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Utilizing Health Belief Model to Enhance the Preventive Behavior against Iron-Deficiency Anemia among Pregnant Women

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Abstract:
Background: *Anemia in pregnancy is a major public health problem and one of the leading causes responsible for maternal and perinatal morbidity and mortality.* ***The aim*** *of the present study was to investigate the effect of health belief model on enhancing the preventive behavior against iron-deficiency anemia among pregnant women.* ***Design:*** *Aquasi-experimental design was utilized to fulfil the aim of the study****. Sample:*** *A convenient sample of 100 women were included in the present study.* ***Setting:*** *The present study was conducted at Antenatal Out patient clinic in Benha university hospitals.* ***Data*** *were collected through an interviewing questionnaire sheet, knowledge assessment sheet, and Health belief model constructs.* ***Results*** *there was no statistically significant difference between both intervention and control groups mean knowledge, Health belief model constructs and preventivee behavior score before program implementation. Meanwhile, a highly statistically significant difference (p-values < 0.001) was observed between the two groups after program implementation. Also there was a positive highly statistically significant correlation between total knowledge and total health behavior score in both intervention and control groups before and after program implementation.****The present study concluded*** *that educational programs based on HBM has been effective on the adoption of preventive behaviours of iron deficiency anemia. This type of education is low cost and can prevent expensive pregnancy complications and adverse obstetric outcomes.* ***Recommendations:*** *The study recommended that pregnant women should be provided with instructional booklets about anemia based on HBM to improve their knowledge and health belief.*

Keywords: *Health Belief Model, iron-deficiency anemia, pregnant women.*

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I. Introduction

Anemia is a global public health problem affecting two billion people worldwide. Almost half of all preschool children, pregnant women, and close to one-third of non-pregnant women are anemic Worldwide**.(Gebreamlak, et al., 2017) [1].** It is reported that 56% of pregnant women in developing countries and 18% in developed countries are anaemic and in Africa, the estimated prevalence in pregnant women is 50-60%. **(Adesuyi., 2016) [2].** According to WHO, anemia is classified as mild degree (Hb 9.0-11.0 g\dl), moderate (7.0-9.0 g\dl) and severe (4.0-7.0 g\dl)**.(Rajeev, & Swamy, 2015). [3] .**

According to the World Health Organization "anemia is a condition in which the number of RBCS or their oxygen-carrying capacity is insufficient to meet physiologic needs, which vary by age, sex, attitude, smoking, and pregnancy status **(Duko, et al., T 2017) [4].** During pregnancy, women need more iron for red blood cells to support fetal growth and placental and support the development of brain cells in fetus. The third trimester of pregnancy, the fetus stores iron for supplies during the first six months of life. In the first trimester of pregnancy Hemoglobin formation still very little. Hemoglobin formation continued to increase during the second and third trimesters. This is due to the increased need for iron. **(Sholihah., & Hanafi., 2017) [5].**

Anemia in pregnant women has severe consequences on health, social, and economic development. Anemic pregnant women will be at risk of low physical activity, decrease the woman's reserve to tolerate bleeding either during or after childbirth, increase maternal morbidity and mortality, especially those with severe anemia. **(Abdulwahid., & Ahmed ., 2017) [6] .** In addition, both pregnant women and their neonates encounter negative consequence including fetal anemia, low birth weight (LBW), preterm delivery, intrauterine growth restriction and perinatal mortality **(Gedefaw., et al., 2015) [7].**

The effectiveness of health education programs depends largely on the proper use of theories and models of health education. Theory-based education can further improve the health behaviors **(Abd El Aziz, 2016) [8].** Health Belief Model (HBM) is one of the interpersonal models of health education (derived from the theories of behavioral sciences) widely used for preventive behaviors. **(Mirzaei et al., 2017) [9].**

Health belief model (HBM) tries to explain why some people adopt disease preventive behaviors while others do not. The structures of the HBM include perceived severity, perceived susceptibility, perceived benefits, perceived barriers, modifying variables, cues to action, and self-efficacy **(Hosseini, et al., 2017) [10].** According to this model, if women have the belief that by doing a series of measures can reduce the side effects and hazards of especial behavior (perceived benefits), and do these actions and measures that their benefits are more than barriers of especial behavior such as time and cost (perceived barriers), they will select a preventive behavior to be out of risk. **(Ghaderi et al., 2017) [11].** Based on Health Belief Model, people change their behavior when they understand that the disease is serious, otherwise they might not turn to healthy behaviors **(Khani et al.,2015) [12].**

Significance of the study :

The World Health Organization (WHO) has reported that about 2.17 billion people worldwide are suffering anemia. The most vulnerable groups are pregnant women. These reports also reveal that the prevalence of anemia among pregnant women is 40-60 percent in developing countries. **(Baharzadeh, 2017) [13]** Anemia has been negative effects on the health of women and children in developing countries, so that more than 30 % of the people in world are suffering from anemia. Iron deficiency plays the most important role in anemia and it is the cause of the 50% of anemia in the world. **(Mehrabian et al.,2016) [14].**

Maternal mortality is one of the important indicators of quality of health services in a country and anemia during pregnancy is one of the important causes for maternal mortality which contributed to 22,000 maternal deaths**.(Nivedita K. et al., 2016) [15].** Anemia has been known to be associated with low birth weight, premature delivery, intra uterine growth retardation and thus increased perinatal mortality. **(Swapna., 2017) [16].** Considering the importance of the problem of iron deficiency anemia in pregnant women this study aimed to evaluate the effect of health belief model on enhancing the preventive behavior against iron-deficiency anemia among pregnant women.

Aim of the study:-

Aim of the present study is to investigate the effect of health belief model on enhancing the preventive behavior against iron-deficiency anemia among pregnant women through:

- Assessing the pregnant women' knowledge, health beliefs, and health behaviors to prevent anemia to identify their needs.
- Designing and implementing health preventive program based on HBM according to pregnant women' needs.
- Evaluating the improvement of pregnant women' knowledge, health beliefs, and health behaviors to prevent anemia.

Research hypothesis:

Pregnant women who received health educational program based on HBM are expected to have better knowledge, health beliefs, and health behaviors to prevent anemia compared to control group.

II. Materials And Method

1. Materials

Design: A quasi-experimental study design was used (time series design) pre/post-test , two groups are studied.
Setting: The study was conducted at Antenatal Out patient clinic in Benha university hospitals. This clinic is located at the ground floor of the out patient building which include only one room women attend for ante-natal care and follow up, family planning counseling or for any out patient procedures . It starts from 9AM to 12AM.
Subjects Type and Criteria: A conveniant sample of 100 pregnant women were included in the current study. Women of pilot study (10) were included in the sample. The inclusion criteria include the following; Primigravida in the first or second trimester of pregnancy, normal pregnant women , carrying singleton fetus, and consentaneous to participate in the study. Women were excluded from the study if they were experienced pregnancy complications (bleeding, pre-eclampsia, blood pressure during pregnancy, and preterm birth). The sample was randomly divided into an intervention (50) and control (50) group.
Tools: Two tools were used for data collection.

1.A structured interview questionnaire sheet:

Interviewing questionnaire was developed by the researchers in Arabic language after reviewing of related literature. It consisted of two sections:

- **Section (1)** Socio demographic data such as (age, educational level, occupation, income and telephone number).
- **Section (2)** Knowledge of the studied women regarding anemia and its prevention. It was adopted from [17] (**Padmavathi, & Hephzibah, 2015) [17].** This part was used before and after implementation of the HBM which included 21 questions about knowledge about anemia (which include meaning, signs and

symptoms, causes, high risk group, complications, effect on pregnancy, treatment and prevention of anemia)

Scoring : Each questions was assigned a score of (1) given when the answer was completely correct , a score (0) was given when the answer was incorrect. The total score of each section was calculated by summation of the scores of its items. The total score for the knowledge of a participant was calculated by the addition of the total score of all sections. The mean and standard deviation was calculated. As well As women total knowledge score was classified as the following:

- Adequate ≥ 60 % of total knowledge score.
- Inadequate < 60% of total knowledge score .

2. Health belief model constructs:

The HBM was adapted from (**Khoramabadi M., 2016) [18] .**Modifications were done by the researchers on Arabic language. This tool composed of two parts.

Section (1) : Composed of the main four HBM constructs: ***perceived susceptibility*** to anemia (five items), ***perceived severity*** of anemia (seven items), ***perceived barriers*** of performing anemia prevention (six items), and ***perceived benefits*** of anemia prevention (six items).

Scoring : The answers to the questions about each of the above mentioned constructs and the nutritional preventive behaviors of anemia were recorded on a Likert scale rating from 1 to 5 i.e. from totally agree to totally disagree, respectively. Accordingly, each of the options was scored as follows: "totally agree" was scored 5 points, "agree" was scored 4 points, "no idea" was scored 3 points, "disagree" was scored 2 points, and "totally disagree" was scored 1 point. The total score for the main four HBM constructs of a participant was calculated by the addition of the total score of all sections and classified as the following:

- High ≥ 75 %
- Moderate 50-75
- Low < 50%

Section (2) : Composed of the ***preventive behaviors of anemia*** (with 12 questions) regarding anemia preventive behavior. .

Scoring : For each behavior, the positive response scored 2, and the negative response scored 1. The total behavior score was calculated by adding the scores for the positive one and classified as the following:

- Satisfactory ≥ 60 % of total knowledge score.
- Unsatisfactory < 60% of total knowledge score .

II . Method :-

The study was executed according to the following steps:

- **Approval:**

An official permission was obtained from the hospital authorities in the identified setting to collect the necessary data and implement the program.

- **A Pilot study:**

After the development of tools, a pilot study was carried out on 10% of the studied subjects (10) pregnant women who were included in the study sample.

The purposes of the pilot study were to:

- Ascertain the clarity and the applicability of the tools
- Ascertain the relevance and content validity of the tools.
- Estimate the time needed to complete the sheet.
- Detect any problem peculiar to the statements such as sequence and clarity that might interfere with the process of data collection . The necessary changes were undertaken.

Results of the pilot study:

After conducting the pilot study , it was found that:

- The tools were clear and applicable; however, few words were modified .
- Tools were relevant and valid.
- No problem that interferes with the process of data collection was detected.
- Following this pilot study the tools were made ready for use.

- **Validity & reliability:**

Content validity was done to assure that the utilized tools measure what it was supposed to measure. Tools developed by the researchers were examined by a panel of five experts to determine whether the included items clearly and adequately cover the domain of content addressed.

- **Reliability :**

Test-retest was repeated to the same sample of pregnant women on two occasions and then compares the scores The Cronbach's coefficient alpha of knowledge questionnaire was 0.853. and 0.721 for health belief model.

- **Ethical Considerations:**
- Approvals of women were obtained before data collection and after explaining the purpose of the study
- Anonymity was assured as the filled questionnaire sheets were given a code number (not by names).
- The women were ensured that questionnaire sheet will be used only for the purpose of the study and will be discarded at the end of the study.
- The study maneuvers do not entail any harmful effects on participation.
- The women who participated in the study were informed about having the right to withdraw at any time without giving any reason.

- **Field work:**

A written official agreement was obtained from the Faculty of Nursing Dean, then directed to Benha University Hospital Director. Written official letter was taken and delivered to the Director of Obstetrics and Gynecology Outpatient Clinic, in order to obtain their approval to conduct the study after explaining its purpose. The study was carried out through four phases: assessment, planning, implementation, and evaluation. These phases were carried out from beginning of Jan 2018 to the end of june 2018, covering along a period of six months. The previous mentioned setting was visited by the researchers three days/week (Saturdays, Tuesdays and Thursdays) from 9.00 am to 12.00 pm.

1- Preparatory phase (Initial assessment)

At the beginning of interview the researcher greeted the pregnant woman, introduced herself to each pregnant woman included in the study, explained the purpose of the study, and asked for participation. Upon consent to participate, the woman was interviewed to assess demographic characteristics and knowledge regarding anemia, HBM, and health behaviors to prevent anemia. The data obtained during this phase constituted the baseline for further comparisons to assess the effect of the program.

2- Planning phase:

The researchers developed power point presentation about anemia based on HBM with simple Arabic language to suit women' level of understanding based on the needs identified in the assessment phase from the intervention group, view of the related literature and the conclusion& recommendations of relevant studies. It stressed the areas of major deficiency in women' knowledge about anemia (meaning of anemia, causes, risk factors, signs and symptoms, diagnosis, methods of treatment ,prevention, benefits of prevention and early treatment. Special attention was given to anemia with pregnancy. The health educational program involved two sessions were conducted to a small group (10) of the intervention group. The program was implemented according to pregnant women' physical and mental readiness. The duration of each session lasted from forty five minutes to one hour including periods of discussion according to their achievement, progress and feedback. Different methods of teaching were used such as lecture and group discussion.

3- Implementation phase:

A- Women were divided into two groups (study & control) each woman in both study & control was asked to read and sign the informed consent form. The participants also were assured that their information will remain confidential to the researchers, and it is released unnamed and in general.

B- The pre-test was performed by administering the coded anonymous questionnaire on the participants in the intervention and control groups, and some explanations were given on how to fill out the questionnaire. To avoid cross contamination of data between both groups, control group was assessed first. Average time for the completion of each woman interview was around (10-15 minutes).

C- Pregnant women in the control group only received routine prenatal care in health care centers, while women in the intervention group participated in theory-based sessions, in addition to the routine prenatal care provided by the health care centers.

D- Teaching the intervention group members was performed using the methods of lecture, group discussion, question and answer, and pamphlets provided by the researchers, in groups of 10 members in two 45-60 minutes sessions over five weeks in the target centers.

E- The educational content in **the first session** included general **i**nformation about anemia, positive change in nutrition habits and behaviors. In order to increase women motivation, they were provided with educational pamphlets on nutrition during pregnancy. Each session lasted for 45-60 minutes.

F- **In the second session**, to raise knowledge, the participants learned how to properly use supplements, vitamins, and minerals in pregnancy and nutrition tips in dealing with the effects of anemia **(perceived severity)**, and the prevalence of anemia in pregnant women **(perceived susceptibility),** emphasizing the benefits and the significance of preventive behaviors of anemia **(perceived benefits)**. Also, group discussions were conducted to overcome the barriers **(perceived barriers)** to healthy **behaviors**. At the end

of the second session, women were provided with another pamphlet on anemia (iron deficiency) during pregnancy and also at the end of each session; 10 minutes were devoted to questions and answers.

G- **3 month after the last educational session**, all participants in both experimental and control groups were invited to complete the posttest questionnaire . **Also,** according to the principles of ethics in research, the members of the control group were provided by the educational pamphlet prepared by the researchers.

4- Evaluation phase:

After education based HBM; the effect of the program was evaluated by using the same format of pre-test. Post-test was conducted for control group first then intervention group; this was done after three months of program implementation.

- **Statistical design:**

- Analysis of data was carried out by the researcher, Data was verified prior to computerized entry and categorized, coded, computerized, tabulated using IBM SPSS (statistical package for social science) statistical software version (20).
- Qualitative data were described using numbers and percent. Quantitative data were described using minimum and maximum. Mean and standard deviation(Mean ±SD) .
- Comparison between different groups regarding categorical variables was tested using Chi-square test. When more than 20% of the cells have expected count less than 5, correction for chi-square **(X^2)** was conducted using Fisher's exact test.

For normally distributed data , comparison between two independent population were done using independent (t) test.

- Pearson's Correlation Coefficient (r) was also used to evaluate association between studied variables.
- A significant level value was considered when $p \leq 0.05$ and A highly significant level value was considered when $p \leq 0.01$.
- No statistical significance difference when p>0.5 .

III. Results

Table(1): Frequency distribution of studied groups regarding socio-demographic characteristics :

Socio-demographic characteristics	Study group		Control group		X^2	p-value
	no	%	no	%		
Age						
• Less than20	9	18.0	6	12.0	1.27	<0.05
• 20-30	34	68.0	39	78.0		
• More than 30	7	14.0	5	10.0		
Educational level						
• Read & write	6	12.0	4	8.0	1.65	<0.05
• Primary	6	12.0	4	8.0		
• Secondary	16	32.0	14	28.0		
• Universal	22	44.0	28	56.0		
Occupation						
• Working	35	70.0	32	64.0	0.40	<0.05
• Not working	15	30.0	18	36.0		
Monthly income						
• Sufficient	22	44.0	21	42.0	1.04	<0.05
• InSufficient	27	54.0	26	52.0		
• Sufficient and saves	1	2.0	3	6.0		
Income						
• Not enough	39	78.0	41	82.0	0.25	<0.05
• Enough	11	22.0	9	18.0		

Table (1): reveals that there was no statistically significant difference between intervention and control groups regarding their socio demographic characteristics.

Table(2): Mean and standard division of studied groups regarding total knowledge:

Total knowledge	**Control group**				**Study group**			
	Mean	±SD	t test	p-value	Mean	±SD	t test	p-value
pre	29.6200	±5.79546	1.49	>0.05	29.9600	±5.96917	9.18	<0.001
Post	32.1000	±4.64780			39.3000	±4.77344		

Table (2) demonstrates that, there was no statistically significant difference regarding mean knowledge score before and after program implementation among the control group. Meanwhile, a highly statistically significant difference (p-values < 0.001) was observed before and after program implementation among the study group.

Figure (1): frequency distribution of studied groups regarding total knowledge pre and post program :

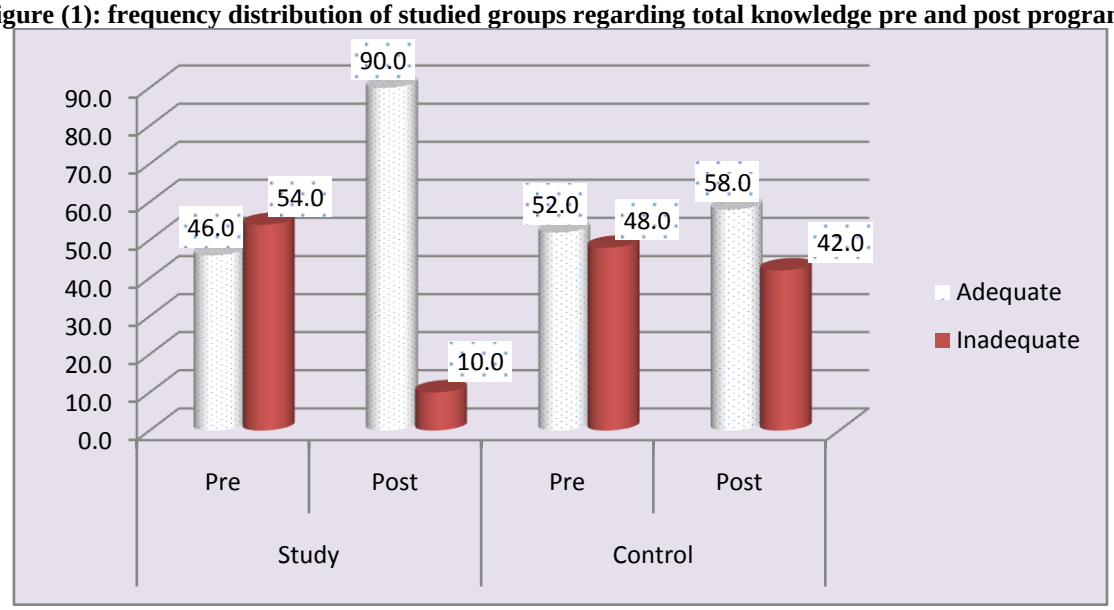

Figure (1): represents that total knowledge score regarding anemia during pregnancy were greatly improved after intervention than pre intervention among study group while there were minimal improvement after intervention than pre intervention among control group

Table(3): mean and standard deviation of studied samples regarding total Health belief model:

Health belief model	Control study				Study group			
	Mean	±SD	t test	p-value	Mean	±SD	t test	p-value
Total perceived suspitability								
pre	13.6600	±2.92498	2.60	>0.05	13.6600	±2.92498	10.33	<0.001
Post	14.6000	±2.84999			19.7400	±3.09582		
Total perceived benefits								
pre	16.1400	±3.36858	3.19	>0.05	15.9600	±3.32560	13.72	<0.001
Post	16.8600	±3.31361			24.0400	±2.41560		
Total perceived severity								
pre	20.3800	±2.86349	2.69	>0.05	19.0600	±2.84576	15.59	<0.001
Post	20.9400	±2.83138			29.2800	±4.51320		
Total percieved barriers								
pre	17.4000	±2.43277	1.48	>0.05	17.2200	±2.36721	8.26	<0.001
Post	18.4600	±2.51696			24.2800	±5.17072		

- Paired t test

Table (3) shows that, there was no statistical significant difference regarding the four main HBM constructs (perceived susceptibility, perceived benefits, perceived severity and perceived barriers) before and after program implementation among the control group. However, a highly statistically significant difference (p-values < 0.001) was observed regarding the four main HBM constructs before and after program implementation among the study group.

Figure (2): frequency distribution of studied groups regarding total health belief model pre and post program

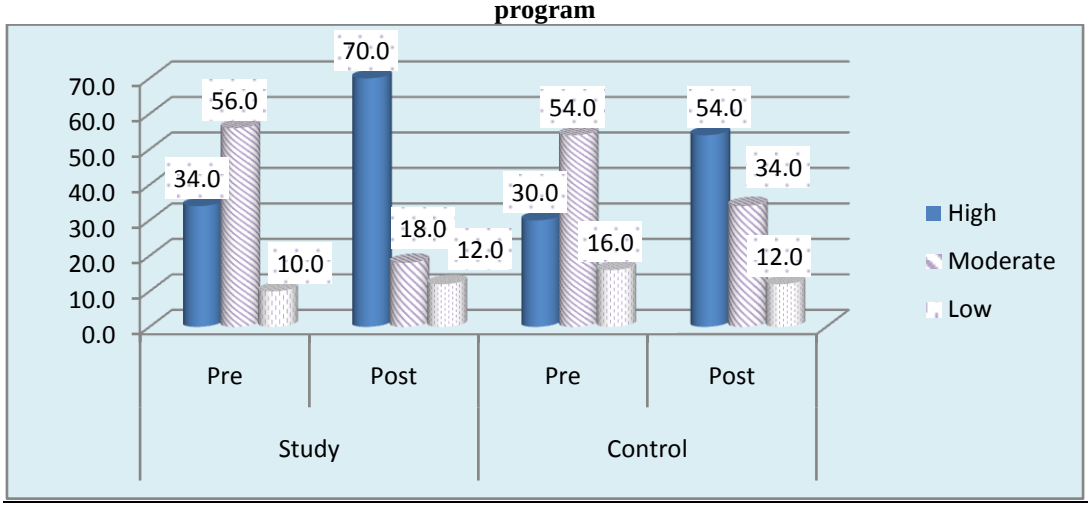

Figure (2): represents that health belief model regarding anemia during pregnancy were greatly improved after intervention than pre intervention among study group while there were minimal improvement after intervention than pre intervention among control group.

Table(4): Mean and standard division of studied samples regarding total preventive behavior:

Total preventive behavior	**Control group**				**Study group**			
	Mean	±SD	t test	p-value	Mean	±SD	t test	p-value
pre	14.9000	±1.56818	1.76	>0.05	15.1400	±1.52543	12.88	<0.001
Post	16.2200	±1.54246			22.1600	±3.41282		

Table (4) demonstrates that, there was no statistically significant difference health behavior to prevent anemia during pregnancy before and after program implementation among the control group. Meanwhile, a highly statistically significant difference (p-values < 0.001) was observed before and after program implementation among the study group.

Figure (3): frequency distribution of studied groups regarding total preventive behavior pre and post program

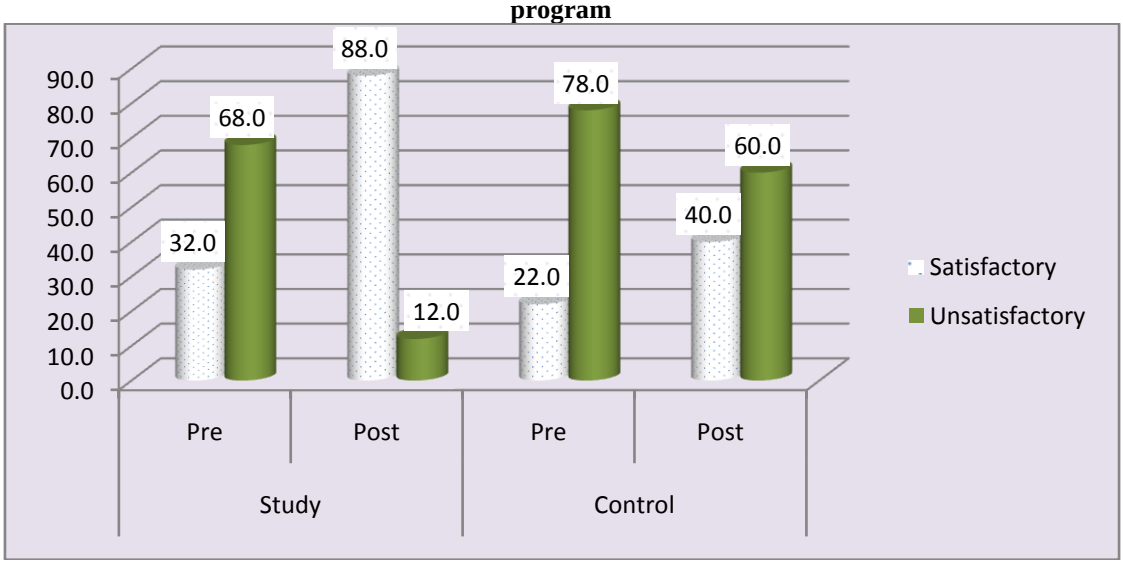

Figure (3): represents that total preventive behavior regarding anemia during pregnancy were greatly improved after intervention than pre intervention among study group while there were minimal improvement after intervention than pre intervention among control group

Table(5): correlation between total knowledge and preventive behavior pre and post program for study and control group :

	Total Knowledge							
Total Preventive Behavior	**Study group**				**Control group**			
	Pre		Post		Pre		Post	
	r	p-value	r	p-value	r	p-value	r	p-value
	0.41	0.32	0.71	<0.001	0.27	0.85	0.45	>0.05

Table (5): clarifies that, there was a positive highly statistically significant correlation between total knowledge and total health behaviour score in both study and control groups before and after program implementation.

Table(6): correlation between total health belief model a

	Health belief model							
Total Preventive Behaviour	**Study group**				**Control group**			
	Pre		Post		Pre		Post	
	r	p-value	r	p-value	r	p-value	r	p-value
	0.39	0.22	0.81	<0.001	0.32	0.35	0.51	>0.05

nd preventive measure pre and post program for study and control group:

Table (6) Illustrates that, there was a positive highly statistically significant correlation between total health behaviour score and total HBM four main constructs in both study and control groups before and after program implementation.

IV. Discussion

Pregnancy period is one of the most critical periods of women's lives and has a major impact on lifestyle and nutritional behaviors, and the nutritional status of women during pregnancy can have a significant impact on their health and on the development of the fetus. This study aimed to evaluate the effect of health belief model on enhancing the preventive behaviour against iron-deficiency anemia among pregnant women. In this regard, anemia caused by iron deficiency is a serious health problem and affects the psychological and physical growth which could have a significant impact on fetus development and health. Based on the findings after the intervention, mean scores of knowledge, perceived susceptibility, perceived severity, perceived barriers, perceived benefits, and preventive behaviors in the interventional group compared to the control group, significantly increased. **(Hosseini, et al., 2017) [10].**

In the present study findings, no significant differences were found among the intervention and the control groups in terms of age, educational level, occupation, and monthly income. This results mean that the two groups under study are homogenous. This is similar to **Khoramabadi et al., 2016 [18].** as well as **Shahnazi et al., 2015 [19].**. They conducted their studies to detect the impact of education intervention based on HBM on different health behavior among pregnant women. They pointed out that, there was no significant difference between the intervention and the control groups regarding their age, educational level, monthly income and occupation.

On investigating pregnant women' knowledge about anemia, The present study findings revealed a significant increase in the mean scores of knowledge on the intervention group compared to control group three months after program implementation and this confirms the effectiveness of the educational program designed based on HBM in promoting nutritional behavior of pregnant women under intervention. The results of the present study agree with **Kamalifard et al. [20].**,who reported that the use of an educational package in two sessions for two weeks, in the form of lectures and movies, could improve the level of knowledge during pregnancy. Therefore, the need for increasing knowledge on nutritional behaviours regarding iron deficiency anemia in pregnant women is reaffirmed.

Similar to this study, **Fathizadeh et al. [21].** determined the effect of educational program based on precede pattern on knowledge, attitude and nutritional performance related to iron deficiency anemia, the results showed statistically significant increase in mean score of knowledge, attitude (predisposing factors), training classes, participation in educational programs and the use of educational resources (enabling factors), encourage teachers and parents and peers (reinforcing factors) and performance of the experimental group compared to the control. Contrary to our study, they didn't intend aspects of health belief model. Knowledge was the common aspect in this study that had increased by intervention.

Additionally **Khoramabadi[18].** showed that there were significant differences in both study and control groups at different stages of the study when comparing the mean knowledge scores between the two groups, and this study recommended that Promotion of nutritional knowledge in society through nutritional education would go a long way to reduce malnutrition and this could be considered a necessity for developing

countries and selecting a suitable model for health education is the first step toward planning effective health promotion programs

The current study results showed that total knowledge score regarding anemia during pregnancy were greatly improved after intervention than pre intervention among study group while there were minimal improvement after intervention than pre intervention among control group. This may be due to the reason that routine follow up of pregnancy cause minimal improvement in the knowledge of control group while the educational program based on HBM cause great improvement in the knowledge of intervention group this will ensure the importance of health education based on HBM. Also **Anuradha M (2014) [22].** show that the overall gain in knowledge in relation to prevention and management of anaemia was found to be strongly and highly significant at $P<0.01$ and $P<0.05$ levels in the study group compared to control group.

Regarding The four main HBM constructs, The current study results showed a significant increase in the mean scores of perceived susceptibility on the intervention group compared to control group three months after program implementation. The results also showed that there was a significant difference between the study and control groups in terms of perceived susceptibility so that; women believed that they may be at the risk of anemia as a result of an unhealthy nutrition. This belief may lead to the adoption of healthy behaviors by the mother, which is similar to the findings of **Mansourian et al [23]** in the application of Health Belief Model.

Additionaly **Ghaderi et al., [12].** stated that after the intervention, mean scores of perceived susceptibility, perceived severity, perceived benefits, cues to action, self-efficacy and iron deficiency anemia and preventive behaviors in the interventional group compared to the control group, significantly increased. Also In the study by **Montazeri et al**., **[24].** the results showed a significant increase in the perceived susceptibility in the interventional group compared to control group. So, these studies reported that education can increase susceptibility to disease that were consistent with our obtained results. Also **Hamideh et al, 2017** ., **[25].** reported that in the pre intervention stage, there was no significant difference between the two intervention and control groups regarding demographic variables, but after the educational intervention, the mean of model constructs in the intervention group, in particular perceived susceptibility (29.066 ± 2.725) and knowledge (23.000 ± 2.763) was significantly increased ($P <0.05$).

The results also indicated a significant difference in mean score of perceived severity between the intervention and control groups three months after program implementation . An increase in the perceived severity means that the pregnant women in the intervention group realized the seriousness of the risks associated with the violation of proper nutrition and anemia, and finally understood that in the event of failure to comply with proper and balance nutrition they are at the risk of anemia complications. As sometimes woman's false beliefs and misconceptions about health problems make them feel they are less at risk of having a health problem, as compared to their peers. In other words, people usually underestimate the risk of their exposure to threats, as compared with the risk estimated for their peers. This result is similar to the findings of **Baharzadeh et al., [26].** who indicated there were a significant difference in mean score of perceived severity between the intervention and control groups. This result is similar to the findings of **Javaher Tehrani et al [27].**

The significant differences in the mean scores of perceived barriers between the intervention and control groups showed a positive effect of education on perceived obstacles. That is to say that women in the intervention group could perceive the barriers as the major factors to prevent adoption of anemia preventive behaviors. This results is inconsistence with **Ghaderi et al., [12]. who** stated that after the intervention, mean scores of perceived barriers showed a significant reduction in the interventional group compared to the control group.The present study showed that after the intervention the mean score of perceived benefits in the intervention group significantly increased than the control group. This may be due to after the educational program, the mothers in the intervention group understood the benefits of health behaviours and got motivated to do recommended behaviours so that it is observed that the mean score of nutritional behavior had significant improvement between the intervention and control groups after the educational intervention. Also **Mirzaei [28].** stated that Before training, there was not a significant difference in the mean scores of the health belief model constructs and health function between two groups, ($p > 0.05$). But three months after intervention, the mean scores of perceived susceptibility, severity, benefits, barriers, perceived self-efficacy, practice guidance and health performance were significantly different between two groups ($p <0.001$).

The results showed that educational program based on HBM was effective in improving nutritional behaviors in the prevention of anemia in the intervention group, this may b due to if people have a higher perception of the threats or health problems, they take into account possible health warnings that may occur and thus take to action to prevent health problems or health threats and make great change in their attitudes and behaviours. The results of the present study agree with **Zelalem et al., [29].** who reported that after the implementation of nutrition education, there were positive effect of nutrition education observed in knowledge change and behaviour improvement pre and post assessment respectively. **Javahery Tehrani [27].** in his study on pregnant women reported a similar result. Also **Hamideh et al, 2017**., **[25].** reported that there was a significant difference between the control group and the intervention group in all constructs of HBM and

nutritional behaviour. Additionally **Sukandara et al. in 2015 [30],** showed that education improves knowledge of nutrition during pregnancy and nutritional behavior and the constructs of HBM

The results showed that there was a positive highly statistically significant correlation between total knowledge and total health behavior score in both intervention and control groups before and after program implementation. as well as there was a positive highly statistically significant correlation between total health behavior score and total HBM four main constructs in both intervention and control groups before and three months after program implementation . The results of the present study agree with **(Abd El Aziz, 2016) [8].** confirmed that, there was a positive highly statistically significant correlation between health beliefs and health behavior in both intervention and control groups before and two months after program implementation. This finding is consistent with **Yossif & EL Sayed**, **2014** [**31**].who stated that there was a statistically significant correlation between total health beliefs score and total intention score to practice health preventive behavior in both intervention and control groups before and two months after the self-learning package.

. As a consequence, it can be stated that it is helpful to design educational interventions to take advantage of the significant effects of the mentioned constructs on adopting anemia preventive behaviours. Accordingly, designing an educational program based on the HBM is an urgent need to increase the pregnant women awareness about the severity and susceptibility of anemia which can enhance their preventive practice.

V. Conclusion

In this research, based on the statistical results, there was no statistical significant difference regarding the four main HBM constructs (perceived susceptibility, perceived benefits, perceived severity and perceived barriers) and nutritional behavior before and after program implementation among the control group. However, a highly statistically significant difference (p-values < 0.001) was observed regarding the four main HBM constructs before and after program implementation among the study group.Therefore, education and interventions based on this model have been able to increase the knowledge of pregnant mothers and their behavior by fearing that complications of iron deficiency anemia will develop their neonate and identifying the existing barriers and understanding the benefits of appropriate adopting with nutritional behavior. Thus this study show that HBM is effective in improving pregnant women' knowledge and health behaviors regarding anemia. In general, the results of the present study showed HBM was able to increase the preventive behavior of iron deficiency anemia and confirmed that educational programs based on HBM has been effective on the adoption of preventive behaviors of iron deficiency anemia. This type of education is low cost and can prevent expensive pregnancy complications and adverse obstetric outcomes.

Recommendations

Based on the findings of the current study , the following recommendations are suggested :

- Pregnant women should be provided with instructional booklets about anemia based on HBM to improve their knowledge and health belief.
- The approach of primordial prevention should be adopted, which involves preventing anemia and spread of risk factors and lifestyle modification through health education programs conducted by the nursing personal both in hospital and community. The nurse and health workers can distribute iron and folic acid supplements to the antenatal mother.

Further research:

- Replication of this study on a large sample and in different settings is recommended for generalization of results.

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