

The Effect of Smart Monitoring System on Attitudes and Adherences of Consuming Iron Supplement Tablets in Pregnant Women

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ABSTRACT

Anemia is a condition of hemoglobin or red blood cells below 7gr/dl. The government's efforts to encourage pregnant women to consume 90 Fe tablets during pregnancy have not achieved national coverage due to the absence of a monitoring and evaluation program that is direct to low attitudes and adherence. Therefore, it is necessary to design an effective strategy with a smart monitoring system to observe the attitudes and adherence of pregnant women in consuming Fe tablets. The study aimed to determine the effect of a smart monitoring system on attitudes and adherence to the consumption of iron supplement tablets in pregnant women in the work area of Puskesmas Klego 1. The type of research adopted quantitative with the pre-experimental method using the one-group pre-test and post-test design research design. The sampling used a total sampling technique with 50 respondents. Data analysis utilized paired T-test and Wilcoxon test to determine the effect of a smart monitoring system on attitudes and adherence. The analysis of the Paired T-Test presented p value = 2.61 ($p = 2.61 > 0.05$). It indicated no effect of the smart monitoring system on attitudes. The results of the Wilcoxon test analysis obtained a p-value = 0.000 ($p = 0.00 < 0.05$). There are differences in the effect of using the smart monitoring system on the attitudes of pregnant women in the work area of Puskesmas Klego 1. Recommendations for further research are to enhance the application features.

Keywords: *Anemia, Attitude, Adherence, Iron tablet, Smart monitoring system*

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1. INTRODUCTION

Anemia is a nutritional disease that is frequently discovered in the world. Around 1.62 million (25%) of the population have experienced anemia, and commonly encountered during pregnancy. The World Health Organization (WHO) estimated that 40% of pregnant women experienced anemia. There were approximately 370 million women in developing countries suffering from iron deficiency of anemia, including pregnant women (WHO, 2018)

Anemia is defined as a decrease in the hemoglobin concentration in the blood (Reticulocyte Blood Cell) in delivering oxygen to peripheral tissues (Means, 2019).

The World Health Organization (WHO) stated that the worldwide prevalence rate of Anemia

was 41.8%. In pregnant women, it occurred around 35% - 75%, an average of 56%, and about 18% in developing countries.

Meanwhile, the 2013 Riskesdas data was 37.15% in Indonesia. The 2018 Riskesdas data reached 48.9%. Therefore, it concluded that over the past five (5) years, the anemia problem in pregnant women has increased by 11.8%. According to Riskesdas 2018, Indonesia had 48.9% of pregnant women experience Anemia, and 84.6% ensue in the 15-24 years age group (Ministry of Health RI, 2018).

Meanwhile, in Central Java in 2015, the prevalence rate of Anemia for pregnant women was 57.1%. In 2018, It was 11.5% in Surakarta and 22.2% in the Klego area of Boyolali. The coverage of iron supplement tablets was only 86.8 % (Health Department of Boyolali 2020).

The anemia incidence in pregnant women has several initiating factors. One of the triggering factors is the inadequate consumption of iron tablets. The low awareness of pregnant women also caused the consumption of iron tablets (RI Ministry of Health, 2018). According to (Putri, 2019), women's attitudes during pregnancy significantly generated anemia. In addition, pregnant women's attitude and adherence to consuming iron supplements in Indonesia. There was a limited understanding of side effects, iron absorption, foods, and drugs that interfere with iron absorption. Consequently, media or efforts are required to acclimate a program to monitor pregnant women's attitudes and adherence to consuming iron tablets.

To encourage the success of the research, it is crucial to create an effective educational information communication (IEC) strategy with the rapid development of digital technology in the modern era, the increasing use of smartphones, and the internet in Indonesia (Krismawati, 2022). According to Manik (2021), it is necessary to develop an application model that could be used to observe pregnant women consuming Fe tablets regularly. Then, the Smart Monitoring System Application was made to deliver *notifications* (reminders) of consuming Fe tablets and providing Digital Health Education. It enhances awareness as an encouragement and motivation for pregnant women to drink Fe tablets in the expectancy that they could comply with consuming these Fe tablets during pregnancy. Efforts to improve the attitude and adherence of pregnant women used *mobile-based applications*.

Based on the results of a preliminary study from 30 November to 3 December 2022 at the Puskesmas Klego 1, the interview result with two (2) midwives stated that many pregnant women in their area experienced anemia. In addition, the researchers also obtained ten (10) pregnant women who checked their pregnancies. The results of the ten (10) pregnant women interviews obtained one pregnant woman regularly consumed iron tablets in the third trimester to fulfill hemoglobin (Hb) during labor. While the nine (9) pregnant women in the first and second trimesters did not consume Iron supplement tablets routinely for various reasons such as forgetfulness and no one reminded them, they tended to be terrified of side effects such as nausea or dizziness, supposing healthy (they did not need to take iron tablets), and limited knowledge and information about did not consuming iron tablets consequence. In addition, the results data of manual monitoring in the MCH handbook for pregnant women presented that they left iron tablets routinely in the first and second trimesters. Researchers obtained several pregnant women with chronic energy deficiency (KEK).

The study aimed to determine the effect of the Smart Monitoring System on Attitudes and Adherence of Pregnant women birth number consuming Iron Supplement Tablets in the work area of Puskesmas Klego 1.

2. METHOD

The type of research was quantitative with pre-experimental methods and one group pre-test and post-test design. The sampling used a total sampling technique of 50 respondents. Data analysis utilized paired T-test and Wilcoxon test to determine the effect of Smart Monitoring Systems on attitudes and adherence. Data was collected through an attitudes questionnaire and the quantity of adherence monitoring. Research has been declared ethical with number 1081/UKH.L.02/EC/II/2023.

3. RESULTS AND DISCUSSIONS

The obtained results in this study were:

Table 1. Frequency distribution of respondents based on the pregnant women's age

Description	Mean	Median	Sd
Women age	27.24	26.00	5.247

Based on Table 1, the average age of the respondents in the treatment group was 27.24 years with a 5.247 standard deviation. Age affects one's comprehension and mindset. The older you get, the more developed your comprehension and perspective. Hence, the knowledge achieved is getting better.

Research conducted by (Sjahriani & Faridah, 2019) stated that pregnant women's age affects the incidence of Anemia, but does not affect attitudes and adherence to consuming iron tablets. It was in line with research conducted by (Shofiana, 2018) that older pregnant women do not necessarily have a high tablet consumption rate, and vice versa, younger mothers do not necessarily have a low consumption rate.

Respondents in this study were aged >20 years and above 39 years. According to (Central Statistics Agency, 2022), the majority of mothers in Indonesia were 20-35 years old (73.32%). Older pregnant women do not necessarily have a high iron supplement consumption rate. Conversely, younger pregnant women also do not necessarily have a low iron tablet consumption rate. Therefore, the study inferred that the pregnant women's ages did not affect their attitude and adherence to iron supplement consumption. The results were in line (Gebremichael, 2020) that adherence to consuming iron tablets was unrelated to age.

Table 2. Respondents' Frequency distribution based on gestational age

Description	Mean	Median	Sd
Gestational Age	26.04	26.00	7.205

Based on Table 2. the average gestational age of respondents in the treatment group was 26.04 years with a standard deviation.

Table 3. Respondents' frequency distribution based on Parity

Total Parity	Frequency	Percentage
Once	21	42%
Twice	21	42%
Three Times	8	16%

Based on table 4. The parity or the number of respondent's pregnancies in the treatment group with once pregnancy was 21 people (42.0%), twice pregnancies were 21 people (42.0%), and three times pregnancies were 8 people (16.0%).

Parity is the number of live births by a woman. According to research (Afsari, 2021), Parity > 3 was a factor for anemia. Mother's parity or pregnancy experience underlies the formation of perceptions about iron tablets because the mothers who provide delivery for the second time already comprehend and understand the importance of iron tablets. Mothers with twice parity or more will have different perceptions from mothers with once parity (Azes, 2018).

The researchers assumed that pregnant women with twice parity or more comprehended the side effects and that parity was one of the factors for anemia. Pregnant women with high parity will be steadier and more compliant in taking iron tablets because they have more understanding and experience. Thus, the attitude and adherence of pregnant women is better. It was in line with research (Azes, 2018) that revealed a significant relationship between maternal parity and adherence with iron supplement consumption.

Table 4. Respondents' frequency distribution based on education

Education levels	Frequency	Percentage
Elementary School	5	10%
Junior High School	8	16%
Senior High School	30	60%
Academy/ University	7	14%

Based on Table 4, the education of respondents in the treatment group presented an elementary education level of 5 people (10.0%), junior high school level of 8 people (16.0%), high school level of 30 people (60.0%), and academic or university of 7 people (14.0%). So, most of the respondents graduated from high school.

Education is an activity or learning process to develop or enhance particular abilities so that educational objectives could stand independently (Notoatmodjo, 2012). In this study, respondents with higher education tended to have better attitudes and adherence than mothers with lower education. They tended to have less attitude and adherence in terms of comprehension and understanding as well as technological stuttering. Hence, it concluded that education related to the mothers' attitudes and adherence to consuming iron tablets.

The research was also confirmed by (Edison, 2019) who stated that the level of education can affect the incidence of anemia in pregnant women. In addition, according to (Kusmaryati, 2022), education influenced the adherence factor to the consumption of iron supplement tablets, pregnant women who had upper secondary education 3-4 times had good adherence to consuming iron supplements compared to those who did not have upper secondary education.

Table 5. Respondents' frequency distribution based on information sources

Type of Information Source	Frequency	Percentage
Tool Media	1	2%
Electronic Media	2	4%
Health Officer	47	94%

Based on Table 8, the information sources that respondents received with media instruments were one (1) person (2.0%), electronic media with two (2) people (4.0%), and health workers with 47 people (94.0%). Therefore, the results indicated that the prevalence of pregnant women respondents understand information from health workers such as midwives and cadres.

Table 6. The respondents' frequency distribution based on the amount of information

Total Information	Frequency	Percentage
Once	13	26%
Twice	7	14%
Three Times or more	30	60%

Based on Table 9, the number of information that respondents obtained once with 13 people (26.0%), twice with seven (7) people (14.0%), and three times or more people with 40 people (60.0%).

Adherence refers to the individual behavior commensurate with recommended actions by a health practitioner or knowledge acquired from information sources (Permana, 2019). The more information obtained, the more knowledge about health, the better the attitude and adherence of a mother.

Every respondent who checks routinely for pregnancy and ANC in the Puskesmas Klego 1 receives education about the significance of consuming iron tablets. Besides that, obtain information from pregnant women's classes and electronic media. Respondents who received information >3 times tended to have a positive attitude and good adherence. When conducting research, after socializing the smart monitoring system application, they also provided education where 70% of respondents comprehended the importance of taking iron tablets and preventing anemia.

In this study, researchers used electronic media in the form of the Smart Monitoring System of the

Android application. According to (Nurherliyany, 2022), information and media were the factors for anemia and adherence.

Table 7. The level of attitude towards the consumption of iron supplement tablets in pregnant women in the Puskesmas Klego 1 using the smart monitoring system

Category	<i>Pre-Test</i>		<i>Post Test</i>	
	Frequency	Percentage	Frequency	Percentage
Adherence	8	16%	47	94%
No adherence	42	84%	3	6%

Based on Table 10, the pretest and posttest outcomes revealed positive results. It concluded that there was no difference between pretest and posttest.

Attitude is a closed state of a person against the obtained stimulus. In this study, attitudes are categorized into two (2) types of positive and negative attitudes.

In this study, the pretest result was 100%, and the posttest was 100% with positive results. Therefore, it inferred no difference between attitudes pre- and post-using the smart monitoring system.

Table 8. The adherence level to iron supplement consumption in pregnant women in the Puskesmas Klego 1 using a smart monitoring system

Category	<i>Pre-Test</i>		<i>Post Test</i>	
	Frequency	Percentage	Frequency	Percentage
Positive	50	100%	50	100%
Negative	0	0	0	0

Based on Table 11, the pre-test on adherence revealed eight (8) people as compliant (16%) and 42 people as non-compliant (84%). While the post-test obtained significant results with 47 people as adherence (94%) and three (3) people as non-adherence (6%). It inferred that there was a difference between pre-and post-intervention.

Adherence with iron supplement consumption is that pregnant women consume iron supplement tablets every day, and the number of iron supplement tablets accepted is at least 90 consecutive tablets during pregnancy (RI Ministry of Health, 2020). Mothers expressed to be respectful in consuming iron supplement tablets if the mother consumes >90 tablets of taken iron supplement tablets.

The results of this study indicated that the adherence level before accepting the smart monitoring system application revealed eight (8) people in the compliant category (16%) and 42 people in the non-compliant category (84%). Meanwhile, after receiving the intervention, it presented that 47 people were in the compliant category (94%), and three (3) people were in the non-compliant category (6%). It deduced that there was a difference between pre-and post-intervention of 78%.

This research was in line with (Krismawati, 2022) regarding the effect of the Sahabat Ibu Hamil (ASIH) application on adherence to taking Fe tablets and hemoglobin levels of pregnant women increased by 35.3%. In this study, non-adherence of pregnant women taking iron supplement tablets was influenced by forgetfulness, uncomfortable side effects such as nausea, vomiting, dizziness, and the mother's boredom. It was also in line with the research (Juanda, 2020).

Table 9. Analysis of the effect of the smart monitoring system on the consumption attitude of pregnant women's iron supplement tablets at the pretest and posttest

Attitude	Sig (2-tailed)
Pretest& Posttest	.261

The Smart Monitoring System application is a mobile-based Android application model to monitor pregnant women consuming iron supplement tablets regularly and improve the attitudes and adherence of pregnant women.

Based on the conducted research, there was no significant change in the attitude level to consuming

iron-supplemented tablets. The pretest and post-test obtained 100% positive results. It deduced that there was no difference between the pretest and posttest treatment regarding the mother's attitude. Meanwhile, the results of the paired T-test indicated a value of $p=.261$ ($2.61 > 0.05$). H_a was rejected, and H_o was accepted. Consequently, there was no difference between pre and post-intervention attitudes in the treatment group using the smart monitoring system.

Based on the opinion of the researchers, this happened because the mother's attitude regarding iron tablets was fairly good. Pregnant women are always educated about the importance of taking iron tablets during routine pregnancy checks and ANC every month so that there are no significant changes. Conducting education about anemia and Iron-supplement tablets, pregnant women already understand adequately about anemia and iron-supplement tablets. However, respondents' adherence to taking iron supplement tablets was poor because they forgot, and no one reminded or monitored them. There was no effect of the smart monitoring system application on the consumption attitude of pregnant women's iron supplement tablets.

The attitude of respondents during the monitoring study demonstrated a positive attitude by confirming the consumption of iron-supplement tablets in the WhatsApp group one day when the maintained application.

Table 10. Analysis of the effect of the smart monitoring system on adherence to consumption of iron supplements for pregnant women at the pretest and posttest

Adherence	Sig (2-tailed)
Pretest & Posttest	0.000

Table 10 presented the Wilcoxon test results with $p = 0.000$ ($0.000 < 0.05$). Then, H_o was rejected and, H_a was accepted. There were differences in pre- and post-intervention of adherence in the treatment group using the smart monitoring system that increased the adherence score by 78%. This research was in line with (Krismawati, 2022) concerning the effect of using the Sahabat Ibu hamil (ASIH) application on pregnant women which stated that the results of research using the Rank Spearman test increased the adherence score significantly ($r=0.506$; $p<0.001$) by 18.4%.

Consumption of iron tablets is an effort to meet iron needs. At the same time prevent anemia in pregnant women. The behavior of a pregnant woman who is aware of the importance of taking iron tablets every day could reduce the disobedience of pregnant women to consume iron tablets to avoid anemia during pregnancy (Ministry of Health Republic of Indonesia, 2020)

Based on the opinion of the researchers, regular consumption of Fe tablets is necessary during pregnancy to prevent anemia and its negative effects. If anemia occurs during pregnancy, it is required to increase education, motivation, and monitoring of pregnant women in consuming Fe tablets during pregnancy. Pregnant women's adherence with drinking iron tablets in Indonesia was poor due to limited knowledge and mothers' adherence with taking iron tablets. One of the efforts to increase pregnant women's adherence is by providing information about side effects, and how to consume iron tablets through the effective use of information and communication technology without limited space and remotely. The smart monitoring system application could improve the adherence of pregnant women to consume iron tablets. This condition indicated that the application of a smart monitoring system could increase the adherence level to consuming iron supplement tablets in pregnant women at the Puskesmas Klego.

CONCLUSION

1. The characteristics of respondents based on the mother's age in the treatment group revealed an age range of 21-39 years with an average respondent age of 27.24, A range of Gestational age of 7-39 weeks with an average gestational age of 26.04, Parity of the birth number once (1) with 42%, twice with 42% and three (3) times with 16% and with a frequency of 50 people. Mother's education offered the most high school level with 60%. The mothers worked as housewives with 74%, Mother's income < Rp. 800,000 by 66%. The majority of information sources came from health workers with 94%. The number of information obtained three (3) times or more than 60%.
2. The attitude level of iron supplement consumption in pregnant women in the Puskesmas Klego 1 at pre and post-intervention of all 50 respondents revealed a positive category of 100% and the

level of adherence to consuming iron supplements in pregnant women in pre-intervention obtained adherence with 16% and non-adherence with 84%. While post-intervention presented adherence with 94% and disobedience with 6%

3. There were differences in attitudes and adherence to the consumption of iron supplement tablets in pregnant women in the Puskesmas Klego 1 with a 100% pretest. The attitude post-test obtained 100% results with positive results. Post-intervention results of the paired T-test obtained $p=.261$ ($2.61 > 0.05$). The results indicated no effect of the Smart Monitoring System application on the consumption attitude of pregnant women's iron supplement tablets.

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REFERENCES

- [1] Afsari. 2021. (n.d.). Tantri Sulistia Afsari. (2021). Pengaruh Pemberian Kartu Pantau Dan Petunjuk Konsumsi Tablet Tambah Darah (Ttd) Terhadap Jumlah Konsumsi Ttd Dan Kadar Hemoglobin Ibu Hamil Di Wilayah Kerja Puskesmas Padang Serai Kota Bengkulu Tahun 2021 .
- [2] Ali Azes, G., Azza, A., & Kholifah, S. (n.d.). (2018). Hubungan persepsi tentang tablet fe dengan kepatuhan mengkonsumsi tablet fe pada ibu hamil trimester iii di wilayah kerja puskesmas mumbulsari.
- [3] Aminin, F., & Dewi, U. (2020). Kepatuhan Ibu Hamil mengkonsumsi Tablet FE di Kota Tanjungpinang tahun 2017. *Jurnal Ners Dan Kebidanan (Journal of Ners and Midwifery)*, 7(2), 285–292. <https://doi.org/10.26699/jnk.v7i2.art.p285-292>
- [4] Badan Pusat Statistik (BPS). 2022. (n.d.). *Badan Pusat Statistik (BPS)*. Data Usia Ibu Hamil. 2022.
- [5] Edison, E., Kebidanan, A., & Bone, L. (2019). Hubungan tingkat pendidikan dengan kejadian anemia pada ibu hamil Anemia Ibu Hamil Tingkat Pendidikan. *Universitas Muhammadiyah Tangerang*, 4.
- [6] Gebremichael, T. G. , & W. T. G. (2020). (n.d.). *Gebremichael, T. G., & Welesamuel, T. G. (2020). Adherence to Iron-Folic Acid Supplement and Associated Factors Among Antenatal Care Attending Pregnant Mothers in Governmental Health Institutions of Adwa Town, Tigray, Ethiopia: Cross-Sectional Study. PLoS One, 15(1), e0227090. https://doi.org/10.1371/journal.pone.0227090.*
- [7] Juanda, S. F. E. 2020. (n.d.). *Juanda, S. F. E. (2020). Factors that Influence the Adherence of Pregnant Women in Consuming Iron Supplements : Systematic Literature Review. PLACENTUM Health Scientific Journals and Their Applications, 8(1), 18–24. .*
- [8] Kemenkes RI. 2018. (n.d.). *Hasil Utama Riset Kesehatan Dasar Tahun 2018. In: Badan Penelitian dan Pengembangan Kesehatan, editor. Jakarta. 2018*
- [9] Krismawati, E., Widjanarko, B., Zen Rahfiludin, M., Kesehatan, M. P., & Masyarakat, K. (n.d.). (2022). Pengaruh aplikasi sahabat ibu hamil (asih) terhadap kepatuhan minum tablet fe dan kadar hb ibu hamil. <http://journal.stikeskendal.ac.id/index.php/Keperawatan>
- [10] Kusmaryati, P., Herawati Jurusan Kebidanan, N., & Kemenkes Jambi, P. (2022). *Article korelasi antara indeks massa tubuh (imt) dengan kadar hb remaja di smp satu atap desa suka maju kecamatan mestong muaro jambi. https://stikes-nhm.e-journal.id/OBJ/index*
- [11] Manik, R. (2021). Sosialisasi Penggunaan Aplikasi (Sumiferos) Pencegahan Anemia dengan Kepatuhan Ibu Hamil Mengkonsumsi Tablet Besi. *Jurnal Abdimas Kesehatan (JAK)*, 3(2), 229. <https://doi.org/10.36565/jak.v3i2.204>
- [12] Means, R. T. E. (n.d.). (2019). *Diagnosis and Management Anemia in the Young and Old and Old and Old and Old.*
- [13] Nurherliyany, M., Herry Garna, H., Wijayanegara, H., Ciamis, S. M., Dharma, S., & Bandung, H. (n.d.). *Jurnal Kesehatan | 45 bina generasi. Jurnal kesehatan edisi, 14(1), 2022. https://ejurnal.biges.ac.id/index.php/kesehatan/*
- [14] Permana, V. A. , S. A. , & M. M. 2019. (n.d.). Permana, V. A., Sulistiyawati, A., & Meliyanti, M. (2019). Faktor-faktor yang Mempengaruhi Kepatuhan Ibu Hamil dalam Mengkonsumsi Tablet Fe di Puskesmas Griya Antapani Kota Bandung tahun 2019. *Jurnal Sehat Masada, XIII(2), 50–59.*
- [15] Shofiana, F. I., Widari, D., & Sumarmi, S. (2018). Pengaruh Usia, Pendidikan, dan Pengetahuan Terhadap

Konsumsi Tablet Tambah Darah pada Ibu Hamil di Puskesmas Maron, Kabupaten Probolinggo. 1–12.
<https://doi.org/10.2473/amnt.v2i4.2018.356-363>

- [16] Sjahriani, T., & Faridah, V. (2019). Faktor-faktor yang berhubungan dengan kejadian anemia pada ibu hamil (Vol. 5, Issue 2).