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Original Research Paper

Pregnant Women's Awareness, Intention and Compliance regarding Folic Acid Usage for Prevention of Neural Tube Defects According to Health Belief Model in Beni-Suef City

Hanan El-Zeblawy Hassan^{1*}, Entisar Mohammed Youness², Kamal Mohammed Zahran³ and Fatma Saber Nady⁴

¹Lecturer of Maternal & Newborn Health Nursing, Faculty of Nursing, Beni - Suef University, Egypt

²Assistant Professor of Obstetrics & Gynecological Nursing, Faculty of Nursing, Assuit University, Egypt

³Assistant Professor of Obstetrics & Gynecology, Faculty of Medicine, Assuit University, Egypt

⁴Demonstrator of Maternal & Newborn Health Nursing, Faculty of Nursing, Beni-Suef University, Egypt

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Background: Folic acid fortification to reduce NTDs, such as spina bifida and anencephaly as well as congenital heart disease, is considered one of the most successful public health initiatives in the past 50-75 years. No representative data about folate intake are available for Egypt. Despite, if FA guideline is followed, an estimated 50-80% of NTDs could be prevented, compliance with this guidance is sub optimal among women of childbearing age in Egypt.

Aim: Estimate the true prevalence of awareness, intention & compliance regarding FA intake, according to the health belief model in the Beni Suef city.

Methods: A descriptive cross-sectional study in antenatal care units which affiliates to five settings in Beni-Suef city with a total of 500 pregnant women by using a structured interview questionnaire.

Results: The great majority of the studied women had intention to follow a high Folate diet, only 3.6% had adequately used FA. Highly statistically significant difference between women's knowledge and their compliance with FA, HBM total score positively affects the studied women's intention to follow a high Folate diet.

Conclusion: Lower reports of FA used before pregnancy as revealed by this study could serve as a good indicator for the need for improvements in Egyptian health organizations.

Key words: Intention - Compliance - Folic Acid - Neural Tube Defects - Health Belief Model.

INTRODUCTION

Approximately 15% of pregnant women develop serious preventable complications, and millions of newborns do not survive the first week of life due to the absence or lacks of proper prenatal health care. Emerging evidence suggests that exposure to environmental stimuli, including dietary factors at the earliest stages of life may influence the risk of developing disease later in life in the offspring. A concept known as fetal programming, Folic acid (FA) supplementation in women was, therefore, introduced to address two principal problems, maternal anemia and Neural Tube Defects (NTDs). (BNFNB, 2004) and (Burdge & Lillycrop, 2010).

The latest prevalence of spina bifida and anencephaly rates in the United States, reported in 2006, was 3.05 and 1.56 per 10,000 live births, respectively (NTDs ascertainment project, 2010). On the other hand, the incidence of spina bifida in countries in which the fortification of enriched grain product with Folate is not compulsory or endorsed officially was 5.32

per 10,000 live births (ICBD Center, 2009). NTDs are birth defects of the brain and spine that can result in varying degrees of paralysis, loss of bowel and bladder control and even death. In addition, fortification with FA decreased Prevalence of oral-facial clefts (Yazdy & Xing, 2007), reduce the risk of stroke (Clarke et al., 2010), reduce rates of a childhood cancer called Wilms' tumor (Grupp et al., 2011), slow down the bone loss "osteoporosis" perhaps by decreasing homocysteine, delay menopause or relieve its symptoms, and reduce side-effects of estrogen replacement (Carlton, 2011). Also, lower incidence of breast cancer (Ericson et al., 2007).

Although there is no one perfect indicator of the Folate status of a population at this point, there are few that provide a fairly accurate picture. The recommended forms of biochemical measurements includes; Decreased serum Folate less than 7 nmol/L (3 ng/ml) is a short-term indicator of deficiency; Decreased red blood cell Folate less than 305 nmol / l (140

microg / l) is a long-term indicator of reduced body stores; increased serum homocysteine 12-16 micromole/l (1.62-2.2 mg/l) reflects inadequate Folate intake or Metabolism. Megaloblastic anemia: Macrocytosis or a mean corpuscular volume (MCV) of > 100fL) is raised by Folate deficiency (AACC, 2011). Researchers reported Folate recommendations during pregnancy as the following; The Upper Limit (UL) of FA for women (including during pregnancy): 800 mcg/day (0.8 mg) per day for 14-18 years old, and 1,000 (1.0 mg) per day for 19-50 year olds (CDOPH, 2010). Recently, the mother risk program has published guidelines for women of childbearing age, consisting of three different recommendations that vary according to age, ethnicity, compliance, and genetic congenital anomaly risk status (Wilson et al., 2007). However, women

1 µg of food Folate	= 1 µg of DFE
1 µg of folic acid from food or as a supplement taken with meal	= 1.7 µg of DFE
1 µg of folic acid taken on an empty stomach	= 2 µg of DFE

Folate deficiency may result from a failure to meet the increased body demand during pregnancy and lactation and may also be caused by a genetic condition that decreases the active form of methylene tetra hydro Folate reductase (Expert Group on Vitamins, Minerals & Food Standards Agency, 2003), short inter-pregnancy intervals, and may result from abnormal absorption, excretion or metabolism of Folate or a combination of both (Sanchez et al., 2006). A complete lack dietary Folate takes months before the deficiency develops as normal individuals have about 500–20,000 µg of Folate in body stores. Common signs & symptoms of Folate deficiency are subtle and include; nausea, loss of appetite, diarrhea, pale skin, macrocytic anemia, pregnancy complications, shortness of breath, nerve damage, limb numbness “peripheral neuropathy”, weight loss with poor absorption of other nutrients, mental confusion, forgetfulness or other cognitive declines, mental depression, sore or swollen tongue, peptic or mouth ulcers, headache, heart palpitations, irritability, and behavioral disorders. Low levels of Folate can also lead to homocysteine accumulation that associated with occlusive vascular disease. Synthesis and repair of DNA are impaired and this could lead to cancer development (Linus Pauling Institute, 2004 and Gentili, 2009).

The Health Belief Model (HBM) was designed as a psychological model to help explain and predict the adoption of a health behavior. It has been one of the most used health behavior change theories in health education, health promotion and disease prevention (Jones & Bartlett, 2010). This model demonstrates the relationship between an individual's attitudes towards a particular set of behaviors or conditions, and their subsequent willingness or ability to make changes to improve or protect their health (National observatory obesity, 2010). At its core, the model suggests that the likelihood of an individual taking action for a given health problem is based on the interaction between four types of belief (Figure A). The model predicts that individuals will take action to protect or promote health if: 1) they perceive themselves to be susceptible to a condition or problem, 2) they believe it will have potentially serious consequences, 3) they believe a course of action is available which will reduce their susceptibility, or minimize the consequences, & 4) they believe that the benefits of taking action will outweigh the costs or barriers (Maggie, D. & Wendy, M., 2006).

Nurses are often the first health care providers to encounter women with preconception and prenatal issues. Since

with a history of poor compliance with medications as well as other lifestyle issues such as no consistent birth control and possible teratogenic substance use are advised to consume a daily multivitamin containing 5 mg of folic acid. The minimum recommendation by health authorities is 400µg (0.4mg) folic acid supplementation in pregnancy (Health Canada, 2005 and WHO/CDC, 2008). Folic acid fortification to reduce NTDs is considered one of the most successful public health initiatives in the past 50-75 years (Berry et al., 2010). The Dietary Folate Equivalents (DFE) is used to measure Folate and FA. $DFE = [(total\ synthetic\ Folate) \times 1.7] + total\ food\ Folate\ intake$. So, a serving of food fortified with 50 mcg of FA would provide $1.7 \times 50 = 85$ mcg, (Stoltzfus & Dreyfuss, 2004).

education about Folate usage and proper consumption is a crucial component of NTDs and spina bifida prevention, nurses are in a key position to carry out health education, (Wynbrandt & Ludman, 2008). They are who have continuous contact with women, and are usually most accessible source of information for them. To facilitate this process, nurses can act as teacher and educators concerning dietary intake, weight management, and potentially harmful nutritional practices (Houghton, 2009). Educate women to take a daily supplement of 0.4 mcg of FA beginning before getting pregnant & continuing throughout the duration of pregnancy (Dobson et al, 2006), choose a supplement containing FA as fortified breakfast cereals and yeast extract, and to consume foods & drinks rich in Folate as peas and beans and orange juice (NIHCE, 2008). In order for providers to successfully counsel their clients, they must first understand the behavioral factors influencing a woman's adherence.

Significance of the study

Currently, the CDC recommends that all women of childbearing age consume 0.4 mg of FA per day and five mg for women at higher risk for NTDs (NIHCE, 2008) to significantly reduce the occurrence and recurrence of NTDs. If this guideline is followed, an estimated 50% to 70% of NTDs could be prevented (CDC, 2011). The most common anomalies in both live and still births in Egypt are the anomalies of Central Nervous System (CNS) (Tomatir et al., 2009). In Egypt the frequency of congenital malformations (CMs) among children aged 0-18 years were 2%. The estimated incidence of CMs of the CNS is 26.92%. Frequency of NTDs is 29.57% of that of the CNS (Shawky, M.R., and Sadiq, D.I., 2011).

Recent cohort data suggest that FA may also play a role in reducing the severity of NTDs. It is recognized that compliance with this guidance is sub optimal, although little is known about the reasons why? (Bol et al., 2006). Aside from reducing incidence of NTDs, different examples of various disease processes and defects and how naturally occurring Folate, or synthetic FA interferes with or decreases symptoms of these diseases or defects as reduce the risk of cleft lip by one-third (Wilcox & Solvoll, 2007), also a 70% decrease in the risk of spontaneous preterm labor and birth between 20th & 28th weeks gestation, and a 50% decrease between 28th & 32nd weeks gestation (Bukowski et al., 2009).

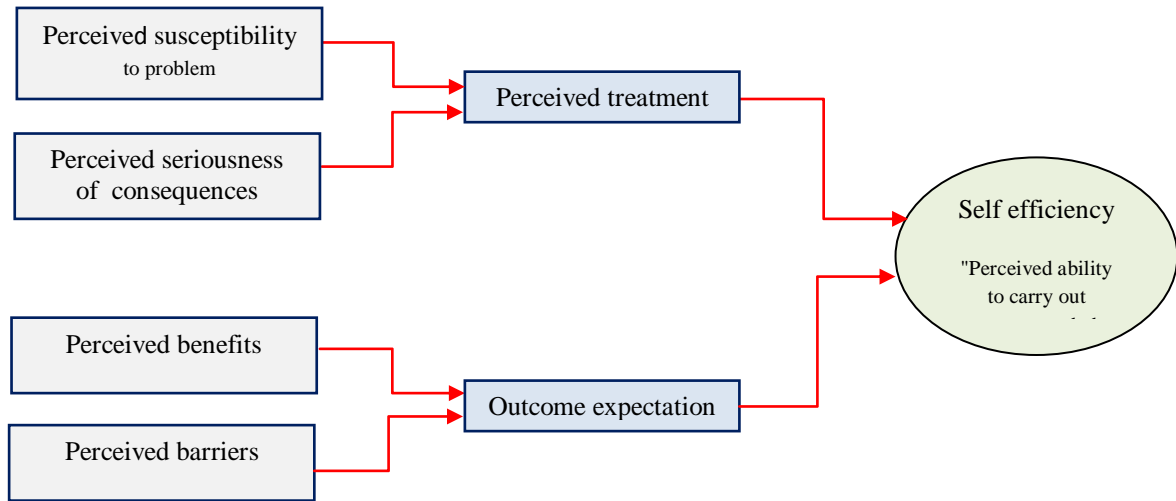


Figure A: The health belief model. **Source:** Nutbeam and Harris (2004)

No study has been conducted on the awareness and intake of additional FA among women at childbearing age in Egypt. In an effort to understand better the stagnancy of reported use of FA supplements in the face of global efforts to increase awareness and knowledge about FA, this study conducted to estimate the true prevalence of FA awareness, as well as to what extent the intention, identify and describe the relationship of reported awareness and intention of FA to the regular consumption of a vitamin containing FA in the general female population in Beni Suef city. In addition, the HBM can be used to guide examination of the women's Folate attitudes, behaviors and beliefs, and detect appropriate educational techniques.

Aim of the study

The present study was conducted to assess women's awareness, intention & compliance regarding of FA intake before and during pregnancy, according to the health belief model in the Beni Suef city.

Research questions

Are women's awareness and attitude toward FA benefits of intake affected their intention and compliance to follow a high Folate diet?

Subjects and Methods

I. Research design

A descriptive cross-sectional study design was chosen for this study.

II. Research Setting

The study was conducted in antenatal care units which affiliate to five settings in Beni-Suef city. These settings include; Three Primary Healthcare Centers (PHCs) and two hospitals which entailed.

1. Beni Suef University Hospital
 - Antenatal care unit & outpatient clinic
2. General Hospital.

- Antenatal care unit & outpatient clinic
- 3. The Primary Healthcare Centers
 - Maternal and child health care number "1 "
 - Maternal and child health care number "2 "
 - Maternal and child health care number "3 "

III. Subjects

No previous studies have been conducted to assess the awareness and intake of additional FA among women of childbearing age in Egypt. In estimating the true prevalence of FA awareness in the general female population, it was assumed that this would be approximately near to the numbers previously reported. In the UK 21-48% use FA, in Iran 27. 6% were knowledgeable about FA importance, and 20.12% use it (Nosrat *et al.*, 2012), in Dubai 88.1%use it at some times (Wilton *et al.*, 2009). Prevalence of the use in Egypt is unknown, so the average prevalence was 50%. The sample size was selected by convenient purposive sampling by EPI INFO, 2000 statistical package, according to the equation for a sample size for descriptive study design $n = Z_{1-\alpha/2}p(1-p)/d^2$ (Bhalwar *et al* 2009). The total sample size was 380 for women who were registered with PHCs, Beni-Suef University and General hospital seeking antenatal care.

- The sample size was raised to 500 for greater power of the study and to safeguard against any missing items of the questionnaire and get more informative results.

IV. Tool of data collection

- A semi structured interview questionnaire was designed based on the literature review. The questions were modified from a version of an FA quiz from the CDC (found at <http://www.cdc.gov/ncbddd/folicacid/quiz.html>). (CDC, 2010).
- Collection of data by using one tool which contains three main parts as follows:

Part I

Includes socio-demographic data; medical & obstetrical history, level of education and income.

Part II

Questionnaires for awareness, Practice of FA usage and self-report adherence & compliance of FA among women in child bearing age.

The questions covered the main points about Folate and health.

- Awareness is measured based on the "yes" response to the question, "Have you ever heard about Folate and folic acid"? A scoring system of women's knowledge was developed by the researcher. The total grade of knowledge equal 18 grades, each correct answer took 2 grades; incomplete answer took 1 grade, while wrong one took zero. The total knowledge score was classified as: <60% was regarded as inadequate knowledge and $\geq 60\%$ was regarded as adequate knowledge.
- Practice of FA usage is measured as folic acid use was recorded into 3 categories: "1" indicates adequate use "reported use before and during pregnancy", "2" indicates sub-adequate use "reported using only before or during pregnancy" "3" indicates never used "reported not taking supplements neither before nor during pregnancy".
- Compliance assessment is measured by questionnaire by asking the studied women how many times have you forgotten or have you chosen not to take your FA tablets? Pill counting adherence, defined Women as compliant if they took 65% or more of the prescribed supplements, which translated to taking the supplements at least 4d/wk. A similar definition of adherence was used in previous studies based on self-reported adherence data (CDC, 2007 and Jastiet al., 2005). Pill count adherence = Number of tablets taken in last month / Number of tablets prescribed in last month * 100

Part III

Questionnaires for perception related to FA taking behavior according to HBM.

- The health belief model assumes that behavior depends upon the expected outcomes of an action and the value an individual places on those outcomes. It comprises of 18 items, statements included all constructs of the HBM, Which are: "1" perceived susceptibility, "2" perceived severity, "3" perceived benefits, "4" perceived barriers, "5" self-efficacy and "6" cues to action. The way a person relates themselves to each of these areas is predictive of how likely they are to engage or not engage in a certain behavior.
- The health belief model is constructed using a Likert scale. In this study this scale consists of several declarative items that designed to assess participants' beliefs about Folate. The questionnaire developed was a modified version of the HBM questionnaire used in a study by Kloebler and Batish (1999), which was found to be predictive of intention to permanently follow a high Folate diet in low-income pregnant women and found that perceived benefits was the most predictive of intention to follow a high Folate diet (Folate intention). To make the questionnaire more practical for use with limited time, the questionnaire

was shortened from its original 56 statements to 18 statements; omitting redundant statements. Also, statements from all constructs of the HBM were included.

- Respondents were asked to indicate the degree to which they agree or disagree with the opinion expressed by the statement. Then a person's total score was determined by adding together individual item scores to form a summated rating scale which was scored by the Likert scale with six options from strongly agree (score 6) to strongly disagree (score 1). In the reverse condition of the answers for the perceived barriers construct, absolutely disagree scored "6" and absolutely agree scored "1".
- A scoring system of women's perception was designed by the researcher. The total grade of perception equal 108 grades. The total perception score was classified as: <60% was regarded as negative perception and $\geq 60\%$ was regarded as positive perception. A higher HBM total score reflects greater support for a woman's likelihood to follow a high Folate diet.

V. Methods of data collection

This study was covered in the following phases:-

- Validity of tool:** Five experts reviewed the content validity of the tool from maternity and gynecological nursing professors and obstetric and gynecological medical professors.
- Reliability:** Confirming the stability of the questionnaire, Cronbach's alpha was used because it gives the minimum reliability coefficient scale.
- Administrative and Ethical Aspects:** A written permit clarifying the purpose of the study was obtained from the director of the PHCs, University and General Hospital. An informed consent to conduct the study, after explanation of the study's aim, was taken from each studied women to protect their rights before the start of the study. Every woman participating in the study was assured clearly about the confidentiality of the information gathered, and its use only for this study. A unique identifying number (subject ID) was assigned to the data collected from each woman to maintain confidentiality.
- Pilot study:** A pilot study was implemented in 10% of women included in the study, which was equal to 50 to ascertain the relevance of the tools, and estimate the length of the time needed to fill the sheet. Analysis of the pilot study revealed that minor modifications are required. These modifications were done and women included in the pilot study were included in the total sample.
- Field Work:** The researcher identified herself to the subjects and explained to them the nature of the study, its importance and procedures to be performed. Data collection took about 45 minutes for each woman to fill a questionnaire on the scheduled days for antenatal care in the selected settings as: Saturday, Monday, and Wednesday from 9:00 a.m. until 12:00 p.m. in the antenatal units. The assessment of data took 8 months to be collected during the period from January 2013 to August 2013. By reviewing the antenatal visits' appointment in the selected settings of the study, the researcher

interviewed the participants face to face on the day of visit to answer a questionnaire in the antenatal clinics in the PHCs, University and General Hospital. During this interview the researcher clarified the aim of the study to the women and that their level of knowledge and perception is very important to enable healthcare providers to better meet the needs of pregnant women. The questionnaire was obtained and questions that assessed participants' Folate knowledge were answered, then the researcher provided the studied women with detailed, accurate Folate information that included health education and distributed brochures to raise awareness about FA. This health education included: The nature of FA, signs and symptoms of its deficiency, complications of its deficiency during pregnancy, and nutritional sources of Folate, and answer the questions of participants related to this subject. Finally, the researcher assessed the HBM model constructs. The researcher constructed a categorization both for the studied women's knowledge about FA intake pre and during pregnancy as follows: inadequate if <60% of all questions were answered correctly, adequate knowledge was considered if $\geq 60\%$ of all questions were answered correctly. A scoring system of perception also took negative if <60% of all statements were answered correctly, positive perception was considered if $\geq 60\%$ of all statements were answered correctly.

- f) **Statistical Design:** Collected data were coded and analyzed. Proper statistical tests were used to determine whether there was a significant difference or not, using the statistical package for social science (SPSS), version 20. As follows:
- Description of quantitative variables as mean and SD (Mean \pm SD)
 - The student t-test was used for comparison of means of two independent groups.
 - Chi-square " χ^2 " was used for comparison of frequency and percentages of qualitative variables.
 - Regression analysis was run to assess the effect of the independent variables (women characteristics) on the dependent variables (knowledge, perception, intake of FA).
 - Probability (p-value) was considered as follows:
 - P value > 0.05 insignificant
 - * P < 0.05 mild significant
 - ** P < 0.01 moderate significant
 - *** P < 0.001 highly significant

Results

Table (1): Shows that women's mean age was 26.115 ± 5.515 , while 39.4% of them had secondary education. The majority of them (93.4%) were housewives, 77% of women were living in urban areas, and 59.2% were of extended family type. Moreover, 76.6 % of them were multiparous.

Table (2): It is obvious from the table that slightly more than two thirds (71.6%) of the studied women had an awareness and understanding of FA. Also, this table demonstrates that more than one quarter of women (28.4%) didn't know its natural and couldn't describe it, while only 4.6% described FA as a dietary supplement for prevention of pregnancy complication & help in implantation of the embryo, medication

for management of weak fetus, calcium supplement for mother and fetal health, and supplement for better health for women. In addition, it reveals that more than half (55.0%) of the studied women didn't know sources to get Folate and FA. Moreover, approximately one third of women (32%) didn't know anything about FA benefits during pregnancy, while other ones had general knowledge that "FA decreases the risk of NTDs". Shortly, the great majority of the studied women (80.4%) had an inadequate level of knowledge about FA.

Figure (1): Demonstrates that more than two thirds of the studied women (70.8%) took FA during the current pregnancy, almost (95.8 %) of them took it when they found out they were pregnant "sub-adequate use", while only (3.6%) took it pre and during pregnancy "adequate use". In addition, it shows their perceived causes of non-usage of FA, it revealed that 38.4% of the studied women who reported non- intake of FA as they need prescription in order to take it, other reasons mentioned by 20.6% of the studied women mentioned other causes as presence of side effects, too busy to remember taking it, high cost, had false impression that she got balanced nutrition from foods, have a healthy fetus and any medication taken during pregnancy will cause bleeding, doctor tell them that you don't need it, and fear of any medications.

Figure (2): Reveals that the great majority of the studied women had intention to follow a high Folate diet.

Figure (3): Indicates that 63.8% of the studied women who reported intake of FA were compliant to its intake.

Table (3): Demonstrates the studied women according to their opinion regarding the governmental strategies of FA fortification "whether or not FA should be added to all bread products". Almost more than two thirds of them (70.6%) agreed with this concept. The key perceived benefits of adding FA into all bread products were that every pregnant need it at 61 %. Other opinions were regarding the addition of FA to bread products represents 5.9% and includes (folic acid in bread is better than medication, agree if it is important for me, why not, agree only if doctor prescribe it, and this help me get better health). Those who were against this strategy of inclusion of FA in bread products mainly 5.4% and included (take only medication prescribed by a doctor, may create a nutrient imbalance in the body, and may be harmful. Presence of side effects, and not important, we don't take anything and have a healthy baby).

Table (4): Illustrates that there was a highly statistically significant difference between women's compliance with FA and their knowledge ($p=0.005$). While there wasn't a statistically significant difference between women's compliance with FA and their perception related to FA intake behavior ($p=0.205$)

Table (5): Illustrates that the studied women's age, level of education, occupation and parity were determinants of FA usage with statistically significant difference ($p=0.020, 0.001, 0.045, 0.001$) respectively.

Table (6): Shows the relationship between current intake of FA and knowledge of the proper time of intake, only 16.1% of those who took FA knew the proper time of intake "before and during pregnancy,", highly statistically significant difference ($p=0.001$). It is obvious that 53.7% of them didn't know other ways to get it, with a highly statistically significant difference ($p=0.001$). Moreover, near half (44.1%) of the studied women who reported FA intake with the current pregnancy mentioned that; macrocytic anemia is the main complications associated with deficiency of FA intake, and 4% listed other complications as "bad development of fetus, preterm birth, gestational diabetes, general sickness, weakness, decrease calcium in the mother and fetus, and Pregnancy Induced Hypertension (PIH).

With highly statistically significant difference ($p=0.001$). Also, it is clear that more than three quarters (75.4%) of the studied women who had awareness about FA, as well as reported taking it, mentioned that physicians were the main source of their knowledge with a highly statistically significant difference ($p=0.001$).

Table (7): It is clear from table that knowledge of time of intake, age groups, levels of perception, mother educational level, and knowledge of complications associated with FA deficiency had more effect on the dependent variable (FA intake) as the odd ratio = (1.715, 1.435, 1.333, and 1.007) respectively and the accuracy of prediction about 87.9%.

Table (8): Illustrates that perceived susceptibility ($r = 0.422$, $p < 0.001$), perceived severity ($r = 0.228$, $p < 0.001$), perceived barriers ($r = 0.433$, $p < 0.001$), self efficacy ($r = 0.561$, $p < 0.001$), cues to action ($r = 0.597$, $p < 0.001$), and the HBM total score ($r = 0.600$, $p < 0.001$) positively affects the studied women's intention to follow a high Folate diet.

Discussion

Nutrition plays an essential role in the development of a healthy pregnancy. Not only does the pregnant woman need to have an understanding of the essential nutritional elements, but she must also be able to assess and modify her diet for the developing fetus and her own nutritional maintenance (Olsen, 2008). Nurses need to be alert of their vital role as disseminators of this information to women they care for (De Rosset et al., 2009). Despite the fact that Beni Suef district had the highest number of new births, in 2010; (21% of all births in Beni Suef). The populations living in these areas are reflected to be middle to low income class families, thus their children are more prone to nutritional deficiencies (El Sayed, 2012). Also, as many women do not plan a pregnancy, in particular those at nutritional risk because of poor dietary habits and/or socioeconomic status.

As a significant cause of morbidity and infant mortality, neural tube defects such as spina bifida and anencephaly represents a worldwide public health concern. Globally, NTDs affect more than 300,000 pregnancies annually; approximately 3,000 of those occur in the U.S. (CDC, 2011). Studies have also shown that 50-80% of NTDs can be prevented if a woman consumes a sufficient amount of FA (0.4mg) daily before the conception, and throughout the first trimester of her pregnancy (Czeizel et al., 2004 & Wolff et al, 2009). The result of the present study showed that 42.6% of them aged 18-24 years, while more than one-third (39.4%) of them had secondary education, and the majority of them (93.4%) were house wives (table 1). These findings are not consistent with Riazi et al. (2012) who studied awareness of pregnant women about FA supplementation and found that (32.9%) of the studied women's age ranged from 20-24 years old, while the majority of individuals (42.9%) had elementary education, and in the line with the same investigator regarding occupation, who stated that most respondents (95.7%) were housewives.

The prevention of NTDs mainly depends on the awareness and use of supplements containing FA as well as antenatal screening for NTDs. No representative folate intake data are available for Egypt, but it was estimated that cereal foods could contribute to 60% of the daily folate intake (Hefni et al., 2010). The present study findings revealed that more than two thirds (71.6%) of the studied women had awareness regarding FA (table 2). These findings are in line with Jou, et al., (2009) in Taipei, Taiwan who found that nearly 90% of the women reported that they had heard about FA. Also, with

findings of Al-Hossani et al., (2005) in Abu Dhabi, United Arab Emirates who found that FA of heard have to claimed 79.1% However, they aren't in line with Nawapun and Phupong, (2007) who reported that the awareness of FA was 24.4% among Thai women. The present study showed a high level of awareness of FA, but reflected poor knowledge regarding FA and the prevention of NTDs. A possible explanation for this gap was that pregnant women receive their antenatal care soon after confirmation of pregnancy. This indicates a poor notification of health care personnel and lacks of public health efforts about the issue of FA and NTDs in spite of poor nutritional habits. Only 17.2% described FA as a dietary supplement to prevent birth defects. These findings aren't in line with findings of Kalafatelia and Fryer (2011) in New Zealand who reported that 30% of those who had heard of FA described it as something that was needed before/during pregnancy to specifically help minimize the risk of NTDs (i.e. spina bifida). Moreover, more than half (55.0%) of the studied women didn't know what other sources to get folate and FA. These results contradicted with findings of Kalafatelia and Fryer (2011) who found that 88% were aware that FA was available through supplements. This study suggested that pregnant women are not motivated to alter their dietary habits. More likely, they are influenced either by social pressure from doctors or a family member, which implies that information from these personal sources could provide valuable support for dietary change. Also, dietary behavior during pregnancy is characterized by specific food cravings or food aversions (Reeves et al., 1998) in Michigan. Briefly, the present study findings revealed that more than three-quarters (80.4%) of the studied women had an inadequate level of knowledge about FA. Egypt does not have any specific official recommendations about FA periconceptional use. The key findings of the present study were that overall, more than two thirds (70.8%) of the studied women took FA during current pregnancy. Almost of them (95.7%) took it when they found out they were pregnant "sub adequate use". This result is in the opposite direction with Nosrat et al., (2012); Wilton & Foureur 2009). Also, with results of Tarrant et al. (2011) who investigated maternal health behaviors during pregnancy and associations with socio-demographic and infant characteristics in Ireland and found that 88% of women took FA during pregnancy and 44% of them took supplement before the conception/during the 1st month of pregnancy.

In the worth, 38.4% of the studied women who reported non intake of FA their justification was that they need a prescription in order to take it, other reasons mentioned by 20.6% of them such as presence of side effects, too busy to remember taking it, high cost, had the false impression that she got balanced nutrition from foods, have a healthy fetus and any medication taken during pregnancy will cause bleeding, doctors said you don't need it, and fear of any medication (figure 1). Stenglin et al., (2010) supporting these findings in European countries that main reasons reported by women for not taking FA in the periconceptional period were: deficient advice 43% and lacks of awareness 40%. Interestingly, according to the present study the initial visit may be at the end of the 1st trimester, and soon it's away from period of neural tube formation, and prescription of FA in this time is not important. In studying women's intention to follow a high folate diet, the present study revealed that the great majority (89.8%) of the studied women had intention to follow a high folate diet (figure 2). Intake of FA tablets as reported in this study was clear that 63.8% of the studied women who took FA were had compliance to its intake by using pill counting formula (figure

3). These findings are in agreement with the result of Tucker, et al., (1996) who found that only about one-third of patients comply with treatment, one-third partially comply & one-third never comply. While contradicted with the findings of Ibrahim et al., (2011) who reported that 63.3% of women in Suez Canal showed no compliance and 36.7% showed compliance.

The only reasonable approach to maintaining adequate periconceptional levels of FA would appear to be through food fortification. Recently in 2010, Egypt introduced mandatory folic acid and iron fortification of the flour used for the production of subsidized pita bread (GAIN, 2009) to reduce the incidence of both neural tube defect, and anemia. Almost more than two third (70.6%) of study women agreed with this strategy of fortification. The key perceived benefits of adding FA into all bread products represented by 61% of the studied women and was that every pregnant woman need it and 39.5% of those against the mandatory fortification objected as they "don't like the idea of the everyone being medicated" (table 3). According to the present study findings, there is a lack of public health advice regarding the benefits of fortification and so women are least likely to benefit from this strategy. A highly statistically significant difference was observed between women's compliance to FA and their knowledge (table 4). For determinants of FA usage, the present study revealed that there was a statistically significant difference between women's intake of FA and their occupation, age, level of education and parity (table 5). These findings aren't in line with findings of Nosrat et al, (2012), and Jou, et al., (2009) who reported that educational level and age of mothers did not relate to the correct intake of FA among pregnant women in Taipei, Taiwan. While it is consistent with Vitale et al., (2009) who reported that age, and education are independently and statistically associated with intake of FA among pregnant women in Croatia. Also, McNally & Bourke., (2010) who reported that mothers living in rural locations were more likely than mothers living in urban locations to report taking FA during pregnancy. When referring to FA intake and the studied women's obstetrical history as a determinant of its usage, the present study revealed that mean parity (1.93 + 1.63) was the statistically significant independent factor affecting FA intake. These findings are in line with findings of Timmerman S et al., (2009) who found that multiparity was also positively associated with inadequate FA use in the urban population in the Netherlands. This indicates that women receive advice and counseling only during pregnancy and this necessitate importance of teaching women about the benefits of FA intake with any contact with health personnel as in family planning, Pap smear, etc. So, official health education initiatives have promoted FA supplementation and a diet rich in folate through mass media, including TV, newspapers, and magazine articles worldwide (CDC., 2010). Public health campaigns aimed at increasing awareness, knowledge, and periconceptional use of FA. It should concentrate on using appropriate intervention methods worldwide. Narasimhan, (2012) & The CDC, (2011) recommended that all women of childbearing age should consume 0.4 mg of FA per day and 5 mg for women at higher risk for NTDs.

The present study illustrated that there was a highly statistical significant difference between women's intake of FA and their knowledge and perception (table 6). These results are consistent with Chacko et al., (2003) who studied the knowledge about NTDs and Preconceptional prevention practices in minority young women in Texas and found that adequate folate diet was not associated with knowledge, while Anzaku (2013) in Nigeria reported that women who had

knowledge of FA took it at some points during the periconceptional period. In more details, When refer to the relationship between women's intake of FA, women's knowledge of proper time of intake, and ways of getting FA, interestingly, despite the fact that only 16.1% of those who took FA listed pre and during pregnancy as the proper time of intake. More than half of them didn't know other ways or sources to get FA. With regard to the relationship between women's intake of FA and their knowledge of complications of its deficiency, it is reasonable to assume that those women who took a daily supplement containing FA might not have been doing so for any particular reason related to FA and the prevention of birth defects. As the present study indicated that only 18.6% of women who reported current intake of FA listed NTDs as a main complication. In contrast, these results contradicted the study of Tekkesin & Taser, (2012) who, reported that women in Istanbul, Turkey, who were aware of the importance of the FA were 1.6 times more likely to take periconceptional FA than women who, were unaware of it. The present study showed that more than three quarters (75.4%) of the studied women who reported taking FA had received their knowledge from a physician. These results are consistent with Wilton & Foureur (2009) in Dubai, who reported that 76.2% of women who took FA cited a medical practitioner as the source of their information on the need for FA. These occurred as people place higher trust on the physician, and obey their instructions.

Moreover, by using the binary logistic regression between dependent variable (FA intake) and independent factors (the studied women characteristics), it is clear that levels of knowledge of other ways to get FA, knowledge of time of intake, Age groups, mother educational level, and knowledge of complications associated with FA deficiency had more effect on dependent variable (FA intake) as the odd ratio= (0.971, 1.715, 1.435, 1.333, and 1.007) respectively and the accuracy of prediction about 87.9% (table 7). This is in the same line with Kloeblen & Batish (1999) who investigated folate knowledge, intake from fortified grain products, and periconceptional supplementation patterns of a sample of low-income pregnant women, according to the HBM in Atlanta and found that Perceived susceptibility, perceived severity, perceived benefits, self-efficacy and the HBM total score were positively correlated with folate intention. The perceived barriers construct was negatively correlated with folate intention.

Importantly, this high level of perception achieved after clarification of the importance of the FA in relevant information to them, its natural sources which already are available in our country, cost effective, and break down the barriers to daily use of FA by the women. This may increase the likelihood of engaging in this positive health behavior through using of media, showing pictures of an infant with NTDs or disability, and perhaps even joking about the myth that vitamins make you fat. Regarding the relationship between constructs of HBM and the studied women intention to follow a high folate diet, the present study revealed that a statistically significant difference between them. In contrast, these results contradict studies by Kloeblen & Batish (1999) who found no correlations between the HBM constructs and parity or maternal ethnicity. It is clear that the HBM statement was clear, obvious, and easily understood, and the majority of women respond after clarifications of the model positively and showed their predisposition to engage in this positive behavior regardless of their characteristics. (table 8)

Table 1: Distribution of the Studied Women According to their Characteristics

Variable	Total (n = 500)	
	No	%
Age groups		
18-24	213	42.6 %
25-34	243	48.6 %
35-45	44	8.8 %
Mean \pmSD	26.115 \pm 5.515	
Women's educational level		
Illiterate	154	30.8 %
Read and write	108	21.6 %
Secondary education	197	39.4 %
University education	37	7.4 %
Post graduate education	4	0.8 %
Occupation		
Housewives	467	93.4 %
Working	33	6.6 %
Residence		
Urban	115	23 %
Rural	385	77 %
Type of family		
Nuclear	204	40.8 %
Extended	296	59.2 %
Parity		
Nullipara	117	23.4 %
Multipara	383	76.6 %

Table (2): Distribution of the studied women according to their awareness of Folate and FA

Variable	Total (n = 500)	
	No.	%
Awareness of FA; (Hearing about FA.)		
Yes	358	71.6%
No	142	28.4%
Mother's description of FA.		
Dietary supplement	104	20.8 %
Dietary supplement for anemia	82	16.4 %
Dietary supplement for better fetal health and prevent birth defects	86	17.2 %
Iron ,vitamin	41	8.2 %
Medication	22	4.4 %
Don't know it	142	28.4 %
Others	23	4.6 %
#Sources of getting Folate or FA.		
Taking dietary supplements	104	20.8%
Eating fortified foods	54	10.8 %
Eating diet high in vitamins	74	14.8 %
No other ways, none	8	1.6 %
Don't know	275	55.0 %
#Benefits of FA during pregnancy.		
Helps ensure women have a healthy baby	163	32.6 %
Decreases the risk of NTDs	117	23.4 %
Help your body create RBCs	136	27.2 %
Don't know	160	32.0 %
knowledge level		
Adequate	98	19.6 %
Inadequate	402	80.4 %

#More than one option was checked.

Figure (1): Distribution of the Studied Women According to their Current & Adequate Usage and Perceived Causes of non Usage of FA.

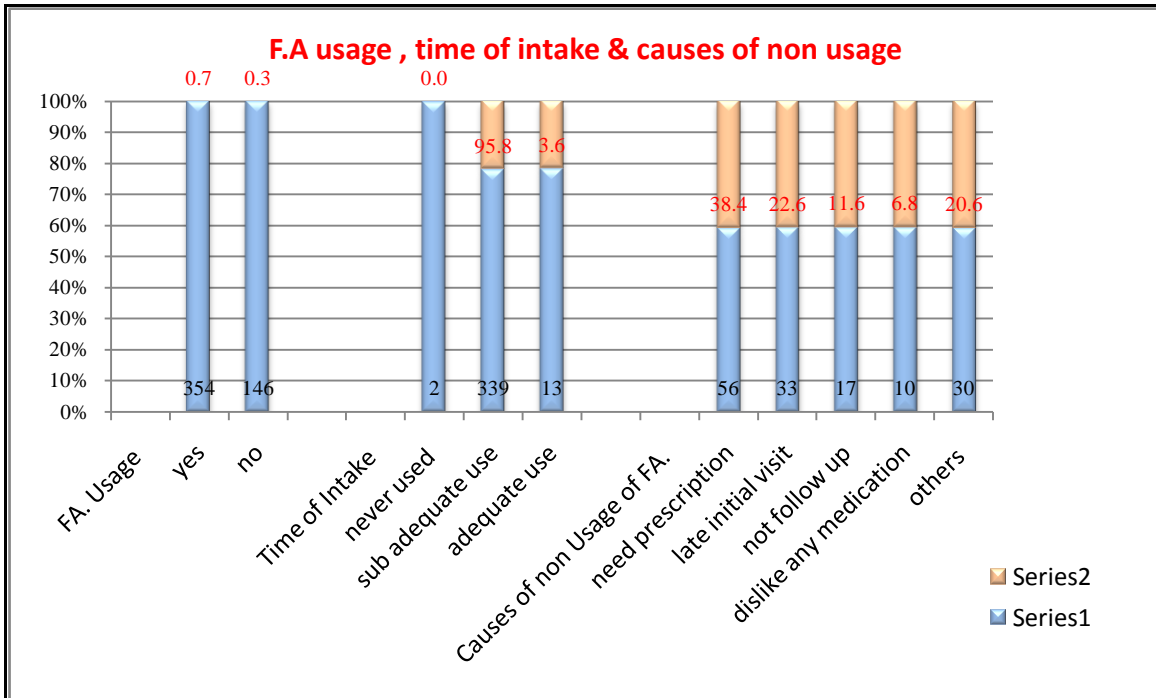


Figure 2: Distribution of the Studied Women According to their intention to follow a high Folate diet

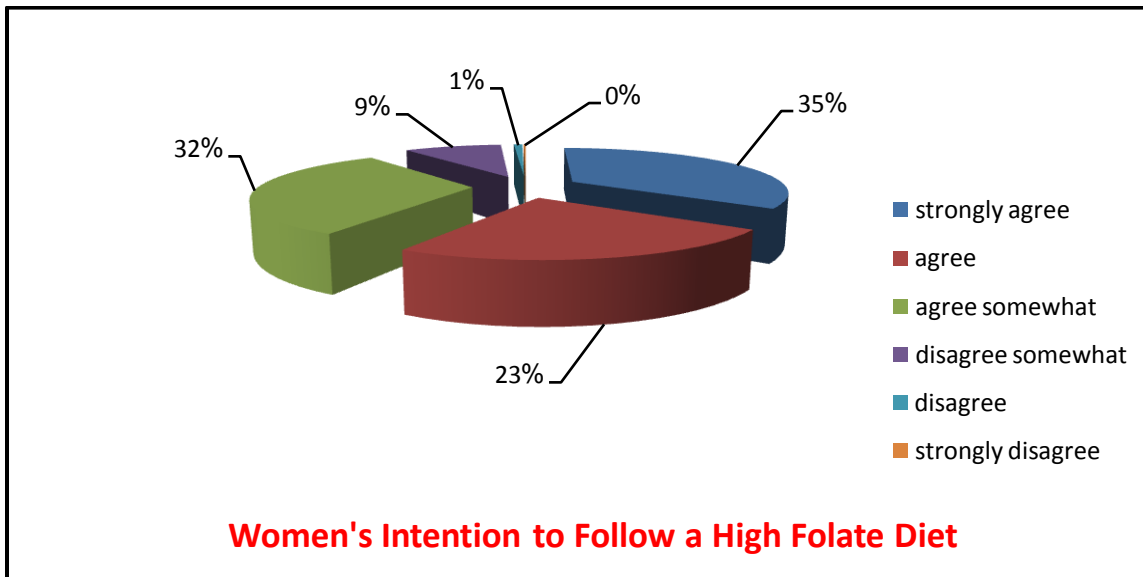
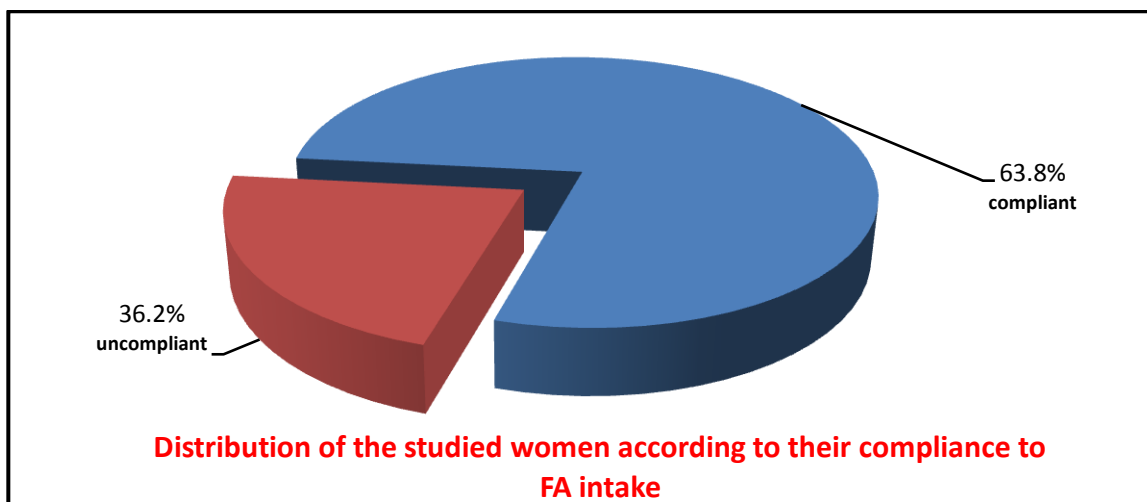


Figure 3: Distribution of the studied women according to their compliance to FA intake**Table (3):** Distribution of the studied women according to their opinion regarding the governmental strategies of fortification

Variable	Total (n = 500)	
	No.	%
Agreement to add FA in bread products.		
Agree	353	70.6 %
Disagree	147	29.4 %
#Causes of agreement to this strategy (n=353).		
All women planning to be pregnant or are pregnant fulfill the daily requirements	72	20.4 %
Babies will be born without defects, and anemia	40	11.3 %
Every pregnant need it	215	61 %
Would make it more accessible to all	56	15.9 %
Others	21	5.9 %
#Causes of refusal of the strategy (n=147).		
Limit consumer choices	8	5.4 %
Increase costs of bread	29	19.7 %
Create nutrient imbalance in body	7	4.8 %
Don't like the idea of every one being medicated	58	39.5 %
Don't know enough about it	43	29.3%
Others	8	5.4 %

#More than one option was checked.

Table 4: The relationship between compliance to FA and the studied women knowledge and their levels of perception

Variable	Compliance						P. value
	Compliant (226)		Not compliant (128)		Total (354)		
	No	%	No	%	No	%	
Knowledge level							
Adequate	67	29.4	30	23.4	97	27.4	0.005**
In adequate	159	70.6	98	76.6	257	72.6	
Levels of perception							
Positive	196	86.8	97	75.8	293	82.7	0.205
Negative	30	13.2	31	24.2	61	17.3	

Table 5: Distribution of the Studied Women According to determinants of FA Usage

Variables	Current FA. Supplement						P. value
	Yes (354)		No (146)		Total (500)		
	No.	%	No.	%	No.	%	
1-The Studied Women Sociodemographic Characteristics							
Age groups							
18-24	149	42.1	61	41.7	210	42.0	0.020*
25-34	178	50.3	63	43.2	241	48.2	
35-45	27	7.6	22	15.1	49	9.8	
Mother's educational level							
Illiterate	90	25.4	64	43.8	154	30.4	0.001**
Read and write	82	23.2	26	17.8	108	21.6	
Secondary education	145	41	52	35.6	197	39.4	
University education	33	9.3	4	2.8	37	7.4	
Post graduate education	4	1.1	0	0.0	4	0.8	
Occupation							
House wife	326	92.1	141	96.6	467	93.4	0.045*
Working	28	7.9	5	3.4	33	6.6	
2- Parity	1.93 + 1.63			0 + 0			0.001**

Table 6: The relationship between women's intake of FA and their detailed knowledge about it

Variable	Current intake of FA Supplement						P. value
	Yes (354)		No (146)		Total (500)		
	No.	%	No.	%	No.	%	
Proper time of intake.							
Before pregnancy.	8	2.3	1	0.7	9	1.8	0.001**
During pregnancy.	244	68.9	24	16.4	268	53.6	
Before and during pregnancy.	57	16.1	7	14.8	241	48.2	
At no stage, don't need to.	27	7.6	22	15.1	49	9.8	
Don't know.							
#Other ways to get FA.							
Take supplements.	80	22.6	15	10.3	95	19	0.001**
Eating fortified foods.	44	12.4	10	6.8	54	10.8	
Eating diet with vitamins.	39	11	35	24	74	14.8	
No other ways, none.	5	1.4	3	2.1	8	1.6	
Don't know.	190	53.7	84	57.5	274	54.8	
#Complications associated with deficiency of FA intake.							
NTDs.	66	18.6	10	6.8	76	15.2	0.001**
Macrocytic anemia.	156	44.1	14	9.6	170	34	
Limb numbness, nerve damage.	10	2.8	3	2.1	13	2.6	
Pregnancy complication.	79	22.3	7	4.8	86	17.2	
Don't know.	48	13.6	110	75.3	158	31.6	
Others.	14	4	5	3.4	19	3.8	
Source of knowledge about FA.							
Books, net, and media.	4	1.2	1	0.7	5	1	0.001**
Physician.	267	75.4	18	12.3	285	57	
Relatives.	9	2.5	2	1.4	11	2.2	
Social members.	19	5.4	2	1.4	21	4.2	
Nurses of MCH.	20	5.6	8	5.5	28	5.6	
No source of information.	35	9.9	115	78.7	150	30	

#More than one option was checked.

Table 7: Binary Logistic Regression between dependent Variable (FA usage) and independent Factors (the Studied Women Characteristics)

Factors affecting usage of FA	Sig.	Odd ratio	Accuracy
Knowledge of complications associated with FA deficiency	0.925	1.007	87.9%
Knowledge of time of intake	0.009**	1.715	
Knowledge of other ways to get FA	0.766	0.971	
Source of information about FA	0.155	0.781	
Age groups	0.166	1.435	
Mother educational level	0.507	1.133	
Residence	0.398	0.719	
Occupation	0.323	0.348	
Constant	0.053*	0.025	

Table 8: The relationship between constructs of HBM and the studied women intention to follow a high folate diet

Constructs of HBM	Mean ± SD	Intention to follow a high folate diet (n=500)	
		R	P value
Perceived susceptibility	60.97 ± 17.7	0.422	0.000***
Perceived severity	92.10 ± 10.86	0.228	0.000***
Perceived barriers	66.13 ± 15.42	0.433	0.000***
Self- efficacy	71.93 ± 18.13	0.561	0.000***
Cues to action	70.0 ± 18.94	0.597	0.000***
The HBM total score	2.362 ± 0.55	0.600	0.000***

Conclusion

The results of the present study concluded that, the mean age of the study sample was 26.115 ± 5.515, 39.4% of them had secondary education, 93.4% were housewife and 76.6% of them were multiparous. The great majority of the studied women had intention to follow a high folate diet and 63.8% were compliant to its intake. Although FA awareness, as indicated by the present study, was 71.6%, only 3.6% had adequately used it "pre and during pregnancy" and 19.6% of the studied women had adequate knowledge regarding FA. Lower reports of FA use before pregnancy, as revealed by this study, could serve as a good indicator for the need for improvements in Egyptian health organizations.

There is a highly statistically significant difference between women's compliance with FA and their knowledge. Moreover, women's age, level of education, occupation and parity were determinants of FA usage with statistically significant difference. In addition, highly statistically significant difference was observed between women's intake of FA and their detailed knowledge about FA as well as their source of information. Their physicians were the main source of women's knowledge. Also, perceived susceptibility, perceived severity, perceived barriers, self-efficacy, cues to action, and the HBM total score positively affect the studied women's intention to follow a high folate diet.

Recommendations

Based upon findings of the current study, the following recommendations to the women and public at large can be suggested:

- i. As lacks of adequate awareness about FA, receiving no advice regarding FA usage, and no source of knowledge about FA were the determinants of non-intake of FA. Hence, it is important to implement a continuing educational program for women, including counseling skills using all available mass media as well as a well-organized periconceptual FA supplementation program to raise their awareness of FA.
- ii. Application of HBM is recommended to improve women & health care provider about perception related to FA intake benefits.

LIST OF ABBREVIATIONS

AACC	American Association For Clinical Chemistry
BNFNB	British Nutrition Foundation Nutrition Bulletin.
CDC	Center For Disease Control and Prevention.
CDOPH	California Department of Public Health
CMs	Congenital Malformations.

CNS	Central Nervous System.
DFE	Dietary Folate Equivalents.
FA	Folic Acid.
GAIN	Global Alliance for Improved Nutrition
HBM	Health Belief Model.
ICBD	International Centre On Birth Defects.
MCV	Macrocytosis or A Mean Corpuscular Volume.
NIHCE	National Institute for Health and Clinical Excellence
NTDs	Neural Tube Defects.
PIH	Pregnancy Induced Hypertension
UL	Upper Limit.

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