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■ Original Research Article

Contributory Factors to Anaemia in Pregnancy in Benin City, Nigeria

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ABSTRACT

Introduction: About a third of the world population is affected by anaemia, with most of this burden on developing countries, Nigeria inclusive. Anaemia, though preventable, is a major contributor to maternal morbidity and mortality. Factors associated with anaemia in pregnancy include poor nutrition, socio-cultural behaviours, and certain infections. **Methods**: We studied the habits, dietary diversity and pattern of infections that may explain occurrence of anaemia in 386 pregnant women (18-45years old) attending antenatal care at the Stella Obasanjo Women and Children Hospital (SOWCH) and the Central Hospital in Benin City, Nigeria between July-December 2019. Data obtained was analyzed using SPSS version 26.0 and level of significance (p) set at =0.05. **Results**: The mean age (±SD) of the study population was 30±4years, 20 (5.2%) women had positive MP, 11 (2.8%) were HIV positive, 3 (0.8%) were HBsAg positive while none was found with a reactive anti-HCV. The mean Hb (±SD) was 10.9± 1.1g/dl. The prevalence of anaemia was 45.6% with only mild and moderate forms recorded. Factors associated with anaemia were lack of ITN use (p= 0.03), alcohol consumption during pregnancy (p= 0.00) and HIV infection (p=0.01). There was a significant correlation between Hb and gestational age (p=0.00) as well as duration of last childbirth (p= 0.02). The mean WDDS (±SD) was 9±1, with 99.0% participants having a high WDDS. There was no association between WDDS and occurrence of anaemia. **Conclusion**: the high burden of anaemia persists. Health promotion strategies to limit factors associated with anaemia in

pregnancy are advocated. The role of dietary diversity on anemia remains inconclusive. **Keywords**: Anaemia, Dietary diversity, alcohol in pregnancy, HIV infection, malaria

Introduction

Anaemia is the reduction in oxygen carrying capacity due to reduced haemoglobin concentration (Hb) expected for age, sex and specific environment.[1] About a third of the world population is affected, with most of this burden on developing countries, Nigeria inclusive.[2] Women, especially of child bearing age, and children under 5years are prone to anaemia due to demands specific to their physiologic states as well as increased susceptibility to concurrent infections.[2] Worldwide, about 42% of pregnant women are anaemic.[1,3] In developed countries such as America and France, the prevalence of anaemia in pregnancy was 24.1% and 15.8% respectively.[4,5] Higher values have been reported in Asia and Africa. Values observed in Turkey and India were 74.1% and 64% respectively.[6,7] In Ghana, one study showed 77.5% pregnant women were anaemic.[8] The prevalence of anaemia reported among pregnant women in south-east Nigeria was 77%.[9] In Okada, Edo state, 49.3% of studied pregnant women were found to be anaemic.[10] According to the World Health Organization (WHO), any country with prevalence of anaemia at 40% or higher in vulnerable groups has a severe public health problem.[11] Maternal anaemia, though preventable, is a major contributor to maternal morbidity and mortality. Anaemia is estimated to contribute to more than 115,000 maternal deaths and 591,000 prenatal deaths globally per year.[12]

Factors associated with anaemia in pregnancy include multiparity, poor nutrition, low maternal educational status, and other sociocultural factors.[13,14] These include observance of food taboos and herbal medication use during pregnancy. Some of the herbal concoctions contain alcohol which contributes to the burden of anaemia in exposed mothers.[15] Economic factors which affect health seeking behavior have also been implicated in anaemia occurrence, as well as in compliance with expected standard of medical care. Women of low socio-economic status find it difficult to seek antenatal care, eat an adequate diet or adhere to prescribed supplements due to financial incapacitation.[13,14,16]

Nutritional anaemia accounts for most cases of anaemia in pregnancy with iron deficiency being a leading cause.[17] The lack of other food nutrients such as vitamin B12, A and folate may lead to anaemia.[17] Pregnant women are at a higher risk because of increased nutritional demands necessary for foetal growth and development.[18] An association between low dietary diversity and anaemia has been established.[19] Pregnant women are also physiologically prone to dilutional anaemia from increased plasma volume expansion relative to red cell mass, however, this may become pathological.[17] In Africa, common infections that predispose to anaemia include malaria, helminthiasis and Human Immunodeficiency Virus (HIV) infection.[20,21] Pregnant women are prone to these infections due to a relative immunosuppression in this physiologic state.[20,21] A form of aplastic anaemia has also been identified in pregnancy, whether related to viral hepatitis infection or not.

Anaemia during pregnancy has adverse effects on both mother and the unborn child. It is associated with increased maternal morbidity and mortality, impaired lactation, prematurity, low birth weight or intrauterine fetal death at the extreme.[22] Anaemia also has devastating costs to individual and national productivity. Women with anaemia in pregnancy have decreased work capacity. They may be unable to earn their livelihood especially when their work involves manual labour.[20,23] It is therefore pertinent to identify factors associated with anaemia in pregnancy, and to mitigate them where possible.

Materials and Methods

This was a cross-section observational study that involved consenting pregnant women (18-45years old) attending antenatal clinic at the Stella Obasanjo Women and Children Hospital (SOWCH) and the Central Hospital, located in Benin-City, Nigeria. Ethical clearance was granted by the Edo State Hospital Management Board, with reference number, CH/A40/56. Those who carried multiple gestation, had chronic co-morbidities or conditions predisposing to anaemia, such as haemolytic anaemias, or were actively bleeding or recently transfused with blood (<3months) were excluded from the study. Using a systematic random sampling technique, participants were recruited for the study (based on the calculated sample size using the formula: n = Z 2 P (1-P)/d2) within a period of 6months (July-December 2019). Each participant was administered a questionnaire which addressed demographic parameters, social habits, relevant obstetric history to the study, as well as a dietary recall table. Educational level was categorized as low (primary school or no formal education) or high (at least secondary school education and above). Income was divided into those who earned below or above the Nigerian minimum wage.[24] The Women Dietary Diversity Score (WDDS) by Food and Agriculture Organization (FAO) was adopted to calculate the number of food groups consumed by the individual respondent over the previous 24-hour recall period.[25] Food consumed was grouped into ten, being roots and tubers, grains, pulses, nuts/seeds, meat/fish/poultry, milk/milk products, vitamin A-rich dark green leafy vegetables, other vitamin A-rich vegetables/ fruits, other vegetables, and other fruits. Obtainable score ranged from 0-10. Scores were divided into low (0-4) or high (5-10) dietary diversity.

About 5mls of venous blood was then drawn aseptically into ethylene-tetra-di-amine (EDTA) anticoagulated bottle to determine Hb concentration, analysed within 4hours of collection using the Sysmex KX-219 (2006) haemato-analyser. Anaemia was determined using WHO criteria; first and third trimester: <11.0 g/dL; second trimester: <10.5 g/dL; mild (9.0-10.9g/dl), moderate (7-8.9g/dl), severe (4-6.9g/dl) and very severe anaemia (<4g/dl).1 The remnant sample was then centrifuged to obtain plasma which was decanted into a freshly labeled sterile specimen bottle. This was used to determine malaria parasitaemia (MP), Hepatitis B surface antigen (HBsAg), antibody to Hepatitis C (anti-HCV) and HIV reactivity using rapid test kits (immunochromatography).

Data obtained was analysed using SPSS version 26.0 statistical package. Mean and standard deviation (SD) were used to describe continuous variables and proportions for categorical data. Chi-square analysis was used for group comparisons to determine the significance of observed differences or association where applicable. Pearson's correlate was used for correlation between continuous variables. Level of significance (p) was set at =0.05.

Results

A total of 386 pregnant women with a singleton gestation participated in this study. Table 1 shows their socio-demographic and clinical details. The mean age (±SD) of the study population was 30±4years, while mean gestational age was 31±5weeks. Majority of the women (318; 82.4%) were in their third trimester, 67(17.4%) and one (0.2%) in second and first trimesters respectively. Most of the women (328; 99.0%) had a high educational exposure. Those who earned above the national minimum wage were 171(44.3%). Eighty-one (21.0%) of the respondents were grand multiparous. A low duration of last childbirth (<2years) was found in 52(13.5%) versus 334(86.5%) with a high duration (=2years). Of the studied women, 134 (34.7%) had had an abortion, while 78(20.2%) had had a miscarriage. Table 2 depicts the habits of the participants. Only 80 (20.7%) used insecticide treated net (ITN). Seventy-eight (20.2%) women admitted to herbal medication use while 46(11.9%) consumed alcohol during current pregnancy. Food taboos were observed by only seven (1.8%) of the women while 72(18.7%) had a history of pica(ice>

chalk/clay> paper>sand, as in Figure 1). The mean WDDS (±SD) was 9±1, with 99.0% (382/386) participants having a high WDDS. Table 3 shows the distribution of food groups consumed by the respondents. There was a statistically significant positive correlation between WDDS and income (p= 0.01, r= 0.12), but none with age (p=0.12 r=0.07) and educational status (p= 0.7. x2= 0.62) as shown in Table 4. Twenty (5.2%) women had positive MP, 11 (2.8%) were HIV positive, three (0.8%) were HBsAg positive while none was found with a reactive anti-HCV.

The mean Hb (±SD) was 10.9± 1.1g/dl. The prevalence of anaemia was 45.6% (176/386). Majority of the women had a normal Hb (210; 54.4%), 163(42.2%) had mild anaemia and 13 (3.4%) had moderate anaemia. There was no one with severe anaemia. Factors associated with anaemia were lack of ITN use (p= 0.03, x2= 4.56), alcohol consumption during pregnancy (p= 0.00, x2= 16.7) and HIV infection (p=0.01 x2=5.98) as in Table 5. There was a significant correlation between Hb and gestational age (p=0.00, r= -0.18) as well as duration of last childbirth (p= 0.02, r= 0.15). There was no association between malaria parasitemia, previous miscarriage, pica, food taboos, herbal medication use, WDDS and occurrence of anaemia.

Table 1: Socio-demography and clinical parameters of the participants

Variable	Frequency (n=386)	Percentage (%)
Age		
<35years	319	82.6
=35years	67	17.4
Educational status		
No formal education	4	1.0
Primary	31	8.0
Secondary	236	61.1
Tertiary	115	29.8
Employment status		
Unemployed	151	39.1
Employed	235	60.9
Income		
<?18,000	215	55.7
=?18,000	171	44.3
Marital status		
Single	17	4.4
Married	369	95.6
Gestational age		
First trimester	1	0.2
Second trimester	67	17.4
Third trimester	318	82.4

Parity		
Nulliparous	0	0
Multiparous	305	79.0
Grand-multiparous	81	21.0
Duration of LCB		
Low (<2years)	52	13.5
High (=2years)	334	86.5
Previous Abortion		
Yes	134	34.7
No	252	65.3
Previous Miscarriage		
Yes	78	20.2
No	308	79.8
Mean (± SD) age (years)	30±4	
Mean (± SD) Hb (g/dl)	10.9±1.1	
Mean (± SD) WDDS	9±1	
WDDS		
Low (0-4)	4	1.0
Adherent (5-10)	382	99.0
Occurrence of anaemia		
Anaemic	176	45.6
Non-anaemic	210	54.4
Distribution of anaemia		
Mild	163	42.2
Moderate	13	3.4
Severe	0	0.0

LCB- last childbirth; WDDS- women dietary diversity score

Table 2: Some habits of the participants

Variable	Frequency (n=386)	Percentage (%)
ITN use		
Yes	80	20.7
No	306	79.3
Herbal medication use		
Yes	78	20.8
No	308	79.2
Alcohol use		
Yes	46	11.9
No	340	88.1
Food Taboos observance		
Yes	7	1.8
No	379	98.2
Pica		
Yes	72	18.7
No	314	81.3

ITN- insecticide treated net

Table 3: Distribution of food groups consumed by participants

Variable	Frequency (n=386)	Percentage (%)
Grains	381	98.7
Roots and tubers	370	95.9
Pulses	359	93.0
Nuts/Seeds	362	96.8
Meat/Fish/Poultry	370	95.9
Milk/Milk products	341	88.3
Vitamin A-rich dark vegetables	365	94.6
Other Vitamin A-rich fruits/veg	330	85.5
Other vegetables	379	98.2
Other fruits	348	90.2

Table 4: Correlation between Hb, WDDS and selected variables of participants

Variable	Hb r	p
Age	0.13	0.07
Gestational age	-0.18	0.00
LCB	0.15	0.02
WDDS	0.04	0.41
Variable	**WDDS r**	**p**
Age	0.07	0.12
Income	0.12	0.01

LCB- last childbirth; WDDS- women dietary diversity score

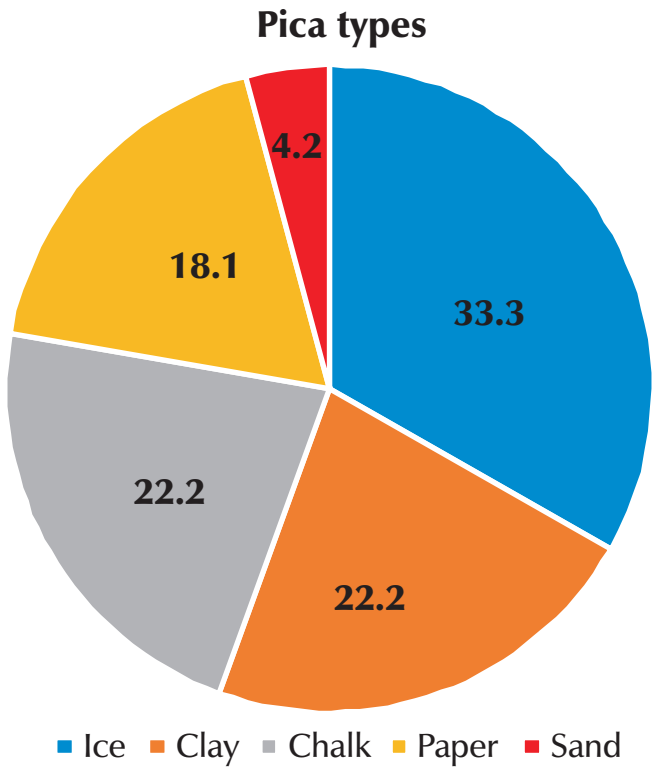

Figure 1: Pica distribution among participants (n= 72)

Table 5: Association between anaemia and some social, obstetric, and clinical parameters

Variable	Anaemic, n(%)	Non-anaemic, n(%)	X^2	P-Value
Age			0.17	0.67
<35years	147 (46.1)	172(53.9)		
=35years	29 (43.3)	38 (56.7)		
Multiparity			2.21	0.13
Nulliparous	0 (0)	0 (0)		
Multiparous	145 (47.5)	160 (52.5)		
Grand-multiparous	31 (38.3)	50 (61.7)		
Gestational age			4.23	0.12
First trimester	1 (100.0)	0 (0.0)		
Second trimester	24 (35.8)	43 (64.2)		
Third trimester	151 (47.5)	167 (52.5)		
LCB duration			0.26	0.61
Low (<2years)	22 (42.3)	30 (57.7)		
High (=2years)	154 (46.1)	180 (53.9)		
ITN use			4.56	0.03
Yes	148 (48.4)	158 (51.6)		
No	28 (35.0)	52 (65.0)		
Herbal medication use			0.02	0.88
Yes	141 (45.8)	167 (54.2)		
No	35 (44.9)	43 (55.1)		
Alcohol use			16.74	0.00
Yes	168 (49.4)	172 (50.6)		
No	8 (17.4)	38 (82.6)		
Food Taboo observance			1.91	0.15
Yes	171 (45.1)	208 (54.9)		
No	5 (71.4)	2 (28.6)		
Pica			2.20	0.13
Yes	38 (53.5)	34 (46.5)		
No	138 (43.8)	177 (56.2)		
WDDS			0.69	0.62
Low (0-4)	1 (25.0)	3 (75.0)		
High (5-10)	175 (45.8)	207 (54.2)		
MP			0.00	0.95
Negative	167 (45.6)	199 (54.4)		
Positive	9 (45.0)	11 (55.0)		
HBsAg			0.54	0.59
Negative	174 (45.4)	209 (54.6)		
Positive	2 (66.7)	1 (33.3)		
HIV			5.98	0.02
Negative	167 (44.5)	208 (55.5)		
Positive	9 (81.8)	2 (18.2)		

LCB- last childbirth; ITN- insecticide treated net; WDDS- women dietary diversity score. MP- malaria parasite; HBsAg- Hepatitis B surface antigen; HIV- Human immunodeficiency virus

Discussion

Anaemia remains a cause of global concern in pregnant women. Finding amenable reasons for anaemia in these women is plausible, and that informed the decision for this research work. We studied the habits, dietary diversity and pattern of infections that may explain occurrence of anaemia in 386 pregnant women in Benin City, Nigeria.

a) **Habits**

Identified habits of the women studied included poor usage of insecticide treated net (20.7%), a low frequency of herbal medication use (20.2%) and alcohol consumption (11.9%). Sleeping under an insecticide treated net helps to prevent against mosquito bite, an important factor in malaria transmission. Malaria is known to cause significant morbidity and mortality within children under five years as well as in pregnancy. It can also worsen pre-existing anaemia in pregnancy.26 Though we found a low prevalence of malaria (5.2%) among these women, measures to reduce spread need to be emphasized. These include health education through various channels and at antenatal visits, providing insecticide treated net freely, as well as chemoprophylaxis in malaria endemic zones such as Nigeria.[27,28]

The Centers for Disease Control and Prevention (CDC) describes any use of alcohol in pregnancy as significant and unsafe.[29] Though women may not take plain alcohol during pregnancy in Nigeria, they may consume herbal medications often. We found that to be so from our study, as more women admitted to taking herbal medications than alcohol. These locally prepared herbal concoctions usually contain alcohol and may predispose them to developing anaemia.[30] Significant alcohol consumption is associated with malabsorption and different red cell pathologies as well as foetal alcohol spectrum disorder.[31] We found 11.9% of the women studied had consumed alcohol in their index pregnancy, unlike 59.2% reported in Bayelsa, Nigeria.[32] The Bayelsa study also showed that many women don't know the adverse effects of alcohol on pregnancy.[32] Awareness should be raised on alcohol effects and benefits of abstinence during pregnancy.

b) **Dietary diversity**

Nutrition is an important component in the outcome of a pregnancy. Dietary diversity is one of the ways to access nutritional status. A high dietary diversity guarantees the supply of macro- and micro-nutrients needed for both mother and her growing foetus.[25,33] As nutritional anaemia accounts for a major proportion of anaemia in pregnancy, an emphasis on good nutrition as well as supplementation is pertinent. The women we studied showed a high dietary diversity (99.0%), with only 4 of them falling short of consuming at least 5 food groups. These women consumed all food groups we assessed in reasonable proportion. Also, only a few of them observed food taboos, a fact which supports their understanding of the importance of good nutrition in pregnancy. Though most of our participants had a high dietary diversity than previously reported, we think this may be due to difference in sample size, study area and level of education of the respondents in these studies.[34,35] We also found a positive correlation between WDDS and income. There have been conflicting reports on the association of dietary diversity and income.[36] However, earning an income influence purchasing power which includes food options. Food security is also guaranteed when an individual has a source of income.[37] Supportive laws for women empowerment and employment are therefore in congruence with our study findings.

c) **Infections**

We had a low prevalence of malaria (5.2%) compared to other reports in Nigeria.[38] Though we used a rapid diagnostic test, the gold standard for malaria diagnosis remains a blood film examination.[39] The prevalence of HBsAg among participants was also low (0.8%), as well as HIV (2.8%). We found no one with HCV infection. Ikeako et al found higher values in South-Eastern Nigeria, perhaps because they studied more women and used more sensitive assay methods.[40]

d) **Anaemia and associated factors**

The mean Hb in this study was 10.9± 1.1g/dl. The work of Saaka et al in Ghana gave a close report to ours, while higher value was obtained in Ethiopia by Grum et al.[41,42] Our study showed that women with longer duration of last childbirth had higher Hb (p== 0.02, r= 0.15). Grum et al equally found that birth interval was associated with anaemia when a bivariate analysis was conducted in their study.[42] These findings corroborate WHO recommendation of at least 2years child spacing to prevent complications such as anaemia in women.[43] As gestational age increases, the risk of anaemia increase due to increasing foetal growth and nutritional demands.[44] This may explain why in the studied women, there was a negative correlation between Hb and gestational age (p=0.00).

There was a high prevalence of anaemia (46.5%), just as demonstrated in other parts of Nigeria and Africa. Even higher values have been reported in earlier works.[45] The distribution of anaemia we found (mild more than moderate) was close to previous reports, save that we found no one with severe anaemia unlike others.[45]

Factors significantly associated with anaemia included alcohol consumption (p=0.00), non-usage of insecticide treated net (0.03) and HIV infection (p=0.01). It is a well documented fact that HIV is associated with anaemia, even in pregnancy.[46] Infection with HIV may inhibit or destroy haemopoietic cells leading to features of bone marrow suppression, anaemia inclusive. The presence of anaemia in the face of HIV infection may also connote disease progression.[47] We however found no association between WDDS and anaemia. This is as reported in northern Ghana and Islamabad.[36,41] Our finding however contradicts that of other works, making the association between dietary diversity and anaemia inconclusive.[48] Studies incorporating rural and urban participants within Nigeria are suggested for a broad view on this subject matter.

e) **Limitations of the study**

The findings of this study may not be a true representation of women in Benin City as it was institution based and did not cover women living in rural areas. Dietary diversity was assessed by individual recall and may be limited by memory of the participants. The prevalence of infections reported may also be underestimated as superior assay methods were not used due to resource constraint.

Conclusion

From this study, the high burden of anaemia persists. Factors associated with anaemia included non-usage of insecticide treated net, alcohol consumption and HIV infection. Health promotion strategies to limit these factors are advocated. The role of dietary diversity on anemia remains inconclusive and further studies in this regard are advised within Nigeria.

Conflict of Interest

The authors declare no conflicts of interest.

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Checklist ***(to be tick marked, as applicable and one copy attached with the manuscript)***

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Covering letter

- ☑ Signed by all contributors
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