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FOLIC ACID AWARENESS AMONG HEALTHCARE PROFESSIONALS AND MEDICAL STUDENTS IN JEDDAH, SAUDI ARABIA: CROSS-SECTIONAL STUDY

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Abstract

Objectives: *Folic acid, a water-soluble vitamin, is used in the formation of red blood cells, amino acid metabolism, and DNA/RNA synthesis. Moreover, folic acid is used during cellular division. The current study aims to assess the awareness and knowledge among health care providers about folic acid consumption during preconception at the King Abdul-Aziz University Hospital (KAU-H), Jeddah, in 2017.*

Methods: *In this cross-sectional study, we randomly selected participants, with a total number of 305 health care providers including medical students, nurses, and doctors working at KAU-H in 2017. The data were collected using a validated online self-administered questionnaire.*

Results: *Out of 305 participants, 203 (66.6%) were medical students at multiple colleges; two-thirds of the students were in the sixth year of medical college at KAU (66, 21.6%). With respect to the comparison of level of knowledge regarding work and academic year, the results revealed significant differences in knowledge level, with doctors and fifth-year medical students obtaining higher scores than others (p=0.04, p=0.001, respectively).*

Conclusion: *The level of knowledge and work, and academic year were significantly related. Continuous medical education programs and campaigns are needed to increase the awareness level. Future studies (cohort, intervention and qualitative studies) with larger sample sizes, from several institutions across the country should be conducted to determine the level of awareness, the main reasons for this inadequate level and how to bridge the knowledge gaps.*

Key words: *Folic acid, Awareness, Healthcare professionals, Neural tube defects (NTDs), Pregnancy*

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INTRODUCTION:

Folic acid is a water-soluble vitamin that is used in red blood cell formation, amino acid metabolism, DNA/RNA synthesis, and cellular division. Folate is the natural form of folic acid and is found in cereal grains, fruits, and vegetables such as orange and broccoli. [1-3]

In 1965, the relationship between neural tube defects (NTDs) and folic acid deficiency was established.[4] NTDs are characterized by failure of neural tube closure during the early embryonic period due to low methionine and high homocysteine levels, leading to morbidity and mortality, due to the malformation of the brain and spinal cord, leading to anencephaly, and spina bifida.[5,6]

Fortification of wheat flour with folic acid in Saudi Arabia has become mandatory. After exclusion of other syndromic and chromosomal causes of NTD, the pre-fortification prevalence of NTD in Saudi Arabia was 1.43/1,000 live births and the post-fortification prevalence was 0.81/1,000 live births. This level is still considered high and maybe due to lack of awareness. [7]

The American Academy of Pediatrics and severalstudies recommend that healthy pregnant females should take about 0.4 mg(400µg) of folic acid daily for at least one month before conception and during the first trimester to reduce the risk of NTD by up to 50–70% and 4mg(4,000µg) to reduce recurrence by 72% [8–11]. No similar study has been conducted in Saudi Arabia about folic acid awareness among health care providers.

The aim of the current study was to assess the awareness and knowledge among health care providers about preconception folic acid consumption at King Abdul-Aziz University (KAU) Hospital, Jeddah, in 2017.

METHODS:

In this cross-sectional study, participants were randomly selected, with a total of 305 health care providers including medical students, nurses and doctors working at KAU Hospital in Jeddah, Saudi Arabia in 2017. The data were collected using a validated online self-administrated questionnaire, and Microsoft Excel was used for data entry.

Ethical approval to report this case series was obtained from Institutional Ethics Committee, King Abdulaziz University Hospital, Jeddah, Saudi Arabia. Written consent was obtained from each participant.

The Questionnaire

The questionnaire comprised 2 parts with 48 questions. The first was the demographic data (age, nationality, monthly income, marital status, academic year and specialty for students, and position and specialty for healthcare workers) and the second was the knowledge about folic acid (type, deficiency, sources, critical time, doses and contraindications).

Scores were allocated as follows: For each correct answer a score of 1 was given and for an incorrect answer a score of 0 was given, the overall score was 37.

Statistical analysis

The collected data were analyzed using SPSS Statistics for Windows, Version 20.0(IBM Corp., Armonk, NY, USA). Parametric data were presented as means, and standard deviations (minimum and maximum) and non-parametric data were presented as numbers (percentages). Knowledge regarding work and academic year among participants were compared using one-way ANOVA test. A p-value of<0.05 was considered statistically significant.

RESULTS:

Out of 305 participants, 203 (66.6%) were medical students at multiple colleges, followed by 53 nurses (17.4%) and 45 (14.2%) were doctors. Two-thirds of the students were in the sixth year of medical college, KAU (66, 21.6%), and more than half of the doctors were residents (29, 53.7%). The majority, 223 (74.8%), were 19–25 years of age, Saudis (290, 95.1%), and single 247 (81%) (Table 1).

The results in Table 2 revealed that the main sources of knowledge regarding folic acid were online and the internet (30%), followed by doctors and family/friends equally (25%), and lastly school (20%). The majority (281, 91.8%) stated the importance of folic acid (Table 2).

Table 3 shows the results of awareness of folic acid sources; two-fourths of the participants stated that green vegetables were an important source of folic acid (74.4%), followed by citrus fruits (45.6%), and lastly bread (18%).

Table 4 shows the results of awareness of folic acid type; more than half stated that folic acid is from the vitamin B group (58.7%).

Supplementary Table 1 showed the results of awareness of folic acid deficiency; the majority of the participants stated NTDs (83%), while less than one-fifth stated colon obstruction (11.2%).

Supplementary Table 2 shows the results of awareness of the critical time for folic acid supplementation; the majority of the participants stated that folic acid is important for pregnant women (90.2%). The majority stated the critical time for folic acid supplementation was 3 months before pregnancy and during the first trimester (82.0%).

Supplementary Table 3 shows the results of awareness of folic acid doses; one-third stated the correct dose for normal pregnancy (0.4mg) (37.4%), while one-third stated the correct dose for women with previous abnormal pregnancies (4mg) (36.7%).

Supplementary Table 4 shows the results of awareness of folic acid usage; two-thirds stated the correct daily dosage for pregnant women (67.9%).

Supplementary Table 5 shows the results of awareness of contraindications for folic acid; one-third of the participants stated contraindication with valproicacid use (34.5%), and less than one-fifth stated contraindication with fluorouracil use (15.8%) (Supplementary Table 5 and Figure 1).

The results in Supplementary Table 6 revealed that the overall mean score was 14.5±6.2 (39.2%), the highest mean score was 2.0±1.0for critical time (66.7%) and the least mean scores were 1.3±0.8 and 1.3±1.0for type and doses (32.5%) (Supplementary Table 6 and Figure 2).

With respect to the comparison of the level of knowledge regarding work and academic year, the results revealed significant differences in knowledge level, with doctors and fifth-year medical students having higher scores compared to others (p=0.04, p=0.001, respectively) (Supplementary Table 7).

DISCUSSION:

Several studies have been conducted on folic acid awareness in different counties, are as and populations, especially those targeting the dosage and critical timing of administration.[1-3] Other studies focused on the awareness rates, such as folic acid preventing NTDs, or folic acid supplementation before pregnancy.[4,12,13]

The current study aimed to assess the knowledge level of folic acid among healthcare providers, particularly doctors, where severalstudies reported that the main sources of information is the doctors and health providers.[14-17]

Although the results of the current study showed that the majority of the participants (92.0%) knew about the importance of folic acid during pregnancy, only one-third of the participants (37.8%) had average-level knowledge about folic acid. This was consistent with an Ethiopian study, in which less than half of physicians (47.7%) had good level of knowledge,[13]and an Iranian study in which 46.8%of physicians had good knowledge.[18] In a study conducted in Jeddah, only 12% of college students were aware of the importance of folic acid[19] and in an Indian study, this proportion was7.4%.[20] This poor level of knowledge could be due to a shortage of refresher training and guidelines on folic acid.

Folic acid is a type of vitamin B (B9),[4,21] and the main sources are green vegetables, citrus fruits, and bread.[4,12] The current study results revealed that less than half knew the type of folic acid (32.5%) and its resources (41.7%). These proportions were lower than those of an Ethiopian study in which 65.8% knew the sources.[13]

Since 1960, the relationship between NTDs and poor folic acid intake during preconception and the first trimester have been reported and confirmed by many studies.[4,22,23] NTDs are one of the main serious congenital anomalies contributing to infant mortality and serious disability; it is the second commonest type of birth disorder after congenital heart diseases[14,24,25] The results of the current study showed that only one-fourth (26.7%) of the participants had knowledge about the risk of folic acid deficiency. In contrast, more than half (56.1%) knew about the benefits of folic acid in preventing NTDs.[13] In a study conducted in the USA, 97% of participants knew the important role of folic acid in preventing some birth defects,[25] while in an Indian study only 11.8% of participants were aware of the role of folic acid in preventing NTDs.[19]

The proper time for taking folic acid supplements is very important for the normal development of the nervous system of the fetus and to reduce the risk of NTDs, this time is 3 months before pregnancy and during the first semester. NTDs occur in the first month of pregnancy, during days 22–28 of fetal development, which is very early and at that time most women are unaware that they are pregnant. Therefore, when pregnant women find out about the pregnancy and start taking folic acid after the first month of pregnancy, the damage may already have happened.[18,21,26] The results of the current study showed that the majority (66.7%) of the study population knew about the critical timing for administration of folic acid, so the risk to maternal

and fetal health could be prevented. In contrast, the results of an Ethiopian study showed great differences in which only 21.9%were aware of the critical time[13];in an Indian study 47.5%were aware of the right timefor administration,[20] while in the USA the majority knew the critical time (88%).[26]

Since the early 1990s the World Health Organization and the Center for Disease Control have recommended the following: the correct dose of periconceptional folic acid for women to achieve the desired blood folate status is 400 µg (0.4mg) daily in women with normal pregnancy and showing the lowest risk of NTDs, and 4mg daily in high-risk women with a history of NTDs or women with certain chronic diseases (such as epilepsy).[4,26-28] The results of the current study showed that one-third of participants knew the right dose (33.8%), which is higher than that identified in an Ethiopian study (5.1%),[13] while it is lower than those identified in studies conducted in India (61.4%)[20] and the USA (58.0%).[26]

The findings of knowledge score comparison regarding specialty revealed a significant difference among participants, where doctors showed higher levels of knowledge, followed by medical students, then nurses and technicians($p=0.002$). Similar results were reported in an Iranian study, in which health care staff showed the lowest level of knowledge ($p< 0.02$).[18]The findings of knowledge score comparison regarding academic year revealed a significant difference among healthcare professional students, where those who were in their fifth year showed higher levels of knowledge than others regarding folic acid. This could be due to the fact that the obstetrics and gynecology curriculum is taught in the fifth year of medical college.

Overall, knowledge of folic acid and prescribing practice of health professionals differ from country to country. In the United States, healthcare providers knew the important role of folic acid in preventing NTDs, and most of them knew the correct dose and critical time to receive folic acid to prevent birth defects.[26] However, in developing countries, the majority of health providers had inadequate knowledge on the role, correct dose and critical time when folic acid is to be taken to prevent NTDs and other birth defects.[13,20]

LIMITATIONS:

This study had a number of limitations. Firstly, the sample size was small. Secondly, this study was conducted in a single center and hence, generalization of the findings may not be possible. Thirdly, the majority of the participants were not gynecologists, and did not work in antenatal care clinics, and labor and delivery wards, meaning that they were probably not working on updating their knowledge about folic acid and its role in preventing congenital abnormalities.

CONCLUSION:

The study sheds light on the higher level of average level of knowledge among healthcare workers and students. Mainly, the right doses for normal pregnancy or women with previous abnormal pregnancies, bread as sources, and folic acid contraindication with concomitant use of valproic acid and fluorouracil. There is a significant association between level of knowledge and work, and academic year. There is the need for continuous medicaleducation programs and campaigns to increase the awareness level. More studies with different designs (cohort, intervention and qualitative studies), larger sample sizes and from several institutions across the country should be held to determine the level of awareness, the main reasons for this inadequate level and how to bridge the knowledge gaps. This will help to increase the overall healthcare level among the Saudi community.

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Table 1. Demographic data

Variables	N	%
Doctors	45	14.8
Medical students	203	66.6
Nurses	53	17.4
Technicians	4	1.3
Position of doctors		
Intern	17	31.5
Resident	29	53.7
Specialist	5	9.3
Consultant	3	5.6
Students' academic year		
2.00	37	12.1
3.00	45	14.8
4.00	25	8.2
5.00	43	14.1
6.00	66	21.6
Missing	89	29.2
Age, years		
19–25	228	74.8
26–30	46	15.1
31–35	22	7.2
36–40	5	1.6
41–45	1	.3
>45	3	1.0
Nationality		
Saudi	290	95.1
Non-Saudi	15	4.9
Monthly income		
5,000-10,000	133	43.6
less than 5,000	20	6.6
more than 10,000	64	21.0
Missing	88	28.9
Marital status		
Single	247	81.0
Married	55	18.0
Divorced	3	1.0

Table 2. Information resources

Variables	N	%
Resources *		
Doctors	100	25.0
Family and friends	100	25.0
School	80	20.0
Web sites and internet	120	30.0
Is folic acid important		
Yes	280	91.8
No	25	8.2

* Multiple responses

Table 3. Awareness of folic acid sources (# correct answer)

Variables	N	%	Variables	N	%
Green vegetables are one of the natural sources of folic acid					
Strongly disagree	1	.3	No	78	25.6
Disagree	7	2.3			
I don't know	70	23.0			
Agree	102	33.4	Yes#	227	74.4
Strongly agree	125	41.0			
Citrus fruits are one of the natural sources of folic acid					
Strongly disagree	12	3.9	No	166	54.4
Disagree	23	7.5			
I don't know	131	43.0			
Agree	88	28.9	Yes#	139	45.6
Strongly agree	51	16.7			
Saturated fats are one of the natural sources of folic acid					
Strongly disagree	51	16.7	No #	274	89.8
Disagree	76	24.9			
I don't know	147	48.2			
Agree	20	6.6	Yes	31	10.2
Strongly agree	11	3.6			
Red meat is one of the natural sources of folic acid					
Strongly disagree	5	1.6	No #	278	91.1
Disagree	4	1.3			
I don't know	269	88.2			
Agree	20	6.6	Yes	27	8.9
Strongly agree	7	2.3			
Sugar is one of the natural sources of folic acid					
Strongly disagree	59	19.3	No #	287	94.0
Disagree	95	31.1			
I don't know	133	43.6			
Agree	16	5.3	Yes	18	6.0
Strongly agree	2	.7			
Bread is one of the natural sources of folic acid					
Strongly disagree	34	11.1	No	240	82.0
Disagree	71	23.3			
I don't know	135	47.6			
Agree	41	13.4	Yes#	55	18.0
Strongly agree	14	4.6			

Table 4. Awareness of folic acid type

Variables	N	%	Variables	N	%
Folic acid is a type of vitamin A					
Strongly disagree	65	21.3	No #	259	84.9
Disagree	70	23.0			
I don't know	124	40.1			
Agree	31	10.2	Yes	46	15.1
Strongly agree	15	4.9			
Folic Acid is a type of vitamin B					
Strongly disagree	11	3.6	No	126	41.3
Disagree	10	3.3			
I don't know	105	34.4			
Agree	54	17.7	Yes#	179	58.7
Strongly agree	125	41.0			
Folic Acid is a type of vitamin C					
Strongly disagree	15	4.9	No #	300	81.9
Disagree	12	3.9			
I don't know	223	73.1			
Agree	6	2.0	Yes	55	18.1
Strongly agree	49	16.1			
Folic Acid is a type of vitamin E					
Strongly disagree	14	4.6	No #	255	80.9
Disagree	13	4.3			
I don't know	228	74.7			
Agree	1	.3	Yes	50	19.1
Strongly agree	49	16.1			

correct answer

Figure legends

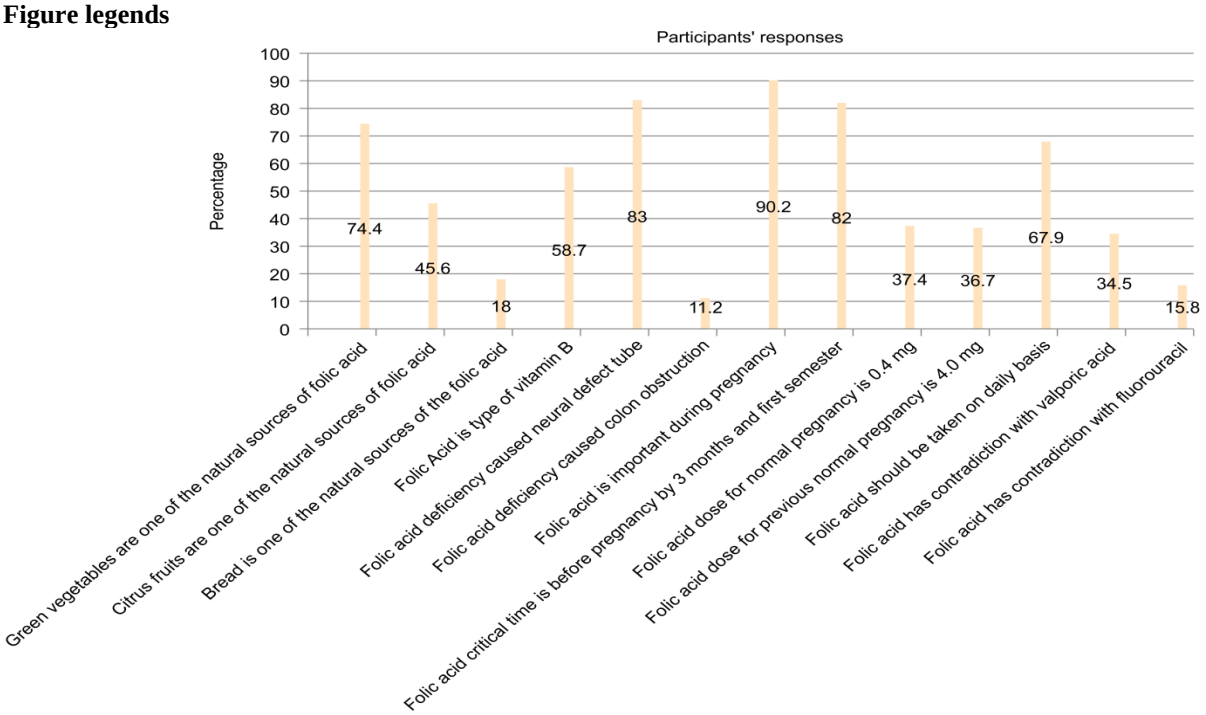

Figure 1. Participants' responses

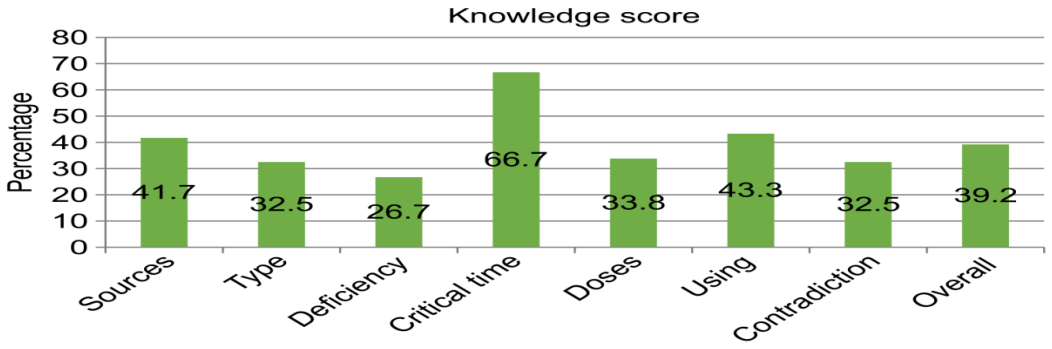

Figure 2. Knowledge scores

Supplementary Table 1. Awareness of folic acid deficiency (# correct answer)

Variables	N	%	Variables	N	%
Folic acid deficiency causes neural tube defects					
Strongly disagree	0	0			
Disagree	5	1.6	No	52	17.0
I don't know	47	15.4			
Agree	56	18.4	Yes#	253	83.0
Strongly agree	197	64.6			
Folic acid deficiency causes respiratory distress					
Strongly disagree	22	7.2			
Disagree	51	16.7	No #	240	78.7
I don't know	167	54.8			
Agree	43	14.1	Yes	65	21.3
Strongly agree	22	7.2			
Folic acid deficiency causes colon obstruction					
Strongly disagree	23	7.5			
Disagree	58	19.0	No	271	88.8
I don't know	190	62.3			
Agree	20	6.6	Yes#	34	11.2
Strongly agree	14	4.6			
Folic acid deficiency causes congenital heart disease					
Strongly disagree	13	4.3			
Disagree	26	8.5	No #	171	58.3
I don't know	142	46.6			
Agree	82	26.9	Yes	124	40.7
Strongly agree	42	13.8			
Folic acid deficiency causes neurogenic bladder					
Strongly disagree	7	2.3			
Disagree	2	.7	No #	287	94.1
I don't know	278	91.1			
Agree	11	3.6	Yes	18	5.9
Strongly agree	7	2.3			
Folic acid deficiency causes cleft palate					
Strongly disagree	11	3.6			
Disagree	29	9.5	No #	187	61.3
I don't know	147	48.2			
Agree	72	23.6	Yes	118	38.7
Strongly agree	46	15.1			

Supplementary Table 2. Awareness of folic acid critical time

Variables	N	%	Variables	N	%
Folic acid is important during pregnancy					
			Yes	275	90.2
			No	30	9.8
The critical time for folic acid is 3 months before pregnancy and the first trimester					
Strongly disagree	1	.3			
Disagree	11	3.6	No	55	18.0
I don't know	43	14.1			
Agree	46	15.1	Yes[#]	250	82.0
Strongly agree	204	66.9			
The critical time for folic acid is the second trimester					
Strongly disagree	58	19.0			
Disagree	90	29.5	No [#]	230	75.4
I don't know	82	26.9			
Agree	51	16.7	Yes	75	24.6
Strongly agree	24	7.9			
The critical time for folic acid is the third trimester					
Strongly disagree	70	23.0			
Disagree	94	30.8	No [#]	256	84.0
I don't know	92	30.2			
Agree	30	9.8	Yes	49	16.0
Strongly agree	19	6.2			

[#] correct answer

Supplementary Table 3. Awareness of folic acid doses (normal and abnormal pregnancy)

Variables	N	%	Variables	N	%
The folic acid dose for normal pregnancy is 0.4 mg					
Strongly disagree	18	5.9			
Disagree	19	6.2	No	191	62.6
I don't know	154	50.5			
Agree	29	9.5	Yes[#]	114	37.4
Strongly agree	85	27.9			
The folic acid dose for normal pregnancy is 0.8 mg					
Strongly disagree	38	12.5			
Disagree	52	17.0	No [#]	259	84.9
I don't know	169	54.4			
Agree	27	8.9	Yes	46	15.1
Strongly agree	19	6.2			
The folic acid dose for normal pregnancy is 2.0 mg					
Strongly disagree	34	11.1			
Disagree	57	18.7	No [#]	256	83.9
I don't know	165	54.1			
Agree	29	9.5	Yes	49	16.1
Strongly agree	20	6.6			
The folic acid dose for normal pregnancy is 4.0 mg					
Strongly disagree	32	10.5			
Disagree	59	19.3	No [#]	262	85.9
I don't know	171	56.1			
Agree	22	7.2	Yes	43	14.1
Strongly agree	21	6.9			
The folic acid dose for women with a previous abnormal pregnancy is 0.4 mg					
Strongly disagree	42	13.8	No [#]	272	89.2
Disagree	51	16.7			

I don't know	179	58.7			
Agree	16	5.2	Yes	33	10.8
Strongly agree	17	5.6			
The folic acid dose for women with a previous abnormal pregnancy is 0.8 mg					
Strongly disagree	39	12.8			
Disagree	50	16.4	No #	274	89.9
I don't know	185	60.7			
Agree	16	5.2	Yes	31	10.1
Strongly agree	15	4.9			
The folic acid dose for women with a previous abnormal pregnancy is 2.0 mg					
Strongly disagree	33	10.8			
Disagree	43	14.1	No #	254	83.3
I don't know	178	58.4			
Agree	28	9.2	Yes	51	16.7
Strongly agree	23	7.5			
The folic acid dose for women with a previous abnormal pregnancy is 4.0 mg					
Strongly disagree	13	4.3			
Disagree	19	6.2	No	193	63.3
I don't know	161	52.2			
Agree	32	10.5			
Strongly agree	80	26.2	Yes#	112	36.7

correct answer

Supplementary Table 4. Awareness of folic acid usage among pregnant women (# correct answer)

Variables	N	%	Variables	N	%
Folic acid should be taken on a daily basis					
Strongly disagree	2	.7			
Disagree	5	1.6	No	98	32.1
I don't know	91	29.8			
Agree	54	17.7	Yes#	207	67.9
Strongly agree	153	50.2			
Folic acid should be taken 5-6 times/week					
Strongly disagree	39	12.8			
Disagree	72	23.6	No #	262	85.9
I don't know	151	49.5			
Agree	36	11.8	Yes	43	14.1
Strongly agree	7	2.3			
Folic acid should be taken 3-4 times/week					
Strongly disagree	46	15.1			
Disagree	71	23.3	No #	273	89.5
I don't know	166	51.1			
Agree	18	5.9	Yes	32	10.5
Strongly agree	14	4.6			
Folic acid should be taken 2 times/week					
Strongly disagree	50	16.4			
Disagree	77	25.2	No #	285	93.4
I don't know	158	51.8			
Agree	13	4.3	Yes	20	6.6
Strongly agree	7	2.3			

Folic acid should be taken 1 time/week					
Strongly disagree	36	11.8			
Disagree	46	15.1	No #	391	95.4
I don't know	209	68.5			
Agree	8	2.6	Yes	14	4.6
Strongly agree	6	2.0			
Folic acid should be taken less than once/week					
Strongly disagree	38	12.5			
Disagree	49	16.1	No #	295	96.7
I don't know	208	68.1			
Agree	6	2.0	Yes	10	3.3
Strongly agree	4	1.3			

Supplementary Table 5. Awareness of folic acid contraindications

Variables	N	%	Variables	N	%
Folic acid is contraindicated for concomitant use with valproic acid					
Strongly disagree	5	1.6			
Disagree	7	2.3	No	200	65.5
I don't know	188	61.6			
Agree	35	11.5	Yes#	105	34.5
Strongly agree	70	23.0			
Folic acid is contraindicated for concomitant use with captopril					
Strongly disagree	3	1.0			
Disagree	2	.7	No #	301	89.7
I don't know	296	97.0			
Agree	3	1.0	Yes	4	1.3
Strongly agree	1	.3			
Folic acid is contraindicated for concomitant use with fluorouracil					
Strongly disagree	6	2.0			
Disagree	7	2.2	No	257	84.2
I don't know	244	79.0			
Agree	21	6.9	Yes#	48	15.8
Strongly agree	27	8.9			
Folic acid is contraindicated for concomitant use with furosemide					
Strongly disagree	10	3.3			
Disagree	13	4.3	No #	258	84.6
I don't know	235	76.1			
Agree	23	7.5	Yes	47	15.4
Strongly agree	24	7.9			

correct answer

Supplementary Table 6. Knowledge scores

Variables	Mean± SD	Range (min–max)	Total	Percentage
Sources	**2.5±1.3**	**(0–6)**	**6**	**41.7**
Type	**1.3±1.0**	**(0–4)**	**4**	**32.5**
Deficiency	**1.6±1.0**	**(0–6)**	**6**	**26.7**
Critical time	**2.0±1.0**	**(0–3)**	**3**	**66.7**
Doses	**2.7±1.5**	**(0–8)**	**8**	**33.8**
Using	**2.6±1.5**	**(0–6)**	**6**	**43.3**
Contradiction	**1.3±0.8**	**(0–4)**	**4**	**32.5**
Overall	**14.5±6.2**	**(0–37)**	**37**	**39.2**
Overall percentage	**40.0±16.0**	**(0–100)**		

Supplementary Table 7. Comparison of knowledge scores regarding demographic data

Variables		Mean	±	SD	P value
	Medical student	14.2	±	5.5	
	Nurse	13.9	±	5.0	**0.04***
	Doctor	16.5	±	5.5	
	Technician	8.7	±	4.0	
	2.00	12.1	±	5.0	
Students' Academic year	3.00	10.5	±	6.5	
	4.00	13.8	±	5.7	**0.001***
	5.00	16.2	±	6.1	
	6.00	15.9	±	6.2	