

# Factors related to taking folic acid supplements before next pregnancy in parous women

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# Factors related to taking folic acid supplements before next pregnancy in parous women

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## Abstract

**Objective:** Taking folic acid supplements in the period before pregnancy is recommended for the prevention of neural tube defects (NTDs); however, the rate of taking folic acid supplements is low, and lower in parous than primiparous women. The objective of this study was to clarify factors related to taking folic acid supplements before pregnancy in parous women. **Methods:** An anonymous self-administered questionnaire was sent by mail to women 18 months after childbirth. Women not planning to become pregnant again were excluded. Logistic regression analysis was performed to examine factors related to taking folic acid supplements before pregnancy. **Results:** Of 163 parous women, 115 (71%) planned to take folic acid supplements before their next pregnancy and 48 (29%) did not. The factors related to taking folic acid supplements before pregnancy were: information sources (friends and acquaintances, odds ratio: OR = 6.11; mother and child health handbook, OR = 4.82), knowledge (daily intake of folic acid supplements starting 1 month before pregnancy, OR = 3.42), positive attitude (understanding the necessity, OR = 8.53), and the timing of taking folic acid supplements in the last pregnancy (before pregnancy, OR = 11.21). **Conclusion:** Our findings suggest that the planned intake of folic acid supplements before pregnancy in parous women is related to their ability to collect and utilize information.

## KEY WORDS

neural tube defects, folic acid supplement, behavioral change, pregnancy plan, interconception care

## Introduction

### 1. Background and Objective

Neural tube defects (NTDs) are a group of birth defects that include spina bifida, myelomeningocele, encephalocele, and anencephaly. NTDs cause miscarriage and stillbirth, and after birth, depending on severity, may cause intellectual disability and gait and excretion disorders. Thus, NTDs impose long-term physical, mental, and financial burdens on patients and their families. The pathogenesis of NTDs has not been fully elucidated because of the involvement of both genetic and non-genetic factors<sup>1)</sup>. However, folic acid supplements were reported to reduce the risk by about 50%<sup>2, 3)</sup>. Therefore, implementing a policy of adding

folic acid to cereals or recommending folic acid intake through diet and supplements is recommended in many countries to prevent NTDs. In Japan, the former Ministry of Health and Welfare has recommended folic acid supplementation in addition to dietary intake of folic acid to women of reproductive age, women planning to become pregnant, and pregnant women since 2000<sup>4)</sup>. The guidelines recommend the intake of folic acid supplements at least 1 month before conception to maintain blood folic acid levels before the activation of cell division<sup>5)</sup>. However, between 2012 and 2014, the mean percentage of those who started taking folic acid before pregnancy was 8%<sup>6)</sup>, compared to 23% after pregnancy recognition (potentially too late

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for neural tube closure) and 69% who did not take it<sup>6)</sup>. The incidence of spina bifida was 4.2/10,000 newborns in 1997-2001 and 5.6/10,000 in 2007-2011 after the recommendation of intake was issued<sup>7)</sup>; thus, the recommendation had little effect. Since the statistics include neither artificial nor spontaneous abortions, the true prevalence is estimated to be about 1.5 times higher<sup>8)</sup> than that reported by the Japan Association of Obstetricians and Gynecologists<sup>7)</sup>. Although folic acid supplements cannot completely prevent NTDs, the bioavailability of folic acid contained in natural foods is lower than those of the supplements. Therefore, the intake rate of folic acid supplements should be increased.

Previous studies of folic acid supplementation reported the characteristics of individuals who did not take folic acid before conception and socio-cognitive and psychosocial determinants concerning supplement intake. The characteristics of the group that did not start supplementation from before conception consisted of social determinants (low education, low household income, no marriage, younger age), obstetric history (spontaneous pregnancy, no history of natural abortion, being parous), and lifestyle (smoking, obesity, no habit of using supplements)<sup>9, 10)</sup>. The intake rate is lower in parous women than in primiparae<sup>10)</sup>. Even if NTDs were not observed in the first pregnancy, they may occur in subsequent pregnancy. In addition, the recurrence rate of NTDs is high among those who gave birth to a child with NTDs. Thus, the intake rate should be increased in parous women. Healthcare workers that are engaged in postpartum and infant health examinations should encourage increased intake before conception for the next pregnancy.

Secondly, regarding the socio-cognitive and psychosocial determinants of the intake of folic acid supplements, intake has been reported to be related to intention, awareness (awareness of the effects of supplement intake and risk of adverse effects of supplements), attitude (pros, cons), inclination for health promotion and disease prevention, and self-efficacy<sup>11)</sup>. However, as this study was concerned with supplements in general and pregnant women were excluded from the subjects, whether its results are applicable to the intake of folic acid supplements by pregnant women is uncertain. In addition, a previous

study reported that about half of pregnancies were unintended<sup>12)</sup>. The motivation and willingness to take folic acid supplements as well as planning to start them may differ depending on the presence or absence of a pregnancy plan. Thus, factors related to an intake plan for folic acid supplements before conception should be clarified in those with a pregnancy plan to allow healthcare workers to utilize them in providing health guidance.

The objective of this study was to clarify factors related to planning to take folic acid supplements before next conception in parous women for the prevention of NTDs.

## 2. Definitions of Terms

### 1) Folic acid supplements

Folic acid supplements were defined as preparations containing folic acid alone or multivitamin preparations containing synthetic folic acid. Folic acid-fortified foods, such as rice, bread, milk, lactic acid bacilli drinks, juices, and cereals supplemented with folic acid, were not included as folic acid supplements.

### 2) Women not planning to become pregnant

Women not planning to become pregnant were defined as those who had no plans for the next pregnancy. Those who were undecided about the next pregnancy were included as “planning to become pregnant”, as they may plan to become pregnant in the future.

## Methods

### 1. Study design

This study was a cross-sectional study using a self-administered questionnaire.

### 2. Setting and samples

This survey was conducted in areas where the Japan Environment and Children’s Study (JECS)<sup>6, 10)</sup> had not been conducted, as previous studies reported that intake rates tended to increase in areas where the survey had been conducted on folic acid supplements<sup>6, 13)</sup>. To examine the intake rates and recognition of folic acid in areas where no survey had been conducted, three cities and towns where questionnaires could be distributed were selected. The questionnaires were distributed between June 2019 and February 2020. The subjects were 902 mothers who visited for the 18-month health checkup of their babies. Pregnant women, members of

the children's families other than their mothers who visited for the legally mandated health checkup, and mothers who lacked literacy in Japanese were excluded.

### 3. Data collection/procedure

The anonymous self-administered questionnaires were distributed by the author or the survey staff to the subjects by orally explaining the objective and methods of the survey. The questionnaires were collected by mail, and the subjects were asked to return them using the attached envelopes anonymously. The investigators were selected from qualified nurses or those who had knowledge about counseling as they were required to provide care to subjects who complained of psychological anxiety due to the requests during the survey.

### 4. Measurements

Regarding the plan for the next pregnancy, we asked "Are you planning to become pregnant?", and answers were obtained using a nominal scale of "yes", "I am not sure", "no", and "I am pregnant". Regarding the plan to take folic acid supplements, answers were obtained using the nominal scale of "take from pre-conception", "take after I know I am pregnant", and "I will not take it". Questions about determinants of folic acid intake were prepared using the integrated change model (ICM) (Vries, 2005)<sup>14)</sup> used in studies of supplement intake as a framework. In the present study, we used ICM by selecting variables that were related to intake in the constructs (questions). In addition to the ICM, a Japanese version of the Fetal Health Locus of Control (Manabe, 2001)<sup>15)</sup> scale was referenced to determine mothers' attitudes and awareness toward fetal health and the causes of abnormalities. Moreover, the Health Regulatory Focus (Gomez, 2013)<sup>16)</sup> was referenced to evaluate whether health promotion or disease prevention was chosen as a priority. The model and scales were permission to use by the developer. Other variables were referenced according to studies concerning folic acid supplement intake<sup>6, 13, 17, 18)</sup> and those concerning beliefs about supplement intake<sup>11, 19)</sup>.

The constructs of ICM included attitude ("I will take it if there are no adverse effects" or "I do not see the necessity"), self-efficacy ("I am confident that I will take it every day"), and risk perception ("I may give birth to a baby with NTDs"). Furthermore, barriers ("feeling that there is a cost burden" and "feeling

that buying them is bothersome") were prepared. A total of 16 questions were answered according to a 5-point scale of "I strongly agree (5)", "I agree (4)", "I am not sure (3)", "I disagree (2)", and "I strongly disagree (1)". In addition, as a behavioral factor, "the circumstances of folic acid supplement intake in the last pregnancy" was asked using a nominal scale of "take from pre-conception", "after I knew I was pregnant", "I did not take it", and "I am not sure". Regarding the "experience of using supplements other than folic acid", a nominal scale was used to assess the frequency of use. Regarding biological factors, we asked whether the subjects had "experiences of spontaneous abortions or stillbirths" and "experiences of treatments for infertility or recurrent pregnancy losses". Regarding knowledge, questions about whether the subjects knew about NTDs, folate, and folic acid supplements were answered according to a nominal scale of "Yes, I do" or "No, I don't". Regarding perceived cues, we asked whether the subjects had "acquaintances who delivered babies with NTDs". Regarding information factors, sources of information were presented, and we asked whether the subjects were recommended to take folic acid supplements. There were 22 questions about these items. There were two questions about environmental factors (price), and the subjects were asked to write the price that they were willing to pay for folic acid supplements and foods supplemented with folic acid. The wordings of these questions were modified according to a previous study using ICM<sup>20)</sup>. Regarding the health locus of control of intake, "my own health management affects the baby" and "the health of the baby is determined by fate", which were considered to be related to this study, were selected from a Japanese version of the Fetal Health Locus of Control Scale. Answers were obtained using a 5-option scale according to the scales of the other questions. Regarding the Health Regulatory Focus, one item from questions about "promotion" was used, and whether the subjects "were willing to do all they could" was answered using a 5-point scale. "Prevention" was substituted for "It is important to prevent NTDs with folic acid supplements", which is a question concerning the awareness about intake. Regarding attributes, we asked 12 questions such as age, education level, and marital status. In addition to these questions, four questions

concerning the time when the subjects wanted to obtain information and contents of information that they wanted were prepared for the future implementation of interconception care, and answers were obtained from multiple choices by permitting multiple answers. The total number of questions was 59. Three midwives assessed all the questions, and unclear wordings were

modified according to their opinions. The questionnaire was further modified on receiving advice from three experts in obstetrics.

### 5. Ethical considerations

The subjects were given an oral explanation about the objective and contents of the study and informed that the study was not initiated by a local government,

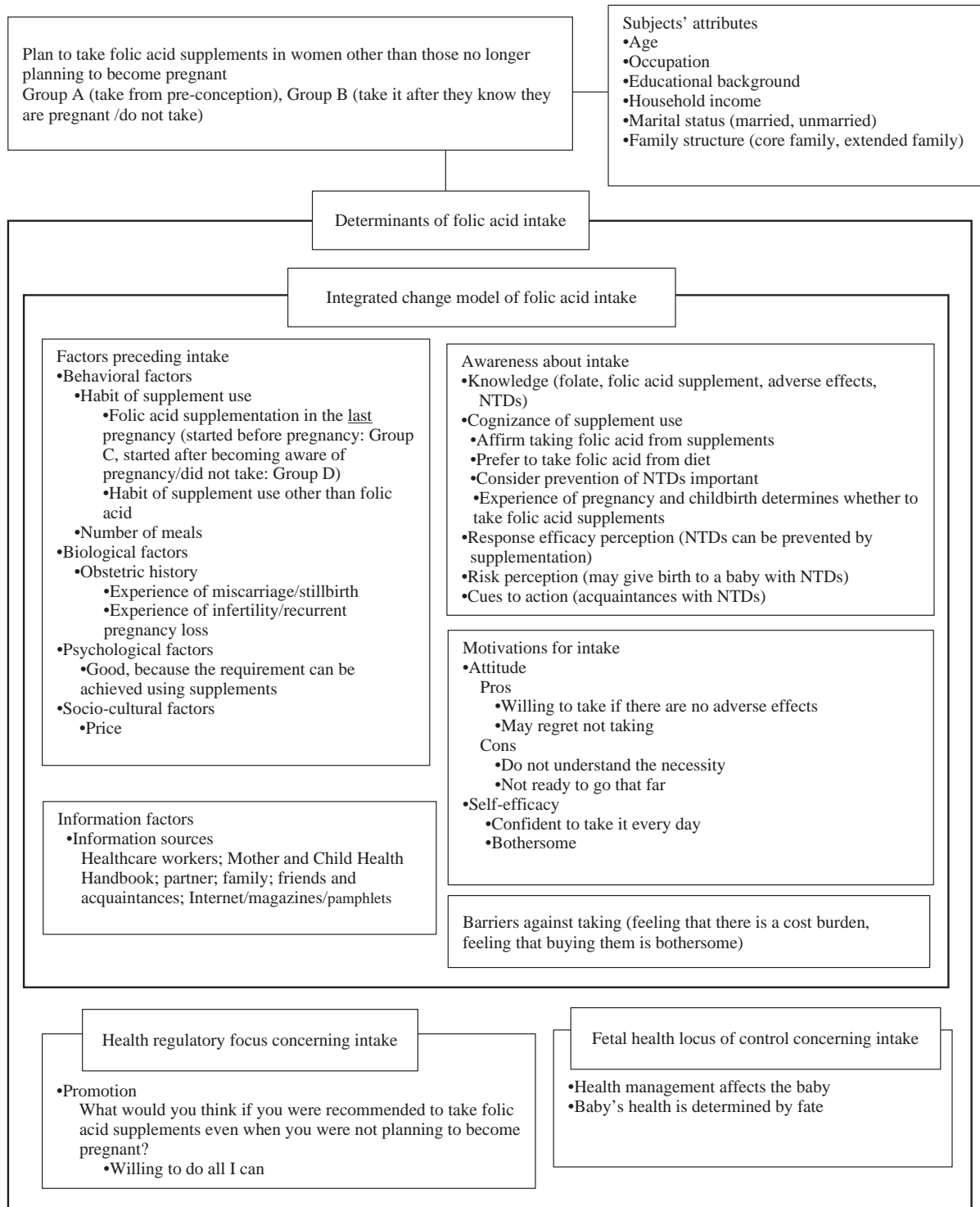


Figure 1 Conceptual diagram of the study

that cooperation in the study was voluntary, and that they would not suffer any disadvantage in their health assessments should they refuse to cooperate. The survey was performed anonymously to protect personal information, and the subjects were instructed not to indicate their names or addresses on the envelope used to return the questionnaires. The subjects were considered to have consented to cooperate in the study by returning the questionnaires. This study was approved by the Medical Ethics Committee of Kanazawa University (Approval number: 912-1).

#### 6. Data analysis

The subjects were divided into those who planned to take folic acid supplements “take from pre-conception” (Group A) and those who planned to “take it after they know they are pregnant” or would “not take it” (Group B). Regarding last pregnancies, those who took folic acid supplements before pregnancy were classified as Group C, and those who took them after becoming pregnant or did not take them were classified as Group D. After confirming that the answers to the questions about the determinants of folic acid intake according to the 5-point scale were not disproportionately concentrated in “I am not sure”, the answers of “I strongly agree” and “I agree” were combined as an “agree” group, those of “I am not sure” as a “not sure” group, and those of “I disagree” and “I strongly disagree” as a “disagree” group. Comparisons between Groups A and B were made using Pearson’s  $\chi^2$ -test, or Fisher’s exact test. To investigate the determinants of intake, binomial logistic regression analysis was performed by the forward stepwise method (likelihood ratio) using planning of intake as the dependent variable. In consideration of the number of subjects in Group A, to avoid overfitting of the model, the items that showed significant differences between Group A and Group B and items with  $\phi$  coefficient and Cramer’s V greater than 0.2 were used as independent variables. Social determinants and history of obstetric care were adopted as independent variables as in previous studies<sup>6, 10</sup>, even if no significant difference was observed between the two groups. IBM SPSS Statistics 26.0 software was used for statistical analyses. Differences between the two groups with a  $p$  value of  $< 0.05$  were regarded as significant.

## Results

The questionnaires were collected from 314 subjects (collection rate: 35%). We excluded a total of 28 subjects by list-wise deletion: six pregnant women, four women who were “not sure” about the time of intake of folic acid supplement in the last pregnancy, 14 women who did not answer about whether they were planning to take folic acid supplements in the next pregnancy, three women who did not answer more than half the questions concerning knowledge about folic acid supplementation, and one woman did not answer the questions about attributes. Valid responses were obtained from 286 (32%) women.

#### 1. Circumstances of taking folic acid supplements in the last pregnancy

Eighty-one subjects (28%) started taking folic acid supplements before pregnancy in their last pregnancy, 150 (52%) began to take them after they knew they were pregnant, and 55 (19%) were not take them. To prevent NTDs, half of the subjects started taking folic acid supplements late (after becoming pregnant). In the last pregnancy, 185 (65%) were planning to become pregnant, but only 59 (32%) of them started taking folic acid supplements before pregnancy. Concerning parity, 151 (53%) were primiparas, and 135 (47%) were multiparas. Significant differences were noted in the numbers of deliveries and the statuses of intake during last pregnancies ( $\chi^2 [2, n = 286] = 7.29, p = .026$ ). Poor intake was more common among those with two or more deliveries (adjusted standardized residual = -2.7).

Three subjects (1%) had previously delivered babies with NTDs and were at risk of recurrence of NTDs of which one (0.3%) took folic acid supplements before pregnancy. Furthermore, one woman (0.3%) had epilepsy but did not take folic acid supplements.

#### 2. Relationship between the plan for the next pregnancy and the plan to take folic acid supplements in the next pregnancy

Ninety-five subjects (33%) were planning to become pregnant again, 85 (30%) were not sure, and 106 (37%) were not planning to become pregnant. A significant correlation was observed between the plan for the next pregnancy and the plan to take folic acid supplements in the next pregnancy ( $\chi^2 [4, n = 286] = 83.37, p < .001, V = .38$ ), and few of those not planning to become pregnant planned to take folic acid supplements before

next conception (before next conception = -6.3; after they knew they were pregnant = -1.1; will not take = 8.8). Those who were not planning to become pregnant were excluded from the subsequent analyses.

### 3. Relationships between plans for taking folic acid supplements before pregnancy and their determinants

Among 180 parous women planning to become pregnant again, data were collected from 163 women with complete data. One hundred fifteen subjects (71%) were classified as Group A, and 48 (29%) were classified as Group B, which consisted of 39 who planned to take folic acid after they knew they were pregnant and nine who would not take it. The average

age of the 163 women was 33 years (mean  $\pm$  SD: 33  $\pm$  4 years). Of the women, 73 (45%) had university or graduate school education as the highest level of academic achievement and 91 (56%) had a household income of 2-6 million yen. Although these attributes were included in the social determinants, they were not significantly correlated with plans to take folic acid supplements (Table 1).

Regarding the relationships between the plans for folic acid supplements intake and their determinants, 49 (94%) of the 52 (32%) women in Group C who took folic acid supplements before conception in the last pregnancy were planning to take them in the next pregnancy. On the other hand, 45 (41%) of the 111

Table 1 Comparison of plans to take folic acid supplements according to the subjects' characteristics

	Total <i>n</i>	Plan to take folic acid supplements				$\chi^2$ value	<i>p</i> -value	$\phi, V$
		Group A ( <i>n</i> = 115)		Group B ( <i>n</i> = 48)				
		<i>n</i>	(%)	<i>n</i>	(%)			
( <i>N</i> = 163)								
Age								
≤34 (range: 24-34) years	105	72	(68.6)	33	(31.4)	0.56	.455	.06
≥35 (range: 35-41) years	58	43	(74.1)	15	(25.9)			
Parity								
1	114	84	(73.7)	30	(26.3)	1.79	.181	.11
2 or above	49	31	(63.3)	18	(36.7)			
Occupation								
Full-time	84	63	(75.0)	21	(25.0)	.539 * <sup>1</sup>	.14 * <sup>2</sup>	
Part-time	31	22	(71.0)	9	(29.0)			
Housewife	39	24	(61.5)	15	(38.5)			
Student	1	1	(100)	0	(0.0)			
Others	8	5	(62.5)	3	(37.5)			
Educational background								
Junior high/high school	30	19	(63.3)	11	(36.7)	3.64	.162	.15 * <sup>2</sup>
Technical/junior college	60	39	(65.0)	21	(35.0)			
University/graduate school	73	57	(78.1)	16	(21.9)			
Household income								
<2 000 000 yen	3	2	(66.7)	1	(33.3)	.895 * <sup>1</sup>	.06 * <sup>2</sup>	
≥2 000 000 and <6 000 000 yen	91	63	(69.2)	28	(30.8)			
≥6 000 000 and <10 000 000 yen	54	40	(74.1)	14	(25.9)			
≥10 000 000 yen	9	7	(77.8)	2	(22.2)			
No answer	6							
Marital status								
Married	160	112	(70.0)	48	(30.0)	.556 * <sup>1</sup>	.09	
Unmarried	3	3	(100)	0	(0.0)			
Family structure								
Core family	135	98	(72.6)	37	(27.4)	1.58	.209	.10
Extended family	28	17	(60.7)	11	(39.3)			

Note: The data are *n* (%). The *p* values were calculated by  $\chi^2$ -test, or Fisher's exact test.

Comparisons were made between Group A and Group B. Group A: women who plan to use folic acid supplements before pregnancy. Group B: women who plan to start using folic acid supplements after they became aware of being pregnant or women who do not plan to use folic acid supplements either before conception or after they became aware of pregnancy.

\*<sup>1</sup> Fisher's exact test

\*<sup>2</sup> Cramer's V

(68%) women in Group D were planning to “take it after they know they are pregnant” or would “not take it” ( $\chi^2 [1, n = 163] = 20.61, p < .001$ ) (Table 2-1).

The largest proportion ( $n = 134$ ; 82%) of the subjects acquired information about taking folic acid supplements from the Internet, maternity magazines, and pamphlets. About 30% of the sources used for

information consisted of friends and acquaintances, The Mother and Child Health Handbook, and healthcare workers (Table 2-1).

Regarding knowledge, 87 (53%) knew “it is better to start taking folic acid supplements from more than 1 month before conception” for the prevention of NTDs. Less than half knew “adverse effects are rare if there

Table 2-1 Relationship between plans and determinants of taking folic acid supplements

(N = 163)								
	Total <i>n</i>	Plan to take folic acid supplements				$\chi^2$ value	<i>p</i> -value	$\phi, V$
		Group A ( <i>n</i> = 115)		Group B ( <i>n</i> = 48)				
		<i>n</i>	(%)	<i>n</i>	(%)			
<b>Factors preceding intake</b>								
<b>Behavioral factors; habit of taking a supplement</b>								
Taking folic acid supplements was started in the <b>last</b> pregnancy								
Group C	52	49	(94.2)	3	(5.8)	20.61	.000	.36
Group D	111	66	(59.5)	45	(40.5)			
Habit of taking a supplement <b>other than folic acid</b>								
Every day/frequently/occasionally	55	44	(80.0)	11	(20.0)	3.57	.059	.15
Rarely/did not take/not sure	108	71	(65.7)	37	(34.3)			
<b>Biological factors: obstetric history</b>								
Infertility/recurrent pregnancy losses	32	27	(84.4)	5	(15.6)	3.66	.056	.15
miscarriage/stillbirth	46	30	(65.2)	16	(34.8)	0.88	.349	.07
<b>Psychological factors</b>								
Good because the requirement can be achieved by taking supplements								
Strongly agree/agree	113	79	(69.9)	34	(30.1)	0.10	.953	.02 <sup>*1</sup>
Neither agree nor disagree	40	29	(72.5)	11	(27.5)			
Disagree/strongly disagree	10	7	(70.0)	3	(30.0)			
<b>Socio-cultural factors: price</b>								
Folic acid supplement (yen)								
0-1000	78	52	(66.7)	26	(33.3)	5.91	.116	.19 <sup>*1</sup>
1001-2000	33	25	(75.8)	8	(24.2)			
2001-3000	30	19	(63.3)	11	(36.7)			
3001-10000	16	15	(93.8)	1	(6.3)			
No answer	6							
Foods fortified with folic acid (yen)								
0-1000	82	60	(73.2)	22	(26.8)	2.71	.439	.14 <sup>*1</sup>
1001-2000	21	12	(57.1)	9	(42.9)			
2001-3000	20	15	(75.0)	5	(25.0)			
3001-10000	10	8	(80.0)	2	(20.0)			
No answer	30							
<b>Information factors: information sources</b>								
Healthcare workers	55/162	41	(74.5)	14	25.5%	0.70	.404	.07
Mother/child health handbook	61/163	53	(86.9)	8	13.1%	12.52	.000	.28
Partner	17/162	14	(82.4)	3	17.6%	1.31	.253	.09
Family	17/162	15	(88.2)	2	(11.8)	2.91	.088	.13
Friends and acquaintances	62/163	53	(85.5)	9	(14.5)	10.74	.001	.26
Internet/magazines/pamphlets, etc.	134/163	101	(75.4)	33	(24.6)	8.43	.004	.23

Note: The data are *n* (%). The *p* values were calculated by  $\chi^2$ -test, or Fisher's exact test.

Comparisons were made between Group A and Group B. Group A: women who plan to use folic acid supplements before pregnancy. Group B: women who plan to start using folic acid supplements after they became aware of being pregnant or women who do not plan to use folic acid supplements either before conception or after they became aware of pregnancy. Group C: women who started using folic acid supplements before pregnancy. Group D: women who started using folic acid supplements after they became aware of being pregnant or women who did not use folic acid supplements either before conception or after they became aware of pregnancy.

<sup>\*1</sup> Cramer's V



is compliance with dosage and regimen", "folate is water-soluble and heat-labile", and "women planning to become pregnant should supplement their diet with an additional 400  $\mu\text{g}$  of folic acid" (Table 2-2). Regarding cognizance of supplements use, 149 (91%) considered it acceptable to take folic acid from supplements, and none were opposed to "taking folic acid from supplements". One hundred forty-four (88%) subjects considered it important to prevent NTDs with folic acid supplements (Table 2-2). However, 88 (54%) of the subjects "wished to take folate from their diet rather than from supplements", and this view was significantly correlated with the "habit of taking supplements other than folic acid" among the behavioral factors (Fisher's exact test,  $p = .005$ ,  $V = .26$ ). Of the 88 subjects (54%) who "agreed" with the statement, "the experience of pregnancy and childbirth determines whether a person takes folic acid supplements or not", 70 (80%) planned to take them before their next pregnancy (Table 2-2). A significant correlation was found between risk perception of "may give birth to a baby with NTDs" and the plan to take folic acid supplements in the next pregnancy ( $\chi^2 [2, n = 163] = 13.47$ ,  $p = .001$ ). Similarly, a significant correlation was observed between perception of "NTDs can be prevented by supplementation" and planning intake before conception (Fisher's exact test,  $p = .012$ ) (Table 2-2).

Plans for taking supplements were significantly correlated with attitude, and a higher percentage of those who understood its necessity had a plan for folic acid supplementation ( $\chi^2 [2, n = 163] = 21.03$ ,  $p < .001$ ) (Table 2-3). A significant correlation was observed between "may regret not taking" and the planning intake before conception ( $\chi^2 [2, n = 163] = 12.91$ ,  $p = .002$ ) (Table 2-3).

No significant difference was observed in the "feeling that there is a cost burden" and "feeling that buying them is bothersome", which were expected to be barriers (Table 2-4).

#### 4. Determinants related to plans to take folic acid supplements

For binomial logistic regression analysis, data were collected from 163 (115 in Group A and 48 in Group B) subjects with complete data. Table 3 shows the results of the analysis by the forward stepwise method (likelihood ratio). The model  $\chi^2$  was significant at

$p < 0.01$ , and each variable was also significant ( $p < 0.05$ ). The results of Hosmer-Lemeshow test showed a satisfactory fit ( $p = 0.737$ ), and the percentage of correct classifications was also satisfactory at 82.8%. Determinants related to the planning of sufficient folic acid intake in the parous women included the presence of information sources (friends and acquaintances, odds ratio: OR = 6.11; Maternal and Child Health Handbook, OR = 4.82) and acquisition of knowledge (appropriate timing for folic acid intake: at least 1 month before conception, OR = 3.42). Moreover, we found a positive association between taking folic acid supplements (understanding of the need, OR = 8.53) and folic acid intake before conception in the last pregnancy (OR = 11.21).

#### Discussion

The World Health Organization recommends that healthcare workers take initiative to support women and make them able to self-manage their intake of iron and folic acid supplements after childbirth<sup>21</sup>). In the present study, determinants related to planning to take folic acid supplements before the next pregnancy in parous women were identified by excluding women with no plans for the next pregnancy. Women who were planning to start taking folic acid before the next pregnancy were aware of information about folic acid, acquired knowledge, and had a positive attitude to its intake. As applying obtained knowledge to experience is related to health literacy<sup>22</sup>), in the present study, variables that were significant were considered to be related to health literacy. Thus, healthcare workers need to provide support to improve women's ability to select and use information appropriately during the preconception and interconception periods.

Many of the subjects in this study obtained information concerning folic acid supplements from the Internet, magazines, and pamphlets. However less than half of the women had knowledge about the right timing and amount of folic acid supplements, that adverse effects are rare if there is compliance with dosage and regimen, and the characteristics of dietary folate. Moreover, the information was not sufficient to change their behavior through the understanding of the need for intake. Among the participants in this study, a larger proportion were highly educated and a



Table 2-3 Relationships between plans and determinants of taking folic acid supplements

(N = 163)								
	Total <i>n</i>	Plan to take folic acid supplements				$\chi^2$ value	<i>p</i> -value	V
		Group A ( <i>n</i> = 115)		Group B ( <i>n</i> = 48)				
		<i>n</i>	(%)	<i>n</i>	(%)			
<b>Motivation for intake</b>								
<b>Attitude; cons</b>								
Do not understand the necessity								
Strongly agree/agree	13	4	(30.8)	9	(69.2)	21.03	.000	.36
			-3.3		3.3			
Neither agree nor disagree	36	19	(52.8)	17	(47.2)			
			-2.7		2.7			
Disagree/strongly disagree	114	92	(80.7)	22	(19.3)			
			4.3		-4.3			
Not ready to go that far								
Strongly agree/agree	76	53	(69.7)	23	(30.3)	2.53	.281	.13
Neither agree nor disagree	44	28	(63.6)	16	(36.4)			
Disagree/strongly disagree	43	34	(79.1)	9	(20.9)			
<b>Attitude; pros</b>								
May regret not taking								
Strongly agree/agree	65	56	(86.2)	9	(13.8)	12.91	.002	.28
			3.6		-3.6			
Neither agree nor disagree	63	39	(61.9)	24	(38.1)			
			-1.9		1.9			
Disagree/strongly disagree	35	20	(57.1)	15	(42.9)			
			-2.0		2.0			
Willing to take if there are no adverse effects								
Strongly agree/agree	91	73	(80.2)	18	(19.8)	10.63	.005	.26
			3.0		-3.0			
Neither agree nor disagree	39	25	(64.1)	14	(35.9)			
			-1.0		1.0			
Disagree/strongly disagree	33	17	(51.5)	16	(48.5)			
			-2.7		2.7			
<b>Self-efficacy</b>								
Confident to take it every day								
Strongly agree/agree	58	44	(75.9)	14	(24.1)	5.81	.055	.19
Neither agree nor disagree	43	34	(79.1)	9	(20.9)			
Disagree/strongly disagree	62	37	(59.7)	25	(40.3)			
Bothersome								
Strongly agree/agree	80/162	56	(70.0)	24	(30.0)	0.95	.623	.08
Neither agree nor disagree	41/162	27	(65.9)	14	(34.1)			
Disagree/strongly disagree	41/162	31	(75.6)	10	(24.4)			

Note: The data are *n* (%). (The numbers at the bottom are adjusted standardized residuals). The *p* values were calculated by  $\chi^2$ -test. Comparisons were made between Group A and Group B. Group A: women who plan to use folic acid supplements before pregnancy. Group B: women who plan to start using folic acid supplements after they became aware of being pregnant or women who do not plan to use folic acid supplements either before conception or after they became aware of pregnancy.

lower percentage belonged to the low-income bracket compared to the JECS<sup>10</sup>); however, the intake rate before conception was 28%. In this study, the intake of folic acid supplements before conception in the last pregnancy was a factor related to planned intake before conception in the next pregnancy. Therefore, the timing and supplemental doses for taking folic acid supplements, information about adverse effects, and the characteristics of dietary folic acid should be

explained to women before pregnancy or after delivery. Both preconception care and interconception care are necessary, as demonstrated previously<sup>17</sup>). In the previous study, having received the Maternal and Child Health Handbook was a factor related to the planned intake of folic acid supplements. The handbook provides information about folic acid and is used to record the results of health examinations for several years after birth; thus, it may promote the intake of folic acid

Table 2-4 Relationships between plans and determinants of taking folic acid supplements

(N = 163)								
	Total	Plan for take folic acid supplements				$\chi^2$ value	p-value	V
		Group A		Group B				
		n	(%)	n	(%)			
<b>Barrier</b>								
Feeling that there is a cost burden								
Strongly agree/agree	101	72	(71.3)	29	(28.7)	2.42	.299	.12
Neither agree nor disagree	27	16	(59.3)	11	(40.7)			
Disagree/strongly disagree	35	27	(77.1)	8	(22.9)			
Feeling that buying them is bothersome								
Strongly agree/agree	82	58	(70.7)	24	(29.3)	1.14	.566	.08
Neither agree nor disagree	30	19	(63.3)	11	(36.7)			
Disagree/strongly disagree	51	38	(74.5)	13	(25.5)			
<b>Health regulatory focus concerning intake</b>								
Willing to do all I can								
Strongly agree/agree	131	100	(76.3)	31	(23.7)	.004 <sup>*1</sup>	.26	
			3.3		-3.3			
Neither agree nor disagree	29	14	(48.3)	15	(51.7)			
			-2.9		2.9			
Disagree/strongly disagree	3	1	(33.3)	2	(66.7)			
			-1.4		1.4			
<b>Health locus of control concerning intake</b>								
My health management affects the baby								
Strongly agree/agree	154	112	(72.7)	42	(27.3)	.017 <sup>*1</sup>	.23	
			2.5		-2.5			
Neither agree nor disagree	6	3	(50.0)	3	(50.0)			
			-1.1		1.1			
Disagree/strongly disagree	3	0	(0.0)	3	(100)			
			-2.7		2.7			
Health of the baby is determined by fate								
Strongly agree/agree	54	38	(70.4)	16	(29.6)	.26	.880	.04
Neither agree nor disagree	72	52	(72.2)	20	(27.8)			
Disagree/strongly disagree	37	25	(67.6)	12	(32.4)			

Note: The data are n (%). (The number at the bottom are adjusted standardized residues). The p values were calculated by  $\chi^2$ -test, or Fisher's exact test.

Comparisons were made between Group A and Group B. Group A: women who plan to use folic acid supplements before pregnancy. Group B: women who plan to start using folic acid supplements after they became aware of being pregnant or women who do not plan to use folic acid supplements either before conception or after they became aware of pregnancy.

<sup>\*1</sup> Fisher's exact test

supplements in the planning of the next pregnancy.

In the present study, only a small percentage of women chose healthcare workers as a source of information, suggesting that they were not a factor related to folic acid intake before conception. Women at high risk of NTDs, such as those who had given birth to babies with NTDs before<sup>23)</sup> and those with a history of epilepsy<sup>24)</sup>, did not receive sufficient information about folic acid supplements. Healthcare workers should encourage individual women, depending on their medical and reproductive histories, to increase their intake rate of folic acid supplements before conception in their next pregnancies to reduce the risk of NTDs.

Although few intervention studies that aimed at improving the recognition and intake rate of folic acid

supplements have been reported in Japan, several local governments in Japan have signed agreements with companies to increase the intake rate of folic acid supplements and folic acid supplements; furthermore, pamphlets for information provision on folic acid were distributed to pregnant women<sup>25)</sup>. However, whether they actually purchased and took folic acid supplements before conception in the next pregnancy is unclear. In addition, a small number of local governments collaborated with research institutes to measure the dietary intake of folic acid and blood folic acid concentration for the health improvement of residents as well as pregnant women<sup>26)</sup>. In the present study, obtaining information from friends and acquaintances was a factor related to the intake of

Table 3 Binomial logistic regression analysis of taking folic acid supplements

(N = 163)					
	Partial regression coefficient	Significance probability	OR	95% CI	
				Lower limit	Upper limit
Time of the beginning to take folic acid supplements in the <u>last</u> pregnancy					
Group C	2.42	.001	11.21	2.53	49.76
Group D					
Source of information concerning folic acid intake before conception					
Friends/acquaintances					
Recommended	1.81	.001	6.11	2.01	18.62
Not recommended					
Mother and Child Health Handbook					
Recommended	1.57	.003	4.82	1.69	13.81
Not recommended					
Knowledge					
Should start taking from more than 1 month before conception					
Know	1.23	.012	3.42	1.32	8.87
Do not know					
Awareness					
Experience of pregnancies and childbirths determines intake					
Strongly agree/agree	1.75	.055	5.73	0.97	33.97
Neither agree nor disagree	0.29	.748	1.34	0.23	7.86
Disagree/strongly disagree					
Do not understand the necessity					
Strongly disagree/disagree	2.14	.015	8.53	1.52	47.75
Neither agree nor disagree	1.49	.113	4.42	0.70	27.71
Agree/strongly agree					
Constant	-3.92	.002	0.02		

Model  $\chi^2$ -test  $p < .01$

Percentage of correct classifications: 82.8%

Variables included in multivariate analysis: status of folic acid supplement use, source of information (Mother and Child Health Handbook, friends and acquaintances, Internet/magazines/pamphlets), knowledge (folate is water-soluble and heat-labile, should take an extra 400  $\mu\text{g}$  of folic acid supplements before pregnancy, should start taking more than 1 month before pregnancy, adverse effects are rare if there is compliance with dosage and regimen), cognizance (affirm taking folic acid from supplements, prefer to take folic acid from diet, it is important to prevent NTDs with folic acid supplements, experience of pregnancies and childbirths determines the intake, NTDs can be prevented by taking folic acid supplements, may give birth to a baby with NTDs), attitude (do not understand the necessity, may regret not taking, willing to take if there are no adverse effects), health regulatory focus concerning intake (willing to do all I can), health locus of control concerning intake (my health management affects the baby), experience of treatment for infertility or recurrent pregnancy losses, educational background.

Group C: women who started using folic acid supplements before pregnancy. Group D: women who started using folic acid supplements after they became aware of being pregnant or women who did not use folic acid supplements either before conception or after they became aware of pregnancy.

Abbreviations: OR, odds ratio; CI, confidence interval.

folic acid supplements before pregnancy. Therefore, more women may take folic acid supplements before conception if they have friends and acquaintances who took folic acid and provided relevant information. In behavioral economics, "bandwagon effects" describe a phenomenon in which people determine their

behaviors under the influence of their colleagues and neighbors and are a factor related to behavior change<sup>27)</sup>. Furthermore, those planning to take folic acid supplements before conception may have obtained information through interpersonal communication<sup>28)</sup> or changed their behavior due to social modeling of their

friends and acquaintances<sup>29</sup>).

According to our study, the latest delivery was a result of unplanned pregnancy in 16% and of neither planned nor unplanned pregnancy in 19% of respondents. It should be kept in mind that folic acid supplements are recommended for women of childbearing age with or without a pregnancy plan. Healthcare workers providers need to support these women to improve their ability to select and use information appropriately.

### **Limitations**

Our survey had several limitations. The response rate of the questionnaire was low (35%), and the valid response rate was reduced further by some respondents not answering some questions. Moreover, as the survey was conducted 18 months after childbirth in consideration of the occasional detection of NTDs in the developmental process of children and avoided the postpartum high-stress period, there may have been recall bias. Furthermore, as the participants in the survey were likely to have a positive attitude to taking folic acid supplements, participant bias was also present. Determinants of taking folic acid supplements before the next conception in parous women may not have been measured accurately by our original questionnaire. In Japan, as grains are not fortified with folic acid, folic acid supplements are recommended; thus, people's awareness of folic acid supplements may be different compared with countries in which the deficit of folic acid is complemented by other methods. In this study, plans to take folic acid supplements in the next pregnancy were investigated by excluding parous women no longer planning to have babies; however, our results may differ from the actual outcomes, as actual behavior was not followed up. Despite these limitations, a strong point of this survey was that it had less participant bias compared with studies conducted at particular centers, because the subjects were limited

to non-pregnant parous women, the time of survey was standardized to 18 months after the last childbirth, and the questionnaires were distributed on the occasion of a legally mandated health checkup.

### **Conclusion**

Determinants of planning to take folic acid supplements in parous women were identified. Parous women with plans to become pregnant again obtained information and knowledge about taking folic acid supplements, understand the necessity, and showed a positive attitude to taking folic acid supplements. Moreover, parous women were planning to utilize the experience of intake before conception for their next pregnancy. Many parous women mentioned the Internet, magazines, and pamphlets as sources of information. On the other hand, many of them had no knowledge about the characteristics of dietary folate, the timing for starting or amount to take of folic acid supplements, and adverse effects being rare if there is compliance with dosage and regimen. Therefore, it is suggested that healthcare workers need to support women to improve their ability to select and use information both in the preconception and interconception period.

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## 経産婦の葉酸サプリメント摂取予定に関連する要因

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### 要 旨

**目的：**神経管閉鎖障害を予防するために受胎以前から葉酸を補足することが推奨されているが、葉酸サプリメントの摂取率は低く、初産婦より経産婦の方が摂取率が低い。本研究の目的は経産婦の受胎以前からの葉酸サプリメント摂取予定に関連する要因を明らかにすることである。

**方法：**出産後 1 年 6 か月の人を対象に、無記名自記式質問紙調査を行い、郵送法で回収した。次回の妊娠計画がない人を除外して、受胎以前からの葉酸サプリメント摂取予定に関連する要因をみるためにロジスティック回帰分析を用いた。

**結果：**経産婦 163 名のうち受胎以前から葉酸サプリメントを摂取予定の人が 115 名 (71%)、受胎以前から摂取予定がない人が 48 名 (29 %) であった。受胎以前から葉酸サプリメントを摂取することに関連する要因は情報源 (友人や知人, odds ratio: OR = 6.11 ; 母子健康手帳, OR = 4.82), 知識 (受胎 1 か月以上前から葉酸サプリメントを摂る, OR = 3.42), 摂取に対する前向きな姿勢 (必要性がわかる, OR = 8.53), 及び直近の妊娠時の葉酸サプリメント摂取時期 (受胎以前, OR = 11.21) であった。

**結論：**経産婦の受胎以前からの葉酸サプリメント摂取予定に関連する要因は情報収集と活用能力であることが示唆された。