The Use of Mobile-phone Applications to Improve the Compliance of Pregnant Women to Take Iron Tablets: A Systematic Review

Arlina Dewi (arlinadewi@umy.ac.id)  
Universitas Muhammadiyah Yogyakarta

Anggit Wirasto  
Universitas Harapan Bangsa

Trisna Setya Dewi  
Universitas Muhammadiyah Yogyakarta

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Abstract

Background

Iron deficiency is the most common etiology of anemia in pregnancy. Consistent supplementation improves IFAS (Iron Folic Acid Supplementation) compliance. This study aimed to give an overview regarding mobile phone utilization to improve pregnant women's compliance to take iron supplementation.

Method

This study is a systematic review that was performed by collecting and reviewing the relevant article. The search was performed using Google Scholar, PubMed, and Scopus databases. The articles involved were determined by following criteria such as, randomized controlled trial design, involving pregnant women as the object, and measuring pregnant women's compliance after receiving the intervention.

Results

This study involved 7 articles published from 2014 to 2022. All the studies showed that reminders using mobile applications such as text messaging, mobile phone calls, and mHealth apps have a positive impact on improving pregnant women's compliance to take iron supplementation. Pregnant women who received a reminder have higher compliance for taking iron supplementation regularly than pregnant women who do not receive a reminder.

Conclusion

The usage of the mobile phone as a reminder has a positive impact in improving pregnant women's compliance to take iron supplementation regularly.

1. Background

Anemia is a condition when the haemoglobin level is not enough to sustain what the body requires, as it is lower than the normal value. Anemia is a global public health issue affecting young children and pregnant women in particular. Anemia is classified into three levels consist of mild, moderate, and serve. In pregnant women, the range of a mild level is 100–109 g/l, a moderate level is 70–99 g/l, and a serve level is lower than 70 g/l (1). WHO estimated that the global prevalence of anemia among children under five was 42%, and pregnant women were 40% (2).

Some studies found that the most common cause of anemia during pregnancy was iron deficiency (2–4). Oral iron supplements are often the first line of defence in the treatment of mild anemia (5). The prenatal nutrition care system should prioritize the enhanced utilization of essential nutrients such as iron, minerals, and high-biological-value vitamins. Additionally, interventions aimed at reducing the prevalence and severity of anemia in pregnant women should be emphasized (3). Sufficient iron supplementation can significantly improve IDA
Iron Deficiency Anemia) (6). In order to ensure the health of women and their unborn children, healthcare facilities and providers should increase their education and promotion of IFA supplementation (7).

The use of the supplement consistently will lead to improve IFAS (Iron Folic Acid Supplementation) compliance, which will contribute to reduce the incidence of anemia among pregnant women. A reduction in the number of pregnant women who suffer from anemia is one step toward achieving better maternal and infant health outcomes across the nation (8). The lack of knowledge of iron supplementations and forgetfulness were associated with poor pregnant women's adherence to take iron tablets (9, 10). Another study also found that lack of iron supplements compliance among pregnant women was influenced by perceived of the side-effects and awareness of iron supplements (11).

The suggested strategies to improve compliance among pregnant women regarding IFAS (Iron Folic Acid Supplementation) consumption was maintaining and enhancing health education(12). The adoption of a health information package program as part of a comprehensive national strategy for preventing anemia during pregnancy is something policymakers should consider doing (13). Some studies found that one of the effective ways to provide health education and self-management intervention for behavioral health change was mobile phone application utilization (14–17). There is a significant difference between pregnant women's knowledge and behavior before and after receiving a smartphone-based health behavioral intervention to address iron deficiency anemia. The post-intervention hemoglobin level was also significantly higher than the pre-intervention level (18). This study aimed to give an overview regarding mobile phone utilization to improve pregnant women's compliance to take iron supplementation.

2. Method and design

2.1. Study Design

This study used a systematic review to estimate the benefits of a mobile phone utilization to increase pregnant women's compliance to take iron supplementation. This study performed by collecting the articles that systematically relevant to mobile phone usage for improving pregnant women's compliance to take iron supplementation.

2.2. Research Procedure

The search was performed using Google Scholar, PubMed, and Scopus database. This study used a PRISMA flowchart to illustrate the steps of study selection (Fig. 1). The researchers independently screened the article by identifying the abstract based on the following criteria:

2.3. Study Design and Research's object

The study designs included randomized control trials with the pregnant women as the research's object.

2.3.1. Intervention

Using a mobile phone intervention as a strategy to improve pregnant women's compliance to take iron tablets

2.3.2. Outcome
Measuring improvement of iron supplementation compliance among pregnant women who receives reminder through mobile phone utilization.

3. Results
Table 1
Characteristics of The Included Studies

<table>
<thead>
<tr>
<th>Authors, Year</th>
<th>Study Design</th>
<th>Intervention Received</th>
<th>Control Group Received</th>
<th>Outcome</th>
<th>Result</th>
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<tbody>
<tr>
<td>Rahman, et al. 2022 (19)</td>
<td>Randomized controlled trial</td>
<td>Education video provided through WhatsApp, followed by weekly reminder.</td>
<td>Education given by nurses with antenatal book to assist.</td>
<td>Hemoglobin level was the major outcome, whereas knowledge level on anemia in pregnancy and attitude toward iron supplementation were supplementary outcomes.</td>
<td>The &quot;MyPinkMom&quot; program was found to have a positive impact on various factors related to anemia in pregnancy. Specifically, participants demonstrated an increase in hemoglobin levels (mean = 10.75, SD = 0.48), iron intake (mean = 20.55, SD = 5.12), awareness of anemia in pregnancy (mean = 26.41, SD = 2.17), and attitude score (mean = 6.44, SD = 0.69) following their involvement in the program.</td>
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<td>Authors, Year</td>
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<td>Sontakke, et al. 2022 (20)</td>
<td>Randomized controlled trial</td>
<td>Standard therapy followed by mobile phone call reminders.</td>
<td>Standard therapy alone.</td>
<td>Improved compliance of iron supplementation pregnant women using mobile phone call reminders.</td>
<td>The intervention group demonstrated a greater degree of adherence to iron supplementation as compared to the group that did not receive the intervention. The results of the study indicate that there was a significant increase in the mean hemoglobin concentration (0.96 gm/dl) in the study group as compared to the control group (0.59 gm/dl), with a p-value of less than 0.00001.</td>
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<tr>
<td>Elsharkawy, et al. 2021(21)</td>
<td>Randomized controlled trial</td>
<td>The Information Package Program (HIPP) is a health education initiative that utilizes the WhatsApp platform to deliver follow-up educational health messages and reminders.</td>
<td>Standard antenatal care entails regular monitoring of vital signs, such as blood pressure and heart rate, as well as conducting assessments of weight, blood and urine samples, and physical examinations.</td>
<td>Enhancing awareness regarding anemia, adherence to iron supplementation, and hemoglobin levels among pregnant women diagnosed with anemia.</td>
<td>The study findings indicate a significant statistical difference (p 0.001) in the proportion of individuals who consistently consumed their IFA supplements between the intervention group (90.8%) and the control group (66.4%).</td>
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<tr>
<td>Authors, Year</td>
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<tr>
<td>Singh, et al. 2020 (22)</td>
<td>Randomized controlled trial</td>
<td>Monitoring and supervision through mobile phone text messaging</td>
<td></td>
<td>The utilization of female community health volunteers for capacity building and text messaging interventions directed towards expectant mothers could potentially enhance gestational weights and hemoglobin levels in pregnant women.</td>
<td>Hemoglobin levels improve with FCHV capacity enhancement and mobile text messaging for expecting mothers. Hemoglobin levels were significantly different in pregnant women with different education levels. Higher-educated people had a mean (SD) hemoglobin level of 11.89 mg/dl (0.90 mg/dl) compared to 11.16 (1.02 mg/dl) in the control group. Its p-value was 0.012.</td>
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<tr>
<td>Ainscough, et al. 2019 (23)</td>
<td>Randomized controlled trial</td>
<td>The impact of the PEARs behavioural lifestyle intervention, which is complemented by a smartphone application, on maternal dietary intake, including iron supplementation.</td>
<td>Conventional care that lacks dietary guidance.</td>
<td>Improving dietary intakes (include iron tablets) on maternal through PEARs behavioural lifestyle supported by a smartphone app.</td>
<td>The utilization of a smartphone application to support a behavioural-lifestyle intervention during pregnancy resulted in enhancements in dietary intakes, physical activity, and motivation to participate in exercise. The utilization of a smartphone application to support a behavioural-lifestyle intervention during pregnancy resulted in improved dietary intakes.</td>
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<td>Choudhury, A., and Choudhury, M. 2022 (24)</td>
<td>Randomized controlled trial</td>
<td>Maternal care through mHealth app</td>
<td>Maternal care through traditional intervention (verbally)</td>
<td>Using mHealth application called “Mobile for Mothers” as tool to improve maternal health awareness and maternal behavioral change (include iron tablet consumption)</td>
<td>The intervention group exhibited a significant increase in the consumption of iron tablets (P = 0.001), with the number of participants consuming iron tablets rising from 193 out of 288 at starting point to 612 out of 663 at the completion.</td>
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<tr>
<td>Khorshid, et al. 2014 (25)</td>
<td>Randomized controlled trial</td>
<td>Received 100 iron tablets followed by three reminders and four educational health messages for every weeks during 12 weeks</td>
<td>Received 100 iron tablets and information how to use it properly</td>
<td>Improving iron supplementation compliance among pregnant women using SMS utilization</td>
<td>The intervention group exhibited a significantly higher compliance rate for iron supplements (94%) compared to the control group (66%), as evidenced by a statistically significant result (P = 0.003).</td>
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</table>

This systematic review involved 7 studies with Randomized Controlled Trial study design, and pregnant women as the object. Based on the result, all of the studies showed that reminder using mobile phone application for iron tablet supplementation were have positive impact among pregnant women. The studies compared between pregnant women who receives reminder and pregnant women who does not. Pregnant women who receive reminder has higher compliance for taking iron tablet regularly than pregnant women who does not receive reminder. Some of the studies measuring the hemoglobin level for knowing the compliance, and the others measuring the daily iron intake. Based on the studies which have been reviewed there are several methods for reminding pregnant women to take iron supplementation using mobile phone application such as:

### 3.1. Text Messaging

Majority of the studies used text messaging for reminding the pregnant women to take iron tablet regularly (19, 21, 22, 25). Some studies was implementing the intervention for improving maternal and child health through the application and followed by text messaging for supporting the application as reminder to take iron supplementation (19, 22) and the others studies was implementing text messaging as reminder along with health education (21, 25).

### 3.2. Phone call
One of the studies used phone call reminders for reminding pregnant women to take iron supplementation. This study used the standard therapy for pregnant women followed by phone call reminders (20).

### 3.3. mHealth Application

Another studies implemented the mHealth Application for improving pregnant women behavioural lifestyle and awareness which included the reminder feature to remind pregnant women to take iron supplementation as a part of behavioural lifestyle and awareness (23, 24).

In addition to improve the compliance of iron supplementation, mobile phone application also assisted to improve the awareness, knowledge and behavioural lifestyle among pregnant women (19, 21, 23, 24).

### 4. Discussion

The compliance among pregnant women to take iron supplementation caused by various factors such as forgetfulness, educational status, experiencing health problem, knowledge and exposure to information (26). In order to increase the compliance of pregnant women to take iron supplementation, it is essential to create a better communication for counselling and changing their behavior before and during antenatal care (27). Providing the education with telephone assistance made a positive impact in improving pregnant women’s knowledge regarding anemia. Periodically throughout pregnancy, nurses should check in with their pregnant patients to see how well they understand anemia and taking their iron folate supplements, and continue to educate and empower their patients as necessary (28).

As the forgetfulness is the common reason for non-compliance behavior, important for pregnant women to keep their iron tablets in a place that is easy to get to, and the support from family to remind the pregnant women (26, 27). The effectiveness of utilizing a smartphone application to monitor the adherence of pregnant women to iron supplementation has been demonstrated. This can serve as a prompt for women to remember to take their dietary supplements (29). Mobile phone call reminders along with standard therapy proved led to a larger rise in hemoglobin among pregnant women with iron deficiency anemia (20) it also proved that mobile phone assistance can improve the compliance of pregnant women to take iron supplementation. Moreover, text message reminders can also improve patient medical compliance. There are several benefits of using text message assistance as it's a common part of people’s daily life, such as low cost budget, easily personalized, sent directly to individuals, and automatically (30).

Pregnancy monitoring assisted by mHealth application and health education through online media can improve self-literacy, health literacy, and perceived control of pregnant women (31). Due to the fact that most of pregnant women use a mobile phone application to know their pregnancy information such as fetal development, physical activity, track of the body change, and another evidence-based information (32). It makes mobile phone application is potential to provide health information among pregnant women (24, 25). The intensity of the features in mobile phone application where the pregnant women received the reminders can assist pregnant women to fulfill their needs during pregnancy (33). The information provide through mobile phone can be able to access repeatedly, it makes easier for pregnant women to access the information all the times they need it (34). The mobile phone application for pregnancy suggested can be able to cover a comprehensive common mobile phone communication such as messaging application, social media.
networking, email, etc (35). Another study revealed that reminders and providing the information through a mobile application such as mHealth was acceptable for assisting health intervention and more cost effective (36, 37).

Mobile phone apps and text messaging proved could assist for self-management medication, and cope with the barriers to compliance in medication such as forgetfulness. For the integration of mHealth technology to be successful in patient self-management and to increase medication adherence, it will be essential to integrate the opinions and engagement of medical providers and pharmacists (38). The use of mobile apps could help to ensure that patients will not forget to take their medication or give it incorrectly dose, which ultimately improves patient safety (39). The health project monitoring system can be set up fast if assisted by the mobile-based reporting system. Managers can improve the program's efficiency as the system gives a real-time information during the program's implementation. The mobile-based solution is urgently needed and would help advance maternal health as a Sustainable Development Goal (SDG) (40).

5. Conclusion

The usage of mobile phone as reminder has positive impact in improving pregnant women's compliance to take iron supplementation. The utilization of various modes of mobile phone reminders, including text messages, phone calls, and health applications, can aid pregnant women in adhering to a regular iron supplementation regimen. In addition to enhancing compliance with iron supplementation, various studies have demonstrated its potential to enhance knowledge, awareness, and behavioral lifestyle. The stakeholders could consider the use of mobile phone as reminder in healthcare facilities to assist self-monitoring for pregnant women for improving maternal health.

Abbreviations

IFAS : Iron Folic Acid Supplementation
IDA : Iron Deficiency Anemia
SDG : Sustainable Development Goal

Declarations

- Ethics approval and consent to participate
  Not Applicable
- Consent for publication
  Not Applicable
- Availability of data and materials
The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

- Competing interests

The authors declare that we have no competing interests

- Funding

The authors did not receive any funding

- Authors' contributions

AD contributed to designed the research, reviewed the literature, extracted the data and wrote the manuscript. AW contributed to database search, reviewed the literature and extracted the data. TSD contributed to database search and extracted the data.

- Acknowledgment

Not applicable

References


21. Elsharkawy NB, Abdelaziz EM, Ouda MM, Oraby FA. Effectiveness of Health Information Package Program on Knowledge and Compliance among Pregnant Women with Anemia: A Randomized Controlled Trial.


Figures
Figure 1

The Systematic Review Process using PRISMA Flowchart