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The Effect of Educational Intervention Based on the Health Belief Model on Iron and Folic Acid Consumption in Pregnant Women: A randomized controlled trial study

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ABSTRACT

Background: Anemia is a major public health problem and a leading cause of maternal morbidity and mortality. This study aimed to investigate the effect of educational intervention based on the Health Belief Model (HBM) on the consumption of iron and folic acid (IFA) in pregnant women of Herat city.

Method: The present research was a randomized controlled field trial. The study was performed in the antenatal ward of health centers in Herat city. A total number of 114 pregnant women were included by two-stage cluster sampling, participants divided in two groups, The intervention group was provided with eight training sessions but the control group received only routine services. Data were collected by a researcher-made questionnaire, its validity checked by the experts' panel and reliability were checked by test-retest and Cronbach's alpha. Questionnaires were filled out before, immediately, and three months after the training in the targeted group. Data were analyzed using SPSS.V.26.

Results: Except for the perceived severity and benefits, there was no significant difference between the control and intervention groups concerning the mean scores of knowledge, behavior, perceived susceptibility, perceived barriers, self-efficacy, and cues to action before training ($p > 0.05$), but There was a significant statistical difference between the control and intervention groups in all items ($p < 0.001$) immediately and three months after training.

Conclusion: This study showed the effectiveness of HBM-based educational intervention on iron and folic acid consumption. Therefore, this model can be applied to designing and implementing of educational interventions.

Key words: Education, Folic acid, Health belief model, Iron, Pregnant women

INTRODUCTION

Anemia is a severe global public health problem, mainly affecting young children and pregnant women. Anemia is a condition in which the number of red blood cells or the hemoglobin concentration within them is lower than normal (1). There are many types anemia like iron deficiency anemia, vitamin deficiency anemia (folic acid and vitamin B12) , aplastic anemia, hemolytic anemia, sickle cell anemia and so on, but the most common cause of anemia is a nutritional deficiency like iron, folate, and vitamin B12 (2). In this study focus is on iron and folic acid deficiency anemia. Red blood cells use a molecule called hemoglobin to transport oxygen around the body. To make hemoglobin, cells require iron to build a component called heme. If an individual does not get enough iron in their diet, the body cannot produce enough red blood cells, or the cells lack hemoglobin. This condition is known as iron deficiency anemia. When body face to lack of folic acid, the red blood cells become immature and large than normal size, these cells cannot leave the bone marrow, so they are not enable to enter the blood stream and do not deliver oxygen, this called megaloblastic anemia or folic acid deficiency anemia (1, 2). Folic acid has multi functions in human body like help in production of red blood cells and hemoglobin, prevention some cancers, Prevention of nervous system disorders in fetus, reduction chance of abortion, help in production of DNA and RNA. But according to micronutrient guideline of Afghanistan that accepted by Ministry of public health, WHO and UNICEF, folic acid is recommended from the beginning of pregnancy to six months after delivery to prevent nervous system disorders in fetus and maternal anemia (1,2,3). The prevalence of anemia differs based on location (1,2). WHO has estimated that 42% of children less than five years of age and 40% of pregnant women worldwide suffer from anemia (WHO, 2021) (1). In Afghanistan the prevalence of anemia is 43.2% in non-pregnant women and 36.5% in pregnant women, 24% of whom had iron deficiency anemia. Also 7.4% adolescent girls have folic acid deficiency. The women who have no school education are more anemic (80.4%) than the women who have completed their primary and secondary school education (7.8% and 11.8% respectively) (3). Iron and folic acid (IFA) deficiency anemia during pregnancy has serious consequences for the health of the mother and fetus, the most common of which are preeclampsia, premature birth, post-delivery hemorrhage, the higher chance of abortion, neural tube defects, low birth weight, fetal death, and infant or maternal mortality (4, 5, & 6). Despite the distribution of IFA tablets and free counseling services in governmental health centers, IFA deficiency in pregnant women is still one of the public health problems in Afghanistan (6,7). One of the highlighted barriers to IFA consumption has been reported unawareness of pregnant women about iron and folic acid (4, 6, 7). Therefore, different studies have certified that educational interventions can improve the adherence of pregnant women to iron and folic acid consumption and change their related behaviors (8-15,18-20). Health education models have an important contribution to the planning, implementation, designing tools, and assessment of educational intervention (16). Many studies have confirmed the application of HBM-based education (11,15,16,18-20,21-23). Therefore, this study aimed to investigate the effect of HBM-based educational intervention on iron and folic acid consumption in pregnant women of Herat city. HBM assumes that people's behaviors change when they face a health threat and feel vulnerable. In such conditions, the required actions should be acceptable to them regarding cost and barriers. In addition, people should have self-efficacy to perform and maintain the behavior (17). The figure below shows HBM constructs.

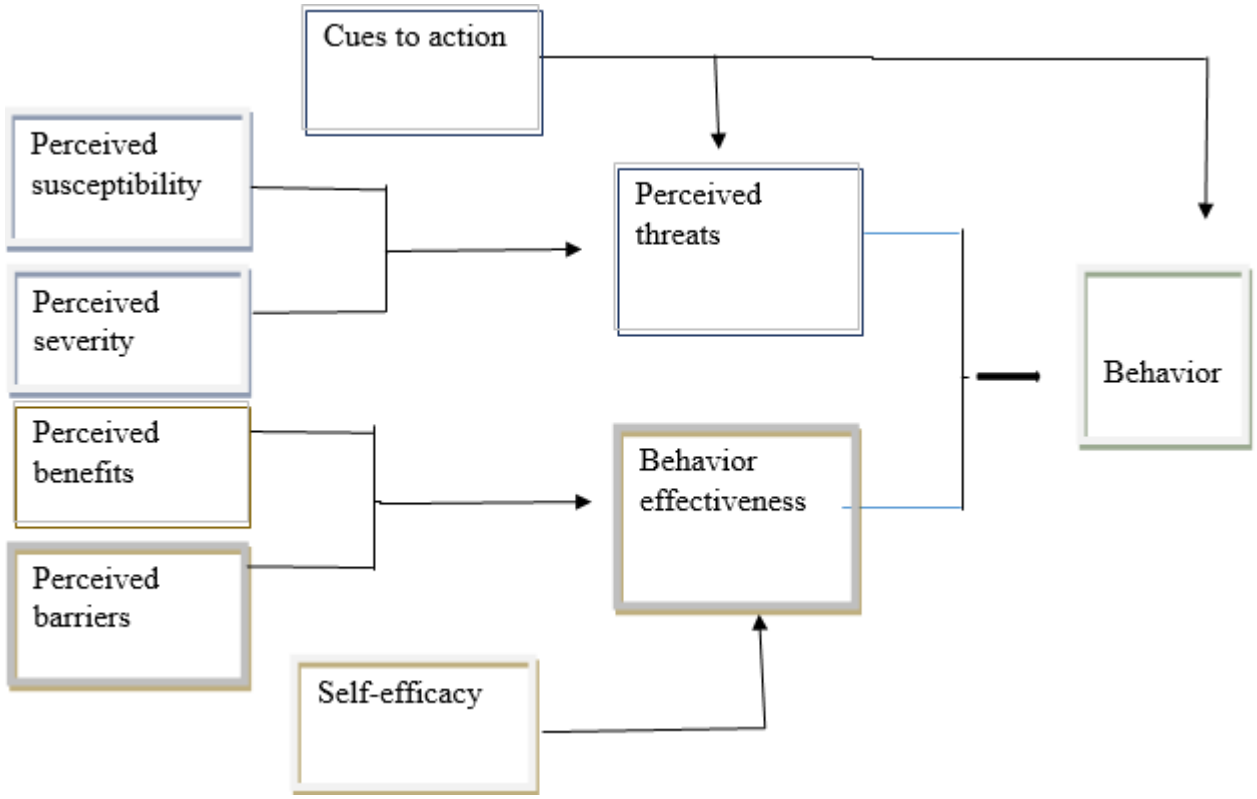

Figure (1) Health Belief Model and its relationship with behavior

In this model, perceived susceptibility refers to the individuals' belief about their chances of getting a particular condition/disease. Perceived severity refers to a person's belief about the seriousness or severity of a condition/disease. Perceived benefits indicate an individual's belief regarding the advantages of the behavior. Perceived barriers represent the cost or challenges of taking action or behavior. Self-efficacy shows the individuals' confidence and belief in their ability to take action or perform a given behavior. Cues to action are events, people, or things that trigger people to change behavior (16).

Method and material

Study design: This is a randomized controlled field trial study and was performed on pregnant women attending ANC services of health centers.

Setting: The study conducted in Manarha, Nawabad, and Babayee Barq comprehensive health centers and Baghi Dasht sub-health centers from October 2021 to January 2022.

Ethical code: this study approved with ethical code of IR.BUMS.REC.1400.182 and register number of 4565550 by research committee of social science in Birjand University of medical science.**Sampling and Sample size**: The sample size was calculated to be 60 pregnant women in every group considering the perceived susceptibility, 95% confidence, 90% power, and 21% drop-out possibility, as emphasized by Hassan et al. (24).

$$n = \frac{\left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}\right)^2 (S1^2 + S2^2)}{(\bar{x}1 - \bar{x}2)^2} = \frac{(1.96 + 1.28)^2 (1.72^2 + 2.52^2)}{(19.33 - 17.89)^2} = 47$$

These women were included in the study through two-stage cluster sampling. Accordingly, first, Herat city were divided in to four zones of north, south, east and west. This city has totally 14 health centers and one

health center were selected randomly (drawing) from the each zone. Second, two health centers allocated to the control group and two health centers allocated to the intervention group. Finally, all eligible pregnant women were listed from antenatal care register book and after that the required sample size was selected from this list by simple randomized method (draw their number). The sample size selection process was double blind, so both the researcher and the participants did not know each other. During this study control group did not access to intervention group because the distance between selected health centers was far. During the intervention, three participants dropped out from each group. Finally, 114 pregnant women (57 each group) were the sample size of the study. **Inclusion and exclusion criteria**: Informed satisfaction, 15-49 years of age, 12-24 weeks of pregnancy, not anemic, living in Herat city, and speaking in Persian or Pashto languages were the inclusion criteria. Exclusion criteria were unwillingness to continue, abortion, death, and absence for more than two training sessions.

Data collection tools: A researcher-made questionnaire were designed for data collection. The primary questionnaire was comprising of demographic characteristics (n=6), knowledge (n=16), behavior (n=6), and HBM constructs. The questions of the HBM constructs included perceived susceptibility (n=6), perceived severity (n=7), perceived benefits (n=6), perceived barriers (n=10), self-efficacy (n=10), and cues to action (n=6). A panel of six experts at Birjand University of medical sciences (four health education PhDs, one master of nursing-community health, one health management Ph.D.) and surveillance manager of Herat public health directorate (master of public health) reviewed the content validity of the questionnaire, with CVR =1 and CVI = 0.96. Two questions of perceived severity, one of the perceived barriers, and one of self-efficacy were removed after content validity checking. After that the questionnaire distributed to 30 pregnant women and asked their idea about the quantitative face validity. They checked and impact score of all items were more than 1.5 and considered for next step. In construct validity checking both convergent validity and discriminant validity checked, according to this assessment those constructs that were related together showed same score. For instance, those people that have gotten high score in susceptibility, severity and benefits, they were seeking positive behaviors. Also, those people that gotten high score in barriers they had less self-efficacy. Reۃliability was measured by test-retest on 30 pregnant women with a time interval of two weeks that all question had significant correlation ($P < 0.05$) and Cronbach's alpha was 0.91.

Knowledge (n=16) was measured using a three-option scale, including "*yes, no, and I don't know*" with range score of 1-3 and total range score of 16- 48, while behavior (n = 6) was measured by a three-option scale, including "*usually, sometimes, and never*" with range score of 1-3 and total range score of 6- 18, Finally, the constructs of HBM were measured using the five-point Likert scale "*strongly agree, agree, neither agree nor disagree, disagree, and strongly disagree*". The range of scores in all construct of health belief model was 1-5. And the range of total scores in perceived susceptibility and perceived severity was 5-25, perceived benefits and cues to action 6-30, and in perceived barriers and self-efficacy was 9-45.

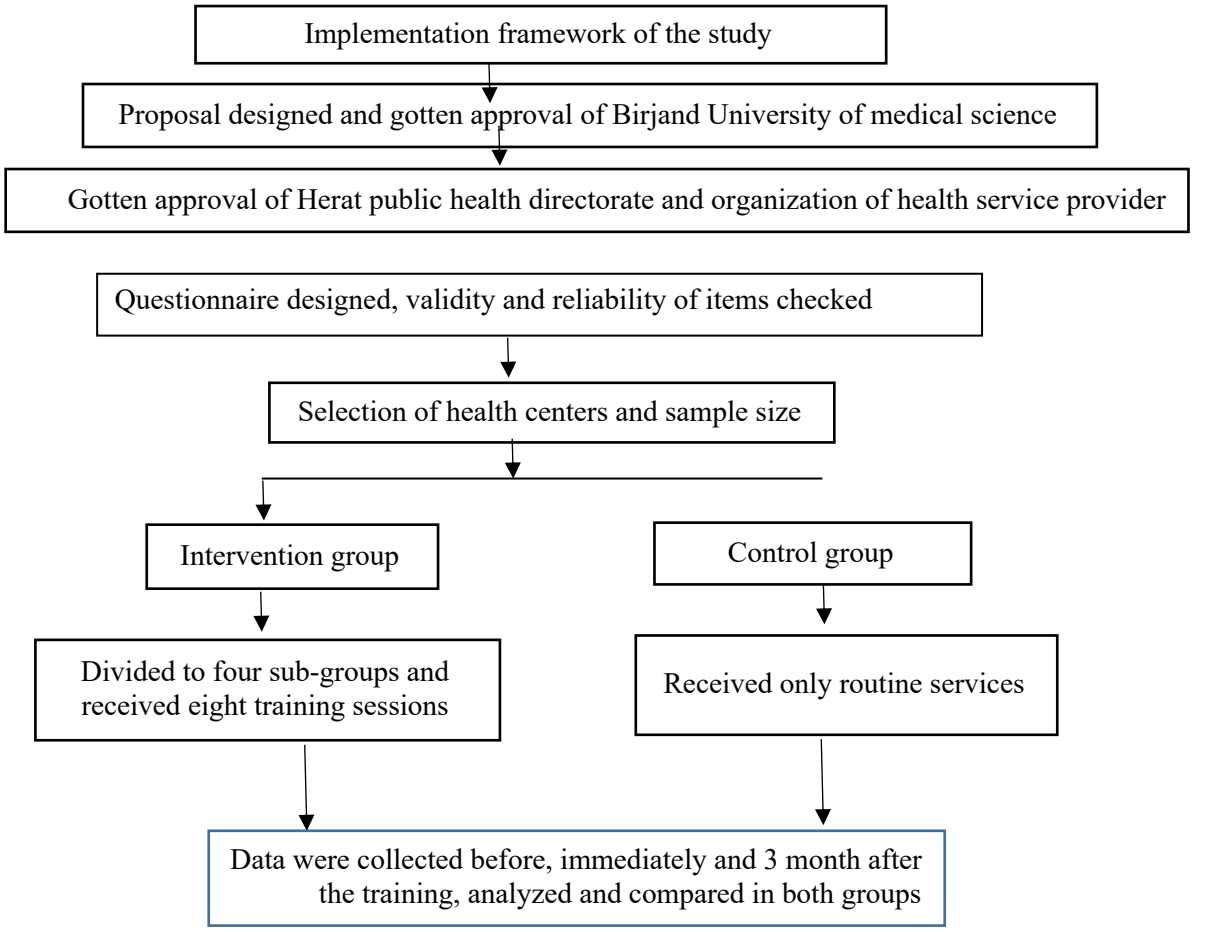

Figure 2: Working flowchart/framework of the study

Educational intervention and materials: The intervention group was divided into four sub-groups receiving eight training sessions, each 45 minutes long. The training was conducted by the researcher and health center midwives, with a focus on women's knowledge, related behavior of IFA consumption, and HBM constructs. The educational materials were taken from nutrition standard operational procedures guidelines, the national guideline of micronutrients, nutrition counseling package guidelines for participants, and nutrition counseling package guidelines for facilitators. The control group only received routine ANC services. Table 1 describes the details of conducting the intervention.

Table (1) Training's outlines and conducting methods

Sessions	Titles/topics	Targeted construct	Implementation method
1	Participants and facilitator's introduction, study goal, objectives, and general information about anemia	Knowledge and research goal	Lecture

2	Anemia description (prevalence, high-risk group, severity), consequences in pregnant women and fetus, and prevention	Perceived susceptibility and perceived severity	Lecture
3	Introduction of Iron and folic acid tablets, the importance of iron and folic acid (IFA), the role of IFA tablets in the prevention of anemia	Perceived benefits	Lecture, group discussion, and video clips
4	Natural resources of IFA and behaviors related to IFA consumption in women	Knowledge and Behavior	Lecture and group discussion
5	IFA and cultural behaviors, misconception/gossip news about IFA in Herat community.	Behavior and perceived barriers	Lecture, video clips, and group discussion
6	IFA consumption and barriers, recognizing and overcoming barriers, and its methods	Perceived Barriers and self-efficacy	Lecture and group discussion
7	Anemia and cues to action, cues to action resources for IFA consumption	Cues to action	Lecture and group discussion
8	Review of all training and response to participants' questions	All items	Lecture and question-answer

Data collection and analysis: data were collected using a made researcher questionnaire. The questionnaires were distributed in both control and intervention groups before, immediately, and three months after training. Educated respondents filled out the questionnaires themselves, while illiterate women completed them through interviewing. Data were analyzed by chi-square test, Fisher's exact test, independent t-test, Mann-Whitney test, repeated measures of ANOVA, and Bonferroni test in SPSS.V.26. The Significance level was considered 0. 05 in all tests.

Results

In this study, the mean age score was 25.42 ± 5.861 and 27.46 ± 6.874 years in the control and intervention groups, respectively. There was no significant difference in the mean score of age, occupation, education level, number of children, and family income level between the two groups, respectively (P = 0.196, P = 0.197, P = 0.875, P = 0.101, P = 0.73). The highest frequency was found in the categories of illiterate (n=50, 43.9%), under 25 years (n=58, 50.9%), housewife (n=69, 60.5%), and pregnant women who had three children (n=28, 24.6%) [Table 2].

Independent T-test showed that there was no significant difference between the control and intervention groups in the mean scores of knowledge, behavior, perceived susceptibility, perceived barriers, self-efficacy and cues to action before the training respectively, (P = 0.187, P = 0.26, P = 0.268, P = 0.218, P = 0.079). However, the difference was significant in the perceived severity (P = 0.027) and perceived benefits (P = 0.005). After the training, the two groups were significantly different in all items (P = 0.001). [Table 3].

The repeated measures ANOVA showed that there was no statistically significant difference in the mean

scores of knowledges, perceived susceptibility, perceived severity, perceived barriers, and self-efficacy immediately and three months after training in the control group ($P > 0.05$). However, the mean scores of perceived benefits, cues to action, and behaviors showed significant differences ($P < 0.05$). The repeated measures ANOVA showed that there was a significant difference in the mean scores of all items immediately and three months after training in the intervention group ($P < 0.001$). [Table 3]. Also, the repeated measures ANOVA indicated a significant difference in the mean scores of immediately and three months after the training in all items, it means that stability of the training significantly reduced after three months.

Table (2) Frequency distribution of studied groups regarding demographic characteristics.

Variable \ Group		Control Number (%)	Intervention Number (%)	Significant level*(p-value)
Age	< 25 years	33(57.9)	25(43.9)	0.198
	25-35 years	2035.1)	23(40.5)	
	>35 years	4 (7)	9(15.8)	
Education	Illiterate	26(45.6)	24(42.1)	0.875
	Basic level	7(12.3)	11(19.3)	
	Immediate level	9(15.8)	9(15.8)	
	High school	6(10.5)	6(10.5)	
	University degree	9(15.8)	7(12.3)	
Women occupation	Unemployed	12(21.1)	20(35.1)	0.197
	Housewife	39(68.4)	30(52.6)	
	Formal job	6(10.5)	7(12.3)	
Husband education	Illiterate	14(24.6)	16(28.1)	0.065
	Basic level	18(31.6)	21(36.8)	
	Immediate level	12(21.1)	6(10.5)	
	Bachelorette	5(8.8)	12(21.1)	
	University degree	8(14)	2(3.5)	
Husband occupation	Unemployed	18(31.6)	15(26.3)	0.739
	Free job	35(61.4)	39(68.4)	
	Formal job	4(7)	3(5.3)	
Children number	Without a child	14(24.6)	8(14)	0.101

	One child	7(12.3)	8(14)	
	Two children	14(24.6)	7(12.3)	
	Three children	9(15.8)	19(33.3)	
	Four or more than four children	13(22.8	15(26.3)	
Family income level	Less than life expenses	26(45.6)	22(38.6)	0.73
	Equal to life expenses	25(43.9)	29(50.9)	
	More than life expenses	6(10.5)	6(10.5)	

Chi-square test*

Table (3) Mean score and significance level of knowledge, behavior, and HBM constructs in studied groups.

Variables	Group	Mean ± SD Before	Immediately after	After 3months	P- value**
Knowledge	Control	35.72 ± 5.675	35.05 ± 3.975	36.12 ± 5.369	P = 0.216
	Intervention	34.54 ± 3.505	44.88 ± 1.89	44.54 ± 2.653	P <0.001
	p-value*	P = 0.187	P <0.001	P <0.001	
Behavior	Control	13.00 ± 1.667	13.39 ± 1.221	13.89 ± 1.555	P = 0.007
	Intervention	12.91 ± 1.184	16.11± 1.249	16.12 ± 1.181	P <0.001
	p-value*	P = 0.75	P <0.001	P <0.001	
Perceived susceptibility	Control	16.74 ± 3.015	17.18 ± 2.928	17.58 ± 3.803	P = 0.069
	Intervention	15.54 ± 2.612	22.18± 1.571	20.54 ± 1.712	P <0.001
	p-value*	P = 0.26	P <0.001	P <0.001	
Perceived severity	Control	17.95± 2.022	17.95 ±2.15	17.33 ± 2.363	P = 0.076
	Intervention	17.14 ± 1.817	22.61± 1.436	21.89 ± 1.46	P <0.001
	p-value*	P = 0.027	P <0.001	P <0.001	
Perceived benefits	Control	22.07± 3.57	20.98 ± 2.364	21.61 ± 3.554	P = 0.029
	Intervention	20.3 ± 2.958	27.35 ± 1.837	26.28 ± 2.374	P <0.001
	p-value*	P = 0.005	P <0.001	P <0.001	
Perceived barriers	Control	24.51 ± 4.4	25.21 ± 4.902	24.04 ± 4.031	P = 0.157
	Intervention	25.3 ± 3.047	18.26 ± 3.462	18.47 ± 3.434	P = 0.001

	p-value*	P = 0.268	P <0.001	P <0.001	
Self-efficacy	Control	29.21 ± 3.233	29.65 ± 3.062	29.63 ± 3.016	P = 0.464
	Intervention	28.54 ± 2.475	41.58 ± 1.851	40.02 ± 1.837	P <0.001
	p-value*	P = 0.218	P <0.001	P <0.001	
Cues to action	Control	14.54 ± 3.742	15.89 ± 4.287	15.46 ± 4.559	P = 0.027
	Intervention	14.74 ± 3.984	22.81 ± 4.711	21.39 ± 4.601	P <0.001
	p-value*	P = 0.79	P <0.001	P <0.001	

*Independent T test, **repeated analysis of variance

Discussion

Anemia in pregnant women is a public health challenge in Afghanistan, with severe consequences for both mother and fetus. Therefore, this study aimed to investigate the effect of HBM-based educational intervention on iron and folic acid consumption in pregnant women.

According to demographic analyzes, child bearing age was very low in this city and 50.8% of the participants were less than 25 years old. 49.1% participants had three or more than three children, and 43.8% of them were illiterate (unable to reading). The result of this study does not support by other studies (4, 8,9,13), because education level and pregnancy age of the participants in this study were low than mentioned studies, but the number of participants who have three or more than three children were more in this study than mentioned studies. The difference might be due to different culture, environment and infrastructures. Consecutive births, early age pregnancy and lack of education usually increase the chance anemia in pregnant women.

The results of the present study confirmed knowledge improvement regarding IFA consumption in pregnant women, which is similar to the findings of Jalambadani et al. (12), who investigated the effect of education on iron consumption based on the theory of planned behavior in pregnant women in Mashhad. It is also consistent with the results obtained by Baharzada et al. (15) concerning the effects of HBM on promoting preventive behaviors against iron deficiency anemia among pregnant women in Shushtar city. This study and Jalambadani et al's (12) study were conducted with a similar method and in person sessions, therefore, there is a possibility that their results are also similar. Finally, HBM-based educational intervention can promote pregnant women's knowledge of IFA consumption.

The results of the present study indicated positive effects of the educational intervention on the perceived susceptibility of pregnant women in Herat city. This result is consistent with the study of Baharzada et al. (15), exploring the effect of HBM on promoting preventative behaviors against iron deficiency anemia among pregnant women in Shushtar city. Also, the study of sharifirad et al. (21) confirmed the result of this study regarding the effectiveness of a nutrition education program based on the HBM in pregnant women. The method of this study is similar to the studies of Baharzada et al (15) and Sharifrad et al (21), so the similarity of the results are also possible. In conclusion, HBM-based educational intervention can increase susceptibility to diseases or challenges.

The present study indicated significant effects on the perceived severity in pregnant women, but the mean score of this construct increased significantly in the control group too. In the intervention group, this result is consistent with the findings reported by Mirzaei et al. (18), who investigated the application of HBM to promote preventive behaviors against iron deficiency anemia among female students of high school in Fereydan city. Also, the study of Salama et al. (11), who examined the impact of HBM on enhancing the preventative behaviors against iron deficiency anemia among pregnant women. Meanwhile, the result of this

study in control group is not supported by the mentioned studies, the difference in control group might be due to ANC counseling that provided by health centers to all pregnant women. According to mother and chid guidance handbook of Afghanistan, this counselling provides for pregnant women at least in four sessions. Finaly, the result of this study indicated that pregnant women perceived the severity of IFA deficiency after training.

According to the findings of this study, educational intervention had positive effects on perceived benefits, which is similar to the results of Salama et al. (11) and Baharzada et al. (15) who investigated application of HBM on enhancing the preventative behaviors against iron deficiency anemia among pregnant women. As well as both studies conducted in same methods, therefore, there is a possibility of similarity in results also. In other words, pregnant women clearly understood the benefits of IFA consumption during pregnancy.

The results of this study confirmed the effects of educational intervention on perceived barriers in pregnant women, which is similar to the findings of Mirzaei et al. (18), Salama et al. (11) and , Baharzada et al. (15), who have investigated the application of HBM to promote preventive behaviors against iron deficiency anemia among pregnant women. As well as the method of this study is similar with the studies of Mirzaei et al (18), saama et a (11) and Baharzada et al (15). thererfor, there is a possibility that their results are also similar. Based on the studies, pregnant women could perceive the barriers as the major factors in reducing IFA consumption.

The current study showed the effectiveness of HBM-based educational intervention on the self-efficacy of pregnant women. This finding is in line with the results obtained by Baharzada et al. (15) and Salama et al. (11), who studied the use of HBM to enhance preventative behaviors against iron deficiency anemia among pregnant women. The results are also consistent with the findings of Jalambadani et al. (12), who investigated the effect of education on iron consumption based on the theory of planned behavior in pregnant women in Mashad. The similarity of the results might be do to similiarity in the method of this study with the method of mentioned studis. Finally, educational intervention can improve self-efficacy in pregnant women to overcome existing obstacles.

The result of this study confirmed the effectiveness of education on cues to action regarding iron and folic acid consumption in pregnant women. This result is consistent with the findings reported by Baharzada et al. (15) concerning the effects of HBM on promoting preventive behaviors against iron deficiency anemia among pregnant women in Shushtar city and also is consistent with the study of Mirzaei et al. (18), who investigated the application of HBM to promote preventive behaviors against iron deficiency anemia among female students of high school in Fereydan city. This milarity in results might be due to similarity in the methods of the studies.

The result of the study indicated the effectiveness of the educational intervention on behaviors regarding IFA consumption in pregnant women. This result was confirmed by the studies of Salama et al (11), khanmohammadi et al (13), Baharzada et al (15) and Mirzaei et al (18) Who studied the application of education intervention to enhancing preventive behaviors against iron deficiency anemia. As well as the method of this study is similar with the mentioned studies. Therefore, the similarity of results is possible also. In other words, there is a significant correlation between educational intervention and IFA consumption, as pregnant women can modify their behaviors through education. Finally, regular education of pregnant women during pregnancy will reduce IFA anemia.

Limitations and challenges: The Islamic Republic of Afghanistan government collapsed on August 15, 2021. Taliban took over Afghanistan, and the senior staff of the Herat public health directorate was replaced with Taliban members. Coordination with the new staff of the Herat public health directorate took one month, which was a challenging task. On the other hand, we did not find any studies in Afghanistan about educating

pregnant women on iron and folic acid consumption, which may be a weakness of this study. Besides, there was no standard questionnaire for this study, making the research process more difficult.

Suggestions: This study was conducted in Herat city. A similar study can be conducted in other cities of Afghanistan to compare their results with the current research. Also, this study can be performed in districts and villages of Herat province to compare their results. Finally, this training can be conducted based on other theories and models of health education to compare their result with the present study.

Conclusion: This study supported the application and effectiveness of HBM-based education intervention on IFA consumption in pregnant women. Thereby, the application of this model is highly suggested in the education programs.

Ethical consideration: Participation in this study was voluntary. The data were collected after obtaining informed consent. The participants had the right to withdraw from the study any time. Participants' names were not written on the questionnaires for anonymity. After the latest data collection, training for 60 minutes was conducted for the control group. Researchers tried to consider all ethical rules in the process of the study.

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Conflict of interests: None declared.

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