

effect of mobile control application

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Research Article

Effect of Mobile Control Application on the Compliance of Ferrum Tablets Consumption Among Pregnant Women

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Abstract

Background and Objective: Majority of the causes of the Maternal Mortality Rate (MMR) was bleeding due to anemia in pregnancy. Iron supplementation programmes are one of the strategies to battle Anemia. The purpose of this study was to assess the effect of mobile control application on the compliance of ferrum tablets consumption among pregnant women. **Materials and Methods:** A pre post intervention has been conducted to analyze the effect of mobile control application on the compliance of ferrum tablet consumption among pregnant women. 86 pregnant women at the first and second trimester were enrolled. They were given 90 tablets oral iron and instructed to consume one tablet daily. The compliance before intervention was measured as a pre test using a questionnaire. Application of iron reminder was installed on the mobile phone of the participants, their family and midwives who take care of them. The post test of compliance was conducted after 30 days of iron together the using of mobile control application. Data were analyzed using descriptive and inferential statistic. **Results:** The results showed that majority of participants had a low compliance of ferrum tablet consumption (33.7%) and it was increased to 72.1% after the intervention. There was an effect of mobile application program on the compliance of ferrum tablet consumption ($t = -3.183, p = .002$). **Conclusion:** The introduction of mobile control application can improve the compliance of ferrum tablet consumption among pregnant women in Kaduhejo Banten Indonesia.

Key words: Anemia, pregnant women, ferrum tablet, mobile application, ferrum tablet

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Maternal mortality (MMR) in Banten is still high. Banten Provincial Health Office reported that Banten is the top five national position as the region with the highest MMR. Majority of the causes of the MMR was bleeding due to anemia in pregnancy¹. Anemia is a common problem for pregnant women. Anaemia has adverse consequences including fatigue, decreased work capacity and poor pregnancy outcomes such as preterm birth, low birth weight and increased risk of maternal death during both delivery and the postpartum period².

Anaemia has multi factorial causes involving complex interaction between nutrition, infectious diseases and this complexity presents a challenge to effectively address the population determinants of anaemia³. Although not all anaemia is a consequence of iron deficiency, iron deficiency is the major cause in the developing country including Indonesia⁴. A study found that the common cause of anaemia among pregnant women is iron deficiency². In addition, there is an evidence suggest that up to 90% of maternal anemia may be contributable to in adequate consumption of oral iron⁵. Furthermore, noncompliance to the ferrum tablets is one of the most important challenging factors in the fight against anaemia⁶.

Routine Fe supplementation in pregnancy is a common practice to prevent iron deficiency and anaemia⁷. A study found that compliance on iron supplements among pregnant women was positively related to Hemoglobin concentrations⁸. Furthermore, perceived health benefits from consume the supplements and higher knowledge of health program were associated with higher pill consumption, while experiencing side-effects and disliking the taste of the supplements were associated with lower pill consumption⁸.

To battle iron deficiency and anaemia, a study in Senegal has implemented iron supplementation programmes for pregnant women, but most community based programmes have not been shown to be effective⁹. Studies conducted in South-East Asia, Latin America and in only a few African countries have shown that the main reasons why these programmes have been less effective is low compliance of taking daily iron supplements⁷. Furthermore, it is also found that there is a low compliance on taking iron supplementation (55%) among pregnant women in Indonesia⁷.

Compliance with iron/folic acid supplementation in Senegal can be increased by providing women with clear instructions about tablet intake and educating them on the health benefits of the tablets⁷. A direct observer to monitor the administration of oral iron supplementation among pregnant

women is helps to improve compliance⁵. In addition, it is also found that women who received free tablets did have a significantly higher compliance than women who received prescriptions⁷.

Some factors which related to high compliance of iron were perceived health benefits from taking the supplements and high level of knowledge while factors related to low compliance were negative side-effects and disliking the taste of the supplements⁸. In addition, another study found that forgetfulness was factor related to low compliance⁶. Compliance was positively related to Hb concentrations⁸.

Some intervention studies have been conducted to improve compliance to medication such as mobile control application¹⁰. However, these studies did not include family member and health care worker as the user of mobile in supporting patients to obey medication. It seems that there is a need to conduct a study to identify the effect of Mobile Control Application on the Compliance of Ferrum Tablets Consumption among Pregnant Women in Indonesia. This study would be effective in improving the iron status of pregnant women by mobile application which is not explored before in Indonesia.

MATERIALS AND METHODS

The study was conducted from September, 22nd 2017-September, 26th 2017. Within the Indonesia, Banten Province was selected as the study site due to the high prevalence of maternal mortality rate due to intrapartum bleeding¹. Within Banten, Pandeglang regency was selected due to the high prevalence of anaemia among pregnant women (37,1%)¹. Within Pandeglang, there are 36 districts. Kaduhejo district was selected randomly as the study site. The population in this study was pregnant women in the work area of Kaduhejo Health Centre. 86 pregnant women were selected as the sample purposively with the inclusion criteria, first or second trimester of pregnancy, single pregnancy, communicable and able to use mobile phone application. They were given 90 tablets of oral iron and instructed to consume it one tablet daily. The compliance before intervention was measured using a questionnaire that has been developed by the researcher after thirty days of ferrum tablet consumption. The application was installed on the mobile phone of pregnant women, their family and also the midwife who take care of pregnant women. Both midwife and pregnant women's family could monitor the iron consumption of pregnant women by mobile phone. The post test of compliance was conducted after 30 days of ferrum tablet consumption together the using of mobile control application.

Mobile control application was used as the intervention. This application was created using Php programming language for applications via Web (browser) and Java programming language for mobile applications (android and iPhone). The database used is: MySql. The application is stored using cloud server technology with ip public that has been forwarded with domain name that is: Pedulianemia.com.

Designing graphic interventions development process was explained as follows.

Designing graphic interventions

Development process: This web application makes pregnant women, family and midwife easier to see the track and report in or taking iron supplements. Pregnant women used the Mobile Application to input data in consuming iron supplements. They can input data easily and also remember when to take the iron supplement, because the second method is providing reminder fixture of taking iron supplements. In addition, not only the pregnant women will be reminded by the application but also their family and midwife who take care of them

The graphic design principles: In order for the implementation this mobile application to run properly should note is as follows:

- Accurate means that data in input and report results should be appropriate
- User friendly means that the application must be easy to be used by the user
- Up to date means the data received by the Health Centre coordinator is highly integrated
- Network means the application is always connected by the Internet network

Graphics integration with application mobile: After the preparation of the application mobile development is completed a pilot study in Banten was conducted. The results of using this mobile application were:

- Pregnant women are obedient in taking iron supplements
- Husbands and family reminded pregnant women on taking iron actively
- Pregnant women can also know the level of protein consumption contained in food

Data were collected using a questionnaire which has been developed by the researcher. It has been tested for

validity and reliability as the cronbach alpha = 0.86. The questionnaire consists of ten items which related to compliance of ferum tablet consumption. There are eight positive items which direct to obedient and two negative items which direct to not obey. One point was delivered if the subjects agree with the positive statement and zero was delivered if the subjects disagree to the positive item and oppositely for negative items. Subjects were advised to join the study for more than 60 days. They were also advised to use mobile application and administered ferum tablet. Data were recorded in two set of time which was pre intervention after 30 days consumption of ferrum tablet and post intervention after 30 days consumption of ferrum tablet and using mobile control application. Univariat and bivariat analysis were performed. As the data were distributed normally, a paired sample t-test was used to analyze the mean difference of compliance to ferrum tablet consumption before and after intervention.

Data analysis: Data were analyzed using descriptive and inferential statistics. Descriptive statistics were used to analyze demographic data including age, ethnic and family income. Dependent t-test was used to analyze the mean difference of compliance before and after intervention. The assumption of normality and homogeneity of variance of the variables have been conducted before determine the appropriate statistical analysis.

RESULTS

Demographic data: Based on Table 1, it can be concluded that majority of the respondents were sunda ethnic (89.5%) and have the low family income (76.7%). The age of respondents were ranged in 16-40 and the mean of age of respondent was 28.9.

Frequency distribution of compliance of ferum tablet consumption: Table 2 shows that majority of the respondents

Table 1: Demographic data

Characteristics	n	Percentage
Age		
Mean = 28.9, SD = 4.306		
Min-Max = 16-40		
Ethnic		
Jawa	7	8.1
Sunda	77	89.5
Batak	1	1.2
Others	1	1.2
Family income		
Low	66	76.7
High	20	23.3

Table 2: Compliance of ferrum tablet consumption

Compliances	Pre test		Post test	
	n	Percentage	n	Percentage
Not compliant	57	66.3	24	27.9
Compliant	29	33.7	62	72.1
Total	86	100	86	100

Table 3: Mean difference pre and post test of the compliance of ferrum tablet consumption

	M	SD	95% Confidence Interval of the difference		t	p
			Lower	Upper		
Pre test	6.17	2.613	0.371	1.606	-3.183	0.002
Post test	7.16	1.728				

(66.3%) have not compliant of ferrum tablet consumption before the intervention. In addition, the respondents have compliant of ferrum tablet consumption after the intervention (72.1%). It can be concluded that number of participants who compliant to ferrum tablet consumption was increased after the intervention.

The effect of mobile application program on the compliance of ferrum tablet consumption: Table 3 shows the comparisons of mean scores of pre test and post test. It can be concluded that the mean scores of compliance before the intervention was 6.17 (SD = 2.613). It was increased after the intervention to 7.16 (SD = 1.728). There was a statistically significance difference between pre test and post test mean scores on the compliance of ferrum tablet consumption $t = -3.183, p = 0.002$. It can be concluded that there was an effect of mobile application control on enhancing the compliance of ferrum tablet consumption among pregnant women.

DISCUSSION

Anaemia prevention programme is recently strengthened by the Ministry of Health of Indonesia. Pregnant women can get iron tablets free of cost at all health centres through distribution by these workers. In spite of these efforts anaemia still stands as a major problem among pregnant women. Compliance to iron is an important factor determining anaemia status of pregnant women.

In this study, 33.7% participants were found compliant to ferrum tablet which is comparable to 61.7% in an Indian⁶. In another study in Senegal compliance to Iron pills found was 69%⁷. It can be concluded that Indonesian has a lower compliance to iron supplementation compare to other countries.

Family income was a factor related to ferrum tablet consumption compliance. A study revealed that women who

received free iron/folic acid tablets during the prenatal visit had significantly higher compliance than women who received a prescription⁷. Some barriers may prevent or delay pregnant women from complying, one of which is financial: a significant proportion (21%) of pregnant women who had the low compliance indicated that they could not purchase their iron prescriptions⁷. This study showed that majority of participants (66.7%) had low level of family income. It can be assumed that family income may be related to the low compliance to ferrum tablet consumption. However, further analysis of this assumption has not been done.

This present study showed that there was an effect of mobile control application program on the compliance of ferrum tablet consumption among pregnant women. Although the similar interventions have not been conducted previously, some studies showed that other reminder strategies has effectively contributed to improve compliance to ferrum tablet consumption. A randomized control trial has showed that Using SMS (Short Message Service) reminders was an efficient way of improving compliance with iron supplementation among pregnant women¹¹. However, this study did not conclude that better compliance could improve anemia in pregnancy. In addition, a pilot study in a low income country, India showed that the using of automated voice calls has improved adherence to iron supplements during pregnancy¹².

Mobile phone reminder has been used to improve adherence in other cases. A mobile phone text reminders sent to health workers' personal mobile phones improved the adherence to malaria treatments in Kenya¹³. It showed not only a short-term effect of the intervention but also a long-term improvement 6 months afterwards. Furthermore, a study in Northern Nigeria found that a using of mobile phone decision support application was effective to improve the quality of antenatal care services provided by health care workers¹⁰.

Mobile graphic reminder is part of an application that reminds a patient about the need to follow the routine of taking medicine. A mobile reminder application helps patients to follow the routine of taking medication of tuberculosis in Africa¹⁴. A meta analysis has been conducted to assess the effect of mobile phone intervention on glycaemic control in diabetes self-management¹⁵. It found that mobile phone intervention was effective to improve glycaemic control and self-management in diabetes care, especially for Type 2 diabetes patients¹⁵. Although many studies have shown the effect of mobile phone application to medication adherence, but only this present study included the family member and health care worker as the user to monitor adherence of the patient. It can be concluded that this present study has some benefits such improve medication adherence, improve family support and improve health care worker support to pregnant women.

The global spread of mobile phones has improve broad aspirations regarding the potential role of technology in improving health. We do not agree that using mobile application control should replace a traditional package of case-management interventions such as in-service training, supervision and dissemination of guidelines and job aids. Our intervention provided large and sustained improvements in the quality of care given to pregnant women. Therefore, we recommend that mobile application control should be used to improve compliance to ferrum tablet consumption among pregnant women. As an effective intervention strategy to improve adherence with oral iron supplementation in pregnancy, government and policy makers need to look to the research community for evidence based recommendations on how to proceed with this intervention on improving health. Mobile control application is recommended as an automatic reminder because it has a low cost and is easy to be used.

CONCLUSION AND RECOMMENDATIONS

The study evaluated that there are mask effect on iron supplementation compliance among pregnant women in Indonesia to 72.1% after mobile control application and majority of patients showed positive response. **Compliance of pregnant women with iron supplementation can be greatly improved by** providing mobile application control.

It is recommended for the government and policy makers to pay attention on the mobile application control as an intervention on improving adherence with medication. This evidence should be socialized to the health care workers and pregnant women. Limitations of this study are that there was no control group and no further analysis of characteristic

respondents in relation to compliance. Furthermore, the clinical outcomes of the participants have not been analyzed. This study recommends to further study to analyze the compliance by giving the similar intervention using a control group and explore potential longer-term effects on client health outcomes.

SIGNIFICANCE STATEMENTS

The study evaluated that there are mask effect on iron supplementation compliance among pregnant women in Indonesia to 72.1% after mobile control application and majority of patients showed positive response. **Compliance of pregnant women with iron supplementation can be greatly improved by** providing mobile application control. The study appraises the effects of mobile app in raising the status of iron supplementation compliance in pregnant women and positive response is taken out of the survey. This study would be effective in improving the iron status of pregnant women by mobile app which is not explored before in Indonesia.

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