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Effectiveness of BASNEF Model- Based Health Education on Reduction of Iron Deficiency Anemia among Pregnant Women

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ABSTRACT

Background: Iron deficiency anemia is associated with many problems especially during pregnancy like expanded dangers of maternal mortality, preterm labor and low birth weight. ***AIM***: To assess the effectiveness of BASNEF model based health education on reduction of iron deficiency anemia among pregnant women. ***DESIGN:*** A quasi- experimental research design was utilized**.** ***SETTING***: This study was conducted in Outpatient Clinics of Obstetrics and Gynecology at Benha University Hospital. ***SAMPLING*:** A Purposive sample included 200 pregnant women was used. ***TOOLS:*** Two tools were used for collecting data included a structured interviewing questionnaire, and BASNEF Model Questionnaire**.** ***RESULTS:*** The current study indicated that there was a significant improvement in the mean score of total knowledge and total BASNEF scores in the study group post program implementation and after three months compared to the control group. Also, there was a positive statistically correlation between total BASNEF scores and hemoglobin, ferritin and hematocrit levels in the study group post program implementation and after three months ($p<0.05$). ***CONCLUSION:*** The application of health education utilizing BASNEF Model had improved pregnant women's knowledge, belief, attitude, subjective norms and enabling factors regarding iron deficiency anemia. ***RECOMMENDATION:*** Dietary advices should be available for all pregnant women through media, guidelines, brochures, antenatal classes and follow up.

Keywords: BASNEF Model, Iron deficiency anemia, Pregnant women.

Introduction

Pregnancy is considered to be one of the most important periods in a woman's life and has a great influence on lifestyle and nutritional behavior. In addition, woman's nutrition during pregnancy can have a major effect on her health and the development of her unborn baby. ***(Mohaddesi et al., 2017***).

In addition, pregnant woman and the developing fetus are more susceptible to iron-deficiency anemia and are at significant risk of iron deficiency under normal dietary circumstances. During pregnancy, there are increased demands for iron to support the developing fetus and placenta and to increase the mother's red blood cell mass. ***(Means, 2020)***.

Worldwide, iron deficiency anemia is the most common nutritional deficiency disorder and occurs when dietary iron is insufficient for hemoglobin synthesis and defined as decreased hemoglobin level less than 11 g/dL or decreased a hematocrit level less than 33%. ***(Nahrisah et al., 2020)***.

Also, iron deficiency anemia affects 25 to 50% of the world's population and about 50% of pregnant women. Recent studies show that the prevalence of anemia during pregnancy is about 14% in developed

countries and 51% in developing countries ***(Liyew et al., 2021).***

Moreover, iron deficiency during pregnancy can predispose many adverse effects for the mother and fetus including an increased risk of sepsis, low birth weight, post-partum hemorrhage, maternal and perinatal mortality. Also, recent studies have demonstrated that insufficient iron consumption during pregnancy can increase the risk of cardiovascular disease for the newborns in the future ***(Auerbach et al., 2019)***.

BASNEF model is a simplified approach to understanding behavior and can motivate early adoption of healthier eating habits and more strenuous lifestyle to promote long-term health and prosperity also, is effective in improving knowledge, attitudes and behaviors of women **(*Pirzadeh et al., 2018)***.

BASNEF model was first introduced in 1988 by John Hubley and used for identifying and evaluating different behavioral patterns, also helps in developing new attitudes and behaviors towards a particular concern. This model includes four main parts beliefs, attitudes, subjective norms and enabling factors which based on the theory of reasoned action (***Akbarzadeh et al., 2017)***.

Nurses play necessary role in providing proper services to enhance correct and regular usage of supplements and introduce pregnancy care through improving awareness and skills of pregnancy. Evidence has shown that nutrition based health education can reduce the incidence of various diseases such as anemia in many countries. So, the implementation of nutritional education programs is considered necessary to increase nutritional awareness ***(Jeihooni et al., 2021)***.

Significance of the problem

During pregnancy, poor nutrition and inadequate diet can affect mother and fetus and predispose numerous nutritional problems like anemia. Therefore, good nutrition is considered an important aspect of pregnancy that should not be ignored ***(Fallah et al., 2017)***.

Anemia is the most common nutritional deficiency disorders that affecting 41.8% of pregnant women globally. In Egypt, about 25% of pregnant women suffer from anemia and mainly result from inadequate intake of iron, vitamin B12, folate, parasitic infections, and acute blood loss .Also, recent studies displayed that anemia result in 20% of deaths during pregnancy ***(Juul et al., 2019) (Ministry of Health and Population, Egypt, 2019).*** Also, many complications may occur during delivery related to iron-deficiency anemia as expanded hazard of blood transfusion, cesarean section, preterm labor, and entrance of newborn to intensive care unit ***(Lewkowitz et al., 2019.)***

One of the most used strategies to promote nutrition during pregnancy is nutrition instruction based on BASNEF model; however less research has been carried out regarding effectiveness of BASNEF model-based health education on reduction of iron deficiency anemia among pregnant women in Faculty of Nursing, Benha University**.**

Aim of the study

The study aimed to assess the effectiveness of BASNEF model based health education on reduction of iron deficiency anemia among pregnant women**.** The aim was accomplished through:-

1- Assessing pregnant women's knowledge regarding iron deficiency anemia during pregnancy.

2- Assessing pregnant women's beliefs, attitude, subjective norms and enabling factors regarding iron deficiency anemia during pregnancy.

3- Designing, implementing and evaluating the impact of health education based on BASNEF model on reduction of iron deficiency anemia during pregnancy.

Research hypothesis

Pregnant women who attended health education program based on BASNEF model will have good knowledge, beliefs, attitude, subjective norms and enabling factors regarding iron deficiency anemia during pregnancy than those who will not.

Operational definitions

- Iron deficiency anemia is a common type of anemia that result from loss of blood, insufficient iron intake and poor absorption of iron that lead to deficiency of healthy RBCs that carry oxygen to the body's tissues.

- BASNEF model, an acronym for Beliefs, Attitudes, Subjective Norms and Enabling Factors, it is a comprehensive and complete model which is adopted to study behaviors, offers plans for change and defines the factors effective for the individuals' decision making**.**

Subjects and Method

Study design: A quasi-experimental research design was applied to achieve the aim of study (Two groups, control and study).

Study setting:-

The study was conducted at Outpatient clinics of obstetrics and gynecology of Benha University Hospital which is the main hospital serving ALQalyubia Governorate and the surrounding areas and provides emergency and routine care for pregnant women.

Study subjects:-

A Purposive sample of 200 pregnant women that was admitted to Outpatient clinics of obstetrics and gynecology of Benha University Hospital during six months and meeting the following inclusion criteria, Pregnant women, at first trimester, medically diagnosed with iron deficiency anemia and accepted to participate in the study. The exclusion criteria were pregnant women who had mental disorders, blood disorders, abnormal pregnancy and women who refused to participate in the study.

The pregnant women were randomly divided into two groups (study group included 100 pregnant women who receive the educational program and control group included 100 pregnant women who didn't receive the educational program) appointing that odd number were considered in study group and even number in control group.

Study tools:-

Two tools were utilized as follow:

Tool I: A structured interviewing questionnaire: the researchers prepared questionnaire after extensive review of related literature then translated into simple Arabic language and included four parts as following:

Part (1): Demographic characteristics of pregnant women and included 9 questions (age, education, spouse education, occupation, spouse job, residence, family size, family income and duration of pregnancy).

Part (2): Pregnant women's measurements and lab investigations: Height, Weight, BMI, Hb level, ferritin level and hematocrit level.

Part (3): Obstetrics history it included data about number of pregnancies, number of labors,

feeding type, duration of feeding, methods of contraception and number of abortion.

Part (4): knowledge of pregnant women concerning iron deficiency anemia during pregnancy and consisted of 16 questions about definition of iron deficiency anemia, causes, symptoms, diagnosis, complication on both women and fetus, prevention, treatment, management,….etc.**).** Each item of knowledge was given a score (1) when the response was correct and a score (0) for incorrect response or don't know. The total knowledge score was summed and ranged from (0- 16). The total score was classified as the following:

- **Good** ≥ 75 %
- **Average** 60 - < 75 %
- **Poor** < 60 %

Tool II: BASNEF Model Questionnaire: It was adapted from ***Mehrabian et al., 2016*** and modified by researchers and consisted of 4 sections:

Section (1): **Pregnant women's believes about iron deficiency anemia**

it consisted of 14 items to assess beliefs e.g. (balanced diet is important during pregnancy, women nutrition during pregnancy is different from others, take nutritional supplements each day, keep a record of everything you eat each day, have periodic lab tests to assess your progress ...etc.). The women's response was assigned based on two points of Likert scale (true/false) and each item was given score (1) for true and a score (0) for false. The total scores ranged from 0-14. A score of (10-14) indicated strong health believes, a score of (7- <10) indicated neutral health believes while a score of < 7 indicated weak health believes.

Section (2)**: Pregnant women's attitude regarding iron deficiency anemia(IDA) during pregnancy:** It included 8 items that assessed attitude as (Regular ANC visit is good to prevent IDA, tell physician or other health care provider about abnormal signs or symptoms, it is essential to take special diet during pregnancy, Iron supplements can prevent IDA… etc.). The woman's response was done based on three points Likert scale, a score (1) given for "disagree" score (2) for "uncertain" and score (3) for "agree". The total scores of attitude ranged from (8-24) where a score of (15-24) indicated positive attitude while, a score of <15 indicated negative attitude regarding iron deficiency anemia.

Section (3): **Assessment of pregnant women's subjective norms regarding iron deficiency anemia (IDA) during pregnancy:** It included 10 items e.g. (Do you follow a diet during pregnancy? Do you eat a variety of foods? Do you take iron supplements? Do you know the necessary precautions when taking iron supplements? Do you eat normal meals that contain iron? Do you know what the barriers to iron absorption are? …etc.). Each item was assigned using two points Likert scale (Yes/No), a score (1) for 'yes" and score (0) for 'no' response. The total scores ranged from 0-10 with the higher scores indicated the more affective the subjective norms were on women to take iron supplements to prevent iron deficiency anemia.

Section (4)**: pregnant women's enabling factors regarding iron deficiency anemia (IDA) during pregnancy:** consisted of 8 items e.g. (Family support, access to health insurance, Monthly income, availability of Referral services and Iron supplements …etc.). The women's response was assigned based on two points of Likert scale (true/false) and each item was given score (1) for true and a score (0) for false. The total scores ranged from 0-8. The higher scores indicated positive effect of enabling factors on using iron supplements during pregnancy.

Method

The study was accomplished through the following steps:

Administrative process:

1- An official hospital permission and written approval to conduct the study was obtained by submission an official letter issued from the Dean of Faculty of Nursing at Benha University to the director of Benha University Hospital, in order to obtain agreement to conduct the research after explaining purpose and getting the statistical numbers of pregnant women attending ANC clinic enrolled within hospital annually.

2- Ethical consideration:

This study was confirmed by the Scientific Research Ethical Committee in Faculty of Nursing, Benha University. The researchers discussed the purpose of the study to every woman to obtain informed consent for participation in the study also; the women have freedom to withdraw from the study at any time. In addition, the researchers illustrated to the women that all information was used for research purpose only.

3- Tool development:

Tools of data collection were developed by the researchers after the review of literature and written in simple Arabic language to suit level of women's understanding.

4- Validity of the tools:

The tools of data collection were reviewed by panels of three experts in the field of Obstetrics and gynecology health nursing at Benha University to test content validity, clarity and appropriateness of the content.

5- Reliability of the tools:

The reliability was done by cronbach's Alpha coefficient test which showed that each of the tools consisted of relatively homogenous items as indicated by the moderate to high reliability of tools. The internal consistency for knowledge questionnaire was 0.76%. The internal consistency for BASNEF Model sections were 0.9, 0.79, 0.83, 0.91 for beliefs, attitude, subjective norms and enabling factors respectively.

6- A Pilot study:

It was done on 10% of total time of study (three weeks) which included (20) women who met inclusion criteria. It was applied to ensure that the study tools were simple, clear and applicable. In addition, to discover the possible handicaps and problems that the researchers may face during data collection. The women involved in the pilot were included in the study as no modifications were done.

7- Data collection:

This study was carried out from the start of February, 2021 to the end of October, 2021 covering 9 months. The researchers visited the previous illustrated study setting 3 days / week from 9 am to 2 pm.

8- The study was conducted through:

A- Preparatory Phase

To fulfill the aim of research the researchers started with reviewing national and international literature regarding the different aspects of the research problem which assisted the researchers to be aware of the dimension and severity of the problem and guide the researchers to make tools of data collection.

B- Interviewing and assessment phase

At the beginning, researchers greeted participated women, illustrated study purpose, gave women all data concerning the study such as duration, activities and took oral consent. The average time for completing questionnaire for each woman was (20-30 minutes) and

the number of women interviewed was done according to the admitted cases who accepted participation in the study.

C- Designing of the program

According to findings which acquired from interviewing phase, the educational program based on BASNEF model was constructed, and researchers determined the numbers of sessions, contents, various methods of teaching, and educational media. After that, objectives of the program were constructed as the following:

General objectives

General objectives were aimed to improve pregnant women knowledge, beliefs, attitude, subjective norms and enabling factors regarding reduction of iron deficiency anemia during pregnancy.

Specific objectives

It was aimed to:

- Provide pregnant women with knowledge regarding reduction of iron deficiency anemia during pregnancy.
- Enhance health beliefs and attitudes regarding reduction of iron deficiency anemia during pregnancy.
- Modify health practices and subjective norms of pregnant women toward reduction of iron deficiency anemia during pregnancy.
- Enhance enabling factors of pregnant women toward reduction of iron deficiency anemia during pregnancy.

D- Implementation of the program

The participants were classified into two groups (study and control group) by randomization. Then, the educational program was applied; each session lasted 30 to 40 minutes for small group of women involved 3-4 pregnant women. A variety of teaching methods were used such as lecture, group discussion; questions and answers and Power-Point presentation based on the BASNEF model. The instructional content of sessions involved modification of wrong believes and behavior about iron deficiency anemia, also improve their awareness regarding the definition of iron deficiency anemia and its causes, symptoms, diagnosis, complication on both women and fetus, prevention, treatment and management using BASNEF model. At the final of each session the pregnant women were motivated to ask questions to modify their wrong understanding.

The educational program was conducted at the waiting room of the antenatal clinic. Blood analysis as: hemoglobin, ferritin, hematocrit levels was performed before implementation of the study then after a month of program implementation and after three months for follow up.

E- Evaluation phase:

To evaluate and recognize the impact of educational program based on BASNEF model, the researchers used the same tools which were used preprogram immediately after implementation of the program. Then follow up after three months was done through telephone calls or another antenatal visits using the same previous tools for both study and control groups.

9- Statistical analysis of data:

Data were confirmed before entry and statistical analysis was done utilizing the statistical package for social sciences (SPSS version 2021). Descriptive statistics were done that included (mean, standard deviation, frequency and percentage) and tests of significance as (paired t-test, chi-square test). A statistical significant difference was considered when

p≤ 0.05. In addition, a highly statistical significant value was considered when p< 0.001.

Results

Table (1) shows that 38% and 33% of the study and control groups respectively were in the age group of 20-<25 years with mean age 24.39±4.91 years for study group and 24.24±5.04 for control group. Also, 44% and 48% of study and control groups respectively had secondary education. Additionally, (70% and 75%) and (62% and 66%) of study and control groups were housewives and lived in rural areas respectively.

Table (2) demonstrates no statistically significant relation between study and control groups concerning lab analysis of hemoglobin, ferritin and hematocrit levels. Also, there was no significant relation between study and control groups regarding, length, weight and BMI.

Table (3) shows that 44% and 32% of study and control groups respectively were primigravida. Regarding methods of contraception about 16% and 25% of study and control groups respectively had used lobe.

Table (4) demonstrates that the mean score of knowledge of the study group increased from 18.70±10.44 preprogram to 34.73±11.18 post program implementation and to 34.48±11.38 at follow up phase also, there was a highly statistically significant differences between study and control groups post program implementation and at follow up phase (p<0.001).

Table (5) clarifies that the mean score of the total BASNEF scores increased from 24.42±5.82 preprogram to 45.79±3.55 post program implementation and 43.18±2.47at follow up phase also, there was highly statistically significant relation between study and control groups post program implementation and at follow up phase (p<0.001).

Figure (1) illustrates that 82% and 80% of the study group had good knowledge post program implementation and at follow up phase respectively compared with 14% preprogram implementation while, 17% and 18% of the control group had good knowledge post program implementation and at follow up phase.

Table (6) shows that there was a positive statistically significant correlation between total knowledge and total BASNEF score in the study group post program and after 3 months of the program while, that there was no statistically significant correlation between total knowledge and total BASNEF score in the control group pre, post and after 3 months of the program implementation.

Table (7) demonstrates that there was a positive statistically significant correlation in the study group between total knowledge and education and job preprogram implementation while, a positive statistically significant correlation was found between total knowledge and age, education, job, residence and income post program and after 3 months of the program implementation.

Table (8) clarifies that there was a positive statistically significant correlation between total BASNEF score and job and income in the study group preprogram. While, there was a positive statistical correlation between total BASNEF score and age, education, job, residence and income post program implementation and at follow up phase except for residence.

Table (9) illustrates that there was a positive statistical correlation between total BASNEF score and blood analysis values of hemoglobin, ferritin and hematocrit in the study group post program

implementation and at follow up phase. While, there was a negative statistical correlation between total BASNEF score and blood analysis values in the control group pre, post and at follow up phase.

Results

Table (1): Frequency distribution of studied women (study and control group) regarding demographic characteristics (n=200).

Items	Study (n=100)		Control (n=100).		X^2	p-value
	No	%	no	%		
Age						
<20yrs	20	20.0	25	25.0	.908	.824
20-<25yrs	38	38.0	33	33.0		
25-<30	24	24.0	24	24.0		
>30	18	18.0	18	18.0		
Min –Max	17-34		17-34			
Mean ±SD	24.39±4.91		24.24±5.04			
Educational level						
Illiterate	12	12.0	10	10.0	.443	.931
Primary	24	24.0	22	22.0		
Secondary	44	44.0	48	48.0		
High education	20	20.0	20	20.0		
Spouse education						
Illiterate	15	15.0	12	12.0	.445	.800
Primary	11	11.0	18	18.0		
Secondary	42	42.0	41	41.0		
High education	32	32.0	29	29.0		
Job						
Employee	30	30.0	25	25.0	.627	.428
Housewife	70	70.0	75	75.0		
Husband job						
Employee	46	46.0	42	42.0	.325	.569
Worker	54	54.0	58	58.0		
Residence						
Rural	62	62.0	66	66.0	.347	.556
Urban	38	38.0	34	34.0		
Family size						
Two person	29	29.0	25	25.0	.487	.784
3 person	40	40.0	44	44.0		
More than three	31	31.0	31	31.0		
Family income						
Sufficient and save	18	18.0	12	12.0	1.427	.490
Sufficient	24	24.0	25	25.0		
Not sufficient	58	58.0	63	63.0		

Table (2): Mean and standard deviation among studied women (study and control groups) regarding lab analysis

Items	Study				Control				T	p-value
	Min	Max	Mean	±SD	Min	Max	Mean	±SD		
Hemoglobin level	8	12	10.35	1.17	8	12	10.31	1.01	.264	.792
Ferritin level	7	150	58.72	30.52	7	130	59.57	29.37	.201	.841
Hematocrit level	20	46	33.61	6.69	20	46	33.06	6.14	.605	.546
Length	150	176	162.57	7.82	150	180	162.74	8.11	.155	.877
Weight	55	86	72.86	7.94	58	89	73.54	7.55	.625	.533
BMI	20	36.26	27.66	3.43	20.45	38.44	27.91	3.64	.496	.621

Table (3): Frequency distribution of studied women (study and control group) regarding obstetrics history (n=200).

Items	Study (n=100)		Control (n=100).		X^2	p-value
	No	%	No	%		
No .of pregnancy						
1	44	44.0	32	32.0	3.359	.340
2	30	30.0	39	39.0		
3	12	12.0	12	12.0		
More than3	14	14.0	17	17.0		
No. of labor						
No	44	44.0	32	32.0	3.359	.340
1	30	30.0	39	39.0		
2	12	12.0	12	12.0		
More than2	14	14.0	17	17.0		
Method of contraception						
No method	44	44.0	32	32.0	4.557	0.336
Lobe	16	16.0	25	25.0		
Injection	15	15.0	13	13.0		
Norplant	11	11.0	12	12.0		
Pills	14	14.0	18	18.0		

Table (4): Mean and standard deviation among studied women (study and control groups) regarding total knowledge through the program phases

Items	Preprogram		Post program		Follow up (after 3 months)		t1	p-value	t2	p-value	t3	p-value
	Mean	±SD	Mean	±SD	Mean	±SD						
Total knowledge												
Study	18.70	10.44	34.73	11.18	34.48	11.38	.027	.978	10.58	.000**	10.07	.000**
Control	18.66	10.45	19.83	7.86	20.53	8.58						

*** Statistically significance p<0.05 ** highly statistically significance p<0.001**

t1 independent t test between study and control pre program
t2 independent t test between study and control post program
t3 independent t test between study and control after 3 months of the program

Table (5): Mean and standard deviation among studied women (study and control groups) regarding total beliefs, attitude, subjective norms and enabling factors of BASNEF model through the program phases

Items	Preprogram		Post program		Follow up (after 3 months)		t1	p-value	t2	p-value	t3	p-value
	Mean	±SD	Mean	±SD	Mean	±SD						
Total belief												
Study	5.58	2.37	11.02	1.89	10.16	1.27	.090	.928	15.998	.000**	15.201	.000**
Control	5.55	2.33	6.06	2.45	6.04	2.39						
Total attitude												
Study	13.24	3.30	20.07	2.05	19.40	1.42	1.677	.095	19.285	.000**	20.247	.000**
Control	12.49	3.01	12.91	3.09	12.57	3.05						
Total subjective norms												
Study	2.96	2.12	8.00	1.33	7.48	1.03	1.310	.192	14.045	.000**	13.347	.000**
Control	3.33	1.85	3.99	2.52	3.92	2.45						
Total enabling factors												
Study	2.64	1.72	6.70	1.12	6.14	.77	.000	1.000	16.570	.000**	16.105	.000**
Control	2.64	1.70	2.98	1.94	2.91	1.84						
Total BASNEF scores												
Study	24.42	5.82	45.79	3.55	43.18	2.47	.521	.603	29.032	.000**	28.911	.000**
Control	24.01	5.28	25.94	5.83	25.44	5.61						

*** Statistically significance p<0.05 ** highly statistically significance p<0.001**

t1 independent t test between study and control pre program
t2 independent t test between study and control post program
t3 independent t test between study and control after 3 months of the program

Figure (2): percentage distribution of studied women (study and control groups) regarding their total knowledge level through the program phases

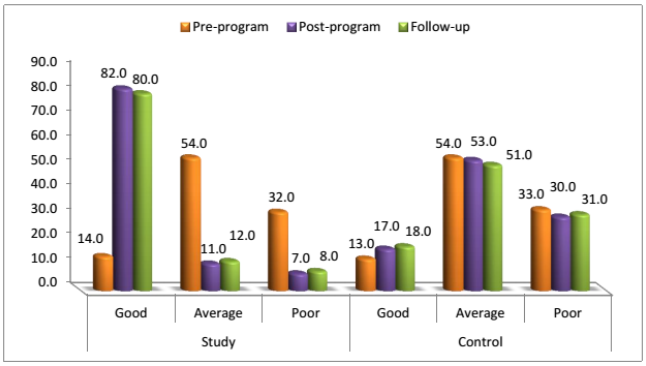

Table (6): Correlation between total knowledge and total BASNEF score among studied women (study and control group) through the program phases

Total knowledge	Total BASNEF score			
	Study		Control	
	r	p-value	r	p-value
Pre program	-.125	.216	-.080	.430
Post program	-.284	.004*	-.183	.069
After 3 months of the program	-.271	.006*	-.156	.122

Items	Pre				Post				Follow-up			
	Study		Control		Study		Control		Study		Control	
	r	p-value	r	p-value	r	p-value	r	p-value	r	p-value	r	p-value
Age	.419	.062	.482	.072	.890	.000**	.522	.082	.695	.005*	.252	.080
Education	.715	.000**	.823	.006*	.526	.000**	.732	.009*	.745	.000**	.652	.008*
Job	.519	.015*	.719	.007*	.580	.000**	.691	.014*	.519	.000**	.567	.014*
Residence	.326	.078	.556	.085	.638	.017*	.665	.065	.791	.024*	.665	.084
Income	.254	.057	.854	.004*	.821	.000**	.745	.003*	.582	.000**	.534	.005*

Table (7): Correlation between total knowledge and demographic characteristics among studied women (study and control group) through the program phases

Table (8): correlation between total BASNEF score and demographic characteristics among studied women (study and control group) through the program phases

Items	Preprogram				Post program				Follow-up (after 3 months)			
	Study		Control		Study		Control		Study		Control	
	r	p-value	r	p-value	r	p-value	r	p-value	r	p-value	r	p-value
Age	.009	.929	.004	.966	.199	.047*	.124	.219	.231	.021*	.135	.181
Education	.150	.137	.033	.745	.367	.000**	.131	.195	.381	.000**	.134	.184
Job	.236	.018*	.027	.786	.387	.000**	.129	.200	.402	.000**	.051	.212
Residence	.021	.834	.114	.260	.204	.042*	.058	.565	.185	.065	.064	.524
Income	.212	.034*	.164	.102	.341	.001**	.234	.019*	.345	.000**	.216	.031*

Table (9): correlation between total BASNEF score and blood analysis among studied women (study and control group) through the program phases

Items	Preprogram				Post program (after 1 month)				Follow-up (after 3 months)			
	Study		Control		Study		Control		Study		Control	
	r	p-value	r	p-value	r	p-value	r	p-value	R	p-value	r	p-value
Hemoglobin	.212	.693	.233	.190	.740	.034*	.215	.321	.680	.005*	-.194	.053
Ferritin	.209	.214	.279	.051	.725	.037*	.220	.282	.720	.047*	.243	.151
Hematocrit	.236	.239	.067	.511	.619	.018*	.087	.388	.651	.011*	.118	.242

Discussion

Iron deficiency anemia is the most commonly health problem that occur during pregnancy which may affect pregnant woman and baby all over the world. So, the current study was conducted to assess the effectiveness of BASNEF model-based health education on reduction of iron deficiency anemia among pregnant women.

Regarding demographic data of the studied women, the findings of the current study illustrated that the mean age of the studied pregnant women was 24.39±4.91 for study group and 24.24±5.04 for control group, when study done by ***Gahangiri et al., (2020)*** found that the mean age of participants was 30.10±5.8 for intervention group and 28.78±4.6 for control group. Also, ***Al-Tell et al., (2010***) who conducted a study on 102 pregnant women in Palestine and found that mean age of studied pregnant women was 22±.624.

Our study results demonstrated that about half of the studied pregnant women in both groups had secondary education also; more than one third of their spouses had secondary education. Additionally, most of studied pregnant women were housewives and more than half of their spouses were workers and not employees. This result is similar to ***Al-Tell et al., (2010***) who illustrated that 45.1% and 43.1 of study and control groups respectively had secondary education and more than two thirds of them were household. Also, a study conducted by ***Triharini et al., (2019)*** in Indonesia on 30 pregnant women found that 60.0% of the intervention group and 79.9% of the control group had secondary education levels.

This result discussed the fact that lack of pregnant women knowledge and practice about healthy lifestyle and good eating habits increase their risk to iron deficiency anemia.

Moreover, about two thirds of study and control groups were from rural areas. This result agrees with ***Abdel Mageed et al., (2017)*** who found that nearly two thirds of study group came from rural areas.

Regarding family size and income more than one third of both groups had three persons and more than half of them have insufficient monthly income. The previous study results may make pregnant women more susceptible to iron deficiency anemia.

The results of the current study showed that Body Mass Index (BMI) for study group was 27.66 ± 3.43 as the minimum BMI was 20 and maximum was 36.26. As for control group it was 27.91 ± 3.64 as the minimum BMI was 20.45 and maximum was 38.44. This result is relatively come in line with ***Sunuwar et al., (2019)*** who found that BMI in intervention group was 22.18 ±3.15 and in control group was 22.87 ±3.86.

Regarding lab analysis, the current study found that the mean score of hemoglobin level was 10.35±1.17 for the study group and 10.31±1.01 for control group with minimum result 8 and maximum result 12 for both groups. While ***Gahangiri et al., (2020)*** found that the mean score of hemoglobin level was 12.80±1.5 for intervention group and 13.02±1.08 for control group. Also, in the current study the mean score of Ferritin level was 58.72±30.52 for study group and 59.57±29.37 for control group with minimum result 7 and maximum result 150 for study group and minimum result 7 and maximum result 130 for control group. Also, the mean score of hematocrit level was 33.61±6.69 for study group and 33.06±6.14 for control group with minimum result 20 and maximum result 46 for both groups. This result may be due to the lack of iron which causes decrease volume of RBCs (hematocrit level) and therefore decrease hemoglobin level.

The current results demonstrated that less than half of the study group and nearly one third of the control group were primigravida. In contrast, ***Al-Tell et al., (2010)*** illustrated that 25.5% of study group and 33.3% of the control group were primigravida. This mean that most of study sample had less experience and are at greater risk of developing iron deficiency anemia.

Regarding total knowledge of study and control groups, the results of the present study showed that there was no significant differences between both groups preprogram implementation while, a highly significant differences was found between both groups post program implementation and at follow up phase ($p<0.001$). In the same line, ***Hasneezah et al., (2020)*** who conducted a study on 162 women in Sepang found that the educational intervention based on Health Belief Model was effective in improving the knowledge score ($p=0.009$). Also, ***Sunuwar et al., (2019)*** found that change in maternal knowledge score about anemia and iron rich foods was significantly high in the intervention group over control group ($p<0.001$). These results reflected the efficiency of educational intervention based on BASNEF model for improving knowledge about iron deficiency anemia and how to prevent it during pregnancy.

Additionally, the current study showed a highly statistical significant difference between study and control group related to all items of BASNEF model (Beliefs, Attitude, Subjective norms and Enabling factors) post-program implementation and after three months of follow-up. These results agrees with a study conducted in Iran on 88 pregnant women by ***Hazavehei et al., (2014)*** and demonstrated that there was statistically significant difference in all items of BASNEF model after intervention and after two months except for enabling factors. While ***Gahangiri et al., (2020)*** found a statistically significant difference

between study and control group after intervention related to attitude and subjective norms only.

In the present study, pregnant women's belief, attitude and subjective norms improved after the educational program in the study group more than control group, which mean that BASNEF-based educational intervention was effective in changing behaviors of pregnant women and increase healthy habits.

Taking into account the enabling factors is very important to change any undesirable behavior, as ignoring them in any health educational program will lead to failure to change the behavior, in this study, enabling factors such as prenatal care, access to health insurance, sufficient income, family support and care for pregnant women play an important role in encouraging pregnant women to change unhealthy eating habits and choose healthy nutrition to prevent anemia during pregnancy.

The current study demonstrated a positive statistically correlation between total knowledge and total BASNEF score in study group, this result illustrates that providing pregnant women with knowledge through the program help them to have high health beliefs and positive attitudes toward IDA. Also, the improvement in pregnant women's knowledge also affects subjective norms and help to change behavior for the better.

According to correlation between total knowledge and demographic characteristics among studied women through the program phases, the results revealed that there was a positive statistically significant correlation in the study group between total knowledge and education and job preprogram implementation while, a positive statistically significant correlation was found between total knowledge and age, education, job, residence and income post program and after 3 months of the program implementation.

This result indicated that advanced maternal age and level of education reflects on women's knowledge and practices with regard to iron deficiency anemia during pregnancy, also, employed women are more knowledgeable than housewives as a result of gaining experiences from their counterparts at work. Additionally, the women's residence has a significant impact on women's knowledge and experience, as urban women have a greater opportunity to participate in educational programs and continuous follow-up of pregnancy through frequent antenatal visits than their counterparts in rural areas, also, income certainly has an important role in prevention of iron deficiency anemia as sufficient income help pregnant women to assume a healthy life style and good eating habits with proper consumption of supplements during pregnancy.

In contrast ***Egryani et al., (2017)*** in his study on 48 women in Semarang found that there was no statistical significant correlation between total knowledge and age, education and income.

According to correlation between total BASNEF score and demographic characteristics among studied women through the program phases, the results showed that there was a positive statistically significant correlation between total BASNEF score and job and income in the study group preprogram. While, there was a positive statistical correlation between total BASNEF score and age, education, job, residence and income post program implementation and at follow up phase except for residence. For control group there was positive statistically correlation between BASNEF score and income only post program implementation and at follow up phase.

Regarding correlation between total BASNEF score and blood analysis among studied women (study

and control group) through the program phases there was a significant improvement in the hemoglobin, ferritin and hematocrit levels of study group compared to control group post-program implementation and after three months of follow-up. These results are in the same line with study of ***Sunuwar et al., (2019)*** that found a significant improvement in the hemoglobin concentration of intervention group compared to control group in pregnant women. Also, ***Otoo and Adam, (2016)*** found that change in Hb concentration was significantly higher in the study group over the control group, 0.1±1.3 vs. −0.7±1.4, respectively (p=0.004). Moreover, ***Al-Tell et al., 2010*** found high statistical significant differences between study and control groups in hemoglobin level at 2nd and 3rd trimester.

Conclusion

Based on the results of the present study it was concluded that health educational program based on BASNEF Model had positive effect on improving pregnant women's knowledge, belief, attitude, subjective norms and enabling factors related to iron deficiency anemia among pregnant women immediately after program implementation and after three months. Also, it was effective on improving hemoglobin level of the study group through the program phases. Hence, the findings of the current study had supported the research hypothesis and achieved the aim of the study.

Recommendations

- Dietary advices should be available for all pregnant women through media, guidelines, brochures, antenatal classes and follow up..

-Developing awareness program for all pregnant women regarding iron deficiency anemia to enhance their knowledge and behaviors about nutrition and supplements during pregnancy.

-Dissemination of the educational booklet to all antenatal clinics at Benha city to reduce prevalence of iron deficiency anemia during pregnancy.

Further studies to be performed:-

Application of BASNEF model- based health education on reduction of iron deficiency anemia among female adolescent nursing students.

Application of other models to prevent iron deficiency anemia and measure its effectiveness on maternal and fetal outcomes.

Limitation of the study

One of the problems that the researchers faced in this study were overcrowding and noise in outpatient clinics, which caused interruption during sessions also, some sessions were postponed.

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