Determinants And Pattern Of Anaemia In Pregnancy At Booking In Federal Medical Centre Owerri, South-East, Nigeria.

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Abstract

Objective:

To determine the prevalence of anaemia, the associated risk factors and the red cell morphological pattern among pregnant women at booking in Federal Medical Centre Owerri.

Materials and Methods:

A cross-sectional descriptive study of 400 women at the booking clinic over a 12-week period was done. Pretested structured questionnaire was used to obtain their biodata, obstetric and medical histories with the help of 2 trained assistants. The results of other routine antenatal investigations were obtained and filled on the questionnaire. Venous blood sample collected from each woman under aseptic condition was taken to the haematology lab where a full blood count was done with an ERMA PCE-210 auto haematology analyzer to obtain the haemoglobin concentration and red cell indices of each woman. Also a peripheral blood film was made from each sample for red cell morphology analysis using light microscopy. Data obtained was analyzed with the IBM® SPSS® statistical package version 20.

Results

The mean haemoglobin concentration was 10.9 ± 1.5g/dl and 55.5% of all the women were anaemic (haemoglobin concentration < 11g/dl). Anaemia was significantly related to level of education (p = 0.02), low socioeconomic class (p =0.04), HIV-positive status (p =0.001), history of fever in the index pregnancy (p = 0.04), history of excessive menstrual flow prior to pregnancy (p = 0.002) but only history of anaemia in the last pregnancy (OR = 0.39; p = 0.03; 95% CI = 0.17 – 0.89) and HIV-positive status (OR = 0.12; p = 0.05; 95% CI = 0.02 – 0.99) were found to be independent determinants of anemia. The commonest red cell morphology on blood film was microcytosis and hypochromasia among the anaemic women suggesting iron deficiency anaemia.

Conclusion

Correction of anaemia and replenishment of iron stores should be ensured during postnatal and preconception care; Women need to be more economically empowered and advocacy for prevention and improved management of HIV among reproductive-aged women, early antenatal booking, proper management of febrile illnesses in pregnancy, and fortification of stable foods with iron.

Keywords: Anaemia, pregnancy, prevalence, risk factors, Owerri

Introduction

Anaemia in pregnancy is a major public health problem especially in the developing countries[1]. Traditionally, anaemia has been defined as a reduction in the oxygen carrying capacity of blood due to either a decrease in the total number of erythrocytes [each having a normal quantity of haemoglobin] and/or a diminished concentration of haemoglobin per erythrocyte[2]. On the other hand, the World Health Organization [WHO] has defined anaemia in pregnancy as haemoglobin concentration less than 11.0g/dL or packed cell volume [PCV] less than 33 per cent [3]. Haemoglobin concentrations of 10 – 10.9 g/dL, 7.0 – 9.9 g/dL and less than 7 g/dL were classified as mild, moderate and severe anaemia respectively [3]. However, because the relative plasma expansion in pregnancy is particularly marked in the 2nd trimester, the United States Centre for Disease Control and Prevention has suggested 10.5 g/dL as the cut-off from 12 weeks gestation[4]. This is supported by findings from large studies in Caucasians, which found a range of haemoglobin concentration between 10.4 g/dL and 13.5 g/dL in early pregnancy in women receiving iron supplements [5]. In most of the developing countries the lower limit is often accepted as 10g/dL because a large percentage of pregnant women with this level of haemoglobin concentration tolerate pregnancy, labour and delivery with good outcome[6].

The prevalence of anaemia in pregnancy varies considerably both within and between countries because of differences in socioeconomic conditions, lifestyles and health-seeking behaviours across different cultures[7]. The WHO estimates that anaemia affects nearly half of all pregnant women in the world: 52 per cent in the developing countries compared with 23 per cent in the developed world [7]. A study done in the United kingdom by Barroso et al (defining anaemia at booking as haemoglobin concentration < 11g/dL) gave an incidence of anaemia in pregnancy of 24.4 %[8] while some African studies gave prevalence rates of 66% and 57% respectively using the WHO definition of anemia[9-10]. In Nigeria, prevalence rates reported from different studies range between 17% and 76.5% [11-19]. Studies done in some parts of South-Eastern Nigeria namely Anambra, Enugu and Abakaliki, by Ukibe et al, Dim et al and Ugwaja et al also using the WHO

definition of anaemia reported prevalence rates of 75%, 40.4%, and 72.2% respectively [17-19]. In addition, Olatunbosun et al in Uyo, South-South Nigeria; Anorlu et al in Lagos, South-West Nigeria; Nwizu et al in Kano, North-west, Nigeria and Burkar et al in Gombe, North-East, Nigeria found prevalence rates of 54.5%, 35.3%, 17%, and 51.8% respectively [11, 14-16].

Anaemia in pregnancy may be physiological or pathological [20]. Physiological anaemia of pregnancy arises because blood volume expands by approximately 50% (1000mls) and the total red blood cell mass expands by approximately 25% (300mls) during a singleton gestation [21]. However, the red blood cell count is usually greater or equal to 3.2 million/mm^3 and the red cell morphology is normal with central pallor. The pathological anaemia in pregnancy may be categorized by the underlying causative mechanism, red cell morphology or by whether they are inherited or acquired [21]. A mechanistic approach differentiates anaemia into those caused by decreased red blood cell production, those caused by increased red blood cell destruction, and those caused by blood loss [21-22]. Decreased red cell production may result from lack of nutrients, such as iron, vitamin B_{12}, or folate. This lack may be as a result of dietary deficiency, malabsorption, or bleeding. Bone marrow disorders or suppression, hormone deficiencies like erythropoietin, and chronic disease or infection also may lead to decreased production [21]. Haemoglobinopathies and febrile illnesses like malaria and urinary tract infections would result in increased red blood cell destruction[20-23]. Anaemia may also be classified by red cell size into microcytic and macrocytic anaemia. Macrocytic anaemia is associated with mean corpuscular volume (MCV) of greater than 100 fL. Reticulocytosis also may cause increased MCV. A common cause of macrocytic anaemia is folate deficiency. Microcytic anaemia is associated with an MCV less than 80 fL. The most common cause of microcytic anaemia is iron deficiency. Another common cause of microcytic anaemia in certain ethnic groups is haemoglobinopathy like sickle cell disease [21].

Anaemia in pregnancy especially severe anaemia, which affects about 7 percent of pregnant women, is directly or indirectly associated with about 20-30 % of all maternal mortality [3, 24-26]. A United Nations expert panel considered severe anaemia an associated cause in up to half of the maternal deaths worldwide[27]. Estimates of maternal mortality resulting from anaemia range from 34/100,000 live births in Nigeria to as high as 194/100,000 in Pakistan[28, 29]. Also, a metaanalysis of several studies has shown that anaemia during early pregnancy, but not during late pregnancy is associated with slightly increased risk of preterm delivery and low birth weight[7].

The findings from different studies both within and outside Nigeria on the major risk factor(s) responsible for anaemia in pregnancy are not homogenous[14, 23, 30-32]. Therefore, the knowledge of the prevalence, pattern and determinants of anaemia in pregnancy in different communities would help provide data that would improve preventive programmes and reveal information on the most vulnerable groups in these communities[33]. It is against this backdrop that the UNICEF/WHO Regional Consultation on the Prevention and Control of Iron deficiency Anaemia and the African Regional consultation on the control of Anaemia in Pregnancy recommended that sample surveys and epidemiological studies to determine the prevalence and aetiology of pregnancy related anaemias be carried out in each of the sub regions of Africa especially in localities/regions/communities where there is no or insufficient data on anaemia in pregnancy[33, 34]. There is paucity of data on anaemia in pregnancy in Imo state generally and Owerri in particular. This study was therefore designed to assess the determinants and pattern of anaemia in pregnancy at first antenatal (booking) visit among pregnant women at Federal Medical Centre, Owerri. This will help to assess the magnitude of the problem in our locality and in devising strategies to reduce the adverse sequelae of anemia in pregnancy. It would also provide baseline data for health care providers and stakeholders in the state and nationwide to evaluate existing and future intervention programmes and advocacy in terms of reducing the burden of anaemia in pregnancy. More so, since a number of the factors that would be studied may predate pregnancy, this study might help emphasize the need for the reinforcement of preconception clinics.

Materials and Methods

This cross-sectional study was conducted among pregnant women attending booking visit at the antenatal clinic of the Federal Medical Centre (FMC), Owerri in Imo state South-East Nigeria. The prevalence of anaemia in pregnancy in Enugu, South-East Nigeria based on a study done by Dim et al is 40.4% [18]. The estimate from this study was designed to be within five percent of the actual prevalence with a confidence interval of 95 percent. Therefore the sample size was calculated using the formula. [37]

$$\mathbf{n = Z^2Pq / d^2}$$

The minimum sample size required for the study was about 370 women. However the sample size was increased to 407 women using an attrition rate of 10%.

The details of the study were carefully and thoroughly explained to all the women booking for antenatal care at the beginning of each clinic. A written informed consent was obtained from each willing woman before she was recruited into the study. The participants retained the absolute right and freedom to decline from participating or withdrawing from the study at any time with no consequences to them.

A review of previous year's antenatal records showed that about 6480 women booked for antenatal care annually giving an average booking rate of about 124 women per week. The number of women expected to book over the 12 week period of the study was about 1488. A systematic random sampling technique was used. The attendance register of women at each booking clinic served as the sampling frame. An attendance number was assigned to each of the women at the booking clinic from the register. Each of these numbers was written on similar sized piece of paper and thoroughly mixed in a container from where the first woman was randomly picked blindly. If the woman picked did not meet the inclusion criteria, a new number was drawn until one that met the criteria was picked. The remaining numbers of women will be selected through a systematic fashion, at fixed intervals (sampling interval: 1488/407 = 4) of every fourth number on the sampling frame to make up to the required 31 women per week.

The inclusion criteria include pregnant women at their first antenatal visit that were willing to participate in the study. On the other hand, the exclusion criteria will be women who did not give consent, those on follow-up antenatal visit, those who had received blood transfusion(s) in the index pregnancy and women that are already receiving treatment for anaemia in pregnancy before their booking visit.

The participants were given a structured, pretested questionnaire with the help of two trained assistants (junior residents) ensuring that appropriate and accurate information was obtained as much as possible. The information required included: maternal age, parity, gestational age, height, weight, last child birth, mode of delivery in the last child birth, last menstrual period, level of education, occupation of the client and that of her spouse, history of fever in present pregnancy, history of vaginal bleeding in the present pregnancy, history of chronic illness, history anaemia in last pregnancy, and history of excessive menstrual flow prior to pregnancy. Social class 1 to 5 was assigned to each client based on the scoring system designed by Olusanya et al [38] .A tourniquet was applied above the level on the upper limb from which blood sample was to be collected and the area cleaned with spirit swab. 5ml of venous blood was collected

from each participant using plastic disposable syringes into properly labeled sample bottles containing ethylene diamine- tetra acetic acid (EDTA). The blood samples were taken to the haematology laboratory where some were fed into an ERMA PCE 210 automated haematology analyzer to determine the full blood count of each client. Also some of the blood of each client was used to prepare a peripheral blood smear that was viewed under a light microscope to determine the red cell morphology of each client. All pieces of information were obtained with strict confidentiality as the participants and their samples were identified by initials and serial numbers on their questionnaire, laboratory forms and specimen bottles. Also results of each client's haemoglobin genotype and retroviral screening done routinely as part of booking investigations were sought and recorded on the questionnaire.

. The size of the red cells was gauged by comparing them to the nucleus of a small lymphocyte[39] Red cells that were smaller than the nucleus of the small lymphocyte were taken to be microcytic while those that were larger were taken to be macrocytic. Red cells that were equal in size to the nucleus of the small lymphocyte were adjudged normocytic. The automated mean corpuscular volume also assisted in making a classification. Next, the shape of the red cells was evaluated. Normal shaped red cells are biconcave and if there were great variation in shape, poikilocytosis was said to be present. The colour of the red cells was then assessed. Red cells with normal colour were normochromic while those that were pale in colour were hypochromic.

The women with anaemia or abnormal red cell morphology were counseled on the need for further evaluation and investigation and were referred to their obstetrician for further management. All the women at booking were given haematinics at the hospital pharmacy based on the prescription sent there.

Ethical approval was obtained from the Ethics Committee of the Federal Medical Centre Owerri. Data was analyzed with IBM® Statistical Package for the Social Sciences version 20. Descriptive statistics was computed for all relevant variables and comparative analysis was done with the chi-square test using a level of confidence of < 0.05. Multivariate logistic regression analysis was done with the significant variables to ascertain the determinants of anaemia in pregnancy at booking.

Results

400 of the 407 pregnant women recruited for the study had complete data for analysis. The mean age of the women was 30.02 ± 5.05 years with a range of 18 to 40 years. More than half of the booking women studied (60.5%) had tertiary level of education while 2.3% and 37.3% had primary and secondary levels of education respectively. Most of the women were married (98.8%); the remaining few were either single (1%) or widowed (0.3%) as shown in table 1. The mean parity among the women studied was 1± 1.39 with a range of 0 – 7. Majority of the women (55.3%) booked for antenatal care in the second trimester while only 13% booked in the first trimester, table 1. The mean haemoglobin concentration among the women studied was 10.9 ± 1.5 g/dl with a range of 6 to 15.7 g/dl.

26.3% were anaemic using haemoglobin concentration of 10 g/dl. However when the WHO standard of less than 11g/dl employed in this study was used, two hundred and twenty-two women (55.5%) were anaemic [95% CI]; majority (52.7%) of the anaemic women had mild anaemia while 45.9% and 1.4% had moderate and severe anaemia respectively (Fig 1 and 2).

100% of the booking women with primary level of education were anaemic while 52.3% and 55.8% of those with secondary and tertiary levels of education respectively had anaemia. The observed difference was statistically significant (X^2 = 7.82, P = 0.02); Table 2. Women in the lower social class had the highest prevalence of anaemia at booking (90%) and this finding was also statistically significant (X^2 = 6.33, P = 0.04). Similarly, women with history of fever in the index pregnancy were more likely to be anaemic (61.6%) compared to those who had no history of fever. This difference was also statistically significant (X^2 = 4.16, P = 0.04), Table 3. In addition, there was more prevalence of anaemia in women who had anaemia in their last pregnancy (76.3%) and this trend was statistically significant (X^2 = 7.09, P = 0.01). Furthermore the proportion of anaemic women among those that had excessive menstrual flow prior to their index pregnancy was higher (77.8%) compared to those with no such history (52.7%). The observed difference was also statistically significant (X^2 = 9.18, P = 0.002). In the same vein the HIV- status of the women significantly affected the development of anaemia with prevalence of anaemia higher in those with positive HIV test (X^2 = 11.82, P = 0.001). Pregnant women aged 19 years and below had the highest prevalence of anaemia (81.8%) while those aged 20 – 24 years had the lowest prevalence (50%). However this difference was not statistically significant (X^2 = 5.55, P = 0.24).

Similarly, anaemia was more common among the single women (75%) than the married one (55.2%) but this finding also was not statistically significant (X^2 = 1.43, P =0.49). The woman's parity, trimester at booking, and history of bleeding in the index pregnancy did not significantly affect presentation with anaemia at booking in the study population. In addition, history of chronic medical illness (X^2 = 0.69, P = 0.40), interpregnancy interval (X^2 = 0.01, P = 0.94), mode of delivery (X^2 = 1.26, P = 0.53), and history of haemorrhage in the last pregnancy (X^2 = 2.81, P = 0.94), had no significant effect on the prevalence of anaemia in these women at booking (Table 3). Multivariate analysis showed that anaemia at booking in the study population was significantly and independently related to history of anaemia in the last pregnancy (OR = 0.39; P = 0.03, 95% CI = 0.17 – 0.89), and HIV positive status (OR = 0.12; P = 0.05, 95% CI = 0.02 – 0.99) as shown in table 4.

Majority of the women (71.5%) had normocytosis on blood film while 27.0% and 1.5% had microcytosis and macrocytosis respectively. 100% of the women with microcytosis and 83.3% of those with macrocytosis were anaemic at booking. Anaemia was also noted in 38.5% of women with normocytosis. These findings were statistically significant (X^2 = 122.9; P = 0.001). Hypochromic red cells on blood film were found in 27.5% of the women at booking while 72.5% had normochromic red cells. 100% of the women with hypochromic red cells had anaemia and this was the case in 39.0% of clients with normochromic red cells. These findings were also statistically significant (X^2= 117.11; P = 0.01). Normal shaped red cells were seen in 79.8% of the clients while 20.2% of the women at booking had poikilocytes on their blood film. 98.8% of the women with anaemia had poikilocytosis on blood film.

Table 1: Socio demographic variables

Variable	Frequency (N)	Percentage (%)

Age		
19 and below	11	2.8
20-24	42	10.5
25-29	135	33.8
30-34	126	31.5
35 and above	86	21.5
Education level		
Primary	9	2.3
Secondary	149	37.3
Tertiary	242	60.5
Marital status		
Married	395	98.8
Single	4	1
Widow	1	0.3
Social class		
1	236	59.1
2	40	10
3	114	28.5
4	5	1.3
5	5	1.3
Parity		

0	137	34.3
1	108	27.0
2	66	16.5
3	54	13.5
4	25	6.3
5 and above	10	2.5
Gestational age at booking		
First trimester	52	13.0
Second trimester	221	55.3
Third trimester	127	31.8
Mode of delivery		
Vaginal	202	77.1
Assisted vaginal	10	3.8
Abdominal	50	19.1

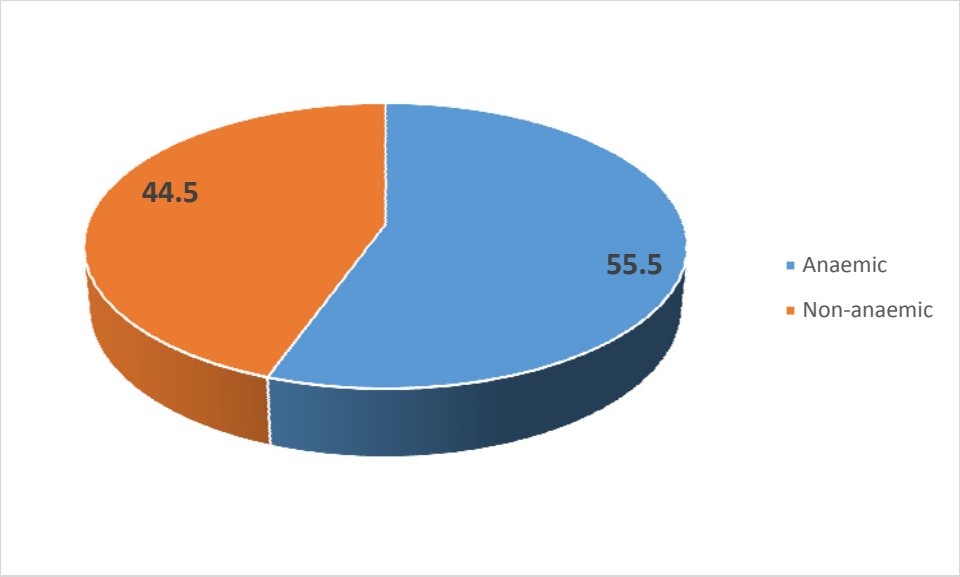

Fig. 1 Pie chart showing percentage of anaemic and nonanaemic clients at booking

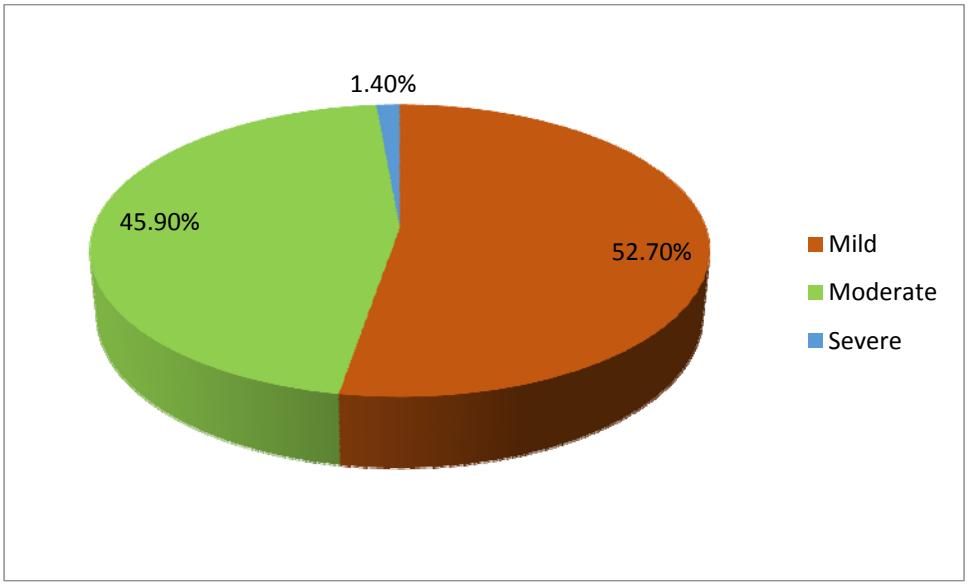

Fig. 2 Pie chart showing severity of anaemia among the booking clients

Table 2: Association between sociodemographic characteristics of pregnant women at booking and anaemia in the study population

Variable	Anaemic	Not Anaemic		
	N (%)	N (%)	Total (%)	X^2 (p value)
Age				
19 and below	9(81.8)	2(18.2)	11(100)	5.55(0.24)
20-24	21(50)	21(50)	42(100)	
25-29	81(60)	54(40)	135(100)	
30-34	66(52.4)	60(47.6)	126(100)	
35 and above	45(52.3)	41(47.7)	86(100)	
Education				
Primary	9(100)	0(0)	9(100)	7.82(0.02)*
Secondary	78(52.3)	71(47.7)	149(100)	
Tertiary	135(55.8)	107(44.2)	242(100)	
Marital status				
Married	218(55.2)	177(44.8)	395(100)	1.43(0.49)
Single	3(75)	1(25)	4(100)	
Widow	1(100)	0(0)	1(100)	
Social class				
Upper class	156(56.5)	120(43.5)	276(100)	6.33(0.04)*
Middle class	57(50)	57(50)	114(100)	

Lower class	9(90)	1(10)	10(100)	
Parity				
0	77(56.2)	60(43.8)	137(100)	1.76(0.88)
1	63(58.3)	45(41.7)	108(100)	
2	33(50)	33(50)	66(100)	
3	28(51.9)	26(48.1)	54(100)	
4	15(60)	10(40)	25(100)	
5 and above	6(60)	4(40)	109100)	
Gestational age at booking				
First trimester	28(53.8)	24(46.2)	52(100)	0.14(0.93)
Second trimester	122(55.2)	99(44.8)	221(100)	
Third trimester	72(56.7)	5(43.3)	127(100)	

*Statistically significant p values

Table 3; Association between some clinical characteristics of pregnant women and anaemia

Variable	Anaemic	Not Anaemic		
	N (%)	N (%)	Total (%)	X^2 (p value)
History of fever in index pregnancy				
Yes	106(61.6)	66(38.4)	172(100)	4.16(0.04)*
No	116(50.9)	112(49.1)	228(100)	

History of bleeding in index pregnancy				
Yes	14(43.8)	18(56.3)	32(100)	1.46(0.23)
No	208(56.5)	160(43.5)	368(100)	
History of chronic medical illness				
Yes	14(66.7)	7(33.3)	21(100)	0.69(0.40)
No	207(54.9)	170(45.1)	377(100)	
Inter pregnancy Interval				
<24 months	74(55.2)	60(44.8)	134(100)	0.01(0.99)
≥24 months	71(55)	58(45)	129(100)	
Mode of delivery in last pregnancy				
Vaginal	114(56.4)	88(43.6)	202(100)	1.26(0.53)
Assisted vaginal	4(40)	6(60)	10(100)	
Abdominal	26(52)	24(48)	50(100)	
History of Anaemia in last pregnancy				
Yes	29(76.3)	9(23.7)	38(100)	7.09(0.001)*
No	116(51.6)	109(48.4)	225(100)	

Bleeding in last pregnancy				
Yes	17(73.9)	6(26.1)	23(100)	2.81(0.94)
No	128(53.3)	112(46.7)	240(100)	
Excessive menstrual flow				
Yes	35(77.8)	10(22.2)	45(100)	9.18(0.002)*
No	186(52.7)	167(47.3)	353(100)	
HIV status				
Positive	20(90.9)	2(9.1)	22(100)	11.82(0.001)*
Negative	202(53.4)	176(46.6)	378(100)	

*Statistically significant p values

Table 4; Multivariate Logistic analysis of risk factors associated with anaemia in pregnant women at booking

Risk factors	B	S.E	Odds ratio	P value	95% C.I
Level of education	0.019	0.27	1.01	0.94	0.60-1.73
History of fever in index pregnancy (yes)	-0.46	0.26	0.63	0.08	0.38-1.06
History of Anaemia in last pregnancy(yes)	0.93	0.42	0.39	0.03*	0.17-0.89
Excessive menstrual	-1.11	0.67	0.33	0.10	0.09-1.24

bleeding(Yes)					
HIV(Yes)	-2.10	1.07	0.12	0.05*	0.02-0.99
Social class	0.001	0.47	1.00	0.99	0.40-2.49

*Statistically significant p values

Table 5: Association between some red cell morphological pattern of pregnant women and anaemia

Variable	Anaemic	Not Anaemic		
	N (%)	N (%)	Total (%)	X^2 (p value)
Red cell size				
Macrocytosis	5(83.3)	1(16.7)	6(100)	122.9(0.001)
Microcytosis	108(100)	0(0)	108(100)	

Normocytosis	110(38.5)	176(61.5)	286(100)	
Red Cell Colour				
Hypochromic	110(100)	0(0)	110(100)	117.11(0.001)
Normochromic	113(39)	177(61)	290(100)	
Red cell shape				
Normal	144(45)	176(55)	320(100)	73.17(0.001)
Poikilocytosis	79(98.8)	1(1.3)	80(100)	

Discussion

The prevalence of anaemia in pregnancy at booking in the study population was 55.5% using the WHO minimum criteria of haemoglobin concentration < 11g/dl or PCV < 33%. This rate is similar to the figure (54.5%) reported by Olatunbosun et al in Uyo [11] but higher than results from Enugu (40.4%) [18], Lagos (35.3%) [14] and Gombe (51.8%) [16] all in Nigeria. Barroso et al also reported lower values (24.4%) in the UK [8] but studies in Anambra (75%) [17] and Abakaliki (72.2%) in South East Nigeria and some African countries namely Burkina Faso (66.6%) [9] and Malawi (57%) [10] reported higher values. All these studies defined anaemia as haemoglobin concentration < 11g/dl except the one done in Uyo which used packed cell volume less than 33 as cut off. The high prevalence of anaemia at booking in this study may be due to a combination of factors including poor health seeking behaviour and poor compliance to medications. The prevalence of anaemia in this study is slightly higher than the 52% reported by the World Health Organization for prevalence of anaemia in pregnancy in developing countries [7]. This could mean that the situation has not really improved. The majority of the women in this study had mild to moderate anaemia with only 1.4% being severely anaemic. These findings are similar to the results from Olatunbosun et al [11] and Ugwaja [19] except that for the absence of severe anaemia in

these studies. The mean haemoglobin concentration among the women at booking was 10.9g/dl and this falls within the definition of anaemia in pregnancy by the World Health Organization. On the other hand, if haemoglobin concentration of less than 10g/dl was used as cut-off the prevalence of anaemia would be 26.3% which is less than what was reported by Nwizu et al in Kano [14] using the same cut-off point.

In this study, women in the adolescent age group had the highest prevalence of anaemia at booking (81.9%) but there was no significant association between age of the women and increased risk of anaemia in pregnancy at booking. Similar results were noted from a retrospective study in Enugu by Dim et al [18]. However, Scholl et al [40] and Ogbeidi et al [41] found an association between adolescent age and increased risk of anaemia in pregnancy but did not consider the effect of parity on maternal age. This was put into consideration by Van den Broek et al 10 who found that when corrected for gravidity and trimester at booking, there was no significant increased risk of anaemia among adolescents.

The prevalence of anaemia was significantly higher in women with primary level of education compared with those with secondary and tertiary education. Also women from the low socioeconomic class (90%) were significantly more affected by anaemia compared to those in higher socioeconomic classes. This corroborates with reports from other studies in Nigeria [11, 14]. Women in low socioeconomic class, as a result of lack of education or financial constraints may not afford or have access to good maternal health services [14]. They are therefore, more prone to the deleterious effects of malaria, poor nutrition, chronic infection and diarrheal diseases. This same category of women may also have preexisting iron deficiency prior to pregnancy. However, when multivariate logistic regression analysis was done, low socioeconomic class and primary education were not independent risk factors for the development of anaemia in pregnancy at booking. This could be explained by the fact that level of education of a woman has an effect on her socioeconomic class.

Although there was no effect of parity on haemoglobin levels in this study as was also reported by Dim et al [18], an increased risk in primigravidae has been documented by other workers like Van den Broek et al [10]. The most frequently given explanation for this has been that primigravidae are known to have an increased susceptibility to malaria [10, 11]. On the other hand other researchers like Nwizu et al [14] and Adinma et al [22] have reported that increasing parity is a

predictor of anaemia in pregnancy. This could be attributed to occurrence of pregnancies in quick succession and overconfidence-induced late booking, which is more common in multigravidae and grandmultiparous women [14].

The women that booked in the second and third trimester were more likely to present with anaemia at booking but this finding was not statistically significant as was also documented by Ibrahim et al in Bayelsa. [42] This finding was found to be statistically significant in the reports by Anorlu et al and Nwizu et al in Lagos and Kano respectively [14, 15]. This could be explained by the expected decline in haemoglobin level with advancing gestational age due to relative plasma expansion, increased foetal demand, underlying maternal infection and untreated anaemia in early pregnancy [4, 14]. In addition, most of the women (85.1%) booked for antenatal care during the second and third trimester. This is similar to reports from other studies in Nigeria [11, 18, 14]. This could suggest that the decision on the time to book for antenatal care is based on advice from friends and relatives rather than from health personnel.

The significant higher risk of anaemia at booking in women with history of fever in the index pregnancy noted in this study was also reported by Olatunbosun et al in Uyo, South-south Nigeria [11]. Fever may be a proxy for malaria, a major cause of both anaemia and febrile illness in pregnancy especially in malaria holoendemic area like Nigeria [11]. Multivariate logistic regression analysis showed that history of fever in the index pregnancy was not an independent risk factor for anaemia in pregnancy at booking.

The percentage of women with anaemia was higher among those with interpregnancy interval of less than 24 months but this finding was not statistically significant. This is similar to what was reported by Bukar et al in Gombe [16]. This short interpregnancy interval between pregnancies prevents the woman's recovery from the effects of previous pregnancies thus increasing the risk of maternal depletion syndrome [14].

The history of bleeding in the index pregnancy had no association with higher risk of anaemia in pregnancy at booking in this study. This is at variance with the report from Uyo [11] that found significant association between history of bleeding in the index pregnancy and risk of anemia at booking. The reason for the finding in the current study could be that implantation bleeds which are not usually heavy may be the cause in most of the clients with history of bleeding.

The majority of the women with history of chronic medical illness other than HIV (66.7%) were found to be anaemic at booking. However there was no significant association. The reason for the increased risk is that chronic diseases can interfere with the production of red blood cells.

The prevalence of anaemia at booking in the women had no association with the mode of delivery in their last confinement. This could be explained by the decreasing morbidity associated with caesarean delivery as a result improved surgical skills, antibiotic therapy and availability of blood and blood products.

History of anaemia in the last pregnancy was found to significantly increase the risk of anaemia at booking among the women in the current study. This concurs with an earlier study by Olatunbosun et al [11]. This finding remained significant when corrected for the mode of delivery and was found to be an independent risk factor for anaemia at booking after multivariate logistic regression analysis. The possible explanations for this include untreated hookworm infestation, poor compliance to haematinics for at least 6 weeks post delivery to replenish iron stores, and eating of iron-deficient diets.

Most of the women that had history of bleeding in the last pregnancy (73.9%) were found to be anaemic compared to those with no such history. However, this finding was not statistically significant. The greater prevalence of anaemia in women with history of bleeding in the last pregnancy may due to depleted iron stores with uncorrected anaemia prior to pregnancy.

Women with history of excessive menstrual bleeding prior to the index pregnancy had a significant higher risk of anaemia in pregnancy at booking. This could also be due progressive depletion of iron stores with uncorrected anaemia before conception in these women.

Although Ibrahim et al [42] in their study in Bayelsa found no significant association between HIV status and anaemia in pregnancy, there was a significant association between HIV-positive status and increased risk of anaemia at booking in the current study. Similar findings had been documented by studies in Burkina Faso and some other parts of Nigeria [9, 11, 18]. This observation is expected as HIV infection is a recognized risk factor for anaemia. The suggested mechanisms include a direct effect of the virus itself, bone marrow suppression due to cytokine release, and anaemia as a result of chronic inflammation and opportunistic infections which may be further exacerbated by antiretroviral medication like Zidovudine, a component of highly active

antiretroviral therapy[11]. Multivariate analysis also noted HIV-positive status as an independent risk factor for anaemia at booking in the study population.

The most common red cell morphological pattern noted on blood film among the anaemic women was normocytosis with hypochromia. This agrees with findings by Olatunbosun et al [11]. This blood film picture is suggestive of iron deficiency anaemia. The high percentage of possible iron deficiency anaemia in this study could be due to chronic blood loss from excessive menstrual bleeding and undiagnosed/untreated hookworm infestation, ingestion of iron-deficient diets, proliferation of fake haematinics and poor compliance to haematinics. All these may result in depleted iron stores prior to booking. In addition, 38.2% of the women with normocytosis were anaemic. This may have been from chronic medical illnesses which cause decreased production of normal-sized red cells or febrile illness in pregnancy that increase red cell destruction. Also the normocytic anaemia may have resulted from plasma expansion noted more in the second trimester which was when most of the women booked. The non-anaemic women mostly had normocytic and normochromic red cells on blood film. Poikilocytosis was seen in 98.8% of the women with anaemia. These abnormally shaped red blood cells are a feature of anaemia from different causes.

The limitations of this study include the fact that it was a hospital based study which may limit its application to the general population due to the effect of selection bias. Also, even though a good number of clients are from rural communities surrounding Owerri, majority of the pregnant clients that seek care in our hospital are more of the educated and those in higher social classes. Also, the facility is a tertiary centre and as such attracts clients who had complications in their previous pregnancies and those anticipating complications in their index pregnancy. Therefore, the findings are more valid for women booking in our centre and similar facilities in the region.

Conclusion

This study has shown that the prevalence of anaemia in pregnancy at booking in our environment is still high. It also revealed that primary education, history of fever in the index pregnancy, excessive menstrual bleeding prior to pregnancy, anaemia in the last pregnancy, HIV seropositive status, and low socioeconomic class were significantly associated with increased risk of anaemia at booking. However, only HIV seropositive status and history of anaemia in the index pregnancy were found to be independent risk factors. The commonest red cell picture on blood film among the anaemic clients was microcytosis and hypochromia which are indicative of iron deficiency anaemia.

Virtually all the factors significantly related to anaemia at booking in the study predated the pregnancy. Therefore, efforts should be made to ensure that women achieve conception with normal haemoglobin concentration. This could be achieved through correction of anaemia and replenishing of iron stores in the puerperal period and establishment of functional preconception care clinics in our health institutions.

In addition, universal iron-folic acid supplementation in women in the reproductive age at risk of anaemia such as those with excessive menstrual bleeding could be beneficial. Regulatory bodies should intensify efforts to ensuring the micronutrient fortification of commonly consumed local food products. Also public health campaigns and advocacy that creates awareness on the need to book early in pregnancy will help the prevention and early treatment of anaemia in pregnancy.

Furthermore, efforts towards the education and socioeconomic empowerment of our women should be intensified by all stakeholders. This will improve their access to quality health care services and ability to ensure proper nutrition. Also education of women on the control of malaria through intermittent preventive therapy in pregnancy, use of long-lasting insecticide treated bed nets, indoor residual spraying, and Artemisinin Combination Therapy. A multicentre study in the region that will also look at specific possible aetiological factors is recommended.

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