

Educational Program Based on Health Belief Model on Premarital Females' Perception Regarding Preconception Folic Acid Supplementation

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Abstract

Background: Folic acid is essential for the fetus's growth and development. It has been demonstrated that taking folic acid supplements both before and throughout the first trimester of pregnancy significantly reduces the risk of neural tube defects (NTDs). **Aim:** Evaluate the effect of educational program based on health belief model on premarital females' perception regarding preconception folic acid supplementation. **Design:** One group pre-post tested as part of a quasi-experimental design. **Setting:** The study was conducted at Atlas Medical Center in Helwan City. **Sample:** A purposive sampling of 122 premarital females. **Tools:** Three tools were used: (1) Structured Interviewing Questionnaire, (2) Knowledge assessment tool and (3) Health Belief Model Scale. **Results:** The current study shows that 77% of the participants had a low perception regarding preconception folic acid intake and 5.7% only had high perception at the pretest stage, while 51.6% at post education of those with low perception decreased to 8.2 % and those with high perception increased to 51.6 % at the posttest stage. Also, a significant improvement in knowledge level concerning preconception folic acid supplementation after the program's implementation in addition health belief model total score are significantly higher than pre-program implementation. **Conclusion:** The study concluded a positive correlation between the total level of knowledge and the health belief scores regarding preconception folic acid intake at both pre and post educational program of the premarital females who participated in the educational program. **Recommendations:** Increasing awareness among women of reproductive age about the importance and optimal timing of folic acid intake before conception.

Keywords: Educational program, Folic acid supplementation, Health Belief Model, Perception, Preconception, Premarital females.

Introduction:

The time between planning to conceive and actually becoming pregnant is known as the preconception period. This definition, however, fails to take into account the fact that up to 50% of pregnancies are unintended or unplanned, and that it may take months or even years to treat high-risk factors such as severe undernutrition or obesity. Congenital abnormality rates, maternal and neonatal mortality, fertility, and premature delivery are all significantly impacted by the preconception period (Mohamed et al, 2020).

The frequency of birth abnormalities is significantly reduced when mothers perceive the benefits of folic acid (FA) in avoiding birth abnormalities, such as neural tube defects (NTDs) (Alquraini, 2019). Problems with behavioral

adjustments could be the reason for the disparity between folic acid awareness, knowledge, and use (Ramadan, 2020). Numerous factors, such as maternal age, marital status, educational attainment, economic grade, occupation, forgetfulness, the number of prior gestations, as well as if the pregnancy was planned, and ignorance of the folic acid intake benefits before and throughout pregnancy, are linked to preconception folic acid supplementation (Wald et al, 2020).

The manufactured kind of folate is utilized in food fortification and supplements is folic acid (FA), which is the water-soluble form of vitamin B9. FA aids in the formation of the neural tube during the early phases of evolution. (Habib et al, 2022). Folate, the natural form of folic acid, is found in leafy greens, liver, beans, citrus fruits,

and egg yolks, among other foods, FA can also be found in supplements and fortified meals such as whole grains (Sabi et al, 2022). Folic acid is crucial because, especially prior to pregnancy, it lowers the likelihood of having a baby with certain brain and spinal cord birth defects. These birth defects are extremely dangerous and typically cause paralysis or death (Jalambadani et al, 2020).

Among the most prevalent vitamin deficiencies among women today is FA deficiency, which can cause several NTDs, including spina bifida, anencephaly, and encephalocele, that can cause permanent impairment and early death. Other issues like congenital heart defects, orofacial abnormalities, abruptio placenta, preeclampsia, premature labor, pregnancy loss, and multiple pregnancies can also result from folic acid deficiency during pregnancy (Fahim et al, 2023).

Most pregnant women are unaware that they are carrying a child. until the 29th day after conception, when neural tube abnormalities occur as a result of the open neural tube failing to close. Consequently, it is thought that it might be too late to begin to take folic acid supplements following pregnancy's first month to avoid NTDs (Sadiq & Hussein, 2022). Additionally, compared to the natural form of folate, The bioavailability of synthesized folic acid is greater, and dietary folate alone is not enough to lessen the NTDs risk as effectively as possible. As a result, many nations advise women taking FA before becoming pregnant (Moser et al, 2019).

The United States Public Health Service (USPHS) recommends 400 µg (0.4 mg) of folic acid per day for every woman who is of childbearing age. Since 2010, the Korean Nutrition Society has also recommended this amount for those women who are of childbearing age. Additionally, for what is known as "periconceptional use," the World Health Organization (WHO) and numerous other nations advise all women to adhere a 0.4 mg daily folic acid supplement dose between four to twelve weeks before pregnancy or from the time they begin attempting to conceive until twelve weeks of pregnancy (Cui et al, 2021).

Additionally, at least one month before conception, the WHO advises women whose pregnancies have previously been impacted by

NTDs to take 5,000 µg of daily FA (Teshome et al, 2022). Furthermore, according to some regulations, women who are more likely to have NTDs such as those suffering diabetes, of body mass index (BMI) of ≥ 30 , or those on antiepileptic drugs or any other folate antagonists should take high amounts (4-5 mg/day). Importantly, FA is advised for any females who are having sex but not use contraception or who are attempting to conceive (Dwyer et al, 2022).

In addition to helping women understand the effects of FA deficiency to diminish the risk of non-transferable disorders and enhance pregnancy outcomes, maternity nurses are crucial in educating and counseling those young women who are pregnant on the significance of taking folic acid, where to find it, and how much to take during the preconception and pregnant periods (Carter et al, 2022).

Moreover, nurses have a unique chance to affect women's behaviors regarding preconceptionally FA intake and food choices because of their frequent interactions with women and their status as their primary information source (Lu et al, 2020). Therefore, nursing education programs should be implemented with a focus on improving these women's knowledge in order to prevent future NTDs. This can be accomplished verbally or through booklets, leaflets, or referrals to high-risk groups informing women about the benefits of preconceptionally FA intake and the latest guidelines surrounding it (Berhane & Belachew, 2022).

One theoretical framework is the Health Belief Model (HBM) which is designed to explain and forecast behaviors related to health, especially when it comes to using health services. It serves as a guide for initiatives aimed at preventing illness and promoting health. It is among the most widely used models for identifying behaviors associated with health. The model's cornerstone is the idea that the main element affecting a one's desire to change oneself health-related behaviors is the perception of one's own health. In behavior change interventions, HBM highlights the significance of addressing a person's perceptions of self-efficacy, barriers, benefits, and susceptibility. The six elements of the HBM are standardized as "perceived severity, perceived susceptibility, perceived benefits,

perceived barriers, cues to action, and self-efficacy" (Boskey, 2023).

Significance of the study:

Because of inadequate or nonexistent folic acid consumption throughout the preconception stage, neural tube abnormalities are believed to be the most prevalent congenital abnormalities among women who are pregnant. Nearly 29% of neonatal deaths worldwide are caused by NTDs, which affect about 300,000 newborns annually (Kindie & Mulu, 2022). Congenital defects are becoming more prevalent in Egypt, where they account for 65.3% of live birth (Mohamed et al, 2020).

According to recent research, getting enough folic acid both before and throughout the first few months of pregnancy significantly lowers the threat of preventable NTDs, particularly spina bifida, by 50% to 70% (Oumer et al, 2020). Inadequate folate supplementation led to a 5/1000 incidence of spina bifida in Egypt. Global folic acid fortification can prevent 150,000 to 210,000 NTDs annually in low- and middle-resource countries, saving those children from death or permanent disability (CDC, 2022). Furthermore, a number of studies carried out in different areas revealed that women knew very little about the prevention of NTDs and the proper use of preconception folic acid (Read & AbuAlhommos, 2021).

Additionally, these young premarital women are ready for the reproductive life that lies ahead of them, but regrettably, they may become parents without the assistance, education, or skills required to become mothers. In order to prevent these NTDs and the effects they will have on them as future mothers and their offspring, it is crucial to raise their awareness through the implementation of such educational programs based on HBM regarding the advantages of folic acid intake, appropriate timing and duration of it.

The study's aim:

This research's purpose was to assess the effect of the educational program based on health belief model on premarital females' perception regarding preconception folic acid supplementation.

Research hypothesis:

When a health belief model-based training program is implemented to premarital females, their perception and knowledge of folic acid supplementation prior to conception will improve than before.

Subjects & Methods:

A. Research design:

Pre- and post-tests in a quasi-experimental study design (one group) was employed to accomplish the study's aim.

B. Setting:

This study was carried out at the "Atlas Medical Center" in Helwan City. Atlas Medical Center is a comprehensive facility that offers primary healthcare services through a family file system to ensure comprehensive, ongoing, and integrated care. It is situated in the American Project area in Al-Majarra 3. Notably, with an average of 300 beneficiaries per month, Atlas Medical Center is the only facility in Helwan area offering premarital exams and premarital counseling services which includes: Measuring weight, height, blood pressure, and sugar readings which are all part of these counseling services, along with tests for HIV, hepatitis C and B, anemia, RH, and blood types. This diversity of services reflects the vital role of the center in improving community wellness and its standard of life.

C. Sampling:

Type of sample: A purposive sample from community center was utilized in the current study with the following criteria:

Inclusion criteria:

- Females attending the previously mentioned setting for premarital examination
- Females who are able to read and write.
- Females who participation willingness to the study.

Exclusion criteria:

- Females with any psychological disorders or congenital abnormality.

Sample size:

Sample was calculated using the infinite equation according to Open Epi info 2013

software, Version 3, using the following assumption: a confidence interval of 95%, a design effect of 1, a statistical power of 90%, a significance level of 5%, and a two-sided alpha error of 5%. The total population was estimated to be approximately 3,600, according to annual statistics from Atlas Medical Center in Helwan City for the year 2022. A proportion of 50% was assumed to maximize the sample size. Consequently, the calculated size of the sample was decided upon to be 122 females.

D. Instruments for gathering data:

The process of gathering data involved the use of three tools.

Tool I: Structured Interview Questionnaire:

The researchers developed it following a survey of pertinent literature. (Fahim et al, 2023, Habib et al, 2022 & Sadiq & Hussein, 2022). There were three parts to it:

Part (1): Participants' personal, sociodemographic characteristics and anthropometric measurements: It was created to evaluate the features of the premarital females including: age, occupation, residence, degree of education. In addition, anthropometric measurements include calculating height in centimeters and weight in kilograms, then converting the results into BMI (kg/m²).

Part (2): Past medical and family history: It was created to assess the prior medical and family history of the premarital females such as past medical issues (anemia, vaginal infection, polycystic ovaries and premenstrual syndrome) and family members with children who have neural tube abnormalities.

Part (3): Source of premarital females' information regarding preconception folic acid intake: such as the health care workers (physician, nurse), family, friends, social media, school, university, radio, T.V, magazine, newspaper or others.

Tool II: Tool for Assessing Knowledge: The researchers have updated and adapted this tool from Mohamed et al. (2023) to assess the premarital females' knowledge regarding preconception folic acid consumption before and after the educational program. It has

been written in English and simply converted to Arabic, and it consisted of 23 questions of multiple-choice type and close-end questions. It was split up into 3 sections as follows:

Section (1) had an eye in preconception care data. (Composed of 8 questions) Section (2) was interested in finding out folic acid knowledge. intake and deficiency (Composed of 12 questions) Section (3) was interested in knowledge of neural tube defects (Composed of three questions).

Knowledge scoring system: It is about 23 questions to evaluate knowledge of preconception folic acid intake (overall exact score was 46 points). Those part answers ranged from: A comprehensive, accurate response was scored (2), incompletely right reply was scored (1), and don't know or wrong response was scored (0). The total scores for the premarital females' knowledge concerning preconception folic acid intake were divided into two levels; these levels are satisfactory and unsatisfactory knowledge and adapted from Sabi et al, (2022) as:

- **Unsatisfactory knowledge** < 60% (< 28 points).
- **Satisfactory knowledge** ≥ 60% (≥ 28 points).

Tool III: Health Belief Model Scale (HBM):

Based on research undertaken by Kloeblen and Batish (1999), the health belief model scale is a predictor of pregnant low-income woman's desire to consume a diet rich in folate. The researcher modified the health belief model scale to assess premarital women's health beliefs regarding preconceptionally folic acid intake. The Health Belief Model Scale consists of six subscales that represent different health beliefs to folic acid intake and deficiency. These subscales include: **Perceived susceptibility** (It composed of 4 items), **Perceived severity** (It composed of 5 items), **Perceived benefits** (It composed of 9 items), **Perceived barriers** (It composed of 9 items), **Self-efficacy** (It composed of 2 items), and **Cues to action** (It composed of 6 items).

Scoring system: HBM scale consisted of 35 items, the scoring system ranged from agree to disagree depending on the degree of agreement: agree =3, neutral = 2 and disagree =1, with total optimal score = 105.

The degree of health-related beliefs was categorized as follows (**Kamal et al., 2017**):

- **Low perception** < 50% (< 52 points).
- **Moderate perception** 50% to 75% (52 to 78 points).
- **High perception** >75% (> 78 points).

Tool validity:

A panel of experts made up of five professors in the specialties of Maternal and Newborn health Nursing and Community Health Nursing tested and assessed the study tools for face and content validity in order to determine the tools' applicability, relevance, clarity, comprehension, and completeness. Some questions were added, changed, and rearranged to make the necessary corrections and adjustments. After determining the content validity index (%) of its items, the questionnaire's face validity was determined based on the opinions of experts and came out to be 97%.

Tool reliability:

The test-retest method was used twice to estimate reliability among the same sample of ten premarital females, and the results were compared using the SPSS software. The reliability of the tools in identifying the study's objectives was demonstrated by the Cronbach's coefficient alpha test. With reliability coefficients of 0.875 and 0.910, the results demonstrated the high levels of reliability of the second and third instruments, respectively.

Ethical considerations: Prior to beginning the study, the Scientific Ethical Committee (Number 36, October 2023) at Helwan University's Faculty of Nursing, and the manager of the mentioned settings granted research approval to conduct this study. To win the trust and confidence of the premarital women undergoing premarital exams, the researchers gave them a description of the research goals. The researchers promised to protect the subjects' data's confidentiality and anonymity. The premarital females were made

aware of their freedom to opt-out of the study at any moment and that they could choose not to participate.

A pilot study involving 10% (12) of the premarital females was carried out two weeks prior to the actual study to ascertain the method of selecting the females, assess the relevance, lucidity, and relevance of the research instruments, and calculate the time required to complete the instruments. The pilot study was added to the study sample since the results showed that no changes were needed.

Field work:

Study Duration: The study's data collection and educational program implementation took place two days a week, from 9 a.m. to 2 p.m., from the start of November 2023 to the end of February 2024. It included four phases, which are as follows: assessment, planning, implementation, and evaluation phase.

Assessment phase: The study researchers welcomed the premarital women who met the eligibility criteria, gave them an introduction to the research topic, and, before to the interview, obtained their informed agreement to take part in the research. The questionnaire took an average of 15 to 20 minutes to complete; during this phase, baseline data on knowledge and perception towards folic acid intake before conception was gathered from premarital females. Tools were distributed to collect preliminary information on the characteristics of women by using tool-I. The baseline assessment also included females' knowledge towards folic acid intake before conception (tool-II- pre-test), and female's perceptions about perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, and cues to action according to the HBM (tool- III-pre-test). Questionnaires were distributed and collected on the same day.

Planning phase: Considering the findings of the pre-test, the researchers identified the essential needs of the premarital females. Using instructional media, they prepared

an educational session and produced an instructional booklet in Arabic about the significance of FA intake preceding conception and its impact in preventing NTDs. They also used a variety of teaching methods, including lectures, videos, posters, and group discussions. The number and type of sessions were determined.

Implementation Phase:

The researchers provided the teaching program for premarital females in the previously mentioned setting throughout this phase. Six groups of twenty to twenty-one women each were formed. Each group participated in the educational program for a total of two weeks. There were four sessions in the program. Each 30- to 45-minute session included discussion times focusing on the female participants' feedback and accomplishments. Females were offered sessions through online platforms and in-person contacts based on their appropriateness and preferences. At the end of each working session, the schedule was established. The educational sessions covered the following topics:

Session 1: Each woman received an introduction to the meaning, importance, and main components of preconception care, as well as the dangers of being underweight or overweight during pregnancy, the essential advice for maintaining a healthy diet prior to becoming pregnant, and the essential prenatal vitamins to take. This information was included in a brochure given to participants.

Session 2: Emphasized on the importance of consuming folic acid (FA), its advantages, the optimal time to take it, the recommended dosage, methods of obtaining it, foods high in it, the conditions that call to increase folic acid levels, and the causes, signs, and primary consequences of folic acid insufficiency.

Session 3: The seriousness of neural tube defects (NTDs) and their causes are discussed during this session, along with the possible significant health

consequences, the need for treatment, and its wider impacts on individual and social health.

Session 4: An increased emphasis concerning the significance of taking supplements of FA in order to prevent abnormalities in neural tubes (NTDs), maintaining a healthy lifestyle, and answering the participants questions.

Evaluation phase: At the end of the fourth session, the evaluation was conducted through post-test questionnaires (Tool-I & II), which were identical to the pre-test to verify the changes in the presented females' level of knowledge and perceptions regarding folic acid consumption before pregnancy immediately following the implementation of the educational program based on the health belief model.

Limitations of study:

Because the Atlas Medical Center is the only facility in the Helwan area offering premarital counseling services, the sample was only taken from one location, which led to a small sample size. Additionally, the Atlas Medical Center's packed and noisy waiting area made it more difficult and time-consuming to conduct the study.

Administrative design:

The manager of Atlas Medical Center received formal letters from the dean of Helwan University's Faculty of Nursing granting permission to collect data and execute the educational program. The researchers met with the administrative staff to discuss the purpose and goals of the study as well as the educational program.

Statistical design:

The Software Statistics Package for Social Science (SPSS), version 21, has been employed to gather, code, arrange, and interpret the findings utilizing the proper statistically significant tests. Descriptive statistics were used, such as percentages, frequency, mean, along with standard deviation. Also, significance tests (Chi-square test, and the correlations within the quantitative variables were found using Pearson correlation.

At a p -value ≤ 0.05 , statistical significance was considered.

Results:

Table (1) Illustrates that the mean age of the premarital females was 22.7 ± 2.33 and three quadrants of them (75.4%) were from urban areas and less than two thirds (60.7%) don't work. Regarding females' education, 16.4% of them were reading and writing only, while 42.6% and 41.0% of them graduated from secondary education (diploma) and university, respectively.

Table (2) clarifies that 32.8% of the premarital females had normal weight ($18 < 25$), while 67.2% of them were overweight ($25 < 30$), and the mean body mass index was 25.79 ± 2.54 kg/m².

Table (3) indicates that 54.1% of the premarital females had no previous health problems while 45.9% of them had previous health problems like anemia, vaginal infection, polycystic ovaries and pre-menstrual syndrome. As regarding to the family history of neural tube defects, 95.1 % of the families of the premarital females having children without neural tube defect.

Figure (1) shows that 40.9% of the premarital females reported that the health care workers served as the primary source of their information about preconception folic acid intake, after that from their friends and social media (28.6% & 15.8%), respectively.

Table (4) illustrates that there was a high statistically significant difference considering subtotal knowledge scores of premarital females regarding preconception care, FA intake and NTDs at pre and post implementation of educational program. As their all-total scores increase in post-test than in pretest with a p -value= 0.000.

Figure (2) shows the satisfactory knowledge level of the participants increased from 24.6% before implementation the educational program to 83.6% after the educational program implementation.

Table (5) indicates that there is a high significant relation between pre- and post-program implementation as regarding to the subtotal Health Belief Model scores of the premarital females with regard to pre-conceptual FA intake at both. As the mean scores of the all-subtotal items are increased in the posttest than in the pretest.

Figure (3) shows that 77% of the premarital females who had a low perception of the total health beliefs regarding preconception folic acid intake and 5.7 only had high perception at the pretest, while 51.6% at post education those with low perception decreased to 8.2 and those with high perception increased to 51.6 at the posttest.

Table (6) reveals that there was a significant relation between premarital females' knowledge regarding pre-conception folic acid intake and their all socio-demographic data in both pre and post the educational program, except the data of the BMI, only the significant relation was noticed in the pre-education.

Table (7) clarifies that there was a highly significant relation between premarital females' health belief regarding pre-conception folic acid intake and their all socio-demographic data in both pre and post the educational program.

Table (8) reveals a highly statistically significant positive correlation between the overall knowledge level and the health belief scores regarding preconception folic acid intake at both pre and post educational program where $r=0.454$, $P= 0.000^*$ and $r= 0.356$, $P= 0.000^{**}$ respectively.

Table (1): Distribution of the Premarital Females Regarding Socio-demographic Characteristics (n=122).

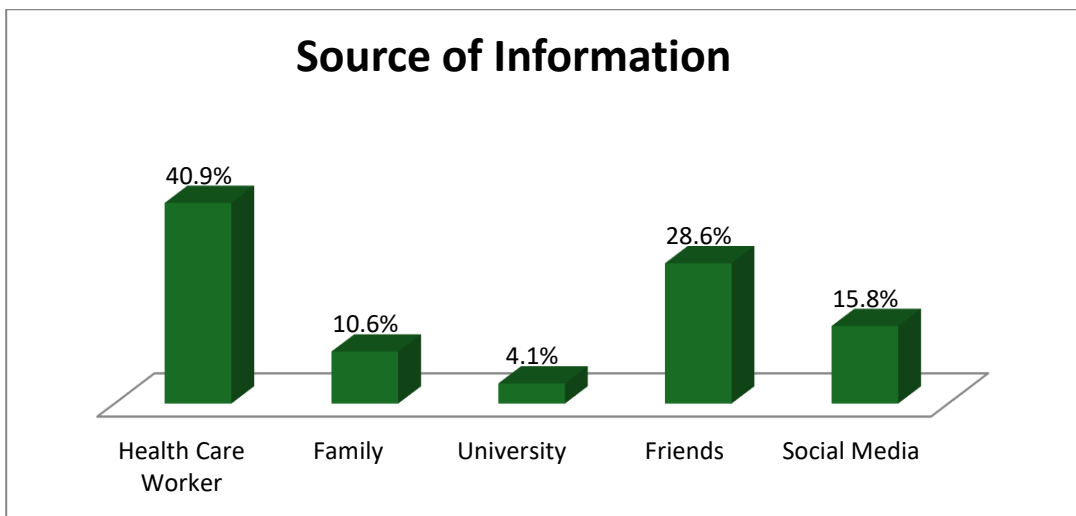
Items	No.	%
Age/ years		
19 – 22	52	42.6
23– 26	64	52.5
27 – 29	6	4.9
Range	19-28	
Mean \pmSD	22.7 \pm 2.33	
Residence		
Rural	30	24.6
Urban	92	75.4
Level of education		
Read and write	20	16.4
Secondary education	52	42.6
University education	50	41.0
Occupation		
Employee	48	39.3
Not working	74	60.7

Table (2): Distribution of the Premarital Females' Mean Score of Anthropometric Measurements (n=122).

Items	No	%
Height		
Range	155- 175	
Mean \pm SD	164.43 \pm 5.84	
Weight		
Range	58-85	
Mean \pm SD	70 \pm 8.70	
BMI		
Normal weight (18 <25)	40	32.8
Overweight (25 < 30)	82	67.2
Range	21.1-29.7	
Mean \pm SD	25.79 \pm 2.54	

Table (3): Distribution of the Premarital Females Regarding Past Medical and Family History (n=122).

Items	No.	%
Previous health problem		
No	66	54.1
Yes	56	45.9
If yes, what are these (n = 56)		
Anemia	22	39.3
Vaginal infection	16	28.6
Polycystic ovaries	10	17.8
Pre-menstrual syndrome	8	14.3
Relatives have children with neural tube defect		
No	116	95.1
Yes	6	4.9



* Multiple responses.

Figure (1): Distribution of the Premarital Females According to Their Source of Information about Preconception Folic Acid Intake (N = 122).

Table (4): Comparison of Premarital Females' Subtotal Knowledge Scores regarding preconception folic acid intake Pre and Post Program Implementation (n = 122).

Items	Pre-program				Post program				X2	P-Value
	Un-satisfactory		Satisfactory		Un-satisfactory		Satisfactory			
	N	%	N	%	N	%	N	%		
Knowledge about preconception care. Mean ±SD	107	87.7	15	12.3	27	22.1	95	77.9	17.25	0.000**
	6.81±4.324				9.01±4.57				t=8.540	0.000**
Knowledge about folic acid intake. Mean ±SD	92	75.4	30	24.6	13	10.7	109	89.3	18.64	0.000**
	2.83±1.751				3.25±1.57				t=15.689	0.000**
Knowledge about Neural tube defects. Mean ±SD	81	66.4	41	33.6	30	24.6	92	75.4	2.41	0.000**
	10.80±7.13				16.53±8.08				t=4.369	0.000*

*: Significant at P ≤ 0.05, **: highly significant at p=0.000.

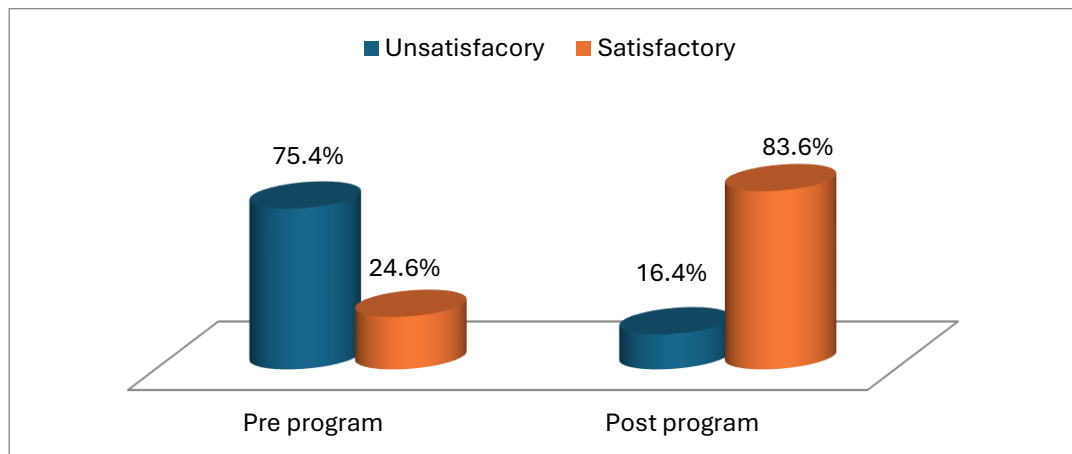


Figure (2): Distribution of the Premarital Females According to Their Total Knowledge Score Concerning Preconception Folic Acid Intake Pre and Post Educational Program (n = 122)

Table (5): Comparison of the Subtotal Health Belief Model Scores of the Premarital Females Regarding Preconception Folic Acid Intake Pre- and Post-program Implementation (n = 122).

Items	Pre-program						Post program						X ²	P - Value
	Low		Moderate		High		Low		Moderate		High			
	N	%	N	%	N	%	N	%	N	%	N	%		
Susceptibility	94	77.1	22	18.0	6	4.9	18	14.8	35	28.7	69	56.5	17.46	0.000**
Mean ±SD	5.39±2.099						9.67±22.947						t=13.06	0.000**
Perceived severity	101	82.8	15	12.3	6	4.9	10	8.2	55	45.1	57	46.7	14.81	0.000**
Mean ±SD	7.057±2.559						11.393±3.289						t=11.49	0.003**
Perceived Benefits	94	77.1	15	12.3	13	10.6	8	6.6	62	50.8	52	42.6	15.40	0.000**
Mean ±SD	15.032±6.320						22.787±7.072						t=9.02	0.01*
Perceived barriers	90	73.8	25	20.5	7	5.7	5	4.1	72	59.0	45	36.9	7.21	0.000**
Mean ±SD	10.975±4.595						11.656±4.122						t=1.217	0.01*
Efficacy	60	49.2	62	50.8	0	0.0	12	9.9	58	47.5	52	42.6	15.49	0.000**
Mean ±SD	3.016±1.001						4.557±1.414						t=9.813	0.000**
Cues	94	77.1	28	22.9	0	0	16	13.1	54	44.3	52	42.6	11.77	0.000**
Mean ±SD	8.213±2.433						13.672±4.244						t=12.32	0.000**

*: Significant at $P \leq 0.05$, **: highly significant at $p=0.000$.

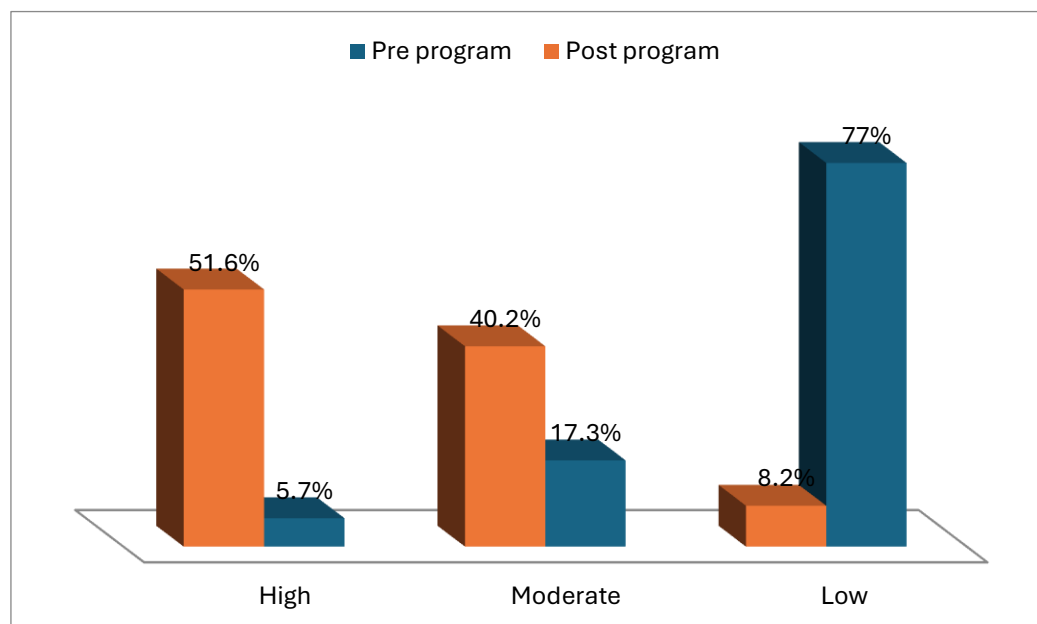
**Figure (3):** Total health belief level of the premarital females regarding pre conception folic acid intake pre and post educational program (n = 122).

Table (6): Relation between Socio-demographic characteristics of the studied sample and total knowledge scores regarding pre-conception folic acid intake (n = 122).

Items	Total knowledge								X ² , P	
	Pre				X ² , P	Post				
	Un-satisfactory		Satisfactory			Un-satisfactory		Satisfactory		
	No.	%	No.	%		No.	%	No.		%
Age/ years										
19 – 22	47	51.1	5	16.7	11.68, 0.01**	6	30	46	45.1	1.612, 0.000**
23– 26	42	45.7	22	73.3		13	65	51	50	
27 – 29	3	3.2	3	10.0		1	5	5	4.1	
Residence										
Rural	29	31.5	1	3.3	9.69, 0.001**	5	25	25	24.5	1.002, 0.002**
Urban	63	68.5	29	96.7		15	75	77	75.5	
Levels of education										
Read and write	20	21.7	0	0	30.22, 0.000**	6	30	14	13.8	8.131, 0.000**
Secondary education	47	51.1	5	16.7		3	15	49	48	
University education	25	27.2	25	83.3		11	55	39	38.2	
Occupation										
Employee	30	32.6	18	60.0	7.11, 0.01**	7	35	41	40.2	0.189, 0.04*
Housewife	62	67.4	12	40.0		13	65	61	59.8	
BMI										
Normal weight	36	39.1	4	13.3	6.83, 0.01**	6	30	34	33.3	0.084, 0.496
Overweight	56	60.9	26	86.7		14	70	68	66.7	

*: Significant at $P \leq 0.05$, **: highly significant at $p=0.000$.**Table (7):** Relation Between Socio-Demographic and Anthropometric Characteristics of The Studied Sample and Total Health Belief Level Regarding Preconception Folic Acid Intake (N = 122).

Items	Total Health Belief level										X ² , P			
	Pre						X ² , P	Post						
	Low		Moderate		High			Low		Moderate		High		
	No.	%	No.	%	%	No.		No.	%	No.		%	No.	%
Age/ years														
19 – 22	52	55.3	0	0	0	0	33.986, 0.000*	5	27.8	30	43.5	17	48.6	4.770, 0.001**
23– 26	39	41.5	20	95.2	5	71.4		11	61.1	35	50.7	18	51.4	
27 – 29	3	3.2	1	4.8	2	28.6		2	11.1	4	5.8	0	0	
Residence														
Rural	30	31.9	0	0	0	0	11.85, 0.001**	4	23.2	16	23.2	10	28.6	0.427, 0.554
Urban	64	68.1	21	100	7	100		14	76.8	53	76.8	53	71.4	
Level of education														
Read and write	20	21.3	0	0	0	0	34.549, 0.000**	2	11.1	11	15.9	7	20	2.251, 0.000**
Secondary education	52	55.3	0	0	0	0		7	39.9	28	40.6	17	48.6	
University education	22	23.4	21	100	7	100		9	50	30	43.5	11	31.4	
Occupation														
Employee	34	36.2	8	38.1	6	85.7	6.718, 0.07*	9	50	27	39.1	12	34.3	1.233, 0.02*
Housewife	60	63.8	13	61.9	1	14.3		9	50	42	60.9	23	65.7	
BMI														
Normal weight	38	40.4	0	0	2	28.6	12.789, 0.01**	5	27.8	24	34.8	11	31.4	0.359, 0.01**
Overweight	56	59.6	21	100	5	71.4		13	72.2	34.8	45.	24	68.6	

*: Significant at $P \leq 0.05$, **: highly significant at $p=0.000$.

Table (8): Correlation between Total knowledge and total health belief regarding preconception folic acid intake

Items	Total knowledge			
	Pre program		Post program	
	r	P	R	p
Total Health Belief	0.454	0.000*	0.356	0.000**

** : highly significant at $P \leq 0.000$, r: Correlation Coefficient

Discussion:

Because the preconception period offers a chance to encourage optimal embryogenesis through appropriate maternal behaviors, such as consuming enough folic acid, it is crucial for preventing unfavorable pregnancy outcomes. The Health Belief Model states that women's perceptions of the perceived benefits of the suggested behavior (such as FA intake) and the perceived health threat (such as folate deficiency) impact their decisions to start and continue health-related behaviors, such as supplementing with FA. Maternal awareness and perception of folic acid's advantages are crucial in lowering the prevalence of birth disorders because it plays a critical role in preventing congenital malformations, including NTDs (Fahim et al, 2023).

The purpose of the current shown study was to assess how premarital females' perceptions regarding preconception folic acid supplementation were affected by the health belief model based educational program. According to the studied females' personal and socio-demographic characteristics, the current research showed that the mean age of the premarital females was (22.7 ± 2.33). This result is consistent with a study by Mohammed et al. (2020) in Egypt which found that the mean age was between 22.18 ± 0.78 . indicating that a significant proportion of premarital females are in their early to mid-twenties.

Less than two-thirds of them were unemployed, slightly Over three-fourths of them were from urban areas, the highest percentage was for those who were secondary school graduates, and less than two thirds didn't work. This result contrasts with Habib et al., 2022 who found that regarding occupation, most of the study population were housewives, and nearly three-quarters of them were from rural areas. Additionally, the largest

percentage of the sample had a secondary education. These finding also are slightly contradicted to a study by Bizuneh and Azeze (2022) which showed that nearly half were housewives, and more than a quarter were college-educated.

According to anthropometric measurements, the current study found that over two-thirds of the studied females were overweight ($25 < 30$) and that BMI mean was 25.79 ± 2.54 . This finding is congruent with Mohamed et al., 2020 whose results revealed that the mean body mass index was 24.19 ± 3.50 kg/m². Also, Elzaki et al. (2019) stated that female students' BMI mean was 24.21 ± 4.234 kg/m². Compared to regional and global averages, the study shows a higher average BMI and a higher prevalence of overweight people. This implies that public health initiatives aimed at controlling and preventing overweight and obesity are necessary, especially if the sample is representative of larger population patterns. Effective health strategies and interventions can be tailored by having a thorough understanding of the specific factors causing this high prevalence.

Regarding to previous health and family medical histories, the current research showed that, nearly more than half of the premarital females had no prior medical problems, while less than half had previous health problems like anemia, vaginal infection, polycystic ovaries and pre-menstrual syndrome. These findings demonstrated a poor intake of multivitamins and a poorly balanced, healthy diet. Additionally, the fact that women with a history of health issues may seek out information on preconception health and pregnancy may help to explain the correlation between preconception folic acid awareness and prior health issues. This result was in the same line with Mohamed et al., 2020 who concluded that just over two-thirds of the pupils in the study had never experienced any

health issues before. Of the pupils in the study, slightly over two-thirds had never experienced any health issues. Anemia rate among them was less than two-thirds.

The current study also illustrated that the most of the studied females' families had children without neural tube defect. This result might be referred to the illiteracy of the studied group of the exact previous history. This result contradicted to the findings of **Alnaami et al., 2018** who showed that almost 25% of female college students had a relative with a congenital defect.

Regarding the primary source of the studied females' information, the findings clarified that, nearly half of the premarital females reported that the health care workers were the main source of their information about preconception folic acid intake, while the second source was from their friends and social media. This result indicated the vital role of health workers in educating preconception females in Health centers which in result encourage these females to folic acid consumption.

A study by **Alsammani et al. (2017)** found that doctors were the most common source of folic acid information (62%), followed by newspapers (21%). This finding supported the current study. In contrast, the findings of the study by **Begashaw et al. (2022)** contradicted this one as the authors found that over half of the women derived their knowledge about folic acid from schoolteachers and media.

The findings of the current study demonstrated that the educational program significantly improved the knowledge scores of premarital females regarding neural tube defects, folic acid intake, and preconception care. where the satisfactory knowledge level of them increased after the educational program implementation. These results suggested that educational interventions were highly effective in raising awareness about essential topics such as folic acid supplementation, which plays a crucial role in reducing NTDs and enhancing reproductive health outcomes. This result agreed with **Mohammed et al. (2020)** They found that the post-total students' knowledge mean scores for pre-conceptual folic acid intake had improved in a highly statistically

meaningful way. The majority of them were well-informed on the post-preventive program.

This result aligned with research findings conducted in Egypt by **Habib et al. (2022)**. The study found that the study participants' mean score on the posttest following the educational intervention implementation was higher than their pretest score prior to the educational intervention implementation. According to the researcher, those notable findings are connected to low educational attainment and the cultural norms of communities. This finding was consistent with **Teshome et al. (2022)**, who demonstrated that women with four or more antenatal care visits (ANC) were 2.3 times more likely than those with fewer than four "ANC" visits to be aware of their consumption of FA and iron during the preconception period. Furthermore, these results were consistent with a study by **Raad and AbuAlhommos (2021)** that discovered that about 25% of individuals had a good awareness level of folic acid, while the majority had poor awareness.

The findings of a study by **Al-Zahrani and Al-Marwani (2022)** also aligned with these findings. According to AIMS Medical Science, participants' knowledge of FA was significantly higher on average after the intervention than it was prior to it ($p < 0.001$). Furthermore, these results are consistent with the findings of a study by **Soliman et al. (2021)** explained that the pregnant women mean knowledge score concerning FA consumption during pregnancy was statistically significant, rising from a lower percentage prior to the health education sessions to a higher percentage following them.

The current research illustrated the presence of a highly high significant relation between pre- and post-program implementation as regarding to the subtotal Health Belief Model scores of the premarital females regarding pre-conceptual folic acid intake at both as it is increased at posttest than the pretest. This finding could be explained by that the health belief model based educational program played a vital part in enhancing the female participants' understanding of the significance of folic acid consumption prior to conception. This explanation was corroborated by **Fahim**

et al. (2023), who showed that while nearly one-third of the sample had a positive attitude toward folic acid intake, over two-thirds had a negative attitude. This might be the result of pregnant women's lack of awareness and knowledge about folic acid intake that strongly indicated the importance of such programs in improving the perception about the significance of prenatal folic acid consumption. Moreover, the presented result was in the same line with **Mohammed et al. (2020)** whose results showed that with reference to pre-conceptional folic acid consumption and pre-preventive programs, over 10% of the nursing pupils had a favorable opinion of overall health. Additionally, more than seventy percent of them had positive perceptions of the post-preventive program.

In a study of **Bernardo (2022)** who found that over three-quarters of pregnant women had a fair (negative) level of attitude toward folic acid tacking during pregnancy. This result was consistent with that found in that study. However, the findings of the study contradicted those of **Abdulmalek (2019)**, who discovered that many pregnant women interviewed had favorable attitudes regarding taking folic acid supplements. In contrast, according to **Ali and Lefta (2018)** the majority of pregnant women in the study had positive attitudes regarding the use of folic acid during pregnancy. A post-preventive program significantly outperforms a pre-preventive program in terms of the overall score of the health belief model and its subscales, which include perceived susceptibility, perceived severity, perceived benefits, self-efficacy, and cues to action ($P \leq 0.001$). These findings were consistent with a study by **Mohammed et al. (2020)** in Egypt which found that the health belief model improved following a preventive program.

As regarding to the association between premarital females' knowledge regarding pre-conceptional folic acid intake and their all socio-demographic data, the current research revealed that there was a significant relation between the females' all socio-demographic data and knowledge in both pre and post the educational program, except the data of the monthly income and BMI, only the significant relation was noticed in the pre-education. The results of the current study were in line with

those of **Yasmin et al. (2022)**, who demonstrated a significant correlation between participants' education and their awareness of folic acid ($P=0.004$). The same study demonstrated a strong correlation between participants' age and folic acid knowledge ($P=0.001$), which was inconsistent with the relationship between women's age and their degree of knowledge. Additionally, **Cui et al. (2021)** provided support for this conclusion by demonstrating that women with a college or university degree were more likely to be aware of FA and to start taking FA at the appropriate time than women with only a primary or secondary school education.

The current research clarified that there was a highly significant relation between premarital females' health belief regarding pre-conceptional folic acid intake and their all socio-demographic data in both pre and post the educational program which reflected the significant effect of introducing preventive education based on HBM in improving premarital females' perception about FA intake to prevent any harm during pregnancy especially the neural tuba defect. The current study found a statistically significant positive correlation between the studied females' total knowledge and health belief scores before and after the educational program. This result could be explained by the fact that better perceptions and more robust health beliefs are a result of increased knowledge. This result was in consistent with **Kim et al. (2018)**, who observed those women who knew about folic acid and those who didn't were compared in terms of how frequently they used folic acid supplements. In general, those with more knowledge were more likely than those without to use folic acid supplements. Another supported finding argued by **Mohammed et al. (2020)** and **Arlinghausetal 2018** when comparing the total health belief and total knowledge scores of the students under study before and after the preventative program, the results showed a statistically significant positive link.

Conclusion:

In addition to the mean of health belief model total score and its subscales being significantly higher than pre-program

implementation, the study found that premarital females who took part in the educational program demonstrated a significant improvement in their overall knowledge level regarding preconception folic acid supplementation after the program's implementation. The mean score of the perceived barriers subscale, on the other hand, was significantly lower than pre-program implementation. The current study's results met its objectives and provided evidence in favor of the hypothesis that premarital women's perceptions of their preconception folic acid intake were improved by the implementation of the health belief model based educational program.

Recommendations:

- Increasing awareness among women of reproductive age about the importance and optimal timing of folic acid intake before conception.
- The significance of folic acid consumption and the monitoring of folic acid nutrition status through dietary evaluation or blood folic acid concentration estimation should be regularly taught to married and unmarried women.
- Campaigns to promote health should emphasize the advantages and security of FA supplementation for all women who are of age at which children can be born.
- Further research should be conducted to examine the outcomes of preconception folic acid supplementation on pregnancy and birth outcomes, including congenital anomalies like NTDs.

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