

# Folic Acid for the Prevention of Fetal Neural Tube Defects

**Olajubu Aanuoluwapo Omobolanle**  
<https://orcid.org/0000-0001-9617-8660>  
Obafemi Awolowo University, Nigeria  
bolajubu@gmail.com

**Aremu Olayinka Olaitan**  
<https://orcid.org/0000-0003-4360-2338>  
Obafemi Awolowo University, Nigeria  
olawhyk@yahoo.com  
yinka1430@gmail.com

**Oladejo Oluwatobiloba Rukayat**  
Obafemi Awolowo University, Nigeria

**Olowokere Adekemi Eunice**  
Obafemi Awolowo University, Nigeria  
ayaolowo@gmail.com

## Abstract

The use of folic acid supplements before and during the first three months of pregnancy significantly reduces the risk of fetal neural tube defects (NTDs). This study assessed knowledge and factors that influence the use of folic acid, the actual use of folic acid and its relationship with socio-demographic factors among women of childbearing age in the Ife Central Local Government, Ile-Ife, Osun State, Nigeria. A cross-sectional descriptive design was adopted to select 400 women of childbearing age who participated in the study using a self-structured questionnaire. Results from this study showed that 39.8 per cent of the study participants had good knowledge about the benefits of folic acid, 64.6 per cent of the participants reported to have used folic acid at one time in their lives, while 55.5 per cent of them reported not to have taken folic acid before their pregnancy. This study also revealed a significant association between the respondents' socio-demographic factors and the use of folic acid with a p-value of .000 ( $p\text{-value} < 0.05$ ). The study concluded that knowledge about the use of folic acid for the prevention of NTDs among women of childbearing age is not adequate and that very few of them used folic acid at the appropriate time.

**Keywords:** folic acid supplements; neural tube defect; pregnancy; pregnant women; prevention

## Introduction

Folate-sensitive neural tube defects (NTDs) are an important, preventable cause of morbidity and mortality worldwide. In low-income countries, NTDs may account for 29 per cent of neonatal deaths due to observable birth defects (Blencowe et al. 2010). In Nigeria, the incidence of NTDs varies between 0.5 per 1 000 live births and is responsible for 1.9 per cent of all admissions among certain ethnic groups (Anyanwu, Danborno, and Hamman 2015).

The exact causes of NTDs are not known. Many different factors, including genetics, nutrition, and environmental factors, are known to play a role. Research shows that getting enough folic acid (also known as folate or vitamin B9) before conception and early in pregnancy can greatly reduce the risk of spina bifida and other NTDs (NICHD 2018). The reported incidence of NTDs varies from country to country and even within regions in the same country (Copp, Stanier, and Greene 2013). An incidence of 7.33/1 000 births have been reported in India, and 0.6–1.3 in the USA, whereas in Nigeria rates of 2.75 to 7/1 000 births have been reported (Anyanwu, Danborno, and Hamman 2015; Greene, Stanier, and Moore 2011; Sachdeva et al. 2014).

Folate is a water-soluble B vitamin that occurs naturally in food. It is an essential nutrient that humans cannot synthesise. Folic acid is the synthetic form of folate that is found in supplements and added to fortified foods. Folate is found naturally in a wide variety of foods particularly leafy green vegetables such as spinach, asparagus and lettuce, grains such as beans, peas and lentils, fruits such as oranges, and cantaloupe melons, and also in kidney, liver, egg yolks and yeast (Waugh, Grant, and Ross 2010). Folic acid has thus been shown to reduce effectively the risk of NTDs as supported by evidence from recent systematic reviews on folic acid for the prevention of NTDs in both high- and low-income countries (Wolff et al. 2009).

The Centers for Disease Control (CDC) recommends that all women of childbearing age eat a diet high in folic acid or take a multivitamin with 400 micrograms of folic acid each day, especially one month before conception through the first three months of pregnancy. This dosage is the amount found in most over-the-counter multivitamins. However, women who have had a previous NTD pregnancy are recommended to take an even higher dosage of folic acid before planning a pregnancy (CDC 2016).

The WHO recommends that all pregnant women receive a standard dose of 30–60 mg iron and 400 µg folic acid beginning as soon as possible during gestation (WHO 2012). Many studies have shown poor periconceptional use of folic acid among pregnant women in Nigeria (Anzaku 2013; Lawal and Adeleye 2014). To ensure adequate levels of folic acid, public health interventions surrounding supplementation and food fortification become necessary. The best public health interventions must target all women of reproductive age. Hence, the need for this study to assess the knowledge and use of folic acid for the prevention of NTDs among women of childbearing age.

## **Research Methodology**

### **Study Design**

This study is a descriptive study to assess the knowledge and use of folic acid for the prevention of fetal NTDs among women of childbearing age in Ile Ife, Nigeria.

### **Study Setting**

This study was conducted in the Ife Central Local Government Area of Osun State, South-West Nigeria. The Ife Central Local Government is in Ile Ife, the cradle of the Yoruba civilisation and race. The Local Government consists of multi-ethnic nationalities predominantly dominated by the Yoruba, Igbo, Edos, Hausas, Fulani and foreigners who are from other parts of the country. The inhabitants are mostly traders, university and polytechnic lecturers, civil servants and students. The Local Government also houses several educational institutions such as private and public secondary and primary schools as well as healthcare centres, private hospitals, maternity centres and dispensaries. The establishment of all these healthcare facilities in the Local Government Area is owing to the sensitivity of government to the healthcare of people resident within the boundaries of the Local Government Area. Ife central local government has 11 political wards.

### **Study Population**

Women of childbearing age (18–45 years) and who are residents in Ife Central Local Government, Ile-Ife, formed the population for the study.

### **Instrument for Data Collection**

The study made use of a pretested, self-developed, semi-structured questionnaire which comprised a mixture of closed- and open-ended questions to accommodate a large range of different responses from the respondents. Information on the socio-demographic characteristics of the respondents, the level of the respondents' knowledge on the use of folic acid for the prevention of fetal NTDs, the respondents' use of folic acid, and factors that influence the use of folic acid among women of childbearing age was also obtained.

### **Procedure for Data Collection**

A letter of permission to collect data was duly signed by the head of the Department of Nursing Science OAU, Ile-Ife, and was submitted to the Local Government chairman following which permission was granted to conduct the study in the selected wards. Informed consent to participate in the study was also sought from the individual subjects.

## **Sampling Technique and Sample Size**

A multistage sampling technique was used to select respondents from all 11 political wards in the Ife Central Local Government, which was divided into two clusters of wards based on the proximity of the wards. A random sampling method was then used to select two wards in each cluster. Thereafter, households were selected systematically with every third household on each street in the ward being selected. Purposive sampling was then used for the selection of women of childbearing age in each household.

Using Cochran's formula for finite population:  $n = Z^2pq/e^2$  with estimated proportion of an attribute 39 per cent (NPC and ICF Macro 2009), the total sample size was 400, which was divided equally among the 4 wards.

## **Data Analysis**

The data collected were sorted, coded and inputted into the statistical package for social sciences (SPSS version 17.0) for analysis using descriptive statistical techniques such as mean, frequencies and percentages. Questions on knowledge of folic acid for the prevention of NTDs were developed and covered eight items, with possible responses of "Yes" or "No". The "Yes" response was given a value of 2 points and the "No" response was given 0; the maximum possible score was 16. The higher the score, the greater the level of knowledge about folic acid for the prevention of NTDs. The respondents that scored 60 per cent and above of the maximum obtainable score (i.e. 10 and above) were judged to have good knowledge on folic acid for the prevention of NTDs, while those that scored below 60 per cent (9 and below) were judged to have poor knowledge.

## **Ethical Consideration**

Informed consent of the individual participants was obtained before the administration of the questionnaire and after they were given adequate information on the nature, purpose and procedure of the study. Confidentiality regarding the respondents' information was always maintained by ensuring that their names were not linked to the questionnaires. Participation was voluntary, and the respondents were informed that they could withdraw from the study if they so desired without any penalty.

## **Results**

### **Socio-demographic Characteristics of Respondents**

Table 1 shows the socio-demographic data of the respondents. The majority (135; 33.8) of the respondents are within the age group of 25–31 years, the respondents with tertiary education are 253 (63.3%), and those who practice Christianity 277 (69.3). A total of 175 (43.8%) respondents generate less than ₦50 000 in a month, and 249 (62.3%) of the respondents are married.

**Table 1:** Socio-demographic characteristics of respondents

<i>Socio-demographics</i>	<i>Frequency (N)</i>	<i>Percentage (%)</i>
<i>Age</i>		
18–24	121	30.3
25–31	135	33.8
32–38	87	21.8
39–45	57	14.3
<i>Educational status</i>		
None	9	2.3
Primary	24	6.0
Secondary	114	28.5
Tertiary	253	63.3
<i>Religion</i>		
Christianity	277	69.3
Islam	123	30.8
<i>Total number of children</i>		
0	100	25.0
1–2	198	49.5
3–4	69	17.3
More than 5	33	8.3
<i>Income level (₦)</i>		
< 50 000	175	43.8
50 000–70 000	123	30.8
80 000–100 000	57	14.3
> 100 000	45	11.3
<i>Marital status</i>		
Single	145	36.3
Divorced	6	1.5
Married	249	62.3

### **Knowledge of Folic Acid for the Prevention of Fetal Neural Tube Defects**

Table 2 shows the knowledge of the respondents on NTDs. A total of 289 (72.3%) of the respondents believed that folic acid prevents anaemia and an equal number believed that it will increase their energy levels. A total of 282 (70.5%) said it should not be taken during pregnancy only. A total of 343 (85.8%) agreed that folic acid prevents babies from developing abnormalities.

The summary of the respondents' knowledge of folic acid for the prevention of fetal NTDs showed that 160 (39.8%) had good knowledge while 240 (60.2%) had poor knowledge.

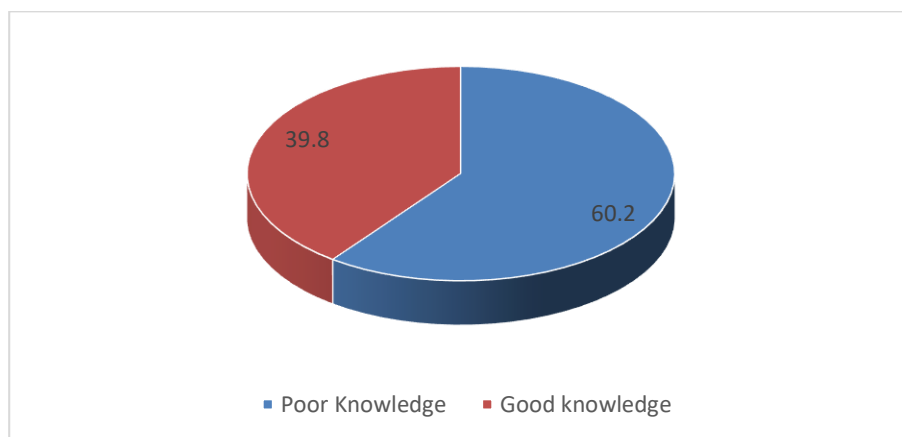
**Table 2:** Knowledge of folic acid for the prevention of fetal NTDs

<i>Knowledge</i>	<i>Frequency (N)</i>	<i>Percentage (%)</i>
<i>What is folic acid</i>		
Vitamin	156	39.0
Mineral	69	17.3
Supplement	175	43.8
<i>When is a woman supposed to start taking folic acid</i>		
Before getting pregnant	90	22.5
During pregnancy	120	30.0
Before and during pregnancy	141	35.3
After delivery	6	1.5
I do not know	43	10.8
<i>Taking folic acid in the first trimester of pregnancy is important because it prevents baby from having any abnormalities</i>		
Yes	334	83.5
No	66	16.5
<i>Women who are pregnant or trying to get pregnant can get enough folic acid from the food they eat</i>		
Yes	225	56.3
No	175	43.7
<i>What are the other ways you know of that women who are pregnant or are planning to get pregnant can get folic acid</i>		
Taking multivitamins	162	40.5
Taking supplements	135	33.8
Eating foods and drinks that had folic acid added to them	228	57.0
None	20	5.0
Do not know	67	16.8
<i>Folic acid helps to prevent my baby from having abnormalities</i>		
Yes	343	85.8
No	58	14.3
<i>Folic acid should be taken during pregnancy only</i>		
Yes	118	27.5
No	282	70.5

<i>Knowledge</i>	<i>Frequency (N)</i>	<i>Percentage (%)</i>
<i>What types of foods do you think are naturally good sources of folate</i>		
Green vegetables	282	70.5
Milk	96	24.0
Oranges	114	28.5
Do not know	105	26.3
<i>Folic acid can increase energy levels when a woman is pregnant</i>		
Yes	298	74.5
No	102	25.5
<i>Taking folic acid while pregnant prevents anaemia</i>		
Yes	289	72.3
No	108	27.0

### Summary of Respondents' Knowledge

Figure 1 gives the summary of the respondents' knowledge, where 160 (39.8%) showed good knowledge while 240 (60.2%) showed poor knowledge.



**Figure 1:** Respondents' level of knowledge on the use of folic acid for the prevention of fetal NTDs

### Use of Folic Acid among Women of Childbearing Age

Table 3 shows the use of folic acid among the respondents. A total of 258 (64.5%) have taken folic acid before, while 123 (30.8%) used it in the first trimester of their pregnancy. A total of 178 (68.9%) did not take any vitamins or supplements containing folic acid.

**Table 3:** Use of folic acid among the respondents

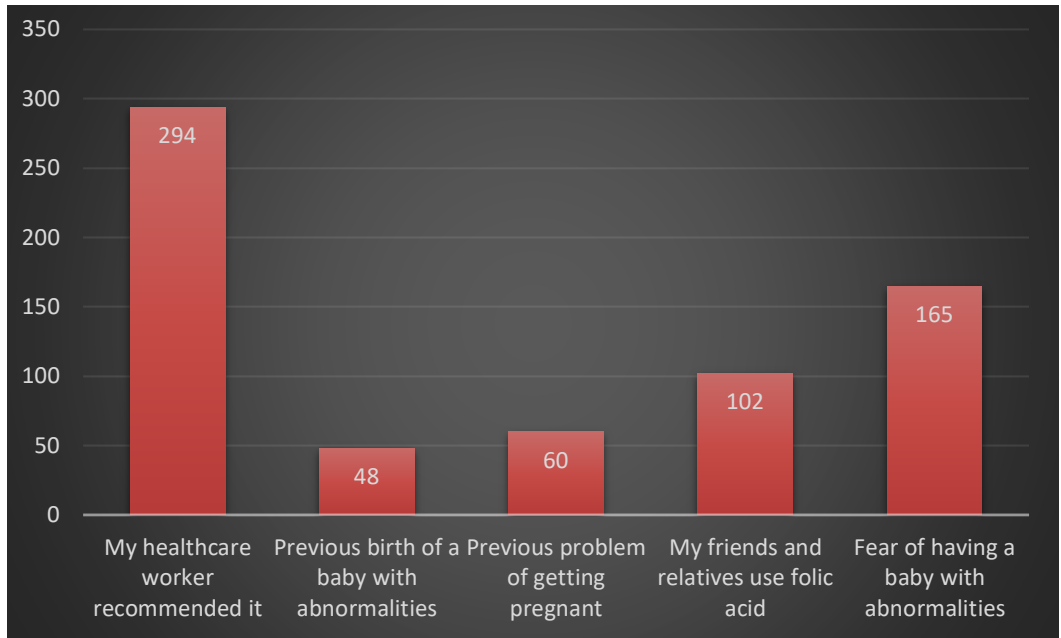
<i>Use</i>	<i>Frequency (N)</i>	<i>Percentage (%)</i>
<i>Have you ever taken folic acid before</i>		
Yes	258	64.5
No	142	35.5
<i>If yes, when</i>		
Before I got pregnant	108	27.0
In my first trimester	123	30.8
Three months after delivery of my baby	27	6.8
<i>Did you take folic acid supplements before getting pregnant</i>		
Yes	178	68.9
No	80	31.1
<i>Are you taking any vitamins or supplements that contain folic acid</i>		
Yes	180	69.8
No	78	30.2
<i>How often do you take folic acid</i>		
Daily	207	80.2
Weekly	35	13.5
Never	16	6.2

### **Factors Influencing and Inhibiting the Use of Folic Acid among Women of Childbearing Age**

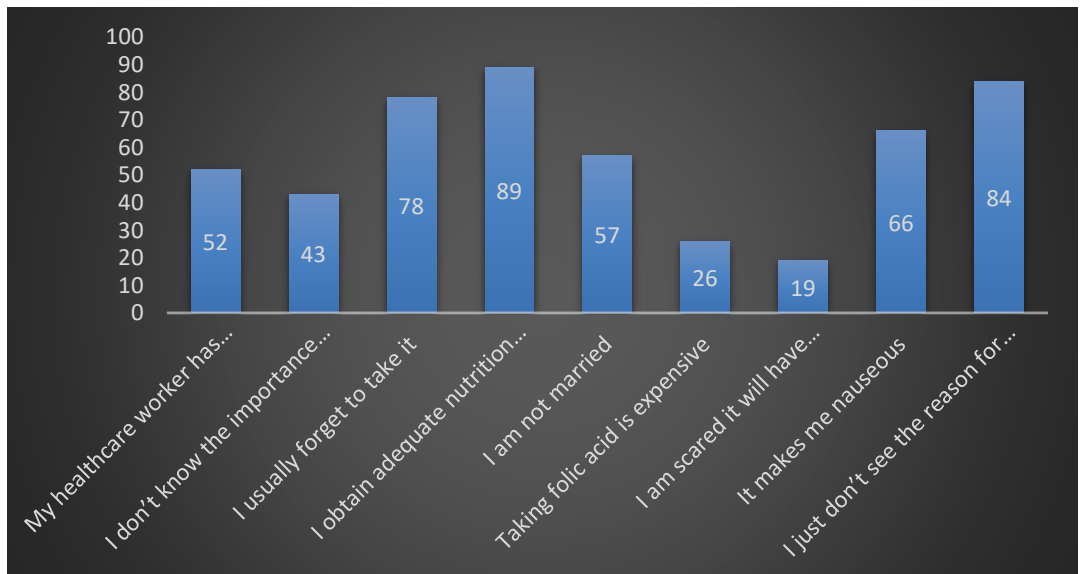
The factors influencing the use of folic acid as reported by the respondents showed that 294 (73.5%) of the respondents used folic acid because it was recommended by a healthcare worker while 165 (41.3%) use it because they fear their babies might have abnormalities. (See Figure 2.)

Other factors inhibiting the use of folic acid among the respondents were the claim that it makes them nauseous (66; 16.5%) and 84 (21.0%) said they do not see the need for folic acid. (See Figure 3.)





**Figure 2:** Factors that influence the use of folic acid among respondents



**Figure 3:** Additional factors that inhibit the use of folic acid among respondents

The chi-square test association between the educational level and marital status of the respondents and their use of folic acid indicates that there is a significant association between respondents' educational level and their knowledge on the use of folic acid for the prevention of NTDs (p-value of < 0.001). (See Table 4.)

**Table 4:** Chi-square test association between the educational level and marital status of the respondents and their use of folic acid

<i>Use of folic acid</i>	<i>Education level</i>				<i>Total N (%)</i>	<i>p-value</i>
	<i>None N (%)</i>	<i>Primary N (%)</i>	<i>Secondary N (%)</i>	<i>Tertiary N (%)</i>		
Daily	0 (0)	6 (1.5)	75 (18.8)	126 (31.5)	207 (51.8)	< 0.001
Weekly	3 (0.8)	0 (0)	12 (3.0)	69 (17.3)	84 (21)	
Never	6 (1.5)	18 (4.5)	27 (6.8)	58 (14.5)	109 (27.3)	
Total	9 (2.3)	24 (6.0)	114 (28.5)	253 (63.3)	400	
<i>Use of folic acid</i>	<i>Marital status</i>			<i>Total N (%)</i>	<i>p-value</i>	
	<i>Single n (%)</i>	<i>Divorced n (%)</i>	<i>Married n (%)</i>			
Daily	36 (9.0)	6 (1.5)	165 (41.3)	207 (51.8)	< 0.001	
Weekly	45 (11.3)	0 (0)	30 (7.5)	63 (15.8)		
Never	64 (16.0)	0 (0)	54 (13.6)	118 (29.6)		
Total	145 (36.3)	6 (1.5)	249 (62.3)	400		

Table 5 shows the relationship between the respondent’s knowledge of folic acid and their use of folic acid. This indicates that there is a significant relationship between the respondents’ knowledge of folic acid and their use of folic acid for the prevention of NTDs (p-value of < 0.001).

**Table 5:** Cross tabulation of use of folic acid and knowledge of folic acid

	<i>Knowledge of folic acid</i>		<i>Total</i>	<i>p-value</i>
	<i>Good</i>	<i>Poor</i>		
Yes	225	33	258	0.000
No	0	142	142	
Total	225	175	400	

## Discussion of Findings

This study revealed a considerable poor level of knowledge regarding the use of folic acid for the prevention of NTDs. Less than one-third of the women reported that folic acid intake should begin as early as before pregnancy. This is similar to the report of Muhammad, Namrah and Syeda (2015) but in contrast to that of El-Mani et al. (2014) where the majority of the women reported that folic acid intake should begin before pregnancy. This could be owing to inadequate preconceptional care programmes in Nigeria where most women started taking folic acid in their first trimester of pregnancy.

Good knowledge among women in this study about folic acid was 39.8 per cent. This is significantly lower than the 58.8 per cent as shown in the study by Muhammad, Namrah and Syeda (2015), 64.6 per cent among Nigerian women as reported by Anzaku (2013), and 98 per cent by El-Mani et al. (2014). The disparity in the level of knowledge across these settings could likely be owing, in part, to the fact that only women who were pregnant or had recently completed a pregnancy were probably more likely to retain information related to the role of folic acid in the prevention of NTDs as well as having a healthy baby.

In this study, the majority of women have poor knowledge. The rationale behind this poor knowledge among pregnant women possibly was owing to the lack of awareness, infrequent and fewer antenatal visits and visits at term pregnancy. The educational status was also noted to influence the use of folic acid which is in line with a study conducted among Saudi females on maternal knowledge and the use of folic acid which showed that the level of education was directly proportional to the use of folic acid (Ota et al. 2012).

Hence, the results of this study strongly recommend that knowledge about folic acid be provided through awareness campaigns and telecommunication media. Nursing staff and midwives should contribute to motivate and educate the women, as it is their professional and ethical obligation. This also suggests that there is considerable room for improvement in the role of healthcare providers in discussing folic acid with their patients. Because folic acid must be consumed before pregnancy to reduce the risk of NTDs, and because about one-half of all live births are the result of unintended pregnancies, it is imperative that nurses take their time to discuss folic acid not just with pregnant women but with all women in the community who can become pregnant.

The findings on the use of folic acid among women of childbearing age revealed that more than half of the women reported to have used folic acid before, but only a small number of these women reported that they used folic acid prenatally. This is similar to the studies carried out by Tort et al. (2010) and Alkaabi, Alsenaidi and Mirghani (2013) where it was reported that only a minority of the women used folic acid prenatally. A national periconceptional folic acid campaign could significantly increase the awareness and use of folic acid in women of a reproductive age.

Although more than half of the women in this study reported a daily use of folic acid, this is lower compared to the results of the study carried out by Chantal, Juan, and Evans (2014) but higher than the report of the folic acid campaign by Safefood (2016) which indicated that only one in three routinely takes folic acid. These results showed us that we are getting closer to the desired objective.

Despite the availability of scientific evidence on the prevention of NTDs by folic acid supplementation and its recommendation by health authorities, 35.6 per cent of the pregnant women did not take folic acid during pregnancy, and 44.5 per cent of the

women took folic acid before pregnancy with the aim of preventing NTDs. The poor intake of folic acid among these women could be a result of low recommendation from policymakers, fewer prescriptions and recommendations by healthcare providers, and a lack of awareness about folic acid supplements, its importance and the recommended time for women. The other factors may be a failure of healthcare providers to prescribe folic acid at protective times and a lack of preconceptional care.

It is evident from this study that even though most women are using supplements containing folic acid, they do not know why they are taking them and did not start taking them at the correct time. Promoting knowledge about the importance of folic acid intake via community sensitisation, the use of the media and healthcare personnel should contribute to increasing its knowledge and correct use.

The folic acid intake rate for NTD prevention in the present study indicates that special intervention plans should be developed by health policymakers. This intervention could be screening women of childbearing age for folic acid use and providing information on the benefits of folic acid supplementation, training healthcare providers on NTD and other birth defect prevention mechanisms, and providing education for the whole community even early at high school level using the media and other methods.

### **Factors that Inhibit or Facilitate the Use of Folic Acid among Women of Childbearing Age**

This study showed that the minority of the women cited that their health worker has never told them about the importance of taking folic acid supplements. This is in agreement with the study carried out by El-Mani et al. (2014) where less than one-third of the women included in the study reported that they had not received adequate information from their health professionals about the need to take these supplements. This could be owing to omission on the part of the healthcare workers.

This study also revealed that less than one-third of the study population cited forgetfulness as an inhibitor to taking folic acid. This does not correlate with the results of the study by Muhammad, Namrah and Syeda (2015) where slightly above one-third of the study participants reported forgetfulness as one of the factors inhibiting folic acid use. In this study, the majority of the participants reported that the reason they do not take folic acid is because they obtain adequate nutrition from their diet. However, in the study carried out by Manniën et al. (2013) to assess the factors associated with not using folic acid supplements preconceptionally, not having a partner and being unemployed were factors related to the non-use of folic acid.

Findings from this study showed that the majority of the women take folic acid simply because their health worker recommended it. These findings are similar to the results from the study by Faughnan et al. (2009) which explored the barriers and motivators to taking folic acid supplements among women aged 18–30 years in Ireland, where more

than half of the study participants reported that hearing the recommendation from a trusted health professional was viewed as a strong motivator for taking folic acid.

## **Implications for Nursing and Midwifery**

Without knowing why folic acid supplements are prescribed, it could be less likely that women of reproductive age would follow prescriptions or adhere to medication. It is therefore important for nurses and midwives to increase awareness and provide comprehensive information that will equip women of childbearing age with adequate knowledge about the benefits and use of folic acid for the prevention of NTDs. It is also important for nurses to be aware of the various nutrient supplementation guidelines, as adherence to these guidelines plays a great role in reducing the incidence of NTDs in any society.

## **Conclusion**

This study therefore concluded that less than half of the women of childbearing age in Ife Central Local Government have adequate knowledge about the use of folic acid for the prevention of NTDs, and very few of them used folic acid at the appropriate time. The folic acid intake rate for NTD prevention in the present study indicates that special intervention plans should be developed by health policymakers. These interventions could be screening women of childbearing age for the use of folic acid and providing information on the benefits of folic acid supplementation, training healthcare providers on NTD and other birth defects prevention mechanisms, and providing education for the whole community even early at high school level using the media and other methods.

The other most important intervention that could be developed by policymakers and other stakeholders is to start preconceptional care for women who plan to become pregnant. This action might improve folic acid usage for preventing NTDs and other birth defects and early antenatal care registration. The folic acid rate of intake in this study also indicates that urgent action is required from healthcare providers to improve usage during protective periods against NTDs and other congenital anomalies. Further effort is therefore required, and necessary to have health education on NTDs and folic acid usage during premarital health examinations, when providing family planning services and during other contact with the community.

## **Recommendations**

1. There is a need for public health education targeting women of reproductive age on the importance of folic acid as a reproductive health-promoting supplement in the setting environment.
2. There should be more efforts by the public health sector in enlightening the general populace on the importance of periconceptional folic acid intake by

women of childbearing age so as to effect a positive attitudinal change among them.

3. More efforts are needed to promote awareness about folic acid through the media because of its wider coverage among the population. Hence, young females will also benefit and use the knowledge positively when married and this will contribute to the overall increase in the correct use of folic acid for the primary prevention of NTDs among women of reproductive age in our environment.
4. Fortification of staple foods with this vitamin will help in increasing folic acid intake among women, which will eventually contribute to the prevention or reduction of the incidences of NTDs among our populace.
5. Folic acid should be freely available, and guidelines should exist to enable women to access it, especially preconceptionally.

## **Study Limitations**

A limitation of the study was that it was conducted in one city. Hence, the findings of this study may not be generalised to other cities in the country, especially in rural areas and small towns. Also, the use of folic acid was only as reported by the respondents which may not represent its actual usage. Despite these limitations, the present study provides some insight into the knowledge of women of the usage of folic acid for prevention of NTDs. Further studies should include investigation of actual usage, the detailed data on frequency, dose, and timing of folic acid supplement use, the analysis of many maternal characteristics as determinants of supplement use, and a multicity design strategy.

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