Health Belief Model and Nursing Students' Perception about Benefits of Pre Conceptional Folic Acid Intake

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ABSTRACT

Context: Preconception folic acid intake is necessary for optimal embryogenesis. Using the health belief model is excellent to improve the young women's belief towards recommended healthy behaviors of taking folic acid.
Aim: The study aimed to examine the effect of the health belief model on nursing students' perception of the benefits of pre-conceptional folic acid intake.
Methods: A quasi-experimental design (pre-posttest) was used. The research was conducted at the Faculty of Nursing, Benha University on a purposive sample of (120) 4th-year female nursing students. Two tools of data collection were used. They are a self-administrated questionnaire and a Health Belief Model Scale.
Results: There was a highly statistically significant difference concerning all items of nursing students' knowledge regarding pre conceptional folic acid intake pre and post-program (P ≤ 0.001). Furthermore, the mean total score of the health belief model subscales post-preventive program is significantly higher than a pre-preventive program (P ≤ 0.001). Meanwhile, the mean score of perceived barriers post-preventive program is significantly lower than a pre-preventive program (P ≤ 0.001).
Conclusion: The health belief model improved nursing students' perception of pre-conceptional folic acid intake benefits. The study recommended applying the health belief model for all female university students as preventive behavior toward the benefits of pre-conceptional folic acid intake.

Keywords: Health Belief Model, nursing students' perception, pre conceptional, folic acid

1. Introduction

The preconception period can be defined as the time from the intention to conceive to actual conception. However, it ignores that many pregnancies (up to 50%) are unintended or mistimed. The preconception period significantly impacts fertility, rates of congenital anomalies, preterm birth, and infant and maternal mortality *(The Lancet, 2018)*.

Maternal perception about folic acid's importance in preventing congenital malformation included neural tube defects play an essential role in decreasing numbers of birth with disorders *(Alquraini, 2019)*. Difficulties in behavioral changes could explain the gaps between awareness, knowledge, and use of folic acid. Many factors contribute to behavioral changes associated with folic acid supplements. Low use of folic acid supplements was reported to be associated with lack of pregnancy intention, high cost of folic acid tablets, forgetfulness, and lack of knowledge *(Kim et al., 2018)*.

Folic acid (vitamin B9) is the synthetic form of folate used in supplements and food fortification. Folic acid (FA) helps cut the risk of having a baby with specific congenital disabilities of the brain and spinal cord, especially before getting pregnant *(Jalambadani et al., 2020)*. Nutritional folate consumption is not sufficient for optimal reduction of neural tube defects (NTDs) risk. Therefore many countries encourage women to take folic acid before conception *(Moser et al., 2019)*.

The United States Public Health Service (UNPHS) had recommended taking 400 μg of folic acid daily for three months before conception until the 12 weeks of gestation for all women who are planning to become pregnant. Besides, synthetic folic acid has a higher bioavailability than the natural form of folate *(Ikeda-Sakai et al., 2019)*. No protection was observed in women who started folic acid after the seventh week of gestation because NTDs occur during the 22th-28th days of the embryonic period before most women even know about pregnancy. So, folic acid supplements initiation after the first month of pregnancy is too late to prevent NTDs *(Lee et al., 2019)*.

Pre-conceptional folic acid protects against fetal structural anomalies, including neural tube defects, orofacial abnormalities, and congenital heart defects. It also protects against placental abruption and preterm birth. It is

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recommended to all women attempt conception or sexually active without contraception *(Khan & Robinson, 2018)*. Pre-conceptional folic acid administration can efficiently decrease women's risk to produce fetuses with neural tube defects with an 85% decline in the high prevalence and 41% in low prevalence areas *(Kamran et al., 2018)*.

Several factors have been associated with preconception folic acid supplementation, including maternal age, educational status, marital status, employment status, the number of prior pregnancies and income, whether the pregnancy was planned or unplanned, the level of knowledge and awareness of the importance of folic acid supplementation before and during pregnancy for promoting the use of preconception folic acid to prevent NTDs *(Ezzeddin et al., 2019)*.

Neural tube defects (NTDs) persist as a common and potentially devastating birth defect affecting the central nervous system and axial skeleton that occur as a result of a defect in the closure of a part of the neural tube during the early weeks of intrauterine development *(Murphy & Westmark, 2020)*. Worldwide, NTDs affect 0.5-2 in every 1000 pregnancies. The precise cause of NTDs is not fully realized, but researchers expect that a combination of genetic, health, and environmental factors are involved *(Welderufael et al., 2019)*.

Therefore, educational programs should focus on improving the knowledge of future mothers. Particular attention should be stressed to healthy, balanced nutrition and familiarizing women with food products rich in natural folic acid sources. Adequate education of young women would improve the prevention of neural tube defects in the future by disseminating knowledge for women about the latest recommendations, taking folic acid at a dose of 0.4 mg at least 12 weeks before the planned pregnancy *(Mroczek et al., 2018)*.

Maternity nurses and midwives can emphasize intervention and start an educational campaign that can emphasize the importance of consuming folic acid supplements and folate diet regularly to promote the healthy outcome of the pregnancy and reduce the risk of neural tube defects *(Puri et al., 2019)*. Nurses should be fully aware and provide folic acid supplementation advice. Women generally present at the obstetricians' clinics following conception, at a time too late for prevention of potentially avoidable NTDs. Post-natal clinics could also provide a venue for educating and informing women of folic acid benefits for future pregnancies *(Gatt et al., 2019)*.

Health Belief Model (HBM) is an explanatory theoretical model most relevant and applied when investigating motivation to act on asymptomatic and not developed illnesses. The HBM comprises six concepts: perceived severity and susceptibility, benefits and barriers, self-efficacy, and cues to action. This model allows charting a roadmap of the current gaps in a women's understanding of, motivation, or ability to engage in a healthy behavior *(Urbanovich & Bevan., 2020)*.

2. Significance of the Study

The most frequent congenital anomalies were the high rate of neural tube defects due to no or low folic acid use during the preconception period *(Taye et al., 2019)*. In Egypt, congenital anomalies are increasing and have become 65.3/1000 live births *(Abdou et al., 2019)*. Pre-conceptional folic acid significantly decreases the risk of NTDs. The incidence of NTDs in developing countries has been up to four folds higher than in developed ones. *(Berihu et al., 2019)*. In Egypt, the incidence of Spina Bifida was 5/1000 due to a lack of folate supplementation *(Maged et al., 2016)*. Also, the incidence of neural tube defects was increased in primigravida offspring *(Reda et al., 2019)*.

The rate of non-preventable NTDs can be brought down to 5-6/10,000 births when folic acid is taken correctly in the preconception period *(Gatt et al., 2019)*. Over 2000 children would have been saved each year from death or a lifetime handicap if folic acid fortification had been implemented *(Wald et al., 2020)*. The global prevalence of folate deficiencies worldwide is not known precisely but is more marked in Africa *(Bationo et al., 2020)*.

Improving folic acid knowledge among healthcare providers and students is an essential step in promoting the use of preconception folic acid to prevent NTDs *(Ishikawa et al., 2018)*. There are limited studies in the Obstetrics and Woman's Health Nursing department directed to evaluate the perception of folic acid benefits among young Arabic women to the best of our knowledge. Therefore, increasing female nursing students' perception of pre-conceptional folic acid benefits is crucial and would prevent many problems and decrease maternal and neonatal morbidity and mortality.

3. Aim of the study

The study aimed to examine the health belief model's effect on nursing students' perception of the benefits of pre-conceptional folic acid intake**.**

3.1. Research objectives

- Assessing nursing students' perception regarding pre-conceptional folic acid benefits.
- Designing and application of preventive program based on the health belief model according to nursing students' needs.
- Evaluating the effectiveness of a preventive program on improving nursing students' perception of pre-conceptional folic acid benefits.

3.2. Research hypothesis

Health belief model preventive program would positively affect nursing students' perception of pre-conceptional folic acid benefits.

4. Subjects & Methods

4.1. Research design

A quasi-experimental research design was utilized to

accomplish the study's aim (one group pre/post). A quasi-experiment is an empirical interventional study used to estimate an intervention's causal impact on the target population without random assignment. Quasi-experimental research shares similarities with the traditional experimental   design or randomized   controlled trial, but it specifically lacks the element of random assignment to treatment or control *(Dinardo, 2008).*

4.2. Research Setting

The research was conducted at the Faculty of Nursing at Benha University. It was established in 1988. The building consists of four floors. Each floor includes two runways. It is located in Benha City.

4.3. Subjects

158   A purposive sample was selected from the mentioned study setting. A total of 120 female nursing students were included in the current study, which comprises the target population due to more engaged and married females than in other classes. The total number of students enrolled in the fourth academic year 2018/2019 (375) students, (95) males and (280) female. The sample size was calculated according to the following formula:

$$n = \frac{N}{1 + N(e)^2}$$

Where:
n = the sample size
N = the finite population
e = level of significance or (limit of tolerable error). Error = 0.05
I = unit (a constant),

Only one hundred and twenty females were selected according to the following inclusion criteria.
- Female nursing students.
- Engaged or married students.
- Pregnant students because they may be benefited in the next pregnancy.
- Free from medical, psychological, obstetrical disease or congenital abnormality.

4.4. Tools of the study

Two main tools were used for data collection.

4.4.1. A Self-Administered Questionnaire

The researcher developed it after reviewing related literature *Alblowi and Alomayri (2018); LaBrosse (2011).* It was written in simple Arabic language in the form of closed and open-end questions and divided into three parts:
Part 1 concerned with the studied sample's personal and socio-demographic characteristics included age, marital status, residence, working, monthly income, and phone number. Besides, anthropometric measurements involved measurement of weight (measured in kilograms) and height (measured in centimeters), which were converted into body mass index (measured by kg/m^2).
Part 2 encompassed medical and family history. It included a history of any health problems (anemia, headache) and

relatives having children with neural tube defects.
Part 3 incorporated the assessment of female nursing students' knowledge regarding pre-conceptional folic acid intake. It consisted of three sections:
Section 1 was concerned with knowledge related to preconception care. It consists of 8 questions (definition, importance, barriers, components, risks of underweight and overweight, healthy diet before pregnancy).
Section 2 was concerned with knowledge related to folic acid. It consists of 12 questions (definition, benefits, the best time to take folic acid, symptoms of folic acid increasing, complications, and folic acid deficiency).
Section 3 was concerned with knowledge related to neural tube defects. It consists of 3 questions (definition, causes, prevention of neural tube defects). This part was used twice pre and post-program implementation.
Knowledge's scoring system

All knowledge variables were weighted according to questions included in each section, with a total of 23 questions. Each question was given a score of 3 when the answer was the complete and correct answer. A score of 2 when the answer was the incomplete correct answer, and a score of 1 when the answer was incorrect, or I do not know. The total score of each section was calculated by summation of the scores of its items. The total score for each student's knowledge was calculated by the addition of the total score of all sections. The total score of knowledge was ranged from 23 – 69.

The score of total knowledge was classified as the following:
- Good: ≥ 75% correct answers (51- 69 marks)
- Average: 50 - < 75% correct answers (34-51 marks)
- Poor: < 50% correct answers (23-34 marks)

4.4.2. Health Belief Model Scale

The health belief model scale was adapted from *Kloeblen and Batish (1999).* It was predictive of following a high folate diet in low-income pregnant women permanently and was modified for use with students. Modifications were done by the researcher under the guidance of a panel of experts and were translated into the Arabic language to evaluate health beliefs of female nursing students towards pre conceptional folic acid intake. It is composed of 36 items, including six subscales forming the health beliefs model. The subscales are:
- Perceived susceptibility of folic acid deficiency consisted of 4 items.
- The perceived severity of the folic acid deficiency consisted of 5 items.
- Perceived benefits of folic acid intake consisted of 10 items.
- Perceived barriers of folic acid intake consisted of 9 items.
- Self-efficacy of folic acid intake consisted of 2 items.
- Cues to action for folic acid intake consisted of 6 items.

This tool was used twice pre and post-program implementation.

Scoring system

The health belief model scale uses a three-point Likert scale to rate the items (agrees, uncertain, disagree). The researcher corrected the responses, and for each statement, 3 points were given for positive responses (agree) while two were given for uncertain, and 1 point was given for negative responses (disagree), respectively. Scores had a possible range from 36 to 108 for the total health belief model score, with a low score indicating low perception and a high score indicating high perception. For the five subscales, higher scores indicating extremely healthy beliefs. However, for the subscale concerning barriers, higher scores indicate more negative health beliefs.

The level of health beliefs was classified according to *Kamal et al. (2017):*

- Low perception when the total score was less than 50%.
- Moderate perception when the total score was 50% to less than 75%.
- High perception when total score was more than 75%.

4.5. Procedures

The content validity of questionnaires was reviewed by five jury experts related to specialty composed of 3 assistant professors from Faculty of Nursing, Benha University, one professor of Obstetrics and Gynecological nursing at Faculty of Nursing, Zagazig University, and one professor Obstetrics and Gynecology at Faculty of Medicine, Benha University to ascertain clarity, relevance, comprehensiveness, and applicability of tools. Cronbach's alpha tested reliability, the internal consistency of the knowledge questionnaire was 0.913, and the health belief model scale was 0.891.

Ethical consideration: Official permission from the selected study setting was obtained for the fulfillment of the study. Verbal approval from each student to participate in the study was taken before history taken, the aim of the research was explained to each student, the research was not causing any physical, social, or psychological risk on the participant, and each participant was free to withdraw at any time of data collection without obligation.

Official approval from Dean Faculty of Nursing, Benha University, containing the title, the objective was obtained to conduct the study. Then, the researcher interviewed each student and obtained informed oral consent before starting the data collection.

A pilot study was conducted on 10% (12 female nursing students) of the total sample before starting data collection to test the simplicity, clarity, applicability of the study tools, and feasibility of the research process using a self-administered questionnaire and health belief model scale, as well as the estimation of the time needed to fill the questionnaire. No modifications were done. Students who shared in the pilot study were included in the main study sample.

Fieldwork: Data collection was carried out from the beginning of February to the end of May 2019. The researcher visited the pre-mentioned setting from 9 am to 3 pm, three days per week (Sunday, Tuesday, and Thursday) to collect data from female nursing students until the sample size was completed. The researcher implemented the program through 4 phases as the following:

Assessment phase: At the beginning of the interview, the researcher greeted the students, introduced herself to them, and took oral consent to participate in the study. The average time required to complete the questionnaire was around 15-20 minutes; in this phase of the program, the students' perception was assessed by collecting and analyzing baseline data from the filled tools (pre-test).

Planning phase: Based on the results obtained from the pre-test assessment of students' knowledge regarding pre conceptional benefits of folic acid intake and review of relevant literature, the researcher identified the target group's crucial needs. The researcher designed the educational booklet in the Arabic language supported by figures. The sessions' number and its content were determined. The researcher used different teaching methods such as lectures, group discussions with the instructional media's assistance as pictures and data show.

Implementation phase: In this phase, the researcher implemented the prevention program to the studied students at the pre-mentioned setting. Students were divided into six groups, and each group consists of 20 students. The duration of the educational program lasted two weeks for each group. The program was divided into six sessions. Each session lasted 45- 60 minutes, including periods of discussion according to students' achievement, progress, and feedback.

Evaluation phase: After implementing the program, the researcher immediately applied the post-test to evaluate the knowledge acquired. The evaluation was done using the post-test questionnaires, which were the same formats as the pre-test, to compare the change in the studied students' perception immediately after implementing the preventive program based on the health belief model.

4.6. Data analysis

Data were verified before computerized entry. The Statistical Package for Social Sciences (SPSS version 20) was used, followed by data analysis and tabulation. Descriptive statistics were applied (e.g., mean, standard deviation, frequency, and percentages). Also, tests of significance (Chi-square test and Fisher Exact Test) were applied to test the study hypothesis. Pearson correlation coefficients were used to test the correlation between variables. The significant difference was considered at $p \leq 0.05$

5. Results

Table 1 shows that 50.8% of the studied female students were in the age group of 22-< 23 years old with the mean age 22.18 ± 0.78 years, 63.3% of the studied students were engaged, 60% were resident in rural areas. Finally, 48.3% of them had enough only income.

Table 2 indicates that the mean weight and height were 62.88 ± 8.17 kg, 161.26 ± 5.98 cm, respectively, and the mean body mass index was 24.19 ± 3.50 kg/m2.

Table 3 reveals that slightly more than two-thirds (68.3%) of the studied students had no previous health problem as anemia and severe headache, less than two-thirds of them (60.5%) had anemia—most of the studied students (98.3%) of their families having children without neural tube defects.

Table 4 clarifies a highly statistically significant difference regarding mean total scores of preconception care, folic acid intake, neural tube defects, and the total knowledge post-preventive program compared to pre-preventive program (P ≤ 0.001).

Figure 1 illustrates that more than one-tenth of students (12.5%) had good knowledge regarding pre conceptional folic acid intake pre-preventive program. In contrast, most of them (90.9 %) had good knowledge post-preventive program.

Table 5 reveals that the mean total score of the health belief model and its subscales, perceived susceptibility, perceived severity, perceived benefits, self-efficacy, and cues to action post-preventive program are significantly higher than a pre-preventive program (P ≤ 0.001). Meanwhile, the mean score of perceived barriers post-preventive program is significantly lower than a pre-preventive program (P ≤ 0.001).

Figure 2 demonstrates that more than one-tenth (11.7%) of studied students had a high perception of total health beliefs regarding pre-conceptional folic acid intake pre-preventive program. In comparison, most of them (89.2%) had high perception post-preventive program.

Table 6 shows a statistically significant positive correlation between total knowledge and health belief scores pre and post preventive program (P ≤ 0.001).

Table (1): Frequency and percentage distribution of the studied students' socio-demographic characteristics (n=120).

Socio-demographic characteristics	No.	%
Age (years)		
21-<22	22	18.4
22-<23	61	50.8
23-<24	37	30.8
Mean ± SD	22.18 ± 0.78	
Marital status		
Engaged	76	63.3
Married	44	36.7
Residence		
Urban	48	40.0
Rural	72	60.0
Monthly income		
Enough and spared	30	25.0
Enough only	58	48.3
Not enough	32	26.7

Table (2): Distribution of the studied students' mean score of anthropometric measurements (n=120).

Anthropometric measurements	Minimum	Maximum	Mean ± SD
Weight (kg)	46.00	23.18 ± 1.48	62.88±8.17
Height (cm)	145.00	175.00	161.26±5.98
Body mass index (kg/m^2)	17.90	34.20	24.19±3.50

Table (3): Frequency and percentage distribution of the studied students past medical and family history (No=120)

Past medical and family history	No.	%
Any previous health problems		
Yes	38	31.7
No	82	68.3
If yes, health problems are (N=38)		
Anemia	23	60.5
Severe headache	15	39.5
Relatives have children with NTDs		
Yes	2	1.7
No	118	98.3

Table (4): Comparison of studied student mean score of knowledge pre and post-program implementation.

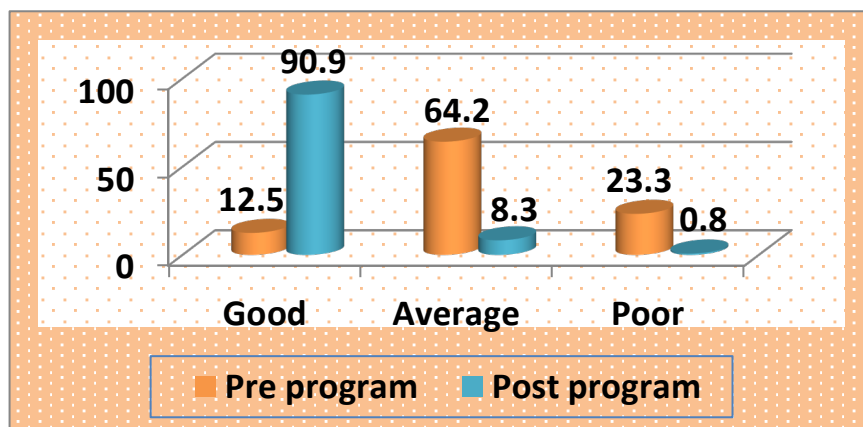| Knowledge element	Maximum score	Pre-program N= 120 Mean ± SD	Post-program N= 120 Mean ± SD	Paired t-test	P-value
Preconception care	24	15.58 ± 2.45	23.18 ± 1.48	30.706	0.000
Folic acid intake	36	19.63 ± 4.47	33.16 ± 4.65	20.241	0.000
Neural tube defects	9	5.12 ± 1.11	7.92 ± 1.27	17.570	0.000
Total	69	40.23 ± 5.85	64.32 ± 5.91	29.055	0.000

Figure (1) Percentage distribution of the studied female students regarding the total level of knowledge regarding pre-conceptional folic acid pre and post preventive program (N= 120).

Table (5): Comparison of Health Belief Model regarding subscales regarding pre-conceptional folic acid intake pre and post-program implementation. 161

| Health Belief Model Subscales	Maximum score	Pre-program N= 120 Mean ± SD	Post-program N= 120 Mean ± SD	Paired t-test	P-value
Perceived susceptibility	12	6.47 ± 1.86	10. 88 ± 1.12	20.526	0.000
Perceived severity	15	8.54±0.58	14.08 ± 1.05	55.613	0.000
Perceived benefits	30	17.11 ± 1.99	27.83 ± 1.98	41.627	0.000
Perceived barriers	27	20.60±2.88	14.74± 2.15	16.848	0.000
Self-efficacy	6	2.32 ± 0.63	5.43 ± 0.92	29.220	0.000
Cues to action	18	9.96±2.10	16.49 ± 1.58	27.850	0.000
Total	108	69.82 ± 10.87	92.12 ± 5.46	19.667	0.000
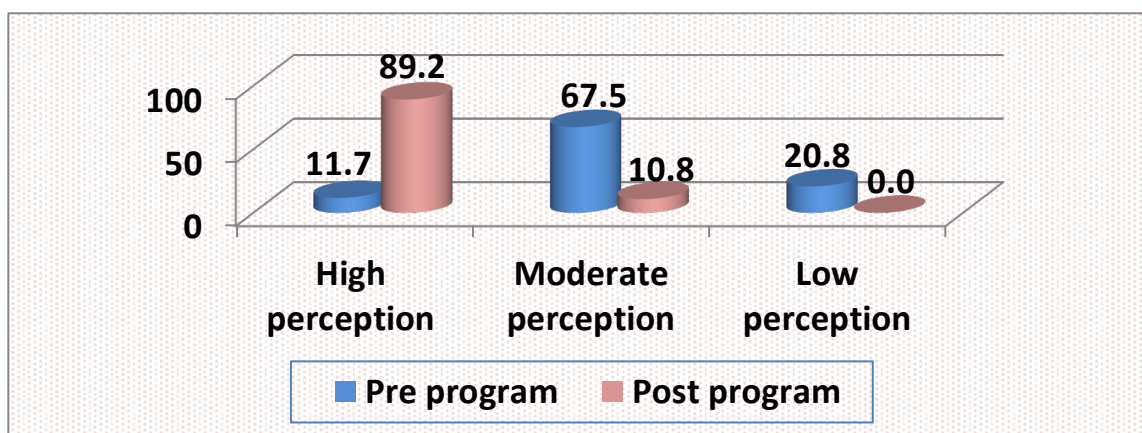
Figure (2): Percentage distribution of the studied students' perception of the total health beliefs regarding pre conceptional folic acid pre and post-preventive program (N= 120).

Table (6): Correlation between studied students' total knowledge and health belief scores pre and post preventive program (N=120).

Variables	Total knowledge score			
	Pre-program		Post-program	
	r	P-value	r	P-value
Total health belief score				
Pre-program	0.724	0.000		
Post-program			0.861	0.000

6. Discussion

Preconception is a critical period for the prevention of adverse pregnancy outcomes. During the preconception period, folic acid intake is necessary for optimal embryogenesis *(Bayrami et al., 2020)*. The impact of NTDs is considered a global healthcare issue affecting many newborns, which account for the second leading cause of infant mortality and result in high morbidity each year. Fortunately, the risks of NTDs can be reduced by 70% when using folic acid supplements (0.4 mg/day) before conception and throughout the first trimester of pregnancy *(Turgut et al., 2019)*.

The high prevalence of folate deficiency underlines the need to implement preconception folic acid supplementation as part of maternal health services *(Bhide & Kar., 2019)*. According to the HBM framework, women's decisions to initiate and adhere to a new behavior are influenced by the perceptions of the health threat (folate deficiency) and the proposed behavior (folic acid intake) *(Nechitilo et al., 2016)*.

The present research aimed to examine the effect of the health belief model on nursing students' perception of pre-conceptional folic acid benefits. According to the studied female students' socio-demographic characteristics, the current research shows that half of the studied sample was in the age group of 22-<23 years with a mean age of 22.18±0.78 years because most female students in this age were engaged and married. This result is nearly similar to a study carried out in Australia by *Fayet-Moore, (2014),* who studied "Micronutrient status in female university students: Iron, zinc, copper, selenium, vitamin B12 and folate" and found that the participants' mean age was 22.6 ± 2.9 years.

The result of the present research revealed that more than half of them were resident in rural areas. This result also agrees with a study performed by *Sailaja et al. (2019),* who studied "Effect of structured teaching programme on Folic Acid supplements in the prevention of congenital anomalies among undergraduate students in a selected college, Tirupathi" and demonstrated that the majority of the undergraduate female student (58%) residing in the rural areas.

Regarding anthropometric measurement, the current research results reveal that the mean body mass index was 24.19±3.50 kg/m². This result is consistent with *Pino (2015)*, who studied "Folate intake in Portuguese female students' population and its relation to body mass index, physical activity level, and intake of other nutrients and confirmed that mean body mass index of female students was 22.1±0.4 kg/m². This finding is congruent with *Elzaki et al. (2019)*, who studied "assessment of the knowledge, dietary habits, and nutritional status among Mansoura University students and stated that female students' mean body mass index was 24.21±4.234 kg/m². Also, the results of current research reveal that around two-thirds of studied students had normal ideal weight. This result is nearly similar to *Virk et al. (2018),* who studied "pre-conceptual and prenatal supplementary folic acid and multivitamin intake, behavioral problems, and hyperkinetic disorders. A study based on the Danish national birth cohort clarified that nearly two-thirds of subjects were normal body weight.

Regarding past medical and family history, the current research shows that slightly more than two-thirds of the studied students had no previous health problems. Among them, less than two-thirds were anemic. This result reflects a lack of multivitamins intake and a low balanced healthy diet. Also, the association of having previous health problems and preconception folic acid awareness may be explained by the fact that women who had any previous health problem may seek information about preconception health and pregnancy *(Cairn cross et al., 2019)*.

The current research results reveal that most families of studied students have children without neural tube defects. The present research comes in the same line with *Alquraini (2019)*, who studied "Perceptions of Folic Acid knowledge and intake among women in the childbearing age in Al-Ahssa'a-Saudi Arabia 2018." It illustrated that 99.5% reported no family history of a child with neural tube defects. This finding contradicted *Alnaami et al. (2018),* who demonstrated that nearly one-quarter of female college students had a relative with a congenital anomaly. This finding may be due to the presence of a positive family history of neural tube defects.

The present research results reveal a highly statistically significant improvement in the post total students' knowledge mean scores regarding pre-conceptional folic acid intake. In the post-preventive program, most of them had good knowledge. This result may be due to the positive effect of the preventive program and the learning sessions. Also, the topic of the research is considered vital and sensitive to their future life and work. So, the students were very interested and satisfied during the learning sessions.

This result comes in the same line with *Stevens et al. (2018)*, who studied "Folate supplementation to prevent birth abnormalities: Evaluating a community-based participatory action plan for refugees and migrant workers on the Thailand-Myanmar border." Their study aimed to assess women's knowledge pre and post-intervention and found a significant improvement in the knowledge about the importance of taking folic acid before conception post-intervention compared to baseline (p<0.001).

Concerning the level of knowledge regarding pre-conceptional folic acid pre and post preventive program, the present research results revealed that more than one-tenth of the studied students had good knowledge at the baseline. This result may be due to insufficient coverage of the nursing curriculum to this issue, which needs to be updated with the knowledge about the benefits of pre-conceptional folic acid and the association with neural tube defects.

This result is nearly similar to *Koirala and Pokharel (2018)*. They studied "Assessing the level of knowledge in the pre-conceptional use of Folic Acid supplement among primigravida women" and showed that 10.8% of total respondents had good knowledge about pre-conceptional folic acid benefits. This result is in agreement with *Goshu et al. (2018),* who studied "Women's awareness and associated factors on preconception folic acid supplementation in Adet, Northwestern Ethiopia, 2016: Implication of reproductive health" and revealed that only 15.9% of participants had good knowledge on preconception folic acid supplementation.

Concerning health belief model subscales regarding pre-conceptional folic acid among studied students, the current research results reveal that the mean total score of the health belief model and its subscales, perceived susceptibility, perceived severity, perceived benefits, self-efficacy, and cues to action post-preventive program are significantly higher than the pre-preventive program. However, the mean score of perceived barriers post-preventive program is significantly lower than the pre-preventive program. These results could be reflecting that most of the students were believed that neural tube defects could significantly affect their lives and the high score seems to imply that studied students understand the benefits of folic acid intake.

This result goes in the same line with a study conducted in Iran by *Araban et al. (2017)*. They studied "Nutrition modification aimed at enhancing dietary iron and folic acid intake: An application of the health belief model in practice." They demonstrated a significant increase in mean score post-intervention compared to the baseline to all health belief model constructs, while the perceived barriers were significantly decreased. These findings are supporting the current research hypothesis.

The present research results revealed that more than one-tenth of nursing students had a high perception of total health beliefs regarding pre-conceptional folic acid intake pre-preventive program. At the same time, more than three-quarters of them had high perception post-preventive program. This finding may be due to the preventive program based on the health belief model had a significant role in improving the perception of the studied students towards the importance of pre conceptional folic acid intake.

The present research revealed a statistically significant positive correlation between total knowledge and total health belief scores pre and post preventive program regarding the correlation between total health belief and total knowledge of the studied students. This finding may be due to good knowledge reflected with high perception and better health beliefs. This finding was also revealed by *(Arlinghausetal 2018).*

7. Conclusion

Based on the present study's findings, it could be concluded that there is a highly statistically significant difference concerning all items of students' knowledge regarding pre conceptional folic acid intake pre and post preventive program, the mean total score of health belief model subscales: perceived susceptibility, perceived severity, perceived benefits, self-efficacy and cues to action post-preventive program are significantly higher than the pre-preventive program, while mean score of perceived barriers post-preventive program is significantly lower than the pre-preventive program, the effect of health belief model had a positive effect on increasing nursing students' perception about benefits of pre conceptional folic acid. Therefore, the research hypothesis was supported.

8. Recommendations

- Health belief model education for all female university students as a healthy behavior guide towards folic acid deficiency is recommended.
- Increase awareness about the importance of preconception folic acid intake among female students.
- Dissemination of the booklet and posters to improve students' perception concerning the optimal time and benefits of taking folic acid is emphasized.

Further research
- Future research should conduct a similar study on a large sample for generalizing the findings.

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10. References

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