

Health Education Program for Pregnant Women with Iron Deficiency Anemia

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Abstract: Iron deficiency anemia is a global public health problem; the pregnant women are the most vulnerable groups to iron deficiency anemia. This study aimed to evaluate the effect of health education program for pregnant women with iron deficiency anemia. **Design:** A quasi experimental design carried out at Nozha Family Medicine Center in Masr Al-Gadida District. A purposive sample composed of 48 pregnant women with iron deficiency anemia. Two tools were used: First tool: Structured interviewing questionnaire which included; demographic characteristics, past obstetric history, knowledge about iron deficiency anemia and reported practices related to eating habits. The second tool was the medical record. **Results:** This study proved that there are statistically significant differences between pre/post implementation of health education program regarding total satisfactory knowledge, and pregnant women's reported practices towards level of dietary diversity, eating habits and cooking methods of meat and vegetables (foundry& grilled). However, There is statistically significant difference ($p < 0.05$) between pre/post implementation of program regarding the first and second reading of hemoglobin levels, while there is no statistically significant difference ($p > 0.05$) between pre/post implementation of program regarding the second and third reading of hemoglobin levels. **Conclusion:** It can be concluded that, the health education program for pregnant women with iron deficiency anemia led to significant improvements in their knowledge and practices that was proved by a slightly improvement among levels of hemoglobin in the three readings from start to the end of this study. **Recommendations:** A nutritional program on consumption of iron-rich foods and iron/folate supplementation is recommended to prevent anemia in pregnant women

Keywords: Iron deficiency anemia, pregnant women, health education program.

1. INTRODUCTION

The world health organization (WHO) defines anemia in pregnancy as "Anemia is a condition in which the number and size of red blood cells, or the hemoglobin concentration, falls below an established cut-off value ($< 11 \text{ g/dL}$ and hematocrit less than 33%), So the pregnant woman who had hemoglobin concentration of $< 11 \text{ g/dL}$ and hematocrit less than 33% is considered anemic pregnant woman. Anemia is an indicator of both poor nutrition and poor health [1].

The WHO [2] added that anemia is considered a serious public health problem today; it impairs health and well-being in women and increases the risk of maternal and neonatal adverse outcomes. It affects half a billion women of reproductive age worldwide as 29% (496 million) of non-pregnant women, and 38% of pregnant women aged 15-49 years were anemic. The prevalence of anemia was highest in south Asia and central and west Africa.

Iron deficiency is of the most common nutritional deficiencies and accounts for over 90% of cases, resulting in a negative balance between the amount of biologically available iron and an organic need. This condition can impair the mental and psychomotor development, reduce the individual's work performance, reduce resistance to infection and cause increased maternal and child morbidity and mortality [3].

Women go through a variety of physiological changes during pregnancy. Changes in the blood circulatory system are particularly notable, permitting normal fetal growth. Even in normal pregnant women, the hemoglobin concentration decreases with dilution according to the increase in the volume of circulating blood. Since iron and folic acid in amounts necessary to the fetus are preferentially transported to the fetus, the mother is likely to develop iron deficiency anemia and folic acid deficiency anemia [4].

During pregnancy there is an increase of iron requirements, therefore the likelihood of presenting iron deficiency is high if there is not supplementation during the pregnancy. Diagnosing of deficiency in pregnant women is critical because several evidences relate iron deficiency anemia to increased risk of maternal and fetal morbidity and mortality and premature delivery and low birth weight [5].

Iron deficiency anemia (IDA) is directly affected by one's diet, as iron is typically ingested through iron-rich and nutrient-dense foods. Furthermore, dietary iron is absorbed in the gastrointestinal tract. When a woman's diet lacks one of these two criteria, the result is iron deficiency (ID) and then possibly IDA over time. These conditions depend on the severity of deficiency as well as other factors [6].

Dietary iron is found in a variety of foods, but is particularly greatest in red meats, seafood, green leafy vegetables, dark chocolate, beef liver, and nuts. Iron-fortified foods include cereal and most other grain products. Women who consume diets with little to no intake of meats or iron-fortified foods, such as vegans and vegetarians have a great need for other sources of iron [7].

Lack of knowledge contributes to high anemia prevalence worldwide. People at risk of anemia may not know it is an important contributor to poor health, and may not be aware of preventive behaviors such as good nutrition and dietary practices, good infant feeding practices, sanitation-related practices, and cultural biases, such as those prohibiting certain foods or requiring women to eat after others have finished [8].

Most effective step to reduce the prevalence of anemia during pregnancy is health education. Health education constitutes awareness about iron deficiency anemia in terms of exposures, risk factors, essential nutrition ingredients and the importance of iron supplementations [9]. Many women had lack of knowledge or are not aware about their medical condition or the risk factors which can be life threatening. So, it is necessary for all women to take safety measures and more precautions, in order to avoid the occurrence of IDA before, during and after pregnancy [10].

The community health nurse as a pregnancy educator and health care provider should be knowledgeable enough to correct rumors and misbeliefs about problems of pregnancies and can play an essential role in informing and educating pregnant women to correct these problems and prevent their complications [11].

Significance of the study:

[12] reported that the prevalence of anemia among pregnant women in Egypt was reported found among 22.6 % in 2016. The National Institutes of Health mentioned that about half of all women aged 15-49 years are suspected to have IDA. In Africa, 57.1% of pregnant women are anemic which is considered as a severe public health problem in developing countries [7]. Furthermore, it is a major cause of morbidity and mortality of pregnant women and increases the risks of fetal, neonatal and infant mortality. Anemia during pregnancy contributes to 20% of all maternal deaths [13].

So, the management of this public health problem in community must be discussed from several lines or several views. Based on the previously mentioned statistics, the educational program is considered very important for pregnant women with IDA to avoid or decrease the risk of preterm labor or low birth weight and improve health status of mothers and fetal outcome. This program includes assessment of pregnant women with IDA eating habits and dietary diversity, follow hematologic laboratory results and teach the pregnant women how to prepare food in order to minimize the loss of iron and also encourage to take food high in vitamin C for iron absorption.

Aim of the Study:

This study aimed to evaluate the effect of health education for pregnant women with iron deficiency anemia through:

- Assessing pregnant women with iron deficiency anemia level of knowledge regarding anemia during pregnancy to identify their needs detected.
- Assessing the pregnant women with iron deficiency anemia reported practices related to their eating habits during pregnancy.
- Developing and implementing a health education program designed according to their needs.
- Evaluating the effect of the health education on pregnant women with iron deficiency anemia knowledge, practices and their level of hemoglobin.

- **Hypotheses:**

- The health education will have a positive effect on improving knowledge and practices related to eating habits of pregnant women with iron deficiency anemia.
- The health education will improve health condition of pregnant women with iron deficiency anemia through improving their level of hemoglobin

2. SUBJECT AND METHODS

The subject and methods of the current study will be discussed under the following four (4) designs: Technical design, operational design, administrative design and statistical design.

Technical Design:

It included research design, setting, subjects and tools for data collection.

Research design:

A quasi experimental design was utilized for this study.

Setting:

The study was conducted at Nozha Family Medicine Center affiliated to Ministry of Health in Masr Al-Gadida District, North Cairo Governorate. There are four centers in this district; one of them was chosen namely Nozha family medicine for application of the health education program where it has a high attendance rate from pregnant women, to select from them those with iron deficiency anemia.

Research subjects:

This study was carried out on a purposive sample of 48 pregnant women with iron deficiency anemia during pregnancy. The total number of pregnant women with iron deficiency anemia who attended the ante natal clinic in Nozha Family Medicine Center was 1750 during the previous year (2016). The average number of pregnant women with IDA attending the center per day ranged from 5 – 6. The total number of pregnant women with IDA during five months was 48 were chosen according to the following inclusion criteria:

- Hemoglobin level is less than 11g/dL (Hb<11g/dL WHO,2011) based on medical record and this must be estimated not more than 4 weeks before the time of selection
- Pregnant women included in this study are at their second trimester of pregnancy.
- Age ranged from 20 - 35 years (excluded any high risk pregnant women, with hematological diseases, and parasitic infection).

Tools of data collection:

Two tools were used for data collection (Pre/post health education program):

First tool: Structured interviewing questionnaire, developed by the researchers based on literature review, and written in simple clear Arabic language consisted of four parts as the following:

Part I: Designed to collect data about the demographic characteristics of the pregnant woman with iron deficiency anemia. It included woman's age, educational level, occupation and monthly income (questions: 1- 4).

Part II: Designed to collect data about the pregnant woman with iron deficiency anemia past obstetric history such as; parity, number of abortions, interval between pregnancies, family planning method, problem with family planning methods, previous pregnancy, labor and post partum period. In addition, the present complaints of the pregnant woman with IDA such as, fatigue, headache, drowsiness, decrease concentration, weakness, blurred vision and feeling of isolation (questions: 5-14).

Part III: Devoted to the pregnant woman with iron deficiency anemia knowledge about iron deficiency anemia covering areas such as; importance of antenatal follow up, meaning, risk factors, high risk pregnant women, causes, signs and symptoms, complications on mothers and fetus, food rich with vitamin C and iron, and protection from anemia during pregnancy (questions: 15- 25).

Scoring system:

This part of interviewing questionnaire was carried out according to the following scoring system:

For knowledge items, the correct answers were predetermined according to literature review, a correct response was scored 2 and the incorrect one was scored 1. For each item of knowledge, the scores of the items were summed-up and the total divided by the number of the items. These scores were converted into a percent score. The total score of women knowledge was 20 points, classified into: satisfactory $\geq 50\%$ (10-20points) and unsatisfactory $< 50\%$ (0-<10 points).

Part IV: Designed to assess pregnant woman with iron deficiency anemia reported practices related to eating habits during pregnancy as pregnant woman's dietary diversity, reported practices eating habits which inhibit absorption of iron and methods of cooking during pregnancy.

This assessment carried out through three parts:

The first part; this part of questions was designed to assess pregnant woman's dietary diversity; it was adopted from [14]. In this part, the pregnant woman was asked to recall the foods she had consumed in the previous 24 hours. A detailed list of all the ingredients of the dishes, snacks, or other foods consumed was generated to enable better classification of mixed dishes. The foods were then categorized into 12 food groups (1) cereals (2) roots and tubers (3) vitamin A – rich fruit and other fruits (4) Vitamin A rich vegetables, dark green leafy vegetables, and other vegetables (5) legumes and nuts (6) meat poultry (7) fish (8) fats and oils (9) dairy (10) eggs (11) sweets and (12) spices, condiments and beverages.

Scoring system:

Pregnant woman's Dietary Diversity Score (DDS) was calculated by gathering information on dietary intake using single 24 hour dietary recall method. The score was categorized as **Low** ($DDS \leq 3$ food groups), **medium** ($DDS = 4$ or 5 food groups) and **high** ($DDS \geq 6$ food groups). Then, identify the changes which happened in pregnant woman's practices related dietary diversity of eating through making comparison of the woman's practices in pre and post health education program.

The second part: This part of questions was designed to assess pregnant woman's reported practices regarding different items of eating habits which inhibit absorption of iron as drinking tea or cola after meal, using lemon juice in cooking, taking milk and its products after iron supplementation, use of frozen vegetables and meat and not drinking orange or lemon juice after taking iron supplementation

Scoring system:

The response of this part of the questions was designed as (Yes) and (No), was analyzed as follows: a value of (0) was attributed to (Yes) and a value of (1) was attributed to (No).

The third part: This part of questions was designed to assess pregnant woman's habits related to methods of cooking during pregnancy as method of cooking vegetables and meat.

Scoring system:

This part of questions had multi choice for different methods of cooking (steamed, boiled, foundry, grilled) The reported methods of cooking were analyzed as following: a value of (0) was attributed to foundry method, a value of (1) was attributed to boiled method, a value of (2) was attributed to grilled method and a value of (3) was attributed to steamed method. Then, the changes which happened in pregnant women's practices related methods of cooking were identified through making comparison of woman's practices in pre and post health education program regarding methods of cooking

2nd tool: the second tool was based on each woman's medical record, from which the researchers collected the following data:

Laboratory medical record related to diagnosis of anemia such as complete blood picture that shows the degree, progress and type of anemia. The routine investigation in Family Medicine Center was carried out 4 times, the first time in the first visit and the other three times in second and third trimesters. Hemoglobin level of the woman was taken from medical record and matching with a standardized one done by the [1].

Validity and Reliability:

Tools of data collection were submitted to and reviewed by a panel of five experts in the fields of community health nursing and dietitian to test the content validity. Each of the experts was asked to examine tools for content coverage, clarity, wording, length, format, and overall appearance. Modifications were done according to the panel's judgment on the clarity of sentences and content appropriateness as rephrasing and cancelling for two questions" were done. Reliability analysis was conducted to investigate the instrument internal consistency used in the study; test-retest reliability was applied. The tool proved to be strongly reliable ($r=0.8333$)

Operational Design:**Preparatory Phase**

During this phase, a review of the literature was done through reviewing the available national and international related literature to be oriented with various aspects of the research problem and to develop the study tool.

Pilot study:

After the development of tools of data collection, a pilot study was carried out on 5 pregnant women with iron deficiency anemia. The purpose of the pilot study was to ascertain the relevance and content validity of tools, to estimate the time needed for data collection and detect any problem that might face the researchers and interfere with data collection. After conducting the pilot study, the necessary changes were performed; some questions were rephrased, others cancelled, the tools were reconstructed and made ready for use. These pregnant women were excluded from the main study sample.

Ethical considerations:

All the pregnant women with iron deficiency anemia rights were secured; each one was informed about the nature of the expected outcomes of the study. They were assured that all data will be treated confidentially and information will be used only for the research purpose and for their benefits and each study subject was allowed enough time throughout the study. Researchers ensured that, the study posed no risk or hazards on their health and their participation in the study is voluntary. Pregnant women who were willing to participate in the study and met the inclusion criteria were approached by the researchers and asked for verbal consent to confirm their acceptance. They were also informed about their right to withdraw at any time without giving any reasons.

Field work:

- The actual field work was carried out over a period of 5 months from beginning of November 2017 up to the end of March 2018.
- The researchers were available in the study setting 2 days/week from 10.0 a.m. to 1.00 p.m.
- Data were collected from the pregnant women through individual interviews at the waiting room in Nozha Family Medicine Center using the pre constructed tool. Each interview took about one hour.
- Preparation for assessment took one month for developing the data collection tool obtained from literature review. Data collection and filling in of questionnaire and implementation of the health education program took 3 months. Follow up of pregnant women with iron deficiency anemia took one month. The follow up was started immediately after completing baseline assessment for all pregnant women with iron deficiency anemia.
- Pregnant women were informed to be in contact with the researchers by telephone for any guidance at any time.

Health education program development included 3 phases:

Phase 1: Preparation for assessment: (1month): Based on the preparatory phase for developing the data collection tool obtained from the interviewing questionnaire, as well as literature review (pre/post test).

Phase II: Design and implementation: (4 months): The health education program was designed based on analysis of the actual needs of pregnant women with IDA in pre assessment by using the pre constructed tools. The health education program was developed through determining the general objective, contents, teaching methods and aids used.

The general objective: was to improve the knowledge and practices of pregnant women with IDA eating habits.

Contents: Contents were designed to meet needs of pregnant women with iron deficiency anemia and to fit into their interest and levels of understanding. Teaching methods used in theoretical part were lectures presentation and group discussions, while in practical part they were conducted through demonstration and re-demonstration. Teaching aids included: laptop, posters and real objects.

Sessions: The sessions took place at the waiting room in Nozha Family Medicine Center. The total number of sessions' hours was 8 (3 hours theoretical and 5 hours practical). Each session took about 45 minutes integrated with teaching points and the researchers before going on to a new topic used questions to check the pregnant women's recall and understanding of the material already covered. The sessions included the following parts:

Part 1 - Promotion of pregnant women with iron deficiency anemia knowledge about anemia during pregnancy, the researchers provided information about the importance of antenatal follow up, meaning, risk factors, high risk pregnant women, causes, signs and symptoms, complications on mothers and fetus, food rich with vitamin C and iron and protection from anemia during pregnancy. At the beginning of the first session, an orientation about the program and its purposes were given. From the second session, each one started by a summary about what was given through the previous session and objectives of the new one were presented, taking into consideration using simple and clear language to suit the level of all pregnant women with iron deficiency anemia.

By the end of each session, a summary was made, and time was allocated for questions and answers, and a plan for next session was presented. The researchers adjusted with the pregnant women with iron deficiency anemia a day for the next session according to follow up time of each pregnant woman. Except for the last session, a termination of sessions through feedback was done.

Part 2: Practices for the pregnant women with iron deficiency anemia included pregnant women's dietary diversity, reported practices eating habits which inhibit absorption of iron and methods of cooking during pregnancy. The pregnant women were given an educational booklet, designed by the researchers, in Arabic language, to serve as a referral guideline for them. The educational booklet was evaluated for its content validity and clarity by a panel of experts, professors in the field of community health nursing and dietitian. In the light of their comments, the necessary modifications were carried out and the final form of the educational booklet was administered.

Phase III: Evaluation of the health education program: Evaluation of the program was done by using the post test questionnaire which was the same formats of pre-test in order to compare the change in pregnant women's knowledge and practices; it was assessed after one month from implementation of the health education program to evaluate the outcome.

Administrative design:

An official permission to carry out the study was obtained through an issued letter from the Dean of the Faculty of Nursing, Ain Shams University, to the Director of the selected family medicine Center for permission of data collection and conducting the study. The letter included the title, aim and the expected outcomes of the study.

Statistical Design:

The collected data were organized, revised, scored, tabulated and analyzed using the number and percentage distribution. Statistical analysis was done by computer using statistical package for social sciences (SPSS). Qualitative variables were compared using Chi-square test and analyzed using paired t- test. The significance of the results was considered as follows: When $P > 0.05$: it is a statistically insignificant difference, while $P < 0.05$ and $P < 0.001$: it is a statistically significant difference.

3. RESULT

Table I: shows that the current study sample included 48 pregnant women suffering from iron deficiency anaemia during pregnancy. The age of this sample ranged from 20 - \leq 35 years with a mean age of 26.3 ± 3.8 years, and for 41.7% of this sample ranged from 30 - \leq 35 years. As regards educational level, 43.8% of them had secondary level of education, this result shows also that 60.4% of study sample were working. Meanwhile, 68.7% of them had insufficient income.

Table II: demonstrates that 77.1% of study sample were multipara, 43.2% of them had two years interval between previous pregnancies and 48.4% of study sample were using pills as method of family planning, while 35.5% of them had bleeding as problems resulting from use of family planning. As regards problems in previous pregnancy, 73.9% of them had anemia. Meanwhile, 75.0% and 66.7% of them had bleeding as problems in previous labour and puerperal period.

Figure I: elaborates that 70.8%, 79.6% and 81.2% of pregnant women with iron deficiency anemia had drowsiness, headache and fatigue as the present complaints.

According to the research hypothesis, Table III: shows that there are statistically significant differences ($p < 0.001$), in all items of studied sample knowledge regarding iron deficiency anemia during pregnancy between pre/post implementation of health education program. As regards total satisfactory knowledge, there is a statistically significant differences between pre/post implementation of the health education program ($p < 0.001$).

According to the research hypothesis, Figure II: displays that 64.6% of the study sample had low dietary diversity score (≤ 3 groups of food) pre implementation of the health education program compared to 16.7% of them had low dietary diversity score post implementation of the health education program. As well, there is statistically significant difference between pre/post implementation of the health education program regarding all levels of dietary diversity of the study sample ($X^2 = 47.343$ at $p < 0.001$).

Table IV: illustrates that, there was a statistically significant difference ($p < 0.001$) regarding pregnant women's mean of dietary diversity pre/post implementation of the health education program.

Table V: clarifies that, there were statistically significant differences ($p < 0.001$) in all items of pregnant women with iron deficiency anemia who reported their practices of eating habits which inhibit absorption of iron pre /post implementation of the health education program.

Figure III: clarifies that, there are statistically significant differences ($p < 0.001$) in the items **boiled and on the steam** of cooking methods of vegetables. Meanwhile, there are statistically significant differences ($p < 0.05$) in the items **fundry and Grilled** of cooking methods of vegetables between pre/post implementation of the health education program regarding pregnant women's practices towards cooking methods of vegetables.

Figure IV: shows that there are statistically significant differences ($p < 0.05$) in all items between pre/post implementation of the health education program regarding pregnant women's practices towards cooking methods of meat.

According to the research hypothesis, Table VI: reveals that, the rang of first reading of HB 8.5-10.3 with a mean HB level 9.34 ± 0.45 compared to the rang of third reading 9.0 -10.8 with a mean HB level 10.08 ± 0.38 of pregnant women with iron deficiency anemia. As well, There is statistically significant difference ($p < 0.05$) between pre/post implementation of program regarding the first and second reading of HB levels, meanwhile there is no statistically significant difference ($p > 0.05$) between pre/post implementation of program regarding the second and third reading of HB levels.

Table I: Distribution of Pregnant Women with Iron Deficiency Anemia According to Their Demographic Characteristics (n = 48).

Characteristics	N	%
Age		
• 20 –	12	25.0
• 25 –	16	33.3
• 30 - ≤ 35	20	41.7
Mean \pm SD	26.3 \pm 3.8	
Education		
• Don't read and write	7	14.5
• Primary education	11	22.9
• Secondary education	21	43.8
• University education	9	18.8
Occupation		
• House wife	19	39.6
• Working	29	60.4
Monthly income		
• Sufficient	15	31.3
• Insufficient	33	68.7

Table II: Distribution of Pregnant Women with Iron Deficiency Anemia According to Their Past Obstetric History (n = 48).

Item	No	%
Parity		
Primipara	11	22.9
Multipara	37	77.1
Previous abortion	9	18.8
Interval between pregnancies (n= 37)		
One year	12	32.4
Two years	16	43.2
More than 2 years	9	24.4
Methods of family planning (n= 31)		
Loop	9	29.0
Pills	15	48.4
Injection	7	22.6
*Problems resulting from use of family planning (n= 31)		
Irregular period	24	77.4
Bleeding	11	35.5
* Problems in previous pregnancy (n=23)		
Gestational diabetes	3	13.1
Anemia	17	73.9
Bleeding	2	8.7
Eclampsia	1	4.3
Hyper emesis gravid	6	26.1
Problems in previous labor (n= 4)		
Bleeding	3	75.0
Infection	1	25.0
Problems in previous puerperal period (n= 3)		
Bleeding	2	66.7
Puerperal sepsis	1	33.3

*total items not mutually exclusive

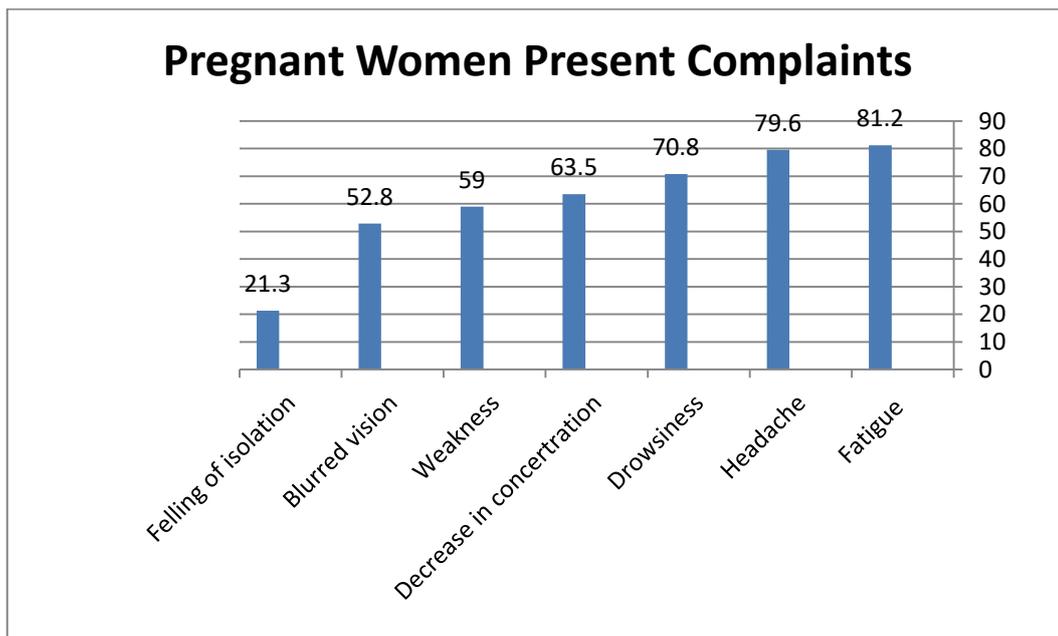


Figure I: Percentage Distribution of Pregnant Women with Iron Deficiency Anemia According to Their Present Complaints (n = 48).

Table III: Distribution of Pregnant Women with Iron Deficiency Anemia According to Their Satisfactory Knowledge about Iron Deficiency Anemia during Pregnancy Pre/Post Implementation of the Health Education Program (n=48).

Items	Pre Satisfactory knowledge		Post Satisfactory knowledge		X ²	p value
	No.	%	No.	%		
Importance of antenatal follow up	9	18.7	34	70.8	26.33	0.000*
Meaning of iron deficiency anemia	12	25.0	36	75.0	24	0.000*
Causes of iron deficiency anemia	6	12.5	39	81.3	45.55	0.000*
Signs and symptoms of anemia	13	27.1	41	85.4	33.19	0.000*
Risk factors for occurrence of anemia during pregnancy	5	10.4	31	64.5	30.04	0.000*
High risk pregnant women for anemia during pregnancy	8	16.6	36	75.0	32.89	0.000*
Complications of anemia on mothers and fetus	7	14.5	41	85.4	48.17	0.000*
Food rich with vitamin C	15	31.3	43	89.5	34.15	0.000*
Food rich with iron	9	18.7	43	89.5	48.50	0.000*
Protection from anemia during pregnancy	6	12.5	41	85.4	51.06	0.000*
Total Satisfactory Knowledge	13	27.1	38	79.2	26.14	0.000*

*Statistically significant difference

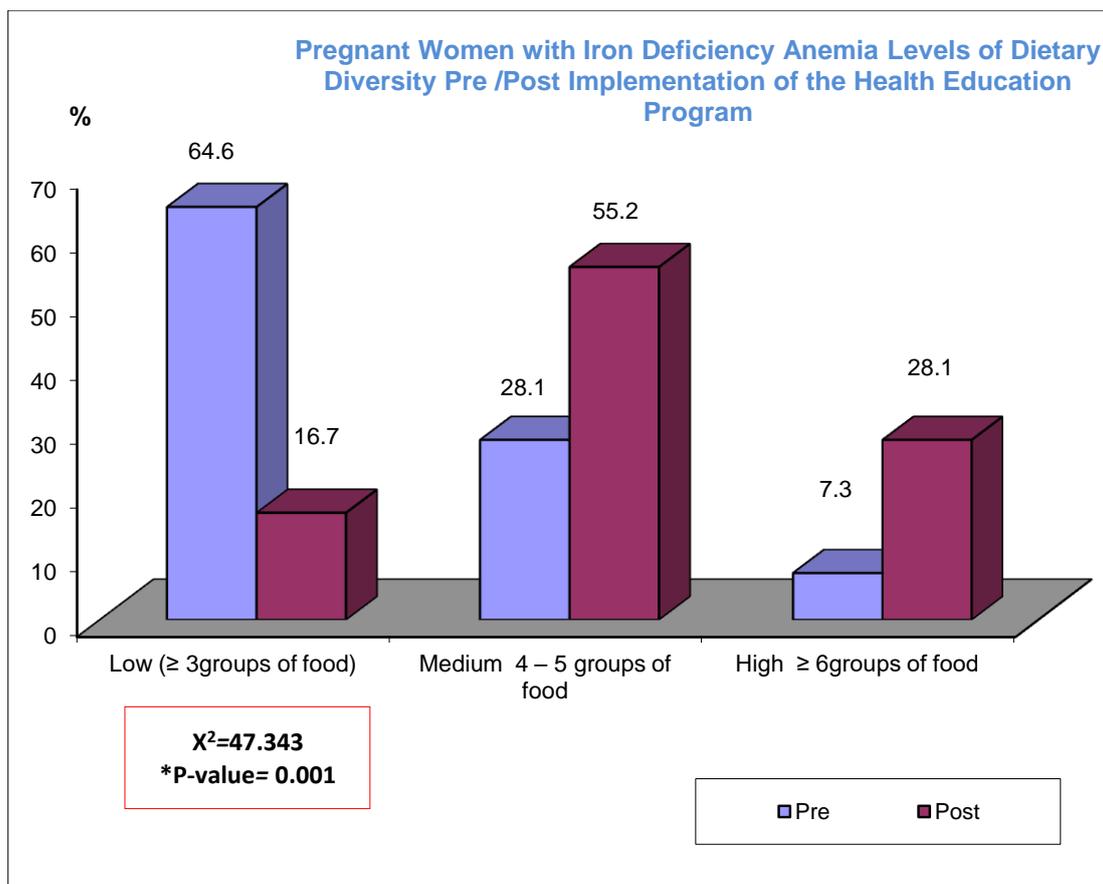


Figure II: Percentage Distribution of Pregnant Women with Iron Deficiency Anemia According to Their Levels of Dietary Diversity Pre /Post Implementation of the Health Education Program (n=48).

Table IV: Distribution of Pregnant Women with Iron Deficiency Anemia According to Mean of Dietary Diversity Pre/Post Implementation of the Health Education Program (n=48).

Dietary diversity	Pre	Post
Range	2 – 7	3 – 9
Mean ± SD	3.52 ± 1.04	4.72 ± 1.38
T- test	9.23	
P- value	0.001*	

Table V: Distribution Statistical difference of Pregnant Women with Iron Deficiency Anemia Reported Practices Regarding Different Items of Eating Habits Which Inhibit Absorption of Iron Pre/Post Implementation of the Health Education Program (n=48).

Eating habits	Pre		Post		X ²	P-value
	N	%	N	%		
Drinking tea or cola after eating	41	85.4	6	12.5	51.06	0.001*
Using lemon juice in cooking	38	79.2	2	4.2	53.89	0.001*
Taking milk and its products after iron supplementation	23	47.9	5	10.4	16.33	0.001*
Use of frozen vegetables and meat	36	75.0	11	22.9	26.05	0.001*
Not drinking orange or lemon juice after taking iron supplementation	39	81.3	8	16.6	40.06	0.001*

*Statistically significant difference

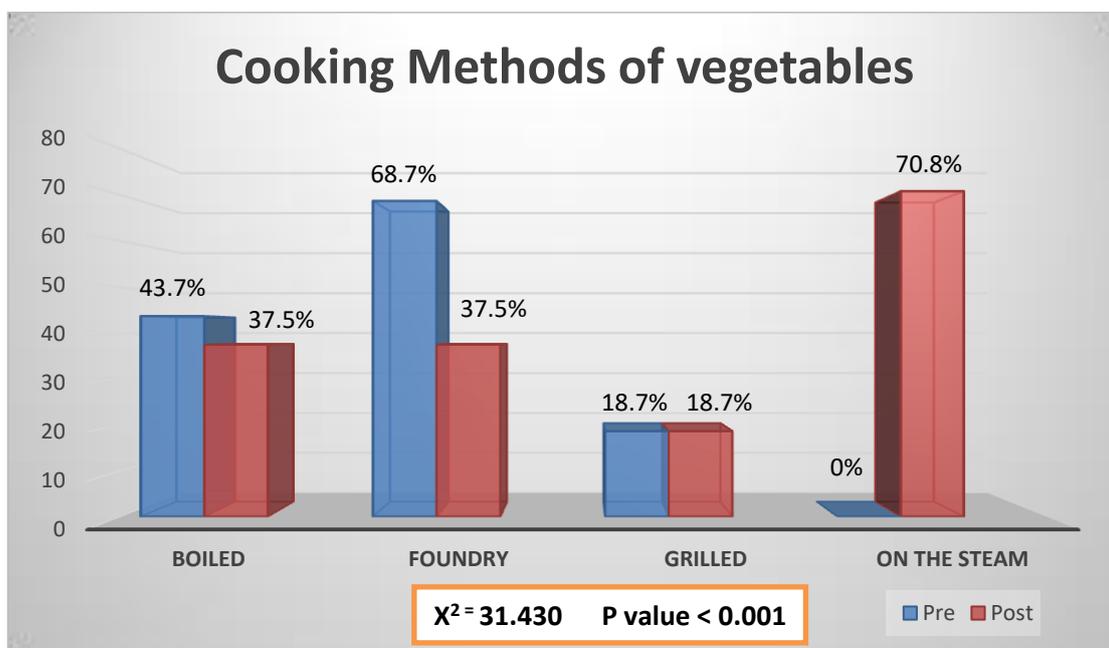


Figure III: Percentage Distribution of Pregnant Women with Iron Deficiency Anemia Reported Practices Regarding Different Items of Cooking Methods of vegetables Pre /Post Implementation of the Health Education Program (n=48).

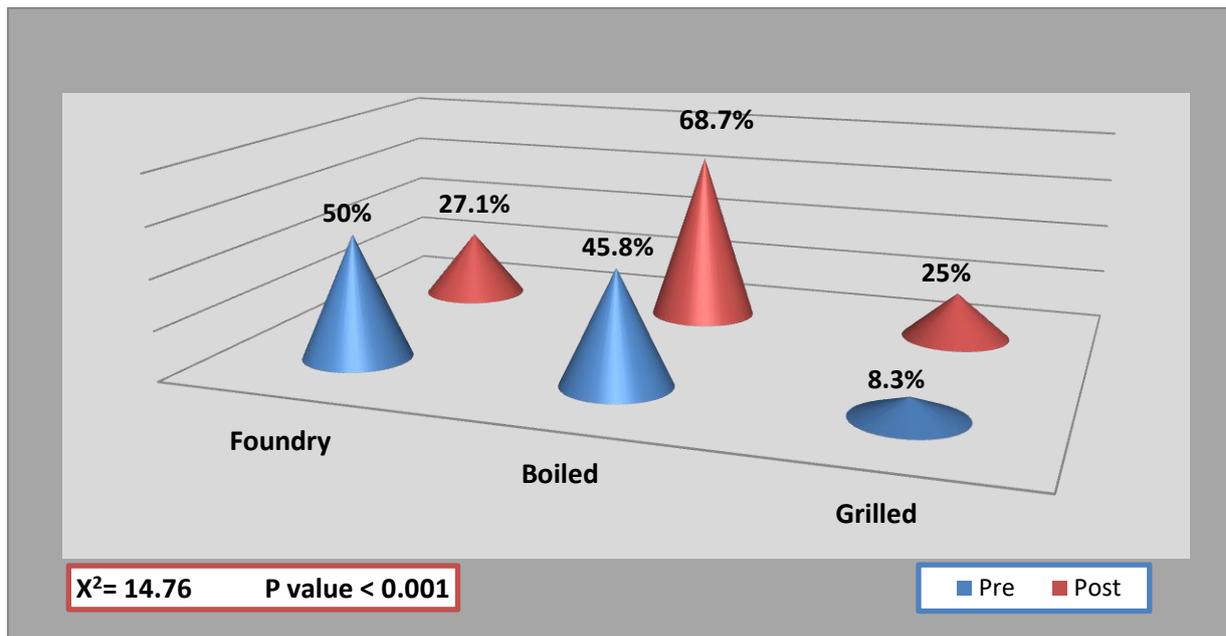


Figure IV: Percentage Distribution of Pregnant Women with Iron Deficiency Anemia Reported Practices Regarding Different Items of Cooking Methods of meat Pre /Post Implementation of the Health Education Program (n=48).

Table VI: Distribution of Pregnant Women with Iron Deficiency Anemia According to Their Three Readings of Hemoglobin Levels From Start to the End of the Study (n=48).

Items	Range			mean± SD		
The first reading of HB	8.5	–	10.3	9.34	±	0.45
Second reading of HB	8.7	–	10.5	9.56	±	0.39
Third reading of HB	9	–	10.8	10.08	±	0.38
<i>t- test between the first and second reading of HB</i>	<i>t- test</i>			P- value		
	22			<0.05		
<i>t- test between the second and third reading of HB</i>	<i>t- test</i>			P- value		
	0.39			>0.05		

4. DISCUSSION

Iron deficiency anemia is a life-threatening event in the woman life of reproductive age that represents risks to both mother and her fetus. Iron deficiency anemia may develop for several reasons, there is usually a dietary deficiency of iron and there may also be a lowered absorption of iron. In addition, there are factors contributing to anemia among antenatal mothers such as; socio demographic data (age, level of education, income, parity and occupation), prenatal care, and maternal health status *Melku et al.* [15].

Correction of iron deficiency in pregnancy involves educating the pregnant women about well-balanced meals and add more foods that are high in iron to their diet, foods that are high in vitamin C can actually help the body absorb more iron,

so it is beneficial to make these additions as well, consume foods and beverages which contain substances that inhibit iron absorption from plant foods at least one hour after meals and using cooking techniques that minimize the loss of micronutrients and increase the bioavailability of micronutrients *WHO* [16]. In the light of the previous concept researchers conducted this study to evaluate the effect of an educational program for pregnant women with iron deficiency anemia.

The current study included 48 pregnant women with iron deficiency anemia, with mean age of 26.3 ± 3.8 years and less than half of the study sample their age ranged from 30 - ≤ 35 years (table I). These results are in agreement with that of *Rezk et al.* [17], who conducted a study about "Prevalence and risk factors of iron deficiency anemia among pregnant women in rural districts of Menoufia Governorate, Egypt", found that prevalence of iron deficiency anemia among pregnant women in the second trimester represented 51.3% of 2470, their age was above 30 years. As well, these findings are supported by *Tawfik et al.* [18], who carried out a survey about "Anemia and iron deficiency anemia in Egypt", which showed the prevalence of anemia among mothers (20 – 49 yr) was the highest (47.2%).

Previously, *the WHO* [1], reported that iron deficiency anemia is one of the most prevalent health issue among women within reproductive age group and estimated that this prevalence 14% in developed while 51% in developing countries. Incongruent to the previous results, *Soliman et al.* [19], found that the mean age of their studied sample of mothers was 32.10 ± 0.27 in their study about "Prevalence of anemia in Egypt (Al-Gharbia Governorate) ". *These results may be due to* that women in reproductive age are at the highest risk for anemia as their requirements for iron are higher than any other age group resulting from excessive loss of iron or demand of iron associated with menstruation and child birth.

Concerning the educational level of the study sample, the current study findings revealed that less than half of pregnant women with iron deficiency anemia respondent had studied up to secondary level of education, less than one quarter of them studied up to primary level of education and less than one fifth of them don't read and write, whereas only less than one fifth of anemic pregnant women were graduate from university (table I). These results are consistence with those of *Nwizu et al.* [20], who conducted a study about "Socio-demographic and maternal factors in anemia in pregnancy at booking in Kano, northern Nigeria", and reported that one of the main finding of their study was that the prevalence of anemia among pregnant women was inversely related to their educational level, anemia was significantly higher among women with no formal education compared to women with formal education.

Also, these findings of the current study are in agreement with those of *Campigotto et al.* [21], who studied "Factors relating to iron deficiency anemia in pregnancy; An integrative review", revealed that one the main finding of their study among the socio-economic factors related to iron deficiency anemia in pregnant women was low education level. In contrast to the previous result, *Rezk et al.* [17], in Egypt found that 43.3% of their studied sample had high educational level. *The result of the present study might be related to* that, pregnant women with less education had difficulty to adhere to prenatal care and iron supplementation and understand the importance of proper nutrition for their health and that of their fetus. In addition, lack of education and understanding about health-related issues can contribute to delay in seeking care when it is needed or to the inappropriate management of life-threatening pregnancy complications.

As regards occupation, the present study finding revealed that less than two third of the pregnant women with iron deficiency anemia were working, while, more than one third of them were house wife (table I). Consistent with the findings of the present study, the study conducted, in Egypt, by *Rezk et al.* [17], showed that 56.2% of their studied samples were working. In contrast to the previous results, *Soliman et al.* [19], in Egypt found that 85.7 % of their studied mothers are jobless.

Considering monthly income, the present study result revealed that more than two third of study sample had insufficient monthly income (table I). This result is in agreement with that of *Nwizu et al.* [20], in northern Nigeria, who found that the prevalence of anemia among pregnant women was inversely related to their economic status, women from the low socioeconomic class (64.7%) were significantly more affected by anemia compared to those in higher socioeconomic classes in northern Nigeria.

Furthermore, this result is consistent with those of *Ndukwu and Dienye* [22], in their study about "The prevalence and socio-demographic factors associated with anemia in pregnancy in a primary health center in Nigeria", they reported that the prevalence of anemia was observed to be increasing as the socio-economic status reduced; anemia occurred more

frequently in the lower social classes. *These results could be related to* that those pregnant women in low socio-economic classes are likely to be poorly educated and often have financial constraints. These women cannot afford good health services or they might not have access to health services. The result is that they suffer the deleterious effects of poor nutrition.

Concerning parity of the studied sample, the current study showed that more than three quarter of the of study sample were multipara (table II). This result is in agreement with that of *Rezk et al.* [17], in Egypt, who found that prevalence of iron deficiency anemia among pregnant women with more than 3 children was 87.2%. As well, these findings are supported by *Campigotto et al.* [21], who observed that the number of pregnancies has been one of the factors related to anemia; women with more than two pregnancies are more likely to have low serum iron. In a similar study, *Nwizu et al.* [20], in northern Nigeria, who founded that 65.6% in their studied sample were multiparity highlighted that, this factor may induce anemia by reducing maternal iron reserves at every pregnancy and by causing blood loss at each delivery.

Furthermore, the previous results are consistent with those of *Alene and Dohe* [23], in their study about "The prevalence of anemia and associated factors among pregnant women in an urban area of the Eastern Ethiopia", they found that the risk of developing anemia in pregnant women with 3–5 pregnancies is increased when compared with those who had less than 3 pregnancies, and added that the pregnant women who had 3–5 pregnancies were 1.95 times more likely to be anemic, compared with those who had less than 3 pregnancies. As well, these findings are supported by *Elzahrani* [24], whose study on "The prevalence of iron deficiency anemia among pregnant women attending antenatal clinic in Saudi Arabia", found that increased number of pregnancies and deliveries is positively associated with the risk of developing anemia. *This result could be due to* the loss of iron and other nutrients during increased and repeated pregnancies and also the possibility of sharing of resources with the fetus.

Incongruent the previous result, *Makhoul et al.* [25], whose study entitled " Risk factors associated with anemia, iron deficiency and iron deficiency anemia in rural Nepali pregnant women", they did not find association between gravidity and anemia. This could be due to the difference in socio-cultural characteristics of this study population.

As regards interval between pregnancies, the present study finding revealed that about one third of the pregnant women with iron deficiency anemia had one year interval between their pregnancies (table II). This finding is supported by *Nwizu et al.* [20], in Nigeria, who reported higher risk of anemia among women with shorter pregnancy intervals in their study and this short interval between pregnancies, delays the mother's recovery from the effects of previous pregnancies thus increasing the risk of maternal depletion syndrome. They clarified that since the fetal demand is met first, the mother is left with further depleted iron stores and thus anemia develops. It has been shown that the exhausted maternal iron stores at the end of one pregnancy take almost two years to be replenished

Concerning the present complaints of the pregnant women with iron deficiency anemia the current study showed that the majority of them complain from fatigue and headache, less than three quarter complain from drowsiness and less than two third complain from decrease in concentration, and more than half from weakness and blurred vision while almost one fifth only complain from feeling of isolation (figure I). These findings are supported by *Breymann* [26], who studied "Iron deficiency anemia in pregnancy" and reported that fatigue is the chief complaint by all women with iron deficiency anemia, while drowsiness and poor concentration are other symptoms most specifically exhibited by pregnant women. As well, these findings are in agreement with those of *Siteti et al.* [27], who found that loss of energy, or weakness, and exertion dyspnea are cardinal complaints across all pregnant women with iron deficiency anemia in their study about "Anemia in pregnancy: Prevalence and possible risk factors in Kenya. *These results may be due to* that reduced hemoglobin level leads to abnormally low amount of oxygen circulating to body tissues which causes these complaints.

Concerning knowledge of the studied sample about anemia during pregnancy, the current study results showed statistically significant differences in all items in pre and post of nursing intervention program related to women's knowledge (table III). This improvement in the study sample's knowledge pointed to the positive effect of the educational program. This result is in agreement with that of *Sivapriya and Parida* [28], who conducted a study entitled "A Study to assess the knowledge and practices regarding prevention of anemia among antenatal women attending a tertiary level hospital in Pune", they found that although 31% of antenatal women had average knowledge regarding diet aspect of anemia, however, all them had poor knowledge regarding prophylactic treatment of anemia. Furthermore, the findings of the current study are in accordance with that of *Mamta and Devi* [29], whose study on the "Prevalence of anemia and

knowledge regarding anemia among reproductive age women" in India, found that 52% of their sample had poor knowledge regarding anemia, its cause, prevention and management. The results of the current study reflect the urgent need to improve knowledge and awareness among pregnant women related to anemia during pregnancy.

The WHO [30], report on "Global database on the implementation of nutrition action (GINA), national strategy for anemia prevention and control" that every pregnant woman should be self-sufficient and self-reliant and there should be mandatory antenatal counseling sessions for the women to identify the risk factors in pregnancy and structured teaching to reduce the enormous burden of anemia in pregnancy this will be carried out through the various health programs running over the countries to combat anemia and should be considering the role of a nurse as a educator who can provide teaching to pregnant women about the knowledge to improve their health status and prevention of anemia.

As regards reported practices of this study sample related to eating habits during pregnancy as pregnant women's dietary diversity, reported practices eating habits which inhibit absorption of iron and methods of cooking during pregnancy, the current study displays that about two third of the study sample had low dietary diversity score (≤ 3 groups of food) pre implementation of the educational program compared to less than one fifth of them had low dietary diversity score post implementation of the educational program. As well, there is a statistically significant difference ($X^2=47.343$ at $p<0.001$) between pre/post implementation of the educational program regarding all levels of dietary diversity among study sample (figure II). As well, there is a statistically significant difference (t. test=9.23 at $p<0.001$) regarding pregnant women's mean of dietary diversity pre /post implementation of the educational program (table IV).

The previous study results are in agreement with those of *Rezk et al.* [17], in Egypt, who in a similar study found that 62.0% of their studied sample had low intake of animal origin food (less than 3 times/week) and 65.3% of them had low intake of vegetables and fruits (less than 3 times/week. As well, these results are supported by *Wen et al.* [31], whose study entitled "Dietary behaviors during pregnancy: Findings from first time mothers in southwest Sydney, Australia" found that only 7% of mothers reported meeting the recommended vegetable consumption, 13% reported meeting the recommended fruit consumption, 21% reported drinking 2 cups or more of soft drink per day, 12% reported consuming more than 2 meals or snacks from fast-food or take-away outlets per week and a small percentage of mothers (5%) had experienced food insecurity over the past 12 months.

Furthermore, these results are consistent with that of *Singh* [32], who studied "Life style behavior affecting prevalence of anemia among women in India" and found that, the women who never consumed milk or cured are more anemic 34.3% in comparison with those who have consumed daily (49.3 %) weekly (44.0 %) sometimes (41.4 %). Those women who used to consume green or leafy vegetables are less severely anemic as compared to women who rarely consume. Women who never consumed fruits are more prone to be anemic (64.0 %) as compared to women who consumed fruits at least once in a week or sometimes (52.1 & 58.0 %) respectively. Women who sometimes consume non-vegetarian food are less anemic than other categories of women like never and take at least in week and reported that most of anemia is caused due to inadequate supply of nutrients like iron, folic acid and vitamins B12 , amino acids, proteins, vitamin A, C and other vitamin B complex group. Poor eating habits play a major role in the development of iron deficiency anemia that is an important indicator of poor health status.

As well, *Abriha et al.* [33], in their study entitled "Prevalence and associated factors of anemia among pregnant women in Ethiopia: A cross sectional study" found that, 57.8% of their study sample of pregnant women took meat once per week; 33.4% of them took milk twice per week. 45.7% took egg twice per week, 50.2% of ate fruits once per week. 73% took vegetables twice per week and 43.8% of those pregnant women were with medium dietary diversity score. The mean dietary diversity score of those respondents was 4.9.

According to the **Food and Agriculture Organization of the United Nations**, dietary diversity is considered to be a key indicator in assessing the access, utilization, and quality of diet of individuals or household. It can be used as a proxy indicator for measuring nutrient adequacy among pregnant females [14].

The adherence to dietary diversity among pregnant women with iron deficiency anemia post the educational program could be explained by improvement on women's knowledge related to the effect of diet on reducing iron deficiency anemia that motivates them to follow-up the recommended dietary diversity.

Considering this study sample of pregnant women with iron deficiency anemia according to their reported practices of eating habits, which inhibit absorption of iron pre/post implementation of the educational program, the result of the present study clarified that, there are statistically significant differences ($p < 0.001$) between pre/post implementation of the educational program regarding different items of eating habits which inhibit absorption of iron (table V). These results are supported by *Zipp et al.* [34], who reported in their review article about "Effect of tea and other dietary factors on iron absorption" that, iron deficiency is a major world health problem, that is, to a great extent, caused by poor iron absorption from the diet. Several dietary factors can influence this absorption. The foods were grouped according to their nutritional characteristics, iron bioavailability, and ability to promote iron absorption: iron sources (liver, chicken, beef, and beans), absorption facilitators (orange and apple), and absorption inhibitors (milk, dairy products, soda, tea, and coffee). Individuals with low intakes of iron, low intakes of enhancing factors and/or high intakes of inhibitors may be at risk of iron deficiency.

The obvious correction in eating habits among pregnant women with iron deficiency anemia post the educational program implementation could be related to a better understanding of dietary patterns during pregnancy, which could facilitate the development of healthy nutrition.

In the current study, the results showed that there are statistically significant differences ($p < 0.001$) in the items boiled and steam as cooking methods of vegetables. Meanwhile, there are statistically significant differences ($p < 0.001$ & $p < 0.05$) in the items foundry and grilled as cooking methods of vegetables between pre/post implementation of the educational program regarding pregnant women's practices towards cooking methods of vegetables. As well, there are statistically significant differences ($p < 0.05$) in all items between pre/post implementation of the educational program regarding pregnant women's practices towards cooking methods of meat (foundry, boiled and grilled respectively) (figure III & IV).

These study results are in agreement with those of *Fabrin and Crosby* [35] in their review article entitled "A review of the impact of preparation and cooking on the nutritional quality of vegetables and legumes" which reported that, there are several ways to enhance the availability of healthy nutrients through proper selection of the method of cooking. They added that, it is recognized that the nutrients may be destroyed or lost when foods are processed to heat for long periods because of their sensitivity to heat. The methods of cooking are considered responsible for losses of vitamins and minerals in foods, cooking methods that make use of water are associated with greater vitamin loss from fruit and vegetables. Loss of vitamins and minerals from vegetables is mainly because of extraction into the cooking liquid rather than their destruction

As well, *Pereira et al.* [36], who in their study on the "Effect of different home-cooking methods on the bio-accessibility of zinc and iron in Brazil" found that factors influencing the nutrient stability of cooked meats include the size of the cut, the use of cooking water, time and temperature of cooking. For a given type of meat, smaller cuts require less cooking time and have greater thiamine retention. So, the grilling is the best method used for cooking meat and poultry to avoid the loss of minerals and vitamins during cooking them. The results of the present study may be beneficial to the pregnant women to become more knowledgeable about the best methods of cooking to avoid loss of iron and vitamins during cooking, and therefore avoid iron deficiency anemia which has adverse effect on their health.

In the present study, a statistically significant difference ($p < 0.05$) was found in levels of hemoglobin between pre/post implementation of program regarding the first and second reading of HB levels, meanwhile there is no statistically significant difference ($p > 0.05$) between pre/post implementation of program regarding the second and third reading of HB levels (table VI). This result reflects several explanations, such as, the pregnant women had improved dietary habits through taking alternative sources of iron in their meals, and following practices of healthy eating habits (avoid food which inhibits iron absorption and take food which enhances iron absorption, and follow healthy methods of cooking and improve their dietary diversity).

Similarly, the results of the present study were supported by *the WHO* [16] " Guideline: Daily iron and folic acid supplementation in pregnant women. Geneva", which reported that, correction of iron deficiency in pregnancy involves educating the pregnant women about well-balanced meals and add more foods that are high in iron to their diet. Foods that are high in vitamin C can actually help the body absorb more iron, so it is beneficial to make these additions as well, consume foods and beverages which contain substances that inhibit iron absorption from plant foods at least one hour after meals and using cooking techniques that minimize the loss of micronutrients and increase the bioavailability of micronutrients.

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Furthermore, this result is consistent with that of *Sanghvi et al.* [37], whose study entitled "Maternal iron-folic acid supplementation programs: Evidence of impact and implementation", emphasizes that the prevalence of maternal anemia can be reduced by one-third to one-half if action is taken to launch focused, large-scale programs that are based on nutritional education on consumption of iron-rich, food consumption patterns related to frequency and diversity of meals.

5. CONCLUSION

Based on the results of the present study, and research hypotheses, it is concluded that, the educational program for pregnant women with iron deficiency anemia led to significant improvements in their knowledge and practices that are proved by improvements among levels of hemoglobin from start to the end of this study.

6. RECOMMENDATIONS

Based on the findings of this study, the following recommendations can be suggested:

- Increase women awareness about meal composition and food consumption patterns related to frequency and diversity of meals.
- Nutritional program on consumption of iron-rich foods and Iron/folate supplementation is recommended to prevent anemia in pregnant women.
- Further researches are required involving larger study sample of pregnant women at different study settings, throughout Egypt, in order to generalize the results.

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