Original Research Article

Do Women in Rural South-West Nigeria Become Pregnant with Sub-optimal Haemoglobin Concentrations?

ABSTRACT

Background: Anaemia is a major public health concern worldwide particularly in developing countries like Nigeria. In a previous study on determinants of prenatal anaemia, we found out that majority of our respondents had dietary iron intake below the recommended value of 27mg/day and all of them belonged to low socio-economic class. We opined that many of our respondents could have become pregnant with sub-optimal haemoglobin concentration.

Aim : This study was carried out to evaluate the prevalence of anemia and the socio-economic determinants of anaemia in non-pregnant women of reproductive age in our community.

Materials and Methods: The study which was descriptive and cross-sectional, involved two hundred consenting non-pregnant women of reproductive age in Ikenne Local Government Area of Ogun State, Nigeria. Interviewer-administered questionnaire was used to collect socio-demographic information and 24-hr dietary recall data which was used to determine the dietary diversity score (DDS) and daily dietary iron intake (DDI). Using a finger prick, the haemoglobin (Hb) concentration of each respondent was determined with a Haemoglobinometer DG-300HB. Data was analyzed using the Statistical Package for Social Sciences (SPSS) version 23.

Results: The mean age of respondents was 32.04±8.99 years while the age range was 18-43years. The mean and range of Hb concentrations were 11.77±1.02 g/dL and 8-16.67 g/dL respectively. The prevalence of anaemia obtained from this study was 54% (mean 11.77 SD1.02). The prevalence of anaemia was highest amongst respondents who were farmers. There was a statistically significant association between Hb concentration and body mass index (BMI) p=0.009. Of the 200 respondents, 193 (96.5%) had inadequate dietary iron intake (<18mg/day). There was statistically significant association between Hb groupings and daily

dietary iron (DDI) intake. *P*=0.003. With a mean of 2.96±0.95 food groups and range of 1.0-5.0 food groups, 95 % of respondents had low DDS (< 5 food groups). Hb concentration was also significantly associated with DDS as only 1(20%) of 5 respondents that had adequate DDS had Hb concentration below cut-off value.

Conclusion: The prevalence of anaemia in non-pregnant women of reproductive age was high in the community studied making it possible for majority of them to enter pregnancy with sub-optimal Hb concentration. The prevalence was highest amongst respondents who were farmers. Majority of the respondents had inadequate DDS and daily DDI.
Key Words: Anaemia, haemoglobin concentration, Women of reproductive age, dietary diversity score.

INTRODUCTION

Anaemia is a major public health concern worldwide particularly in developing countries (1) where its burden accounts for 89% of all anaemia-related disability(2).
Globally, anaemia affects 24.8% of the population(3) and its prevalence is consistently higher in people with low socioeconomic status, low body weight, and in females who have recently given birth(4).

Though anaemia is often multifactorial in aetiology, the main causes worldwide can be attributable to 3 syndromes: iron deficiency (iron deficiency anemia, hookworm, and schistosomiasis), hemoglobinopathy (sickle cell disorders and thalassemia), and malaria(5) However, iron-deficiency anaemia remains the dominant cause of anaemia worldwide(2).

Patients with anaemia usually present with clinical features such as fatigue, breathlessness, dizziness, and headache(6). Anaemia may impair their work capacity and increase their susceptibility to infections(7).

Anaemia is especially prevalent in women of reproductive age. In 2019, 29.9% of women aged 15-49 years suffered from anaemia (8) and for nonpregnant women, it is defined as Hb concentration below 12 g/dl(9). Data from the World Health Organisation showed that in

Nigeria in 2016, prevalence of anaemia among non-pregnant women aged 15-49 years was 48.80%.(10)

A report by Woldu et al, put the prevalence of anaemia among nonpregnant reproductive-aged women globally at 24.2%.(11) The study also reported that the prevalence was significantly associated with women who were of older age group, had no formal education and those women living with household food insecurity(11). In a review of the epidemiology, clinical assessment, pathophysiology, and consequences of anaemia in low-income and middle-income countries, Balarajan *et al* found that anaemia is disproportionately concentrated in low socioeconomic groups, and that maternal anaemia is strongly associated with child anaemia.(7) In a study we conducted on the socio-economic determinants of prenatal anaemia in rural communities of South-West Nigeria, we found out that majority (90.7%) of our pregnant respondents had dietary iron intake below the recommended value of 27mg/day and all of them belonged to the low socio-economic class(12). We opined that many of them could have become pregnant with sub-optimal haemoglobin concentration(12).

If our opinion was right, prevention of anaemia in non-pregnant women of reproductive age in these communities through robust health talks and poverty alleviation programs could improve the health status of these women when they get pregnant. This will eventually lead to reduction of both maternal and perinatal mortality.

In this study, we sought to verify this opinion by evaluating the prevalence of anaemia in non-pregnant women of reproductive age in our community and find out the socio-economic determinants of anaemia in them.

MATERIALS AND METHODS

Study area

The descriptive and cross-sectional study was carried out between February and May 2021 in Ikenne Local Government Area of Ogun State, Nigeria. Ikenne Local Government is one of the three local government areas where Remo people are found. The other two local governments are Sagamu and Remo North Local Governments. By the 2006 Nigeria Population Census, Remo Land had a population of 628,560 people (Ikenne LG-165,700; Sagamu LG-253,421; Remo North

LG- 209,439)(13) Remo land is within latitude 60^{o} South and 90^{o} North and Longitude 20 30 mins West and 60 30 mins East. It has a tropical climate, a land area of 971.0 Km^{2}, a temperature range of 27^{0} C and 29^{o} C and annual rainfall of 105-128 cm(14).

Data collection, instrument and procedures

Two Hundred non-pregnant women of reproductive age aged 18 -43 years were recruited for the study.

Inclusion Criteria

Women of ages between 18 and 43 years with no evidence of chronic inflammatory disorders such as diabetes, tuberculosis, human immunodeficiency virus and those with inherited anaemic disorders (such as sickle cell anaemia, thalassaemia and glucose -6-phosphate dehydrogenase deficiency)

Exclusion Criteria

Women with history of chronic inflammatory disorders such as diabetes, tuberculosis, human immunodeficiency virus and those with inherited anaemic disorders (such as sickle cell anaemia, thalassaemia, and glucose -6-phosphate dehydrogenase deficiency).

Ethical Considerations

The study received ethics permission from the Office of the Medical Officer of Health (MOH), Ikenne Local Government Area of Ogun State, Nigeria with approval Memo number **IKLG 102/21** dated 27 June 2019. Written informed consent was obtained from the respondents and who were assured of confidentiality of information.

Questionnaire Administration

Interviewer-administered questionnaire was used to collect data. The questionnaire was designed by the authors and adjusted to local setting and pre- tested for congruency and exclusion of ambiguities. It was refined thereafter and applied in the target population. The

English version of the questionnaire was translated into the native language of the study area and then back translated to English language by language and public health experts.

Research assistants were recruited and trained. All questionnaires were checked for completeness, clarity and consistency by the supervisors and investigators including dietitians. The questionnaire was in two parts. The first focused on the socio-demographic information of the respondents. This included age, weight, height, level of education and occupation of the women. The second part was on dietary recall of what the respondents consumed in the preceding 24 hours.

From the weights and heights taken, body mass index was calculated for each subject and categorized into four groups: underweight (<18.5 kg/m^2), normal weight (18.5–24.9 kg/m^2), overweight (25–29.9 kg/m^2) and obese ≥30 kg/m^2) following the WHO guidelines which addresses obesity in general population(15).

The Women Dietary Diversity Score (WDDS) was computed based on 10 food groups which aimed to reflect the micronutrient adequacy of the diet. Each respondent's dietary intake was categorized into inadequate and adequate dietary diversity score if she consumed <5 food groups and ≥5 food groups respectively(16). Finally, daily dietary iron intake was calculated from the DDS. We compared our values with the recommended daily dietary iron intake of ≥18mg for WRA in Nigeria(17).

Using a finger prick, the haemoglobin concentration of each respondent was determined with a Haemoglobinometer DG-300HB manufactured by DouBle, China. A single drop of blood was taken by finger prick after removing the first two drops to ensure that the sample was based on fresh capillary blood. Separate lancet and microcuvette was used to take blood from each respondent. Haemoglobinometer was checked every day before the start of the work for accuracy.

Data Processing and Analysis

Data entry and analysis was performed using the SPSS version 23 (SPSS Inc.). The descriptive data were given in percentages and as mean ± standard deviation (SD). Chi-squared test was used for the analytic assessment. The differences were considered statistically significant when the *P* value obtained is less than 0.05.

RESULTS

Socio-demographic characteristics of respondents.

Two-hundred respondents with age range 18-43 years were recruited for the study. As shown in Table 1, 41% (82 of 200) of respondents were in the age group 35-43 years. This was followed by respondents in the age group 18-24 years who constituted about 32%%. Those in the age group 30-34 years were the least with 12.5%.

About half (53%) of the respondents had secondary education, while 36% (72of 200) had tertiary education. This was followed with respondents with primary education and those who had no formal education with 20% and 2% respectively.

Majority, 61.5% (123 of 200) of the respondents were self-employed as artisans or traders while 18.5% (37 of 200) were employed as teachers, clerical officers, cleaners, messengers in small/medium scale enterprises. Other groups included farmers, 15% and housewive, 5%.

Of the respondents' marital status, more than half, 57% (114 of 200) were married, 37.5% (75 of 200) were single and the rest 11 (5.5%) were divorced or separated.

Respondents of Yoruba extraction had the highest frequency, 69.5% (139 of 200). This was followed by Ibos with 23.5% (47 of 200) while Hausas and other tribes constituted 1.5% and 5.5% respectively.

Mean values and range of age, Hb concentrations, BMI, daily dietary iron intake and dietary diversity score

As shown in Table 2, the mean age of respondents was 32.04±8.99 years while the age range was 18-43years. The mean BMI was 25.64±5.66 kg/m^2 and the range was 16.41-43.42 kg/m^2.

The mean and range of haemoglobin concentrations were 11.77±1.02 g⁄dL and 8-16.67 g⁄dL respectively. The mean dietary iron intake was 9.37±4.5 mg⁄day and range was 0.0-25.0 mg⁄day while the mean DDS was 2.96±0.95 food groups and range 1.0-5.0 food groups.

Haemoglobin concentrations, BMI, iron intake and DDS groupings of respondents.

As shown in Table 3, 54% (108 of 200) of respondents had haemoglobin concentrations below the cut-off value that defines anaemia making the prevalence of anaemia to be 54%.

The BMI groupings are shown in Table 3. About half, 53% (106 of 200) had normal weight, 4(2%) were underweight, 47(23.5%) overweight while 43(21.5%) had obesity.

Of the 200 respondents, almost all, 193 (96.5%) had inadequate dietary iron intake (<18mg/day) and 195(97.5 %) had low DDS (< 5 food groups) while only 5(2.5%) had adequate DDS (≥5 food groups).

Haemoglobin concentrations groupings in correlation with age, education, occupation, marital status, dietary iron intake and DDS

As shown in Table 4, the frequency of anaemia was highest among the age group 25-29 years (65.5%). This was followed by the age group 18-24 years with 61% and age group 35-43 years with 50%. The age group 30-34 years was the lowest with 36%. *p*=0.086

Though not statistically significant, the prevalence of anaemia was highest among respondents with no formal education and lowest in those with tertiary education. While all the 2 respondents with no formal education were anaemic, 43.1%(31 of 72) of respondents with tertiary education were anaemic. The prevalence of anaemia among respondents with secondary education was 52.85% while those with primary education was 45% *P*=0.544

With occupation groupings, farmers had the highest frequency (73.7%) of anaemia. Next to famers were housewives with frequency of 60%. Artisans and traders had the lowest frequency (53.5%). This was however not statistically significant. *p*=0.102

Using marital status grouping, the frequency of anaemia was highest (58.7%) in respondents who were single. This was followed by respondents who were separated or divorced with

54.5%. Respondents who were married had the lowest frequency with 50.9%. This was also not statistically significant *p*=0.575

Haemoglobin groupings were significantly associated with BMI. *p*=0.017. The frequency of anaemia was lowest among the obese people with 39.5%. This was followed by overweight respondents with 42.6% and underweight with 50%. The frequency was highest among respondents with normal weight with 65.1%.

Haemoglobin grouping was also significantly associated with DDI. None of the 7(100%) respondents with adequate DDI intake had Hb concentration below the cut-off value while more than half, 57%(110 of 193) of respondents with inadequate dietary iron intake were anaemic. p=0.003.

There was also a significant association between Hb concentration and DDS. While only 1(20%) of 5 respondents with adequate DDS were anaemic, more than half 54.4% (106 of 195) of respondents with inadequate DDS were anaemic. *p*=0.00001.

DISCUSSION

Globally, there has been little progress in reducing the anaemia burden among women of reproductive age (WRA) over the past two decades, with prevalence actually rising in some South Asian and Sub-Saharan African countries(18). More recent estimates from the World Health Organisation (WHO) indicate that globally, the prevalence of anaemia among WRA has actually increased between 2011 and 2016, from 30% to 33% (19) and in Nigeria, WHO 2016 data gave the prevalence of 48.8% among non-pregnant WRA(20).

The prevalence of anaemia obtained from this study was 54% (mean 11.77 SD1.02). This is categorized under severe public health importance (21) and indicates that a considerable number of women in the community were suffering from anaemia.

This result is consistent with what was reported from Nigeria by the WHO in 2016(11). It is however higher than 35.6% (Mean 12.3 g/dL SD 15.7) obtained from a report from Sudan(22)

and 21.3% (23) reported from Southern Ethiopia but lower than what was obtained in Tanzania, 39.6% (24) in Bursa, Turkey (32.8%)(25) and in Coimbatore district, India (64.4%)(26)

Though all the respondents in our study belonged to the poor socio-economic status, the prevalence of anaemia in farmers amongst them was higher than in the other groups, reflecting poorer economic status of farmers and according to Moore e*t al* may be due to insufficient diet, limited education, exposure to dangerous chemicals, schistosomiasis, hookworm infestations, inadequate access to health services, and delayed diagnosis and treatment(27).

Though not statistically significant, women who had no formal education had the highest prevalence of anaemia when compared with others and the lowest frequency was found among women with tertiary education. This is consistent with previous studies. A study in Bangladesh reported that a lack of education was an important factor related to the prevalence of anaemia among Bangladeshi women. The authors believed that the increase in the education level would likely bring about a decline in the prevalence of anaemia(28). Wilunda *et al* also reported that primary school education reduced the risk of severe anaemia by about 20%, compared with those having no education(24). Preparation of food for the household is the responsibility of women whose knowledge or lack of it about nutrition can affect the health and nutritional status of the entire family(29).

Though not statistically significant, our study revealed that older age group was associated with lower prevalence of anaemia. Respondents in the age category of 18-29 years were more likely to be anaemic as compared to those in category of 30-43 years. This is in agreement with a study conducted in Nepal that reported that being in the young age category was a risk factor for anaemia(30) A similar observation was reported in a study conducted in ten East African countries(31), and in India(32) where younger women had higher prevalence of anaemia. This younger age group may be single, unemployed or students and less economically buoyant to meet up to with the nutritional requirement to prevent anaemia when compared with older ones (30-43 years). However, some reports are not in agreement with our finding. In a study conducted in rural china, Ma *et al* reported that older women of reproductive age had a higher risk of developing severe anaemia(33). Possible reasons for the increase in the risk of anaemia

in the older age group in those studies were thought to be related to reproductive history, pregnancy history-related conditions, and maternal workload(34).

In this study, the prevalence of anaemia among WRA was significantly associated with BMI. This was also observed in our previous report(12) and agrees with the report by Woldu *et al* who observed that being overweight was inversely associated with the prevalence of anaemia(11). It is also consistent with a study conducted in Andhra Pradesh, India, in which overweight and obese women have lower prevalence ratios for anaemia than nonpregnant WRA.(35) This observation can be related to the nature of the diet and lifestyle of the individual because BMI is directly related t o the nutritional status and underweight is related to the nutritional deficiency that results in the reduced bioavailability of essential nutrients which finally leads to anaemia(11).

We found a higher proportion of respondents who were single with anaemia in our study. This corroborates with a study from Nepal where the prevalence of anaemia was found to be lower among married women(36). This, according to Osamor *et al* can be explained by the women's relative position in the household in terms of decision-making. Autonomous decision-making by women is associated with increased utilization of maternal health services(37) thereby resulting in better health outcome. This result is however in contrast to what was observed in Ecuador where single women had lower prevalence of anaemia when compared with married women even after controlling for other factors(38). In lower income countries, married women are likely to carry out most activities including work on crops, domestic activities and taking care of children and having so many responsibilities on their shoulders could harm their health status.(39)

Majority (90.5%) of our respondents had daily iron intake below the recommended value in Nigeria(18 mg/day). The mean daily iron intake was 9.37± 4.53 mg/day with a range of 0.0-25.0 mg/day. Our result agrees with 61–97% of WRA that had a dietary iron intake below the recommended values obtained in 29 European countries ranging from 61% in Ireland to 90–97% in Belgium, Denmark, Hungary, Serbia, and Sweden.(40).

We found out that only 5% of our respondents achieved minimum dietary diversity for women (MDD- W) This is alarmingly and abysmally lower than reports available from some rural Africa communities in Ethiopia with 56%(41), in Senegal, 31.5%.(42) and India in which 44% of women rural communities were classified as having a diverse diet (MDD-W ≥5W) (43). We did not get any report similar or lower than our result. This along with very low number of respondents with adequate DDI intake may reflect the level of poverty in the community studied considering the high cost of certain food groups such as legumes, roots, tubers, vitamin A rich fruits and vegetables, fish and vegetables, fish, meat and poultry observed in the community studied. We also observed that despite being a rural community, most of the food items consumed was brought in from neighboring communities. Majority of the residents who could have taken up farming were engaged in non-farming activities such as petty trading or employed as teachers, clerical officers, and other low-income jobs. Furthermore, the presence of a university with a teaching hospital and of many fraudsters who fled to the area from the cities had contributed to high cost of living in this community. We noticed that little farming activities (cultivation, fruit and vegetable selling) that were carried out in the community were done by few peasants predominantly northerners and their produce were usually taken to neighbouring urban centres for sale making food unavailable and unaffordable in the community.

Conclusion

In conclusion, the prevalence of anaemia in non-pregnant WRA is high in the community studied making it likely for majority of them to enter pregnancy with sub-optimal haemoglobin concentrations. Majority of the respondents had low dietary diversity and inadequate daily iron intake.

Recommendation

An intervention through poverty alleviation, introduction of activities that will make farming more attractive and of mineral supplements including iron and fortification of food to all WRA will go a long way to reduce anaemia in pregnancy. However, more attention should be paid to the education of farmers who had the highest prevalence of anaemia in this study. They need

to be encouraged to adequately consume part of their produce rather than selling everything for economic gain.

Study limitations.

This is a cross-sectional study which did not allow us to establish the causality. It relied on haemoglobin as the measure of anaemia. Further studies should consider other indices that will include iron studies to differentiate the types of anaemia.

TABLES

Table 1: Socio-demographic characteristics of respondents

Variables		N(%)
Age (years)	18-24	64(32)
	25-29	29(14.5)
	30-34	25(12.5)
	35-43	82(41)
Education	None	2(1.0)
	Primary	20(10)
	Secondary	106(53)
	Tertiary	72(36)
Occupation	Housewife	10(5)
	Farmer	30(15)
	Artisan/traders	123(61.5)
	Employed	37(18.5)
Marital status	Single	75(37.5)
	Married	114(57)
	Divorced/separated	11(5.5)
Tribe	Yoruba	139(69.5)
	Ibo	47(23.5)
	Hausa	3(1.5)
	Others	11(5.5)

Table 2: Mean values and range of age, Hb concentrations, BMI, daily dietary iron intake and dietary diversity score.

Variable	Mean	S.D	Range
Age (years)	32.04	8.99	18-43
Weight (kg)	65.16	14.47	40-105
Height (cm)	159.15	6.81	142-180
Haemoglobin (g/dl)	11.77	1.02	8-16.67
BMI (kg/m^2	25.64	5.66	16.41-43.42
Dietary iron intake	9.37	4.53	0.0-25.0
DDS	2.96	0.95	1.0-5.0

DDS- Dietary diversity score
BMI-body mass index

Table 3: Haemoglobin concentrations, BMI, iron intake and DDS groupings of respondents.

Variables		N(%)
Heamoglobin (g/dl)	8-11.9	108(54)
	≥ 12	92(46)
BMI	Underweight	4(2)
	Normal	106(53)
	Overweight	47(23.5)
	Obesity	43(21.5)
Dietary iron intake	Inadequate(<18mg/day)	193(96.5)
	Adequate (≥18mg/day)	7(3.5)
DDS	< 5 food groups	195(97.5)
	≥ 5 food groups	5(2.5)

DDS- Dietary diversity score
BMI-body mass index

Table 4: Haemoglobin concentrations groupings in correlation with age, education, occupation, marital status, dietary iron intake and DDS

Variables		Hb <12(%)	Hb ≥12(%)	Total	P-value
Age (years)	18-24	39(60.9)	25(39.1)	64(100)	0.086
	25-29	19(65.5)	10(34.5)	29(100)	
	30-34	9(36)	16(64)	25(100)	
	35-43	41(50)	41(50)	82(100)	
Education	None	2(100)	0(0)	2(100)	0.544
	Primary	9(45)	11(55)	20(100)	
	Secondary	56(52.8)	50(47.2)	106(100)	
	Tertiary	31(43.1)	41(56.9)	72(100)	
Occupation	Housewife	6(60)	4(40)	10(100)	0.102
	Farmer	22(73.3)	8(26.7)	30(100)	
	Artisan/trader	68(55.3)	55(44.7)	123(100)	
	Employed	16(43.2)	21(56.8)	37(100)	
BMI	Underweight	2(50)	2(50)	4(100)	0.575
	Normal	69(65.1)	37(30.9)	106(100)	
	Overweight	20(42.6)	27(57.4)	47(100)	
	Obese	17(39.5)	26(60.5)	43(100)	
DD(Iron)	Inadequate (<18mg)	110(57)	83(43)	193(100)	0.009
	Adequate (>18mg)	0(0)	7(100)	7(100)	
DDS	Inadequate(<5FG)	106(54.4)	89(45.6)	195(100)	0.00001
	Adequate(≥5FG)	4(80)	1(100)	5(100)	

DDS- Dietary diversity score
BMI-body mass index

COMPETING INTERESTS DISCLAIMER:

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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