

Factors associated with a positive intake of folic acid in the periconceptional period among Korean women

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Abstract

Objective: We aimed to investigate the factors associated with a positive intake of folic acid (FA) during the periconceptional period among Korean women.

Design: In a cross-sectional study of demographic, obstetric and socio-economic data, history of periconceptional intake of FA and awareness of the benefits of FA supplementation in pregnancy were obtained and analysed using the χ^2 test, followed by multiple logistic regression analysis.

Setting: The Maternity School, Cheil General Hospital and Women's Healthcare Center, Seoul, South Korea, between October 2005 and March 2006.

Subjects: In total 1313 pregnant women participating in a two-day training course available every month.

Results: After excluding subjects with incomplete or inconsistent data, there were 1277 women included in the analysis. Participants were aged 29.4 (SD 2.9) years and had a mean gestational age of 27.9 (SD 7.1) weeks. Only 131 (10.3%) women took FA during the periconceptional period. According to multiple logistic regression analyses, the adjusted OR for FA supplementation was 1.79 (95% CI 1.10, 2.91) in women who had previous spontaneous abortions, 4.10 (95% CI 2.43, 6.78) in women who planned their pregnancy and 6.63 (95% CI 2.08, 21.12) in those who were aware of the protective effects of FA.

Conclusions: Periconceptional intake of FA was more likely among Korean women with a history of previous spontaneous abortion, who planned their pregnancy or who were aware of the protective effects of FA during pregnancy. However, the proportion of women who took FA in the periconceptional period was low.

Keywords

Folic acid
Neural tube defects
Periconceptional care

Neurulation is the fundamental embryonic process that leads to the development of the neural tube in two phases⁽¹⁾. The first phase occurs between the third and fourth developmental week (primary neurulation) and leads to the formation of the brain and most of the spinal cord. Secondary neurulation occurs between the fifth and sixth developmental week and creates the lowest portion of the spinal cord including most of the sacral and all of the coccygeal regions. A neurulation defect results in the formation of neural tube defects (NTD). A multi-centre study monitoring all birth defects in Korea reported approximately 3.5 pregnancies per 10 000 births to be affected by NTD⁽²⁾. On the other hand, it has been estimated that 50–70% of NTD could be prevented by a daily intake of at least 400 µg of folic acid (FA) in the periconceptional period⁽³⁾; the highest efficacy of FA is expected to occur at a daily dose level of 5 mg⁽⁴⁾. Unfortunately, approximately

50% of all pregnancies in Korea are unintended⁽⁵⁾, jeopardizing our efforts to promote FA supplementation during the periconceptional period.

Because of the importance of establishing successful public programmes to promote FA supplementation among women of childbearing age, we aimed to investigate which factors are associated with a positive intake of FA in the periconceptional period among Korean women.

Methods

The study was approved by the Institutional Research Board at the Cheil General Hospital and Women's Healthcare Center, Seoul, South Korea, and voluntary consent was obtained from all participants. Within a 6-month period, from October 2005 to March 2006, a questionnaire was given to 1313 pregnant women who

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were participating in a two-day training course at the maternity school of the hospital. The course was available every month and provided information for pregnant women on the prenatal, birth and postpartum periods as well as on breast-feeding benefits. The following information was obtained from the participants: maternal and gestational age, obstetric history (gravidity, parity, number of vaginal deliveries, number of previous abortions), employment status, educational level and household monthly income level. The participants also provided information on whether their current pregnancy was planned, whether they took FA supplementation in the periconceptional period, and whether they were aware of the prevention of NTD by periconceptional supplementation of FA. If participants had a positive history of FA intake, they were also asked to provide the dose according to the following three categories: unknown dose, 400 µg/d or >400 µg/d.

For purposes of the present study, the following variables were classified into two categories: age as <35 years and ≥35 years; number of previous spontaneous abortions as 0 and ≥1; employment status as employed and unemployed; educational level as high school or less and college or higher; and household monthly income level as <\$US 2000 and ≥\$US 2000. The latter was classified by considering that lower economic class in Korea has an average monthly income of <\$US 2000 (\$US 1 was equivalent to approximately 1000 Won at the time of the study). In addition, the time elapsed from 3 months before the estimated date of conception to 4 weeks postconception was considered as the periconceptional period. Based on the approximate time at which the first phase of neurulation is completed⁽¹⁾, we limited the periconceptional period to 4 weeks postconception.

Demographic, obstetric and socio-economic data were compared between participants with positive and negative supplementation of FA in the periconceptional period by the χ^2 test. Those characteristics identified as statistically different between groups ($P < 0.05$) were subsequently included in multivariate logistic regression

analyses in order to obtain the corresponding adjusted odds ratio and 95% confidence interval. The statistical analyses were performed using the Statistical Package for the Social Sciences statistical software package version 10.07 (SPSS Inc., Chicago, IL, USA); all statistical tests were done with α of 0.05 by two-tailed tests.

Results

After excluding subjects with incomplete or inconsistent data, 1277 (97.3%) women were included in the analysis. Included participants were aged 29.4 (SD 2.9) years and had a mean gestational age of 27.9 (SD 7.1) weeks. There were 131 (10.3%) women who took FA during the periconceptional period. Of them, 84.0% had an education level of college or higher, 74.8% were primigravidas, 19.1% had ≥1 previous spontaneous abortion and in 86.3% the pregnancy was planned. The dose of FA was unknown in ninety-eight participants (74.8%), 400 µg/d in 30 participants (22.9%) and >400 µg/d in three participants (2.3%).

The percentage of women with previous spontaneous abortions or who had planned their pregnancy was higher in the group who took FA in the periconceptional period than in the group who did not (Table 1). According to multiple logistic regression analyses, women who had ≥1 previous spontaneous abortions, planned their pregnancy and were aware of the protective effects of FA were more likely to take FA during the periconceptional period. The adjusted OR were 1.79 (95% CI 1.10, 2.91; $P = 0.02$), 4.10 (95% CI 2.43, 6.78; $P < 0.001$) and 6.63 (95% CI 2.08, 21.12; $P = 0.001$), respectively (Table 2).

Discussion

The present study found that only a small percentage (10.3%) of Korean women took FA supplementation during the periconceptional period. This rate is considerably lower than the 20.3% reported previously in Qatar⁽⁶⁾, 25% in Canada⁽⁷⁾, 32% in the USA⁽⁸⁾ and 45.5%

Table 1 Demographic, socio-economic and clinical characteristics: pregnant Korean women ($n = 1277$), October 2005–March 2006

	Periconceptional intake of folic acid				χ^2	P
	Yes ($n = 131$)		No ($n = 1146$)			
	n	%	n	%		
Age ≥35 years	7	5.3	51	4.5	0.22	0.64
Primigravida	98	74.8	897	78.3	0.81	0.37
Previous spontaneous abortions ≥1	25	19.1	126	11.0	7.38	0.007
Planned current pregnancy	113	86.3	686	59.9	35.00	<0.001
Aware of preventive effects of folic acid	128	97.7	983	85.8	14.80	<0.001
Employment status*	103	78.6	881	76.9	0.19	0.66
Education level college or higher	110	84.0	962	83.9	0.00	0.99
Household monthly income ≥\$US 2000†	98	74.8	791	69.0	1.86	0.17

*Employment status at the time of periconceptional period.

†\$US 1 = 1000 Won.

Table 2 Factors associated with periconceptual intake of folic acid: pregnant Korean women, October 2005–March 2006

Variable	Adjusted OR	95% CI	P
Previous spontaneous abortions ≥ 1	1.79	1.10, 2.91	0.02
Planned current pregnancy	4.10	2.43, 6.78	<0.001
Aware of preventive effects of folic acid	6.63	2.08, 21.12	0.001

The results were obtained by multiple logistic regression analyses and included the three variables that resulted as statistically significant in the comparisons between women who took folic acid in the periconceptual period and those who did not.

in the United Arab Emirates⁽⁹⁾. Over the past decade the birth rate in Korea has decreased markedly, to as low as 1.08 per couple⁽¹⁰⁾. However, the rate of planned pregnancies remains low. For example, only 50% of women receiving teratogen-risk counselling services at the Korean Motherisk Program reported a planned pregnancy⁽⁵⁾, and although the percentage was higher in the present study (63.5%), it implies that at least one third of all pregnancies are still unplanned. In the present study, the percentage of planned pregnancies was significantly higher among women who took FA in the periconceptual period than among non-takers of FA. However, the percentage of planned pregnancies was at least five times more than the overall percentage of women who took FA, suggesting that other factors may also affect the periconceptual supplementation of FA.

It is known that highly educated women know more about FA and take it more often in the periconceptual period and first trimester of pregnancy^(6,11). In the present study, the percentage of women who were employed, had an education level of college or higher or had a household monthly income level \geq \$US 2000 did not differ between FA takers and non-takers. On the other hand, a planned pregnancy, the adverse experience of previous abortions and awareness of the benefits of FA in pregnancy were associated with a significantly higher intake of FA during the periconceptual period. However, we were not able to clarify whether in a real-time situation these three factors would independently favour FA supplementation during the periconceptual period. In a previous study, variations in the attitude of women to take FA during the periconceptual period were secondary to the variable knowledge of its benefits among their obstetricians⁽¹²⁾. However, the main source of information on the benefits of FA in early pregnancy appears to be the mass media⁽¹³⁾. This knowledge will be critical in providing public strategies and national campaigns to increase folate awareness among women of childbearing age. On the other hand, the number of unplanned pregnancies remains considerably elevated⁽⁵⁾, limiting the efficacy of public education campaigns to encourage the periconceptual use of FA supplements.

The present study was performed among pregnant women at a mean gestational age of 28 weeks; women who had miscarriages or terminated their pregnancies were not included and therefore their attitude towards intake of FA in the periconceptual period was not

taken into account. In addition, we cannot rule out the recall bias at this advanced gestational age concerning the periconceptual intake of FA among participants. The dose of FA was not evaluated in detail, and therefore some women who took only a few doses during their first weeks of pregnancy were classified as subjects with positive FA supplementation. Finally, for purposes of the analyses, the study variables were categorized a priori, limiting evaluation of the effect of certain variables, e.g. age, on FA supplementation in a wider range of possibilities.

There is still an ongoing debate on the pros and cons of mandatory FA fortification^(14,15); among the cons, FA has been associated with potential cancer promotion as well as with a decrease in plasma homocysteine levels. In addition, FA fortification has been found to be a cause of masking vitamin B₁₂ deficiency, particularly in the elderly population⁽¹⁶⁾. However, diet by itself does not appear to provide pregnant women with sufficient amounts of folate to prevent major birth defects. For example, in Norway, the country with the highest rate of facial clefts in Europe, the fortification of foods with FA has not been allowed⁽¹⁷⁾. In contrast, flour and other grain products are being fortified at a minimum level of 0.14 mg FA/100 g cereal grain in Canada and the USA and a decline in NTD was observed as a result of that fortification^(18,19). However, the fortification level should be enough to provide a daily intake of 0.6 to 0.8 mg FA in order to attain the highest benefits⁽²⁰⁾. In contrast, there is no independent gold standard or reference method for unequivocal characterization of vitamin B₁₂ deficiency, nor an agreement on how to treat or when and how to monitor the effects of treatment available⁽¹⁶⁾. Although deficiency of vitamin B₁₂ in an elderly subpopulation cannot be minimized, the current analysis of risks and benefits is in favour of FA fortification, especially in a population where a very low percentage of pregnant women receive FA supplementation in the periconceptual period and most of women who received FA ignore the dose.

In summary, Korean women undergoing a planned pregnancy, who had previous spontaneous abortions and who were aware of the preventive effects of FA were more likely to take FA during the periconceptual period than those who did not. However, despite its proven efficacy for preventing congenital malformations, intentional intake of FA at the periconceptual period occurred in only approximately 10% of women.

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Author contributions: J.-Y.H. conceived the idea and study design, and coordinated the study. Y.-J.C. collected the information in electronic databases. A.A.N.-O. participated in the study design. H.-K.A. and J.-O.K. performed the statistical analyses. All the authors participated in drafting the manuscript, discussing the results, and preparing, reviewing and correcting the manuscript.

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