

## THE GENERAL PUBLIC'S KNOWLEDGE AND PERCEPTIONS OF PRECONCEPTION FOLIC ACID INTAKE FOR PREVENTION OF BIRTH DEFECTS

Tan B.G.<sup>1,2\*</sup>, Hans V.R.<sup>3</sup>, Nor Azwany Y.<sup>4</sup>, Soon L.K.<sup>1</sup>

<sup>1</sup>School of Health Sciences, Universiti Sains Malaysia, Health Campus, 16150 Kelantan, Malaysia

<sup>2</sup>Nursing Unit, Hospital USM, Universiti Sains Malaysia, Health Campus, 16150 Kelantan, Malaysia

<sup>3</sup>Department of Pediatrics, School of Medical Sciences, Universiti Sains Malaysia, Health Campus, 16150 Kelantan, Malaysia

<sup>4</sup>Department of Community Medicines, School of Medical Science, Universiti Sains Malaysia, Health Campus, 16150 Kelantan, Malaysia

\* Corresponding author: Tan Beng Geok, Nursing Unit, Health Campus, Universiti Sains Malaysia, Health Campus, 16150, Kubang Kerian, Kelantan, Malaysia.  
Email address: tanbg@usm.my/soonlk@usm.my

### ABSTRACT

**Background:** Maternal folic acid (FA) deficiency associated with birth defects is recognized as a serious, worldwide public health concern. However, there are scarce data on the knowledge and perceptions of preconception folic acid intake for prevention of birth defects among the general public in northeast Peninsular Malaysia.

**Materials and Methods:** A cross-sectional study was performed on a random sample (n=300) of the public in northeast Peninsular Malaysia using a pre-tested questionnaire.

**Results:** Of the total participants, 75% was female. The mean age of participants was 33.41 years  $\pm$  10.22. Mean FA knowledge score was 14.52  $\pm$  5.34. Knowledge of preconception FA was found to be associated with gender, marital status, and education level ( $p = <0.05$ ).

**Conclusion:** The study highlights a need for the public to play a vital community health role in advising women of childbearing age about the importance of preconception folic acid intake in preventing birth defects.

**Keywords:** Folic acid deficiency, public, knowledge, perceptions, birth defects, pregnancy

## 1.0 Introduction

Neural tube defects (NTDs), including spina bifida, anencephaly, and encephalocele, as well as congenital heart disease, cleft lips, and cleft palate, are among the most common birth defects, and cause morbidity and mortality among fetuses and babies (Czeizel, 2009, Lonescu-Ittu et al., 2009). A global report on birth defects indicated that more than 90% of all infants with serious birth defects were born in low- and middle-income countries. According to WHO (2016), birth defects affect an estimated 1 in 33 infants and account for 276,000 newborn deaths yearly. The March of Dimes' Global Report on Birth Defects shows that in the South East Asian region, the prevalence of birth defects is estimated at between 55 and 65 per 1000 live births (WHO, 2015).

The Malaysia National Neonatal Registry (MNNR) report from 2010 to 2012 indicated that more than 1000 babies were born with birth defects every year. According to the MNNR, a total of 4830 cases of birth defects were reported in 38 hospitals between 2010 and 2012 (National Malaysia Neonatal Registry, 2013). The prevalence of NTDs was 0.42 per 1000 live births. It was highest among the indigenous people of Sarawak (1.09 per 1000 live births) and lowest among Malaysians of Chinese descent (0.09 per 1000 live births). The most common type of NTD was anencephaly (0.19 per 1000 live births), followed by spina bifida (0.11 per 1000 live births) and encephalocele (0.07 per 1000 live births). Majority of the infants with anencephaly (94.5%), 45.8% with encephalocele and 9.5% with spina bifida died (Boo, Cheah & Thong, 2013).

A woman's preconception consumption of folic acid (FA) is known to prevent a variety of birth defects (Grosse et al., 2016), while FA intake in early pregnancy is known to significantly reduce birth defects (Auriel et al., 2011). Preconception FA intake is associated with morbidity and mortality, including the burden for children with birth defects and their families (Yi et al., 2011). Supplementation with FA has been shown to reduce the risks of NTDs, congenital heart defects, cleft lips and cleft palate, limb defects, and urinary tract anomalies (Bjelakovic et al., 2007).

Folic acid (FA) is the synthetic form of folate, a B-group vitamin naturally present in many foods, particularly leafy green vegetables. FA is presumed essential for cell growth and development (Salim, 2014), thus maternal folate deficiency or insufficiency puts a childbearing woman at higher risk for having a baby affected by NTD. The neural tube closes by the 28<sup>th</sup> day of gestation, hence there is a limited window of opportunity for FA deficiency prevention. In Malaysia, the national recommendation includes that all women of childbearing age consume 400 µg to 800 µg of FA daily in supplement form in addition to FA provided by enriched foods.

However, rice is a staple food for Malaysian. A large portion of the Malaysian population does not consume fortified flour products because the standard practice is to eat rice three times per day, with limited intake of flour-based products (Aznim Ruhana, 2017). Folate deficiencies are a particular concern during pregnancy and can lead to a number of health complications for both the mother and growing baby. For pregnant women, the lack of essential vitamins and minerals can be catastrophic, increasing the risk of low birth weight, birth defects, stillbirth, and even death (UNICEF, 2015)

Although progress has been made in addressing infant mortality and successes have been achieved, many countries in South East Asia have not accomplished Millennium

Development Goal (MDG) 4 (WHO, 2015), which includes the task of addressing birth defects to reduce infant mortality. Furthermore, despite the abundance of information and campaigns concerning FA, many women of childbearing age remain unaware of its importance or do not value the information. As the WHO reported, the problem may be inadequate knowledge and awareness about the benefits of FA during the perinatal period (WHO, 2015).

There is a lack of data about public knowledge and perceptions of FA intake towards birth defect prevention in developed and developing countries. Therefore, gaining knowledge about how the public makes decisions regarding preconception FA intake is of the utmost importance. The aim of this study was to assess the level of knowledge and perceptions of preconception FA intake in regard to birth defect prevention among the public in a tertiary teaching hospital in northeast peninsular Malaysia. This study has the potential to open another window for the promotion of FA preventive medicine in Malaysia, with its results serving as a basis to facilitate awareness programs and public education regarding the benefits of preconception FA intake among childbearing women.

## 2.0 Materials and Methods

This study was approved by the institutional review board of the Universiti Sains Malaysia. A cross-sectional research design was employed for the purpose of assessing the general public's knowledge and perceptions of preconception FA use in preventing birth defects in northeast peninsular Malaysia. A sample size of 323 with a confidence level of 95%, anticipated population proportion (p) of 0.3, and absolute precision (d) of 0.05 was calculated using the WHO sample size calculator. Purposive sampling was undertaken to recruit eligible study participants. Participant study criteria included being members of the public (men and women) aged 18 years and above who visited the Hospital Universiti Sains Malaysia during the data collection period between June and July 2015, and agreed freely to participate. Exclusion criteria included any eligible member of the public who had a child with a birth defect. The hospital is approximately 10 km from the city and is the only university teaching hospital on the northeast coast of Peninsular Malaysia.

Data collection consisted of distributing self-administered questionnaires to 323 members of the public who visited the hospital, 300 of whom agreed to participate, signed the informed consent form, and completed the questionnaire. The researchers formulated the self-administered instrument based on the WHO guidelines and published studies that assessed FA knowledge, attitudes, and practice levels among childbearing women and the public. The data collection instrument consisted of three components: (1) Socio-demographic data (age, gender, marital status, educational level, and the source of FA-related information); (2) knowledge of preconception FA; and (3) perceptions of preconception FA intake.

The questionnaires were submitted to a panel of three experts in obstetrics, neonatology, and nursing for evaluation of content validity, testing for format and item construction. All items were revised based on the review panel's initial comments. They were then resubmitted for further evaluation. All revised items were approved, assuring good content validity. A pilot study was carried out with 30 participants to refine the questionnaire. Its reliability was assessed using Cronbach's alpha (0.876).

Seven questions were used to measure participants' knowledge. A correct answer earned 3 points; a wrong answer added 2 points; and an answer "do not know" earned 1 point. The range of the knowledge scores was 7 to 21. Fifteen questions were used to measure perception, with responses on a 3-point Likert scale from "Agree" to "Not Sure" to "Disagree." The range of attainable scores for perception statements was 15 to 45 points. Hence, the higher the score, the higher the public perceptions of preconception FA intake. Categorization for the studied public knowledge about preconception FA intake was as follows; inadequate if <60% of all questions were answered correctly and adequate if 60 out of all the questions were answered correctly (Hanan et al., 2016). The scoring system for perception consisted of negative if <60% of all statements were answered correctly and positive if 60 out of all the statements were answered correctly.

In order to prevent coercion and protect the study's human integrity, participation was voluntary and participants were informed of their right to refuse or withdraw from the study at any time. Participation was also anonymous and the questionnaire number was coded. Informed written consent was obtained before the testing session in accordance with the Declaration of Helsinki. A completed and returned questionnaire implied consent.

Statistical analyses were conducted using the Statistical Package for Social Sciences (SPSS) software (v.22.0) (SPSS Inc, Chicago, IL). Descriptive statistics were used to describe frequencies and measures of central tendencies. Multivariate logistic regression was used to identify the association between socio-demographic variables and public knowledge levels of preconception FA intake. Age, gender, marital status, and educational level were used as the main independent variables. The results were presented as the odds ratio (OR) and 95% confidence interval (CI). A series of analyses of covariance (ANCOVA) was used to determine the association between socio-demographic variables and public perceptions of preconception FA intake. The numbers of correct answers for each question were quantified in frequency and percentages. The significance level was set at equal to, or less than, 0.05.

### 3.0 Results

#### 3.1 Participants' socio-demographic characteristics

Table 1 summarizes the socio-demographic characteristics of the 300 study participants. Participants' mean age was 33.41 (10.22) years. The majority were female (75%), of Malay ethnicity (97.3%), married (75.3%), and had completed secondary education (61.7%).

**Table 1:** Participants' demographic characteristics (n=300)

Demographics	n	Percentage	Mean (SD)
<b>Age (Years)</b>			33.41 (10.22)
25 and below	73	24.3	
26-35	125	41.7	
36-45	58	19.3	
46-55	34	11.3	
56 and above	10	3.3	
<b>Gender</b>			
Male	75	25	
Female	225	75	

<b>Ethnicity</b>		
Malay	292	97.3
Chinese	5	1.7
Others	3	1.0
<b>Marital Status</b>		
Single	65	21.7
Marriage	226	75.3
Divorce	9	3.0
<b>Education Level</b>		
Primary	16	5.3
Secondary	185	61.7
Degree/Master	99	33

### 3.2 Sources of FA-related information

Table 2 shows the options offered in the questionnaire as possible sources of FA-related information acquired by the public for gaining knowledge. The majority (58.7%) learned about FA from health clinics. The remainder got their information from the internet (18%) and friends (14.3%). Smaller proportions obtained the information from public broadcasting (8.7%), printed material (10%), and others (6%) respectively, while 17.7% had heard of preconception FA campaigns, 67.3% had not and 15% were not sure whether they had heard of such campaigns.

**Table 2:** Sources of FA-related information (n=300)

Sources	n	Percentage
Health Clinics	176	58.7
Public broadcasting	26	8.7
Internet	54	18
Friends	43	14.3
Printed material	30	10.0
Others	18	6.0
<b>Heard of campaign about preconception folic acid</b>		
Yes	53	17.7
No	202	67.3
Not sure	45	15

### 3.3 Public knowledge of preconception FA intake and prevention of birth defects

Table 3 illustrates the public's knowledge of the association between preconception FA intake and birth defect prevention. The public achieved a mean  $\pm$  SD score of 14.52 (5.34), ranging from 7 to 21 on the knowledge questionnaire. On question 1, approximately 54% of participants did not know folic acid was a B vitamin. A large proportion (60.7%) was aware that childbearing women should take FA if they could become pregnant, even if they were not planning a pregnancy. In question 6, 48.7% of participants answered incorrectly and 44.3% did not know that childbearing women who had had one pregnancy affected by birth defects should take FA before pregnancy. Overall, 40% of the 300 study participants were classified as having inadequate knowledge (Table 4).

**Table 3:** Public knowledge of preconception FA intake in preventing birth defects (n=300)

Knowledge of Preconception Folic Acid Consumption Question	True n (%)	False n (%)	Do not know n (%)
Folic acid is a B vitamin	104 (34.7)	34 (11.3)	162 (54)
Folic acid is a type of food supplement	155 (51.7)	32 (10.7)	113 (37.7)
Folic acid reduces the risk of birth defects	181 (60.3)	9 (3)	110 (36.7)
Childbearing women should take folic acid 400micrograms (µg) daily before pregnancy and throughout the first 12 weeks.	136 (45.3)	28 (9.3)	136 (45.3)
Childbearing women should take folic acid if they are capable of becoming pregnant, even if they are not planning a pregnancy	182 (60.7)	12 (4)	106 (35.3)
Only childbearing women who have had one pregnancy affected by birth defects should take folic acid before pregnancy	21 (7)	146 (48)	133 (44.3)
Only childbearing women whose family member has had a pregnancy affected by birth defects should take folic acid before pregnancy	16 (5.3)	148 (49.3)	136 (45.3)

**Table 4:** Public knowledge score on preconception FA use in preventing birth defects (n=300)

Knowledge Score	Frequency (%)	Mean (SD)
Adequate (14.6)	180 (60)	14.52 (5.34)
Inadequate (14.5)	120 (40)	

### 3.4 Association between gender and marital status and public knowledge score on preconception FA use in preventing birth defects (n=300)

Table 5 illustrates the multiple logistic tests used to test the association between socio-demographic characteristics and the public preconception FA knowledge score. Married participants were 2.4 times more likely to have good knowledge than single/divorced participants, and females were 4.5 times more likely than males to have good knowledge.

**Table 5:** Multivariate logistics regression analysis for association between socio-demographic and public knowledge score on preconception FA use in preventing birth defects (n=300)

Characteristic	n (%)	OR (95% CI)	p-value*
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<b>Gender</b>		4.5(2.6; 7.9)	0.001
Male	75(25)		
Female	225(75)		
<b>Marital Status</b>		2.4 (1.4; 4.2)	0.003
Single/Divorced	74 (24.7)		
Married	226 (75.3)		

CI – Confidence interval; OR – Odds ratio

\*Multivariate logistic regression test,  $p\text{-value} \leq 0.05$ , was considered to be statistically significant

### 3.5 Association between socio-demographic characteristics and public perceptions of preconception FA use in preventing birth defects (n=300)

Results of the series of analysis of covariance (ANCOVA) used to evaluate the possible association between socio-demographic characteristics and public perceptions of preconception FA use in preventing birth defects are shown in Table 6. These tests indicated no significant variables.

**Table 6:** ANCOVA analysis for association between socio-demographic and public perceptions of preconception FA use in preventing birth defects (n=300)

Characteristic	n (%)	Mean(SD)	df	p-value**
<b>Gender</b>			1	0.604
Male	75(25)	32.75(3.06)		
Female	225(75)	33.49(3.77)		
<b>Age</b>			1	0.194
Below 25	73(24.3)	33.26(3.34)		
26-35	125(41.7)	33.57(3.81)		
36-45	58(19.3)	33.38(3.54)		
46-55	34(11.3)	32.59(3.78)		
56 and above	10(3.3)	32.40(2.88)		
<b>Marital Status</b>			1	0.08
Single/ Divorced	65(21.7)	32.54(3.34)		
Married	235(78.3)	33.59(3.18)		
<b>Educational Level</b>			2	0.749
Primary	16(5.3)	32.62(3.48)		
Secondary	185(61.7)	33.24(3.65)		
Degree/Master	99(33)	33.46(3.46)		

\*\*ANCOVA test,  $p\text{-value} \leq 0.05$ , was considered to be statistically significant

## 4.0 Discussion

This study assessed the public's knowledge and perceptions concerning preconception FA use in preventing birth defects. It was undertaken in a tertiary teaching hospital in northeast

Peninsular Malaysia. The majority of the participants were female (75%) within the age range of 26–35 years, which is the usual childbearing and marriage age for Malaysian women. More than half of the participants (61.7%) had attained secondary education level, thus they had a good understanding of the questionnaire. Based on the study's results, age, ethnicity, and level of education had no significant association with participants' specific FA knowledge and their overall knowledge about birth defect prevention. However, gender and marital status had a significant association with knowledge about preconception FA and birth defect prevention.

Following preconception FA campaigns set up previously by the Ministry of Health in Malaysia to raise awareness about the prevention of birth defects, the mean score for knowledge about FA was 14.52/21 (SD5.34). The findings showed that more than half (60%) of the public had adequate knowledge toward preconception FA intake in preventing birth defects but their perception score was low. Nearly half (48.7%) of the participants answered incorrectly and did not know that childbearing women who had had one pregnancy affected by a birth defect (44.3%) should take FA before pregnancy. These differences in knowledge and perception may be attributed to the fact that three-quarters (75%) of participants were female and 94.7% had secondary education. Females may have been more exposed to health education messages about this subject during pregnancy when attending follow-up visits at the Antenatal Clinic. It can be suggested that educational level may have a positive influence on public knowledge and perception in relation to preconception FA intake in childbearing women. Another possible explanation may be the lack of innovative education campaigns together with a mandatory reinforcement policy in Malaysia.

The results corroborate the findings of Hisham, Rahman, and Mashhadi (2014), which highlighted a continuous need to educate the public and motivate women of childbearing age to recognize and act on the need to take preconception FA before conception and during the 1<sup>st</sup> trimester of pregnancy to avoid congenital defects in their newborns. The results, in demonstrating a relatively low rate of correct perception among the public (40%), raise concerns related to public comprehension of the role of preconception FA in preventing birth defects. Significant consequences for childbearing women can come from a failure to know about and consume preconception FA. Other researchers have identified an urgent need for a national approach to increase public awareness about the benefits of preconception FA among childbearing women, and recommend educating the public in this regard (Li et al., 2011).

Contrary to the findings of Temel et al. (2015) that knowledge remains average despite campaigns about FA supplementation, the results of this study show that more than half the participants (67.3%) had never heard of preconception FA intake during pregnancy. In addition, 15% of participants were not sure whether they had heard of such a campaign. This may be due to their ignorance about the national campaign related to the benefits of preconception FA supplementation and birth defect prevention, resulting from incomplete outreach of the Ministry of Health's education information programs. The results imply the need for the Ministry of Health to revisit the way health education is implemented and to find more innovative information delivery methods.

Social influence is another possible explanation for participants' lack of awareness of the importance of preconception FA intake during pregnancy, for example, knowledge plays an important role in the development of behaviors, as described by Temel et al. (2015). The study results were in agreement with the outcome of studies by Rofail et al. (2014) and Ksenija Vitale et al. (2009), which revealed that those exposed to education campaigns about FA and its benefits recognized that FA deficiency during pregnancy is associated with birth



defects. The results indicate a need to profile some of the public perceptions about preventing birth defects with a view to incorporating them into knowledge and awareness campaign programs for preconception FA intake by childbearing women.

## 5.0 Conclusion and recommendations

This study has highlighted that public knowledge of preconception FA intake still needs attention. Strategies are required to raise the public's level of knowledge about FA and its benefits to prevent birth defects. This study has laid the foundation for future studies on the pre- and post-study effects of health education knowledge and perceptions, which are recommended to establish the modification of knowledge and perceptions over an extended period.

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## Declaration

Author(s) declare that the information above is correct and the manuscript submitted by us is original. We have no conflict of interest to declare and certify that no funding has been received for the conduct of this study and preparation of this manuscript.

## Author(s) contribution

Author 1: Literature search, conduct the study, analyzing and writing the draft

Author 2: Reviewing and editing

Author 3: Reviewing and editing

Author 4: Idea and concept, reviewing the article and editing

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