The Effect of SMS Gateway Intervention on Increasing Knowledge in Pregnant Women with Anaemia

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ABSTRACT

***Background**: Anemia in pregnancy is one of the indirect causes of the high maternal mortality rate (MMR) in Indonesia. To prevent and overcome anemia in pregnancy, an Iron supplement tablets program (IST) is carried out. However, this Programme has yet to show tangible results. One of the challenges is a low mother's compliance to consuming IST due to a lack of knowledge. Today, Short Messaging Service (SMS) appears to be an alternative to health promotion media. **Objective**: This study aims to determine the effect of SMS gateway on the level of knowledge about IST consumption among pregnant women with anemia. **Methods**: This study is a double-blind experimental research with a Randomized Controlled Trial (RCT) design. We took anemic pregnant women at seven health centers in Makassar City who met the inclusion criteria with a total sample of 68 people (35 control and 33 intervention). **Results**: There was a significant difference in the mean value of pre-test and post-test knowledge levels in the intervention group that received SMS gateway (p-value = 0.047). However, there is no significant difference in the mean value of pre-test and post-test knowledge between the control and intervention groups (p-value = 0.215). **Conclusion**: There is an effect of SMS gateway on the knowledge levels regarding IST consumption among pregnant women with anemia.*

***Keywords**: Anemia, Iron Supplement Tablets (IST), Knowledge, Pregnant women, SMS gateway*

INTRODUCTION

The maternal mortality rate (MMR) in South Sulawesi in 2018 was 139 people, which increased in 2019 to 144 people. According to the Indonesian Ministry of Health, the most common cause of maternal death in South Sulawesi in 2019 was bleeding, which is indirectly caused by anemia in pregnancy (The Ministry of Health of Indonesia, 2020b). Globally, anemia is a health problem experienced by 36.8% of pregnant women worldwide, half of which is due to a lack of iron (Karami et al., 2022). Anemia in pregnancy significantly affects maternal and fetal mortality and morbidity. Pregnant women who suffer from anemia increase the risk of maternal death by 3.7 times higher when compared to mothers with anemia (The Ministry of Health of Indonesia, 2018). The results of the Basic Health Survey or in Indonesia *Riset Kesehatan Dasar (*2018) stated that 48.9% of pregnant women in Indonesia experienced anemia (The Ministry of Health of Indonesia, 2020). Meanwhile, the number of pregnant women suffered from anemia in Makassar City increased from 2.189 cases in 2018 to 2.223 cases in 2019 (City Health Office of Makassar, 2020).

The government has made a significant effort to prevent and overcome anemia in pregnancy by providing iron supplement tablets (IST) (The Ministry of Health of Indonesia, 2021a). the IST program still needs to overcome challenges such as mothers' lack of compliance in consuming IST, namely unfavorable attitudes and actions, knowledge, and side effects caused by the IST (Mardhiah and Marlina, 2019). In addition, to support the IST program, Indonesia has made several efforts to overcome anemia in pregnancy by

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involving husbands, families and the environment of pregnant women (Triharini, 2019). The knowledge level is essential to underlie changes in a person's behavior. Recently, health promotion has used many media such as TV, posters, leaflets, and booklets. Short Message Service (SMS) is one of the alternative media technologies that offers several advantages, namely, low cost and quick delivery; therefore, it will be easier for pregnant women to get information about IST without visiting a health facility (Tasya and Yani, 2019). During the Covid-19 pandemic, the government advised pregnant women to communicate by contacting midwives or health workers via telephone, SMS, social media or chat applications if they have questions (The Ministry of Health of Indonesia, 2020a).

This study aimed to assess the effect of providing information through the SMS gateway method in increasing the knowledge level of pregnant women about anemia.

METHODS

This study was a double-blind, randomized controlled trial (RCT) design. The study was conducted from January 2021 to April 2021 in Makassar City at seven health centers: Pampang, Dahlia, Cendrawasih, Makkasau, Tarakan, Rappokalling, and Kassi-Kassi.

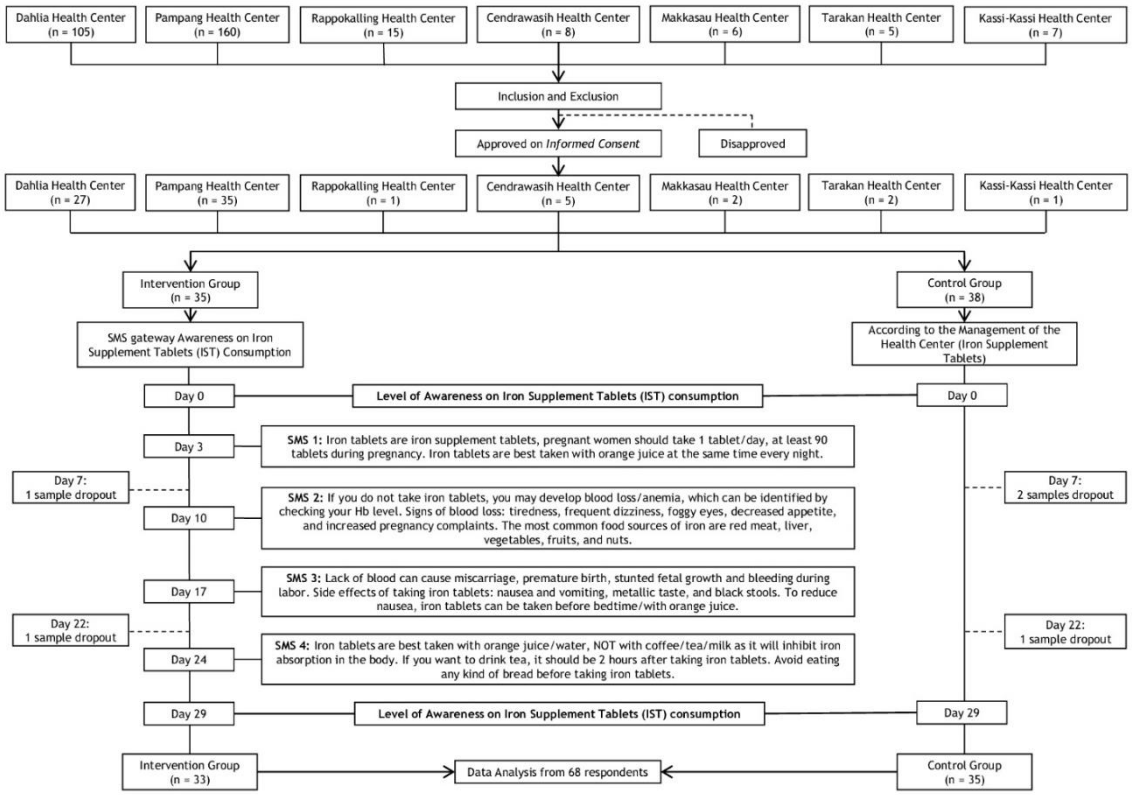

Figure 1. Research Flowchart

We obtained 73 pregnant women that met the inclusion criteria. The inclusion criteria in this study were pregnant women with anemia at <32 weeks of gestation who received IST from the health centers, pregnant women who had mobile phones, could communicate well and were willing to participate in the study. Samples were excluded if she could not read or operate a cell phone. During the study, there were five dropout samples. Therefore, the final sample size was 68 people (35 samples from the control group and 33 samples from the intervention group). Research assistant 1 assigned samples to the control or intervention group by simple randomization methods. We use SMS software by Gili-SMS®. Gili-SMS was installed to the computer first, then connected to the modem (Wardono, 2020). After that it could be used to send

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SMS to many numbers at once. We use Gili SMS for the broadcasting function, making it easy to send SMS to many respondent numbers because SMS can be set to be sent at one time. Gili SMS can also send long SMS with a limit of 1,600 characters so that the information we send is not truncated when it reaches the respondent. We obtained questionnaire from previous research regarding knowledge and attitude on IST in pregnant women (Verrayanti, 2018) and the text was customized to be as SMS information. SMS sent using the Gili SMS software from computer to mobile phone are received exactly the same as what was sent from the computer and are immediately received in the same minute, there is no difference in time from sending the message from the laptop to delivered at the recipient's number. SMS gateway delivery was carried out by research assistant 2, who was blinded from the participant group, the assistant was only tasked to send the SMS and ensure whether the respondents received and read the SMS.

Questionnaire

The questionnaire consisted of 20 multiple-choice questions with five answer options to assess the respondents' knowledge of IST consumption. Questions in the questionnaire included what respondents knew about IST, whom it was given to, how to consume it, what its benefits are, what side effects can arise when consuming IST and how to deal with them, and what foods contain much iron to consume besides IST (Verrayanti, 2018). If the respondents choose the correct answer, they will get 5 points; the total score is 100 for all the correct answers. We delivered the questionnaire via a Google Form. Respondents could answer the questionnaire independently or with help from an enumerator over the phone. All respondents completed the questionnaire on day 0 as a pre-test and on day 29 as a post-test.

Data Analysis

Data analysis used in this study was the Statistical Package for the Social Sciences (SPSS) version 25 application, using univariate analysis to determine the baseline characteristics of respondents. We calculated a relationship between variables using Paired T-Test within groups and Independent T-Test between groups.

Research ethics

This research received Ethical Feasibility on January 7th, 2021, from the Health Research Ethics Commission (KEPK) of Alauddin Islamic State University with letter No.E.039a/KEPK/FKIK/I/2021.

RESULTS AND DISCUSSION

The total number of respondents were 68 pregnant women and the spouse, with most of the respondents in this study aged 26-35 years old (45.6%) and in the second trimester of their pregnancy (69,1%). Both respondents and their spouses graduated from senior high school, 52.9% for the mother and 58.8% for the husband. Although 82.4% of the respondents were housewives, their spouses were employed with a total monthly household income of IDR 1.000.000 to IDR 3.000.000 (51.5%). Finally, about 33.8% of the respondents received less support from their husbands.

Table 1. Characteristics of respondents

Characteristics	Group				P value[1]
	Control		Intervention		
	n	%	n	%	
Mother's Age (Years)					
17 – 25	12	34.3	16	48.5	
26 – 35	18	51.4	13	39.4	1.43
36 – 45	5	14.3	4	12.1	
Mother's Education					
No Education	0	0	1	3	
Elementary Graduate	5	14.3	9	27.3	
Junior School Graduate	4	11.4	2	6.1	3.68
Senior High School Graduate	19	54.3	17	51.5	
Bachelor's Degree	7	20	4	12.1	
Husband's Education					
No Education	0	0	1	3	2.54
Elementary Graduate	7	20	6	18.2	

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Junior School Graduate	4	11.4	3	9.1	
Senior High School Graduate	19	54.3	21	63.6	
Bachelor's Degree	5	14.3	2	6.1	
Mother's Occupation					
Working	6	17.1	6	18.2	0.01
Not working	29	82.9	27	81.8	
Husband's Occupation					
Working	34	97.1	32	97	0.002
Not working	1	2.9	1	3	
Monthly Income					
< IDR 1,000,000	9	25.7	11	33.3	
IDR 1,000,000 – IDR 3.000.000	19	54.3	16	48.5	0.47
> IDR 3,000,000	7	20	6	18.2	
Length of Pregnancy					
Trimester I	5	14.3	11	33.3	
Trimester II	28	80	19	57.6	4.11
Trimester III	2	5.7	3	9.1	
Parity					
0 (Nulliparous)	10	28.6	11	33.1	
1 (Primiparous)	11	31.4	6	18.2	2.49
2 – 5 (Multiparous)	14	40	15	45.5	
>5 (Grandemultipara)	0	0	1	3	
Antenatal Care Frequency					
1	13	37.1	14	42.4	
2	7	20	9	27.3	2.15
3	9	25.7	4	12.1	
≥4	6	17.1	6	18.2	
Hb Levels					
10.0 – 10.9 gr/dL	19	54.3	16	48.5	
7.0 – 9.9 gr/dL	16	45.7	17	51.5	0.22
< 7 gr/dL	0	0	0	0	
Husband's Support					
Good	10	28.6	6	18.2	
Fair	14	40	15	45.5	1.02
Less	11	31.4	12	36.4	

[1]*Chi-square test*

Table 2. Pre-test and Post-test Knowledge Level in Control and Intervention Groups

Group	Pre-test Knowledge (Mean ± SD)	Post-test Knowledge (Mean ± SD)	*P value*[1]
Control	61.86 ± 15.72	62.29 ± 13.89	0.87
Intervention	52.73 ± 15.96	57.42 ± 17.46	0.05*

[1]*Paired t-test*

We found differences in pre and post-test scores, the level of knowledge was slightly higher in the intervention group (p value = 0.05) (Table 2). However, in Table 3 t there was no significant difference between the control and intervention groups level of knowledge (p value = 0.22). In Table 3 it can be seen that there was no difference in consumption of iron tablets in the two groups (p value = 0.89).

Table 3. Pre-test and Post-test Knowledge Level and IST Consumption between Control and Intervention Groups

Variables	Group		*P value*[1]
	Control (Mean ± SD)	Intervention (Mean ± SD)	
Level of knowledge	0.43 ± 14.92	4.70 ± 13.04	0.22
Iron intake consumption	24.03 ± 12.86	24.45 ± 11.55	0.89

[1]*Independent t-test*

Discussion

Our study found an increase in knowledge regarding IST in the

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intervention group which was not shown in the control group. Nevertheless, the consumption of IST was similar between groups. SMS media provided convenience in providing knowledge about IST consumption to pregnant women; this method was more practical, did not require an internet connection, low cost, was more efficient in time and effort, without reducing the quality of the material and health education to be delivered, and can be done quickly and continuously (Balci and Kadioglu, 2019; Nursalam, Dewi and Widhiastuti, 2020). Kodama et al. (2021) found that participants were satisfied with the messages sent because they contained useful and easy-to-understand information for pregnant women. Participants also got the convenience of being able to access information easily at any time because it was on their cell phones (Kodama et al., 2021).

SMS gateway intervention was found to significantly increase the level of knowledge on IST. Previous studies confirmed the effectiveness of this method for various things, such as increasing pregnancy knowledge and compliance on IST by sending SMS every day for two weeks (Candradewi et al., 2021), increasing husbands' knowledge about vasectomy by SMS sent twice a month (Tasya and Yani, 2019), increasing antenatal care compliance and the ability to early detection of danger signs in pregnant women (Coleman et al., 2020; Jones et al., 2020; Ummah, Kostania and Rosalinna, 2020), increasing knowledge and antenatal care visits for pregnant women after being given education via SMS (Kamalah and Harlinah, 2021), increasing knowledge about sexual and reproductive health in adolescents and lasting even after three months post-intervention (Ujang and Sutan, 2018) and increasing patient compliance with hypertension treatment significantly. They found that participants were satisfied with the information in the message and it influenced them to follow a healthy lifestyle (Nursalam, Dewi and Widhiastuti, 2020). A once a week text message can improve proper breastfeeding practices because the information can be trusted with easy and flexible access (Jiang et al., 2018).

Knowledge is an internal factor that influences the formation of a behavior. Knowledge that underlies a behavior will cause the behavior to last longer. A person's behavior will have an impact on his health status (Notoatmodjo, 2018). Knowledge plays an important role in determining complete behavior because knowledge will form beliefs which then, in perceiving reality, provide a basis for decision-making and determine behavior toward certain objects so that it will influence a person's behavior (Aviantika and Rapingah, 2021). Several factors might influence knowledge such as age, education, environment, experience, socio-culture, and economic status (Budiman and Riyanto, 2015; Ummah, Kostania and Rosalinna, 2020). We have assessed those factors representatively by questioning age, education level, family income, husband's support, and the parity. Most of our respondents were 27 years old. Study reported that a person's mindset and capacity will develop with age and the age between 27-35 years was considered a well-received informant (Budiman and Riyanto, 2015; Galaupa and Supriani, 2019). The majority of respondents and spouse had a high school diploma. The higher the level of someone's education, the easier it is to receive information resulting in richer knowledge. On the other hand, less education will hinder one's development of newly introduced things (Budiman and Riyanto, 2015; Ummah, Kostania and Rosalinna, 2020). There was found a significant relationship between education level and level of knowledge and study found that the higher a person's education, the more knowledge he has (Ningsih, Triana and Maimunah, 2021; Damayanti and Sofyan, 2022). We assumed that high school graduate background level of education might probably affect their ability to analyze and apply information they received. The majority of respondents had income in the range of Rp1,000,000 - Rp3,000,000. This amount of income is included in a low socioeconomic group because it has not yet reached the minimum wage, so this can be one of the factors that affect their ability to apply or implement information. Economic status is one of the factors that can affect someone's knowledge, because it determines whether a person can get facilities to support certain activities that can increase their knowledge (Budiman and

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Riyanto, 2015). Moreover, one's knowledge can also be influenced by experiences, both directly and indirectly, for example pregnancy events. Experience can be related to parity as stated in Kusumastuti's (2018) research that mothers with 0 parity or nulliparous who are pregnant for the first time do not have experience in pregnancy which can affect respondents' knowledge about high risks in pregnancy (Kusumastuti, 2018). Both groups in this study had a majority of 2-5 parities (48.4%) which indicates that respondents are already aware of IST consumption from previous pregnancy experiences. Support from husband and family as the closest environment to pregnant women plays an important role in influencing the psychology and motivation of mothers in carrying out health behaviors. With good support, the mother will pay attention to the health of herself and her fetus, one of which is by increasing knowledge about maintaining health during pregnancy (Ummah, Kostania and Rosalinna, 2020). These factors may affect their ability to analyze and apply the information they receive so that it can affect their knowledge and change the way they maintain health during pregnancy, one of which is by taking IST.

As mentioned above, SMS provides several advantages compares to other information tools such as cost effective since SMS does not require an internet connection, SMS can also reach areas with poor signal, so that everyone can get information even if they live in a place with poor signal. These SMS's characteristics are suitable for our respondents that mostly live with low economic status.

Although SMS have many strengths to deliver health information, we cannot deny that today we have other alternative media that more popular than SMS. Nowadays, people are already using smartphones, and one of the most widely used message media is WhatsApp. Through the WhatsApp group, the learning process is more enthusiastic because there are more interactive discussions, especially for some users who have low self-confidence if they have to discuss face-to-face (Handayani and Milie, 2020; Sulistianingsih and Hasyim, 2021; Arisani and Wahyuni, 2023). Similarly with WhatsApp, Facebook is the most used social media by women, followed by Instagram and TikTok. All this tools are equipped with photos and videos which bring them to be more interactive and interesting (Skouteris and Savaglio, 2021; Artikasari, Susilawati and Mayang Sari, 2022; Nurcandrani et al., 2022).

The reason why there were no significant differences in the level of knowledge between the control and intervention groups could be caused by the number of media to get information easily nowadays, variations in individual characteristics of respondents, and the lack of respondents' awareness regarding the importance of IST consumption. The control group who did not receive the SMS intervention could also increase their knowledge about IST because they received information from health workers during ANC visits.

Some previous studies that used SMS as a medium for health interventions conducted informed consent directly to create a social relationship between researchers and respondents (Herlina, 2018; Salsabila, Utami and Nugraheni, 2018; Tasya and Yani, 2019). This could not be carried out in this study because it was conducted during the Covid-19 pandemic.

CONCLUSION

This study concluded that there was a significant increase in knowledge in the intervention group given an SMS gateway containing information about iron supplement tablets (IST), but there was no significant difference in the difference between the scores of the control group and the intervention group.

This study provided evidence that SMS gateway can be an alternative media for knowledge education to prevent or overcome the incidence of anemia in pregnancy. Future researchers should conduct research with a larger sample size, and conduct direct interaction to build bonds and more intense follow-up with research respondents.

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