

# Awareness of Periconceptional use of Folic Acid to Prevent Neural Tube Defects in Young Females of Dakshina Kannada Region, India: A Cross-sectional Study

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## ABSTRACT

**Introduction:** Neural Tube Defects (NTDs) are one of the common congenital anomalies leading to miscarriages and serious disabilities in newborns. NTDs are the second most common type of birth defects. Even though the aetiology of NTDs is multifactorial, Folic Acid (FA) deficiency is the most common cause. There are limited Indian studies on awareness of FA usage in the general public.

**Aim:** To assess the awareness and usage of FA to prevent NTDs in young ladies of Mangaluru, Dakshina Kannada (DK) district, Karnataka, India.

**Materials and Methods:** It was a community-based cross-sectional study conducted at Father Muller Medical College in Dakshina Kannada district, Mangaluru, Dakshina Kannada (DK) district, Karnataka, India from August 2023 to October 2023. A total of 300 young Indian females aged 18-35 years, residing

in the study district, were randomly chosen as participants. Data were collected by an interviewer using a semistructured questionnaire with two components. Part 1 focused on socio-demographic details, while Part 2 gathered information on the awareness of FA supplements, dietary sources of FA, the best time, and dosage of FA supplements to prevent NTDs. Descriptive analysis of the data was done.

**Results:** The study included 90 married and 210 unmarried females. The average age of the participants was 23.7±5.7 years. The study results observed that only 103 (34%) of the participants had heard about FA supplements. A total of 240 (80%) of them said they were not aware of the preferred time for FA. Only 9 (3%) females could mention the correct dose of FA.

**Conclusion:** The study results indicate a gross lack of awareness about FA supplements to prevent NTDs in the general population of the region.

**Keywords:** Anencephaly, Birth defect, Congenital defect, Spina bifida, Supplement

## INTRODUCTION

During intrauterine development, the human brain and spinal cord develop from the Neural Tube (NT). The NT normally closes during the 21-28 days postconception. If there is a failure in the closure of the NT during this period, it leads to congenital anomalies like spina bifida, anencephaly, and all such malformations together will be called NTDs [1,2]. NTDs are the second most common birth defects observed, next only to congenital heart defects [1]. Even though the aetiology of NTDs is multifactorial, FA deficiency has been accepted as the most common cause [2,3]. Vitamin B9 is known as FA, an essential micronutrient during rapid growth and cell division, which cannot be biosynthesised by the human body. Hence, the requirement for FA increases manifold during pregnancy [3]. Methionine is essential for the normal development of the NT into the brain and spinal cord. If there is an FA deficiency, homocysteine does not get converted to methionine [4]. FA is found in many foods like green leafy vegetables, eggs, fruits like kiwi, banana, apples, oranges, various beans like rajma, chickpeas, etc. [5]. Since there is a limitation due to cooking loss of FA, dietary supply of FA may not be sufficient or reliable during pregnancy [4].

Many studies in the past have documented a relationship between NTDs and poor FA intake by mothers [1,2]. The Center for Disease Control (CDC) has recommended the usage of 400 µg of FA daily starting three months prior to conception to the first three months of pregnancy (periconceptional period) by all women planning for pregnancy [6]. They have also recommended a higher dose of FA (4 mg daily) for the ladies who had a family history of, or a previous pregnancy affected by NTDs [1,2]. Every year, 3-4 lakh newborn babies are born with NTDs globally. In India, the prevalence has

been reported to be 4.1 per 1000 live births [3]. Babies affected with anencephaly (partial or complete agenesis of the brain) will not survive, but babies affected with conditions like spina bifida will survive with disabilities. This leads to a physical, financial, and emotional burden on the family as well as to society at large. NTDs also account for a burden on the healthcare setup of the nation which is preventable [1,3,7]. Previous researchers found that just by taking 0.4 mg of FA daily during the periconceptional period as suggested by World Health Organisation (WHO) can reduce the risk of NTDs by up to 80% [4]. Since the NT closes by four weeks of gestation, even before a lady is aware of her pregnancy, it is crucial to start taking FA before conception voluntarily to get the maximum benefit for the prevention of NTDs [4].

Although there are widely available literatures [4,8-12] on the usage of FA in the prevention of NTDs, there are very limited Indian studies in this area. A few of the Indian studies have included only pregnant women/women attending antenatal clinics to know their awareness [9,10]. Since these facts will not provide a true awareness scenario of the general population, the present study was planned to assess the awareness and usage of FA to prevent NTDs in young ladies of Mangaluru, Dakshina Kannada (DK) district, Karnataka, India.

## MATERIALS AND METHODS

The present study was a cross-sectional descriptive study done at the Father Muller Medical College in the Dakshina Kannada region of Karnataka, India over a period of three months from August 2023 to October 2023. Institutional Ethical Committee clearance (Ref No: FMIEC/CCM/398/2023 dated 4.7.2023) was obtained prior to the study.

**Inclusion criteria:** Young Indian females of the age group 18-35 years who were residents of the DK district (either permanent residents or those who had been residing in the district for a minimum of 2 years) were included in the study. Study subjects were randomly selected from the community (approached few offices, colleges, shops, etc.) and from the antenatal clinics of the study hospital.

**Exclusion criteria:** Females above 35 years of age, females who did not wish to be a part of the study voluntarily, trained female staff in antenatal healthcare set ups, females who were non residents of the study district were excluded from the study.

**Sample size:** The sample size was calculated based on the formula,

$$n = Z_{\alpha}^2 p(1-p)/e^2$$

where  $Z_{\alpha} = 1.96$  at a 95% confidence interval,  $p = 73.5\%$  [2], allowable error (e) at 5%. The calculated sample size was 299, rounding off to 300 participants. Since it was a one-on-one interview study, a 10% dropout sample was not included. The interviewer went on collecting data until the number of participants reached 300.

**Data collection:** After obtaining written informed consent from the participants, data was collected by an interviewer administering a semistructured questionnaire. Care was taken to include each participant only once during the interviews conducted at the antenatal clinic. A validated and modified questionnaire was adapted from various literature sources [2,4,5]. The questionnaire had 2 components: Part 1 (10 questions) and Part 2 (11 questions). Part 1 of the questionnaire collected socio-demographic details such as age, code number, address, hospital OPD number, educational status, marital status, pregnancy details, and financial status of the family. Part 2 of the questionnaire collected information on awareness about FA usage to prevent NTDs, how and when to use FA, dietary sources of FA, sources of information if they were aware of FA usage, and family history of NTDs.

Eight questions from the questionnaire were asked to assess participants' awareness of FA, knowledge of when to take FA, correct time to take FA, dietary sources of FA, benefits of taking FA during pregnancy, correct FA dosage, how to take FA, and dosage in cases with a family history of NTDs. A total score was assigned as eight. Scoring was done based on previous study, one score each for positive responses and zero for negative responses [2]. Participants were categorised into 'very poor' (0-2 score), 'poor' (3-4 score), 'intermediate' (5-6 score), and 'high' score (7-8 score) knowledge groups based on their knowledge score [2].

## STATISTICAL ANALYSIS

Data entry was done using Microsoft Excel 365. Descriptive analysis of the data was done. Categorical variables were represented as frequencies and percentages.

## RESULTS

The study was conducted by interviewing 90 married and 210 unmarried ladies, totaling 300 participants. The average age of the participants was  $23.7 \pm 5.7$  years. Out of the 90 married ladies, 60 women already had children, and 19 of them were currently pregnant (12 of them were primigravida). Out of the 300 participants, a total of 144 (48%) were either graduates, postgraduates, professionals, or were pursuing postgraduate courses, 131 (43.7%) were pursuing their graduation courses, and only 25 (8.3%) were at the Pre-University Course (PUC) level or below [Table/Fig-1].

A total of 103 (34.3%) study participants had heard about FA supplements, and only 60 (20%) participants said they knew when to take FA. Out of those 60, only 14 (23%) participants knew the correct time to take FA, i.e., the periconceptional period (three months prior to conception and the first three months of

Parameters	n (%)
<b>Age category (years)</b>	
18-21	151 (50.3)
22-25	52 (17.3)
26-30	41 (13.7)
31-35	56 (18.7)
<b>Educational status</b>	
10 <sup>th</sup> standard and below	14 (4.6)
Pre University Course (PUC)	11 (3.7)
Graduation students	131 (43.7)
Graduates	63 (21)
Postgraduation students	36 (12)
Postgraduates and professionals	45 (15)
<b>Socioeconomic status</b>	
Below Poverty Line (BPL) card holders	18 (6)
Above Poverty Line (APL) card holders	282 (94)
<b>Working Status</b>	
Homemakers	26 (8.7)
Working women	105 (35)
Students	169 (56.3)

**[Table/Fig-1]:** Age distribution, working and educational status of the study participants.

pregnancy). The remaining participants thought FA should be taken after confirmation of pregnancy or during the first three months of pregnancy. The majority of the participants 281 (93.7%) did not know the benefit of taking periconceptional FA. Only 19 women (6.3%) correctly answered that the benefit is to prevent NTDs/birth defects. The other women thought periconceptional FA is to increase haemoglobin, promote wellbeing of the mother and child, helps in bone development, or boost fertility. Only 66 (22%) women knew that FA should be taken daily, and only nine participants (3%) could identify the correct dose as 400  $\mu$ g to prevent NTDs. The majority of the subjects admitted they were unaware of the dose of FA in case of a family history of NTDs [Table/Fig-2]. The ladies who knew the correct answers were either graduates or postgraduates. Those who were aware of the FA supplement mentioned their sources of information as doctors, especially obstetricians (majority), social media, and close relatives.

The study interviewed 19 pregnant women. Only two (10.5%) pregnant women knew that FA supplements should be taken in the periconceptional period, but only one (5%) of the two knew that FA is taken in periconceptional period to prevent NTDs. Out of the 19 pregnant ladies, 14 (73.6%) of them said they had no idea about the dietary sources of FA. The rest of the ladies could name a few sources correctly.

Questions	Answers given	n (%)
Have you heard about FA supplementation?	Yes	103 (34.3)
	No	197 (65.7)
Do you know when to take FA supplement?	Yes	60 (20)
	No	240 (80)
Have you taken FA supplement during previous or current pregnancy? *(Total participants=72)	Yes	60 (83.3)
	No/ Don't remember	12 (16.7)
Name 2-3 rich dietary sources of FA	No idea	219 (73)
	Correct answer	81 (27)
What are the benefits of FA supplements?	No idea	235 (78.3)
	Correct answer	19 (6.3)
	Wrong answer	46 (15.3)

Identify the recommended dose of FA supplement	400 µg (correct Option)	09 (3)
	Don't know	270 (90)
	50 mg/400 mg	21 (7)
How do you take FA supplement?	Daily once (correct option)	66 (22)
	Don't know	229 (76.3)
	Weekly once/ monthly once	5 (1.7)
If there is history of NTD in the family, is it the same dose of FA?	Yes	9 (3)
	No idea	285 (95)
	No	6 (2)
Is there a family history of NTD?	Yes	2 (0.7)
	No	298 (99.3)

**[Table/Fig-2]:** Awareness level of Folic Acid (FA) supplement among the study participants.

\*This question was NOT open for all participants as there were unmarried females and married females who did not have any children at the time of study

When the knowledge scores of the participants about FA were analysed, it was observed that only three (1%) women scored high (7-8), and 238 women (79.3%) scored very poorly (0-2) [Table/Fig-3]. This data suggests that, regardless of educational, working, or marital status, awareness about FA supplementation is very poor in the general population.

Score	n (%)
0-2 (very poor)	238 (79.3)
3-4 (poor)	41 (13.7)
5-6 (intermediate)	18 (6.0)
7-8 (high)	3 (1.0)

**[Table/Fig-3]:** Folic Acid (FA) awareness score of the participants.

## DISCUSSION

Even though the WHO recommended in the 1990s the periconceptional use of FA to reduce the global burden of NTDs, many studies have reported very low knowledge as well as practice of periconceptional folic acid supplementation globally [1-11]. This was the basis for conducting the present study, and surprisingly, even after three decades, the study findings were no different. A study conducted in Raipur district interviewed 429 pregnant women and observed that 61% of the subjects had heard about FA supplementation [11]. Another similar study in Dehradun, which interviewed 400 pregnant women, reported that 73.5% of their participants were aware of FA supplementation [2]. Compared to these studies, in the present study, only 34.3% of the participants had heard about FA supplementation. The other two studies [2,11] included only pregnant women, while the present study was conducted on young women of reproductive age, regardless of their pregnancy or marital status. Thus, the findings of the present study highlight the lack of awareness about FA in the general population.

Various earlier studies have reported a very low level of knowledge about the correct time to start FA supplementation among their participants [1-5,7,8]. A study conducted in Saudi Arabia, which included pregnant women as participants, reported that only 14% of the ladies had started FA prior to conception [1]. An Ethiopian study also reported a very poor knowledge among their participants regarding the correct time to start FA supplementation, with only 3.8% of participants being aware of starting FA in the periconceptional period [10]. Another study from rural Germany reported that the majority (86%) of participants had started their FA supplementation only after the 5<sup>th</sup> week of conception [12].

A Turkish study, which interviewed 1106 non pregnant and 336 pregnant women, reported that more number of pregnant ladies (53.9%) knew the importance of FA in preventing congenital

anomalies compared to non pregnant women (41.4%). The study also found that a higher number of pregnant women (70.2%) was on FA supplementation compared to non pregnant women (15.1%) [13]. Another Indian study conducted in 2022 also reported similar findings, where out of 100 pregnant ladies, only 17 women knew about FA and 13 had started FA prior to conception [9]. These findings were similar to the results of the present study, which found that only 14 (4.6%) participants correctly mentioned the time for FA supplementation. Since the neural tube closes during 21-28 days after conception, as suggested by the WHO, it is essential to start FA supplementation at least three months prior to conception and continue in the first three months of pregnancy to prevent NTDs [1]. But the present study's findings suggest that the general population is ignorant about the most critical time for FA supplementation.

It was observed that there was a very low knowledge of NTDs and the campaign to use FA to prevent NTDs among the study participants. The study found that only 19 participants (6.3%) knew that FA is taken periconceptionally to prevent NTDs. Additionally, the study reported a very poor knowledge about the dietary sources of FA among the participants, with 219 out of 300 participants (73%) said they had no idea about the dietary sources. There was also poor knowledge regarding the correct dose of FA as well as how to take FA [Table/Fig-2]. These findings were in accordance with many other studies [14-17].

A cross-sectional study on pregnant and lactating mothers in Ghana reported that 68% of the subjects had a good level of awareness about FA, and 46% of the women obtained a good score ( $\geq 4$  out of 6) on knowledge of FA [18]. Whereas, Indian studies have reported that the majority of women scoring poorly on knowledge of FA. Saxena V et al., in their study, found that 80% of pregnant women had a very low score, 20% had an intermediate score, and none of the participants had a high score on knowledge about FA [2]. Another study by Pal A et al., also reported very similar findings [11]. The present study's findings were also similar, where it was observed that 238 (79.3%) women had a very poor score, and only three (1%) participants scored very high on the knowledge score for FA. These findings suggest that there is a need for a more robust strategy to be adopted by health officials to make the FA supplementation campaign more popular.

Since it was a one-on-one interview-based study, at the end of the interview, the interviewers took time to educate the young ladies with the correct answers to the questions asked in the questionnaire. All the participants believed such interventions were essential to spread awareness and were willing to follow the instructions.

## Limitation(s)

The present study had very few participants who were from rural areas.

## CONCLUSION(S)

Since FA awareness was very low among the participants irrespective of their educational status, the study recommends an alternate and more robust approach from the health authorities of the region/nation to popularise the concept. Instead of solely depending on doctors to educate patients, it is better to utilise various social media platforms, ASHA workers, and local leaders to popularise the concept of periconceptional FA supplementation to prevent NTDs. More studies can be conducted on the general population (rather than solely on antenatal women) in various parts of the nation to get a clearer understanding of the population's knowledge.

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