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The Impact of Iron and Folate Adherence on the Prevalence of Anaemia in Pregnant Nigerian Women

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Abstract: *Introduction*: The impact of adherence to taking prescribed medications for chronic illnesses has been widely studied with a view to understanding its role on disease burden. This has been extrapolated to the physiologic pregnancy state, where women are expected to take haematinics due to their susceptibility to anaemia. The prevalence of anaemia in pregnancy is reportedly high with more burden on developing countries. This has led to the recommendation of iron and folate supplements for women during pregnancy. *Methods*: We set out to determine the level of adherence (and deterrents) to taking iron and folate supplements as well as the prevalence of anaemia in pregnant women (18-45 years 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. An association between occurrence of anaemia and adherence level was also assessed. *Results*: 400 pregnant women participated in this study. The mean age (±SD) of the study population was 30±4 years, mean gestational age (±SD) was 31±5 weeks. Majority of the women (82.0%) were in their third trimester, 17.5% and 0.5% in second and first trimesters respectively. Total adherence scores obtained ranged from 0-8, with 63.5% being non-adherent to taking their iron and folate supplements. Factors that influenced adherence positively were higher income (p=0.00) and being employed (p=0.01). Top three identified reason for non-adherence were forgetfulness to take prescribed supplement (62.5%), feeling too bored to take supplements daily (44.3%) and unavailability of supplements (38.0%). The mean Hb (±SD) was 10.9±1.1g/dl. The prevalence of anaemia in pregnancy was 46.8%, with mild (43.8%) and moderate (3.3%) forms only. Of the non-adherent group, 69.7% were anaemic versus 30.3% of the adherent group. There was an association between the occurence of anaemia and non-adherence to taking supplements (p=0.01). *Conclusion*: There is a high level of non-adherence to taking iron and folate, prevalence of anaemia, and an association between them. Benefits of adherence to these supplements should be reinforced to women of child bearing age.

Keywords: Adherence, Anaemia, Pregnancy, Iron, Folate, Impact

1. Introduction

Adherence can be defined as "the extent to which a person's behaviour – taking medication, following a diet, executing lifestyle changes – follows medical advice."[1] The impact of adherence to taking prescribed medications for chronic illnesses has been widely studied with a view to understanding its role on disease burden. [2] This has been extrapolated to the physiologic pregnancy state, where women are expected to take haematinics due to their susceptibility to anaemia. [3] Anaemia, which is a reduction in oxygen-carrying capacity due to reduced haemoglobin concentration, is defined by the World Health Organization (WHO) as haemoglobin concentration (Hb) <11g/dl in pregnancy. [4] This applies to the first and third trimester, while Hb <10.5g/dl is considered anaemia in the second trimester. The WHO further divides anaemia according to severity, into mild (9.0-10.9g/dl), moderate (7-8.9g/dl), severe (4-6.9g/dl) and very severe anaemia (<4g/dl). [4] The prevalence of anaemia in pregnancy is reportedly high with more burden on developing countries. [4] Consequences of anaemia include increased maternal morbidity and mortality, impaired lactation, prematurity, low birth weight or intrauterine foetal death at the extreme. [5] Multifactorial causes are implicated in the aetiology of anaemia in pregnant women, foremost being iron deficiency. This has led to the recommendation of iron and folate supplements for women during pregnancy. [6] In a study in Ethiopia, pregnant women who failed to adhere to taking their supplements had anaemia more than those who did. [7] Reasons identified for poor adherence include low educational status, forgetfulness, fear of side effects and pill burden amongst others. [8, 9] We set out to determine the level of adherence (and deterrents) to taking iron and folate supplements as well as the prevalence of anaemia in pregnant women attending antenatal care in Benin City, Nigeria. An association between occurrence of anaemia and adherence level was also assessed.

2. Materials and Methods

This study was a cross-section observational study that involved consenting pregnant women (18-45 years 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 had chronic co-morbidities or conditions predisposing to anaemia, such as haemolytic anaemias, or were actively bleeding or recently transfused with blood (<3 months) 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 $(1-P)/d^2$) within a period of 6 months (July-December, 2019). Each participant was administered a questionnaire which addressed demographic parameters and relevant obstetric history to the study, as well as an adherence scale. The eight-item Morisky Medication Adherence Scale (MMAS-8), a self-report tool, was adopted in this study due to its wide acceptability and usefulness. [10] The questions were scored as follows: Questions 1 – 7, No=1 and Yes=0 while question 8, Never/rarely=1 and all other options=0. The scores were added together and minimum and maximum scores of 0 and 8 were obtained. The participants were grouped either non-adherent (0-5) or adherent (6-8).

About 5mls of venous blood was then drawn aseptically into EDTA anticoagulated bottle to determine Hb concentration, analysed within 4hours of collection using the Sysmex KX-219 (2006) haemato-analyser.

Anaemia and its severity was determined using WHO criteria; first trimester: <11.0 g/dL; second trimester: <10.5 g/dL; and third trimester: <11.0 g/dL; mild (9.0-10.9g/dl), moderate (7-8.9g/dl), severe (4-6.9g/dl) and very severe anaemia (<4g/dl) respectively. [4]

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. Level of significance (p) was set at ≤0.05.

3. Results

A total of 400 pregnant women participated in this study. Table 1 shows their socio-demographic details.

The mean age (±SD) of the study population was 30±4 years, 386 (96.5%) women carried singleton fetus, 11 (2.8%) were with twin gestation while others did not know. Mean gestational age was 31±5 weeks. Majority of the women (328; 82.0%) were in their third trimester, 70 (17.5%) and 2 (0.5%) in second and first trimesters, respectively.

Total adherence scores obtained ranged from 0-8, with 254 (63.5%) being non-adherent to taking their supplements and 146 (36.5%) adherent ones. There was no significant difference in adherence between young women and those with advanced maternal age (p=0.29) as shown in Table 2. Pregnant women who were gainfully employed (43.4%; 108/249) were more adherent to taking iron and folate compared to those unemployed (25.2%; 38/151), a statistically significant finding (p=0.00). Those who earned above the Nigerian minimum wage were also more adherent (43.3%; 78/180) to using these supplements than those who earned less (30.9%; 68/220); (p=0.01). [11] Educational status of the studied women as well as their husband's occupation (where applicable) did not affect level of adherence (p>0.05). Table 3 reflects the reason for non-adherence. From the scale, the main identified reason for non-adherence was forgetfulness to take prescribed supplement (62.5%; 250/400). Other highly proffered reasons were feeling too bored to take supplements daily (44.3%; 109/400), unavailability of supplements (38.0%; 152/400) and not knowing the importance of taking these supplements (27.3%; 109/400).

The mean Hb (±SD) was 10.9±1.1g/dl. The prevalence of

anaemia in pregnancy was 46.8% with 188 women falling short of the WHO standard. In terms of severity, only mild (175; 43.8%) and moderate (13; 3.3%) forms were found among the participants. The distribution of anaemia by trimesters showed that all women in first trimester (100%; 2/2) were anaemic, 35.7% (25/70) in second trimester were anaemic and 49.1% (161/328) in third trimester were anaemic (Table 4). According to the type of gestation, 45.9% (177/386) with single gestation were anaemic while 81.8% (9/11) with twin gestation were anaemic. Most of the anaemic women (86%; 157/187) were <35 years old. Of the non-adherent group, 69.7% (131/254) were anaemic while 30.3% (57/146) of the adherent group were anaemic. The 2 by 2 chi-square test showed a significance between the occurence of anaemia and level of adherence to taking supplements (p=0.01).

Table 1. *Socio-demographic and haematologic characteristics of the study population.*

Variable	Frequency (n=400)	Percent (%)
Age		
<35 years	332	83.0
≥35 years	68	17.0
Educational status		
No formal education	4	1.0
Primary	31	7.8
Secondary	238	59.5
Tertiary	127	31.8
Employment status		
Unemployed	151	37.8
Employed	249	62.3
Income		
<₦18,000	220	55.0
≥₦18,000	180	45.0
Marital status		
Single	17	4.3
Married	383	95.8
Husband's occupation*		
Unemployed	2	0.6
Student	4	1.0
Civil servant/ Professional	61	15.9
Unskilled worker	298	77.8
Others	18	4.7
Type of gestation		
Singleton	386	96.5
Multiple	11	2.8
Don't know	3	0.8
Gestational age		
First trimester	2	0.5
Second trimester	70	17.5
Third trimester	328	82.0
Mean (±SD) age (years)	30±4	
Mean (±SD) Hb (g/dl)	10.9±1.1	
Adherence group		
Non-adherent (0-5)	254	63.5
Adherent (6-8)	146	36.5
Occurrence of anaemia		
Anaemic	187	46.8
Non-anaemic	213	53.2
Distribution of anaemia		
Mild	174	43.5
Moderate	13	3.3
Severe	0	0.0

*n=383.

Table 2. *Association between some socio-demographic parameters and level of adherence among participants.*

Variable	Non-adherent (score 0-5) n (%)	Adherent (score 6-8) n (%)	X^2	P value
Age				
<35 years	207 (62.3)	125 (37.7)	1.11	0.29
≥35 years	47 (69.1)	21 (30.9)		
Educational status				
No formal education	2 (50.0)	2 (50.0)		
Primary	14 (45.2)	17 (54.8)	5.52	0.14
Secondary	153 (64.3)	85 (35.7)		
Tertiary	85 (66.90)	42 (33.1)		
Employment status				
Unemployed	113 (74.8)	38 (25.2)	13.4	0.00
Employed	141 (56.6)	108 (43.4)		
Income				

Variable	Non-adherent (score 0-5) n (%)	Adherent (score 6-8) n (%)	X^2	P value
<₦18,000	152 (69.1)	68 (30.9)	6.59	0.01
≥₦18,000	102 (56.7)	78 (43.3)		
Husband's occupation				
Unemployed	240 (99.6)	1 (0.4)	0.14	1.00*
Employed	141 (99.3)	1 (0.7)		

*=fisher's exact test.

Table 3. *Reason for non-adherence to iron and folate supplements.*

Reason	Frequency (n=400)	Percentage
Forgetfulness	250	62.5
Inconvenience of taking supplements outside home	83	20.8
Pill burden	48	12.0
Cost of medicine	41	10.3
Side effects of taking supplements	46	11.5
Feeling it is not important take supplements	109	27.3
Too bored to take supplements everyday	177	44.3
Unavailability of supplements	152	38.0

Table 4. *Association between some obstetric parameters, level of adherence and occurrence of anaemia.*

Variable	Anaemic, n (%)	Non-anaemic, n (%)	X^2	P value
Age				
<35 years	157 (47.3)	175 (52.7)	0.23	0.63
≥35 years	30 (44.1)	38 (55.9)		
Type of gestation*				
Singleton	176 (45.6)	9 (81.8)	6.11	0.04
Multiple	210 (54.4)	2 (18.2)		
Gestational age				
First trimester	2 (100.0)	0 (0.0)		
Second trimester	25 (35.7)	45 (64.3)	6.41	0.04
Third trimester	161 (49.1)	167 (50.9)		
Adherence group				
Non-adherent	131 (69.7)	57 (30.3)	5.85	0.02
Adherent	123 (58.0)	89 (42.0)		

*=n=388.

4. Discussion

The physiologic demands of pregnancy are diverse with an increase in the recommended dietary allowance for iron and folate being inclusive. [12] This forms the basis for WHO recommendation to give supplemental iron and folate to pregnant women in order to forestall the occurrence of anaemia in them. Despite such recommendation, the prevalence of anaemia, especially in low socio-economic climes like ours, is still high. [13] We set out to determine if our study participants were adherent to taking iron and folate supplements, and related this to the occurrence of anaemia within set adherence groups.

A high level of non-adherence (63.5%) was found among the studied pregnant women. The findings of Ibrahim *et al* was similar to ours though they used self-report and pill count to assess adherence. [14] Higher and lower values than we observed have however been reported across Africa. [15-17] Gainfully employed women and those who earned above the Nigerian minimum wage were more adherent to taking supplements (p=0.00 and 0.01, respectively). An inference that a person's financial status contributes to his level of adherence can then be drawn from this statistically significant finding of ours. A higher income and being

employed have been associated with adherence to medication use in patients with chronic medical conditions. [18, 19] Ibrahim *et al* and Ba *et al* equally reported income as a significant independent positive predictor of adherence in the pregnant women they studied. [14, 20] The institution of a national health insurance scheme and other collaborative health programs to reduce the financial burden of healthcare on Nigerians can help to improve adherence to medications. [21] This improves availability and affordability of medications to all, as the rich help to pay for the poor through pooled contributions into the scheme. Our study failed to prove that higher level of education is associated with better compliance to supplements, though most of the study population comprised women with post-primary level of education. Most authors have established from their works that formal education improves adherence. It is believed that more educated women can read and are therefore more enlightened on the importance of taking iron and folate as well as the consequences otherwise. [22-24]

The main reason given for non-adherence in our study was forgetfulness (62.5%). Most authors have reported this as one of the first three reasons for non-adherence in their study, with even higher values than we report. [14, 20, 25] Measures to assist women to remember taking these pills

need to be reinforced. These include health talks at antenatal visits and on social media platforms, family support/reminders, directly observed therapy, pill diary, joining pregnancy clubs, amongst others. [14, 26] The women we studied also found it a burden to take supplements daily (44%), had no pills available to use (38%) or did not know the importance of taking the prescribed supplements (27%). The need for continuous education on the benefits of taking these pills regularly and making them available in government health facilities, which most of our population use, cannot be overemphasized. Studies have shown that compliance is better when these supplements are given freely to women at antenatal visits than in places where clients have to source them on their own. [9, 27]

The prevalence of anaemia we found (46.8%) was higher than earlier reports by Ikeanyi and Ibrahim (37.6%) in Benin as well as Omote *et al* (32.2%) in Warri. [28, 29] Though Ikeanyi and Ibrahim had a larger sample size than ours, theirs was a retrospective study. Omote *et al* had studied fewer and more elderly women than in this study. Closer reports to ours were however found in Gombe (northern Nigeria), Nepal and Tanzania with prevalence of anaemia being 51.8%, 42.6% and 47.4% respectively. [30-32] We observed that most participants had a mild anaemia, with fewer cases of moderate anaemia but none with severe anaemia. This was in agreement with most authors' reports within Nigeria and some other low socio-economic climes, though some cases of severe anaemia were equally found among the pregnant women they studied. [28, 29, 33]

Pregnant women with multiple gestation had a higher prevalence of anaemia than those with singleton gestation (p=0.04). This is as expected since more foetal mass means more iron and folate demand in pregnancy. [34] We also found that occurrence of anaemia reduced as the gestational age increased (p=0.04), with a slight difference in second trimester, perhaps due to difference in the cut off Hb (10.5g/dl) for anaemia at this stage of pregnancy. [34] The requirement for iron increases as pregnancy advances due to changes in red cell mass. This iron demand is more apparent in the second trimester and may account for lower Hb at this stage, hence a lower cut off recommended for anaemia diagnosis. [4, 34] Our finding was however skewed as we had just two women in their first trimester, attributed to the fact that most women book late for antenatal care in our society.

The occurrence of anaemia was more with women non-adherent to taking their supplements (p=0.0), a similar finding to that of *Ibrahim et al*, though not statistically significant (p=0.12). [14] Other studies have also shown that lack of iron supplementation increases the risk of maternal anaemia as well as its foetal consequences. [35, 36] This finding is as expected since most women in our environment require these supplements to boost their dietary supply of iron and folate due to already established increased demand (in pregnancy) as well as poor supply from the inadequate diet we take in this environment. [34, 37]

We considered the following as limitations of this study: the use of a self-report tool, which may over-estimate the level of adherence reported. This was however chosen for ease and the fact that participants had to source their own supplements independently. Secondly, the study population comprised of more women in late gestation because most women book late for antenatal care. This may give rise to a skewed data and inference drawn from the study.

5. Conclusion

In conclusion, there remains a high level of non-adherence to the use of iron and folate supplements in pregnancy. This is because pregnant women usually forget to take these pills. A higher financial status is associated with improved pill adherence, therefore gainful employment of women is solicited. The prevalence of anaemia in pregnancy is still high and is influenced by non-adherence to iron and folate use. Measures to improve adherence should be reinforced at antenatal visits.

Conflict of Interest

All authors do not have any possible conflict of interest.

Acknowledgements

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