No [*]	343	237		
175	Intestinal helminths				
176	Yes	37	36	16.55(2.24-122.20)	0.006
177	No [*]	363	248		
178					
179					

180

181 Table 4 Multivariate analysis of associated factors for anaemia

	Factor	number	anaemic	OR	Adjusted OR
182	Age (years)				
183	≤19 [*]	60	57	1	
184	≥20	340	228	0.11(0.03-0.35)	0.18(0.05-0.66)
185	Parity				
186	Para 4 and below [*]	331	224	1	
187	Grandmultiparity	69	61	3.71 (1.62-8.51)	2.72(0.85-8.69)
188					

189	Booking				
190	Early [*]	390	283	1	
191	Late	10	2	0.09(0.02-0.45)	2.72 (0.23-12.66)
192	Marital setting				
193	Monogamous [*]	251	160	1	
194	Polygamous	149	125	2.94(1.77-4.88)	2.08(0.96-4.51)
195	Socioeconomic group				
196	High [*]	283	175	1	
197	Low	117	110	5.50 (2.42-12.49)	4.90 (2.09-11.49)
198					
199	Malaria parasitaemia				
200	Yes	145	134	8.45 (4.34-16.40)	5.45(2.59-11.45)
201	No [*]	255	150	1	
202	Bacteriuria				
203	Yes	65	59	4.74(1.99-11.32)	3.74(1.39-10.05)
204	No [*]	235	226	1	
205	Pica ingestion				
206	Yes	57	48	2.36(1.11-4.99)	1.48(0.46-4.74)
207	No [*]	343	237	1	
208	Intestinal helminths				
209	Yes	37	36	16.55(2.24-122.19)	7.28(0.75-11.10)
210	No [*]	363	248	1	

*Reference group

OR-odds ratio

211

212

213 DISCUSSION

214 The principal finding of this study is the high prevalence of anaemia in pregnancy of
 215 71.3% and severe anaemia of 1.4%. This revealed that anaemia in pregnancy was an
 216 important public health problem in Azare. The rate was comparable to 72% of Nguru (north-
 217 eastern Nigeria), 76.5% of Abeokuta (south-western Nigeria), 66% of Bobo-Dialasso
 218 (Burkina Faso) and 72% noted in rural Malawi(8,10,16,17). These figures are in the upper
 219 limit of the reported range of 35-70% prevalence rate for developing countries (1). The rates
 220 are higher than the 56.1% from Delta (southern Nigeria), 35.3% from the commercial city of
 221 Lagos, 35% from Malaysia and 15% for Singapore, a country with rate comparable to
 222 Europe and America(11,14,18). The striking differences may be due to the different
 223 socioeconomic conditions, culture, health-seeking behaviour and availability or otherwise of
 224 maternal health services. The study area is rural in nature and is in the northeast region of
 225 Nigeria which has the worst figures in reproductive health indices and levels of education in
 226 Nigeria (19). Hence the high rates in comparison to places like Delta and Lagos where
 227 socioeconomic condition and availability of maternal health services were better (19). While
 228 studies from south-eastern Nigeria and Ibadan, Western Nigeria had no case of severe
 229 anaemia (9), in this study 1.4% of the anaemic pregnant women were severely anaemic.
 230 Also, in Southern Malawi, 3.6% of anaemic pregnant women had the severe variety (17).

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

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

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

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

260 The majority of the women in the lower socioeconomic class were anaemic. Of this group,
261 85% of them were anaemic and the low socioeconomic class was significantly associated
262 with anaemia. This was similarly reported by the Lagos and Gombe studies (11, 12). Women
263 in these classes are less likely to be educated. Educational attainment has a strong effect on
264 health behaviour and a key determinant of life style (7). More than two-third of the women
265 studied did not have a basic education. These women are less likely to consume diets rich in
266 animal protein, vitamins and more of carbohydrates and have poor access to good health
267 services. They are likely to commence pregnancy with the chronic iron deficit and the foetal
268 demand may worsen it (7). Education will lead to an increased awareness and better
269 utilisation of antenatal care services. Educated mothers are more likely to have their children
270 immunised so that child survival will improve and child spacing becomes feasible.

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

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

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

286 Parasitic infestation during pregnancy is a recognised cause of anaemia in Africa (7, 21).
287 Factors responsible for the transmission of human parasites vary according to geographical
288 location. In this study, malaria parasitaemia was seen in 31.3% with higher frequency in the
289 primigravida women. A similar observation was seen in western Kenya but the Nguru study
290 found higher frequency among multipara (10, 22). The increased risk of malaria among
291 primigravidae has been well described (5, 21). The studies utilised peripheral blood to
292 determine parasitaemia. Malaria parasitaemia was significantly associated with anaemia in
293 this study. This is not an unexpected finding, malaria being an endemic disease in this area.
294 Malaria parasitaemia can directly cause haemolysis and elaboration of inflammatory
295 cytokines that may lead to decrease release of iron from bone marrow, decrease red cell
296 survival and inadequate response to erythropoietin response to anaemia (21).

297 Infestation with intestinal parasites was found in 9.8% of the women. This was higher than
298 0.6% reported from Nguru but lower than 38.8% reported among 2000 near-term pregnant
299 women studied in three Nigerian towns over a year and 15.64% reported from Northern
300 Ghana (10,23,24). The disparity could be as a result of the sampled population, period of the
301 study and geography. The occurrence of helminthic infestation among pregnant women is
302 indicative of faecal contamination of soil and domestic water supply (23). The Nigeria
303 Demographic Health Survey (NDHS) reported that 32% of households have no toilet
304 facilities and improved source of water supply was available to less than half (49%) of rural
305 dwellers (19). Lack of these amenities makes control of these parasites difficult. Anaemia
306 prevention can be improved when malaria and intestinal parasites are adequately
307 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). 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 care given to the women. Issues of recall bias of information, especially last menstrual period was a challenge due to the low level of education of the participants.

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

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339

340 **4. CONCLUSION**

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

349

350 **ETHICAL APPROVAL**

351

352 All authors hereby declare that the work has been examined and approved by the
 353 appropriate ethics committee and have therefore been performed in accordance with the
 354 ethical standards laid down in the 1964 Declaration of Helsinki.”
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