

# Maternal Knowledge and Practices About Folic Acid Intake Among Mothers Attending Primary Health Care Centers in Jeddah City, Saudi Arabia 2012

Ohoud H Balkhair

Associate Consultant, National Guard Hospital, Jeddah, Saudi Arabia.

## ABSTRACT

**Background:** In KSA, there was an apparent decline in the incidence of NTDs after the folic acid flour fortification. However, the incidence is still high, and usually associated with serious morbidity.

**Objectives:** To assess knowledge and practices about folic acid intake and their associated factors among mothers attending ministry of health primary health care centers in Jeddah city, Saudi Arabia.

**Subjects and Methods:** It was a cross-sectional analytic study included a multistage random sample of mothers attending well baby clinic in ministry of health primary health care centers in Jeddah city, Saudi Arabia, 2012. Self-administered questionnaire to measure folate knowledge and practice based on specific items from the Arabic version of Pregnancy Risk Assessment Monitoring System (PRAMS) questionnaire. It consists of 2 parts, total of 17 with 5 questions regarding socio demographic features and clinical data, knowledge and behavior of mothers concerning folic acid supplementation.

**Results:** The study included 366 mothers. Their age ranged between 18 and 48 years and the mean age was 29.6 years (SD 6.1). Two-hundreds and twenty-five mothers (61.5%) were non-Saudi. More than two-thirds of women (69.1%) reported that they had heard or read that taking the vitamin folic acid can help prevent some birth defects. The sources of knowledge varied, with almost two-third of women (65.6%) of women reporting that they had heard about folic acid from a doctor. More than one-quarter of women (27.6%) reporting that they did not take multivitamin at all in the first trimester of pregnancy while the majority of them (85.2%) reporting that they did not take multivitamin at all in the last month of pregnancy and 87.4% did not intake folic acid before pregnancy. High education, Saudi, low gravidity, high income and having information before pregnancy from health care

workers were significantly associated with intake of folic acid in the first trimester of pregnancy.

**Conclusions:** The results of this study showed that almost two thirds of women attended primary health care centers in Jeddah have heard or read about the importance of folic acid supplementation in preventing serious birth defects. The level of folic acid supplements intake during pregnancy was sufficient in the first trimester. However, it was insufficient before pregnancy. Additional measures directed at understanding folic acid usefulness and promoting folic acid awareness and consumption among all non-pregnant Saudi women of childbearing age are warranted.

**Key words:** Folic Acid, Knowledge, Practice, Maternal.

## Abbreviations:

**NTDs:** Neural tube defects; **PHCC:** Primary health care center; **CDC:** Center for disease prevention and control; **WHO:** World Health Organization; **ANC:** Antenatal care; **HCWs:** Health care workers; **FA:** Folic acid; **KSA:** Kingdom of Saudi Arabia; **USA:** United States of America; **UK:** United Kingdom;  $\chi^2$ : Chi-square; **ANOVA:** One-way analysis of variance; **SPSS:** Statistical Package for Social Sciences; **No.:** Number of individuals with an event.


## \*Correspondence to:

Dr. Ohoud H Balkhair,  
Associate Consultant,  
National Guard Hospital, Jeddah, Saudi Arabia.

## Article History:

Received: 08-08-2019, Revised: 05-09-2019, Accepted: 25-09-2019

## Access this article online

|  |  |
|--|--|
| Website:<br><a href="http://www.ijmrp.com">www.ijmrp.com</a> | Quick Response code<br> |
| DOI:<br>10.21276/ijmrp.2019.5.5.025                          |  |

## INTRODUCTION

**Neural tube defects (NTDs)** are among the most common birth defects, contributing to infant mortality and serious disability. It includes defects of the spine (for example, spina bifida), and the brain (for example, anencephaly) that occur during early pregnancy, in the third to fourth week after conception (day 26 to day 28 post conception) often before a woman knows she is pregnant.<sup>1</sup>

## Epidemiology of NTD

Neural tube defects (NTDs) are the most common congenital malformations with a prevalence of 1.0–4.8 per 1,000 pregnancies in the Asian population.<sup>2</sup>

The incidence of NTD admission into the newborn unit of Asir Central Hospital, during the period January 1995 through December 1998 was of 0.78/1000 births in the region.

Only 25% were of the mothers on folate supplementation during the affected pregnancy and no mother received preconceptional folic acid supplementation.<sup>3</sup>

Neural Tube Defects Registry Cumulative Report 2000-2010 In:

- King Faisal Specialist Hospital & Research Centre, Riyadh
- King Faisal Specialist Hospital & Research Centre, Jeddah
- Disabled Children's Association, Riyadh
- Disabled Children's Association, Jeddah
- King Saud Medical Complex, Riyadh
- Al Qunfudah General Hospital, Makkah

A total of 643 patients were registered in the Neural Tube Defects Registry, and mothers of the patients were asked about use of folic acid. In the registry sample only 7(1%) of the mothers took folic acid in preconception period, whereas 6(1%) had it off/on, as compared to 588 (98%) who never had folic acid in their preconception period out of total 601 cases. If we look at the folic acid intake during first trimester situation is little bit better with 22 (4%) had folic acid, while 95 (16%) had folic acid intake off/on. 471 (80%) cases never had it even in the first trimester out of the total of 58 cases.<sup>4</sup>

#### **Role of Folic Acid in Preventing NTD**

Almost 50-80% of these defects can be prevented, if a woman consumes sufficient folic acid daily before conception, and throughout the first trimester of her pregnancy.<sup>1</sup>

Several studies have indicated that taking multivitamins containing folic acid during the periconception period can reduce the risk of other conditions such as heart defects, urinary tract anomalies, oral facial clefts, limb defects and pyloric stenosis.<sup>5</sup>

Over the last 2 decades, folic acid food fortification was adopted by many countries, including the Kingdom of Saudi Arabia (KSA). In KSA, there was an apparent decline in the incidence of NTDs after the folic acid flour fortification. However, the incidence is still high, and usually associated with serious morbidity.<sup>1</sup>

The comprehensive Canadian analysis of neural tube reduction after folic acid flour fortification has reported a 46% reduction. The observed reduction was greater for spina bifida (53%) than for anencephaly (38%) and encephalocele (31%).<sup>5</sup>

#### **Recommendations**

Women in the reproductive age group should be advised about the benefits of daily supplementation with a multivitamin with folic acid (0.4–1.0 mg) and 4.0 mg/d for high risk for at least two to three months before conception and throughout pregnancy and the postpartum period (4–6 weeks and as long as breastfeeding continues).<sup>5</sup> Women should be advised to maintain a healthy diet, Foods containing excellent to good sources of folic acid are fortified grains, spinach, lentils, chick peas, asparagus, broccoli, peas, Brussels sprouts, corn, and oranges. However, it is unlikely that diet alone can provide levels similar to folate-multivitamin supplementation.<sup>5</sup>

Women's awareness of the need for periconceptional folic acid supplements, and compliance with recommendations, has not been well studied in developed and developing countries. To our knowledge, one study only has been conducted among Saudi women on awareness and intake of additional folic acid among women of child-bearing age and the awareness was 12%.<sup>1</sup>

Awareness of folic acid in Qatar was 53.7%, although only 20.3% reported intake of folic acid.<sup>6</sup> In the United Arab Emirates 79.1% of women had heard about folic acid, 29.5% of the women in the study reported that the proper time for folate supplementation

should be before pregnancy.<sup>7</sup> Prevalence of intake of preconceptional folic acid in Lebanon was found to be 14 %.<sup>8</sup>

A study conducted on Taiwanese metropolitan women revealed that nearly 90% of women were aware of folic acid, but only 15.6% of women took supplements containing folic acid before their pregnancies.<sup>9</sup> Awareness of folic acid in the United States was (57%),<sup>10</sup> and Ireland was (63.6%).<sup>11</sup> In other countries with minimal or no national awareness campaigns conducted thus far, such as France, Spain, Germany and Italy, prevalence of periconceptional folic acid intake ranges from 1% to 45%.<sup>12</sup>

#### **RATIONAL**

1. I found that most of mothers in my family are not aware about folic acid and they begin to take the folic acid after the first antenatal visit which is too late, although most of them are multiparous and highly educated.
2. The researcher has a special interest in mother and child health as she is a mother.

#### **AIM**

To assess knowledge and practices about folic acid intake among mothers attending ministry of health primary health care centers in Jeddah city, Saudi Arabia.

#### **OBJECTIVES**

- 1) To assess the level of maternal knowledge about folic acid among women attending well baby clinic in ministry of health primary health care centers in Jeddah city 2012.
- 2) To examine the mothers practices toward folic acid use in the previous pregnancies.
- 3) To examine the impact of selected variables (mother's age, education and number of previous pregnancies) on the use of folate supplements

#### **LITERATURE REVIEW**

As a result of reviewing of the literatures on the knowledge and practices of folic acid, the following had been found:

- One local study conducting in Jeddah city, KSA.
- Three studies in Gulf countries (Qatar, Oman and United Arab Emirates).
- Two studies in Middle East countries (Jordan and Lebanon).
- Eight international studies.

#### **A LOCAL STUDY**

The study was done to investigate the level of awareness about the importance of preconception folic acid supplementation in preventing neural tube defects (NTDs) on the female students of the 3 colleges in Jeddah, Kingdom of Saudi Arabia in April 2008.

The research reported that Almost 88% (217 sample size) were not aware of the importance of folic acid in preventing NTDs and there is a need to increase the awareness of the importance of folic acid among females childbearing age.<sup>1</sup>

#### **STUDIES IN GULF COUNTRIES**

1. Maternal knowledge, attitude and practice on folic acid intake among Arabian Qatari women assessed on 2005. Prevalence of awareness of folic acid in this study was 53.7%. The most common sources of folate information were doctors (63.4%) and newspapers/magazine/books (21.7%).

It is noteworthy that however 53.7% of the respondents in this study admitted of ever hearing about folic acid, only half of them were aware of the benefits in pregnancy; 14% of our study women who had ever heard about folic acid knew about its preventive role against birth defects. These findings indicated that lack of awareness and knowledge about folic acid is widespread among Qatari women of child-bearing age. Further efforts are needed to inform the population and promote the optimal use of folic acid supplements.<sup>6</sup>

2. The aim of another study was to assess the knowledge and behavior of a group of pregnant women about the role of folic acid in pregnancy in Abu Dhabi Emirate, UAE. 79.1% of the interviewed pregnant women in this study had heard about folic acid, and of these 66.7% were aware of the connection between folic acid and neural tube defects. 29.5% of the women in the study reported that the proper time for folate supplementation should be before pregnancy.<sup>7</sup>
3. The objective of a study conducted in Qatar and Oman was to assess the knowledge and use of folic acid among pregnant Arabian women in Qatar and Oman 2005. Results of the survey indicated that 94% of the women knew about folic acid, 41.3% knew it should be taken periconceptionally, 58.5% knew that it prevents birth defects. The majority (88.7%) of women was taking the supplement, 85.0% were taking it regularly and 13.2% took it before getting pregnant. Periconceptional use of supplement was lowest among younger women (4.9%) and illiterate and least educated women (5.3%).<sup>13</sup>

#### STUDIES IN MIDDLE EAST COUNTRIES

1. In Jordan, a study was conducted to assess the Knowledge and practices of folate and multivitamin supplementation among Jordanian pregnant women 2007. In this study, 77% of women took multivitamins during pregnancy but only 58% took folic acid, only 53.7% of women reported that they had heard or read that taking folic acid can help prevent some birth defects. In addition, the most common sources of folate knowledge were the doctor, nurse or health care provider, and a family or friend. Thus, they concluded that the role of health care providers should be enhanced to reach all women of childbearing age through health education campaigns or educational materials rather than depending only on prenatal care visits.<sup>14</sup>
2. In Lebanon, the objective of a study conducted in Lebanon was to assess the prevalence and determine the predictors of preconceptional folic acid use among pregnant women in Lebanon. Prevalence of intake of preconceptional folic acid in Lebanon was found to be 14%. Lower parity and having a history of previous spontaneous abortions were significantly associated with preconceptional folic acid use. They concluded Lebanon currently has a low rate of preconceptional folic acid supplement use. Intervention through the means of awareness campaigns needs to be implemented on a national level.<sup>8</sup>

#### THE INTERNATIONAL STUDIES

1. In United states, a study assessed folic acid awareness and behavior in the United States surveys were conducted of approximately 2000 women (per survey year) aged 18–45

years from 1995–2005 in the United States. The findings in this study showed that whereas a large percentage of women have heard of folic acid, only a small proportion is aware that folic acid prevents birth defects and should be taken before pregnancy. Of all women surveyed in 2005, 19% knew that folic acid prevented birth defects, compared to 4% in 1995. Also in 2005, 7% of women knew that folic acid should be taken before pregnancy, compared to 2% in 1995. The study concluded that succeed in eliminating all folic acid preventable birth defects beyond what fortification has already achieved, more must be done besides educating women and their health care providers.<sup>15</sup>

2. In Canada, a study was implemented to examine the level of knowledge about the usefulness of periconceptional folic acid supplementation in a sample of patients from primary care practices. General awareness of NTDs was high (62.7%); however, knowledge that these defects were preventable was lower (22.5%). Only 7.8% of the women made the association between folic acid intake and NTDs.<sup>16</sup>
3. Another study evaluated women's knowledge and beliefs with regard to folic acid. In 1999-2000, a questionnaire was completed by 1,240 pregnant women in 10 Quebec hospitals. Seventy percent of the respondents were aware of the preventive role of folic acid but only 25% had taken the recommended dose of supplements during the periconception period.<sup>17</sup>
4. Young minority women were enrolled in a folic acid program at 3 urban Houston, Texas, reproductive health clinics and assessed for NTD knowledge and preventive practices. 52% had heard of folic acid, 45% had heard of NTDs, and 50% had heard of birth defects prevention by multivitamins. At enrollment, daily multivitamin intake was very low (9%) and folate-rich foods were consumed in inadequate amounts.<sup>18</sup>
5. In another study investigated public understanding of the importance of folic acid intake in young women aged 18–24 years. Because approximately one half of the young women in that sample are not aware of the importance of folic acid, they concluded that more education is needed in that area. Educational opportunities should target women aged 18–24 years and be tailored to meet their needs.<sup>19</sup>
6. In Germany, pregnant women attending their first or second antenatal visit were asked to fill in a questionnaire aimed at assessing their awareness and use of folic acid in 2005. The aim of the Dutch Ministry of Health is to have 70% of Dutch women wanting to become pregnant use folic acid supplements in the advised period by 2010. While this level has almost been reached among more highly educated women (63%), it will take a great deal more effort, money and creativity to achieve the necessary increase from the current level of 31% among women with a lower educational background.<sup>20</sup>
7. In Taiwan, a study was conducted to evaluate the awareness and use of folic acid during periconceptional period in Taiwan on 2008. The survey on Taiwanese metropolitan women revealed that nearly 90% of women were aware of folic acid, but only 15.6% of women took supplements containing folic acid before their pregnancies. This rate of folic acid use rose to 70.9% early in the first trimester of pregnancy. They concluded that only a small proportion of women have used

folic acid before their pregnancies. A public health policy or strategy to increase the preconceptional use of folic acid was needed in Taiwan.<sup>9</sup>

8. Since 1995, the March of Dimes Foundation has contracted the Gallup Organization to conduct a series of national, random-digit-dialed telephone surveys of a proportionate stratified sample of women of childbearing age to assess awareness, knowledge, and behavior regarding folic acid. The surveys included multiple-choice and open-ended questions. To assess awareness of folic acid, respondents were asked a multiple-choice question. In 2007, approximately 40% of all women surveyed reported daily consumption of a supplement containing folic acid. This percentage was equal to that observed in 2004 and was higher than 33% that reported in 2005 and 32% reported in 2003.<sup>21</sup>

We find that there is a significant difference between the prevalence of the awareness about folic acid between our country and others, so we need more studies to find out the true prevalence in our country.

## METHODOLOGY

### Study Area

Jeddah city is the second main city in kingdom of Saudi Arabia. It is located in the western region of the kingdom on Red Sea coast. Primary health care services are offered by almost 40 governmental PHC of ministry of health, which was divided in to 4 main sectors. The study was conducting in all Ministry of Health PHC centers in Jeddah city.

### Study Design

A cross sectional study of mothers attending well baby clinic in ministry of health primary health care centers in Jeddah city, Saudi Arabia, 2012.

### Study Population

All mothers attending well baby clinic in ministry of health primary health care centers in Jeddah city, who were present at the time of conducting the study.

### Sample Size

Assuming that, from the literature review, the awareness of women about folic acid as average as 20% according to study conducted to measures folic acid awareness among women in childbearing age in Jeddah 2008 which was 12%.<sup>1</sup> And another study of Maternal knowledge, attitude and practice on folic acid intake among Arabian Qatari women 2005 which was 57%.<sup>7</sup> so we have taken the average between two studies which was 20 %.

- Annually children attendance the WBC =65000
- Monthly children attendance the WBC = 5400

Setting the confidence interval of 95% and sample error of 4%, Total population of this study = 65000, adjusted sample size was estimated as 360 mothers.

### Inclusion Criteria

- Mothers attending well baby clinic in MOH primary health care centers in Jeddah city, Saudi Arabia in 2012.
- All nationalities.

### Sampling Technique

All mothers attending well baby clinic in ministry of health primary health care centers in Jeddah who were present at the time of conducting the study.

Sampling technique was multistage sampling:

**First stage:** We selected two centers from each sector by Simple random sampling technique, total = 8 primary centers.

**Second stage:** We selected 45 mothers from each center by convenience sampling technique.

### Data Collection Tool and Technique

Self-administered Questionnaire to measure folate knowledge and practice, based on specific items from the Pregnancy Risk Assessment Monitoring System (PRAMS) questionnaire (CDC, 2009).<sup>21</sup> The PRAMS questionnaire was developed in 1987 by the CDC and is revised periodically. Specific items used in this study were chosen from the 2009 version of the Maternal Nutritional Knowledge and Behavior section of the PRAMS Questionnaire.

The Arabic version 2000 from this Questionnaire was used in a study done in Jordan to assess Knowledge and practices of folate and multivitamin supplementation among Jordanian pregnant women.<sup>14</sup> It consists of 2 parts, 17 questions regarding socio demographic features and clinical data, knowledge and behavior of mothers concerning folic acid supplementation.

- **The first part:** information on demography and personal characteristics which include age, nationality, education level, parity and monthly income.
- **In the second part:** questions about general knowledge and practices about folic acid intake.

In the second part, ten questions selected from PRAMS Questionnaire were used to assess study variables about folate knowledge and practices and the two others questions used before in many articles.

The questionnaire was distributed to the mothers in the waiting area of the well-baby clinics by the researcher herself hand to hand and collected in the same way in the same time.

The researcher was available to clarify any issue and the questionnaires were collected in the same day. This was done over one month period.

## VARIABLES

### Dependent Variables

- Knowledge.
- Practices towards folic acid intake.

### Independent Variables

- Age.
- Nationality.
- Education level.
- Parity.

### Data Entry and Statistical Analysis

Data were entered and analysed by SPSS version 19. Continuous variables were presented as mean, range and standard deviation (SD) while categorical variables were presented as frequency and percentage. Student's t test was utilized to compare the means of two independent quantitative variables and ANOVA test was applied to compare the means of more than two independent quantitative variables. Chi-square test was used for testing the difference or association between two categorical variables. Significance was determined at p value < 0.05.

## ETHICAL CONSIDERATIONS

- Permissions from joint program of family and community medicine and the primary health care administration were obtained.

- Permissions of all PHC centers directors and relevant authorities were obtained.
- The researcher did her best not to disturb the primary health care clinics and she visited all the centers after arranging with the centers directors.
- The verbal consent from each mother to participate in the study was obtained.
- All information will be keeping confidential.
- The researcher acknowledged all participants in primary health care centers.

**Table 1: Baseline characteristics of physicians (n=366)**

| Personal characteristics                         |                           | Frequency | Percentage |
|--|---------------------------|-----------|------------|
| <b>Age in years (missed = 1)</b>                 | <25                       | 72        | 20.4       |
|  | 25-29                     | 114       | 32.3       |
|  | 30-35                     | 114       | 32.3       |
|  | >35                       | 53        | 15.0       |
|  | Range                     |           | 18-48      |
|  | Mean ± SD                 |           | 29.6±6.1   |
| <b>Nationality (n = 366)</b>                     | Saudi                     | 141       | 38.5       |
|  | Non-Saudi                 | 225       | 61.5       |
| <b>Educational level (missed = 1)</b>            | Illiterate/read and write | 56        | 15.3       |
|  | Elementary                | 27        | 7.4        |
|  | Intermediate              | 53        | 14.6       |
|  | Secondary                 | 91        | 24.9       |
|  | University and above      | 138       | 37.8       |
| <b>Gravidity (missed = 3)</b>                    | <3                        | 163       | 44.9       |
|  | 3-6                       | 175       | 48.2       |
|  | >6                        | 25        | 6.9        |
| <b>Household income (SR/month) (missed = 31)</b> | <4000                     | 162       | 48.3       |
|  | 4000-10000                | 129       | 38.5       |
|  | >10000-15000              | 27        | 8.1        |
|  | >150000                   | 17        | 5.1        |

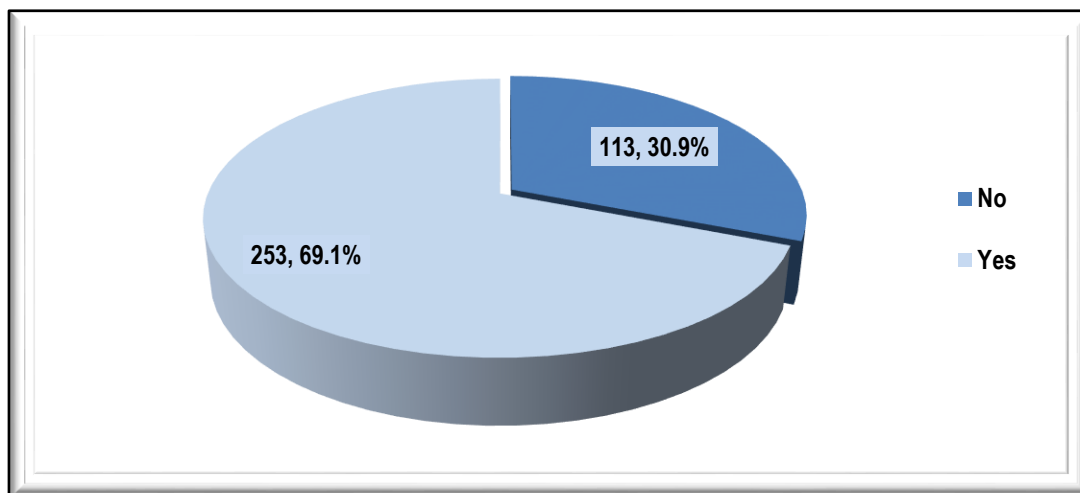
**Table 2: Knowledge of mothers regarding importance and sources of folic acid supplementation.**

| Statements   | Answer |      |
|--|--------|------|
|  | No.    | %    |
| <b>Some health experts recommend taking folic acid</b> |        |      |
| To prevent birth defects                               | 212    | 58.0 |
| To make strong bones                                   | 26     | 7.1  |
| To prevent high blood pressure                         | 2      | 0.5  |
| I don` know  | 126    | 34.4 |
| <b>I`m taking folic acid because</b>                   |        |      |
| I didn`t usually eat the right foods                   | 34     | 9.3  |
| It prevented heart disease                             | 7      | 1.9  |
| It was good for my general health                      | 73     | 19.9 |
| It would help me have a healthy baby someday           | 209    | 57.1 |
| My family or friends said it was a good idea           | 16     | 4.4  |
| My doctor or nurse said it was a good idea             | 101    | 27.6 |
| <b>Food that are rich in folic acid</b>                |        |      |
| Green leafy vegetables                                 | 114    | 31.1 |
| Fish   | 121    | 33.1 |
| Citrus Fruits  | 77     | 21.0 |
| Liver  | 54     | 14.8 |
| Milk   | 84     | 23.0 |

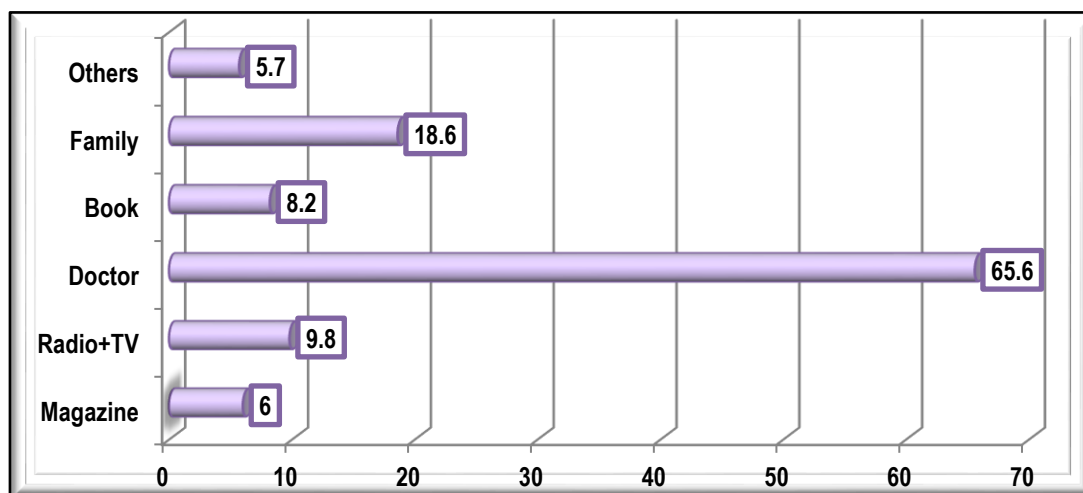
**Table 3: Factors associated with folic acid knowledge.**

| Associated factors   |                           | Folic acid knowledge score (0-3) | p-value  |
|--|---------------------------|----------------------------------|----------|
|  |                           | Mean ± SD                        |          |
| Age in years   | <25                       | 1.25±0.98                        | 0.033**  |
|  | 25-29                     | 1.61±1.02                        |          |
|  | 30-35                     | 1.68±1.01                        |          |
|  | >35                       | 1.57±1.01                        |          |
| Nationality  | Saudi                     | 1.97±0.86                        | <0.001*  |
|  | Non-Saudi                 | 1.33±1.04                        |          |
| Educational level  | Illiterate/read and write | 0.64±0.62                        | <0.001** |
|  | Elementary                | 1.37±1.01                        |          |
|  | Intermediate              | 1.30±0.99                        |          |
|  | Secondary                 | 1.69±1.01                        |          |
| Gravidity  | University and above      | 2.02±0.88                        | 0.228**  |
|  | <3                        | 1.56±1.03                        |          |
|  | 3-6                       | 1.65±1.02                        |          |
| Household income (SR/month)  | >6                        | 1.28±0.98                        | <0.001** |
|  | <4000                     | 1.19±0.96                        |          |
|  | 4000-10000                | 1.91±0.97                        |          |
|  | >10000-15000              | 1.67±0.92                        |          |
| Education from health care workers about taking vitamins with folic acid | >150000                   | 2.47±0.62                        | <0.001*  |
|  | No                        | 1.44±1.01                        |          |
|  | Yes                       | 2.16±0.92                        |          |

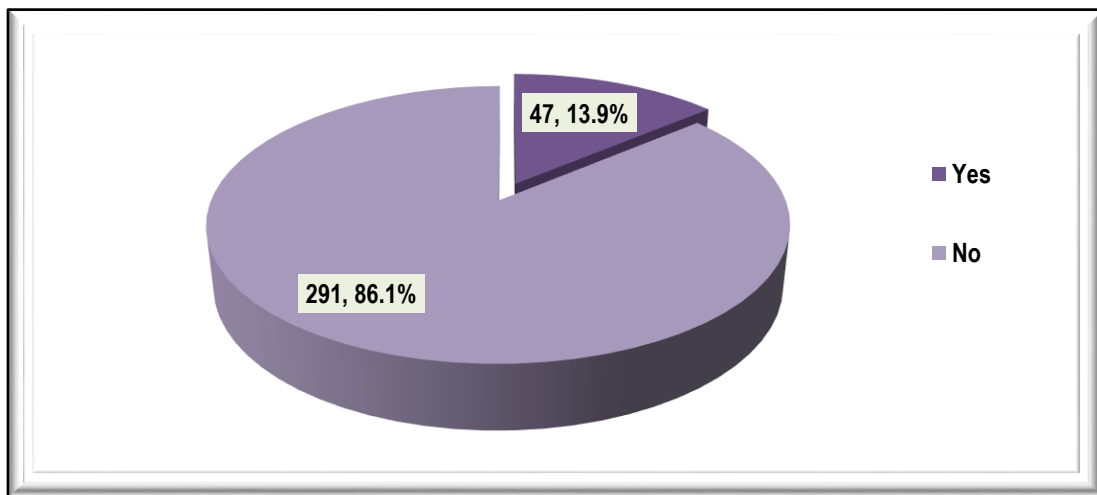
\* Student` t-test; \*\* ANOVA test



**Fig 1: History of hearing or reading that taking folic acid can help prevention of some birth defects.**



**Fig 2: Source of information about folic acid among mothers attended well baby clinics, PHC, Jeddah.**



**Fig 3: History of having education from health care workers about taking vitamins with folic acid before pregnancy.**

## RESULTS

### Baseline Characteristics

The study included 366 mothers. Their age ranged between 18 and 48 years and the mean age was 29.6 years (SD 6.1). Two-hundreds and twenty-five mothers (61.5%) were non-Saudi. More than one-third of them (37.8%) were at least university graduated. Gravidity was less than 3 among 44.9% of them while it was between 3 and 6 in 48.2% mothers. The total house income was less than 4000 SR per month in almost half of them (48.3%) while it was over 15000 SR among only 5.1% of them (Table 1).

### Folic Acid Knowledge

As obvious from figure 1, more than two-thirds of women (69.1%) reported that they had heard or read that taking the vitamin folic acid can help prevent some birth defects.

Prevention of some birth defect as a reason for taking folic acid. Less than 60% (58%) of women recognized that some health experts recommend taking folic acid to prevent birth defects and (57.1%), of the women knew the reason for taking folic acid. A small number (7.1%) identified making strong bones as a reason, and a very small number (0.5%) identified prevention of high blood pressure as a reason. The reasons for taking a folic acid during pregnancy were 'My doctor or nurse said it was a good idea' (27.6%), 'It was good for my general health' (19.9%) and 'It would help me have a healthy baby someday' (57.1%). The least frequent reasons were 'I didn't usually eat the right food' (9.3%), 'My family or friends said it was a good idea' (4.4%) and 'It prevented heart disease' (1.9%). (Table 2)

Regarding food that are rich in folic acid, 31.1% and 21% of women reported green leafy vegetables and citrus fruits, respectively as nutritional sources of folic acid.

The sources of knowledge varied, with almost two-third of women (65.6%) of women reporting that they had heard about folic acid from a doctor. Others reported that they heard about it from a family (18.6%), read about it in a book (8.2%), read about it in a magazine (6%) and 9.8% reported that they heard about it from a radio or television (Figure 2).

### Factors Associated with Folic Acid Knowledge

Table 3 demonstrates that the score of folic acid knowledge was highest among women aged between 30 and 35 years and lowest among those in the age group < 25 years (1.68±1.01 versus

1.25±0.98). This difference was statistically significant,  $p < 0.05$ . Saudi women showed higher significant folic acid knowledge score opposed to non-Saudis (1.97±0.86 versus 1.33±1.04,  $p < 0.001$ ). At least university educated women showed the highest folic acid knowledge score while those illiterate showed the lowest score (2.02±0.88 versus 0.64±0.62). This difference was statistically significant,  $p < 0.001$ . Similarly, women with higher income (>15000 SR/month) showed the highest folic acid knowledge score compared to those with lower income (<4000 SR/month) (2.47±0.62 versus 1.19±0.96). This difference was statistically significant,  $p < 0.001$ . Women who had education from health care worker before pregnancy showed significant higher knowledge score about folic acid than those who hadn't such education (2.16±0.92 versus 1.44±0.01,  $p < 0.001$ ). Gravidity was not significantly associated with folic acid knowledge.

### Using of Folic Acid Supplements

As illustrated in table 3, more than one-quarter of women (27.6%) reporting that they did not take multivitamin at all in the first trimester of pregnancy while the majority of them (85.2%) reporting that they did not take multivitamin at all in the last month of pregnancy and 87.4% did not intake folic acid before pregnancy. Among most of those not taking multivitamin during pregnancy (75%), the reason was 'I didn't think I need to take vitamins'.

### Folic Acid Education

As seen in figure 3, only 47 women (13.9%) reported having education from health care workers about folic acid before pregnancy.

### Intake of Food Rich in Folic Acid

Almost one quarter of women had never taken fruits and/or vegetables early in pregnancy and only between 3 and 6% had taken fruits and/or vegetables as 5 or more servings per day. (Table 4)

## FACTORS ASSOCIATED WITH FOLIC ACID INTAKE During the First 3 Months of Pregnancy

As shown in table 6, Saudi women significantly tended to intake folic acid supplementation during the first trimester of pregnancy more than non-Saudi women (82.3 versus 66.2%,  $p = 0.001$ ).

Women education appeared as a significant factor for folic acid intake during first trimester of pregnancy as the majority (90.6%) of at least educated women compared to only 26.8% of illiterate women have taken folic acid supplementation in that period,  $p<0.001$ . Women with gravidity less than 3 showed higher significant folic acid intake rate during the first trimester of pregnancy than those of higher gravidity ( $>6$ ) (79.1 versus 44.0%,  $p=0.001$ ). Women with higher income ( $>15000$  SR/month) showed significant higher folic acid intake rate during first 3 months of pregnancy compared to those with lower income ( $<4000$  SR/month) (88.2 versus 57.4%,  $p<0.001$ ). Women who had education from health care worker before pregnancy showed significant higher folic acid intake rate than those who hadn't such education (95.9 versus 66.3%,  $p<0.001$ ). Age was not significantly associated with folic acid intake during the first three months of pregnancy.

**During The Past Month**

Table 7 shows that Saudi women significantly tended to take folic acid supplementation during the past month more than non-Saudi women (23.4 versus 9.8%,  $p<0.001$ ). Women with higher income

( $>15000$  SR/month) showed significant higher folic acid intake rate during the last month compared to those with lower income ( $<4000$  SR/month) (35.3 versus 8.6%,  $p=0.003$ ). Women who had education from health care worker before pregnancy showed significant higher folic acid intake rate during the past month of pregnancy than those who hadn't such education (32.4 versus 10.7%,  $p<0.001$ ). Age, education and gravidity were not significantly associated with folic acid intake during the past.

**Before Pregnancy**

As illustrated in table 8, Saudi women significantly tended to intake folic acid supplementation before pregnancy more than non-Saudi women (19.1 versus 8.4%,  $p=0.003$ ). Women with higher income ( $>15000$  SR/month) showed significant higher folic acid intake rate before pregnancy compared to those with lower income ( $<4000$  SR/month) (23.5 versus 6.2%,  $p=0.007$ ). Women who had education from health care worker before pregnancy showed significant higher folic acid intake rate than those who hadn't such education (45.9 versus 4.1%,  $p<0.001$ ). Age, education and gravidity were not significantly associated with folic acid intake before pregnancy.

**Table 4: Using of folic acid supplements**

| Statements  | Answer |      |
|---|--------|------|
|   | No.    | %    |
| <b>Frequency of intake folic acid in the first trimester of pregnancy</b> |        |      |
| Didn't take multivitamin at all   | 101    | 27.6 |
| 1-3 times/week  | 24     | 6.6  |
| 4-6 times/week  | 29     | 7.9  |
| Every day of the week   | 212    | 57.9 |
| <b>Frequency of intake folic acid during the past month of pregnancy</b>  |        |      |
| Didn't take multivitamin at all   | 311    | 85.2 |
| 1-3 times/week  | 18     | 4.9  |
| 4-6 times/week  | 9      | 2.5  |
| Every day of the week   | 27     | 7.4  |
| <b>Intake of folic acid before pregnancy</b>                              |        |      |
| No  | 320    | 87.4 |
| Yes   | 46     | 12.6 |
| <b>Reasons for not taking folic acid before pregnancy (n=320)*</b>        |        |      |
| I wasn't planning to get pregnant   | 96     | 30.0 |
| I didn't think I need to take vitamins                                    | 240    | 75.0 |
| The vitamin give me side effect   | 2      | 0.6  |

\* Not mutually exclusive

**Table 5: Intake of food rich in folic acid early in pregnancy**

| Statements                                     | Answer                 |     |      |
|--|------------------------|-----|------|
|  | No.                    | %   |      |
| <b>Intake of fruits early in pregnancy</b>     | None                   | 84  | 23.0 |
|  | 1 or 2 servings/day    | 213 | 58.2 |
|  | 3 or 4 servings/day    | 57  | 15.8 |
|  | 5 or more servings/day | 11  | 3.0  |
| <b>Intake of vegetables early in pregnancy</b> | None                   | 85  | 23.2 |
|  | 1 or 2 servings/day    | 190 | 51.9 |
|  | 3 or 4 servings/day    | 69  | 18.9 |
|  | 5 or more servings/day | 22  | 6.0  |



**Table 6: Factors associated with folic acid intake during the first 3 months of pregnancy.**

| Associated factors   |                           | Folic acid intake during the first 3 months of pregnancy |            | X <sup>2</sup> -value<br>p-value |
|--|---------------------------|--|------------|----------------------------------|
|  |                           | NO   | Yes        |                                  |
|  |                           | No. (%)  | No. (%)    |                                  |
| Age in years   | <25                       | 24 (33.3)  | 48 (66.7)  | 3.36<br>(0.340)                  |
|  | 25-29                     | 30 (26.3)  | 84 (73.7)  |                                  |
|  | 30-35                     | 28 (24.6)  | 86 (75.4)  |                                  |
|  | >35                       | 19 (35.8)  | 34 (64.2)  |                                  |
| Nationality  | Saudi                     | 25 (17.7)  | 116 (82.3) | 11.17<br>(0.001)                 |
|  | Non-Saudi                 | 76 (33.8)  | 149 (66.2) |                                  |
| Educational level  | Illiterate/read and write | 41 (73.2)  | 15 (26.8)  | 83.96<br>(<0.001)                |
|  | Elementary                | 9 (33.3)   | 18 (66.7)  |                                  |
|  | Intermediate              | 18 (34.0)  | 35 (66.0)  |                                  |
|  | Secondary                 | 20 (22.0)  | 71 (78.0)  |                                  |
|  | University and above      | 13 (9.4)   | 125 (90.6) |                                  |
| Gravidity  | <3                        | 34 (20.9)  | 129 (79.1) | 14.21<br>(0.001)                 |
|  | 3-6                       | 52 (29.7)  | 123 (70.3) |                                  |
|  | >6                        | 14 (56.0)  | 11 (44.0)  |                                  |
| Household income (SR/month)  | <4000                     | 69 (42.6)  | 93 (57.4)  | 31.39<br>(<0.001)                |
|  | 4000-10000                | 20 (15.5)  | 109 (84.5) |                                  |
|  | >10000-15000              | 4 (14.8)   | 23 (85.2)  |                                  |
|  | >150000                   | 2 (11.8)   | 15 (88.2)  |                                  |
| Education from health care workers about taking vitamins with folic acid | No                        | 98 (33.7)  | 193 (66.3) | 25.87<br>(<0.001)                |
|  | Yes                       | 3 (4.1)  | 71 (95.9)  |                                  |

**Table 7: Factors associated with folic acid intake during the past month.**

| Associated factors   |                           | Folic acid intake during the past month of pregnancy |           | X <sup>2</sup> -value<br>p-value |
|--|---------------------------|--|-----------|----------------------------------|
|  |                           | NO   | Yes       |                                  |
|  |                           | No. (%)  | No. (%)   |                                  |
| Age in years   | <25                       | 65 (90.3)  | 7 (9.7)   | 2.39<br>(0.496)                  |
|  | 25-29                     | 96 (84.2)  | 18 (15.8) |                                  |
|  | 30-35                     | 101 (88.6)   | 13 (11.4) |                                  |
|  | >35                       | 44 (83.0)  | 9 (17.0)  |                                  |
| Nationality  | Saudi                     | 108 (76.6)   | 33 (23.4) | 12.61<br>(<0.001)                |
|  | Non-Saudi                 | 203 (90.2)   | 22 (9.8)  |                                  |
| Educational level  | Illiterate/read and write | 52 (92.9)  | 4 (7.1)   | 7.94<br>(0.094)                  |
|  | Elementary                | 22 (81.5)  | 5 (18.5)  |                                  |
|  | Intermediate              | 45 (84.9)  | 8 (15.1)  |                                  |
|  | Secondary                 | 82 (90.1)  | 9 (9.9)   |                                  |
|  | University and above      | 110 (79.7)   | 28 (20.3) |                                  |
| Gravidity  | <3                        | 140 (85.9)   | 23 (14.1) | 1.67<br>(0.433)                  |
|  | 3-6                       | 145 (82.9)   | 30 (17.1) |                                  |
|  | >6                        | 23 (92.0)  | 2 (8.0)   |                                  |
| Household income (SR/month)  | <4000                     | 148 (91.4)   | 14 (8.6)  | 14.02<br>(0.003)                 |
|  | 4000-10000                | 106 (82.2)   | 23 (17.8) |                                  |
|  | >10000-15000              | 20 (74.1)  | 7 (25.9)  |                                  |
|  | >150000                   | 11 (64.7)  | 6 (35.3)  |                                  |
| Education from health care workers about taking vitamins with folic acid | No                        | 260 (89.3)   | 31 (10.7) | 21.87<br>(<0.001)                |
|  | Yes                       | 50 (67.6)  | 24 (32.4) |                                  |

Table 8: Factors associated with folic acid intake before pregnancy.

| Risk factors   |                           | Folic acid intake before pregnancy |                | X <sup>2</sup> -value<br>p-value |
|--|---------------------------|------------------------------------|----------------|----------------------------------|
|  |                           | NO<br>No. (%)                      | Yes<br>No. (%) |                                  |
| Age in years   | <25                       | 66 (91.7)                          | 6 (8.3)        | 1.72<br>(0.632)                  |
|  | 25-29                     | 100 (87.7)                         | 14 (12.3)      |                                  |
|  | 30-35                     | 98 (86.0)                          | 16 (14.0)      |                                  |
|  | >35                       | 45 (84.8)                          | 8 (15.1)       |                                  |
| Nationality  | Saudi                     | 114 (80.9)                         |                | 9.04<br>(0.003)                  |
|  | Non-Saudi                 | 206 (91.6)                         | 27 (19.1)      |                                  |
| Educational level  | Illiterate/read and write | 53 (94.6)                          | 3 (5.4)        | 5.84<br>(0.211)                  |
|  | Elementary                | 22 (81.5)                          | 5 (18.5)       |                                  |
|  | Intermediate              | 49 (92.5)                          | 4 (7.5)        |                                  |
|  | Secondary                 | 77 (84.6)                          | 14 (15.4)      |                                  |
| Gravidity  | University and above      | 118 (85.5)                         | 20 (14.5)      | 0.813<br>(0.666)                 |
|  | <3                        | 145 (89.0)                         | 18 (11.0)      |                                  |
|  | 3-6                       | 150 (85.7)                         | 25 (14.3)      |                                  |
| Household income (SR/month)  | >6                        | 22 (88.0)                          | 3 (12.0)       | 12.03<br>(0.007)                 |
|  | <4000                     | 152 (93.8)                         | 10 (6.2)       |                                  |
|  | 4000-10000                | 106 (82.2)                         | 23 (17.8)      |                                  |
|  | >10000-15000              | 22 (81.5)                          | 5 (18.5)       |                                  |
| Education from health care workers about taking vitamins with folic acid | >150000                   | 13 (76.5)                          | 4 (23.5)       | 93.69<br>(<0.001)                |
|  | No                        | 279 (95.9)                         | 12 (4.1)       |                                  |
|  | Yes                       | 40 (54.1)                          | 34 (45.9)      |                                  |

## DISCUSSION

The percentage of women in this study reporting knowledge about folic acid was lower than in other regional, Asian and Western studies. In this study, more than two-thirds of reported that they had heard or read about folic acid. In a Canadian study<sup>16</sup>, 95% of the participants reported having heard of folate and in a UK study 81% of women were aware of the benefits of folic acid.<sup>22</sup> In a US study conducted with Hispanic women in Texas, 78% of mothers knew about folic acid.<sup>23</sup> Researchers who conducted a study in Malaysia found that 75.4% of the women reported having heard or read about folic acid.<sup>24</sup> However, it is high in comparison to other studies. For example in a Jordanian study, a little more than half of women reported having heard of folic acid.<sup>14</sup> This indicates that most Saudi women who had ever heard or read about folic acid in this study are also aware that it prevents some birth defects. This result supports that the sources of information for knowledgeable women were accurate enough, as they depended mainly on physicians.

In the present study, almost two-thirds of women took folic acid during first trimester of pregnancy and less than 15% took it during the past month or before pregnancy. This percentage of folate users in the current study is low in comparison to other studies. For example, in the study that was conducted in Qatar and Oman by Hassan and Al-Kahrusi, (2008),<sup>13</sup> the majority of women (88.7%) took the folic acid supplement, and in the UK study, 76% of participants reported using folic acid during the first trimester.<sup>25</sup> The results of the present study indicate that the most knowledgeable from health care workers women in the study had good compliance with use of folate.

The relatively low rate of knowledge concerning foodstuffs rich in folic acid reported among our cohort (31.1% and 21% of women reported green leafy vegetables and citrus fruits, respectively as nutritional sources of folic acid) could reflect the lack of a formal nutrition course as a part of their professional curriculum. The same has been reported in another study conducted on student pharmacists in USA.<sup>26</sup> The lack of certain specific knowledge concerning folic acid and prevention of NTDs in the American study was easily rectified. After participating in a short nutrition course, the same survey questions were readministered to the same student pharmacists. At that time, the proportion of student pharmacists who knew that folic acid could prevent NTDs was found to have increased significantly compared with before participation in the course. Significantly, increased proportions of student pharmacists also knew when and how much of this vitamin is needed for optimal protection from NTDs, and could correctly identify sources of folic acid. Providing increased education concerning folic acid and prevention of NTDs to university female students, may, therefore, represent one potential mechanism to increase awareness of this important public health message and increase consumption of folic acid by women of reproductive age.

In addition, In the USA, the Centers for Disease Control and Prevention have organised campaigns to inform the public and health professionals about the necessity for daily consumption of folic acid supplements by all women of childbearing age.<sup>27</sup> Furthermore, Chivu et al. (2007)<sup>28</sup> conducted a systematic review of studies designed to increase awareness of, knowledge about and consumption of folic acid before and during pregnancy.

Interventions included national or local campaigns, as well as printed and audiovisual media. The results revealed that, on average, women's awareness increased from 60% to 72%, knowledge from 21% to 45% and consumption from 14% to 23%. The authors concluded that interventions had a positive effect on folic acid intakes before and during pregnancy.

In the current study, the most common sources of folate knowledge were a doctor followed by a family. The least common resources were a book, magazine and media (television/radio). The same has been reported in a Jordanian study.<sup>14</sup> However, magazines/newspapers, doctors and television/radio were the most common sources of folate information in the Canadian study conducted by French et al. (2003).<sup>16</sup> Furthermore, the Malaysian study conducted by Fauzi et al. (2009)<sup>24</sup> indicated that 23.8% of women heard about folic acid from a health care provider, 24.5% from media, only 9.5% from literature, 10.9% from other sources and 31.3% from multiple resources. Therefore, most aware Saudi women depend on health care providers as a source of a medical knowledge. Moreover, the role of media is very limited in KSA.

The results of the current study showed that the higher the level of education and economic status (income), the significantly higher the folic acid intake. These results are consistent with many studies conducted in the UK,<sup>25</sup> Malaysia,<sup>24</sup> Jordan,<sup>14</sup> Qatar and Oman.<sup>13</sup> In addition, having education from a health care provider before pregnancy was associated with a significant higher rate of folic acid intake. Saudi women showed a significant higher rate of folic acid intake and knowledge than non-Saudi which could be a reflection of the role of health care provider in educating women in Saudi Arabia. The results of the current study also showed that the higher the number of previous pregnancies, the significantly lower the folic acid intake. An explanation might be that women in their first pregnancy get excited and want to take good prenatal care so they use whatever supplements they get from the health centres, which mainly include both folic acid and multivitamins. After they have had several children, it may be harder to get early prenatal care due to time and cost or the pregnancy may be unplanned.

Among limitations of the current study; first: it was conducted in one city Jeddah as well as most of the participants were non-Saudi, which limits the generalisability of study results to all Saudi women. However, a multi-stage sampling technique was adopted and women from different eight PHCCs were included. Second: the study used a self-report questionnaire, in which recall bias might be a consideration, especially when reporting the weekly intake of folic acid and food stuffs. Finally, primary health care centers do not represent the whole population.

## CONCLUSION

The results of this study showed that almost two thirds of women attended primary health care centers in Jeddah have heard or read about the importance of folic acid supplementation in preventing serious birth defects. The level of folic acid supplements intake during pregnancy was sufficient in the first trimester. However, it was insufficient before pregnancy. Folic acid knowledge and intake among some groups (Saudi, high educated, having information before pregnancy from HCWs) was encouraging, and suggests that folic acid education efforts may be beginning to make a difference among some women, mostly from populations that are more affluent.

## RECOMMENDATIONS

- It is the responsibility of health care providers especially physicians and nurses to educate women, particularly those of low education, about folic acid and multivitamins, and to provide precise information about their benefits especially in the periconceptional period.
- Involving medical students after training them in educational strategies would be successful.
- Increasing the fortification level and including all cereals and grains, as well as, flour would result in more prevention of NTDs.
- Additional measures directed at understanding folic acid usefulness and promoting folic acid awareness and consumption among all non-pregnant Saudi women of childbearing age are warranted.
- Sources of folate knowledge should be increased to include medical campaigns, media messages and educational programs. Finally, prenatal care visits should be encouraged not only for women who have their first pregnancy but also for those with previous pregnancies. These visits should be enriched with the essential information about the benefits and importance of folic acid.

## REFERENCES

1. Kari JA, Bardisi ES, Baitalmal RM, Ageely GA. Folic acid awareness among female college students: neural tube defects prevention. *Saudi Med J*. 2008 Dec; 29(12):1749-51.
2. Hema G, Piyush G. Neural tube defects and folic acid. *Indian Pediatrics* 2004; 41:577-86
3. Asindi A, Al-Shehri A. Neural tube defects in the Asir region of Saudi Arabia. *Ann Saudi Med* 2001; 21: 26-9.
4. King Faisal Specialty Hospital and Research Center. NTDR annual report 2010. Available at : [http://rc.kfshrc.edu.sa/rcf/Reports/NTDR\\_Annual\\_Report\\_2010.pdf](http://rc.kfshrc.edu.sa/rcf/Reports/NTDR_Annual_Report_2010.pdf). Accessed on March, 2012.
5. Wilson RD, Johnson JA, Wyatt P, et al. Pre conceptional vitamin/folic acid supplementation 2007: the use of folic acid in combination with a multivitamin supplement for the prevention of neural tube defects and other congenital anomalies. *J Obstet Gynaecol Can* 2007; 29: 1003-26.
6. Bener A, Al Maadid MG, Al-Bast DA, Al-Marri S. Maternal knowledge, attitude and practice on folic acid intake among Arabian Qatari women. *Reprod Toxicol* 2006; 21: 21-5.
7. Al-Hossani H, Abouzeid H, Salah M, et al. Knowledge and practices of pregnant women about folic acid in pregnancy in Abu Dhabi, United Arab Emirates. *EMHJ* 2010; 16(4).
8. Tamim H, Harrison G, Atoui M, Mumtaz G, El-Kak F, Seoud M, Yunis K; National Collaborative Perinatal Neonatal Network (NCPNN). Preconceptional folic acid supplements use in Lebanon. *Public Health Nutr*. 2009 May; 12(5):687-92.
9. Jou HJ, Hsu IP, Liu CY, Chung SH, Chen SM, Gau ML. Awareness and use of folic acid among pregnant women in Taipei. *Taiwan J Obstet Gynecol*. 2010 Sep; 49(3):306-10.
10. Chacko MR, Anding R, Kozinetz CA, Grover JL, Smith PB. Neural tube defects: Knowledge and preconceptional prevention practices in minority young women. *Pediatrics* 2003;112:536.
11. Sayers GM, Hughes N et al. A survey of knowledge and use of folic acid among women of child-bearing age in Dublin. *Journal of Public Health Medicine* 1997; 19(3): 328-32.

12. Bonin M, Bretzlaff J, Therrien S, Rowe B. 1998. Knowledge of periconceptional folic acid for the prevention of neural tube defects. *Arch Fam Med* 7:438–42.
13. Hassan AS, Al-Kharusi BM. Knowledge and use of folic acid among pregnant Arabian women residing in Qatar and Oman. *Int J Food Sci Nutr* 2008;59:70–9.
14. Abu-Baker N, Savage C. Knowledge and practices of folate and multivitamin supplementation among Jordanian pregnant women. *Journal of Research in Nursing* 2011: 1–12.
15. Green-Raleigh H, Carter H, Mulinare J, et al. Trends in folic acid awareness and behavior in the United States: The Gallup Organization for the March of Dimes Foundation Surveys, 1995–2005. *Matern Child Health J* 2006; 10: S177–S182.
16. French MR, Barr SI, Levy-Miline R. Folic intakes awareness of folate to prevent neural tube defects: a survey of women living in Vancouver, Canada. *J Am Diet Assoc* 2003; 103:181-5.
17. Morin P, Wals P, St-Cyr-Tribble D, Niyonsenga T, Payette H. Pregnancy Planning: A Determinant of Folic Acid Supplements Use for the Primary Prevention of Neural Tube Defects. *Canadian Journal of Public Health* 2002;93(4):259-63.
18. Chacko M, Anding R, Kozinetz C, et al. Neural Tube Defects: Knowledge and Preconceptional Prevention Practices in Minority Young Women 2000.
19. Judith Johnson Hilton .A comparison of folic acid awareness and intake among young women aged 18–24 years. *Journal of the American Academy of Nurse Practitioners* 19 (2007) 516–22.
20. Hermien E. K. de Walle, Lolkje T. W. de Jong-van den Berg. Ten years after the Dutch public health campaign on folic acid: the continuing challenge 2005. *Eur J Clin Pharmacol* 2008;64:539–43.
21. CDC. Use of supplements containing folic acid among women of childbearing Age -United States, 2007. *MMR* January 11, 2008; 57(01);5-8.
22. Sillender M. Continuing low uptake of periconceptional folate warrants increased food fortification. *Journal of Human Nutrition and Dietetics* 2000;13(6): 425–31.
23. Canfield MA, Przybyla SM, Case AP, Ramadhani T, Suarez L, Dyer J. Folic acid awareness and supplementation among Texas women of childbearing age. *Preventive Medicine* 2006; 43: 27–30.
24. Fauzi N, McKenna D, Yusoff A and Abd-Rahman N. Awareness and use of folic acid among Malaysian women of childbearing age. *International Medical Journal* 2009; 16(3): 201–9.
25. Brough L, Rees GA, Ctawford MA and Dorman EK. Social and ethnic differences in folic acid use during preconception and early pregnancy in the UK: Effect on maternal folate status. *Journal of Human Nutrition and Dietetics* 2009;22: 100–7.
26. Lynch SM. Assessment of student pharmacists' knowledge concerning folic acid and prevention of birth defects demonstrates a need for further education. *J. Nutr.* 2002; 132:439-42.
27. Bailey LB, Rampersaud GC and Kauwell GP. Folic acid supplements and fortification affect the risk for neural tube defects, vascular disease and cancer: Evolving science. *Journal of Nutrition* 2003; 133: 1961S–1968S.
28. Chivu CM, Brezis M, Tulchinsky TH, et al. Systematic review of interventions to increase awareness, knowledge, and folic acid consumption before and during pregnancy. *The Science of Health Promotion* 2007; 22(1): 1–9.

**Source of Support:** Nil.

**Conflict of Interest:** None Declared.

**Copyright:** © the author(s) and publisher. IJMRP is an official publication of Ibn Sina Academy of Medieval Medicine & Sciences, registered in 2001 under Indian Trusts Act, 1882. This is an open access article distributed under the terms of the Creative Commons Attribution Non-commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

**Cite this article as:** Ohoud H Balkhair. Maternal Knowledge and Practices About Folic Acid Intake Among Mothers Attending Primary Health Care Centers in Jeddah City, Saudi Arabia 2012. *Int J Med Res Prof.* 2019 Sept; 5(5):116-27. DOI:10.21276/ijmrp.2019.5.5.025