

## Pregnant Adolescent Females' Knowledge and Practice towards Iron Deficiency Anemia: Impact of Dietary Intervention-Based Short Message Service

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### Abstract

**Background:** Iron deficiency anemia is one of the most common nutritional deficiencies worldwide and affects approximately 41.8% of pregnant women globally. **Aim:** The aim of this study is to assess the impact of dietary intervention-based short message service on pregnant adolescent females' knowledge and practice towards iron deficiency anemia. **Design:** A quasi-experimental research design was used to achieve the aim of this study. **Settings:** This study was conducted at the Maternal and Child Health Care Center in Shebin El-Kom (Qibly and Bahari) and obstetric clinics in the university hospital. **Sample:** A purposive sample of 100 pregnant adolescent females. **Tools:** Two tools were used for data collection: a structured interview questionnaire, and the Reported Practices Checklist. **Results:** Results showed a highly statistically significant improvement concerning pregnant women's knowledge and practices regarding iron deficiency anemia after dietary intervention-based short message service compared to the pre-intervention phase ( $P \leq 0.001$ ). **Conclusion:** The dietary intervention-based short message service significantly improved knowledge and practices in pregnant adolescent females, demonstrating its effectiveness in addressing iron deficiency anemia. **Recommendations:** Implement dietary intervention-based short message service programs in healthcare settings to improve pregnant adolescent females' knowledge and practices related to iron deficiency anemia.

**Keywords:** Dietary intervention-based short message service, iron deficiency anemia, knowledge and practice of pregnant adolescent female.

### Introduction

Iron deficiency anemia (IDA) is one of the most common nutritional deficiencies worldwide, particularly affecting pregnant women due to the increased demand for iron during pregnancy. This condition not only poses significant health risks to the mother, such as fatigue, weakened immunity, and increased risk of infections, but also has severe implications for the fetus, including preterm delivery, low birth weight, and impaired cognitive and physical development. The prevalence of IDA is especially concerning among adolescent females, who may already be at a higher risk of nutritional deficiencies due to their growth and development needs (Rahman et al., 2021).

Adolescent pregnancies present unique challenges, as young mothers are still undergoing their own physical development while also supporting the growth of a fetus. Proper nutrition during pregnancy is critical for both maternal health and fetal development, yet many adolescent females may lack the knowledge and resources to meet their nutritional needs. The combination of

inadequate dietary intake and the physiological demands of pregnancy can exacerbate the risk of IDA in this vulnerable population, making it essential to address nutritional education and support for pregnant adolescents (Lao et al., 2022).

Education plays a crucial role in the prevention and management of iron deficiency anemia. Increasing awareness and knowledge about iron-rich foods, proper dietary practices, and the importance of iron supplementation can significantly improve the health outcomes for pregnant adolescents. However, traditional educational interventions may not be as effective for this age group, which often prefers more accessible and engaging methods of communication (Ali et al., 2021).

In the digital age, mobile health interventions have emerged as promising tools for delivering health education and promoting behavior change. Short message service (SMS)-based interventions are particularly effective in reaching a wide audience, offering a low-cost, accessible, and convenient way to provide continuous support and reminders. For pregnant adolescent females, who are often adept at using mobile technology, SMS-based

dietary interventions may offer a practical solution to enhance their knowledge and practices regarding iron deficiency (Cane et al., 2022).

While there is growing evidence supporting the effectiveness of health interventions in improving health outcomes, there is limited research specifically focused on the use of SMS-based dietary interventions for pregnant adolescents. Most existing studies have targeted adult populations or focused on other aspects of prenatal care. This gap in the literature underscores the need for targeted research to explore the impact of dietary interventions delivered via SMS on the knowledge and practices of pregnant adolescent females regarding iron deficiency anemia (Singh et al., 2022).

### **Significance of the study**

Iron deficiency during pregnancy is a widespread issue, significantly contributing to the development of anemia, which affects approximately 41.8% of pregnant women globally. However, the exact proportion of women who suffer from iron deficiency without manifesting anemia remains unclear. The development of anemia during pregnancy can be attributed to various factors, including insufficient knowledge about nutrition and low consumption of iron-rich foods. Effective health education and ongoing nursing care are essential in addressing this condition (Stevens et al., 2022).

With the advancement of technology, smartphone applications have become valuable tools in healthcare, providing patients with access to services and information. Research has demonstrated the positive impact of mobile apps on patient outcomes in clinical and healthcare settings. In Egypt, where anemia prevalence exceeds 40%, iron deficiency anemia remains a critical public health challenge (Seabra et al., 2021).

Technology, particularly through SMS and phone reminders, offers a promising solution to improve patient adherence to healthcare appointments. In clinics with high no-show rates, SMS has been identified as a cost-effective and practical method to enhance patient compliance (Chen et al., 2019; Leong, 2019). Recognizing the potential of educational interventions delivered through mobile technology, this study aims to assess the impact

of dietary intervention-based short message service on pregnant adolescent females' knowledge and practice towards iron deficiency anemia.

### **The aim of the study**

The aim of this study is to assess the impact of dietary intervention-based short message service on pregnant adolescent females' knowledge and practice towards iron deficiency anemia.

### **Research Hypotheses**

- The dietary intervention-based short message service is expected to significantly improve pregnant adolescent females' knowledge regarding iron deficiency anemia.
- The dietary intervention-based short message service is expected to significantly enhance pregnant adolescent females' practices related to the iron deficiency anemia.

### **Operational definition**

Dietary intervention-based short message service (SMS) refers to a structured and systematic approach used to deliver educational content and reminders about dietary practices via SMS to improve pregnant adolescent females' knowledge and practices regarding iron deficiency anemia. The SMS content includes information on iron-rich foods, healthy dietary habits, and reminders to encourage adherence to dietary recommendations. The intervention is measured through the frequency, timing, and content of the messages sent and its impact on participants' knowledge and practice outcomes, as assessed through pre- and post-intervention questionnaires and hemoglobin level assessments.

### **Method**

**Research Design:** This study utilized a quasi-experimental design to achieve its aim.

**Research settings:** This study was conducted at the Maternal and Child Health Care Center in Shebin El-Kom (Qibly and Bahari) and obstetric clinics in the university hospital.

**Sample:** The study involved a purposive sample of 100 pregnant adolescent females. Inclusion criteria were:

- Attendance at follow-up antenatal visits.
- Diagnosis of anemia during pregnancy with hemoglobin levels below 11 g/dL.
- Absence of any other medical disorders.

**Sample Size:** The sample size was determined using a G power analysis with a power level of 0.95 ( $\beta=1-0.95=0.05$ ) at an alpha significance level of 0.05, accounting for a large effect size.

#### Data Collection Tools

**Tool I: A structured interview questionnaire:** It was developed by researchers after reviewing relevant literature (World Health Organization, 2020). This tool was divided into three parts:

- **Part 1:** Demographic data, including residence, occupation, age, and educational level.
- **Part 2:** Obstetrical history, covering aspects such as abortion history, pregnancy stage, gestational age, and previous experience with anemia.
- **Part 3:** Knowledge assessment about iron deficiency anemia, including its meaning, including causes, symptoms, diagnostic tests, eating iron-rich foods, prevention, risk factors, sources of iron-rich foods, the importance of iron supplementation, enhancers and inhibitors of iron absorption, and control measures for iron supplementation side effects. Responses were scored as 1 for correct answers and 0 for incorrect answers, with total knowledge scores categorized as satisfactory (>60%) or unsatisfactory ( $\leq 60\%$ ).

**Tool II: Reported Practices Assessment Checklist:** This tool assessed pregnant adolescents' practices towards iron deficiency anemia. Questions covered proper dietary habits, such as consuming iron-rich foods, avoiding tea with meals, regular iron supplementation intake, administering iron supplementation, eating regular, frequent meals and using orange juice with iron supplements. Practices were scored as 1 for done practices and 0 for not done practices, with total scores categorized as adequate ( $\geq 60\%$ ) or inadequate ( $< 60\%$ ).

#### Validity and reliability

The content validity of the tools was evaluated by five experts in maternal and newborn health nursing and family and community health nursing. Their feedback led to rephrasing and canceling modifications to ensure clarity, completeness, and appropriateness. The reliability of the tools was measured using Cronbach's alpha coefficient, with results

showing high reliability: 0.994 for knowledge and 0.893 for practice.

#### Procedure for Data Collection

The study was conducted through three phases: preparatory, implementation, and evaluation.

##### A. Preparatory phase:

This phase involved the assessment of knowledge and practices related to iron deficiency anemia through interview questions and literature reviews. Based on the findings, the researchers developed educational materials in the form of a booklet, which was distributed in Arabic to all participating pregnant adolescent females. Administrative and ethical approvals were obtained from the Research and Ethics Committee at the Faculty of Nursing, Menoufia University. Permission to conduct the study was also secured by the directors of the MCH centers. Participants were informed about the study's objectives, assured of confidentiality, and given the option to withdraw at any time. A pilot study involving 10% of the sample (10 participants) was conducted to refine the tools and assess the feasibility of the research process.

##### B. Implementation phase:

Following approval, data collection commenced in October 2023 and continued through April 2024, taking place three days per week from 9:00 a.m. to 12:00 p.m. in the MCH centers (Quibly and Bahary). During the initial interview, the researcher introduced herself and explained the study's scope and objectives. Each participant completed a pre-test and post-test to assess their knowledge and reported practices towards iron deficiency anemia. Data collection was conducted through face-to-face interviews, each lasting approximately 20 minutes.

After the interviews, a dietary intervention-based short message service (SMS) was launched. The SMS program included sending voice messages, text messages, images, and videos twice daily for four weeks, with content tailored to the participants' needs. Topics covered in the SMS included the importance of iron-rich foods and iron supplementation. Participants were encouraged to respond to SMS queries or contact the researchers for further clarification.

The study's educational component consisted of three sessions: two theoretical and

one practical. The first session covered the definition of iron deficiency anemia, its prevalence, causes, and clinical manifestations. The second session addressed risk factors, sources of iron-rich foods, the importance of iron supplementation, and diagnostic tests for detecting iron deficiency anemia. The third session focused on prevention and management strategies, such as educating participants on consuming iron-rich foods, avoiding tea with meals, regularly taking iron supplements, using orange juice to enhance iron absorption, and understanding the role of enhancers and inhibitors in iron absorption, along with proper medication adherence and cooking habits.

### C. Evaluation phase:

Three months after the dietary intervention, a post-test was conducted to reassess the participants' knowledge and practices using the same tools as the pre-test.

### Statistical Analysis:

Data were analyzed using SPSS version 25. Statistical methods included frequency distribution, percentages, mean, standard deviation, Chi-square tests, and paired sample T-tests. A p-value of  $< 0.05$  was considered statistically significant.

### Results:

Table 1 shows the distribution of pregnant adolescent females in the study. It reveals that most pregnant adolescent females in the study are aged between 17 and 18 years, with a mean age of  $17.13 \pm 1.55$  years. Educationally, 45% of pregnant adolescent females in the study had attained secondary education and 40% had basic education, while 5% are illiterate and 15% had minimal literacy skills. Additionally, 75% of pregnant adolescent females in the study reside in rural areas, and 70% are predominantly housewives.

Table 2 shows the obstetrical history of the studied pregnant adolescent females. It reveals that 85% of the participants have not experienced an abortion, while 10% have had fewer than two abortions and 5% more than two. The distribution across pregnancy stages indicates that 45% of the participants are in the third trimester, with 25% in the first trimester and 30% in the second trimester. Regarding anemia, 40% of participants reported a history of anemia, suggesting a significant proportion with prior health concerns related to iron

deficiency. Gestational age distribution is balanced, with 50% in the 23–28-week range and 50% in the 13–18-week range, reflecting a typical spread across the pregnancy timeline.

Table 3 shows the data demonstrate a significant improvement in pregnant adolescent females' knowledge regarding iron deficiency anemia following a dietary intervention-based short message service. Prior to the intervention, knowledge levels were notably low, with only 16% to 42% of participants correctly identifying various aspects of IDA, such as its causes, symptoms, and prevention methods. After the intervention, there was a marked increase in knowledge, with percentages rising dramatically to 80% to 94% across all areas assessed, including the meaning, incidence, and diagnostic tests for IDA. The p-values for all comparisons were  $\leq 0.001$ , indicating that the observed improvements were statistically significant. This underscores the effectiveness of the dietary intervention-based short message service in enhancing awareness and understanding of IDA among pregnant adolescent females.

Figure 1 shows the comparison of the total knowledge category among the studied pregnant adolescent females regarding iron deficiency anemia pre/post dietary intervention-based short message service. It reveals that 93% of the participants had an unsatisfactory knowledge category before the intervention; however, 84% of them had a satisfactory knowledge category after the intervention.

Table 4 shows the comparison of reported practices among pregnant adolescent females regarding iron deficiency anemia before and after the dietary intervention-based short message service reveals substantial improvements. Before the intervention, practices such as eating iron-rich foods, avoiding tea with meals, and regular iron supplementation were significantly less common, with adherence rates ranging from 20% to 35%. Post-intervention, there were significant increases in these practices, with adherence rates rising from 70% to 85%. The chi-square test results show highly statistically significant differences ( $p \leq 0.001$ ) for all practices assessed, indicating the intervention's

effectiveness in promoting healthier behaviors. For instance, the proportion of participants who ate iron-rich foods increased from 35% to 70%, while those avoiding tea with meals rose from 20% to 80%.

Figure 2 shows the comparison of total practice categories among the studied pregnant adolescent female regarding iron deficiency anemia pre/post dietary intervention-based short message service. It reveals that 90% of the participants had an inadequate practice category before the intervention; however, 80% of them had an adequate practice category after the intervention.

Table 5 reveals the correlation analysis between the total knowledge and practice scores among pregnant adolescent females before and after the dietary intervention-based short message service. It reveals that prior to the intervention, the Pearson correlation coefficient was  $r = 0.476$  ( $p < 0.001$ ), indicating a moderate and statistically highly significant correlation between knowledge and practice scores. After the intervention, the correlation improved to  $r = 0.679$  ( $P < 0.001$ ), reflecting a strong and highly significant association.

**Table 1:** Pregnant Adolescent Female Distribution according to Their Data (n = 100)

Variables	Pregnant women (n=100)	
	No.	%
<b>Adolescent female's age in years</b>		
16 < 17	30	30
17 < 18	70	70
$\bar{x} \pm SD$	17.13 $\pm$ 1.55	
<b>Adolescent female's educational level</b>		
- Illiterate	5	5
-Read and write	15	15
-Basic education	40	40
-Secondary education	45	45
<b>Residence</b>		
-Rural	75	75
-Urban	25	25
<b>Occupation</b>		
Housewives	70	70

**Table 2:** The studied pregnant adolescent female distribution according to Their obstetrical history (n = 100)

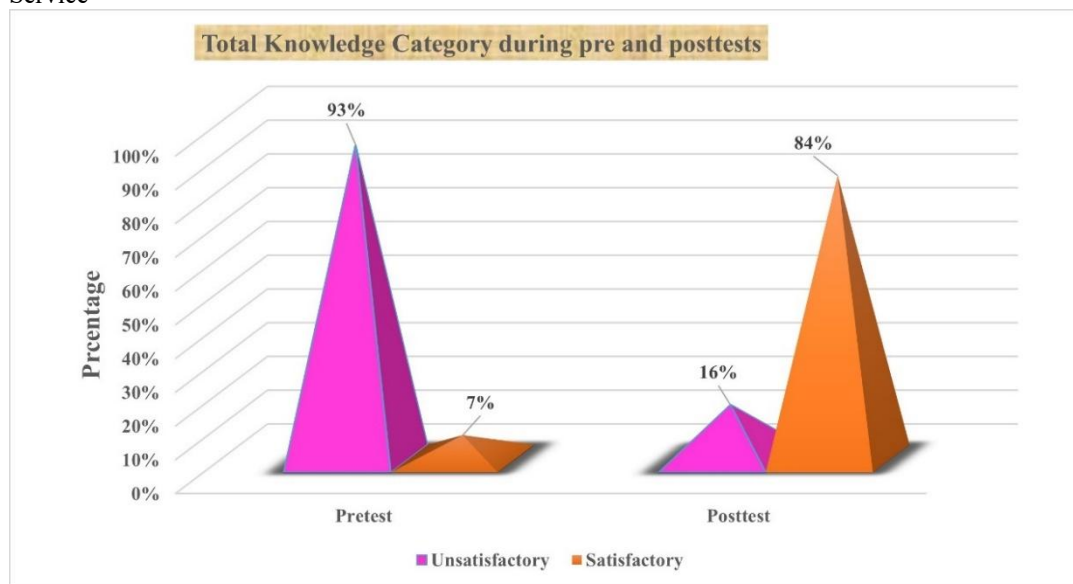
Variables	Pregnant women (n=100)	
	No.	%
<b>Abortion</b>		
Less than 2	10	10
More than 2	5	5
No abortion	85	85
<b>Pregnancy stage</b>		
First trimester	25	25
Second trimester	30	30
Third trimester	45	45
<b>Having anemia previously</b>		
Yes	40	40
No	60	60
<b>Gestational age in weeks</b>		
13-18	50	50
23-28	50	50

**Table (3):** Comparison of Knowledge Level Among the Studied Pregnant Adolescent Female Regarding Iron Deficiency Anemia Pre/Post Dietary Intervention Based Short Message Service (n = 100)

Variables	Pre-dietary intervention-based short message service		Post-dietary intervention-based short message service		X <sup>2</sup>	P value
	No.	%	No.	%		
<b>Meaning of IDA</b>					39.85**	≤0.001
Correct answer	20	20%	94	94%		
Incorrect answer	80	80%	6	6%		
<b>Incidence of IDA</b>					36.85**	≤0.001
Correct answer	30	30%	86	86%		
Incorrect answer	70	70%	14	14%		
<b>Causes of IDA</b>					17.43**	≤0.001
Correct answer	16	16%	82	82%		
Incorrect answer	84	84%	18	18%		
<b>Symptoms of IDA</b>					36.0**	≤0.001
Correct answer	32	32%	80	80%		
Incorrect answer	68	68%	20	20%		
<b>Diagnostic test of IDA</b>					52.17**	≤0.001
Correct answer	18	18%	92	92%		
Incorrect answer	82	82%	8	8%		
<b>Eating iron-rich foods</b>					29.26**	≤0.001
Correct answer	28	28%	86	86%		
Incorrect answer	72	72%	14	14%		
<b>Prevention of IDA</b>					29.26**	≤0.001
Correct answer	24	24%	90	90%		
Incorrect answer	76	76%	10	10%		
<b>Risk factors of IDA</b>					43.71**	≤0.001
Correct answer	36	36%	88	88%		
Incorrect answer	64	64%	12	12%		
<b>Sources of iron-rich foods</b>					30.13**	≤0.001
Correct answer	38	38%	88	88%		
Incorrect answer	62	62%	12	12%		
<b>The importance of iron supplementation</b>					37.34**	≤0.001
Correct answer	35	35%	86	86%		
Incorrect answer	65	65%	14	14%		
<b>Enhancers and inhibitors of iron absorption</b>					20.44**	≤0.001
Correct answer	42	42%	94	94%		
Incorrect answer	58	58%	6	6%		
<b>Control measures for iron supplementationside effects</b>					20.43**	≤0.001
Correct answer	15	30%	78	78%		
Incorrect answer	85	85%	22	22%		

\*\* Highly statistically significant difference (p≤0.001)

**Figure 1:** Comparison of Total Knowledge Category among the Studied Pregnant Adolescent Females Regarding Iron Deficiency Anemia Pre/Post Dietary Intervention Based Short Message Service

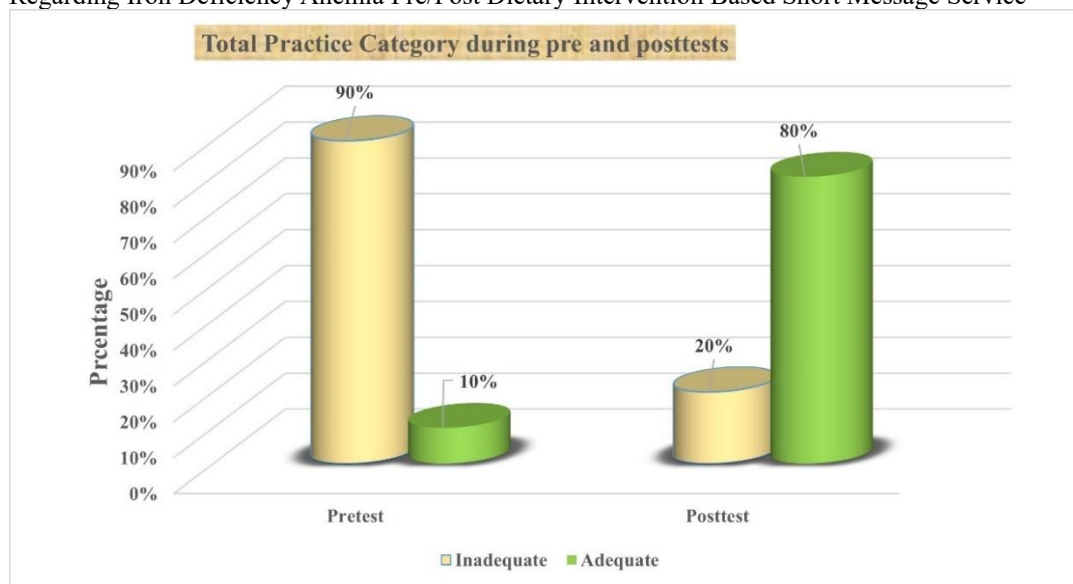


**Table (4):** Comparison of Reported Practice Level among the Studied Pregnant Adolescent Females Regarding Iron Deficiency Anemia Pre/Post Dietary Intervention Based Short Message Service (n = 100)

Variables	Pre-dietary intervention-based short message service		Post-dietary intervention-based short message service		X <sup>2</sup>	P value
	No.	%	No.	%		
<b>Eating iron-rich foods</b>					66.33**	≤0.001
Done	35	35	70	70		
Not done	65	65	30	30		
<b>Don't drink tea with meals</b>					77.22**	≤0.001
Done	20	20	80	80		
Not done	80	80	20	20		
<b>Regular use of iron supplementation</b>					67.44**	≤0.001
Done	25	25	85	85		
Not done	75	75	15	15		
<b>Administer iron supplementation</b>					49.42**	≤0.001
Done	30	30	85	85		
Not done	70	70	15	15		
<b>Eat regular, frequent meals</b>					63.55**	≤0.001
Done	40	40	82	82		
Not done	60	60	18	18		
<b>Use iron supplementation with fruit juice</b>					82.33**	≤0.001
Done	15	15	60	60		
Not done	85	85	40	40		

\*\* Highly statistically significant difference (p≤0.001)

**Figure 2:** Comparison of Total Practice Category among the Studied Pregnant Adolescent Females Regarding Iron Deficiency Anemia Pre/Post Dietary Intervention Based Short Message Service



**Table (5):** 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 = 100)

Variables	Total knowledge score			
	Pre-dietary intervention-based short message service		Post-dietary intervention-based short message service	
	r	P	r	P
<b>Total practice score</b>	0.476**	≤0.001	0.679**	≤0.001

\*\* Correlation is highly significant at the 0.001 level

**Discussion:**

Nutritional awareness is a critical factor influencing various health outcomes, including malnutrition and non-contagious infections. A lack of proper nutritional knowledge often leads to inappropriate practices, contributing to significant health issues. Anemia, a widespread condition, affects over two billion people globally. The World Health Organization (WHO) reports that fifty-eight percent of pregnant women in underdeveloped nations suffer from anemia, primarily due to iron deficiency. However, this condition can be prevented and managed effectively through proper education about iron deficiency anemia and adherence to recommended practices (Padmavathi and Hephzibah, 2020).

Iron deficiency anemia is a prevalent medical condition during pregnancy, especially in underdeveloped nations. It has significant

consequences for both the mother and the fetus. The incidence of IDA during pregnancy varies dramatically between countries, influenced by cultural differences, socioeconomic status, lifestyle, and health-seeking behaviors (Tanay et al., 2021). Anemia is a major public health issue that impacts both socioeconomic development and human health in both developing and industrialized nations, with young pregnant women being particularly vulnerable (Seyoum, 2019).

According to the results, over three-fifths of the participants were aged seventeen to eighteen years, with a mean age of seventeen years. More than two-fifths had secondary education, and three-quarters lived in rural areas. These findings align with the Palestinian Central Bureau of Statistics (2021), which reported similar age demographics among pregnant women in their study. Additionally, Farrag et al. (2020) noted that one-third of



participants in their study were below twenty-five years old, with the majority being unemployed and having completed secondary education. Conversely, Pundkar et al. (2019) found that most of their study participants were between twenty and twenty-five years old when investigating risk factors for anemia during pregnancy.

Regarding obstetric history, most of the pregnant adolescent females in this study had not experienced previous abortions, likely due to their young age. Repeat pregnancies are a known risk factor for developing IDA in subsequent pregnancies, as noted by Malhotra et al. (2019). The current study also revealed that the primary source of knowledge about IDA among the participants was doctors, likely because most of the participants maintained regular follow-up visits and adhered to physician recommendations to ensure a safe pregnancy.

The findings of the current study revealed that the primary source of knowledge about iron deficiency anemia among the pregnant adolescent females was their doctors. This is likely because most of the participants regularly attended follow-up visits and adhered to their physicians' guidance to ensure a healthy pregnancy. The study also found highly statistically significant differences in knowledge scores related to iron deficiency anemia among the participants before and after the dietary intervention-based short message service. This underscores the importance and effectiveness of the SMS-based dietary intervention in enhancing knowledge.

Similar results were reported by Abujilban et al. (2019), who observed that a structured health education program significantly improved the knowledge and compliance of Jordanian pregnant women with anemia. Likewise, El Sayed (2019) found that rural pregnant women became well-informed about iron-rich food sources following a nursing intervention. These findings emphasize the value of SMS-based educational interventions, which have proven effective in increasing knowledge and understanding of specific health practices, such as the paracentesis process.

Further supporting this, studies by Zurovac et al. (2019) demonstrated the success of SMS-based training programs in low-

resource settings, showing their potential as a cost-effective and accessible training tool for nurses and community health workers. Similarly, Abd-Alla (2020) reported positive outcomes from in-service training programs, noting improvements in nurses' knowledge and skills, which align with the current study's findings. These results affirm the efficacy of SMS-based educational guidelines, particularly in enhancing nursing interventions and reducing complications.

SMS technology, offering a mix of text, audio, and visual content, has been shown to be a powerful tool for promoting self-care and facilitating patient-provider interaction (Hassan, 2019). In terms of practice, the present study found highly significant improvements in practice scores related to iron deficiency anemia among the pregnant adolescent females after the SMS-based dietary intervention. This highlights the crucial role of such interventions in improving health practices.

The findings align with those of Abd-El Hameed et al. (2022), who studied the impact of nutritional educational guidelines on pregnant women with iron deficiency anemia in rural areas of Kalyobia governorate. Additionally, randomized controlled trials by Taylor et al. (2019) and Youssef et al. (2019) compared the effectiveness of SMS appointment reminders against a control group that received no reminders, confirming the usefulness of SMS in improving appointment attendance. This conclusion was further supported by Bigna et al. (2019) and Perron et al. (2019), who also found SMS appointment reminders to be effective, as evidenced by improved attendance rates despite no statistically significant differences being observed.

The findings of the current study indicate that, prior to the dietary intervention-based short message service (SMS), most pregnant adolescent females had inadequate practices regarding iron deficiency anemia. However, after the post-intervention, most participants exhibited adequate practices. This suggests that the SMS-based dietary intervention significantly enhanced the participants' knowledge and behaviors related to iron deficiency anemia.

Similarly, Nahrisah et al. (2019) found that integrating pictorial handbook education and counseling improved anemia status, knowledge, food intake, and iron tablet adherence among pregnant women in Indonesia. Their study also noted improvements in the variety, portion, and frequency of iron-rich food consumption following the intervention.

### Conclusion:

Based on the findings of the current research, it can be concluded that the implementation of a dietary intervention-based short message service significantly improved pregnant adolescent females' knowledge about iron deficiency anemia. This supports the first research hypothesis. Furthermore, the study demonstrated that the SMS intervention led to a significant enhancement in the participants' practices related to the prevention and management of iron deficiency anemia, which supports the second research hypothesis. Overall, the study underscores the effectiveness of the SMS intervention in improving knowledge and practices related to iron deficiency anemia in pregnant adolescent females.

### Recommendations:

Based on the findings of the study on pregnant adolescent females' knowledge and practice of iron deficiency and the impact of dietary intervention-based short message service, the following recommendations are proposed:

- Implement and scale up dietary intervention-based SMS programs in various healthcare settings to enhance the knowledge and practices of pregnant adolescent females regarding iron deficiency anemia.
- Develop and distribute targeted educational materials via SMS that focus on iron-rich foods, dietary practices, and management strategies for iron deficiency anemia.
- Incorporate SMS-based dietary interventions into regular prenatal care protocols to ensure continuous education and support for pregnant adolescent females.
- Regularly assess the effectiveness of SMS content and tailor it to meet the specific needs and preferences of different populations of pregnant adolescent females.
- Increase awareness about the benefits of SMS-based interventions among healthcare

providers and pregnant adolescents to foster widespread adoption and engagement.

- Perform additional research with larger sample sizes and diverse populations to further evaluate the effectiveness of SMS-based interventions and refine strategies for improving iron deficiency anemia management among pregnant adolescents.

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