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Women's intention and factors associated with duration of use of Iron-folic acid supplement use in Karu, Nasarawa State, Nigeria: A cross-sectional study

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Abstract

Background Iron-folic acid supplementation is one of the key interventions provided during antenatal care (ANC) services to reduce iron deficiency, maternal anemia, low birthweight and other pregnancy-related complications responsible for maternal and neonatal mortality. However, use of iron-folic acid supplements and adherence with recommended dosage in Nigeria is low. The purpose of this cross-sectional study was to examine factors associated with iron-folic acid supplements use among pregnant women in Karu local government area (LGA), Nasarawa, Nigeria.

Methods Questionnaires were administered in face-to-face interviews with 64 pregnant women (aged 18–49 years) and 19 healthcare providers in selected public primary health facilities across Karu LGA, Nasarawa State. Using the theory of planned behavior, pregnant women's intention to use iron-folic acid supplements during pregnancy was predicted. In addition, factors associated with adherence to duration of use were also examined. Multiple linear regression was performed to examine the effect of attitudes, subjective norms and perceived behavioral control on intention to use, and binary logistic regression was used to examine factors associated with adherence to duration of use. Data was analyzed using STATA 15.0.

Results Almost all participants (97%) reported using iron-folic acid supplements, and 54% reported using iron-folic acid supplements daily. Subjective norm ($p < 0.05$) and perceived behavioral control ($p < 0.05$) significantly predicted intention to use iron-folic acid supplements during pregnancy. However, attitude did not have a predictive influence on intention. Also, pregnant women made an average of 2.7 antenatal care visits (standard deviation (SD) = 1.6), with most women (59%) having their first antenatal care visit within the second trimester (4–6 months) of pregnancy. Only one out of five attended within the first trimester (1–3 months). Overall, for every additional antenatal care visit, there was a significant increase in the likelihood of taking iron-folic acid supplements for three months or more ($p < 0.05$).

Conclusions This study showed that perceived behavioral control and subjective norm were predictors of intention to use iron-folic acid supplements. Frequency of antenatal care visits was significantly associated with adherence

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to duration of iron-folic acid supplement use. Antenatal care attendance is very critical to the use of iron-folic acid supplements and should be promoted.

Keywords Pregnant women, Iron-folic acid supplements, Antenatal care, Theory of planned behavior, Nigeria

Background

Globally, annual maternal deaths comprising deaths due to complications from pregnancy or childbirth-related complications, and neonatal deaths decreased significantly. Maternal mortality ratio (MMR) decreased from 339 deaths per 100,000 live births in 2000 to 223 deaths per 100,000 live births in 2020 [1]. Also, global neonatal mortality rate declined by 44% from 31 to 17 deaths per 1,000 live births between 2000 and 2022 [2]. Despite these reductions, sub-Saharan Africa continued to account for more than two-thirds (70%) of all global maternal deaths, and 46% of the global neonatal deaths [2, 3]. Nigeria remains one of the countries in sub-Saharan Africa where significant progress in reducing maternal deaths have not been achieved with maternal mortality ratio of 512 deaths per 100,000 live births, albeit lower than the regional average of 545 maternal deaths per 100,000 live births annually [3, 4]. The neonatal mortality rate for Nigeria is 34 deaths per 1,000 live births [2].

Anemia, an indirect cause of maternal mortality, occurring in about 40% of pregnant women globally, is strongly associated with increased risk of maternal and perinatal mortality, postpartum hemorrhage, preterm birth, intrapartum-related complications, low birthweight and increased susceptibility to infections [5–6]. Anemia can be prevented through utilization of iron-folic acid supplements during pregnancy, which increase the chances of survival for mother and child [7]. Prior studies have confirmed that iron-folic acid supplements reduced the risk of low birthweight, stunting in children less than 2 years of age, obstetric complications among pregnant women, and maternal and neonatal morbidity and mortality [8–10].

Based on World Health Organization's recommendation, ideally pregnant women should take 180 tablets of iron-folic acid supplements during pregnancy [11, 12]. In some countries, the acceptable level of supplementation intake for pregnant women is 90 or more tablets during pregnancy. However, compliance with iron-folic acid supplementation among pregnant women in Nigeria is very low. The percentage of pregnant women taking 180 tablets or more and 90 tablets in Nigeria are 3% and 14% respectively [12]. Knowledge of iron-folic acid supplementation does not translate into use. A health facility-based study conducted in Southeast Nigeria showed that there was a 10-percentage point difference between knowledge of iron supplements and utilization [13]. Iron supplementation remains the best and only means of preventing iron deficiency anemia, if taken throughout pregnancy. However, few women are aware of this recommendation, and fewer adopt the practice even when they are aware. Low utilization of iron-folic acid supplementation are associated with age, low level of education, and lack of awareness [14–16].

Existing literature mainly examines individual/intrapersonal factors affecting iron-folic acid supplementation during pregnancy, but very few examined other levels of influence of the socioecological model (interpersonal, institutional, community and policy factors) [17–22]. Studies that examined these factors from the socioecological perspective are needed, especially in the rural context of developing countries where most maternal and child deaths were recorded. Furthermore, none of the studies available applied the Theory of Planned Behavior (TPB) to examine pregnant women' intention and behavior towards use of iron-folic acid supplements. TPB is important due to its predictive ability; it emphasizes the roles played by attitude, perception, and social norms in carrying out behaviors effectively, and has been used to investigate various health behaviors [23–25]. Behaviors that have been examined using theory of planned behavior among pregnant women are physical exercise and healthy eating intentions [23–25]. Improving utilization of supplements is essential to improving health outcomes for both mothers and newborns. Therefore, the purpose of this study was to examine factors associated with the use of iron-folic acid supplements among pregnant women in Karu local government area (LGA), Nasarawa, Nigeria.

Specifically, the aims were to assess the association between perceived behavioral control, subjective norms and attitudes toward iron-folic acid use have on pregnant women's intention to use iron-folic acid supplements during pregnancy in Karu LGA, Nasarawa State, Nigeria. Second, the relationships between use of iron-folic acid supplements among pregnant women, and intrapersonal, interpersonal, institutional, community and public policy factors and third, what factors explained adherence to duration of iron-folic acid supplements use.

Methods

Study design and setting

A cross-sectional survey was conducted to examine factors associated with iron-folic acid supplements use among pregnant women in Karu local government area (LGA), Nasarawa, Nigeria. Karu LGA is one of the 13 local government areas of Nasarawa State, with a population of 216,230. The LGA has two secondary health

facilities, 20 public primary health facilities and a large number of private health facilities which are mostly undocumented. For the purpose of this study, data collection took place in the 19 public primary healthcare centers in November 2017. The 20th health facility was under renovation and was not open to the public.

Sample

The sample size was calculated using the results (beta coefficients) of theory of planned behavior constructs from a study that examined the effects on intention to use of multivitamin among college females [26]. Although this study was among non-pregnant population, the behavior examined was close to the use of iron-folic acid supplements. The sample size was estimated based on the dependent variable, "intention to use iron-folic acid supplements", using one sample mean analysis and the following assumptions: 95% level of confidence, 90% power to detect an effect size, and three predictors. The R-square of Full Model, that is proportion of variance in the dependent variable that can be explained by the independent variables, was 0.5, which showed that the effect size is moderate. Twenty-two (22) participants were required to detect the effect of theory of planned behavior constructs on intention to use iron-folic acid supplements. This size was multiplied by three (3) to increase the power. The sample size required for the study was 66 pregnant women, assuming a statistical power of 90%, a significance level of 0.05.

Pregnant women aged 18–49 years old, who attended antenatal care sessions at any of the public primary healthcare facilities, present at the facility at the time of visit, and willing to participate, were the were included in the study. Pregnant women under 18 years old were excluded from participating. Recruitment of participants occurred using daily antenatal care registers. The sample size of 66 was proportionately allocated to the 19 primary healthcare facilities and simple random sampling was then used to select pregnant women from each facility. A random sample of 64 pregnant women who met the inclusion criteria and were present at the selected health facilities at the time of visits were selected. All public primary healthcare centers in Karu LGA were included in the study. In addition, 19 healthcare providers providing antenatal care service in 19 public primary health facilities were interviewed to examine institutional factors.

Data collection

Data were collected using questionnaires in face-to-face interviews from pregnant women and healthcare providers. Prior to data collection, meetings were initiated with health facility managers to request all necessary permissions and obtain support. Pregnant women were recruited through announcements during group antenatal care sessions at health facilities. Group antenatal care sessions in Nigeria are health education class sessions conducted for pregnant women prior to one-on-one consultation with a medical doctor. Pregnant women were informed about the study, and location of the researcher in the facility if interested. At no time were healthcare providers or educators involved in recruitment in order to avoid any perception of coercion. Pregnant women who expressed interest, were interviewed individually in a private meeting room at the health facility, away from healthcare providers or educators. In face-to-face interviews that lasted 20–30 min, women were interviewed after the researcher explained the purpose of the study, what participation entailed, and that no incentive was provided for participation in the study. Information was obtained regarding participants' demographic characteristics, utilization of antenatal care services and frequency of attendance, perceived behavioral control, subjective norms, and attitudes of pregnant women towards use of iron-folic acid supplements, and knowledge and use of iron-folic acid supplementation. Information obtained from healthcare providers included characteristics of health facility, antenatal care service delivery, and information on supplies and stock status of iron-folic acid supplements at the facility.

All survey instruments were generated from questions used in similar studies and pilot-tested before the administration [26–28]. The questionnaire for pregnant women was pretested on a convenience sample of five women with similar characteristics to those of the proposed study population, and revisions made.

Ethics approval and consent to participate

Ethical approval for the study was received from the Georgia Southern University Institutional Review Board (IRB) (H18013) and Nigeria National Health Research Ethics Committee (NHREC) (NHREC/01/01/2007-25/08/2017) to ensure it was conducted in accordance with the Declaration of Helsinki. Also, the Karu Local Government Primary Healthcare Department approved for the study to be conducted in selected health facilities within the local government area. Informed consent was obtained from all participants before the survey was administered, and necessary steps were taken to ensure confidentiality during and after data collection.

Variables

Three dependent variables assessed were intention to use iron-folic acid supplement, use of iron-folic acid supplements, and adherence to duration of use. Intention to use iron-folic acid supplements was measured the using the Theory of Planned Behavior (TPB) constructs consisting of 15 items; these were attitude towards use of iron-folic acid (4 items), subjective norms (4 items), and perceived

behavioral control (4 items), and overall intention was measured using 3 items. All constructs were assessed using 7-point Lickert scales [29]. Items used to measure intention to use iron-folic acid supplements were (i) I intend to take iron-folic acid supplement each day next week; (ii) It is very likely that I will take iron-folic acid supplement each day next week; and (iii) I plan to take iron-folic acid supplement each day next week (*1 = very unlikely to 7 = very likely*).

Attitude towards use of iron-folic acid supplements was measured indirectly using behavioral belief and the relevant outcome evaluation. Items for behavioral beliefs and their corresponding outcome evaluations were (i) Taking iron-folic acid supplement daily would help me to have a healthy pregnancy; (ii) Being healthy is important to me; (iii) Taking iron-folic acid supplement daily helps to protect my baby's health; and (iv) Having a healthy baby is important to me (*-3 = strongly disagree to 3 = strongly agree*). The overall attitude score was the sum of the resulting products, with a positive score representing a positive attitude towards use of iron-folic acid supplements, and a negative score representing negative attitude [29].

Subjective norm was measured using sum of products of normative belief and motivation to comply. Items used to measure normative beliefs were (i) My family (e.g. husband, mother, and mother-in-law) thinks I should take iron and folic acid supplement daily during my pregnancy; and (ii) My doctor or nurse wants me to take iron and folic acid tablet(s) daily (*-3 = strongly disagree to 3 = strongly agree*). Motivation to comply was measured using two items, (i) It is important to me what my family thinks about my taking iron and folic acid supplements; and (ii) When it comes to matters of health, I want to do what my doctor or nurse thinks I should do (*1 = very unlikely to 7 = very likely*).

Lastly, perceived behavioral control was measured using sum of the products of control beliefs and the relevant perceived power scores [29]. Items used to measure control beliefs and corresponding perceived power were (i) It would be difficult for me to remember to take iron-folic acid tablet(s) daily; (ii) Remembering to take iron-folic acid tablet(s) makes it difficult to take them daily; (iii) Taking iron-folic acid supplements will cause me to experience discomfort (nausea); and (iv) Experiencing discomfort (nausea) will make it difficult for me to take iron and folic acid tablets daily (*-3 = strongly disagree to 3 = strongly agree*).

Use of iron-folic acid supplements was measured using the question, "During this pregnancy, did you take Iron-Folic acid tablets?" The response options were, "yes", "no", and "don't know". While duration of use was measured by asking participants, "For how long did you take these tablets?" The response options were, "1–8 weeks", "9–21 weeks", and "22 weeks or more". Participants were asked, "which trimester did use of iron-folic acid tablets start?" The variable for adherence to duration of use was recalculated using the trimester that use of iron-folic acid starts and how long the tablets were taken. Adherence to required dosage was grouped into two: "Yes", took required dosage till date and "No", took less than the required dosage till date. Independent variables included attitude towards use of iron-folic acid, subjective norms, perceived behavioral control, previous pregnancies, live births, number of antenatal care visits, stage of pregnancy at first antenatal care visit, source of information, access to information, and sociodemographic characteristics such as age, education, and employment status.

Data analysis

Data were entered and cleaned using SPSS software, and then exported to STATA 15.0 for analysis.

Descriptive statistics were used to describe the characteristics of the study population. Bivariate analysis was used to examine the relationship between the dependent and independent variables using Fisher's exact test of independence at p-value of < 0.05 for level of significance of association [30]. The effect of perceived behavioral control, subjective norms, and attitudes toward iron-folic acid use on pregnant women's intention to use iron-folic acid supplements during pregnancy was examined using multiple linear regression. Results of the multiple regression were checked to ensure that the assumption of no multicollinearity was met, and heteroscedasticity test was carried out for the assumption of constant error variance [31, 32]. Predictors are uncorrelated, as shown by the variance inflation factor (VIF) of less than 10, and tolerance (1/VIF) greater than 0.1. Fisher's exact test of independence was used to examine factors associated with use of iron-folic acid supplements among pregnant women and duration of use. Lastly, factors that explained adherence to required duration (length) of use of iron-folic acid supplement among pregnant women who reported using iron-folic acid supplements was assessed using multivariate logistic regression model, with p-values less than 0.05 indicated significant associations.

Results

Individual and interpersonal-level characteristics

Participants included 64 pregnant women who attended antenatal care sessions were interviewed. Ages ranged from 18 to 36 years, with a mean age of 27 (SD: ± 4.9; median: 26.5). One in five participants interviewed had no formal education. Among those educated, 44% had secondary education, and 19% had some college or college education. Most were self-employed (48%), a quarter (25%) were in their first pregnancy, and 73% had one or more children. Most participants attended an average of

2.7 antenatal care visits (standard deviation (SD) = 1.6), with 59% having their first antenatal care visit within the second trimester (4–6 months) of pregnancy. All participants reported using at least one supplement, and more than half (54%) reported using iron-folic acid supplements daily (refer Table 1). Participants reported that health workers were the primary source of information (98%) and access to iron-folic acid supplements (89%). Although a similar percent reported buying their supplements from a health facility's dispensary or pharmacy (76%).

The relationships between iron-folic acid supplement use, adherence to duration of use, and the independent variables are reported in Table 2. Among women who reported taking iron-folic acid supplements, 21% attended antenatal care within the first trimester, though not statistically significant. Looking to a Health Worker as a source of information had a statistically significant relationship with use of iron-folic acid supplements ($p < 0.05$). Stage of pregnancy at first antenatal care visit, and frequency of antenatal care visits were statistically significant with adherence to duration of use (Table 2).

Intention to use iron-folic acid supplements

Most participants (95.3%) attending antenatal care services at public primary health care facilities in Karu LGA had strong intention to use iron-folic acid supplements (average score of 6.0 ± 1.0). The combined TPB constructs (perceived behavioral control, subjective norm and attitude) predict the intention to use iron-folic acid supplements during pregnancy, $F(3, 60) = 2.88$, $p < 0.05$ with statistical significance (see Table 3). The combined TPB constructs accounted for 12.6% of the variation ($R2 = (0.126)$ in the intention to use iron-folic acid supplements among pregnant women.

Individually, subjective norm and perceived behavioral control were statistically significant with intention to use iron-folic acid supplements during pregnancy. The regression coefficients were 0.076 ($p < 0.05$) and 0.095 ($p < 0.05$) respectively. From this analysis, we can conclude that every unit increase in subjective norm score, the intention to use iron-folic acid supplement score increases by 0.076 during pregnancy, holding all other variables constant. The coefficient for perceived behavioral control is 0.095. Therefore, with every unit increase in perceived behavioral control score we expect a 0.095 point increase in the intention score.

Duration (length) of use of iron-folic acid supplement among pregnant women

Analysis showed that age of pregnant woman and the number of antenatal care visits made was statistically significant (Table 4). Women aged 25–34 years were approximately 7.4 times more likely to adhere to expected duration of use of iron-folic acid supplements (AOR: 7.36, (95% C, I: 1.25–43.48)) $P < 0.05$. Also, the frequency of ANC visits significantly influences the odds of adhering to expected duration of use. Specifically, women who had four or more ANC visits were found to be 15 times more likely to adhere to expected duration of use of iron-folic acid supplements compared to those who attended less than four visits (AOR: 15.37, (95% CI: 2.15, 109.74)) $P < 0.05$. The findings for education, employment, and live births were all statistically non-significant.

Antenatal care service provision

79% of health providers interviewed were Community Health Extension Workers (CHEWs). All facilities assessed offer antenatal care services, and more than half (58%) reported the availability of ANC guidelines. Most of the primary health care centers (63.2%) provide antenatal care services once a week and all provide iron-folic acid supplements to pregnant women. The characteristics of the primary health care centers are shown in Table 5. More than 90% of facilities offering ANC services had iron and folic acid supplements (94.7%) in stock.

Discussion

This study examined intention to use iron-folic acid supplements among pregnant women attending antenatal care sessions in Karu local government area (LGA), Nasarawa, Nigeria, and factors associated with use and duration of use. Attitude, subjective norms, and perceived behavioral control together predicted the intention to use iron-folic acid supplements during pregnancy among the sampled pregnant women. Together, the theory of planned behavior constructs explained 12.6% of the variance in intention to use iron-folic acid supplements. The predictive ability of the combined constructs should be considered when planning an intervention aimed at improving intention and subsequent use of iron-folic acid supplements. Targeting individual constructs in interventions may not be as effective as applying the theory in a multifaceted approach. Separately, perceived behavioral control was the strongest predictor of intention to use iron-folic acid supplements followed by subjective norm, explaining 9.5% and 7.6% of variance in intention respectively. However, attitude did not play a predictive role on intention to consume iron-folic supplements. Both coefficients for subjective norms, and perceived behavioral control are positive and significant. This demonstrates that an increase in confidence among participants in their ability to take iron-folic acid supplements and an increase in perceived social pressure experienced from important others results in an increased intention to use iron-folic acid supplements.

Similar to the current study, the roles of perceived behavioral control and subjective norm as strong

Table 1 Characteristics of pregnant women ($n=64$)

Characteristics	*N*	%
Mean age of pregnant women	26.8 years	
Age of pregnant women		
18–24	21	32.8
25–34	38	59.4
35 or above	5	7.8
Mother's level of education		
No education	13	20.3
Primary	11	17.2
Secondary	28	43.8
Higher	12	18.8
Type of Employment		
Employed by organization/someone else	8	12.5
Self-employed	31	48.4
Not employed	25	39.1
Previous Pregnancy		
Yes	48	75.0
No	16	25.0
Parity		
0 live birth	17	26.6
1 live birth	13	20.3
2 or more live births	34	53.1
Mean number of live births	1.9	
Stage of pregnancy at first antenatal care visit		
1st trimester (1–3 months)	13	20.3
2nd trimester (4–6 months)	38	59.4
3rd trimester (7–9 months)	12	18.8
Don't know	1	1.6
Mean ANC visits	2.7	
Frequency of ANC visits		
Less than 4 Visits	41	64.1
Four ANC visits or more	23	35.9
Type of supplement used*		
Iron tablets	62	96.9
Folic acid tablets	62	96.9
Vitamins	20	31.2
Duration of use of iron-folic acid tablets		
1–8 weeks	29	46.0
9–21 weeks	29	46.0
22 weeks or more	4	6.3
Don't know	1	1.6
Frequency and regularity of use		
Not once	7	11.1
Once	5	7.9
Two - six times	17	27.0
Seven times (daily)	34	54.0
Source of information on Iron-folic acid supplements*		
Friend	2	3.1
Family/Relative	11	17.2
Health worker	63	98.4
TV/Radio/Mass media	3	4.7
Community health volunteer	2	3.1
Access to Iron-folic acid tablets		
Free distribution during ANC	56	88.9

Table 1 (continued)

Characteristics	*N*	%
Bought from health facility/ pharmacy	48	76.2
Source of iron-folic acid tablets*		
Government hospital	4	6.3
Government health center	60	95.2
Private hospital/ clinic	1	1.6
Pharmacy	2	3.2
Chemist/ PMS	4	6.3

* Participants have more than one response option. ANC = Antenatal care

predictors were observed in other behaviors during pregnancy. A study of healthy eating intentions among pregnant women in Australia observed that the strongest predictors are perceived behavioral control and subjective norm, while attitude was weak though significant [33]. Similarly, perceived behavioral control and subjective norm were strong predictors of nutrition intentions during pregnancy, with attitude as a weak predictor among study participants recruited through pregnancy-related Internet chat forums [25]. The observation in the current study that attitude was a non-significant predictor of use of iron-folic acid supplements may be due to the small sample size, which reduces the effect. A study that examined intention to engage in regular exercise among 618 pregnant women showed similar findings as the current study with attitude as a non-significant predictor [24]. In contrast, other studies have observed attitude as the major predictor of intention to engage in certain behaviors while perceived behavioral control or subjective norms had no significant effect [34–37]. For example, attitude was the strongest predictor followed by perceived behavioral control, while subjective norm had no predictive effect in prospective studies that examined pregnant women's intention to engage in exercise during the second and third trimester of pregnancy among 89 and 62 pregnant women respectively [34, 35]. Similarly, a prospective study examined 104 pregnant women's intention to exercise during first trimester of pregnancy, attitude was the strongest predictor followed by subjective norm, with perceived behavioral control having no significant association [36]. Subjective norm had no predictive effect in a prospective study that examined exercise intention during the first and second trimester among 61 pregnant women, while attitude remained the strongest predictor followed by perceived behavioral control [37].

The effect of perceived behavioral control on intention to use iron-folic acid supplements suggests the need for an effective approach to improve pregnant women's perceived control towards use of iron-folic acid supplements. Demonstration classes that show actual behavioral rehearsal are important and may improve perceived behavioral control [38]. Control beliefs and perceived power will develop through personal experience, secondhand experience (e.g., through mass media or peer experience), persuasion (encouragement), and physiological states [38]. Practical classes may impact perception of control and subsequently strengthen pregnant women's intention to use iron-folic acid supplements. Scholars observed the moderating effect of perceived behavioral control and concluded it has a precondition role in the development of behavioral intention and should be prioritized in health communication before attitude [38, 39]. The positive effect of perceived behavioral control in the current study demonstrates that there are factors that facilitate pregnant women's intention to perform the behavior. In Nigeria, women's decision-making power with regards to their health was observed to be low, remarkably lower in the northern region with decisions to seek healthcare mostly made by the husband (61%) [40]. Hence, the increased perceived behavioral control effect could be due to the husband/partner's decision to support the pregnant women's healthcare. Some of the items used in the current study to measure normative beliefs read; 'My family (e.g. husband, mother, and mother-in-law) thinks I should take iron-folic acid supplement daily during my pregnancy' and 'my doctor or nurse wants me to take iron-folic acid tablet(s) daily'. When individuals have positive perceived behavioral control, the perceived social expectations may be high, leading to intention or performance of the behavior [41]. Also, the effect observed could be due to the availability of free iron-folic acid tablets provided to pregnant women attending antenatal care services in Nigerian public health facilities nationwide [42].

With respect to *subjective norm*, the positive effect on intention to use iron-folic acid supplements demonstrates that interventions to educate pregnant women should also target key influencers. In this current study, the most common source of information on iron-folic acid supplements were health workers (98%), followed by family/relatives (17%). Frequent contact with health workers increased the likelihood of receiving encouragement from health workers to take the supplements regularly [22]. Also, increased support from partners and family members in terms of regular reminders and accompanying pregnant women to antenatal care visits

Table 2 Use of iron-folic acid supplements and adherence to duration of use by individual-level characteristics ($n=62$)

Characteristics	Iron-folic supplement users (%)	Adherence to duration of use (%)
		Yes
Age of pregnant women		
18–24	30.6	20.0
25–34	61.3	71.4
35 or above	8.1	8.6
Mother's level of education		
No education	19.3	17.1
Primary	17.7	11.4
Secondary	43.5	45.7
Higher	19.3	25.7
Type of Employment		
Employed by organization/someone else	12.9	17.1
Self-employed	50.0	37.1
Not employed	37.1	45.7
Previous Pregnancy		
Yes	75.8	71.4
No	24.2	28.6
Parity		
0 live birth	25.8	28.6
1 live birth	19.3	22.8
2 or more live births	54.8	48.6
Stage of pregnancy at first antenatal care visit^		
1st trimester (1–3 months)	21.0	37.1**
2nd trimester (4–6 months)	58.1	57.1**
3rd trimester (7–9 months)	19.3	5.7**
Frequency of ANC visits		
Less than 4 Visits	64.5	48.6**
Four ANC visits or more	35.5	51.4**
Source of information		
Friend	3.2	2.9
Family/Relative	17.7	14.3
Health worker	100.0**	100.0
TV/Radio/Mass media	4.8	2.9
Community health volunteer	3.2	2.9
Source of iron-folic acid tablets		
Government hospital	4.8**	8.6
Government health center	96.8**	94.3
Private hospital/ clinic	1.6	0.0
Pharmacy	3.2	5.7
Chemist/ PMS	6.4	5.7
Frequency and regularity of use		
Not once	11.3	14.3
Once	8.1	5.7
Two - five times	27.4	20.0
Seven times (daily)	53.2	60.0

^ Participants have more than one response option. ANC = Antenatal care. *$p<0.05$. **$p<0.01$

increased the likelihood of taking iron-folic acid supplements and adhering to recommendations [22]. Therefore, interventions should not only focus on the attitudes of pregnant women to strengthen intention and subsequent use of iron-folic acid supplements, but they should also pay attention to increasing perceived social pressure from important others. In Northern Nigeria where women are less likely to make decisions regarding accessing healthcare [40], there is a need to engage significant others especially husbands to increase perceived social pressure.

Health workers as a source of information and source of commodity (iron-folic acid tablets) were significantly associated with use of iron-folic acid supplements among pregnant women in the bivariate analysis. This finding shows the organizational-level factors associated with use of iron-folic acid supplements during pregnancy. Information on benefits and use of iron-folic acid supplements are provided as part of the health promotion talks during antenatal care services. Although some pregnant women reported more than one source of information, most received information through contacts with health providers. Consistent with previous studies, contacts with health providers increased the likelihood of using iron-folic acid supplements during pregnancy [43] and served as the most common source of iron-folic acid supplements [18]. Other independent variables (age, education and level of education, type of employment, previous pregnancy, stage of pregnancy at first antenatal care visit, frequency of antenatal care visits, other sources of information, access to iron-folic acid tablets, and other sources of iron-folic acid tablets) were not significant. Contrary to the current findings, previous studies showed that these factors were significant [18, 21, 43]. The non-significant relationship observed in the current study may be due to small sample size. Similar to the current study, a study that examined iron-folic acid use during pregnancy and associated factors among 856 women in Sudan found no association with education level, parity, and employment. However, older age and use of antenatal care services were associated iron-folic acid supplement use [17]. Associations and non-associations observed in this previous study on iron-folic acid supplement use may be due to different study settings [17].

Almost all participants (97%) reported using iron-folic acid supplements, and 54% reported using iron-folic acid supplements daily. In the bivariate analysis, stage of pregnancy at first ANC visit, and frequency of antenatal care visits are significantly associated with adherence to duration of use ($p<0.05$). However, only frequency of antenatal care visits was included in the follow-up regression analysis due to empty cells when independent variables were cross tabulated with the dependent variable.

The majority of pregnant women interviewed were either self-employed (48%) or unemployed (39%). Among

Table 3 Predictors of intention to use Iron-folic acid supplements

	Mean	S.D	Intention to use Iron-folic acid Supplements			
			B	S.E	P >|t|	95% CI
Constant (Intention)	6.00	1.03	4.561	0.582	0.000	(3.397, 5.724)
Attitude	13.97	3.98	0.003	0.068	0.963	(-0.132, 0.138)
Subjective norm	29.39	8.89	0.076	0.032	0.020	(0.012, 0.139)
Perceived behavioral control	6.42	5.78	0.095	0.045	0.041	(0.004, 0.185)
R^2			0.126			
F (3, 60)			2.880		0.043	
ΔR^2			0.082			

N = 64, CI = confidence interval, S.D = Standard deviation, S.E = Standard error

Table 4 Factors associated with adherence to duration of use of Iron-Folic acid supplements

Variables/Categories	AOR(95%CI)	*p*-value
Age		
18–24	1.00	
25–34	7.36 (1.25–43.48)	0.03*
35 or above	4.30 (0.23–80.22)	0.33
Mother's level of education		
No education	1.00	
Primary	0.11 (0.01–1.51)	0.10
Secondary	1.27 (0.21–7.78)	0.79
Higher	1.00 (0.09–11.23)	0.99
Parity		
0 live birth	1.00	
One live birth	0.78 (0.09–6.59)	0.81
Two or more live births	1.10 (0.17–7.28)	0.92
Frequency of ANC visits		
Less than 4 Visits	1.00	
Four ANC visits or more	15.37 (2.15–109.74)	0.01*
Type of Employment		
Not employed	1.00	
Self-employed	0.23 (0.04–1.53)	0.13
Employed by organization/someone else	1.10 (0.08–14.59)	0.94

AOR = adjusted odds ratio; *N* = 62, CI = confidence interval 1.00 = Reference category, * = significantly associated with duration of use

those self-employed, 35% took iron-folic acid supplements for 9–21 weeks. Previously it was observed that housewives had a higher odds of taking iron-folic acid supplements compared to pregnant women employed outside the home [19]. In the current study, there is no significant association between occupation and duration of iron-folic acid supplement use. Regarding the stage of pregnancy at first antenatal care visit and frequency of antenatal care visits, studies have shown that pregnant women who attended first antenatal care service within the first trimester, and/or had more antenatal care visits were more likely to take more iron-folic acid supplements [17, 19, 21, 22, 43]. Taking the recommended dosage depends on early initiation of antenatal care visits during first trimester and multiple visits [12, 21].

Table 5 Characteristics of primary health care centers in Karu LGA, Nasarawa state

Variable	Frequency (*N* = 19)	Percent (%)
Location		
Urban	10	52.6
Rural	9	47.4
Professional designation		
Community Health Extension Worker	15	79.0
B.Sc, Community Health	2	10.5
Nurse Midwife	2	10.5
Availability of ANC guidelines		
Yes	11	57.9
No	8	42.1
Frequency of ANC service provision		
Once a week	12	63.2
Thrice a week	2	10.5
Four times in a week	1	5.3
Once or twice a month	4	21.0
Service Provision		
Iron supplementation	19	100.0
Folic acid supplementation	19	100.0
Test for Hemoglobin/Anemia	18	94.7
Availability of supplements		
Iron tablets	19	100.0
Folic acid tablets	19	100.0
Stock outs of drugs in the last 3 or 12 months		
Stock out of Iron tablets; Yes	1	5.3
No	18	94.7
Stock out of Folic acid tablets; Yes	1	5.3
No	18	94.7
Drug supplies in the pharmacy are ordered		
Order same time each week/ month/ quarter	14	73.7
Order whenever stocks reach reorder level	5	26.3

Frequency of antenatal care visits was significantly associated with the adherence to duration of taking iron-folic acid supplements in the regression analysis. The more antenatal care visits made by a pregnant woman, the more iron-folic acid supplements taken. This is consistent with findings from a secondary analysis of Demographic and Health Survey (DHS) data of 22 countries

[12]. A minimum of eight antenatal care contacts was recommended, and first contact should be during the first 12 weeks [44, 45]. In the current study, about 36% of pregnant women interviewed attended antenatal care services for at least four times or more. The significant effect of frequency of antenatal care visits in the present study implies that attending antenatal care services compensate for lack of education. Hence, quality information should be provided to pregnant women attending antenatal care to promote use and encourage to attend follow-up antenatal care sessions. It is important to note that all these factors (age, education, previous pregnancy, number of live births, and frequency of antenatal care visits) combined contributed to the duration of use in the overall model, this calls for integrated interventions.

The antenatal care system in Nigeria is critical to the accessibility of iron-folic acid supplements to pregnant women [43]. In the current study, all public primary healthcare clinics in Karu LGA have designated days for antenatal care sessions and provide free iron-folic acid supplements to all pregnant women who attended. These supplements are received from the Karu Local Government Health Department in line with the policy of the Federal Ministry of Health [4]. The provision of free supplements might be a motivating factor for pregnant women to take the supplements.

The present study has some limitations. First, the research was conducted among pregnant women attending antenatal care services in public primary healthcare facilities in Karu local government area (LGA), Nasarawa State, Nigeria. Karu LGA has a government hospital (secondary facility), and private clinics that also provide antenatal care to pregnant women. In addition, 30% of pregnant women in Nasarawa State do not attend antenatal care services [4]. So, study findings cannot be generalized to the general population of Karu LGA or Nasarawa State, but only limited to those using primary healthcare facilities in the LGA. The second limitation was that data was collected through self-report, which could result in recall bias and can cause overestimation or underestimation of associations. Despite these limitations, the study has given an estimation of the factors predicting intention to use, and duration of use of iron-folic acid supplements in Karu LGA, Nasarawa State. Third, the sample size is small, and may account for non-significant relationships observed in the current study.

Conclusion

The current study demonstrates that women who attend antenatal care more frequently are more likely to adhere to iron folic acid supplementation. In addition, the subjective norms women perceive and their ability to choose to seek care are significant factors to attending antenatal care. This study emphasizing how consistent antenatal care attendance and the support of others is critical in achieving recommended intake of iron-folic acid supplements during pregnancy. A large percentage of pregnant women miss taking iron-folic supplements for six months or more when they do not attend antenatal care services. To change this trend, interventions must focus not just on the attitudes and education of the individual women who are pregnant, but also those important to these women should be engaged in promoting use. Demonstration classes should be emphasized during antenatal care sessions and introducing them during the first trimester will address missed opportunities. Community health volunteers should be employed to promote antenatal care and in conjunction with promotions through mass media. Additional use of the Theory of Planned Behavior theoretical frameworks can guide investigations and interventions in the use of iron-folic acid supplements in a more comprehensive study with a larger population.

Abbreviations

ANC	Antenatal care
LGA	Local government area
MMR	Maternal mortality ratio
TPB	Theory of Planned Behavior
IRB	Institutional Review Board
NHREC	National Health Research Ethics Committee
VIF	Variance inflation factor
SD	Standard deviation
CHEWs	Community Health Extension Workers

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Author contributions

The study was conducted in part fulfilment of Georgia Southern University's doctoral degree in public health. TOA was responsible for all aspects of the study, including conceptualization, obtaining ethics approvals, data collection and analysis, and writing and editing the draft and final version of the manuscript. ARH and HR supervised the study and provided substantial contributions to its conceptualization, data interpretation, and reviewing and editing the draft manuscript. All authors read and approved the final manuscript.

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Data availability

The datasets used and analysed during the current study are available from the corresponding author on request.

Declarations

Ethics approval and consent to participate

Ethical approval for the study was received from the Georgia Southern University Institutional Review Board (IRB) (H18013) and Nigeria National Health Research Ethics Committee (NHREC) (NHREC/01/01/2007-25/08/2017) to ensure it was conducted in accordance with the Declaration of Helsinki. Also, the Karu Local Government Primary Healthcare Department approved

for the study to be conducted in selected health facilities within the local government area. Informed consent was obtained from all participants before the survey was administered, and necessary steps were taken to ensure confidentiality during and after data collection.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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References

1. World Health Organization (WHO). World health statistics 2024: monitoring health for the SDGs, sustainable development goals. Geneva: World Health Organization; 2024. https://iris.who.int/bitstream/handle/10665/376869/9789240094703-eng.pdf?sequence=1.
2. United Nations Children's Fund. Levels and trends in child mortality report 2023. Estimates developed by the UN Inter-agency group for child mortality Estimation. New York: UNICEF.; 2024. p. 96. https://childmortality.org/wp-content/uploads/2024/03/UNIGME-2023-Child-Mortality-Report.pdf.
3. World Health Organization (WHO), UNICEF, UNFPA, World Bank Group and UNDESA/Population Division. Trends in maternal mortality 2000 to 2020: estimates by WHO,. United Nations Maternal Mortality Estimation Inter-agency Group. Geneva World Health Organ. 2023. https://iris.who.int/handle/10665/366225
4. National Population Commission - NPC/Nigeria and ICF International. Nigeria Demographic and Health Survey 2018. Abuja, Nigeria: NPC/Nigeria and ICF International. 2019. Available at https://dhsprogram.com/pubs/pdf/FR359/FR359.pdf
5. Stevens GA, Paciorek CJ, Flores-Urrutia MC, Borghi E, Namaste S, Wirth JP, et al. National, regional, and global estimates of anaemia by severity in women and children for 2000–19: A pooled analysis of population-representative data. Lancet Global Health. 2022;10(5):e627–39. https://doi.org/10.1016/S2214-109X(22)00084-5.
6. Wang R, Xu S, Hao X, Jin X, Pan D, Xia H, et al. Anemia during pregnancy and adverse pregnancy outcomes: a systematic review and meta-analysis of cohort studies. Front Global Women's Health. 2025;6:1502585. https://doi.org/10.3389/fgwh.2025.1502585.
7. World Health Organization (WHO). Guideline: daily iron and folic acid supplementation in pregnant women. Geneva: World Health Organization; 2012. https://iris.who.int/handle/10665/77770.
8. Christian P, Khatry SK, LeClerq SC, Dali SM. Effects of prenatal micronutrient supplementation on complications of labor and delivery and puerperal morbidity in rural Nepal. Int J Gynecol Obstet. 2009;106(1):3–7. https://doi.org/10.1016/j.ijgo.2009.03.040.
9. Nisar Y, Dibley M, Aguayo V. Iron-folic acid supplementation during pregnancy reduces the risk of stunting in children less than 2 years of age: a retrospective cohort study from Nepal. Nutrients. 2016;8(2):67. https://www.mdpi.com/2072-6643/8/2/67.
10. Nisar YB, Dibley MJ. Antenatal iron–folic acid supplementation reduces risk of low birthweight in Pakistan: secondary analysis of demographic and health survey 2006–2007. Matern Child Nutr. 2016;12(1):85–98. https://doi.org/10.1111/mcn.12156. https://onlinelibrary.wiley.com/doi/.
11. World Health Organisation (WHO). Daily iron and folic acid supplementation during pregnancy. 2023. https://www.who.int/tools/elena/interventions/daily-iron-pregnancy
12. Sununtnasuk C, D'Agostino A, Fiedler JL. Iron + folic acid distribution and consumption through antenatal care: identifying barriers across countries. Public Health Nutr. 2016;19(4):732–42. https://doi.org/10.1017/S1368980015001652.
13. Ugwu E, Olibe A, Obi S, Ugwu A. Determinants of compliance to iron supplementation among pregnant women in Enugu, southeastern Nigeria. Niger J Clin Pract. 2014;17(5):608. https://doi.org/10.4103/1119-3077.141427.
14. Arega Sadore A, Abebe Gebretsadik L, Aman Hussen M. Compliance with iron-folate supplement and associated factors among antenatal care attendant mothers in Misha district, South Ethiopia: Community based cross-sectional study. Journal of Environmental and Public Health. 2015;2015:1–7. https://doi.org/10.1155/2015/781973
15. Maina-Gathigi L, Omolo J, Wanzala P, Lindan C, Makokha A. Utilization of folic acid and iron supplementation services by pregnant women attending an antenatal clinic at a regional referral hospital in Kenya. Maternal Child Health J. 2013;17(7):1236–42. https://doi.org/10.1007/s10995-012-1120-x.
16. Tinago CB, Annang Ingram L, Blake CE, Frongillo EA. Individual and structural environmental influences on utilization of iron and folic acid supplementation among pregnant women in Harare, Zimbabwe. Matern Child Nutr. 2017;13(3):e12350. https://doi.org/10.1111/mcn.12350.
17. Abdullahi H, Gasim GI, Saeed A, Imam AM, Adam I. Antenatal iron and folic acid supplementation use by pregnant women in Khartoum, Sudan. BMC Res Notes. 2014;7(1):498. https://doi.org/10.1186/1756-0500-7-498.
18. Nisar YB, Dibley MJ, Mir AM. Factors associated with non-use of antenatal iron and folic acid supplements among Pakistani women: A cross sectional household survey. BMC Pregnancy Childbirth. 2014;14(1):305. https://doi.org/10.1186/1471-2393-14-305.
19. Ogundipe O, Hoyo C, Østbye T, Oneko O, Manongi R, Lie RT, et al. Factors associated with prenatal folic acid and iron supplementation among 21,889 pregnant women in Northern Tanzania: A cross-sectional hospital-based study. BMC Public Health. 2012;12(1):481. https://doi.org/10.1186/1471-2458-12-481.
20. Taye B, Abeje G, Mekonen A. Factors associated with compliance of prenatal iron folate supplementation among women in mecha district, Western Amhara: A cross-sectional study. Pan Afr Med J. 2015;20. https://doi.org/10.11604/pamj.2015.20.43.4894.
21. Wendt A, Stephenson R, Young M, Webb-Girard A, Hogue C, Ramakrishnan U, et al. Individual and facility-level determinants of iron and folic acid receipt and adequate consumption among pregnant women in rural Bihar, India. PLoS ONE. 2015;10(3):e0120404. https://doi.org/10.1371/journal.pone.0120404.
22. Wiradnyani LAA, Khusun H, Achadi EL, Ocviyanti D, Shankar AH. Role of family support and women's knowledge on pregnancy-related risks in adherence to maternal iron–folic acid supplementation in Indonesia. Public Health Nutr. 2016;19(15):2818–28. https://doi.org/10.1017/S1368980016001002.
23. De Vivo M, Hulbert S, Mills H, Uphill M. Examining exercise intention and behaviour during pregnancy using the theory of planned behaviour: A meta-analysis. J Reproductive Infant Psychol. 2016;34(2):122–38. https://doi.org/10.1080/02646838.2015.1118022.
24. Lee CF, Chiang IC, Hwang FM, Chi LK, Lin HM. Using the theory of planned behavior to predict pregnant women's intention to engage in regular exercise. Midwifery. 2016;42:80–6. https://linkinghub.elsevier.com/retrieve/pii/S0266613816301693.
25. Whitaker KM, Wilcox S, Liu J, Blair SN, Pate RR. Pregnant women's perceptions of weight gain, physical activity, and nutrition using theory of planned behavior constructs. J Behav Med. 2016;39(1):41–54. https://doi.org/10.1007/s10865-015-9672-z. http://link.springer.com/.
26. Pawlak R, Brown D, Meyer MK, Connell C, Yadrick K, Johnson JT, et al. Theory of planned behavior and multivitamin supplement use in Caucasian college females. J Prim Prev. 2008;29(1):57–71. https://doi.org/10.1007/s10935-008-0127-y. http://link.springer.com/.
27. Columbia University Mailman School of Public Health. 2016 [cited 2017 Jun 05]. Averting maternal death and disability (AMDD). https://www.publichealth.columbia.edu/research/programs/averting-maternal-death-disability-amdd
28. The DHS Program. - Survey Types. [cited 2017 Jun 05]. https://dhsprogram.com/methodology/Survey-Types/index.cfm
29. Francis J, Johnston M, Eccles M, Walker A, Grimshaw JM, Foy R, Kaner EFS, Smith L, Bonetti D. Constructing questionnaires based on the theory of planned behaviour: A manual for Health Services Researchers. Quality of life and management of living resources; Centre for Health Services Research. 2004. http://openaccess.city.ac.uk/id/eprint/1735
30. Creswell JW. Research design: qualitative, quantitative and mixed methods approaches. 3rd ed. Thousand Oaks, CA: Sage; 2014.
31. Acock AC. A gentle introduction to Stata. Rev. 3rd ed. College Station, Tex: Stata Press; 2012. 401 p.

32. Hamilton L. Statistics with STATA: version 12. Cengage Learning; 2012. p. 488.
33. Malek L, Umberger WJ, Makrides M, ShaoJia Z. Predicting healthy eating intention and adherence to dietary recommendations during pregnancy in Australia using the theory of planned behaviour. Appetite. 2017;116:431–41. https://doi.org/10.1016/j.appet.2017.05.028.
34. Symons Downs D, Hausenblas HA. Exercising for two: examining pregnant women's second trimester exercise intention and behavior using the framework of the theory of planned behavior. Women's Health Issues. 2003;13(6):222–8. https://doi.org/10.1016/j.whi.2003.09.004.
35. Downs DS, Hausenblas HA. Pregnant women's third trimester exercise behaviors, body mass index, and pregnancy outcomes. Psychol Health. 2007;22(5):545–59. https://doi.org/10.1080/14768320701372018.
36. Hausenblas HA, Symons Downs D. Prospective examination of the theory of planned behavior applied to exercise behavior during women's first trimester of pregnancy. J Reproductive Infant Psychol. 2004;22(3):199–210. https://doi.org/10.1080/02646830410001723788.
37. Hausenblas H, Downs DS, Giacobbi P, Tuccitto D, Cook B. A multilevel examination of exercise intention and behavior during pregnancy. Soc Sci Med. 2008;66(12):2555–61. https://linkinghub.elsevier.com/retrieve/pii/S0277953608000865.
38. Yzer M. Perceived behavioral control in reasoned action theory: a dual-aspect interpretation. Annals Am Acad Political Social Sci. 2012;640(1):101–17. http://journals.sagepub.com/doi/10.1177/0002716211423500.
39. Martinez LS, Lewis N. The moderated influence of perceived behavioral control on intentions among the general U. S. Population: implications for public communication campaigns. J Health Communication. 2016;21(9):1006–15. https://doi.org/10.1080/10810730.2016.1204378. https://www.tandfonline.com/doi/full/.
40. Osamor P, Grady C. Factors associated with women's health care decision-making autonomy: empirical evidence from Nigeria. J Biosoc Sci. 2018;50(1):70–85. https://doi.org/10.1017/S0021932017000037.
41. Kidwell B, Jewell RD. The moderated influence of internal control: an examination across health-related behaviors. J Consumer Psychol. 2003;13(4):377–86. https://doi.org/10.1207/S15327663JCP1304_05. https://myscp.onlinelibrary.wiley.com/doi/.
42. Fiedler J, D'Agostino A, Sununtnasuk C. Nutrition technical brief: A rapid initial assessment of the distribution and consumption of iron-folic acid tablets through antenatal care in Nigeria. 2014. Arlington, VA: USAID/Strengthening Partnerships, Results and Innovations in Nutrition Globally (SPRING) Project. https://ebrary.ifpri.org/digital/collection/p15738coll5/id/4661
43. Titaley CR, Dibley MJ. Factors associated with not using antenatal iron/folic acid supplements in Indonesia: the 2002/2003 and 2007 Indonesia demographic and health survey. Asia Pac J Clin Nutr. 2015;24(1):162–76. https://doi.org/10.6133/apjcn.2015.24.1.10.
44. Tunçalp Ö, Pena-Rosas J, Lawrie T, Bucagu M, Oladapo O, Portela A, et al. WHO recommendations on antenatal care for a positive pregnancy experience—going beyond survival. BJOG: Int J Obstet Gynecol. 2017;124(6):860–2. https://doi.org/10.1111/1471-0528.14599.
45. World Health Organization. WHO recommendations on antenatal care for a positive pregnancy experience. Geneva: World Health Organization; 2016. p. 152. https://iris.who.int/handle/10665/250796.

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