

# Timely accessing of antenatal care and prevalence of vitamin B12 and folate deficiencies among pregnant women in a Nigerian population

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## ABSTRACT

**Objectives:** Normal pregnancy is accompanied by increased physiologic requirements. Nutritional inadequacy during pregnancy carries the risk of poor pregnancy outcome, including anaemia. Among the leading causes of nutritional anaemia in pregnant women are deficiencies of both vitamin B12 and folate. This study assessed possible influence of timely registration of antenatal care on prevalence of folate and vitamin B12 deficiencies in a Nigerian population.

**Methods:** A structured questionnaire was utilized to obtain sociodemographic, obstetrics and supplement intake information among 180 study participants. Blood samples were collected from each participant for assays of Vitamin B12 and folate by enzyme linked immunosorbent assay methods and measurement of haemoglobin concentration by automation.

**Results:** This study observed 1.7% (3/180) folate deficiency, while the prevalence of vitamin B12 deficiency was 21.7% (39/180). Generally, anaemia was observed in 47.8% (86/180) of the pregnant women. Less than a third (26.7%) of the studied population registered for antenatal care within the first trimester. The highest registration (53.3%) occurred during the second trimester. Greater percentages of folate and vitamin B12 deficiencies were observed in association with late registration for antenatal care.

**Conclusion:** Gestational anaemia still remains a challenge in Nigeria. The prevalence for vitamin B12 deficiency occurred 13 times more compared to folate deficiency. Vitamin B12 and folate deficiencies were observed more among pregnant women who registered late for antenatal care.

**Key words:** Pregnancy, anaemia, vitamin B12, folate.

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## INTRODUCTION

Anaemia remains one of the important health challenges in developing countries that disproportionately affects pregnant women and growing children. Nutritional deficiencies are among the underlying causes of gestational anaemia in sub-Saharan Africa (1,2). The presence of nutritional deficiencies during pregnancy contributes adversely to the outcome of pregnancy with regards to both maternal and infant health (3-6). The negative impact of micronutrient deficiencies on infant health are quite extensive and include increased risks of birth defects, sub-optimal foetal development and chronic health problems in childhood (1,7,8). Against this backdrop, preconception care with possible diet fortification or vitamin supplementation before pregnancy ought to be the ideal approach towards addressing gestational micronutrient deficiency. (5,9,10). However, this dimension of maternal healthcare is not common in developing countries like Nigeria. Inadequate healthcare infrastructure, low socio-economic status, and unplanned pregnancies contribute to the general healthcare-seeking attitudes of women of reproductive age in this part of the globe.

Although nutritional anaemia can be controlled by providing the deficient nutrient(s), either as therapeutic supplements or by fortification of commonly used foodstuff, reports from Nigeria indicate that significant proportions of the population are deficient (1,11). While deficiency states may be tolerable in the apparently healthy general population, the impact of such among pregnant women cannot be overemphasised. Where periconceptional micronutrient assessment and fortification may not be attainable at present in developing regions, supplementation during pregnancy ought to be encouraged at

the earliest. Unfortunately, healthcare in resource-poor settings is neither adequate nor evenly distributed. It is rather available to a proportion of the general population and influenced by determinants of socioeconomic status. Even in developed regions, it is interesting to find that use of dietary supplements among pregnant women is also affected by socioeconomic factors, and significantly increases with the trimester of pregnancy (12,13). Unfortunately, with awareness campaigns shifting towards emerging health challenges, socioeconomic and demographic disparities perpetuate treatable health challenges such as gestational anaemia especially in developing regions of the world.

Notable among the causes of nutritional anaemia are iron, folate, and vitamin B12 (7,14). Already, reports of nutritional anaemia during pregnancy among Nigerian women implicate iron as a significant contributor while not much has been observed for folate and vitamin B12 (15,16). There are guidelines for diagnosis and treatment of vitamin B12 and folate deficiencies involving first line tests and confirmatory assays (17). For the purpose of screening out deficiency states, the first line tests were utilised in this study. The study also sought to observe possible impact of timely conventional antenatal care on the prevalence of folate and vitamin B12 deficiencies among pregnant women accessing antenatal care at a tertiary health institution in Southern Nigeria.

## METHODS

The present study was conducted in the University of Calabar Teaching Hospital, Calabar, Nigeria; a tertiary hospital that caters for the health needs of the general public within the Calabar metropolis and its environs. This cross-sectional

descriptive study enrolled 180 pregnant women attending antenatal clinic at the hospital consecutively within the period of May 2017 to April 2018. The recruited subjects were apparently healthy pregnant women who had no known medical conditions, had no pregnancy complications, and were not on drugs, except for iron, folate and B12 supplements. They had commenced and sustained regular intake of folate and B12 supplements from the time of their enrolment for routine antenatal visit to term. Subjects with preconception intake and cases of supplement intake prior to commencement of antenatal were not part of the enrolled pregnant women. Ethical approval was obtained from the Health and Research Ethics Committee of University of Calabar Teaching Hospital. Informed consent was obtained from each participant enrolled in the research and confidentiality was maintained.

Biodata and information on time of antenatal registration and commencement of vitamin supplementation were obtained using a questionnaire with confirmation from patients' folders. Blood samples were collected from each enrolled subject at term. Firstline tests were conducted as a screening approach for the detection of deficiency states. The study had the limitation of not conducting confirmatory tests. Serum levels of vitamin B12 and folate were assayed by ELISA method using AccuDiag™ ELISA Kit (Diagnostic Automation/ Cortez Diagnostics, Inc. USA). Assay interference for vitamin B12 from lipemia, cobinamide, haemoglobin, bilirubin and rheumatoid factor range from <0.0001- 0.0008, while that of folate from

bilirubin, biotin and lipemia are not detectable by these kit methods. Haemoglobin concentration was measured using an automated Sysmex K2-2IN haematology analyser (Sysmex Corporation, Japan). Statistical analysis using chi square testing was carried out by SPSS 22.0. A p-value of ≤ 0.05 was considered to infer a statistically significant difference.

## RESULTS

The observed mean age of the pregnant women that participated in this study was 30 ±2.1 years. Table 1 shows that the participants were literate and comprised both government and non-government workers. There were more primigravida compared to multi-gravidae pregnant women. Among the pregnant women who enrolled in this study, only 26.7% (48/180) registered for antenatal within the first trimester. The second trimester recorded the highest registration of 53.3% (96/180), while third trimester registration was 20% (36/180). Tables 2 and 3 reflect prevalence rates for folate and vitamin B12 deficiencies as well as their contributions to anaemia among the studied population. It was observed that 1.7% (3/180) of the women had serum level of folate less than 6.8nmol/L. The prevalence of vitamin B12 deficiency in this study was 21.7% (39/180) and 86 (47.8%) of the pregnant women had haemoglobin concentration less than 110g/L. Greater percentages of folate and vitamin B12 deficiencies were observed in association with late registration for antenatal care (Table 4).

**Table 1.** Sociodemographic characteristics of the enrolled pregnant women.

| Variables  | Number<br>n=180 | Percentage (%) |
|--|-----------------|----------------|
| <b>Educational level</b>   |                 |                |
| Secondary Education  | 87              | 48.3           |
| Tertiary Education   | 93              | 51.7           |
| <b>Occupation</b>  |                 |                |
| Civil Servants   | 76              | 42.2           |
| Non-civil Servants   | 104             | 57.8           |
| <b>Gravidae</b>  |                 |                |
| Primigravida   | 121             | 67.2           |
| Multi-gravidae   | 59              | 32.8           |
| <b>Time of ANC Registration/<br/>commencement of supplementation</b> |                 |                |
| First trimester  | 48              | 26.7           |
| Second trimester   | 96              | 53.3           |
| Third trimester  | 36              | 20.0           |

**Table 2.** Prevalence rates of anaemia, folate and vitamin B12 deficiencies among pregnant women in Calabar.

| Parameter   | Cut off value | Total No. | No. of pregnant women with deficiency | %    |
|-------------|---------------|-----------|---------------------------------------|------|
| Folate      | 6.8nmol/L     | 180       | 3                                     | 1.7  |
| Vitamin B12 | 148pmol/L     | 180       | 39                                    | 21.7 |
| Anaemia     | 110g/L        | 180       | 86                                    | 47.8 |

**Table 3.** Contributions of folate and vitamin B12 deficiencies to anaemia among pregnant women in Calabar.

| Parameter   | Cut off value | No. of pregnant women with anaemia | No. of pregnant women with deficiency | %    |
|-------------|---------------|------------------------------------|---------------------------------------|------|
| Folate      | 6.8nmol/L     | 86                                 | 3                                     | 3.5  |
| Vitamin B12 | 148pmol/L     | 86                                 | 39                                    | 45.3 |

**Table 4.** Association between commencement of supplementation with anaemia and deficiency states.

| Gestational age      | Number            | Anaemia           | Folate           | Vit. B12          |
|----------------------|-------------------|-------------------|------------------|-------------------|
| First month          | 9 (5.0%)          | 0                 | 0                | 0                 |
| Second month         | 9 (5.0%)          | 0                 | 0                | 0                 |
| Third month          | 30 (16.67)        | 2                 | 0                | 0                 |
| <b>1st trimester</b> | <b>48 (26.7%)</b> | <b>2 (2.3%)</b>   | <b>0 (0%)</b>    | <b>0 (0%)</b>     |
| Fourth month         | 36 (20.0%)        | 4                 | 0                | 2                 |
| Fifth month          | 30 (16.67%)       | 22                | 0                | 1                 |
| Sixth month          | 30 (16.67%)       | 27                | 0                | 9                 |
| <b>2nd trimester</b> | <b>96 (53.3%)</b> | <b>53 (61.7%)</b> | <b>0 (0%)</b>    | <b>12 (30.8%)</b> |
| Seventh month        | 30 (16.67%)       | 25                | 1                | 21                |
| Eighth month         | 6 (3.33%)         | 6                 | 2                | 6                 |
| Ninth month          | 0 (0%)            | 0                 | 0                | 0                 |
| <b>3rd Trimester</b> | <b>36 (20.0%)</b> | <b>31 (36.0%)</b> | <b>3 (100%)</b>  | <b>27 (69.2%)</b> |
| Grand total          | 180 (100%)        | 86 (100%)         | 3 (100%)         | 39 (100%)         |
| Chi square test      | $\chi^2 = 0.001$  | $\chi^2 = 0.001$  | $\chi^2 = 0.001$ | $\chi^2 = 0.016$  |

## DISCUSSION

Pregnancy, although a normal physiological process, is fraught with changes that often relate to increased nutritional demands. The extra demands on maternal body stores are necessary for proper development of the embryo. Consequences of inadequate nutritional supply during pregnancy extend to both maternal and infant health (5,18). Thus, maternal care during pregnancy considers possible supplementation of basic nutritional requirements that impact on healthy pregnancy, including Vitamin B12 and folate. In reality several factors influence dietary supplement use (12,13). In Nigeria, these supplements are prescribed to pregnant women as they commence antenatal care in health facilities. Time of antenatal care commencement, however, varies among pregnant women. This is largely due to the fact that in developing countries, such as Nigeria, national health insurance schemes do not cover everyone. While civil servants may be covered, a lot of non-government workers cater for the cost of their healthcare directly. Owing to this prevailing situation, financial constraints often hinder early hospital registration.

Anaemia in pregnancy is a global problem associated with increased morbidity and mortality, its persistence in developing regions, however, appears not to be abating. Anaemia among pregnant women in our locality has remained a significant health challenge in maternal health care. The prevalence for general anaemia in pregnancy for this study was 47.8%. The observed prevalence for vitamin B12 deficiency was 21.7%, while that of folate deficiency was 1.7%; indicating that vitamin B12 deficiency is about 13 times higher than folate deficiency among the studied population. More so, vitamin B12 deficiency contributed to 45.3% of anaemia in pregnancy, while folate deficiency stood at 3.5% out of the 86 gestational anaemic cases recorded in this study. In addition to malaria and iron deficiency, which have been reported previously (15,16,19), vitamin B12 deficiency has shown to contribute substantially to maternal anaemia compared to folate deficiency in the same studied population.

Nutritional deficiencies contribute to poor pregnancy outcome, and therefore require that determinants of status be investigated (8,20-23). The present study enrolled pregnant women on vitamin B12 and folate supplementation whose commencement of supplementation corresponded with the time of antenatal care registration. The approach revealed the importance of early antenatal registration in addressing nutritional anaemia among pregnant women in this region as greater percentages of folate and vitamin B12 deficiencies were observed in association with late registration for antenatal care.

Considering that routine antenatal care in this part of the world does not extend to direct laboratory investigation of nutritional factors, deficiency states could go unnoticed until signs associated with severe conditions begin to manifest. A recent study in South-East Nigeria reported spina bifida cystica as the most common anomaly of the central nervous system, and that the majority of mothers of affected children had not taken periconceptional folic acid supplementation (24).

The observation that less than one third (26.7%) of pregnant women commenced antenatal visits and supplement intake in the first trimester of pregnancy poses a challenge to the eradication of nutritional deficiencies in pregnancy. The general implication of this finding is that early pathological defects associated with pregnancy may go unnoticed, contributing to avoidable adverse outcome of pregnancies in this region. More specifically, with regards to the present study, is that there may not be enough time to build up vitamin B12 and folate levels for healthy pregnancy outcome (25). Although supplements are quite readily available and affordable at the community pharmacy outlets, antenatal care affords the opportunity for enlightenment and encourages compliance (24,26). Thus, timely registration for conventional antenatal care would likely impact positively on early commencement of nutritional supplementation and compliance, particularly among women in first-time pregnancy.

In conclusion, gestational anaemia still remains a challenge in Nigeria as a 47.8% prevalence was recorded in this study. There was a 21.7% prevalence for vitamin B12 deficiency, and this frequency of occurrence is 13 times more compared to folate deficiency. Vitamin B12 and folate deficiencies were observed more among pregnant women who registered late for antenatal care.

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