

Effectiveness of Dietary Intervention-Based Short Message Service on Pregnant Adolescent Female's Knowledge and Practice Regarding Iron Deficiency Anemia

1Shaimaa Hashem Elsalous , 2 Salwa El Saied Mahmoud Dawoud, 3Tasneem Ragab Ahmed Salama, 4Hanaa Elsayed Ahmed Shahin

1Maternity and Newborn Health Nursing Department, Faculty of Nursing, Helwan University

2Nursing fellow (woman's Health and Midwifery Nursing), students Hospital Mansoura University, Egypt

3Lecturer of Community Health Nursing, Faculty of Nursing, Beni-Suef University

4Assistant Professor of Maternity and Newborn Health Nursing, Menoufia University, Egypt

Abstract

Pregnancy outcomes are greatly influenced by nutrition, which is widely acknowledged as an essential element of both a successful and healthy pregnancy as well as the long-term health of the offspring. Anemia from iron deficiency during pregnancy is a serious health issue. Because the fetus and mother's need for iron increases throughout pregnancy and reaches its peak at the end, all pregnant women are at risk of developing anemia. **Aim:** To investigate the effectiveness of dietary intervention-based short message service on pregnant adolescent females' Knowledge and practice regarding iron deficiency anemia. **Subjects and method: Design:** A quasi-experimental research design was used to achieve the aim of this study. **Setting:** The study was applied in antenatal outpatient clinics at Mansoura University Hospitals. **Subjects:** A purposive sample of 200 pregnant adolescent females was involved in the study. **Three Tools were used for data collection** 1) a structured interviewing questionnaire, 2) a pregnant adolescent female's reported practices tool (pre and post-test format), and 3) a hemoglobin level assessment sheet (post-test format). **Results:** A statistically significant difference and improvement were detected between pregnant adolescent females' level of knowledge and practice regarding iron deficiency anemia and Hemoglobin (Hb) value after dietary intervention-based short message service. The hemoglobin level mean was increased among the studied pregnant adolescent females after dietary intervention-based short message service. Also, there was a highly significant correlation between demographic characteristics and pregnant adolescent female's level of knowledge and practice in pre- and post- dietary intervention based short message service mainly in the items of gender, and educational qualification. There was a highly significant correlation between demographic characteristics and pregnant adolescent females' level of knowledge in pre- and dietary intervention-based short message service with pregnant adolescent female's age. **Conclusion:** Dietary intervention-based short message service intervention has positive effects on improving pregnant adolescent females' level of knowledge and practice. **Recommendation:** Continuous training programs are recommended in various maternity healthcare settings to improve pregnant adolescent female's knowledge and practices which will reflect on their health and offspring's long-term health. Educational booklets should be provided about foods with a high concentration of iron to reduce iron deficiency anemia among pregnant adolescent females. **Keywords:** Dietary intervention-based short message service, Iron deficiency anemia, Knowledge and practice, Pregnant adolescent female.

Introduction

Iron deficiency is considered the primary cause worldwide and occurs due to insufficient levels of iron needed to produce red blood cells. Since our diet is the main source of iron, iron deficiency anemia usually develops as a result of low dietary intake,

blood loss resulting in loss of iron, problems in iron absorption, and other medical conditions, such as final-stage kidney failure and inflammation (Rahman et al., 2021). iron deficiency anemia cases range from mild to severe. Mild and moderate IDA may be devoid of any signs or symptoms. However, a severe case of IDA, if left untreated, may entail life-threatening consequences (WHO,

2020). Iron deficiency anemia affects 32.8% of pregnant adolescent girls (Cane et al., 2022). Iron deficiency anemia (IDA) increases the risk of miscarriage, premature labor, placental abruption, and low birth weight in women of reproductive age (Lao et al., 2022).

The prevalence of iron deficiency anemia, which is most prevalent in underdeveloped nations, is one of the most prevalent issues connecting undernutrition and public health issues worldwide. Iron deficiency anemia may cause women to feel fatigued and restless because anemia of iron prevents the body from producing enough hemoglobin, which is necessary for red blood cells to carry oxygen (Sun et al., 2021).

Due to the increased blood volume during pregnancy brought on by greater support for the fetus and placenta, pregnant women are more susceptible to iron deficiency anemia. Women who are in the reproductive stage typically have heavy blood loss from menstruation or childbirth, which can lead to iron deficiency anemia (Ali et al., 2021). According to estimates from the World Health Organization (WHO, 2020), anemia affected 32.4 million (38%) pregnant women in 2011 and 496 million (29%) non-pregnant people between the ages of 15 and 49. A prevalence of 73.9% in Guyana, 22.1% in Egypt, 39.7% in Kuwait, 78.0% in Liberia, and 50.0% in Bahrain was also found in earlier investigations on IDA (AlAbedi et al., 2019).

Pregnant women may experience anemia for a variety of reasons, including inadequate antenatal care, close spacing between births, and poor diet. The current high frequency of anemia may be attributed to women's conduct in treating and avoiding anemia, such as not taking iron supplements regularly. Poverty, ignorance, lack of knowledge of the nutritional worth of foods, and an unsanitary environment are the main causes of low intake of iron-rich foods (Singal et al., 2020).

90% of occurrences of the iron-deficient type of pregnancy in women involve iron deficiency anemia. It is seen as a significant public health issue, especially for the poorest populations in developing nations, which are home to 95% of the world's anemic pregnant women. When a woman's iron stores are low or nonexistent at the start of her pregnancy

because of heavy menstruation, a previous pregnancy, a poor iron intake, and increased fetal iron requirements that causes anemia (Singh et al., 2022).

Iron deficiency in the body causes metabolic disorders, lowered immunity in pregnant women, and increased susceptibility to infectious agent attacks. Increased understanding and adherence to appropriate dietary habits can help with anemia, a serious health issue. Most ministries and governmental and nonprofit organizations have implemented policies to provide iron supplementation for pregnant and lactating women as a result of the increased risk of acquiring iron deficiency anemia during pregnancy and lactation (Souganidis et al., 2019).

Depending on the culture and awareness of women, women's understanding of and dietary intake of foods high in iron can help prevent iron deficiency. Acute iron insufficiency in pregnant women and a higher prevalence of low birth weight and neonatal deaths are linked to poorer maternal education (Virginia et al., 2020). One of the most vital preventive aspects in reaching optimum health is maintaining a woman's health through healthy behavior, which is represented by eating nutritious foods (Souganidis et al., 2019).

Hemoglobin, the blood pigment that carries oxygen, contains iron as one of its key constituents. Because blood cannot carry oxygen efficiently when there are insufficient levels of iron in circulation, every cell in the body will not function adequately (Imdad et al., 2019). Iron is typically gained through meals and by recycling iron from old red blood cells. A median quantity of 840-1210 mg of iron is thought to be required for absorption during pregnancy (Anitha et al., 2021).

The promotion of health during pregnancy by obstetrics and gynecology nurses is essential as the focus of health promotion has changed from a disease model to a health model. The most important function is educating and supplying pregnant women with the knowledge they need to help preserve their health during pregnancy, particularly when it comes to nutritional

factors. They have a focus on behavioral adjustments to help expectant women alter their dietary habits and understand what causes an IDA deficiency ((Faghir-Gangi, et al., 2023).

Numerous studies have been conducted and it has been found that there is a correlation between knowledge and practice among pregnant women and anemia. The lower the knowledge and insufficient practice about the prevention and management of anemia in pregnant women, the higher the risk by more than five times. The provision of thorough, succinct, and pertinent information to women before, during, and after pregnancy regarding anemia prevention and management is one of the most significant duties of qualified health professionals. Pregnant women can have anemia prevented and controlled by increasing their understanding of food, using it as a preventative measure, and optimizing their diet (WHO, 2020)

Researchers have established that mobile phones are effective gadgets in all facets of human life. These researchers have used a range of technologies to give therapies in health promotion. 90% of Iranians now have access to cell phones. Short message services (SMS) and cell phones are contemporary tools for engagement and communication. They have a wide range of features and capabilities, incorporating fast speed, availability round-the-clock, cost-effectiveness, relative security, storage capacity, flexibility, and visually appealing material (Shetty et al., 2019). Given that most individuals today lead busy lives and find it difficult to travel and attend training sessions, SMS may be an effective way to offer training interventions. Previous research (Botelho et al., 2019, Arora et al., 2018) demonstrated that encouraging diabetes patients to practice self-management through SMS was a successful tactic.

The effectiveness of computer-based eLearning in impoverished countries may be hampered by a lack of access to and skill with computers. Mobile phones are becoming more and more common as delivery methods for training, and they may offer a cost- and capacity-effective alternative to conventional, computer-based eLearning. Using mobile phones in healthcare and education has increased since they became widely available

(Peter et al., 2019). The percentage of mobile phone ownership among the studied Kenyan healthcare workers was around 98%, and training offered by SMS has enhanced nurse adherence to standards of care in that nation and numerous other African programs. After 30 days, SMS-based training programs have also shown information retention levels that are comparable to those of didactic instruction. Several 'organically generated' mobile-telephone-based learning strategies, such as reflective practice, emotional support, and teaching in unanticipated scenarios, were reported (Zurovac et al., 2019).

The widespread use of information and communication technologies today offers a significant opportunity to encourage diabetic self-care. This is due, in part, to the availability of SMS on mobile devices such as mobile phones. With this service, the patient is continuously reminded to practice self-care. Thus, there is increased interest in the use of SMS as an educational methodological tool to promote self-care by facilitating communication and connecting with people from various socioeconomic and racial backgrounds (Fortmann et al., 2019, Whitehead & Seaton, 2019). Sending text messages has been demonstrated to be an incentive for the right management of diabetes by energizing the recipients and making knowledge assimilation easier.

These results reveal the potential of using this methodological strategy to improve self-care because of the constant reminders about the significance of daily practices for health, which strengthens the connection between the patient and his health center and encourages an improvement in the condition's clinical evolution (Prado et al., 2018). Studies carried out in the United States, India, and Egypt showed that interventions that adopted SMS in their methodological strategy to promote self-care improved clinical outcomes (Arora et al., 2018, Abaza & Marschollek, 2019).

A very important role in supporting health throughout pregnancy is played by nurses who work in primary healthcare settings and family health clinics. The nurse's responsibility now falls under the category of health promotion rather than disease

prevention. Teaching expectant mothers about the value of regular iron supplementation and frequent hemoglobin level measurements is considered to be the most crucial duty. Teaching and educating expectant mothers about the significance of preserving their health during pregnancy, particularly concerning nutritional elements, and encouraging them to change their eating habits and lifestyles that lead to nutritional deficits are the other key roles (Faghir-Gangi, et al., 2023).

Significance of the study:

The deficit in iron in pregnant women's anemia is regarded as a common issue during pregnancy. Anemia is thought to be common in pregnancy, with an estimated frequency of 41.8%⁴; but, it is unknown what proportion of people lack enough iron without anemia. Numerous variables, including a lack of awareness about nutritive foods and a low intake of foods high in iron, contribute to the development of anemia (Stevens et al., 2022).

Health education and continued nursing care can help treat anemia. patients can access healthcare services and information using smartphone apps at any time. Studies have shown that mobile apps can benefit patients in clinical practice and healthcare environments (Schlachta, 2015). In Egypt, where anemia prevalence surpassed 40%, iron deficiency anemia continues to be a major public health concern (Seabra et al., 2021).

Through the use of SMS and phone appointment reminders, technology offers the chance to lower the number of patients who don't show up for appointments. In a clinic with a high no-show rate, SMS is advised as a practical, affordable method to help improve patient appointment adherence (Chen et al., 2019, Leong, 2019). For this reason, the present study was conducted to investigate the effect of educational instructions on pregnant women's knowledge and practice regarding iron deficiency anemia.

Operational definitions:

Quick messaging service (SMS) Messages up to 160 characters (or up to 224 characters if utilizing a 5-bit format) can be delivered to mobile phones and smartphones using the short messaging service (SMS) program. Short

messages are also widely referred to as text messages. Sending and receiving messages is free for a certain amount of messages per month with several mobile phone operators (Hanna 2020).

A guideline is described as a set of statements that have been methodically developed to assist practitioners in making decisions on patient care in particular clinical situations. These must be supported by studies or empirical data (Rao & Tandon 2019).

The study aimed to

Investigate the effectiveness of dietary intervention-based short message service on pregnant adolescent females' Knowledge and practice regarding iron deficiency anemia through:

Assessing pregnant adolescent female's knowledge and practice regarding iron deficiency anemia.

Designing and implementing dietary intervention-based short message service for pregnant adolescent females regarding iron deficiency anemia

Evaluating the effect of dietary intervention based short message service on hemoglobin level among pregnant adolescent female.

Evaluating the effect of the effectiveness of dietary intervention-based short message service on pregnant adolescent female's Knowledge and practice regarding iron deficiency anemia and Hemoglobin (Hb) level.

Research hypothesis:

Educational instruction intervention is expected to have a positive effect on improving pregnant women's knowledge and practice regarding iron deficiency anemia.

Educational instruction intervention is expected to increase pregnant women's hemoglobin levels.

Subjects and Methods:

Research design:

The purpose of this study was accomplished by using a quasi-experimental research approach.

Setting:

The study was applied in antenatal outpatient clinics at Mansoura University Hospital.

Subjects:

A purposive sample of 200 pregnant adolescent females was involved in the study.

Inclusion criteria included:

- Attending for follow-up antenatal visit
- Pregnant adolescent female suffering from anemia during pregnancy (HB less than 11gm)
- Free from any medical disorders,

Sample size:

A power analysis of $0.95(\beta=1-0.95=0.5)$ at alpha was used to determine the sample size. The significance level was set at 0.5 (one-sided) with a big effect size.

Tools of data collection:

The following three instruments were used to gather data for the study:

Tool I: Structured interviewing questionnaire: Following a review of pertinent literature, researchers developed it, and it was divided into three sections (**World Health Organization, 2020**).

Part (1): Pregnant adolescent female's data comprised residence, occupation, age, and educational level.

Part (2): Pregnant adolescent female's obstetrical history; it included four questions about abortion, pregnancy stage, gestation age in weeks, and having anemia previously.

Part (3): Pregnant adolescent female's knowledge about iron deficiency anemia assessment sheet (pre-post tool): it was designed by the researchers to identify the level of pregnant adolescent female's knowledge regarding iron deficiency anemia such as meaning, causes, symptoms, prevention, risk factors, source of iron-rich foods, the importance of iron supplementation, etc.)

Knowledge scoring system: Were scored as one score given for a correct answer while zero for an incorrect answer. Total knowledge scores were categorized as $>60\%$ was

satisfactory knowledge level and $\leq 60\%$ was unsatisfactory knowledge level.

Tool II: Pregnant adolescent female's reported practices iron deficiency anemia assessment sheet (pre and post-test format) (pre-post tool); it was composed of questions regarding correct practice regarding eating iron-rich food, not drinking tea with meals, regular intake of iron supplementation, and use of orange juice with iron supplementation.

It was scored one score for an answer done, and zero scores for an answer not done. Total reported practice scores were evaluated as $\geq 60\%$ considered adequate practice level; and $< 60\%$ considered inadequate practice level.

Tool III: The pregnant adolescent female's hemoglobin level assessment sheet: (pre-post tool); that assessed pregnant **adolescent female's** hemoglobin level was taken pre/post dietary intervention based on short message service intervention at the first visit and after two months. The degree of anemia was estimated according to cut off point of the WHO (2020), it is divided into three degrees concerning Hb level mild (9.0–10.9%gm), moderate (7.0-8.9%gm), and severe degree ($<7.0\%$ gm).

Tool Validity and reliability:

Five experts in the field of obstetrics nursing and community health nursing field evaluated the tools' content validity before utilizing them in the study to ensure that they were clear, complete, and appropriate. The panel's assessment of the clarity of sentences and the suitability of the content guided the "rephrasing and canceling" of the modifications. The Cronbach's Alpha Coefficient Test was used to measure reliability, and the results showed that each of the tools used had generally homogeneous items in each of its components. In terms of knowledge and practice, Cronbach's coefficient alpha was 0.994 and 0.893 respectively.

The procedure of data collection:

The study was done through the following three phases named by; preparatory, implementation, and evaluation phases.

A-Preparatory phase:

Based on assessments of knowledge and practices related to iron deficiency anemia that were made using interview questions and literature reviews. After evaluating relevant literature about the treatment of iron deficiency anemia, the researchers created teaching material (a booklet) and distributed it to all of the study's pregnant adolescent females in the Arabic version of the pamphlet.

Administrative and Ethical Considerations:

The Research Ethical Committee approved the study of the Faculty of Nursing at Mansoura University Hospital. The directors of the antenatal outpatient clinics received administrative approval to carry out this study through a letter from the dean of the nursing faculty at Mansoura University Hospital. The purpose of this letter was to request permission to gather study data. It also included an explanation of the study's goal and the anticipated results from its implementation. Pregnant adolescent females were informed of the study's objectives. The study was optional, and participants were free to decline to participate, the researchers told them. Pregnant adolescent females have the right to leave the study at any time and without explanation. The confidentiality of their information and its usage for purely research objectives were promised to pregnant adolescent females.

Pilot study

Ten percent of the pregnant adolescent females (20) in the study participated in a pilot trial. To develop the final form of the tools, the pilot study results were used to determine the clarity and viability of the research process that needed to be tested for modifications. Pregnant adolescent females who participated in the pilot study were included in The study.

B-Implementation phase:

After receiving approval to carry out the study, the researcher started gathering data. The study included all pregnant adolescent females who at the time of data collection met the inclusion criteria. Pregnant adolescent female were asked for their verbal informed consent to secure both their acceptance and cooperation. Data collection began in October 2023 and continued through April 2024 on three days per week from 9:00 a.m. to 12:00 p.m., the

researchers visited the antenatal outpatient clinics. The researcher introduces herself to start a conversation and describes the scope and goals of the study during the first interview. Each pregnant adolescent female who participated in the study had a pre-and post-test to gauge their knowledge and practices. The instruments were filled through interviews.

The interview took approximately 20 minutes for each pregnant adolescent female to answer and fill out the questionnaire (Tools I&II) to assess the knowledge and practice of pregnant adolescent females regarding iron deficiency anemia and also Hb level. The researcher conducted face-to-face interviews with the pregnant adolescent female; each interview lasted between 10 and 15 minutes before a brief message was sent. The phase of the intervention (dietary intervention-based short message service) Then, for the next four weeks, voice messages, text messages, images, and videos were sent twice daily with the dietary intervention-based short message service based on brief messages. The information was dispersed over the period following the topics according to the actual needs of the pregnant adolescent female.

SMS texts were used as the delivery method for the dietary intervention-based short message service over a month. A post-intervention telephone test was conducted after the final SMS had been issued. Purely theoretical assertions, pregnant adolescent female-response-able queries, and tasks were all part of the SMSs' original design. Important details were stated again. pregnant adolescent females were urged to reply through SMS to questions posed or to engage in conversation with the researcher if they required clarification on specific subjects. SMSs were sent from the researcher's phone. The "posttests" were completed by each pregnant adolescent female over the phone at a prearranged suitable time.

Three sessions were included (two theoretical sessions and one practical). The first session included the iron deficiency anemia meaning, incidence, causes, and clinical features of iron deficiency anemia. The second session contained the following topics: risk factors,

source of iron-rich foods, the importance of iron supplementation, and diagnostic tests for iron deficiency anemia; finally, the third session included prevention, ways of management of iron deficiency anemia as education about eating iron-rich foods, don't drink tea with meals, regular intake of iron supplementation, and use of orange juice with iron supplementation, enhancers, and inhibitors of iron absorption, iron medication adherence, and cooking habits.

Hemoglobin levels in blood samples were measured. Venipuncture was used to draw blood into a container. An experienced laboratory worker took blood samples from each pregnant adolescent female. These tests were all conducted in a private medical testing facility. Hemoglobin levels below 11 g/dL are considered anemic. After three months of nursing intervention, blood samples were again obtained. The first time was before the dietary intervention-based short message service intervention.

Phase III: Evaluation phase:

The first post-test was administered three months after the pregnant adolescent female had received a dietary intervention-based short message service to assess their knowledge and practice regarding iron deficiency anemia by using the same tools used in the pre-test. The hemoglobin level of pregnant adolescent females was also assessed after three months of dietary intervention based on short message service intervention.

Statistical analysis:

Using the Statistical Program for Social Sciences (SPSS) version 23, data were edited, coded, computed, and analyzed after data collection was finished. In addition to calculating the frequency distribution, percentages, mean, and standard deviation, Chi-square, and Paired sample T-tests were utilized to characterize the level of statistical significance, which was set at $p < 0.05$.

Results:

Table (1) shows that 70% of pregnant adolescent females ages ranged between 17 < and 18 years and their mean age was 17.13 ± 1.55 , (45%) of them had secondary education. Regarding residence, 75% of the studied pregnant adolescent

females were living in rural areas. Finally, (70%) of them were housewives.

As shown in **Table 2**, 85% of pregnant adolescent females were not aborted before, and 45% were in the first trimester. Also, it was observed that 40% of them have a previous history of anemia. In addition, 50% of the studied pregnant adolescent females were at 23-28 weeks of gestational age.

Figure (1): Shows the main source of knowledge of the studied pregnant adolescent female **about iron deficiency anemia** was doctors, followed by media, and friends.

Table (3) displays that there were highly statistically significant differences between knowledge mean scores among the studied pregnant adolescent females regarding iron deficiency anemia pre/post dietary intervention based on short message service at $p < 0.001$.

It was observed from **Figure (2)** that 90% of pregnant adolescent females had an unsatisfactory level of knowledge regarding iron deficiency anemia pre-dietary intervention-based short message service as compared to 5% post the dietary intervention-based short message service, While, 95% of them had a satisfactory level of knowledge post intervention as compared to 10% pre dietary intervention based short message service with statistically significant differences at ($p < 0.001$).

Table (4): shows that highly statistically significant differences ($p < 0.001$) were detected between mean scores regarding all practice items among the studied pregnant adolescent female regarding iron deficiency anemia pre/post dietary intervention based short message service.

In **Figure (3):** The results reveal that (85%) had inadequate practice pre-dietary intervention-based short message service participation, compared to 80% of them improved to have adequate practice post-dietary intervention-based short message service participation.

Table (5) shows that 20% of pregnant adolescent females have a moderate level of anemia post-dietary intervention-based short message service compared to 80% of them

with dietary intervention-based short message service. This result indicates a highly significant difference between the pre and post-dietary intervention-based short message service of measuring hemoglobin level at $P < 0.001$.

The study's pregnant adolescent female's total knowledge and total practice scores were correlated before and after the dietary intervention-based short message service, as shown in **Table (6)**. It should be mentioned that after the dietary intervention-

based short message service, with a statistically significant positive association between the total knowledge scores and the total practice scores ($p < 0.0001^{**}$).

Table (7): illustrated that there was a statistically significant relationship between the age, educational level, and residence of the pregnant adolescent female's knowledge and practices and their personal data pre and post-dietary intervention-based short message service.

Table (1): The studied pregnant adolescent female distribution according to their data (n=200)

Item	Pregnant women (200)	
	No.	%
Adolescent female's age in years		
16 < 17	60	30
17 < 18	140	70
Mean \pm Stander deviation	17.13 \pm 1.55	
- Adolescent female's education		
- Illiterate	10	5
- Read and write	30	15
- Basic education	80	40
- Secondary education	90	45
- Residence		
- Rural	150	75
- Urban	50	25
Occupation		
Housewives	140	70
Working	60	30

Table (2): The studied pregnant adolescent female distribution according to their obstetrical history (n=200)

Item	Pregnant women (200)	
	No.	%
Abortion		
- Less than 2	20	10
- More than 2	10	5
- No abortion	170	85
Pregnancy stage		
- First Trimester	50	25
- Second Trimester	60	30
- Third Trimester	90	45
Having anemia previously		
- Yes	80	40
- No	120	60
Gestational age in weeks:		
13-	60	30
18-	40	20
23-28	100	50

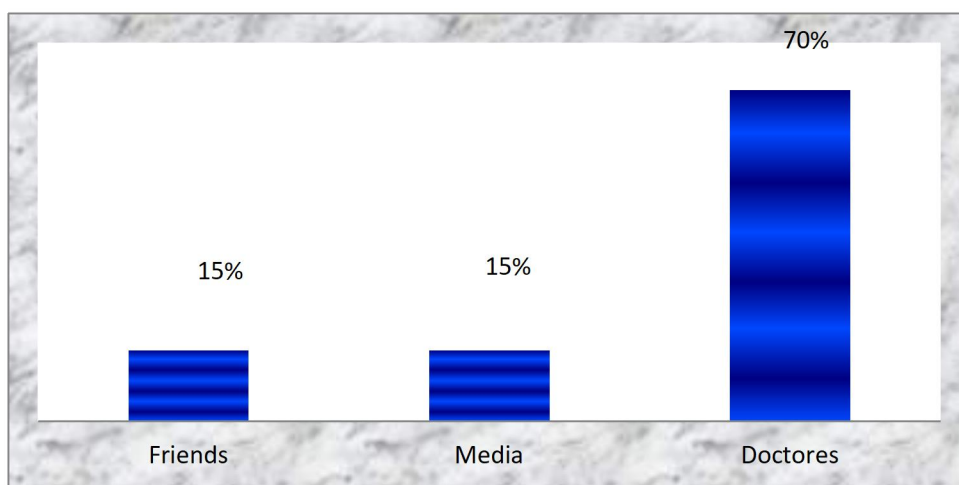


Figure (1): The studied pregnant adolescent female distribution regarding their source of knowledge about iron deficiency anemia (n=200)

Table (3) Comparison of knowledge mean score among the studied pregnant adolescent female regarding iron deficiency anemia pre/post dietary intervention based short message service (N=200).

Pregnant adolescent female's Knowledge	Pre-dietary intervention-based short message service		Post-dietary intervention-based short message service		P value
	No	%	No	%	
Meaning of IDA	10	20%	47	94%	≤0.001**
Incidence of IDA	60	30%	172	86%	≤0.001**
Causes of IDA	32	16%	164	82%	≤0.001**
Symptoms of IDA.	64	32%	160	80%	≤0.001**
Diagnostic test of IDA	36	18%	184	92%	≤0.001**
Eating iron-rich foods	56	28%	172	86%	≤0.001**
Prevention of IDA	48	24%	180	90%	≤0.001**
Risk factors of IDA	72	36%	176	88%	≤0.001**
Sources of iron-rich foods	76	38%	176	88%	≤0.001**
Importance of iron supplementation	70	35%	172	86%	≤0.001**
Enhancers and inhibitors of iron absorption	84	42%	188	94%	≤0.001**
Control measures for iron supplementation sideeffects	60	30%	156	78%	≤0.001**

** Highly statistically significant difference

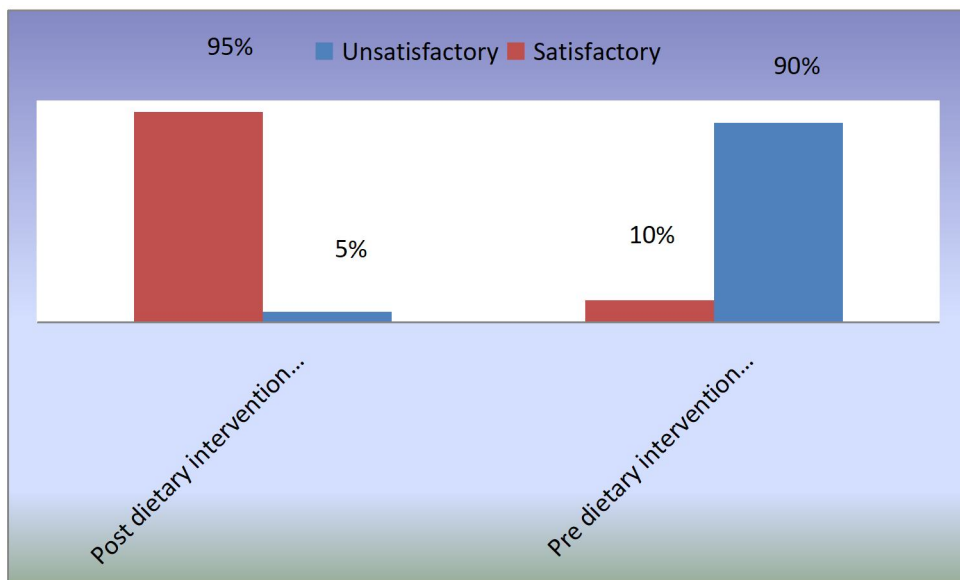


Figure (2): Total knowledge level of the studied pregnant adolescent female regarding their pre and post-dietary intervention-based short message service

** Highly Statistical significant ($P \leq 0.001$)

Table (4) Comparison of reported practice mean score among the studied pregnant adolescent female regarding iron deficiency anemia pre/post dietary intervention based short message service (N=200).

Women s' Practice		Pre-dietary intervention-based short message service		Post-dietary intervention-based short message service		χ^2	P value
		No	%	No	%		
Eating iron-rich foods	Done	70	35	140	70	66.33	$\leq 0.001^{**}$
	Not done	130	65	60	30		
Don't drink tea with meals	Done	40	20	160	80	77.22	$\leq 0.001^{**}$
	Not done	160	80	40	20		
Regular use of iron supplementation	Done	50	25	170	85	67.44	$\leq 0.001^{**}$
	Not done	150	75	30	15		
Administer iron supplementation	Done	60	30	170	85	49.42	$\leq 0.001^{**}$
	Not done	140	70	30	15		
Eat regular frequent meals	Done	80	40	164	82	63.55	$\leq 0.001^{**}$
	Not done	120	60	36	18		
Use iron supplementation with fruit juice	Done	30	15	120	60	82.33	$\leq 0.001^{**}$
	Not done	170	85	80	40		

*Statistically significant difference ($p \leq 0.05$). ** Highly statistically significant difference ($p \leq 0.001$)

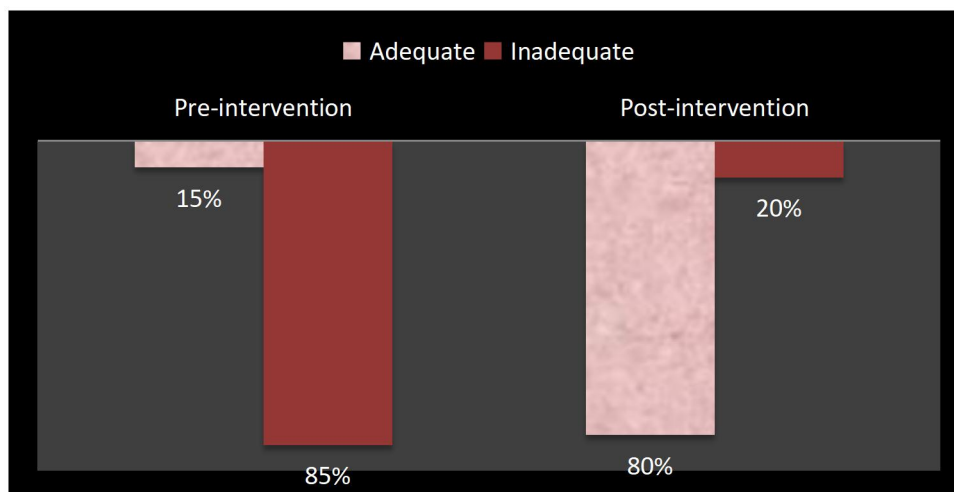


Figure (3): Total practice levels of the studied pregnant adolescent female regarding iron deficiency anemia pre and post-dietary intervention based on short message service (n=200).

Table (5): Distribution of the studied pregnant adolescent female regarding their hemoglobin level pre and post-dietary intervention based short message service (no =200)

Items	Pregnant adolescent female's hemoglobin level			
	Pre-dietary intervention-based short message service		Post-dietary intervention-based short message service	
	No	%	No	%
≥11	0	0%	70	35
Mild (10.0 to 10.9 g/dl)	20	10	90	45.0
Moderate (7.0 and 9.9 g/dl)	160	80	40	20
Severe (less than 7.0 g/dl)	20	10	0	0
X ² = 13.827, p-value=0.001				

Table (6): Correlation between total knowledge score and total practice score of the studied pregnant adolescent female pre and post-dietary intervention-based short message service (n=200).

Variables	Pearson correlation coefficient			
	Total knowledge score			
	Pre-dietary intervention-based short message service (n=200)		Post-dietary intervention based short message service (n=200)	
	r	P	r	P
Total practice score	.476	.000	.679	.000**

** Correlation is significant at the 0.01 level

Table (7): Correlations between pregnant adolescent females' knowledge and practices and their personal data pre and post-dietary intervention-based short message service (n=200).

Items	Knowledge	Practices
Pre- dietary intervention based short message service		
Age	-.136	.069
Education	.132	.188
Residence	-.105	-.155
Occupation	.065	-.064
Post- dietary intervention based short message service		
Age	-.208	-.257*
Education	.309**	.345**
Residence	.307**	.355**
Occupation	.088	-.006

(*) Statistically significant at $p < 0.05$

Discussion:

The most significant contributing factor to a nutritional issue, which can result in difficulties like malnutrition and non-contagious infections, is a lack of nutritional awareness and subsequently inappropriate practice. Over two billion individuals worldwide have anemia. Additionally, the WHO reported that 58% of expectant mothers in underdeveloped nations are anemic. Iron deficiency anemia during pregnancy can be avoided and controlled, nevertheless, by being knowledgeable about iron deficiency anemia prevention and management and according to recommended procedures (Padmavathi et al 2020).

Iron deficiency anemia is a common medical condition during pregnancy and also an issue in underdeveloped nations. Significant effects for both the mother and the fetus are established. Due to cultural differences in socioeconomic level, way of life, and health-seeking practices, Iron deficiency anemia in pregnancy occurs at dramatically variable rates depending on the country (Tanay et al., 2021). Anemia is a major public health issue that has a significant impact on both socioeconomic development and human health in both emerging and industrialized nations. All stages of the life cycle are affected, but young pregnant women are more likely to experience it (Seyoum,

2019). This study set out to investigate the effectiveness of dietary intervention-based short message service on pregnant adolescent females' Knowledge and practice regarding iron deficiency anemia.

According to the results of the current study, more than three-fifths of the pregnant adolescent female were between the ages of 17 < and 18 years, and their mean age was 17.13 ± 1.55 , more than two-fifths of them had a secondary education, and three-quarters of them lived in rural areas. This conclusion is consistent with those of the **Palestinian Central Bureau of Statistics, (2021)**, which showed the age range of pregnant women in his study.

The results are supported by **Farrag et al., (2020)** reported that one-third of participants were below 25 years, the majority of the sample was not employed, and more than half of them completed secondary school education. On the other hand, it was observed in a study by **Pundkar et al., (2019)**, who investigated the risk variables for anemia during pregnancy, and found that the bulk of study participants were between the ages of 20 and 25.

In terms of the investigated pregnant adolescent female's obstetric history, the results of the current study showed that the majority of pregnant adolescent females were not aborted before. This may be related to young age. Repeat pregnancies are a risk factor for the development of iron deficiency

anemia in subsequent pregnancies, according to the findings of a different study by **Malhotra et al., (2019)**.

The current study findings indicated that the main source of knowledge of the studied pregnant adolescent female **about iron deficiency anemia** was doctors. From the researcher's point of view, that's may because the majority of the pregnant adolescent females in this study maintained follow-up visits and followed physician instructions and orders to maintain a safe pregnancy.

The current study findings indicated that there were highly statistically significant differences between knowledge mean scores among the studied pregnant adolescent females regarding iron deficiency anemia pre/post dietary intervention-based short message service. This reflected the importance and positive effect of the dietary intervention-based short message service. This is related to the intervention's beneficial effects. This finding is supported by **the Abujilban et al., (2019)** study, which looked at how a planned health education program affected the compliance and knowledge of Jordanian pregnant women with anemia. They discovered that after the nursing intervention, pregnant women had higher knowledge scores about iron deficiency anemia management. These results were in line with those of a related study conducted by **El Sayed, (2019)**, who noted that all rural pregnant women knew different sources of iron-rich foods after the nursing intervention.

According to the researchers, this demonstrated the benefit of short message service-based educational instructions by showing that people knew more about the paracentesis process. The findings show a correlation between an increase in knowledge test scores and a solely SMS-based educational intervention. Studies employing SMS to train nurses and community health care workers in other poor nation contexts had similar encouraging findings, demonstrating the effectiveness of this affordable and widely accessible training technology (**Zurovac et al., 2019**).

According to **Abd-Alla (2020)** research, which corroborated this conclusion and reported that The in-service training program

had a positive impact on the nurses' knowledge and abilities.

Our findings confirmed and backed up this assertion, showing that the instructional guidelines based on SMS implementation for nurses working with patients having paracentesis had succeeded in achieving its goals by enhancing nursing interventions and lowering problems. Text messages sent via SMS have proven to be effective instruments for promoting self-care and a methodological strategy that patients can use to enhance their care. In this regard, text messages are not only cost-free but also enable provider-user engagement through various multimedia modalities, such as texts, audio, and photos (**Hassan, 2019**).

Regarding pregnant adolescent females' practice scores of iron deficiency anemia, the findings of the present study indicated that highly statistically significant differences were detected between mean scores regarding all practice items among the studied pregnant adolescent females regarding iron deficiency anemia pre/post dietary intervention-based short message service. This is reflected in the important role of the dietary intervention-based short message service in improving pregnant adolescent females' practice regarding iron deficiency anemia. The findings of **Abd ElHameed et al. (2022)**, who examined the impact of nutritional educational guidelines among pregnant women with iron deficiency anemia in rural areas of the Kalyobia governorate, support this conclusion.

Two randomized controlled trials, to compare appointment reminders via SMS with a control group that received no reminders, developed by **Taylor et al., (2019)**; and **Youssef et al., (2019)** show that SMS is effective. This finding was also supported by **Bigna et al., 2019**; and **Perron et al., (2019)** who confirmed that SMS appointment reminders were equally successful. Appointment reminders via SMS are useful, as evidenced by the difference in appointment attendance, which was not statistically significant.

Regarding pregnant adolescent females' practice level of iron deficiency anemia, the findings of the present study indicated that the majority of pregnant adolescent females had an inadequate level of practice pre-dietary

intervention-based short message service; meanwhile, the majority of them had an adequate level of practice post-dietary intervention based short message service. They discovered that pregnant adolescent females' knowledge and behavior related iron deficiency anemia can be improved by dietary intervention-based short message services. As well as **Nahrisah et al. (2019)**, who examined how integrated pictorial handbook education and counseling improved anemia status, knowledge, food intake, and iron tablet compliance among pregnant women in Indonesia who were anemic. They also showed improvements in the variety, weight (portion), and frequency of iron-rich food intake among pregnant women following the intervention.

Regarding pregnant adolescent females' Hb value, the findings of the present study indicated that one-fifth of pregnant adolescent females have a moderate level of anemia post-dietary intervention-based short message service compared to the majority of them pre-dietary intervention-based short message service. This result indicates a highly significant difference between the pre and post-dietary intervention-based short message service for measuring hemoglobin. This result shows a significant improvement and difference in hemoglobin levels between the first and second measurements taken before and after a short message service based on dietary intervention. This improvement explained how the intervention affected the study group's improved hemoglobin levels after the intervention. These results were consistent with a (**World Health Organization, 2020**) study that stated that "many pregnant women have low iron stores when they first become pregnant. Hemoglobin levels improved in the trial after the intervention.

This level changed from 88% mild and 12% moderate after using the health promotion guidelines. This finding is consistent with that of **Abdel-Ati et al. (2019)**, who assessed the effects of a health promotion directive based on health belief instructions on pregnant women in Egypt who were diagnosed with iron deficiency anemia and reported that hemoglobin levels were higher in the study group during the first and second assessments. As reported by **Maka et al.**

(**2019**), mild, moderate, and severe anemia were all reported to occur 28%, 54%, and 18% of the time, respectively. The majority of anemic women (84% of them) were from low socioeconomic backgrounds. Maternal problems affected 16% of the population. In unbooked and referred instances, a poor perinatal outcome was observed. The prevalence of anemia among pregnant women was 18.0%, according to **Grace Stephen et al., (2019)**, which is the polar opposite of the previous statement. Additionally, **Bekele et al. (2019)** stated that mild anemia was shown to be prevalent among pregnant women, followed by moderate anemia. These findings were also consistent with a study by **Irbihat et al. (2021)**, which examined the effects of education on hemoglobin levels in pregnant Indian women. They found that the intervention group's hemoglobin levels significantly improved compared to the non-intervention group.

The current study's findings showed that the study's pregnant adolescent female's total knowledge and total practice scores were correlated before and after the dietary intervention-based short message service, and mentioned that after the dietary intervention-based short message service, with a statistically significant positive association between the total knowledge scores and the total practice scores. This link can be explained by the fact that as knowledge has improved, so too have pregnant women's practices for managing iron deficiency anemia. This finding is supported by a study by **Hershko and Camaschella (2022)** that looked at how I treat unexplained refractory iron deficiency anemia and discovered a significant relationship between the subjects' practice and their knowledge of the management and prevention of iron deficiency anemia during pregnancy.

The findings of the present study revealed that there was a statistically significant relationship between the age, educational level, and residence of the pregnant adolescent female's knowledge and practices and their personal data pre and post-dietary intervention-based short message service. This finding may be explained by the fact that knowledge and practice among pregnant women are intertwined and

influenced by sociodemographic characteristics; from the researcher's perspective, there is a positive correlation between knowledge and practice. From the researchers' point of view, this is reflected that dietary intervention-based short message service met the pregnant adolescent female's needs and improved practice. The findings of the present study have supported the aim and hypothesis of the study and the knowledge and practice among the studied women have improved. From the researchers' point of view, this is reflected in the success of the pregnant adolescent females and its positive effects. Additionally, **Majeed et al. (2019)** reported that the level of iron deficiency anemia among pregnant women was not affected by the level of education and the job status of their study subjects who were in secondary school education and were housewives. This finding can be explained by the fact that educated pregnant adolescent females had access to more information that would be useful to them in acquiring more knowledge.

Conclusion:

Based on the current study's findings, it was determined that dietary intervention based on short message service intervention has positive effects on improving pregnant adolescent female's level of knowledge and practice. The investigated pregnant adolescent female's demographics, her level of knowledge, and her practices about iron deficiency anemia are statistically significantly correlated. Knowledge and practice of iron deficiency anemia among the pregnant adolescent female under study were positively correlated.

Recommendation:

Based on the findings of the present study, the following recommendations were suggested:

- Continuous training programs are recommended in various maternity healthcare settings to improve pregnant adolescent female's knowledge and practices which will reflect on their health and offspring's long-term health.
- Educational booklets should be provided about foods with a high concentration of iron to reduce iron deficiency

anemia among pregnant adolescent females.

- Pregnant women should get Educational booklets on managing and preventing iron deficiency anemia.
- - Teaching all expectant mothers at prenatal care clinics about good nutrition and how to change their eating habits.
- - Determining nutritional recommendations and methods for enhancing women's eating practices throughout pregnancy.
- Replication of the current study on a larger probability sample and other health care settings.

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