

Preconception prevalence of iron, Vitamin B 12 and Folate deficiencies among women of reproductive age in a Nigerian population

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Abstract

Background: Maternal healthcare is an index of national healthcare coverage. Gestational anaemia is reportedly prevalent in Nigeria mainly due to nutritional deficiency and malaria infection. Considerable effort has been directed towards addressing these challenges among pregnant women. However, preconception care is yet to be routinely practised in our locality. It is possible that lack of preconception care, especially with regards to assessment of nutritional status, could be contributing to a gestational health crisis, thus necessitating due investigation.

Methods: This study enrolled 360 women of reproductive age at the University of Calabar Teaching Hospital in southern Nigeria between November 2021 and April 2022. Simple random sampling was used to recruit consenting subjects to be part of the survey where structured questionnaires were administered. Guided by their responses, subjects who were neither on supplements at the time of the study nor in the practice of taking supplements prior to pregnancy were purposively enrolled. Blood samples were collected from each participant for assays of iron, Vitamin B12 and folate by enzyme-linked immunosorbent assay method and measurement of haemoglobin concentration by automation. Data analysis to derive frequencies and Student's t-test comparison of means was carried out using SPSS 22.0.

Results: Folate deficiency was the least at 8.9%, followed by Vitamin B12 deficiency at 14.2% and Iron deficiency at 42.5%. Anaemia was observed to be 31.1% within the studied population. Iron deficiency alone dominated in the observed distribution pattern of the assessed deficiencies Co-deficiency of all three measured parameters stood at 4.4%.

Conclusion: Deficiencies of iron, vitamin B12 and folate are prevalent at the preconception stage in the study area. So, also, is anaemia even though the severity may be considered mild. Women in the study area are at risk of pre-existing anaemia and nutritional deficiency prior to pregnancy. Routine preconception care including assessment of nutritional status is therefore recommended in the study locality.

Key words: Preconception, maternal health, anaemia, nutritional deficiency

Introduction

Maternal healthcare is symbolic in the general healthcare system at a national level as it represents basic healthcare coverage, while maternal mortality has become an important health indicator for national socioeconomic status (WHO, 2022; Edem *et al.*, 2021). Moreso, maternal healthcare by extension proactively caters for infant health.

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This dynamic relationship is readily observed in the adverse consequences of poor maternal nutritional status on the outcome of pregnancy including but not limited to low birth weight, neonatal anaemia and neural tube defect (Rogne *et al.*, 2017; Gernand *et al.*, 2016; Breyman, 2015; Van Sande *et al.*, 2013; Lindsay *et al.*, 2012).

In circumstances of planned pregnancy, assessment of baseline biomedical parameters aids possible interventions such as micronutrient fortification where necessary. Largely confined to cases challenged with infertility, preconception care as part of maternal healthcare is yet to be routinely practised in resource-poor societies as we have in Nigeria (Ojifinni & Ibisomi, 2020).

Pregnancy remains the prompting factor for which most women intentionally enrol for maternal healthcare, and even at this, previous reports from within the study locality have revealed a trend of late antenatal enrolment (Ndem *et al.*, 2021; Egbe *et al.*, 2018).

Gestational anaemia is reportedly prevalent in Nigeria with rates well over 60% (Adewara *et al.*, 2014; Ezugwu *et al.*, 2013). Among the many contributing factors to this anaemia, nutritional deficiency and malaria parasitaemia rank high to which national programmes have been employed towards effective control of these maladies (Akwiwu *et al.*, 2019). Strategies such as routine provision of supplements and distribution of insecticide-treated bed nets during antenatal visits are some of the specific actions taken to improve maternal health during pregnancy (Adaji *et al.*, 2019; Esu *et al.*, 2018; Fleming *et al.*, 1986).

Notwithstanding, maternal morbidity and mortality are yet to be fully addressed (UNICEF, 2016). Reasons advanced for this, particularly with respect to anaemia, include challenges with sustaining intervention programmes and literacy levels in rural areas of the country (WHO, 2019; Akwiwu *et al.*, 2019; Harika *et al.*, 2017). There is also a possibility that lack of preconception care, especially with regards to assessment of nutritional status, could be contributing to gestational health crisis.

It is obvious from the cited literature that iron, vitamin B12 and folate deficiencies stand at the forefront of implicated nutritional deficiencies with poor pregnancy outcome. While these variables have been assessed within the Nigerian pregnant women population, there is paucity of data at the preconception stage among women of reproductive age. This study sought to bridge this gap by looking into the prevalence of iron, vitamin B12 and folate deficiencies among women of reproductive age accessing contraceptive services at the family planning unit of a tertiary health institution in Southern Nigeria. The significance of this study is to highlight the prevalence of common nutritional deficiencies in preconception state among Nigerian women.

Materials and methods

The present study was conducted at the University of Calabar Teaching Hospital, Calabar Nigeria. The centre is a tertiary health facility located in the foremost metropolitan city of Calabar in Southern Nigeria. The sample size was determined ($t^2 \times p(1-p) / m^2$) using the anaemia prevalence of 55% reported for Nigerian non-pregnant women (WHO, 2021). This cross-sectional descriptive study enrolled 360 women accessing family planning services at the hospital between November 2021 and April 2022. Ethical approval was obtained from the Health and Research Ethics Committee (UCTH/HREC/33/532) of the University of Calabar Teaching Hospital. Informed consent was obtained from each participant enrolled in the research and confidentiality was maintained by using assigned codes instead of names during sample and data analyses. Consenting study participants were 21 years old and above.

A Two-step sampling technique was used for subject selection. A simple random approach was used to recruit consenting subjects to be part of the survey where

structured questionnaires were administered. Guided by their responses, subjects who were neither on supplements at the time of the study nor in the practice of taking supplements prior to pregnancy were purposively enrolled for blood sample collection. Bio-data and information on the use of supplements, parity and average daily meal consumption were obtained from the administered structured questionnaire.

The blood sample was collected from each enrolled subject. Serum ferritin was analysed using a Human Ferritin ELISA kit obtained from BioCheck, Inc South San Francisco, USA. Serum levels of vitamin B12 and folate were also assayed by ELISA method using AccuDiag™ ELISA Kit (Diagnostic Automation/ Cortez Diagnostics, Inc. USA) while haemoglobin concentration was measured using automated haematology analyser Sysmex K2-2IN (Sysmex Corporation, Japan). Data analysis to derive frequencies and Student's t-test comparison of means was carried out using SPSS 22.0. A 95% confidence level was set for statistical significance.

Results

Socio-demographic characteristics of the study participants are presented in Table 1. These non-pregnant women were mostly aged 31-40 years, followed by those aged 41-50 years. The lowest number were those between the ages of 21 to 30 years. The study participants had appreciable levels of literacy and were distributed across occupational categories including civil service and self-employment as well as those who were housewives. Most of them lived on a family income of 200-500 USD monthly. Those in the habit of eating twice daily were slightly more than those who ate thrice daily, while multiparous women were more than the primiparous ones.

Table 1. Socio-demographic characteristics of study participants

Variables	Number n = 360	Percentage 100%
Age		
21-30	69	19.2
31-40	182	50.5
41-50	109	30.3
Educational Level		
Primary	0	0
Secondary	212	58.9
Tertiary	148	41.1
Occupation		
Civil servants	121	33.6
Housewives	102	28.3
Self-employed	137	38.1
Family income		
<200 USD	133	36.9
200-500 USD	176	48.9
>500 USD	51	14.2
Average number of meals Per day		
One meal	0	0
Two meals	186	51.7
Three meals	174	48.3

Parity			
Primiparous		168	46.7
Multiparous		192	53.3

Prevalence rates of assessed deficiencies are shown in Tables 2 and 3. Folate deficiency was the least at 8.9%, followed by Vitamin B12 deficiency at 14.2% and Iron deficiency at 42.5% was the highest. Generally, the present study recorded anaemia to be 31.1% within the studied population (Table 2). Considering the pregnancy cut-off value (110g/L) for haemoglobin concentration, 11.9% of the studied population fell below this mark already in a preconception state (Table 3).

Table 2. Prevalence rates of anaemia, folate and vitamin B12 deficiencies within the studied population

Parameter	Cut off value	Total No.	No. of Pregnant Women with Deficiency	%
Folate	6.8nmol/L	360	32	8.9
Vitamin B12	148pmol/L	360	51	14.2
Iron	10µg/L	360	153	42.5
Anaemia	120g/L	360	112	31.1

Table 3. Severity of anaemia within the studied population

Haemoglobin concentration	Cut off value	No. of Pregnant Women with Deficiency n = 360	%
	100-109g/L	43	11.9
	110-119g/L	69	19.2
Anaemic	<120g/L	112	31.1
Non-anaemic	≥120g/L	248	68.9

Iron deficiency alone dominated in the observed distribution pattern of the assessed deficiencies (Table 4). At a prevalence of 35.8%, it constituted more than half of the total deficiencies recorded (129/193). Co-deficiency of all three measured parameters stood at 4.4%. Again, folate deficiency was at the bottom of the list with its sole deficiency recorded at 0.8%.

Table 4. Distribution of single and co-deficiencies within the studied population

Parameter	No. of Pregnant Women with Deficiency n = 360	%
Folate alone	3	0.8
Vitamin B12 Alone	24	6.7
Iron alone	129	35.8
Folate & B12	13	3.6
Folate & Vitamin B12 & Iron	16	4.4
Folate & Iron	0	0
Vitamin B12 & Iron	8	2.2
Total	193	53.5

Mean values of the measured parameters were compared on the basis of parity as well as an average number of meals consumed daily as shown in Tables 5 and 6. Primiparous subjects had significantly higher mean values compared to multiparous participants. Similarly, subjects with an average daily consumption of 3 meals had a significantly higher value than others who reported daily consumption of 2 meals.

Table 5. Impact of parity on the measured parameters

Parameters	Primiparous Subjects n = 168	Multiparous Subjects n = 192	p-Value
Folate (nmol/L)	15.48±4.97	10.09±5.23	0.001
Vit B12 (pmol/L)	324.01±85.85	216.73±97.27	0.001
SF (µg/L)	33.81±23.14	15.73±25.93	0.001
Hb (g/L)	125.46±5.95	117.24±9.44	0.001

Table 6. Impact of average daily number of meals on the measured parameters

Parameters	Subjects on 3 meals per day n = 174	Subjects on 2 meals per day n = 186	p-Value
Folate (nmol/L)	16.84±5.01	8.64±2.92	0.001
Vit B12 (pmol/L)	351.37±77.66	187.67±7.13	0.001
SF (µg/L)	40.13±28.25	9.22±11.17	0.001
Hb (g/L)	127.66±4.99	114.93±7.38	0.001

Discussion

The prevalence of general anaemia in this study was 31.1%. The observed prevalence for iron and vitamin B12 deficiencies were 42.5% and 14.22% respectively, while that of folate deficiency was 8.9%. Apparently, nutritional deficiencies and anaemia are prevalent in the study area beyond the heightened pressure from gestational demands. The observed value of 31.1% for anaemia is lower than the national estimation of 55% but comparable to the global prevalence of 29.6% (WHO, 2021).

It is interesting to note that even among pregnant women in the study locality, a previous study recorded 47.8% anaemia; an observation that is attributable to rich vegetable consumption in the area (Ndem *et al.*, 2021). Furthermore, multiparity and inadequate meal consumption resulted in significantly lower values of the measured parameters. Interestingly, there is a campaign for maternal health in Nigeria in line with the global sustainable development goals (WHO, 2022; UNICEF, 2016).

Much of the strategies for realising this, however, have been directed towards ensuring optimal antenatal coverage and family planning for healthy spacing of childbirth. Regarding the former, prescription and provision of nutritional supplements on a routine basis have long been adopted for healthy pregnancy outcomes. More specifically, a measurable outcome of this fortification drive is the improvement of erythrocytic indices and invariably the reduction of gestational anaemia. So far, preconception anaemia and deficiency states have not received much attention in the study area and could hold the potential of addressing gestational anaemia and its toll on both maternal and infant health.

Additionally, iron deficiency was observed to be about 3 (2.99) times higher than vitamin B12 deficiency and more than 4 (4.78) times higher than folate deficiency among the studied population. This finding places the need for iron supplementation at the top of the list for nutritional intervention within the studied population with regard to the measured parameters. At a point when these subjects could have become pregnant without any recourse to their nutritional state, 11.9% of them were already below the haemoglobin concentration level

(110g/L) used as a cut-off for gestational anaemia. A significant proportion (of 19.2%) had haemoglobin concentration levels between the range of 110-119 g/l which though passes the gestational anaemia cut-off point is still considered anaemic for non-pregnant women.

In all, this study recorded 31.1% preconception maternal anaemia prevalence in Calabar, Nigeria. More than half (53.5%) of the studied population had at least a deficiency of iron, vitamin B12 or folate, while 4.4% had co-deficiency of all three screened parameters. The prevalence of iron deficiency ranked highest in all cases of categorisation among the measured parameters and was in fact higher than the prevalence of anaemia. Iron contributes to erythropoiesis in the haemoglobinisation of developing red cells, thus serving as an important index in the study of the red cell population. A deficiency of stored iron precedes anaemia, making it a marker for early detection of a potential anaemic state (Akwiwu *et al.*, 2019; Harika *et al.*, 2017; Fleming *et al.*, 1986).

Becoming pregnant with either pre-existing anaemia or nutritional deficiency can be quite risky as studies have reported a higher association of birth defects with nutritional deficiencies particularly early in pregnancy (Pafici, 2016; Sukuma *et al.*, 2016; Eke *et al.*, 2016; WHO, 2015). In resource-poor settings such as Nigeria, healthcare coverage is inadequate and the populace is largely passive. Previous studies in this locality had observed late enrolment of pregnant women for antenatal care as well as late commencement of supplement intake which in turn impacts adversely on maternal health (Alfred *et al.*, 2021; Ndem *et al.*, 2021; Egbe *et al.*, 2018).

The efforts to address maternal health issues during pregnancy would be more beneficial if approached proactively. Thus, it may be necessary to drive nutritional fortification as women access family planning services, particularly for women with multiple parity and irregular daily meal consumption. Being a cross-sectional study to determine prevalence, this study had the limitation of not following up on the subjects over time. Future studies could adopt a longitudinal study design that would monitor subjects to the point of conception and beyond.

Conclusion

The present study concludes that deficiencies of iron, vitamin B12 and folate are prevalent at the preconception stage in the study area. So also, is anaemia even though the severity may be considered mild. Multiparity and inadequate meal consumption impact adversely on the measured parameters. These findings imply that the studied population is at risk of nutritional anaemia at the preconception stage. Thus, there is a need for routine preconception assessment of nutritional status in the study locality.

Funding

No external funding was used for this study.

Conflict of Interest

The authors declare no conflict of interest.

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