

Effect of PRECEDE Model Application on Controlling Iron Deficiency Anemia among Children

Jihan Mahmoud Farrag¹, Azza El-Sayed Ali Hegazy² & Manal Mohamed Ahmed Ayed³

¹ Lecturer of Pediatric Nursing Department, Faculty of Nursing, PortSaid University, Egypt.

² Lecturer of Pediatric Nursing Department, Faculty of Nursing El-Fayoum University, Egypt.

³ Assistant Professor of Pediatric Nursing Department, Faculty of Nursing, Sohag University, Egypt.

Abstract

Iron-deficiency anemia (IDA) considered one of the most common nutritional disorders which affected about 30 to 50 percent of children. **Aim:** To evaluate the effect of applying the PRECEDE model on controlling iron deficiency anemia among children. **Subjects and method: Design:** A quasi-experimental research design was utilized in this study. **Settings:** The study was applied in the Pediatric Outpatient Clinics at Sohag University Hospital and Maternal and Child Health Centers at Sohag City (Dar E Salam Abdallah health center). **Sample:** A convenient sample of 360 children and their mothers was recruited from the selected settings. **Three tools were used:** (1) Structured interviewing questionnaire, (2) (PRECEDE model questionnaire), and (3) investigation tool used to measure hemoglobin level. **Results:** knowledge, enabling factors, reinforcing factors, attitudes scores and behaviors of mothers about controlling IDA have been increased, and there was an increasing in the iron level of the studied children with statistical significance after three months of PRECEDE model application. **Conclusion:** It was concluded that PRECEDE Model application was very effective in improving knowledge and practice regarding IDA and modifying mothers' nutritional behaviors to control the IDA among their children. **Recommendation:** Dietary education is recommended for mothers during childhood to control and prevent IDA anemia.

Keywords: *Controlling iron deficiency anemia, Children & PRECEDE model application*

Introduction:

Iron deficiency is considered a systemic condition and the most prevalent hematologic disorder among childhood with many consequences. Iron deficiency anemia occurs when concentrations of hemoglobin are decreased to below optimal levels. Iron deficiency anemia affected more than 45% of children aged less than 5 years in developing countries. They are liable to dietary iron deficiency because of insufficient dietary requirements intake about right and high requirements of iron-related to rapid growth (Camaschella, 2019).

The clinical picture of Iron deficiency anemia included fatigue, weakness, pale skin, chest pain, fast heartbeat or shortness of breath, headache, dizziness or lightheadedness, cold hands and feet, inflammation or soreness of the tongue, brittle nails, and poor appetite (Disease et al., 2016).

Iron deficiency anemia causes included blood loss, iron lack in the diet, an inability to absorb iron. Children who are at risk for iron deficiency anemia are those who need more iron during growth spurts are not eating a healthy iron-rich foods, and routinely donate blood (Belleza, 2020). Mild IDA usually doesn't cause complications. However, if it left untreated, it can be severe and can lead to health problems, including heart problems and growth problems (Kulnigg et al., 2018).

Iron deficiency anemia diagnosis is confirmed by doing complete blood count (CBC), peripheral blood smear, hematocrit test, hemoglobin test, serum iron test, ferritin test, transferrin, and total iron-binding capacity (TIBC), and fecal occult blood test (Belleza, 2020).

Despite progress in medicine and science development, anemia continues to be a common disorder. More than 25% have signs of anemia among the world's population, and more than 50% of them, from children below 5 years of age suffer from iron deficiency anemia. Prevention and reducing iron deficiency anemia risk is essential and it can be prevented by eating a diet containing adequate iron amounts or by iron supplementation and choosing iron-rich foods such as red meat, pork, and poultry, seafood, beans, dark green leafy vegetables, such as spinach, dried fruit, such as raisins and apricots, iron-fortified cereals, bread and pasta, peas, choose foods containing vitamin C to enhance iron absorption which present in broccoli, grapefruit, kiwi, leafy greens, melons, oranges, peppers, strawberries, tangerines, and tomatoes (Kiss & Vassallo, 2018).

There are models which providing some essential guidelines for educational investigations, diagnosis, methods of educational planning and intervention design, facilitating evaluation. One of these models is the PRECEDE-PROCEED model, which is a

framework to change behavior that examines the outcome of health programs. The meaning of PRECEDE is associated with Predisposing, Reinforcing, and Enabling Constructs in Educational/Environmental Diagnosis and Evaluation, and PROCEED stands for Policy, Regulatory and Organizational Constructs in Educational and Environmental (Nazari et al., 2016). Educational intervention depend on the PRECEDE model improve the average knowledge, attitude, enabling and reinforcing factors, and behavior of the individuals. The PRECEDE model provides an appropriate conceptual framework for designing an educational program on the prevention of skin cancer for students (Nadrian et al., 2014).

This model is considered one of the most important and applicable theories at present (Didehvar et al., 2016). It used to design and evaluate a health promotion plan. The PRECEDE component allows the researchers to work backward from the goal of the study to create a project to instruct the formation of the educational intervention. So, the efficiency of this model and obtained acceptable educational results were reported and approved by Hosseini et al., (2014) & Hazavei et al., 2012).

Pediatric nurses play a vital role in the management of children with IDA by the following interventions by assessing their dietary history and perform a physical exam. Give medications, as ordered; administer IM or IV iron when oral iron is poorly absorbed. Perform sensitivity testing of IM iron injection to avoid the risk of anaphylaxis. Advise mothers to provide iron supplements for their children. Inform mothers that salts of iron will change the stool color to dark green or black. Advise mothers to take liquid forms of iron via a straw and rinse mouth with water. Hemoglobin monitoring test, hematocrit, RBC count, and reticulocyte counts (Cappellini et al., 2019).

Additionally, mothers should be encouraged to continue iron therapy for their children. Explain for mothers the diagnostic procedures importance (such as complete blood count) and a possible referral to a hematologist. Explain also, the importance of iron replacement/supplementation. Educate the mothers and the family regarding rich foods with iron (organ and other meats, leafy green vegetables, molasses, beans). Infection prevention is done by assessing signs of infection, such as fever, chills, swelling, pain, and body malaise. Monitor White Blood Cells count; anticipate the need for an antibiotic, antiviral, or antifungal therapy. Care of children with iron deficiency anemia by advising their mothers about sufficient daily requirements of iron (World Health Organization, 2019).

Significance of the Study

Iron deficiency young anemia is most common among children less than 2 years and younger children. It is considered the only nutrient deficiency that causes physical and behavioral impairment. Insufficient iron is considered one from the nutritional disorders all over the world that affects many children especially in developing countries; with an increase in the flow rate of children with IDA (World Health Organization, 2019).

Theoretical definitions:

Iron deficiency anemia: is considered a type of anemia—which blood lacks adequate healthy red blood cells. Red blood cells carry oxygen to the body's tissues. As the name implies, iron deficiency anemia is due to insufficient iron.

Precede

It refers to Predisposing, Reinforcing, and Enabling Constructs in Educational Diagnosis and Evaluation.

Predisposing factors:

They included socioeconomic characteristics that put an individual at risk of developing a disease or disorder which include: knowledge, attitude, self-efficacy, and self-care.

Enabling factors

They mean the accessibility and availability of skills and resources.

Reinforcing factors

They included the attitudes of influential people (family, friends, peers, healthcare providers, media, teachers, community leaders, policymakers, etc.) who influence adopting healthy behaviors.

Precede-proceed model:

Regarding to this model, two categories of enabling resources are found that affect the use of health services which include community and personal enabling resources.

The study aim:

The study was aimed to evaluate the effect of applying the PRECEDE model on controlling iron deficiency anemia among children through:

- 1- Evaluating the effect of applying the PRECEDE model on knowledge and practice of mothers regarding controlling iron deficiency anemia.
- 2- Assessing and evaluating the effect of applying the PRECEDE model on the Hemoglobin (Hb) level of children.

Research Hypotheses:

Hypothesis (1): Mothers' knowledge regarding IDA will be enhanced after applying the PRECEDE model than before.

Hypothesis (2): Mothers' practice of IDA controlling will be improved after applying the PRECEDE model than before.

Hypothesis (3): Blood Hemoglobin level of children of mothers who will receive the PRECEDE model

about iron deficiency anemia controlling will be improved after application than before.

The subjects and methods of the current study were discussed under the following four designs:

- I. Technical Design
- II. Operational Design
- III. Administrative Design
- IV. Statistical Design

Technical Design:

It included researcher design, setting, subject, and tools for data collection.

Research design:

A quasi-experimental research design pre-post-test was utilized in the current research. Quasi-experimental research is a prospective study in which patients self-select or are selected into one of some different treatment groups to compare the real effectiveness and safety of non-randomized treatments (Maciejewski, 2020).

Setting:

The study was applied in the Pediatric Outpatient Clinic at Sohag University Hospital and maternal and child health centers at Sohag City (Dar E Salam Abdallah health center), Egypt, which is located on the ground floor of the outpatient building. It consists of one room. Also, there was a waiting area for mothers and their children and a lecture room that contained an adequate number of seats, and data show where the researchers interviewed the recruited mothers and their children to conduct the current study. Pediatric Outpatient Clinic provides diagnostic and therapeutic services for children from Saturday to Wednesday, from 9 a.m. to 1 p.m. These settings were selected because of the high prevalence of children with IDA in the selected settings and also, it serves the biggest region of the population from both rural and urban areas.

Subjects

Sample type: A convenient sample was used.

Sample size:

It included 360 children and their mothers were recruited from the selected settings.

Sample size calculation:

Sample size included 360 children was calculated using the following formula ($p=30\%$, $\alpha=0.05$, $d=0.05$).

Inclusion criteria included:

- Mothers aged 20-40 years
- Children aged from 1 to 5 years
- Both gender of children
- Available at the time of data collection in the previously mentioned settings

Exclusion criteria included:

Children and their mothers suffering from mental and chronic diseases were excluded from the research study.

Tools of data collection:

Three tools were used for collecting data of the study as the following:

Tool I: A structured interview questionnaire:

It was developed by the researchers after reviewing the related literature and research studies (Belleza, 2020; Cappellini, Musallam, & Taher, 2019); & WHO, 2019), and consisted of three parts as follow:

Part (1): It included four items regarding demographic data of the studied mothers such as age, educational level, occupation, and residence. Also, attending any type of formal education regarding child dietary IDA.

Part (2): It included items questions regarding to demographic data of the studied children such as age and gender.

Part (3): It included three items regarding to the history of IDA among the studied children such as having IDA, taking iron supplementation, and taking treatment for IDA

Tool II: PRECEDE model questionnaire: It was adapted from Green & Kreuter, (2005), it included the following parts:

Part I: To assess mothers' knowledge, it was developed by the researchers after an extensive review of the related literature to identify the level of mothers' knowledge regarding IDA and their source of information. It contains 30 items about the definition of IDA, risk factors for IDA, symptoms of IDA, complications of IDA, and management & prevention of IDA.

Scoring system:

The scoring system was calculated as: (1) for the "correct" answer and (0) for the "incorrect" answer. The total score ranges from 0 – 30, a higher score indicated good knowledge. It was categorized to "good, average, and poor knowledge" as follows: poor<50 %, the average was from 50% to 75 % and good>75 %.

Part II: To assess mothers' attitudes regarding their children's about cause of IDA and nutrition recommendations, it contains seven items. Response divided into 3 score categories were agree, no opinion, and disagree. . A total score equal 21. Total attitude scores ≥ 14 considered positive attitude, score less than 14 considered negative attitudes.

Part III: It includes 6 items to assess enabling and reinforcing factors regarding knowing available resources and facilities for IDA prevention and management and easy access to healthcare facilities, having a formal educational program, having a supportive group such as (friends, relatives, and Doctors) related to their children health nutritional recommendation, and visiting health center regularly by the mothers. Response options were yes and no.

yes answer was given one point and no answer was given zero.

Part IV: To assess the mothers' behaviors (behavioral causes) regarding the feeding of their children by using five topics (regular using of meat product group, fresh fruits and vegetable group, bread and cereal group). The scoring system was calculated as zero given for "no answer", and one given for "yes answer". The total score was 0 – 5. The total score was categorized into "good and bad practices" as follows: bad less than 50% and well more than 50%.

Tool III: Investigation tool used to measure hemoglobin level: Pre-post tool was done to assess children's hemoglobin level two times during the study period, at the first interview, and after three months of applying the PRECEDE model.

Operational Design

Procedures of data collection:

Preparatory phase:

It involved a study of the literature, different studies, and theoretical part of knowledge about various aspects of the research subject by using books, journals, the internet, periodicals, and magazines. Also, this helps in the development of the used tools and designing the booklet that was used for the mothers' teaching program. Data were collected from the beginning of January 2019 to the end of February 2019.

Validity of the tools:

The content validity of the tools was tested by a panel of five experts in pediatric nursing with more than ten years of experience in their field. The board ascertained the face and content validity was 96% of the tools. No modifications were done.

Reliability of the tools:

The tools reliability was assessed through Cronbach's alpha test was $\alpha = 0.91$ for the first tool, $\alpha = 0.75$ for the second tool, and $\alpha = 0.87$ for the third tool

Ethical considerations:

Before the research started, Approval of the Ethical Research Committee of Sohag Faculty of Nursing was obtained before conducting the study. The researchers met both medical and nursing directors of the selected settings to clarify the aim of the study and take their approval. Informed consent was obtained from the studied mothers to allow them to participate in the current study after the aim of the study was explained to them. The researchers informed the mothers that, the study was voluntary and they had the right to withdraw from the study at any time, without giving any reason. Moreover, they were informed that their information would be confidential.

Pilot study

A pilot study was carried out on 10% from the total sample (36) children and their mothers to observe the

clarity and testing of the feasibility of the research process. No modifications were done. Children and their mothers involved in the pilot study were excluded from the study.

Field Work:

The actual study was started from March to August 2019. The researchers have attended the previously mentioned settings two days per week, (Saturday and Sunday); from 9 a.m. to 1 p.m.

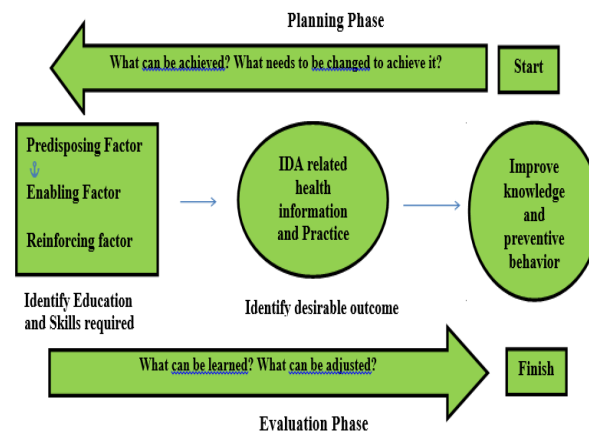


Figure 1: Application of PRECEDE model for improving knowledge and Practice of preventive behavior regarding IDA

Application of nursing intervention guided by precede model: was done through the following phases:

Preparatory phase:

Contents of the educational sessions PRECEDE model application about IDA were designed. Several methods of teaching were used (videos, attractive pictures and posters, and booklet) were prepared and provided based on the mothers' needs. Booklet was written in simplified Arabic language, covered all contents of the sessions, printed out, and given to them the teaching methods regarding the model such as short lectures and group discussions.

Assessment phase:

The researchers introduced themselves to the mothers. Clear and simple explanations about the aim and nature of the current study were discussed by the researchers with mothers. The structured interviewing questionnaire was used to collect children and mothers' characteristics. During this phase, mothers' predisposing factors, enabling factors, reinforcing factors, the behavior practice regarding IDA, and also the attitude towards IDA were assessed based on Precede Model questionnaire as a pretest. The questionnaires were distributed to mothers and collected after completing them. Pre-test was included blood samples that were taken from the studied children to measure their hemoglobin level.

Implementation phase:

Training included two-session (60 min) by the researchers depend on PRECEDE model component for mother and Ferrous Sulfate drop based on the children's blood indices

Two educational sessions regarding IDA were given to the mothers based on PRECEDE model and Ferrous Sulfate drop given to their children based on the children's hemoglobin level. It included one theoretical and one practical session were provided to them in thirty groups of 11–12 mother, one session every two weeks at the lecture's room at the previously mentioned settings in the form of lectures and group discussion with a duration of 50 - 60 minutes for each session. In the 1st session, the definition of IDA, risk factors for IDA, symptoms of IDA, complications of IDA, and management & prevention of IDA were discussed. Also education regarding enabling factor which included education regarding resources and supportive approaches that are vital to conducting behavior and reinforcing factor which included the importance of support from family, friends, and health providers.

While the second session was related to the discussion of mothers' practices of preventive behavior about IDA such as the feeding of their children by using five topics (regular use of meat products group, fresh fruits and vegetable group, bread and cereal group).

At the end of each session, the important points were reviewed. The educational sessions were repeated to each group of mothers. Each mother provided the educational booklet at the end of the 1st session as a guide and was informed about the time of the next session.

Blood samples were determined by measuring hemoglobin. Blood was collected by venipuncture and drawn into a container. Blood samples were taken from all children by an expert laboratory technician. All of these tests were performed in a private laboratory of medical analysis. Anemia was defined when hemoglobin <11 g/dL. Blood samples were taken twice, the first time before beginning nursing intervention and the second time after three months of intervention. The degrees of iron deficiency anemia were determined by the following criteria: iron depletion was defined when a serum ferritin concentration <12 µg/L and iron deficiency anemia when serum ferritin less than 12 µg/L.

The Evaluation phase:

The effect of the PRECEDE model application about IDA and Hemoglobin level of children was also reassessed after and evaluated immediately and after three months of implementation phase using the same Tool II and III.

Administrative design:

An Ethical Approval was obtained from the Dean of Faculty of Nursing and the directors of the Pediatric Outpatient Clinic at Sohag University Hospital and maternal and child health centers at Sohag City (**Dar E Salam Abdallah health center**) to carry out this study.

Statistical Analysis:

Statistical Package for Social Sciences (SPSS) version 21 was used in the current study for statistical analysis of the obtained data. Descriptive statistics, including frequencies, percentages, measures of central tendency, and variance, were calculated for each item. Analysis of variance (ANOVA), X2 test, T-test was used to know differences among the groups, pre and post-test as well as comparing variables such as knowledge, attitudes, and ages; level of IDA, reinforcing and enabling factors, behavioral causes, mothers' education level, the mother's occupation; knowledge and attitude pre-post in each group; IDA indicators, behavioral causes pre-post in each group; and IDA indicators in each group.

Results:

Table (1): Distribution of studied mothers according to their demographic characteristics (n=360)

| Item | Mothers (360) | |
|--------------------------------|---------------------|----|
| | No. | % |
| Mothers ' age in years | | |
| 18 < 30 | 259 | 72 |
| 30 < 40 | 101 | 28 |
| Mean ±Stander deviation | 24.14 ± 6.27 | |
| Mothers ' education | | |
| - Illiterate | 36 | 10 |
| - Basic education | 90 | 25 |
| - Secondary education | 130 | 36 |
| - University education | 104 | 29 |
| Occupation | | |
| - Working | 101 | 28 |
| - Not working | 259 | 72 |
| Residence | | |
| - Rural | 263 | 73 |
| - Urban | 97 | 27 |

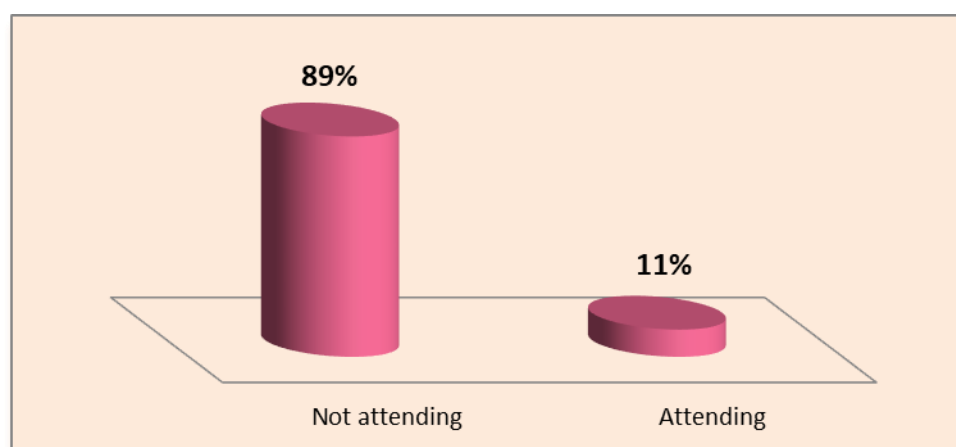


Figure (1): Percentage distribution of the studied mothers according to their attendance to any type of formal education regarding child dietary IDA (n=360).

Table (2): Distribution of studied children according to their demographic characteristics (n=360)

| Item | Children (360) | |
|--------------------------------|--------------------|----|
| | No. | % |
| Children ' age in years | | |
| 1 < 3 | 223 | 62 |
| 3 < 5 | 137 | 38 |
| Mean ±Stander deviation | 2.18 ± 1.67 | |
| Children gender | | |
| - Male | 202 | 56 |
| - Female | 158 | 44 |

Table (3): Distribution of the studied children regarding the history of IDA (n=360)

| Items | No. | % |
|------------------------------------|-----|----|
| Having IDA | | |
| - Yes | 292 | 81 |
| - No | 68 | 19 |
| Taking iron supplementation | | |
| - Yes | 61 | 17 |
| - No | 299 | 83 |
| Taking treatment for IDA | | |
| - Yes | 47 | 13 |
| - No | 313 | 87 |

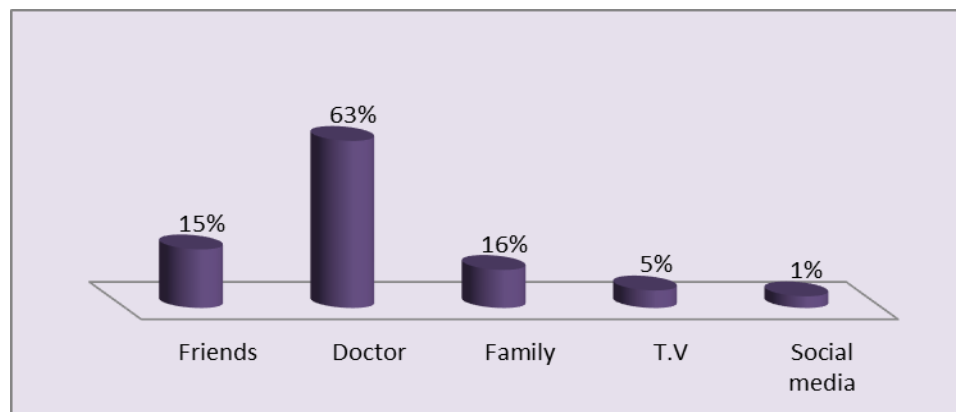


Figure (2): Percentage distribution of studied mothers regarding their source of information about IDA (n=360)

Table (4): Comparison of the mothers' knowledge, enabling factor, reinforcing factor pre and after three months of intervention implementation (n=360).

| Variables | Pre-intervention | | After three-months post-intervention | | X2 | P-value |
|---------------------------------|------------------|----|--------------------------------------|----|------|---------|
| | No | % | No | % | | |
| Knowledge (Predisposing Factor) | 140 | 39 | 284 | 79 | 0.79 | 0.000 |
| Enabling factor | 223 | 62 | 342 | 95 | 0.37 | 0.000 |
| Reinforcing factor | 216 | 60 | 306 | 85 | 0.39 | 0.000 |

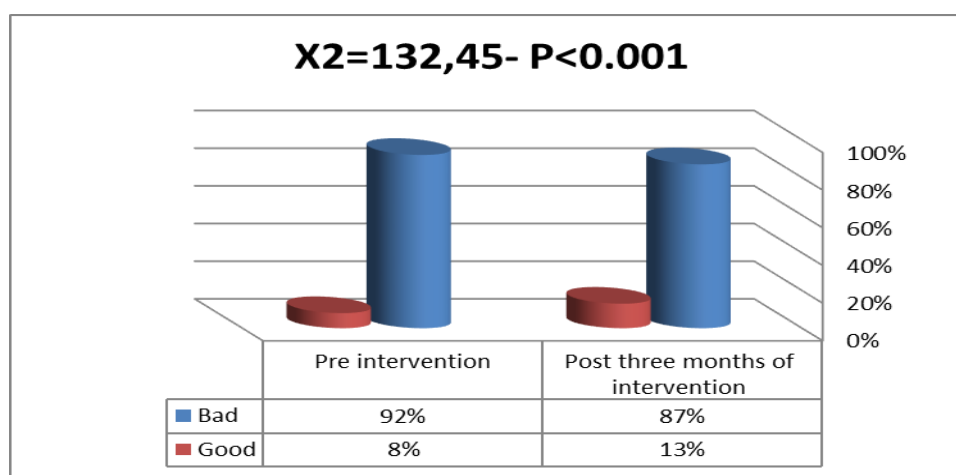


Figure (3): Comparison of the mothers' practices of IDA controlling the behavior of the studied mothers' pre and after three months of intervention implementation (n=360).

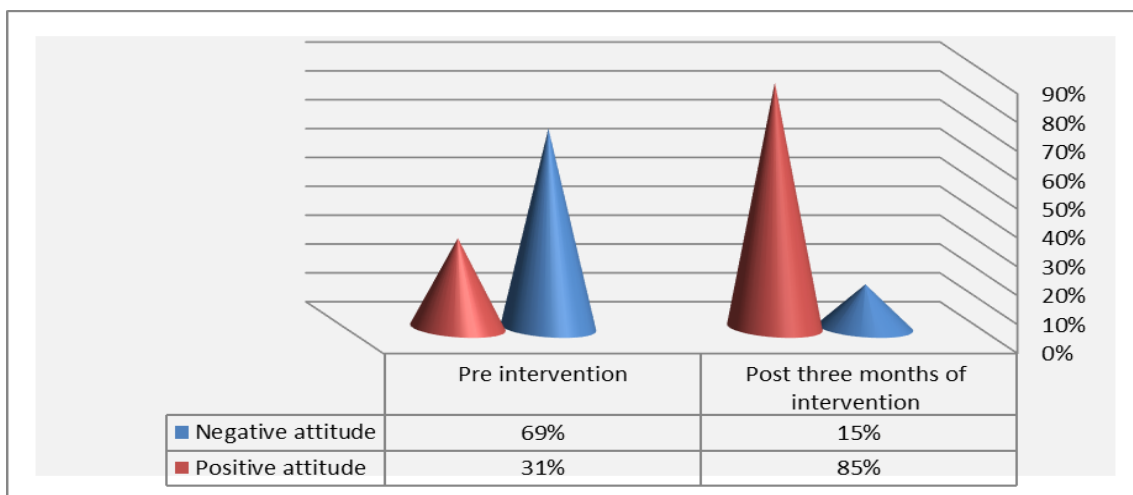


Figure (4): Attitude of the studied mothers regarding controlling of IDA

Table (5): Distribution of IDA levels among the studied children pre and after three months of intervention implementation (n=360).

| Variables | Pre-intervention | | After three-months post-intervention | | X2 | P-value |
|--|------------------|----|--------------------------------------|----|------|---------|
| | No | % | No | % | | |
| Normal iron level | 0 | 0 | 299 | 83 | 0.78 | 0.000 |
| Mild iron deficiency anemia level I | 115 | 32 | 61 | 17 | | |
| Moderate iron deficiency anemia level II | 187 | 52 | 0 | 0 | | |
| Sever iron deficiency anemia level III | 58 | 16 | 0 | 0 | | |

Table (1): Represented that 72% of the studied mothers' age ranged between 18 < 30 years and their mean age 24.14 ± 6.27, (36%) of them had secondary education, meanwhile, and also, it is pointed out that 72% of mothers were not working. Also, the table demonstrated that (73%) of mothers lived in rural areas and 27% of them were from urban areas.

Figure (1): Showed that the majority (89%) of the studied mothers didn't attend any type of formal education regarding child dietary IDA.

Table (2): A total of 360 children participated in the study, illustrated that the mean age of children was 2.18 ± 1.67, the age group from 1 < 3 years was the most prevalent (62 %). Also, it was found that males were more than females 56% compared to 44%.

Table (3): Portrayed that 81% of children having iron-deficiency anemia, majority of mothers (83%) their children did not take iron supplementation. while 87% of children did not take treatment for IDA.

Figure (2): Highlighted that the majority of mothers reported that the main source of information among the studied mothers was doctors (63%).

Table (4): Revealed that mothers' knowledge, enabling, and reinforcing factors regarding IDA were decreased pre-intervention implementation. While there were significant changes and increases in the

knowledge, enabling and reinforcing factors have occurred with statistical significance pre and after three months of intervention implementation.

Figure (3): Clarified that the IDA controlling behavior total practices score of the mothers pre and after three-month post-intervention. It observed that most of the mothers (92%) had bad practices toward IDA controlling pre-intervention and decreased to become 13% after three-month post-intervention. Reversely, 8% of the mothers had good practices toward IDA controlling pre-intervention in comparison to 87 % after three-month post-intervention.

Figure (4): Clarified the total attitude scores of the mothers regarding IDA controlling pre and three months post-intervention. It observed that 69% of mothers had a negative attitude toward IDA controlling pre-intervention and decreased to become 15% three-month post-intervention. Reversely, 31% of the mothers had a positive attitude toward IDA controlling pre-intervention in comparison to 85 % three months post-intervention.

Table (5): Clarified the IDA levels among the studied children pre and after three months of intervention implementation. Significant changes were observed pre and post-intervention in Hb and Serum Iron also,

and Transferring saturation in the children suffering from iron-deficiency anemic. No one of the studied children were healthy at the pre-intervention period, while in the post-intervention iron level increased and become normal level among (83%) of the studied children.

Discussion:

Anemia occurred due to iron deficiency is a widespread disease all over the world among children under five years. Iron deficiency anemia is associated with complex side effects and symptoms (Camaschella, 2019). Iron is considered an important micronutrient that is involved in several physiological processes such as oxygen transport and utilization, oxidative phosphorylation, mitochondrial function, DNA biosynthesis, and ATP production (Camaschella, 2017).

The result of the current study indicated that the majority of the studied mothers didn't attend any type of formal education regarding child dietary IDA. This is may the cause of knowledge and practice deficit and indicated the need to apply the PRECEDE model on controlling IDA.

The result of the current study clarified that the majority of mothers reported that the main source of information among the studied mothers was doctors. This is reflected the importance of medical advice.

The results of the present study clarified that mothers' knowledge, enabling, and reinforcing factors regarding IDA were decreased pre-intervention implementation. While there were significant changes and increases in the knowledge, enabling and reinforcing factors have occurred. This is related to the effectiveness of applying PRECEDE Model to control IDA among children.

These result is similar to a study conducted by Seyed, et al., (2016) in Iran who Applied the PRECEDE Model to control iron-deficiency anemia among children aged 1-5. The mother's knowledge levels and attitude were improved in the PRECEDE Model group; and awareness was increased and significantly different in the post-intervention than pre- intervention.

The result of the this study indicated that the majority of the mothers had bad practices toward IDA controlling pre-intervention and decreased after three-month post-intervention. This is indicating the impact of applying the preceding model which has a significant role in promoting behavior to be positive reinforcements and decrease negative reinforcements. Results of the present study indicated that most mothers had a negative attitude toward IDA controlling pre-intervention and decreased after three-month post-intervention. This result reflects the effect of the applying of model-based interventions on

raising the knowledge level among mothers, especially with the fact that knowledge is important in making a positive attitude and behavior.

The result of the present study indicated that significant changes were found from pre- to post-intervention in Hb and Serum Iron also, and Transferring saturation in iron-deficiency anemic children. No one of the studied children were healthy at the pre-intervention period, while in the post-intervention iron level increased and become normal level among the majority of the studied children. This is reflected the positive effect of applying the PRECEDE model on controlling IDA.

These findings confirmed by the result of the study conducted by Ebadifard, et al., (2017) and found that the PRECEDE-PROCEED Model has been used in different health areas and improve quality of life among diabetic patients.

These results are consistent with the results of Solhi et al., (2016) in Iran who studied " A PRECEDEPROCEED depending educational intervention of quality of life, Ranjbaran et al., (2016), & Sabzmakan et al., (2014) are reporting that applying intervention using the PRECEDE PROCEED Model can increase reinforcing factors and significantly different from the before intervention in the same group and control group.

This result is supported by Tabasi et al., (2018) who studied "Application of the PRECEDE-Proceed Model in Promoting Physical Activity for Prevention of Osteoporosis among Women" and reported that, after the interventions, the mean scores of the reinforcing factors in the study group have improved. Also, the findings of the present study have supported the aim and hypothesis of the current study which indicated the success of the study.

Conclusion:

Based on the present results of the current study and hypotheses, it was concluded that the majority of mothers had knowledge deficits, bad practices, and a negative attitude toward controlling IDA among their children. While improved after PRECEDE Model application which was very effective in improving knowledge, practice, and attitude regarding IDA and modifying mothers nutritional behaviors to control the IDA among their children

Recommendations:

Based on the study's findings, the researchers are recommended that:

- The PRECEDE model regarding IDA should be integrated into pediatric care for children.
- Replication of the study on a larger sample is recommended to maintain generalizability.

- Dietary education is recommended for mothers during childhood to control and prevent IDA anemia.

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