

Original Research Article

KNOWLEDGE OF FOLIC ACID SUPPLEMENTATION AMONG PREGNANT WOMEN AT A TERTIARY HOSPITAL IN SOUTHERN NIGERIA

ABSTRACT

Background: Folic acid is an essential water-soluble vitamin that cannot be synthesized in the human body and so its major source is from diet. It plays an important role in embryonic development. Folic acid deficiency in pregnant women results in megaloblastic anaemia, increased risk of preterm delivery and neural tube defects. The assessment of its knowledge is essential in preventing neural tube defects.

Aim: The aim of this study was to evaluate the awareness and knowledge of folic acid as a preventive measure for neural tube defects, and their determinants amongst pregnant women at the University of Port Harcourt Teaching Hospital.

Materials and methods: This was a descriptive cross-sectional study conducted among 451 antenatal attendees at the University of Port Harcourt Teaching Hospital from January 1 to March 31, 2020. A structured interviewer-administered questionnaire was used to obtain information from the women after consent was given. Data obtained was collated, entered in a spread sheet, and analyzed using SPSS version 25. Results are expressed in means and percentages. The confidence interval was set at 95% and a p-value of < 0.05 was statistically significant. Chi square test and Pearson's correlation were used to determine association between knowledge of folic acid and variables.

Results: Majority 258 (57.2%) of the women were aged 30-39 years and were mostly nulliparous 122 (27.1%). Over two-third 330 (73.2%) had post-secondary education and almost all 409 (90.7%) of the women were married. Most 375 (83.1%) of the pregnant women were aware of folic acid and its use in peri-conception care. The main source of information was from healthcare workers (54.8%), followed by family and friends (14.6%) and online media (12.0%). Only 169 (37.5%) were aware of the role of folic acid in preventing NTDs. Knowledge about the role of folic acid in the prevention of neural tube defects was significantly associated with younger age, post-secondary education, occupation, and low parity (p value < 0.05).

Conclusion: Age, educational level, occupation, and parity were significantly predictive of knowledge of folic acid in the prevention of neural tube defects.

Keywords: Awareness, Knowledge, folic acid, Port Harcourt, Southern Nigeria

1. INTRODUCTION

Folic acid is an essential micronutrient required for multiple metabolic processes. It is essential for numerous body functions such as synthesis, repair, and methylation of deoxy ribonucleic acid (DNA).^[1] It is also a co-factor in certain biological reactions, and it is important in erythropoiesis. It plays a key role in the development of the central nervous system during embryogenesis and aids rapid cell division and growth as seen in utero and in infancy. ^[1]

Folic acid deficiency is a lack of folate in the diet and the signs are often subtle. However, severe folic acid deficiency is associated with megaloblastic anaemia, reduced white blood cell and platelet count, as well impaired function in the mother. ^[2] Pregnant women who are folate deficient are more likely to give birth to low-birth-weight babies, preterm infants, and infants with neural tube defects. ^[2,3]

The causes of folic acid deficiency can be broadly divided into; poor intake, reduced absorption and increased body requirement. Pregnancy increases the demand for folic acid. Aging and medications such as phenytoin reduce the absorption and utilization of folic acid by the body. Folic acid deficiency can also occur when there is inadequate dietary intake. ^[4,5]

Neural tube defects (NTDs) are the most dreaded consequence of folate deficiency. They are congenital structural anomalies of embryonic origin that result from failure of the neural tube to close between day 21 and day 28 post conception, and they cause defects in the brain, spinal cord, and their surrounding structures. ^[6,7,8] They occur worldwide and are the second most common major congenital abnormalities occurring in 2-3% of live births. ^[6,7]

The incidence of neural tube defects in Nigeria is 0.85 to 7/1000 live births. ^[4] NTDs was reported to be 0.95/1000 births in Port Harcourt, 0.85/1000 live births in Abakiliki, 2.2/1000 live births in Sokoto, 2.75/1000 live births in Kano, and 7/1000 live births in the middle belt region

of Nigeria. [9,10,11] In Europe, Asia and United States of America, the rate of NTDs is 5.14-12.5/10,000. [12] In Nigeria, it was reported that the defects were more commonly associated with high parity, and female babies were mostly affected. [4]

Folic acid intake during the peri-conception period is said to be adequate when commenced one month before conception and first three months after conception. This helps protect against numerous congenital anomalies including neural tube, cardiac and craniofacial abnormalities. [1,6,13] Folic acid is available in natural food sources like green leafy vegetables, citrus fruits, legumes, eggs, and banana but folate deficiency is still common in women of reproductive age due to ignorance, poverty, illiteracy, food taboos, low intake or cooking losses as folate can be destroyed by heat. [6,14]

The World Health Organization (WHO) recommends the use of 400 micrograms of folic acid daily in the peri-conception period for the prevention of neural tube defects. However, women who have had babies affected with neural tube defects should be given high doses of folic acid up to 5 milligrams daily and increase their dietary intake of folic acid. [6,15,16] In Nigeria, the Federal Government through the National Agency for Food and Drug Administration and Control (NAFDAC) also recommended fortification of staple foods like wheat flour and breakfast cereal with folic acid. [17] In UPTH, women who desire children are encouraged to take peri-conception folic acid.

Despite this recommendation by the WHO and several countries, intake of folic acid by women of reproductive age is still low especially in developing countries in Sub-Saharan Africa, Nigeria inclusive leading to a higher prevalence of neural tube defects and other congenital anomalies. [4,18]

Though folic acid awareness among pregnant women has been reported in the literature, there are no published reports at the University of Port Harcourt Teaching Hospital. Hence, the study sought to assess the knowledge of use of folic acid as a preventive measure for neural tube defects among pregnant women, and to determine factors that influence their knowledge.

2. MATERIALS AND METHODS

The study was conducted at the antenatal clinic of the University of Port Harcourt Teaching Hospital (UPTH). The University of Port Harcourt Teaching Hospital is a 649-bed tertiary hospital located at Alakahia in Obio Akpor Local Government Area of Rivers State, Southern Nigeria. An average of 2000 deliveries are conducted annually. It serves as a referral centre for all level of health facilities in Rivers state and other neighbouring states. The antenatal clinic operates from Monday to Friday every week and each clinic is run by a team consisting of consultants, resident doctors, house officers, nurses, and other health personnel. An average of 120 antenatal patients is seen on each of these days. The annual average of antenatal attendees is about 2000 women.

This was a descriptive cross-sectional study of all pregnant women who attended the antenatal clinic of the University of Port Harcourt Teaching Hospital (UPTH) between January 1, 2020 and March 31, 2020. Inclusion criteria were all pregnant women receiving antenatal care at the University of Port Harcourt Teaching Hospital who gave consent for the study. Those who had multiple visits during the period under review were excluded in their subsequent visits.

The sample size for this study was determined using the Fisher's formulae $N = \frac{Z^2 P (1-P)}{d^2}$, [19] where P is the prevalence of pregnant women who had knowledge of folic acid in a study done in Nigeria, which was 64%. [6] The minimum sample size was thus calculated to be 407. However, a total of 451 consecutive women that attended the antenatal clinic were recruited into

the study after obtaining an informed written consent from those that met the inclusion criteria. The benefits of the study and confidentiality were explained to women.

A pretested structured interviewer-administered questionnaire was used to obtain information from the women. These included socio-demographic characteristics, whether pregnancy was planned or unplanned, assessment of knowledge of natural sources of folic acid, obstetric history, personal or family history of a child with neural tube defects.

Awareness of folic acid was defined as having heard of folic acid, while Knowledge was defined as knowing that folic acid prevents birth defects, knowing the correct timing for folic acid supplementation, the source of information about folic acid and the sources of folic acid. The peri-conception period was defined as one month before conception to three months after conception.

Data obtained was collated, entered in a spread sheet, and analyzed using SPSS version 25. Results are expressed in means and percentages and presented in tables. Confidence interval was set at 95% and a p-value of < 0.05 was statistically significant. Chi square test and Pearson's correlation were used to determine association between knowledge of folic acid and variables.

3. RESULTS

Socio-demographic characteristics

During the period between January 1, 2020 and March 31, 2020, a total of 451 pregnant women were recruited into this study. Written informed consent was obtained from every participant at the beginning of study. The mean age was 31.13 ± 5.18 years. Majority 258 (57.2%) of the women were in the 30-39 years age group, while 24 (5.3%) of them were aged 40 years and above with only 5 respondents (1.1%) in the less than 20 years age group. Almost all 409 (90.7%) of the women were married, while only 2 (0.4%) were divorced or separated. About

two-third 330 (73.2%) of the respondents had post-secondary education, while about one-sixth 73 (16.2%) were unemployed. Table 1 showed the socio-demographic characteristics.

Reproductive characteristics

Majority of the women were nulliparas 122 (27.1%) and primiparas 121 (26.8%), women with four or more deliveries accounted for 32 (7.1%). The current pregnancy was planned in 319 (70.7%) of the women, with almost all 438 (97.1%) the women having spontaneous conception while 13 (2.9%) pregnancies were achieved through IVF. A few 11 (2.4%) of the women had a history of a still birth or baby with a congenital defect, of which 7 (1.6%) had babies with neural tube defects. This is shown in Table 2.

Awareness of folic acid use

Regarding awareness about folic acid use, 375 (83.1%) of the respondents were aware of folic acid use while 76 (16.9%) did not know. This is shown in Figure 1. The main source of information about Folic acid among the women was from health workers 247 (54.8%), which were doctors, nurses, and pharmacists, followed by family/friends 66 (14.6%) and online media 54 (12.0%). Figure 2 showed the sources of information about folic acid among the study population.

Knowledge of Folic acid

Table 3 showed that only 157 (34.8%) of the women had knowledge of neural tube defects (NTDs), while the remaining two-third 294 (65.2%) had never heard of NTDs. About 169 (37.5%) were aware of the role of folic acid in preventing NTDs, however most 273 (60.5%) of the women did not know. Assessment of their knowledge about types of natural sources of foods rich in folic acid was also carried out and surprisingly, 305 (67.6%) of the women could not correctly identify any source of food rich in folic acid. About 84.5% (459/543) of the women had

positive attitude towards folic acid intake during the peri-conceptional period to prevent NTDs in future pregnancies.

Socio-demographic characteristics and knowledge about folic acid

The proportion of participants aged 30-39 years that had knowledge of folic acid was 83.7%, while 80.5% of study participants aged between 20-29 years, and 60% of those aged < 20 years were knowledgeable ($\chi^2=8.901_F$, $p=0.023$). About 83.6% of the married participants and 77.5% of single women had knowledge of folic acid ($\chi^2=1.295_F$, $p=0.568$). With regards to the level of education, women with post-secondary education were the most knowledgeable, with 87.5% of those with no formal education having knowledge of folic acid ($\chi^2=30.960_F$, $p=0.0001$). All (100%) professionals had good knowledge of folic acid ($\chi^2=10.265$, $p=0.036$).

Table 4 showed that age, level of education and occupation were all significantly associated with knowledge about folic acid (<0.05), with younger, more educated women and women with non-manual skilled occupation having more knowledge about folic acid. However, there was no correlation between marital status and knowledge of folic acid.

Reproductive characteristics and knowledge about folic acid

The proportion of women with two previous deliveries that had knowledge of folic acid was 89.5% and the proportion of primiparous women that were knowledgeable was 88.4%, while 78.7% of nulliparous women had good knowledge of folic acid use ($\chi^2=12.683$, $p=0.013$). Most (83.7%) of the women who reported planning their pregnancy had knowledge of folic acid, while 81.8% of the study participants that reported not planning their current pregnancy were knowledgeable ($\chi^2=0.236$, $p=0.627$). Parity was the only variable that was significantly associated with knowledge about folic acid (<0.013). Women with lower parity were significantly more knowledgeable than multiparous women. Surprisingly, planning of pregnancy,

method of conception, having a previous stillbirth or baby with congenital defects, and history of having a child with neural tube defect were not significantly correlated with knowledge of folic acid for NTD prevention. This is shown in Table 5.

UNDER PEER REVIEW

Table 1: Socio-demographic characteristics of the women

Variables	Frequency (n = 451)	Percent (%)
Age (years)		
<20	5	1.1
20 – 29	164	36.4
30 – 39	258	57.2
40 – 49	24	5.3
Mean Age 31.13 ± 5.18		
Marital status		
Single	40	8.9
Married	409	90.7
Divorced/Separated	2	0.4
Level of education		
None	8	1.8
Primary	17	3.8
Secondary	96	21.3
Post-secondary	330	73.2
Occupational status		
Unemployed	73	16.2
Semi-skilled	66	14.6
Non-manual skilled	174	38.6
Intermediate	112	24.8
Professional	26	5.8

Table 2: Reproductive characteristics of the women

Variables	Frequency (n=451)	Percent (%)
Parity		
0	122	27.1
1	121	26.8
2	114	25.3
3	62	13.7
≥ 4	32	7.1
Planned pregnancy		
Yes	319	70.7
No	132	29.3
Method of conception		
Spontaneous	438	97.1
ART (IVF)	13	2.9
History of having still birth or baby with congenital defect		
Yes	11	2.4
No	440	97.6
History of having a child with neural tube defect		
Yes	7	1.6
No	444	98.4

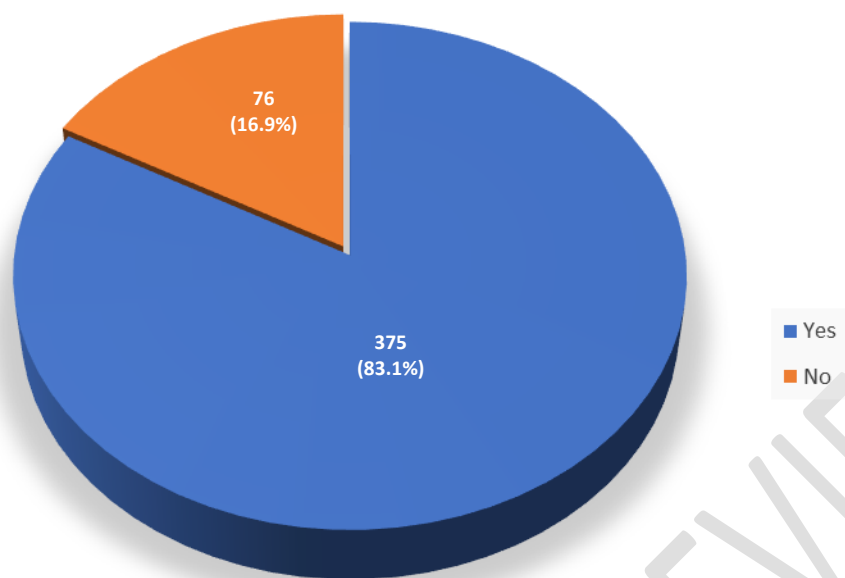


Figure 1: Awareness of folic acid

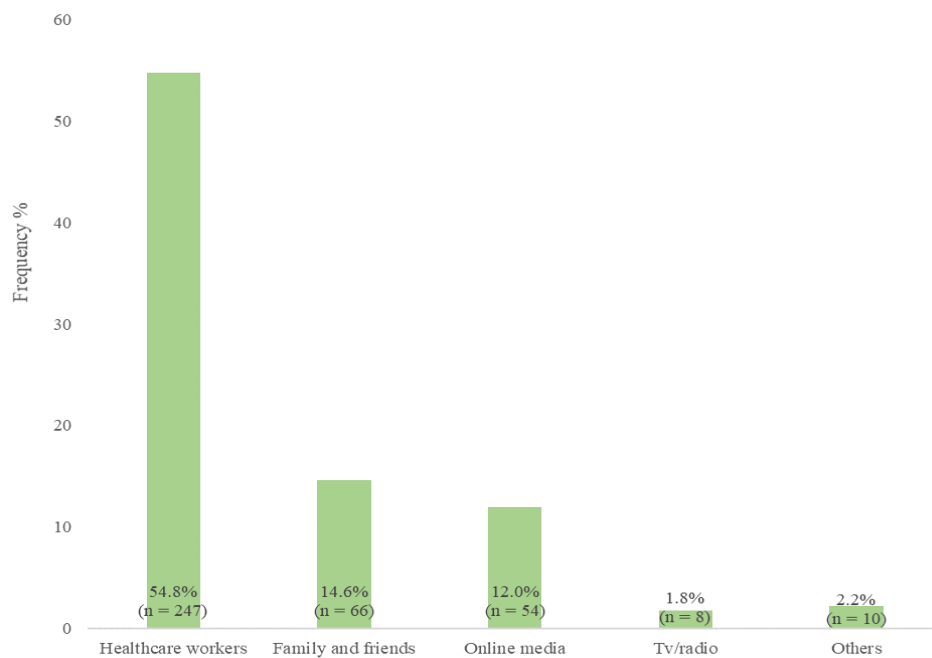


Figure 2: Sources of information about folic acid

Table 3: Knowledge of Folic acid among the women

Variables	Frequency	Percent (%)
Had any pre-conception		
Yes	261	57.9
No	190	42.1
Heard about neural tube defects		
Yes	157	34.8
No	294	65.2
Does folic acid protect against neural tube defects		
Yes	169	37.5
No	9	2.0
Don't know	273	60.5
Food sources of folic acid*		
Vegetable//Fruits/Legumes	111	24.6
Proteins/Poultry	24	5.3
Grains/Nuts/Seed	13	2.9
Beans	17	3.8
Cereal/Oats	15	3.3
Plantain	14	3.1
Rice/Pasta	9	2.0
Bread	6	1.3
Sea foods	5	1.1
Yam	2	0.4
Don't know	305	67.6

*Multiple responses apply

Table 4: Relationship between socio-demographic characteristics and knowledge of folic acid

Variables	Knowledge about folic acid		Total n (%)	Chi square	p-value
	Yes n (%)	No n (%)			
Age (years)					
<20	3 (60.0)	2 (40.0)	5 (100.0)	8.901 _F	0.023*
20 – 29	132 (80.5)	32 (19.5)	164 (100.0)		
30 – 39	216 (83.7)	42 (16.3)	258 (100.0)		
40 – 49	24 (100.0)	0 (0.0)	24 (100.0)		
Marital status					
Single	31 (77.5)	9 (22.5)	40 (100.0)	1.295 _F	0.568
Married	342 (83.6)	67 (16.4)	409 (100.0)		
Divorced/Separated	2 (100.0)	0 (0.0)	2 (100.0)		
Level of education					
None	7 (87.5)	1 (12.5)	8 (100.0)	30.960 _F	0.0001*
Primary	10 (58.8)	7 (41.2)	17 (100.0)		
Secondary	64 (66.7)	32 (33.3)	96 (100.0)		
Post-secondary	294 (89.1)	36 (10.9)	330 (100.0)		
Occupational status					
Unemployed	61 (83.6)	12 (16.4)	73	10.265	0.036*
Semi-skilled	49 (74.2)	17 (25.8)	66		
Non-manual skilled	142 (81.6)	32 (18.4)	174		
Intermediate	97 (86.6)	15 (13.4)	112		
Professional	26 (100.0)	0 (0.0)	26		

*Statistically significant ($p < 0.05$)

F – Fisher's exact test

Table 5: Relationship between Reproductive characteristics and knowledge about folic acid

Variables	Knowledge about folic acid		Total n (%)	Chi square	p-value
	Yes n (%)	No n (%)			
Parity					
0	96 (78.7)	26 (21.3)	122 (100.0)	12.683	0.013*
1	107 (88.4)	14 (11.6)	121 (100.0)		
2	102 (89.5)	12 (10.5)	114 (100.0)		
3	47 (75.8)	15 (24.2)	62 (100.0)		
≥ 4	23 (71.9)	9 (28.1)	32 (100.0)		
Planned pregnancy					
Yes	267 (83.7)	52 (16.3)	319 (100.0)	0.236	0.627
No	108 (81.8)	24 (18.2)	132 (100.0)		
Method of conception					
Spontaneous	362 (82.6)	76 (17.4)	438 (100.0)	2.713	0.100
ART (IVF)	13 (100.0)	0 (0.0)	13 (100.0)		
History of having still birth or baby with congenital defect					
Yes	9 (81.8)	2 (18.2)	11 (100.0)	0.014	0.905
No	366 (83.2)	74 (16.8)	440 (100.0)		
History of having a child with neural tube defect					
Yes	11 (73.3)	4 (26.7)	15 (100.0)	1.067	0.302
No	364 (83.5)	72 (16.5)	436 (100.0)		

*Statistically significant ($p < 0.05$)

4. DISCUSSION

Folic acid is a major co-factor in the process of neurulation in the formation of neural tubes. Deficiency of folic acid in pregnancy is implicated in occurrence of different spectra of neural tube defects in the newborn. [11] Worldwide, neural tube defects occur in 2-3% of live births. [6] It has a prevalence of 0.85-7/1000 live births in Nigeria, [11] and 2.5/1000 live births in South Africa. [20] At the UPTH, the prevalence of NTDs is 0.95/1000 live births. [9] Of the 451 antenatal clinic attendees, 83.1% of them have heard about folic acid. This is similar to reports from Enugu, Sudan, and Riyadh. [4,14,21] It was however higher than the level of awareness reported in Benin and Jos, both in Nigeria. [6,18] This higher level of awareness may be due to the higher educational status and better health seeking behaviour of the women in Port Harcourt, Enugu, and Riyadh as these are all metropolitan cities. Benin and Jos have more rural population, hence the women had lower level of education. Health workers were the main source of information in 54.8% of the participants. Similar reports were obtained from Enugu and Sudan where 52% and 62% of participants reported doctors as sources of information respectively. [4,21] However, despite the high knowledge of folic acid, only 37.5% of the participants knew that folic acid was necessary for the prevention of neural tube defects as well the right time to commence folic acid intake. This is similar to the report from Ghana but higher than those reported in Enugu, Jos, Ethiopia, and Sudan. [4,6,7,21,22] It was however lower than reports from Netherlands, where 63% of the women knew the right timing of folic acid and started folic acid intake in the peri-conception period. [23] This difference is probably due to the higher level of awareness from health education, educational status and good health seeking behaviour of Dutch women.

Younger women were more knowledgeable as they were more educated and had access to information from health practitioners and electronic media. Also, women with lower parity were more knowledgeable probably because they were younger and tend to be more educated. Similar findings were reported in Enugu, Ghana, and the Netherlands. [4,22,23] Reports from Lebanon and Saudi Arabia also showed that younger women with lower parity were more educated and therefore more knowledgeable. [24] Higher level of education will ensure better access to information on folic acid through the various media channels and improve compliance for folic acid intake. However, it was at variance with the findings from Jos where older women with higher parity were reported to be more aware, though less educated. [6] Researchers in Jos postulated that the older women had health talks during antenatal visits in their previous pregnancies and were taught about the importance of folic acid.

5. CONCLUSION

The study showed that there was a high level of folic acid awareness among the pregnant women. Younger, educated women and women with lower parity were more knowledgeable and most of them obtained the information from health workers. More health enlightenment campaigns about folic acid usage in preventing NTDs should be carried out, to bridge the gap between awareness, knowledge, and timing of commencement of folic acid. Furthermore, there should be more advocacies for the fortification of staple foods as this will help build folic acid reserves in women of reproductive age and prevent neural tube defects.

Ethical Approval:

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

Consent

As per international standard or university standard, Participants' written consent has been collected and preserved by the author(s).

REFERENCES

1. Hisam A, Rahman MU, Mashhadi SF. Knowledge, attitude, and practice regarding folic acid deficiency; A hidden hunger. *Pakistan J Med Sci* 2014; 30 (3): 583-585.
2. Davis S, Pavord S. Haematological problems in Pregnancy In: Edmonds KD, Lees C, Bourne T, (editors). *Dewhurst's Textbook of Obstetrics & Gynaecology*. 9th ed. Oxford: Wiley-Blackwell; 2018; 147-160.
3. Albawi SA, Alomayri MH. Assessment of Knowledge, Awareness and Behaviour of folic acid use among females during the childbearing period in Tabuk city. *Egyptian J Hosp Med* 2018; 70 (7): 1242-1247.
4. Onuora AL. Assessment of knowledge and periconceptional folic acid supplementation among childbearing age women (18-45 years) attending antenatal clinics in Enugu. Nigeria (doctoral dissertation). www.oer.unn.edu.ng. Assessed 13 April, 2020.
5. Arif S, Samon V, Samar R. The awareness and use of folic acid during pregnancy at Civil Hospital, Hyderabad. *i- Manager's J Nurs* 2018; 8 (3):22-24.
6. Anzaku AS. Assessing folic acid awareness and its usage for the prevention of neural tube defects among pregnant women in Jos, Nigeria. *J Basic Clin Reprod Sci* 2013; 2: 13-17.

7. Dessie MA, Zeleke EG, Workie SB, Berihun AW. Folic acid usage and associated factors in prevention of neural tube defects among pregnant women in Ethiopia: Cross sectional study. *BMC Pregnancy and Childbirth* 2017; 17(1): 313-314.
8. Peake JN, Copp AJ, Shawe J. Knowledge and periconceptional use of folic acid for the prevention of neural tube defects in ethnic communities in the United Kingdom: Systematic review and meta-analysis. *Birth Defects Research Part A: Clin Molecular Teratol* 2013; 97 (7): 444-451.
9. Ugwu RO, Eneh AU, Oruamabo RS. Neural tube defects in a university teaching hospital in Southern Nigeria. Trends and outcome. *Niger J Med* 2007; 16 (4): 368-371.
10. Ajah LO, Amah CC, Ezeome IV, Ozumba BC, Anozie OB, Asogwa SU. A 10year review of Neural Tube Defects in South-East, Nigeria. *Int J Med Health Dev* 2017; 22 (2): 125-129.
11. Nnadi DC, Singh S. Prevalence of neural tube defects in North-west Nigeria. *Saudi J Health Sci* 2016; 5 (1): 6-10.
12. Selim N, Alkuwari M, Ismail MS. Knowledge, and intake of folic acid among teachers of childbearing age in the state of Qatar: a cross sectional study. *Br Med J Open* 2019; 9 (4):e025005.
13. Maher M, Keriakos R. Women's awareness of periconceptional use of folic acid before and after their antenatal visits. *Clin Med Insights: Women's Health* 2014; 7:9-15.
14. Alodan AA, Ghoraba DA. Maternal knowledge and use of folic acid among Saudi women attending antenatal care clinic at Security forces Hospital, Riyadh, Saudi Arabia. *IOSR J Nurs Health Serv* 2018; 7 (5): 11-19.

15. Tort J, Lelong N, Prunet C, Khoshnood B, Blandel B. Maternal and health care determinants of preconceptional use of folic acid supplementation in France: results from the 2010 National perinatal survey. *BJOG: Int J Obst Gynaecol* 2013; 120 (13):1661-1667.
16. Nilsen RM, Leonani E, Gastaldi P, Allegri V, Agostino R, Faravelli F et al. Prevalence and determinants of preconception folic acid use: an Italian multicentre survey. *Italian J Paediatr* 2016; 42 (1): 65-67.
17. National Agency for Food and Drug administration and control. Food fortification regulation 2019 [internet] Abuja, Nigeria 2019. Available from: https://www.nafdac.gov.ng/wp.contents/uploads/Files/Resources/Regulations/FOOD_REGULATIONS/Food-Fortifications-Regulations-2019.pdf. Assessed 3rd May 2020
18. Morgan E, Akpede N, Osagiede EF, Ayekwenh V, Erah F, Momoh VA et al. The use of folic acid in the prevention of spina bifida: knowledge, attitude and practice of women of childbearing age in low income rural communities. *Romanian Neurosurg* 2019; 33(2):200-214.
19. Patra P. Sample size in clinical research, the number we need. *Int J Med Sci Public Health* 2012; 1(1): 5-10.
20. Fieggen KJ, Fieggen AG. Neural tube defects and folic acid: an obligation for prevention. *Obstet Gynaecol Forum* 2018; 28 (4): 14-18.
21. De Walle HE. Ten years after the Dutch public health campaign on Folic acid: the continuing challenge. *European J Clin Pharm* 2008; 64 (5): 539-543.

22. Alsammani MA, Kunna A, Adam EM. Factors associated with folic acid knowledge and intake among pregnant women in Sudan. *East Mediterr Health J* 2017; 23(10): 662-669.
23. Mohammed BS, Kawawa AR, Wemakor A. Prevalence and determinants of uptake of folic acid in peri – conceptional period in a rural lower-middle-income country, Ghana. *Basic Clin Pharmacol* 2020; 126(3): 254-262.
24. Nasr Hage C, Jalloul M, Sabbah M, Adib SM. Awareness and intake of folic acid for the prevention of neural tube defects among Lebanese women of childbearing age. *Mat Child Health* 2012; 16:258-265.