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Dietary intervention program based on short messages service for mothers of children with iron deficiency anemia

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Abstract---Background: Iron deficiency anemia (IDA) can happen at any age; it is more common in young children. Anemia is a nutritional issue that has a major influence on growth, cognition, work performance, and other areas throughout a person's reproductive years and beyond. Aim: The study aimed to investigate the effect of dietary intervention-based short messages service for mothers of children with iron deficiency anemia. Design: A quasi-experimental research design was used in the current study. Setting: The research was carried out in Pediatric Outpatient Clinics at Damanhour University Hospital. Subject: Non-probability purposive sampling technique was used to select a sample of 100 mothers with their children. Tools: Tool (I): Mothers' interview questionnaire, it was

composed of four parts: Part (1): Mothers' personal data, Part (2): Children's' personal data, Part (3): Children's medical history, Part (4): Mothers' knowledge assessment questionnaire regarding iron deficiency anemia, Tool (II): Mothers' reported practices assessment questionnaire regarding iron deficiency anemia, and Tool (III): Iron level was determined by measuring hemoglobin and serum ferritin concentrations. Results: There was a highly statistically significant difference and improvement between the studied mothers regarding total knowledge and reported practices about iron deficiency anemia pre and post-dietary intervention-based short messages service implementation. There was a significant difference in the children's hemoglobin and serum ferritin concentrations pre and post-dietary intervention-based short messages service implementation at (P<0.001). Conclusion: Dietary intervention-based short messages service has a positive effect on improving the dietary knowledge and practices of mothers who have children with iron deficiency anemia. Recommendations: The study recommended that mothers should continue to receive dietary intervention-based short message services to improve their knowledge and practices.

Keywords---Children, Dietary intervention-based short messages service, Iron deficiency anemia, Knowledge, Practices, Mother.

Introduction

Iron deficiency is the most common hematologic illness in children and is regarded as a systemic ailment with numerous effects. When hemoglobin concentrations fall below ideal levels, iron deficiency anemia develops. In underdeveloped nations, more than 45% of children under the age of five suffer from iron deficiency anemia. Due to inadequate dietary needs intake and high iron requirements associated with rapid growth, they are susceptible to dietary iron insufficiency (Camaschella, 2019).

At any stage of life can experience iron deficiency anemia, however, young children and teenagers are more likely to experience it. According to the World Health Organisation (2019), anemia is a nutritional issue that has substantial effects on growth, cognition, work performance, and other aspects of life that are relevant to reproduction. One of the main factors contributing to anemia in developing nations is nutritional deficiencies, which include lead toxicity, chronic illnesses, and infections. Other contributing factors include a diet low in folic acid, riboflavin, and vitamin B12, as well as other nutrients. In developed nations, groups of infants and toddlers are seen as being more sensitive to IDA. A minimum of 2.7 percent of children between the ages of one and two were discovered to have IDA in the United States (Gupta et al., 2016).

Anemia is a frequent condition despite advancements in science and medicine. In the world's population, more than 25% of people show indications of anemia, and more than 50% of those who are younger than five years old have iron deficiency anemia. Iron-rich foods like red meat, pork, poultry, seafood, beans, dark green

leafy vegetables like spinach, dried fruit, like raisins and apricots, iron-fortified cereals, bread and pasta, peas, and foods containing vitamin C to boost iron absorption, like those found in broccoli, green peppers, and tomatoes, are all important for preventing and reducing the risk of iron deficiency anemia (Kiss & Vassallo, 2018).

Blood loss, a diet low in iron, and an inability to absorb iron are some of the reasons for iron deficiency anemia. Children who often donate blood, don't follow a diet high in iron-rich foods, or who need extra iron during growth spurts are at risk for iron deficiency anemia (Belleza, 2020). Normal IDA doesn't usually result in difficulties. It can be severe and cause health issues, such as heart issues and growth issues if left untreated (Kulnigg et al., 2018).

Nutritional intake errors such as low iron intake during breastfeeding after the fourth month of life, feeding raw cow milk up to 500 ml per day for the first year of a child's life, the lack of supplemental iron, and a plant-based diet are risk factors for iron deficiency anemia in developed countries (Parkin et al., 2016). With 12.5 mg of iron (in the form of coated ferrous fumarate) per sachet, or 37.5 mg of ferrous fumarate salt, or 62.5 mg of ferrous sulfate heptahydrate salt, the World Health Organization recommended giving iron-containing micronutrient powder (MNPs) to infants and toddlers aged six to twenty-three months (Zlotkin et al., 2018). Iron-fortified supplements to food have been successful in lowering the risk of developing IDA in children aged less than 2 years (Wieringa, 2017).

By doing a complete blood count (CBC), peripheral blood smear, hematocrit test, hemoglobin test, serum iron test, ferritin test, transferrin test, total iron-binding capacity (TIBC), and fecal occult blood test, iron deficiency anemia can be diagnosed (Belleza, 2020). The WHO advised evaluating children for IDA before iron supplementation if it was discovered that anemia was occurring with a percentage higher than 5. Additionally, the American Academy of Paediatrics advised IDA screening for 1-year-old children because IDA is exceedingly common and treatable at this age. The Centres for Disease Control and Prevention advised screening for children who were at a high risk of getting IDA, such as those who consumed low iron formula, were premature newborns, or were breastfed for six months without receiving supplemental iron (Kemper et al., 2017).

Children with IDA should begin therapy as soon as possible because, unless the predisposing condition is treated and the iron storage in the bone marrow is replenished, they run the risk of getting ischemia and having their anemia worsen (Fabiano et al., 2018). Ferrous sulfate is the most widely used iron formula worldwide, although there are other iron therapies for IDA. Other iron-containing oral formulations include carbonyl iron, ferric iron salt, ferric iron complexed with polysaccharides (iron polysaccharide complex, IPC), ferrous iron salts, iron complexed with amino acids in casein as iron protein succinylated and iron acetyl aspartylate, and heme-iron polypeptides (Houston et al., 2018).

Researchers who have used a variety of technologies to deliver treatments in health promotion claim that the mobile phone has proven to be a useful tool in all parts of human existence. Cell phones are currently available to 90% of Iranians. Cell phones and short messaging services (SMS) are modern engagement and

communication tools. High speed, constant access, affordability, relative security, storage capacity, adaptability, and attractiveness of material are only a few of their many traits and skills (Shetty et al., 2019). Today's hectic lifestyles make it difficult for most people to travel and attend training courses, hence SMS may be a useful tool for providing training interventions before investigation (Botelho et al., 2019, and Arora et al., 2018) showed that sending SMS to patients was a successful strategy for promoting self-management behaviors.

Mobile phones are increasingly used to deliver training, and they can be a more affordable and practical alternative to traditional, computer-based eLearning. Since they become widely accessible, mobile phone use in healthcare (mHealth) and education (mLearning or mEducation) has risen (Peter et al., 2016). Around 98% of the Kenyan healthcare workers who were the subject of the study have a mobile phone, and training provided by SMS has improved nurses' adherence to African programs and that country's standards of care. After 30 days, SMS-based training programs have shown information retention levels that are comparable to those of didactic instruction. A group of nurses working in rural South Africa described several 'organically created' mobile-telephone-based learning tactics, including reflective practice, emotional support, and instruction in unexpected situations (Zurovac et al., 2019).

Today's pervasive uses of information and communication technologies provide a large opportunity to promote diabetic self-care. This is partly because SMS is available on portable electronics like mobile phones. With the help of this service, the patient is constantly reminded to take care of themselves. As a result, there is growing interest in using SMS as a methodological tool for education that encourages self-care by fostering connections and conversation with people from diverse socioeconomic and racial backgrounds (Fortmann et al., 2017). It has been shown that sending text messages can encourage proper diabetes control by energizing the recipients and facilitating knowledge acquisition (Whitehead & Seaton, 2016).

Because of the constant reminders about the importance of daily practices for health, these results highlight the potential of using this methodological strategy to improve self-care (Prado et al., 2018). This is because it strengthens the relationship between the patient and his health center and promotes an improvement in the condition's clinical evolution. Studies conducted in the US, India, and Egypt demonstrated that self-care treatments that incorporated SMS into their methodological technique enhanced clinical outcomes (Arora et al., 2018, Abaza & Marschollek, 2017).

Mothers play a significant role in their children's lives because they are the primary carers for iron deficiency anemia. They provide the children with foods high in iron (organ and other meats, leafy green vegetables, molasses, beans), administer prescribed medications as directed, and reduce fatigue by creating a schedule for daily activity and rest. Maintain daily cleanliness, mouth and perineal care, and look for local or systemic indicators of infection, such as fever, chills, swelling, pain, and body aches, to stop bleeding and avoid infection (Kemper et al., 2017). The significance of diagnostic procedures (such as a complete blood count) and a potential referral to a hematologist should be

explained to the mothers. Describe the significance of iron replenishment and supplementation as well. Check the White Blood Cell count and determine whether an antibiotic, antiviral, or antifungal therapy is necessary (World Health Organization, 2019).

Pediatric and community health nursing play a crucial role in educating mothers about their children's health about IDA and some specific actions to maintain children's health, such as promoting the consumption of foods rich in iron through healthy dietary change, providing nutritional education, and encouraging iron supplementation for children to maintain children's health (World Health Organization, 2019). Pediatric nurses are essential in the management of children with IDA by reviewing their food history and doing physical examinations. Give medications as directed; if oral iron absorption is poor, give IM or IV iron. To lower your risk of anaphylaxis, perform sensitivity testing on your IM iron injection. Suggest to mothers giving their children iron supplements. Remind mothers that iron salts will cause their children's stools to turn dark green or black. Mothers should be instructed to drink liquid iron using a straw and rinse their mouths with water afterward. Hematocrit, reticulocyte counts, RBC counts, and the hemoglobin monitoring test (Cappellini et al., 2019).

Significance of the Study

Young children under the age of two are especially susceptible to iron deficiency anemia. The prevalence of anemia among children aged 2–12 years old in Egypt was 35.5%. This result was higher than the result presented by Abdel-Rasoul et al., (2015) in Menoufia, Egypt (25.6%). Other studies in different countries showed a higher prevalence of anemia; in Kenya (92%), Ghaza (59.7%), and Kazakhstan (49.8%) (Nabakwe et al., (2015); El Kishawi et al., (2015); Hashizume et al., (2018). A chronic neurocognitive impairment, a learning disability, and a change in motor function are all symptoms of iron deficiency anemia. Restless legs syndrome and febrile seizures are typically experienced by iron-deficient individuals (Jang et al., 2019).

The symptoms of iron deficiency in youngsters, such as weariness and cold intolerance, are only alleviated with the right oral iron therapy (Howard & Kamat, 2018). It is thought to be the only nutritional deficiency that results in physical and behavioral disability. With an increase in the flow rate of children with IDA, inadequate iron is one of the nutritional illnesses that affect many kids worldwide, especially in underdeveloped nations (World Health Organisation, 2019). Children between the ages of twelve and thirty-six months have IDA incidence rates that range from three to forty-eight percent. About 40% of preschool-aged children in low- and middle-income nations are IDA patients (Armitage, & Moretti, 2019).

Technology provides the opportunity to reduce the number of mothers who fail to show up for appointments through the use of SMS and phone appointment reminders. SMS is suggested as a realistic, economical way to assist in improving patient appointment adherence in a clinic with a high no-show rate (Chen et al., 2018). Short message services have many advantages, including cost-effectiveness, accessibility, affordability, flexibility, life-long learning, and the possibility for individuals to study at their own pace. As a result, learning can

become a lifelong process and help to improve new talents. The government, especially at the moment, places a lot of emphasis on online learning via employing short message services (Leong, 2016). Therefore, it was crucial to increase mothers' knowledge of iron deficiency anemia and practices to maintain and promote children's health because mothers are the primary carers for their children at home. This was accomplished through the use of short message services as a new technological methods. Hence, the researchers have conducted this study to investigate the effect of dietary intervention-based short messages service on mothers' knowledge and practices regarding iron deficiency anemia among their children.

Operational definitions

Short message service (SMS): commonly referred to as Text messages can be sent up to 160 characters (maximum 224 characters if using a 5-bit mode) to mobile phones and smartphones via the short messaging service (SMS) program. Many cellular phone providers offer free message receiving and sending for a set number of messages each month (Hanna 2020).

Iron deficiency anemia (IDA): is a form of anemia, in which the blood does not contain enough healthy red blood cells. The body's tissues receive oxygen through red blood cells. Iron deficiency anemia, as its name suggests, is brought on by a lack of iron.

Aim of the study

The study aimed to investigate the effect of dietary intervention-based short messages service for mothers of children with iron deficiency anemia through:
- Assessing the dietary knowledge level among mothers of children with IDA.
- Assessing the dietary practical level among mothers of children with IDA.
- Designing and implementing dietary intervention-based SMS based on the needs of mothers and children.
- Evaluating the effect of dietary intervention-based short messages service for mothers of children with iron deficiency anemia.

Research hypothesis

H1: Mothers of children with IDA (who received dietary intervention-based SMS) are anticipated to gain greater knowledge post-intervention than pre-intervention.

H2: Mothers of children with IDA (received dietary intervention-based SMS, their practices are expected to be improved post-intervention than pre-intervention.

H3: Blood Hemoglobin levels of the studied children are expected to improve post-intervention than pre-intervention.

Subjects and Methods

Research design

A quasi-experimental pre-post-test research design was utilized. 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 conducted in the pediatric outpatient clinics, which are housed in the outpatient building on the ground level of the Damanhour University Hospital. There is only one room in it. A lecture room with enough seats and waiting space for mothers and their children was also present, and data indicate where the researchers interviewed the recruited mothers and their kids for the current study. Children can receive diagnostic and therapy treatments at the Pediatric Outpatient Clinic from Saturday through Wednesday from 9 a.m. to 1 p.m. This setting was chosen because they serve the largest portion of the population from both rural and urban areas and have a high prevalence of children with IDA.

Subjects

Non-probability purposive sampling technique was used to select a sample of 100 mothers with their children with IDA.

Sample calculation

A tool for calculating sample size and power determined that the sample had a 95% power. 95 percent of the time (Thompson, 2012).

Sample size calculation:
The level of significance for power analysis, 0.95(=1-0.95=0.5), at alpha, was used to calculate the sample size. 0.05 (one-sided) was chosen as the significance level, and 0.001 was chosen as the level of extreme significance.

Mothers' inclusion criteria included:
- Mothers with ages ranging from 20 to 40.
- Accept the study's invitation to participate.
- Regular antenatal care

Children inclusion criteria included:
- Children of both sexes.
- Young children between the ages of 1 and 5 years old.
- Children free of additional chronic illnesses.

Exclusion criteria included:
- Children with metabolic/intestinal illnesses, endocrine diseases, and congenital anomalies.

Tools of data collection: Three tools were used:

Tool (I): Mothers' interview questionnaire: Developed by the researchers after analyzing related literature and expert comments for content validity. To avoid misunderstandings, it was translated into Arabic. It was adapted from (Belleza, 2020; Cappellini, Musallam, & Taher, 2019; & WHO, 2019). It was composed of three parts as follows:

Part (1): Mothers' personal data: It contained data which consisted of 3 items related to age, educational level, residence, and attending any educational program regarding child dietary IDA.

Part (2): Children's personal data: It contained data related to age and gender.

Part (3): Children's medical history; It involved six questions about the medical history of the patients such as previous hospitalization, duration, and history of IDA among the studied children such as having IDA, taking iron supplementation, and taking treatment for IDA

Part (4): Mothers' knowledge assessment questionnaire regarding iron deficiency anemia: After a thorough analysis of the pertinent literature, the researchers created it (Belleza, 2020; Taher, 2019; & WHO, 2019).to determine the extent of moms' IDA awareness and the sources of their information. There were 14 items in all. These goods were separated into the following two categories: The first section tests moms' understanding of IDA: The researchers utilized it for all moms in the study and control groups, and it was filled out by them. Ten questions made up the test. Multiple Choice Questions (MCQ) regarding the significance of IDA, its definition, its causes, its risk factors, its symptoms, its complications, its diagnosis, and its preventive measures and treatments.

The second section: evaluates mothers' understanding of food: Four Multiple-Choice Questions (MCQ) about the connection between diet, foods high in IDA, and IDA deficiency.

Scoring system

The subsequent answer ratings were given: Each question had a single valid response; if the mother provided the correct response, she received one grade; if the mother provided an incorrect response or selected "I don't know," a zero was issued; the scores for all selected answers were added together. There were 0 to 14 different scores. The knowledge level was judged to be satisfactory at the cutoff point of 60% and unsatisfactory at less than 60% based on a statistical analysis of the overall grades that were added together and the percentage computed for all participants.

Tool (II): Mothers' reported practices assessment questionnaire regarding Iron deficiency anemia:

The researchers created it following a thorough analysis of the pertinent literature (Nabakwe et al., (2015); El Kishawi et al., (2015); Hashizume et al., (2018); to determine the degree of mothers' reported practice: It was created by the researcher after evaluating the reported practices of mothers with their kids regarding iron deficiency anemia by reviewing the literature. It had ten multiple-choice questions (MCQs) on topics such as how to change one's eating habits, taking iron supplements, consuming foods high in iron, eating foods that boost iron absorption, and having bad habits that prevent iron absorption.

Scoring system

The reported practice questions were in MCQ format, and the five items received a total score of 10; the correct response was given a 1 while the error response was given a 0. The system of total reported practice scores:
- Mothers' practices were adequate if they reported them at a rate of more than 60%.
- Mothers deemed having inadequate practices if their reported practices were below 60%.

Tool (III): Iron level was determined by measuring hemoglobin and serum ferritin concentrations:

Children's hemoglobin levels were measured using a pre-post tool twice during the study period: during the initial interview and three months after using the dietary intervention-based short message service.

Tools validity and reliability:

Five pediatric nursing and community health nursing specialists with more than 10 years of experience on the board evaluated the tool's face and content validity for clarity, thoroughness, and relevance
The Cronbach's alpha test (=0.89) was used to evaluate the tools' reliability. Tool one had a r = 0.94 reliability score, tool two had 0.87 reliability, and the reliability of tool three was (r = 0.93).

Pilot study

The viability of the research procedure, its clarity, and the amount of time required for data collection were tested in a pilot study that involved 10% of the moms (ten mothers and their children). The pilot study didn't need any changes. The pilot study was included in the study sample.

Ethical considerations

Before conducting the research, approval from the dean of the faculty of nursing was obtained and also from the hospital authorities of the selected setting at Damanhour University Hospital. Oral consent was obtained to participate in this study after explaining the aim of this study to the mothers and their children. The researchers informed the mothers and their children that this study was voluntary; they had the right to withdraw from this study at any time without giving any explanation. Also, they were assured that their data would be confidential.

Data Collection Procedure

Preparation, implementation, and assessment are the three phases included in this study: It was designed to investigate the effect of dietary intervention-based short messages service on mothers' knowledge and practices regarding iron deficiency anemia among their children

Phase I: Preparatory phase:

Through the use of books, articles, periodicals, and magazines, a review of the literature on the many elements of the issues from the past and now, both locally and globally, was collected. After studying pertinent contemporary Arabic and English literature, dietary intervention-based short message services including voice messages, text messages, images, and videos were developed in the Arabic language to cover various aspects of the study issue. This brief messaging service based on nutritional interventions was created to cover knowledge and practice gaps among mothers.

Phase II: Implementation phase:

The researcher began collecting information once the study's execution was given the go-ahead. Three days each week, starting in July 2021, data collecting lasted through November 2021. During the first interview, the researcher introduces herself to begin a dialogue and outlines the objectives of the study. A pre-and post-test was given to each woman who took part in the study to evaluate her knowledge and practices. Interviews were used to fill out the instrumentation. Then, each mother took part in a pre-test where her starting knowledge was assessed utilizing (tool I). The researchers took around 15 minutes to complete this instrument individually, after which they evaluated each mother on an individual basis.

The tool I used as a (pretest) intervention to assess each mother to collect the necessary information. Three times the questionnaire was administered. For the first time, it served as a pretest for evaluating mothers' reported practices and understanding of iron deficient anemia. On the second occasion, the same tool was utilized as a posttest immediately after the intervention, and the third time was three months later.

The researcher conducted face-to-face interviews with the mothers; each interview lasted between 10 and 15 minutes before a brief message was sent. Before each interview, the researcher greeted and introduced herself to the mothers, explained the nature and purpose of the study, and then obtained each mother's oral consent to participate in the study. Before providing brief message instructions, the researcher first evaluated personal data and had face-to-face pre-test structured questions completed. The phase of the intervention (recommendations based on a brief message) Then, for the next three months, voice messages, text messages, images, and videos were sent twice daily with the recommendations based on brief messages.

Sessions contents:

Session 1:
All researchers first discussed the program session's material before moving on to the following session's learning objectives. The researchers began the session by evaluating mothers' knowledge and practice on iron deficiency anemia in their children while speaking in an Arabic dialect that was suitable for women to understand.

Session 2:
It included the theoretical part that covered information about iron deficiency anemia, such as the definition of the IDA, risk factors for it, signs and symptoms, causes, preventative measures, management, and treatment. It was introduced via messages, posters, and instructional movies.

Session 3:
It included information about reported practices for iron deficiency anemia and how to improve dietary practices among the studied mothers, iron supplementation, eating foods high in iron, foods that increase iron absorption, unhealthy habits that reduce iron absorption, and performing the necessary tests to ensure pregnancy success were covered in the practical part. It was introduced through presentations, messaging on posters, and instructional movies.

Session 4:
The researchers discussed with the mothers the importance of follow-up for children and the necessity of referrals for serious issues to maintain care and avoid complications.

At the initial interview, hemoglobin was measured to determine the need for blood samples. Venipuncture was used to get blood, which was then drawn into a container. All of the children had blood drawn by a skilled lab professional. These tests were all carried out in a private medical analysis facility. Hemoglobin levels below 11 g/dL were used to define anemia. Two blood samples were collected: once before the start of nursing intervention and once again three months later. The following criteria were used to categorize the severity of iron deficiency anemia: iron depletion was defined as a serum ferritin concentration below 12 g/L and iron deficiency anemia as a serum ferritin concentration below 12 g/L.

The intervention was delivered over three months using SMS texts. After the last SMS was sent, a telephone post-intervention test was carried out. The original design of the SMSs included pure theoretical statements, mother-response-able queries, and tasks. Important information was reiterated. Mothers were advised to text back answers to questions or to speak with the researcher directly if they needed more information on a particular topic. From the researcher's phone, SMS messages were sent.

Phase III: Evaluation phase

The first post-test was administered post immediately and three months after the mothers had received dietary intervention-based short messages service to assess the effect of dietary intervention-based short messages service on mothers' knowledge and practices regarding iron deficiency anemia among their children using the same pretest data collection tools (utilizing tool I, II, and III). After three months of intervention, blood samples were determined by measuring hemoglobin post-test. The following criteria were used to assess the severity of iron deficiency anemia: iron depletion was defined as a serum ferritin concentration below 12 g/L and iron deficiency anemia as a serum ferritin concentration below 12 g/L.

Administrative design

Ethical Approval was obtained from the Dean of the Faculty of Nursing and the directors of the Pediatric Outpatient Clinic at Damanhour University Hospital to carry out this study.

Statistical Analysis

Using a suitable personal computer, data entry was completed. The statistical software SPSS-20 was used to conduct the analysis. The collection, revision, coding, analysis, and tabulation of the data were done utilizing the number and percentage distribution. Quantitative continuous data were presented using descriptive statistics in the form of frequency and percentages, and comparisons between the mean scores of the two study groups were made using student T-tests. The F-test (ANOVA) was employed for several groups. Pearson correlation analysis was performed to evaluate how knowledge and practices interacted before, during, and after the follow-up program. The threshold for statistical significance was set at p 0.05.

Results

Table 1 shows that 75% of the moms who were researched were between the ages of 18 and 30. Additionally, they had a mean age of 23.33± 5.56, (37%) had a secondary education, and 70% did not work. The table also showed that 28% of the mothers were from urban areas and that 72% of them lived in rural areas.
Figure 1 demonstrates that 90% of the mothers who participated in the study didn't attend any IDA training programs before, and just 10% did.
Table (2) Portrays that 100 children in all took part in the study and that their average age was 3.22± 1.33. The age group from 1 to 3 years was the most common (65%). Additionally, it was discovered that boys constituted about 60% of the study .
Table 3 reveals that 85% of the children in the study had IDA, the majority of them (87%) did not take iron supplements, and 80% of children did not receive IDA treatment.
Figure (2) shows that more than half of the mothers who participated in the study reported that doctors (55%) and nurses (30%) were their primary sources of information about IDA.
Table (4) shows that there were statistically significant improvements in all areas of mothers' knowledge before, immediately, and after the implementation of a dietary intervention-based short messaging service. Additionally, it demonstrates that, when compared to the follow-up phase of the implementation of the dietary intervention-based short messages service, the majority of the studied mothers had satisfactory knowledge levels regarding all knowledge aspects (p <0.001.)
Table (5) shows statistically significant increases and improvements in all areas of mothers' reported practices before, immediately, and three months after the implementation of the dietary intervention-based short message service .
Figure (3): shows that there was a highly statistically significant improvement in mothers ' total knowledge mean score in (post and follow-up) dietary intervention-based short messages service implementation phase than in pre dietary intervention-based short messages service implementation phase.

Figure (4): shows that there was a highly statistically significant improvement in mothers ' total practices mean score in (post and follow-up) dietary intervention-based short messages service implementation phase than in pre dietary intervention-based short messages service implementation phase.

Table (6): Reveals that there was a relation between the mothers' demographic characteristics and their mean score of post-intervention knowledge about IDA with statistically significant differences.

Table (7): Clarifies the IDA levels among the studied children pre- and after three months of **dietary** intervention-based short messages service implementation. Significant differences and improvements were observed pre and post-dietary intervention-based short messages service in Hb and Serum Iron.

Table (1): Demographic characteristics of the studied mothers (n=100)

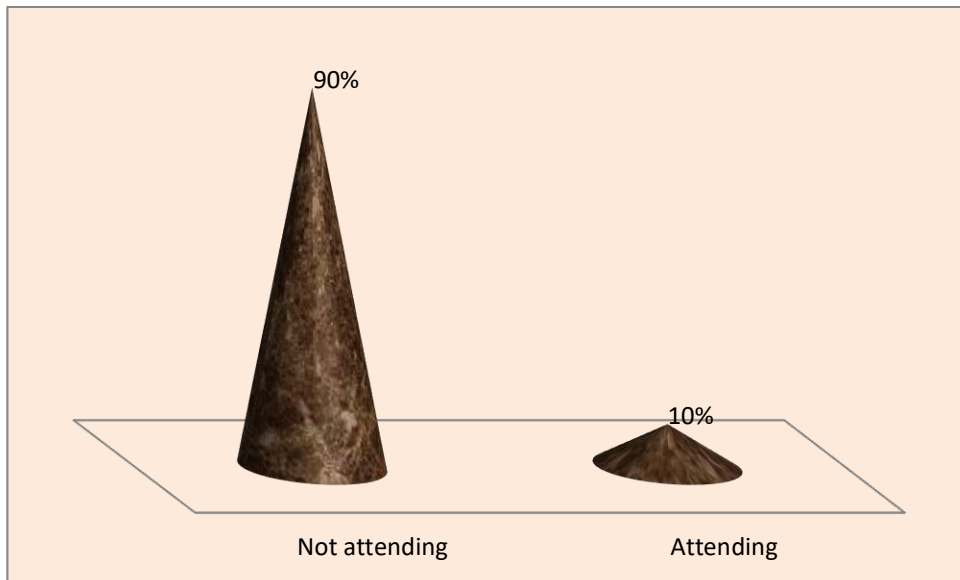| Item	Mothers (100)	
	No	%
Mothers ' age in years		
18 < 30	75	75.0
30 < 40	25	25.0
Mean±SD	**23.33 ± 5.56**	
Mothers ' education		
- Illiterate	9	9.0
- Basic education	26	26.0
- Secondary education	37	37.0
- University education	28	28.0
Occupation		
- Working	30	30.0
- Not working	70	70.0
Residence		
- Rural	72	72.0
- Urban	28	28.0

Figure (1): Attendance of the studied mothers to any type of training program regarding IDA (n=100)

Table (2): Demographic characteristics of the studied children (n=100)

Item	Children (100)	
	No	%
Children's age in years		
1 < 3	65	65.0
3 < 5	35	35.0
Mean ±Stander deviation	3.22 ± 1.33	
Children gender		
- Boy	60	60.0
- Girls	40	40.0

Table (3): Children's medical history regarding IDA (n=100)

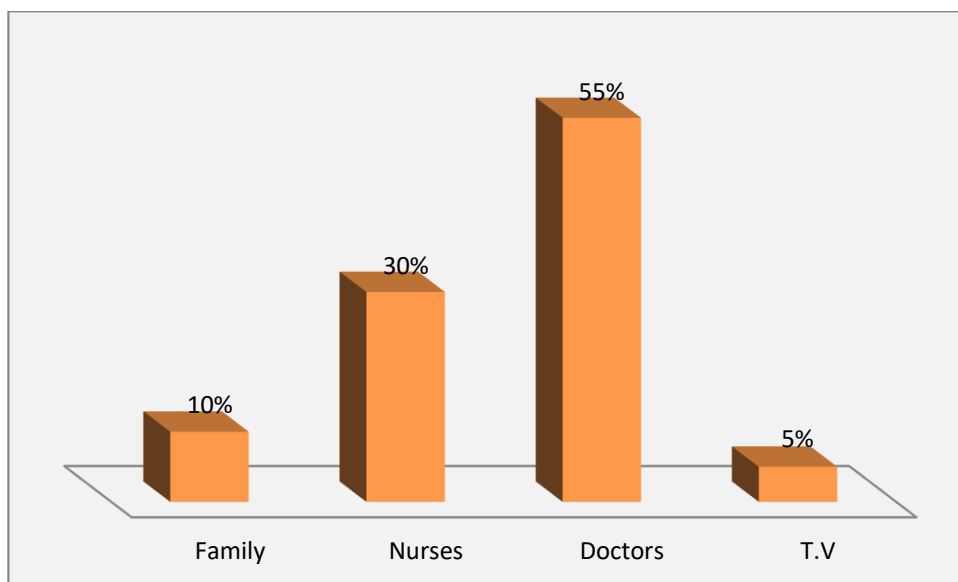| Items	No.	%
Having IDA		
- Yes	85	85.0
- No	15	15.0
Taking iron supplementation		
- Yes	13	13.0
- No	87	87.0
Taking treatment for IDA		
- Yes	20	20.0
- No	80	80.0

Figure (2): Source of information among the children's mothers about IDA (n=100)

Table (4): Comparison between the studied mothers' satisfactory knowledge level pre-, post-immediate, and after three months of dietary intervention-based short messages service implementation (n=100)

Items	Pre-dietary intervention short messages service		Immediately post dietary intervention-based short messages service		After three-months of-dietary intervention-based short message service		X2	P-value
	No	%	No	%	No	%		
Important of iron	37	37.0	91	91.0	94	94.0	76.28	<0.001
Meaning of IDA	30	30.0	90	90.0	89	89.0	65.22	<0.001
Causes of IDA	34	34.0	89	89.0	85	85.0	77.24	<0.001
Risk factors for IDA	16	16.0	88	88.0	87	87.0	68.41	<0.001
Signs/ symptoms of IDA	40	40.0	80	80.0	77	77.0	76.33	<0.001
Diagnosis of IDA	35	35.0	92	92.0	90	90.0	59.25	<0.001
Complications of IDA	33	33.0	87	87.0	85	85.0	74.36	<0.001
Preventative strategies of IDA	23	23.0	89	89.0	86	86.0	66.27	<0.001
Treatment of IDA	29	29.0	90	90.0	88	88.0	73.67	<0.001
Foods that rich in IDA	20	20.0	93	93.0	90	90.0	70.56	<0.001

Table (5): Comparison between the studied mothers' satisfactory practices level pre-, post-immediate, and after three months of dietary intervention-based short messages service implementation (n=100)

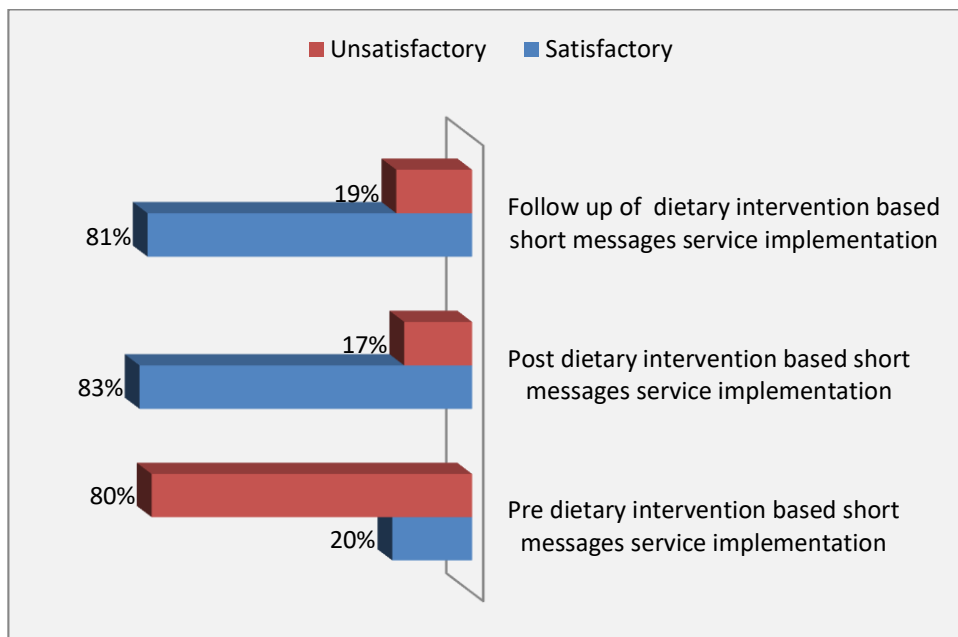| Items	Pre-dietary intervention short messages service		Immediately post dietary intervention-based short messages service		After three-months of-dietary intervention-based short message service		X2	P-value
	No	%	No	%	No	%		
How to improve dietary behaviors	35	35.0	81	81.0	94	84.0	77.33	<0.001
Iron supplementation	30	30.0	80	80.0	83	83.0	69.44	<0.001
Eating foods rich in iron	31	31.0	83	83.0	85	85.0	78.78	<0.001
Foods that increase iron absorption	17	17.0	85	85.0	86	86.0	67.54	<0.001
Unhealthy habits prevent iron absorption	33	33.0	83	83.0	79	79.0	79.22	<0.001

Figure (3): Comparison of the studied mothers' total knowledge about IDA pre, post, and after three months of dietary intervention-based short messages service implementation (n=100)
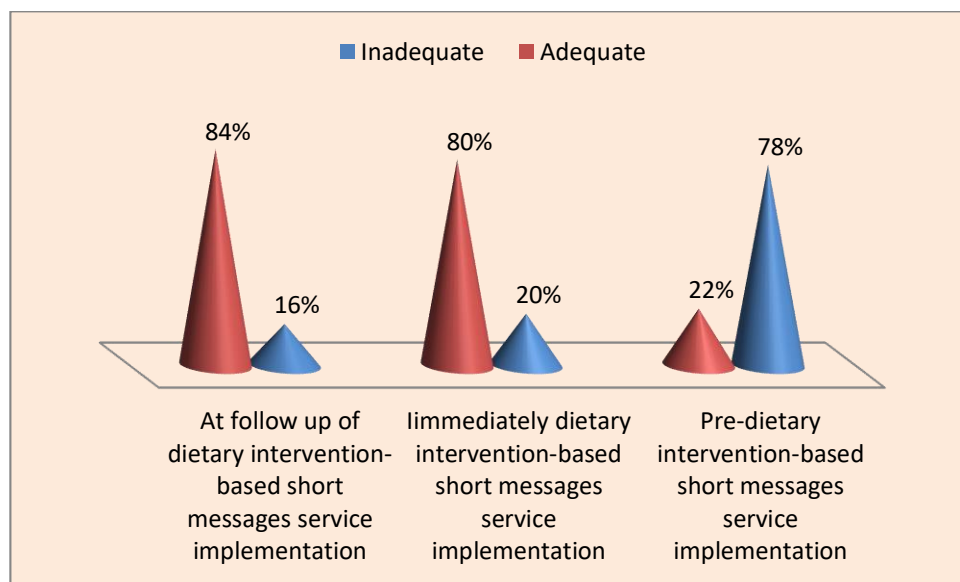
Figure (4): Comparison of the studied mothers' total practices about IDA pre, post, and after three months of dietary intervention-based short messages service implementation (n=100)

Table (6): Relation between Posttest mother's mean score ' knowledge and their demographic characteristics

Total knowledge Demographic characteristics		Post mean score knowledge about IDA		
		Mean ± SD	F	P-value
Age (years)	18 < 30	76.3 ± 3.7	7.3	<0.01**
	30 < 40	78.6 ± 3.8		
Education	- Illiterate	72.33 ± 3.3		
	- Basic education	76.7 ± 3.4	11.3	<0.001 **
	- Secondary education	77.8 ± 2.5		
	- University education	83.7 ± 2.4		
Occupation	- Working	75.3± 2.6	12.4	<0.001 **
	- Not working	79.4 ± 3.7		
Residence	- Rural	73.5 ± 2.2	10.3	
	- Urban	76.4 ±1 .6		<0.001 **

Table (7): Levels of IDA among the studied children pre- and after three months of dietary intervention-based short messages service implementation (n=100)

Variables	Pre- dietary intervention based short messages service implementation		After three-months dietary intervention-based short messages service implementation		X2	P-value
	No	%	No	%		
Normal iron level	0	0	40	40.0		
Level I -Mild iron deficiency anemia	30	30.0	33	33.0	70.78	0.001
Level II-Moderate iron deficiency anemia	55	55.0	20	20.0		
Level III-Sever iron deficiency anemia	15	15.0	7	7.0		

Discussion

Anaemia brought on by an iron deficiency affects children under the age of five all around the world. Anaemia due to iron deficiency is accompanied by a variety of symptoms and adverse effects. Several physiological functions, including oxygen transport and utilization, oxidative phosphorylation, mitochondrial function, DNA biosynthesis, and ATP creation, depend on iron, which is regarded as an important micronutrient (Camaschella, 2019). Due to inadequate food intake, blood loss that causes iron loss, issues with iron absorption, and other illnesses, iron deficiency anemia (IDA) developed (National Heart, Lung, and Blood Institute, 2019).

A few of the problems that nursing staff is currently facing include the spread of technology, consumer demand for high-quality care, cost-containment pressure, a reduction in the length of hospital stays, an aging population, and an increase in the occurrence of comorbidities. The need for highly qualified nurses, who must be prepared with an emphasis on their knowledge and actions that have an impact on patient outcomes, is intimately tied to these challenges (Duchscher, 2019).

According to the current study's findings, the majority of the moms who were evaluated did not participate in any IDA training courses. According to the researchers, this may be the root of the knowledge and practice gap, which further supported the need for the adoption of nutritional intervention-based short message services. It also demonstrated the significance of the current study in enabling mothers to participate in such interventions to enhance their understanding and behavior regarding iron deficient anemia.

The current study's findings made it clear that the majority of the moms who participated in it indicated that doctors and nurses were their primary sources of knowledge. This illustrates how crucial medical guidance is.

The findings of the current study made it clear that there had been statistically significant improvements and changes in all areas of mothers' knowledge before and after three months of the implementation of the dietary intervention-based short message service on IDA. This can be seen in the way that nutritional intervention-based short messaging services are implemented. This finding is consistent with a study by Abu-Baker et al. (2021) who examined "The impact of nutrition education on knowledge, attitude, and practice regarding iron deficiency anemia among females" in Jordan and found that educational intervention is a useful strategy for raising mothers' awareness of iron deficiency anemia.

These findings were in line with a study by Lotfi et al., (2015) that highlighted Moroccan athletes' nutritional knowledge in Kenitra and revealed that their nutritional knowledge score (NKS) was relatively low, showing a significant difference and improvement following nutritional education. Additionally, earlier research conducted in Ethiopia (Gebreyesus et al., 2019) and India (Singh et al., 2019) revealed similar results. This emphasizes the necessity of IDA education for mothers.

This study highlights marked gaps in nutrition-related knowledge of mothers in El Othmanyia village. Before the intervention, the mean knowledge score of mothers was 6.3 and it increased significantly after the intervention (82.2). These results come in agreement with the results presented by Kumari and Dubey, (2016) in Rajasthan (9.3 vs. 13.83). Other studies also showed comparable results in Kenya (9.87 vs. 39.29), Gitau et al., (2016) (48.3 vs. 55), and Ghana (8.3 vs. 21.6) (Otoo G, Adam, 2016). Before the intervention mothers had defective knowledge concerning IDA which significantly improved after the intervention.

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

The result of the current study demonstrated that the majority of studied mothers had satisfactory knowledge levels regarding all knowledge aspects in the post-dietary intervention-based short messages service implementation phase compared to the follow-up phase of dietary intervention-based short messages service implementation. From the researchers' point of view, it demonstrated the positive effects of applying dietary intervention-based short messages service implementation.

The results revealed a highly statistically significant difference between nurses' prior and subsequent understanding of paracentesis following the deployment of instructional guidelines based on short message service. By demonstrating that people had more knowledge of the paracentesis procedure, the researchers claimed that this supported the value of educational instructions sent via short messaging services. The results demonstrate a relationship between an improvement in knowledge test scores and an educational intervention that only uses SMS. Similar encouraging results were obtained from studies using SMS to train nurses and community health workers in various poor nation situations,

confirming the efficacy of this widely available and reasonably priced training tool (Zurovac et al., 2019). The acquisition of theoretical knowledge ought to be a part of a nurse's training, and the absence of assistance might greatly raise the risk of negative outcomes (Zurovac et al., 2018).

The current study's findings showed that the majority of mothers' reported practices significantly improved and increased before, right away, and three months after the introduction of a dietary intervention-based short message service, with statistical significance. This shows the effect of using the dietary intervention-based short messaging service, which is very important in encouraging positive practices .Following nutrition intervention, consumption of foods high in iron increased, according to other research (Alaofe et al., 2018) To encourage the adoption of healthy eating habits, intervention and teaching measures in the area of nutrition are required (Understanding anemia and eating behaviors among youth in Egypt, 2020).

This is in line with a study conducted in the United States that revealed a reduction in anemia prevalence from 62.5% to 28.6% in the group receiving nutrition education sessions compared to the control group (Rojhani & Niewiadomska-Bugaj, 2018) Furthermore, following the dietary instruction sessions, the mean hemoglobin of the Niewiadomska-Bugaj, (2018) investigated youngsters increased significantly. These findings matched those of Gitau et al., (2019) in Kenya (12.8 g/dl–13.4 g/dl) and Grover & Choudhary, (2017) in India (8.55 g/dl–10.66 g/dl). Anemia cure rates were greater in children in the intervention group compared with the control group by Shet et al., (2019) study carried out in India (55.7% vs. 41.4%). However, research conducted in Iran revealed no discernible rise in the mean hemoglobin level following nutritional education.

The present study showed significant improvement in hemoglobin levels after three months of intervention. The anemic students' numbers were reduced to only a few numbers after the end of the program. This may be attributed to the change which occurs in student's dietary practices as a result of the positive effect of the nutritional educational program on their knowledge, besides the effect of iron supplementation. Most of the students willingly took the iron tablets, especially those of the experimental group when they learned more about anemia through the nutritional program. As for changes that occurred in the mean hemoglobin concentration, the present study revealed that the mean hemoglobin concentration of the control and experimental groups was different and significantly increased from the beginning of the study to that after the implementation of the program. It is interesting to note that the mean hemoglobin level of the experimental group was continuously increased during the evaluation phase of the program.

The current study's findings showed that the IDA levels in the children were different before and after three months of the development of a nutritional intervention-based short messaging service. Before and after the dietary intervention-based short message service, significant changes and improvements in Hb and serum iron were seen. This is demonstrated by the deployment of a dietary intervention-based short message service addressing IDA, which has

confirmed the goal and hypothesis of the current investigation and shown the efficacy of the study.

This finding was in line with studies conducted in Egypt and Palestine by Ibrahim and El-Lassy, (2013) and Jalambo et al., (2017) on improvements in knowledge, attitudes, and practices of iron deficiency anemia among iron-deficient female adolescents. These studies found that education can improve knowledge, attitudes, and practices of iron deficiency anemia among iron-deficient female adolescents.

Additionally, this is similar to studies by Gopal and Chand, (2017) who investigated the effectiveness of a structured teaching program on knowledge regarding anemia prevention among adolescent girls in a selected Bharatpur senior secondary school, and Chaluvaraj and Satyanarayana, (2018) who investigated "Change in knowledge, attitude, and practice regarding anemia among high school girls in rural Bangalore" and discovered that educational interventions anemia prevention were effective.

Our results corroborated and supported this claim, demonstrating that the nutritional intervention for mothers based on SMS deployment had been successful in reaching its objectives. Text messages delivered via SMS are efficient tools for promoting self-care and a manner that moms can utilize to improve the care they provide for their children. Regarding this, text messages are not only free but also allow for provider-user interaction through a variety of multimedia modalities, including texts, audio, and pictures (Hassan, 2017). Technology provides the opportunity to reduce the number of patients who miss appointments by using SMS and phone appointment reminders. SMS is recommended as a practical, cost-effective method to help improve patient appointment adherence in a clinic with a high no-show rate (Chen et al., 2018, Leong, 2016).

The authors found that SMS is effective in two randomized controlled studies that compared SMS appointment reminders to a control group that did not receive reminders (Taylor et al., 2012; Youssef et al., 2014). They discovered that SMS appointment reminders were as effective (Bigna et al., 2013 Perron et al., 2013). The difference in appointment attendance rate, which was not statistically significant, demonstrates the value of an SMS reminder.

Conclusion

The current study's conclusions and hypotheses lead to the conclusion that dietary intervention-based short message services can improve mothers' dietary knowledge and practices when their children have iron deficiency anemia. The findings of the current study showed that the IDA levels in the examined children were different before and after the implementation of a dietary intervention-based short message service for three months.

Recommendations

According to the study's conclusions, the researchers advise:
- The study recommended that mothers should continue to receive dietary intervention-based short message services to improve their knowledge and practices.
- The intervention-based short messages service incorporated into pediatric healthcare for children supports healthy nutritional behavior among children with a faster and low-cost approach.
- To preserve generalizability, a larger sample size should be used in a replication of the study.
- To manage and prevent IDA anemia, it is advised that mothers receive dietary education during the early years of a child's life.

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