ความรู้เกี่ยวกับการรับประทานกรดโฟลิกเพื่อป้องกันความพิการแต่กำเนิดของสตรีตั้งครรภ์: การศึกษาแบบภาคตัดขวาง ณ โรงพยาบาลแห่งหนึ่ง
Knowledge on Folic Acid Consumption to Prevent of Birth Defects among Pregnant Women: A Cross-sectional Study at a Hospital in Thailand

นิพนธ์ต้นฉบับ

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Original Article

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บทคัดย่อ

วัตถุประสงค์: เพื่อศึกษาความรู้ของสตรีตั้งครรภ์เกี่ยวกับการรับประทานกรดโฟลิกเพื่อป้องกันความพิการแต่กำเนิด การได้รับข้อมูลเกี่ยวกับกรดโฟลิกและแหล่งที่ได้รับข้อมูลเกี่ยวกับกรดโฟลิก **วิธีการศึกษา:** การวิจัยเชิงบรรยายแบบภาคตัดขวาง กลุ่มตัวอย่างคือสตรีตั้งครรภ์ที่มารับบริการฝากครรภ์ ณ โรงพยาบาลแห่งหนึ่งจำนวน 130 ราย คัดเลือกกลุ่มตัวอย่างแบบตามสะดวก เครื่องมือที่ใช้ในการวิจัยเป็นแบบสอบถามเกี่ยวกับข้อมูลส่วนบุคคล แบบวัดความรู้เกี่ยวกับการรับประทานกรดโฟลิก และแบบสอบถามการได้รับข้อมูลและแหล่งที่ได้รับข้อมูลเกี่ยวกับกรดโฟลิก รวบรวมข้อมูลช่วงมิถุนายน-สิงหาคม พ.ศ. 2562 วิเคราะห์ข้อมูลด้วยสถิติพรรณนา **ผลการศึกษา:** พบว่าสตรีตั้งครรภ์มีคะแนนความรู้รวมเฉลี่ยเท่ากับ 5.7 ± 0.2 จากคะแนนเต็ม 10 คะแนน ร้อยละ 58.5 มีความรู้ระดับดี มีเพียงร้อยละ 33.8 ที่รู้ว่าควรรับประทานกรดโฟลิกก่อนตั้งครรภ์ 3 เดือนและรับประทานต่อจนตั้งครรภ์ 3 เดือน และร้อยละ 40.7 เคยทราบข้อมูลเกี่ยวกับกรดโฟลิกมาก่อน โดยได้รับข้อมูลจากอินเตอร์เน็ตและสื่อโซเชียลเป็นอันดับแรกร้อยละ 22.3 **สรุป:** สตรีตั้งครรภ์มีความรู้เกี่ยวกับการรับประทานกรดโฟลิกเพื่อป้องกันความพิการแต่กำเนิดในระยะก่อนและขณะตั้งครรภ์ยังไม่มาก ดังนั้นบุคลากรสุขภาพที่เกี่ยวข้องควรเร่งการขับเคลื่อนนโยบายของประเทศเกี่ยวกับปัญหานี้สู่การปฏิบัติอย่างเป็นรูปธรรมและทั่วถึง

คำสำคัญ: ความรู้; กรดโฟลิก; สตรีตั้งครรภ์; ความพิการแต่กำเนิด

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Abstract

Objectives: To determine knowledge on folic acid consumption to prevent birth defects among pregnant women, provision of information about folic acid and sources of the information. **Methods:** This cross-sectional descriptive study had 130 pregnant women visiting antenatal care clinic at a hospital using a convenience sampling method. Data were collected from June - August, 2019 by self-reported questionnaires including personal characteristics, knowledge on folic acid consumption to prevent birth defects, provision of information and source of the information. Descriptive statistics were performed to summarize the findings. **Results:** Mean score of knowledge on folic acid was 5.7 ± 0.2 out of 10 points. 58.5% of the participants had a good level of knowledge on folic acid. Only 33.8% had correct knowledge regarding consumption of folic acid 3 months before and after pregnancy. 40.7% had known about folic acid supplementations. The main source of folic acid information was from the Internet and social media (22.3 %). **Conclusion:** Pregnant women had knowledge about folic acid consumption to prevent birth defects before and during pregnancy. It was urgent for responsible health personnel to form a health policy regarding folic acid supplementation into practice.

Keywords: knowledge; folic acid; pregnant women; birth defect

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Introduction

One of the significant health challenges facing Thailand today is the low birth rate and the low quality of born infants.[1] One key contributing factor affecting child quality is congenital anomalies or birth defects. A global health organization's survey found that approximately 3 - 5% of infants worldwide are born with anomalies, totaling around 8 million annually. Congenital anomalies contribute significantly to neonatal and infant mortality, with reports indicating that 240,000 infants die each year globally due to congenital anomalies.[2] In Thailand, there is a lack of national-level data on infants with anomalies, with only some hospitals providing specific statistical reports. However, the reported cases of infants with anomalies exceed 20,000 per year, posing a growing problem.[3]

Congenital anomalies have profound short-term and long-term impacts on infants, families, and the country. The most common congenital anomalies in infants include congenital heart disease, neural tube defects, incomplete development of the brain and spinal cord, and Down syndrome.[2] Currently, it is observed that maternal involvement in preventing congenital anomalies is crucial, particularly through the consumption of folic acid supplementation (FAS) before pregnancy.

Folic acid, or vitamin B9, is found in green vegetables and fruits and is a water-soluble vitamin that plays a vital role in enzymatic reactions related to nucleic and amino acids. It is essential for normal cell division, contributing to the proper development and division of cells in the embryo. In the first 28 days of pregnancy, a deficiency in folic acid can lead to incomplete fetal development, open neural tube defects, and incomplete brain and spinal cord development. Research from various countries shows that folic acid supplementation before and during pregnancy can reduce the risk of neural tube defects by up to 40 - 70%[4,5] and decrease overall brain and spinal cord anomalies by 25 - 50%.[6] The World Health Organization recommends countries to implement policies for folic acid supplementation of 400 micrograms per day for women for three months before conception and continue for the first three months of pregnancy to prevent infant anomalies.[7] For Thailand, there is a national policy known as 'Sao Thai Kaem Daeng (Red-Cheeked Thai Daughters) Having Children for the Nation' that provides special vitamins to young women to take folic acid before pregnancy without any cost to prepare for pregnancy.

Despite efforts to promote folic acid supplementation for preventing congenital anomalies, the practice among Thai women is still limited. A study by Wongkham and colleagues[8] found that only 13.7% of pregnant women took folic acid before pregnancy, while another study by Kaewpoun and colleagues[9] reported a mere 7.0% of pregnant women consumed folic acid before pregnancy. Therefore, the intake of folic acid for pre-pregnancy preparation and its consistent consumption during the pregnancy stages in Thai women remains a concern due to low rates. This may stem from various factors, ranging from policy implementation to the individual factors associated with pregnant women themselves. Particularly, the lack of information and knowledge regarding folic acid has been observed. Research findings indicate that access to information about folic acid and knowledge related to its consumption is correlated with the actual intake of folic acid during pregnancy.[10-12] This insight is drawn from a review of research regarding folic acid information and knowledge related to its intake to prevent birth defects, showing that it is not highly prevalent among pregnant women in Thailand.[8]

In addition, there still lacks clarity, despite numerous studies in various countries, both developed[10,13] and developing[14-20], with research conducted in multiple regions within each country, aiming to reach clearer conclusions for more precise practical implications.

The objectives of this research were to determine the extent of knowledge of pregnant women about folic acid intake to prevent congenital anomalies, and to investigate the information received about folic acid and the sources of this information. The findings from this study could be used to serve as information for developing programs to promote accurate folic acid intake among women in the pre-pregnancy and pregnancy periods.

Methods

This cross-sectional descriptive study was part of a larger project investigating factors influencing folic acid intake in pregnant women.[9] The study population was pregnant women receiving prenatal care at a hospital affiliated with the Thai Red Cross Society in Chon Buri province. A total of 130 participants was selected through convenience sampling, considering specific criteria of 1) being in their first pregnancy, 2) gestational age over 12 weeks, 3) age 20 years or above, and 4) Thai nationality and the ability to communicate in the Thai language. The sample size was calculated based on the main objective of the research using the software program G*Power 3.1.9.2.[24] The effect size was set at 0.15. With type I error set at 5% and the power at 90%, a sample size of 108 was required. A 20% was added to compensate for a potentially incomplete survey data, a total of 130 participants were recruited.[9,21]

Research instruments

The research tool was a self-administered questionnaire created by the researchers based on literature reviews [21-23] and consisted of three parts. The **first part** collected demographic and clinical characteristics of the participants. The **second part** evaluated knowledge about folic acid, including its importance, benefits during pregnancy, and high-folate food sources (10 questions). The questions are multiple-choice with three options, i.e., yes, no, or unknown/not sure, scored as 1 point for the correct answer and 0 point otherwise. The total scores ranged from 0 to 10 points. The categorization of knowledge used the median as a point of division[14], therefore the knowledge level was classified as good (6 - 10 points) or not good (0 - 5 points).

The third part assessed information received on folic acid, including whether they have received information and the sources of information (2 questions).

Content validity was examined by three qualified individuals with expertise in maternal and child nursing. The Content Validity Index (CVI) for the knowledge questionnaire on folic acid prevention of birth defects was determined to be 0.83. Language was also revised as recommended by the experts. For internal consistency reliability, the questionnaire was administered to 30 pregnant women with characteristics comparable to the participants. The reliability was acceptable with a Kuder-Richardson (KR-20) coefficient of 0.79.

Ethical protection for participants

The research received approval from the Ethics Committee of Burapha University (approval number: Sci 037/2562; approval date: April 22, 2562) and permission from the hospital. The research objectives, expected benefits, the questionnaire response process, and the participants' right to withdraw from the study with no negative consequences on the care they received were explained to the participants. Informed consent was obtained from the pregnant women who decided to participate.

Data collection procedure

The researcher began collecting data independently from June to August 2019 at the hospital's antenatal care unit. Pregnant women meeting the criteria were invited to participate. Participants in the research project, 10 to 15 individuals per day, completed the questionnaire in a private room. The survey took about 10 minutes.

Data analysis

Descriptive statistics including mean with standard deviation and frequency with percentage were used to summarize the demographic characteristics and study variables.

Results

Of the 130 pregnant women participants, the majority were 20 – 30 years old (80.8%), with an average age of 25.9 years ± 5.0 years. Most had completed secondary education (40.0%), followed by a bachelor's degree (22.3%). Approximately one-third were company employees (33.1%), and a quarter were unemployed (25.4%). The average total family income per month was 27,514.23 ± 18,112.3 Baht. Most did not have any chronic illnesses (95.4%), family genetic history (95.4%), or preconception contraceptive use (65.4%). The majority did not plan their pregnancies (58.5%).

Regarding knowledge about folic acid intake for preventing birth defects, the participants had an average overall knowledge score of 5.7 ± 0.2 out of 10 points, with a median of 6.0 points. The distribution of total scores ranged from 0 to 10, with 6.9% of the participants having no correct knowledge at all. When categorizing knowledge into two levels, it was found that the proportions of participants with good knowledge (58.5%) and poor knowledge (41.5%) were almost equal.

It was found that the majority had knowledge about the importance and benefits of folic acid for the fetus during pregnancy. Specifically, 73.8% of pregnant women knew that folic acid is essential for the development of the brain and nervous system, 70.8% were aware that folic acid helps prevent fetal neural tube defects, and 68.5% understood that a deficiency in folic acid during pregnancy increases the risk of abnormalities in the baby's nervous system. However, only 33.8% had knowledge about the recommended intake of folic acid before and after the first three months of pregnancy, and awareness regarding food sources rich in folic acid was relatively low at 37.7% (Table 1).

When obtaining information about folic acid, it was found that only 40.7% of pregnant women knew or received information about folic acid. The primary sources of information were social media, including the Internet/online platforms/Facebook, accounting for 22.3%. The second most common source, at 13.8%, was healthcare professionals such as doctors, nurses, and health officers (Table 2).

Discussions and Conclusion

The study found that pregnant women had an average knowledge score of 5.7 out of 10, with 58.5% having good knowledge and 6.9% having no knowledge on any aspect. In this study, pregnant women had better knowledge about folic acid intake to prevent birth defects compared to findings

Table 1 Knowledge about folic acid by items (N = 130).

Item	Knowledge about folic acid	N (%)	
		Correct answers	Incorrect answers
The importance and benefits of folic acid			
1	Folic acid is a substance essential for the development of the fetal brain and spinal cord.	**96 (73.8)**	34 (26.2)
2	Consuming folic acid both before and during pregnancy helps prevent neural tube defects, such as spina bifida.	**92 (70.8)**	38 (29.2)
3	Pregnant women with a history of giving birth to a child with birth defects, such as hydrocephalus or abnormalities of the neural tube, should take folic acid both before and during pregnancy.	62 (47.7)	68 (52.3)
4	A deficiency of folic acid in pregnant women poses a risk of abnormalities in the nervous system of the baby.	89 (68.5)	41 (31.5)
	Folic acid intake		
5	regnant women should not take folic acid pills or any medication during pregnancy.*	85 (65.4)	45 (34.6)
6	Taking folic acid should be started 3 months before pregnancy and continued for 3 months after becoming pregnant.	**44 (33.8)**	86 (66.2)
7	Before pregnancy, it is recommended to take one folic acid tablet daily for a continuous period of 3 months.	87 (66.9)	43 (33.1)
8	Pregnant women who have already consumed a balanced diet from all five food groups may not need to take additional folic acid supplements.	58 (44.6)	72 (55.4)
Sources of food high in folic acid			
9	Folic acid is abundant in foods such as egg yolk, liver, beans, and green-colored vegetables and fruits.	81 (62.3)	49 (37.7)
10	Folic acid is found only in vitamin pills.	40 (30.8)	90 (69.2)

* Negative questions received correct scores for the answers.

Table 2 Sources of information about folic acid (N = 130).

Sources of information about folic acid	N	%
Having understanding about folic acid		
Yes	53	40.7
No	77	59.3
The source of information* (n = 53)		
The Internet/Line Chat/Facebook	29	22.3
Healthcare professionals such as doctors, nurses, and allied health personnel.	18	13.8
Television/radio	6	4.6
Family members/friends	5	3.8
Book/magazine/newspaper	4	3.1

* More than 1 choice was applicable.

from a 6-year study in Thailand among pregnant women attending a hospital affiliated with a university in the northeastern region.[8] Pregnant women had varying levels of knowledge, with 27.41% having no knowledge on any aspect.[8] This might be attributable to previous gaps in knowledge and service provision of folic acid to women before and during pregnancy in healthcare facilities, which have significantly increased over time.

Our research closely aligns with a study involving pregnant women in a province of the Philippines, where over half of the sample had good knowledge about folic acid intake[12], and a study in Kenya which found that 40.9% of pregnant women who received care at a community health center had good knowledge.[14] These pregnant women obtained knowledge from medical personnel, brochures, and guidance from community health volunteers. The research findings among pregnant women in Thailand significantly differ from a study conducted at a general hospital in Ethiopia, where 81.2% had good knowledge about folic acid supplements (total score of 60% and above)[16], contrasting with a study in Egypt where most pregnant women, 88%, had inadequate knowledge about folic acid intake (total score less than 60%).[17]

For knowledge about the benefits of folic acid, our study found that over 70% of pregnant women had knowledge that folic acid is essential for the development of the brain and spinal cord of the fetus. Consuming folic acid before and during pregnancy can help prevent fetal neural tube defects, such as spina bifida. This may be attributable to the dissemination of information regarding this knowledge to the public in Thailand. With an easy access to the internet, the pregnant women can easily search the information. This is consistent with studies in Japan, which found that 70.4% of pregnant women knew that folic acid helps prevent fetal neural tube defects.[10] In China, 82.0%[13] of pregnant women had knowledge of the benefits of folic acid, while 67% of pregnant women in a province in the Philippines knew that taking folic acid was important for both young and pregnant women.[12]

This present research has variations compared to studies in several countries. For instance, in Egypt, 75% of pregnant women lacked knowledge about the benefits of folic acid[17], and only 8.4% of women in a high-risk community had knowledge about preventing fetal neural tube defects through folic acid intake.[18] Similarly, only 6.1% of pregnant women in Cameroon knew about the benefits of folic acid in preventing birth defects and when to start consumption.[20]

Regarding knowledge about folic acid intake, 66.9% of the participants were aware of the need for folic acid intake before pregnancy regularly for three months, whereas only 33.8% knew about the need for intake both before

pregnancy for three months and after the first three months of pregnancy. Although the rate of pregnant women with higher knowledge compared to the study by Wongkham and colleagues[8] where only 24.81% had knowledge about the need for folic acid intake before pregnancy, from 1 - 3 months prior to conception and afterward. This research indicates that correct knowledge about the timing of folic acid intake among Thai women remains a challenge that healthcare professionals need to address accurately. This present study aligns with various studies in different countries. For instance, in Pakistan, 76.7% of pregnant women were unaware of folic acid intake[15], while in Egypt, the majority, 79%, lacked knowledge about when to take folic acid and what dosage to take.[17] A systematic review in various countries reported that only 27.3% of pregnant women had the correct knowledge about folic acid intake according to WHO recommendations.[25]

In the pregnant women participants, 40.7% of them had received information on folic acid intake to prevent birth defects, which is higher than previous studies in Thailand. However, nearly 60% of pregnant women stated they had not been informed about folic acid intake before the study. This aligns with the promotion of folic acid intake that began years ago in countries such as Japan, which provides information in Maternal and Child Health books for all pregnant women. In Kenya, the Ministry of Health had policies in place since 2010, providing folic acid supplements for pregnant women in state healthcare facilities. Research in these countries found that 70 - 90% of pregnant and young women were aware of folic acid and its role in preventing neural tube defects.[10,14,16] Nevertheless, in some countries, policies and practices regarding folic acid supplementation for women are not yet widespread. It is found that the majority of pregnant women, almost 80%, have never received information about folic acid and neural tube defects. [15] As for sources of information about vitamin folic acid, the study found that the first and most frequent source was the Internet and social media platforms such as Line and Facebook, accounting for 22.3%. This aligns with studies in Japan, where pregnant women obtained crucial information primarily from the Internet.[10] This emphasizes that due to campaigns in Thailand, knowledge about folic acid is disseminated. Providing the information regarding preventing congenital disabilities via the Internet is a common way for pregnant women to access information. This is different from studies in some countries such as China[13], Ethiopia[16], Kenya[14], and Iraq[19], where most women received information about folic acid from physicians and medical professionals, especially at public health centres.

The study suggests that healthcare professionals should rapidly promote the country's policy and actions, promoting folic acid knowledge and supplementation for women to prepare before pregnancy and continuously take it during the first three months of pregnancy to raise awareness and overall compliance. For future research, studies with large and more representative sample across the country and studies with intervention to increase folic acid knowledge and supplementation during the pre-pregnancy and pregnancy stages are recommended.

The present study has certain limitations. This study selected participants using a convenience sampling method on pregnant women receiving prenatal care at one hospital in the eastern region. Therefore, the participants may not accurately represent pregnant women in other areas. The results might not be fully generalized to other areas of Thailand.

In conclusion, the research found that the majority of pregnant women (58.5%) did not plan their pregnancy. Only 33.8% had good overall knowledge about taking folic acid to prevent birth defects. Specifically, only 33.8% correctly knew that folic acid intake should start three months before pregnancy and continue for the first three months of pregnancy. About 40.7% had prior knowledge about folic acid, primarily from the Internet and social media.

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References

1. Department of Health. The 2nd national reproductive health development policy and strategy (2017 - 2026) on the promotion of quality birth and growth. 2017. (Accessed on Apr. 8, 2022, at from:https://rh.anamai.moph.go.th/th/download-03) (in Thai)

2. World Health Organization. Birth defects. 2022. (Accessed on Apr. 10, 2022, at https://www.who.int/news-room/fact-sheets/detail/birth-defects)
3. Relief and Pracha Namai Phithak Office. Recommendation letter to the prime minister and recommendation report on folic. 2017. (Accessed on Apr. 10, 2022, at http://www.rtrc.in.th/ewt_news.php?nid=3548&filename=index)
4. Centers for Disease Control and Prevention. Recommendations to improve preconception health and health care: United States. 2006. (Accessed on Apr. 15, 2022, at http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5506a1.htm)
5. De-Regil LM, Peña-Rosas JP, Fernández-Gaxiola AC, Rayco-Solon P. Effects and safety of periconceptional oral folate supplementation for preventing birth defects. Cochrane Database of Systematic Reviews 2015;12:CD007950. (doi: 10.1002/14651858.CD007950.pub3)
6. Liu J, Li Z, Ye R, Liu J, Ren A. Periconceptional folic acid supplementation and sex difference in prevention of neural tube defects and their subtypes in China: Results from a large prospective cohort study. Nutr J 2018;17(1):115.
7. World Health Organization. Preconception care: maximizing the gains for maternal and child health [Internet]. 2013. (Accessed on Apr. 15, 2022, at http://www.who.int/maternal_child_adolescent/documents/preconception_care_policy_brief.pdf)
8. Wongkham J, Ratanasiri T, Paibool M, et al. Maternal knowledge and attitude on folic acid Intakes to prevent birth defects of pregnant women. Srinagarind Med J 2016;31(4):192-196.
9. Kaewpoung S, Deoisres W, Chinsoi, C. Factors influencing folic acid intakes among pregnant women. JBCN Bangkok 2021;37(2):192-202.
10. Yamamoto S, Wada Y. Awareness, use and information sources of folic acid supplementation to prevent neural tube defects in pregnant Japanese women. Public Health Nutr 2018;21(4):732-739.
11. Pathirajaa R, Prathapan R. Awareness, knowledge and the factors that affect the use of folic acid among pregnant and non-pregnant women in the reproductive age in a selected area in Colombo district, Sri Lanka. Sri Lanka J Obstet Gynaecol 2020;42(3):105-114.
12. Bernardo AKM. Assessment of knowledge, attitude and perceived practices on the importance of Folate among Filipino women of child-bearing age in the Province of Batangas. Acta Medica Philippina 2022;56(5):119-127.
13. Cui M, Lu XL, Lyu YY, et al. Knowledge and intake of folic acid to prevent neural tube defects among pregnant women in urban China: A cross-sectional study. BMC Preg Child 2021;21(1):1-9.
14. WanjiraKamau M, Waithira M, ThuoKimani S. Maternal knowledge on iron and folic acid supplementation and associated factors among pregnant women in a rural County in Kenya. Int J Afr Nurs Sci 2019;10:74-80.
15. Yasmin S, Siddiqa A, Rockliffe L, Miyan J. Knowledge of neural tube defects and prevention through folic acid use among women in Faisalabad, Punjab, Pakistan: A cross-sectional survey. Int J Women Health 2022;14:425-434.
16. Yisak H, Ewunetei A. Knowledge, attitude, and practice with iron folic supplementation among antenatal care attendant women Debre Tabor, South Gondar Zone. J Women Health Gynecol 2021;8(1):1-7.
17. Mahmoud NF, Moneim EF A.-E, El-Sayed HF, Said DS. Knowledge and attitudes of pregnant women regarding folic acid supplementation. Int J Health Sci 2022;6(S8):5431–5445.
18. Begashaw B, Tariku Z, Berhane A. Preconception of folic acid supplementation knowledge among Ethiopian women reproductive age group in areas with high burden of neural tube defects: a community based cross-sectional study. J Nutr Sci 2022;11(e48):1-7.
19. Sadiq ZA, Hussein HK. Assessment of knowledge and attitudes among pregnant women' s towards folic acid intake during pregnancy in a sample of women attending primary health care centers in Babylon province. Med J Babylon 2022;19(2):142-151.
20. Alemajo CA, Halle-Ekane GE, Nkengasong EA, Asongalem EA. Peri-conceptional folic acid supplementation: A cross-sectional study to assess the awareness, knowledge, use and associated factors among pregnant women attending antenatal care in two secondary health care facilities, southwest region, Cameroon. Obstet Gynecol Res 2022;5(4):244-253.
21. Lolowa AM, Selim N, Alkuwari M, Salem Ismail M. Knowledge and intake of folic acid among teachers of childbearing age in the State of Qatar: a cross-sectional study. BMJ Open 2019;9(4):1-9.
22. Kim J, Yon M, Kim CI, Lee Y, Moon GI, Hong J, Hyun T. Preconceptional use of folic acid and knowledge about folic acid among low-income pregnant women in Korea. Nutr Res Pract 2017;11(3):240-246.
23. Jamil S, Khan S, Sadia H. Knowledge attitude & practice of folic acid consumption in pregnant women. Int J Pharm Sci Sci Res 2017;3(7):75-82.
24. Faul F, Erdfelder E, Buchner A, Lang AG. Statistical power analyses using G*Power 3.1: tests for correlation and regression analyses. Behav Res Methods 2009;41(4):1149-1160.
25. Ghaffari Sardasht F, Keramat A, Irani M. The level of Knowledge and consumption of folic acid in pregnancy and pre-conception: A systematic review and meta-analysis. Iran J Obstet Gynecol Infertil 2019;22(2):84-98.