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THE EFFECTIVENESS OF TELEMIDWIFE-BASED 'PERMISI GANDU' ALARM FOR MONITORING ADHERENCE TO IRON SUPPLEMENTS CONSUMPTION AND INCREASED HAEMOGLOBIN LEVELS IN ANEMIA ADOLESCENT

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ABSTRACT
Anemia is still a health problem for adolescent and is related to nutrition due to iron deficiency during menstruation. This is because adolescent don't like the smell of iron supplements, forget to take them, are worried about experiencing side effects, and even feel they don't need to take iron supplements. The aim of this research is to determine the effectiveness of telemidwife-based 'PERMISI GANDU' (Pengatur Minum Suplemen Zat Besi Gabung Nipis dan Madu) alarm for monitoring adherence to iron consumption and increased hemoglobin levels in anemia adolescent. The type of research is Quasi-experiment with One group pre-posttest design. The sample was taken using a Purposive sampling technique with a sample size of 36 people in Kecamatan Terangun Kabupaten Gayo Lues. Respondents were given iron supplements and lime infused water mixed with honey once every week for a duration of 4 months. Data collection on consumption compliance uses an observation form combined with video calls by midwives. For the intervention consumption schedule, the Google Calendar setting on the respondent smartphone was used as a reminder alarm. Measurement of hemoglobin levels before and after intervention using a digital hemoglobinometer. Data analysis using the Wilcoxon test. The statistical test results obtained p-value < 0.05, indicating that the telemidwife-based 'PERMISI GANDU' alarm was effective in increasing compliance with iron consumption and hemoglobin levels in anemia adolescent.

Keywords: adolescent; anemia; hemoglobin; iron supplements; telemidwife

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INTRODUCTION

Anemia is the second highest cause of disability in the world. Anemia is also considered a serious public health problem. Anemia can attack anyone, including teenagers. Anemia generally occurs more often in adolescent girls than in adolescent boys. This is because adolescent girls lose iron during menstruation. Therefore, adolescent girls need more iron intake. The behavior of adolescent girls who consume more plant-based foods results in their iron intake not being sufficient for their daily iron needs. In fact, the habits of adolescent girls who want to appear slim make them limit their daily food intake, which makes them susceptible to anemia (Priyanto, 2018). Iron deficiency is the cause of the majority of all cases of anemia. However other conditions such as nutritional deficiency, acute and chronic inflammation, parasitic infections, accelerated growth, increased iron requirements, increased

loss of iron from the body during menstruation, inherited or acquired disorders of hemoglobin synthesis, red blood cell production or survival are also considered to be cause of anemia (Mengistu et al., 2019).

The global prevalence of anemia is 29.9% or around 539 million in women aged 15-49 years. There are three regions with low average hemoglobin concentrations in women and children, including Southeast Asia, Africa and the West Pacific. Indonesia is one of the Southeast Asian countries where the prevalence of anemia is still high at 31.2%. This finding was recorded in 32% of young women aged 15-24 years, which means 3 out of 10 teenagers are affected by anemia. This also means that there are approximately 7.5 million teenagers in Indonesia who are at risk of experiencing obstacles in their growth and development, cognitive abilities and are vulnerable to infectious diseases (WHO, 2022).

Anemia is a condition of decreased erythrocyte mass indicated by a decrease in hemoglobin levels, hematocrit and erythrocyte count. Hemoglobin synthesis requires sufficient availability of iron and protein in the body. Anemia is directly influenced by the consumption of daily foods that have substance less iron, therefore food consumption is related to nutritional status. Adolescent girls are diagnosed with anemia if their hemoglobin level is less than 12 mg/dl (Mirani et al., 2021). Anemia is more common in adolescent girls because physical growth, reproductive maturation and cognitive transformation require high intake of macro and micronutrients including iron. There is an influence of nutritional status factors and food intake with the incidence of iron deficiency anemia in adolescent girls (Samson et al., 2022).

One of the government's programs in realizing healthy adolescents free of anemia is to provide iron supplements to adolescent girls (Kemenkes RI, 2016). In 2018 in Aceh Province, it was found that adolescent girls aged 10-19 years who had received iron supplements were only 12.8% and those who took iron supplements more than 52 tablets in one year were only 0.2% (Azizah et al., 2023). Previous research found that 76.2% of adolescent girls had received iron supplements in the past year, but only 2.13% took iron supplements as recommended. Reasons why adolescent girls do not drink or spend iron supplements obtained from health facilities include those who state feeling unnecessary (26.1%), bad taste and smell (22.9), forgetting to drink (20%), worrying about side effects (19.3%), and other causative factors (11.7%) (Wahyuni S, 2021).

Efforts to reduce the effects of nausea when taking iron supplements, it can be informed to take it at night before going to bed and can be consumed along with vitamin C or with drinks containing vitamin C such as fruit juice (Blanco-Rojo et al., 2011). The combination of vitamin C and iron supplements effectively increases hemoglobin levels. Vitamin C can reduce ferry ions into ferrous ions that can be easily absorbed by intestinal mucosal cells (Balasubramani et al., 2020). The results of research related to the effect of a combination of iron supplements and vitamin C on hemoglobin levels showed an increase in hemoglobin was 0.79 higher than iron supplements without vitamin C (Aini & Safitri, 2021).

The success of iron supplements in adolescent girls is influenced by many factors, one of which is adherence (Ningtyias et al., 2020). Previous research on adherence to taking iron supplements and improving nutritional status using interventions in the form of providing Short Message Service (SMS) reminders showed differences in adherence and hemoglobin levels where the treatment group experienced increased adherence and hemoglobin levels compared to the control group (Khorshid et al., 2014). Utilizing the existing conveniences, there are many innovations to improve compliance in the consumption of iron supplements

through mobile phones. Based on Smartphone User Persona Report (SUPR) data, the average mobile phone user is teenagers with a prevalence of 61% (Syahrina et al., 2020).

Based on recapitulation data from the Terangun Health Center, it was found that 48 adolescent girls were indicated to be anemia. The results of interviews with midwives in Kecamatan Terangun Kabupaten Gayo Lues, said that iron supplements have been distributed in schools, but there are some adolescents who stopped taking them since last year because of the smell of supplements and also reasoned forgetting to drink. As a result, it inhibits essential nutritional care which has an impact on the nutritional status of adolescents. Therefore, it needs to be circumvented when taking iron supplements by providing adjuvant therapy such as infused water, which is a mixture of water, lime and honey. Consumption of iron supplements can be given along with vitamin C because it contributes to the absorption of iron in the body.

In this research, the intervention provided was to monitor the adherence of iron supplements consumption through a telemidwife-based 'PERMISI GANDU' (Pengatur Minum Suplemen Zat Besi Gabung Nipis dan Madu) alarm. This system uses a simple alarm that is easily accessible on smartphones through settings on Google Calendar. The innovation in this research is in line with previous research that conducted telenursing-based monitoring of medication adherence in malaria patients as a health promotion approach by reminding to take medication. Providing education about the importance of complete treatment and even side effect information can be done through telenursing on smartphones (Berwulo et al., 2020). Based on this information, researchers are interested in research with the aim of determine the effectiveness of telemidwife-based 'PERMISI GANDU' (Pengatur Minum Suplemen Zat Besi Gabung Nipis dan Madu) alarm for monitoring adherence to iron consumption and increased hemoglobin levels in anemia adolescent.

METHOD

The type of research is quasi-experiment with one group pre-posttest design. This research was carried out in Kecamatan Terangun Kabupaten Gayo Lues in August-November 2023. Samples were taken using purposive sampling technique with a total sample of 36 people. Based on the sampling techniques, inclusion criteria including women aged 10-24 years, unmarried, regular menstrual cycles, no history of diseases such as infectious diseases, liver disease, chronic diseases and blood disorders, haven't donated blood during last three months, hemoglobin level less than 12 g/dl, using smartphone, and want to be a respondent in this research.

Respondents were given iron supplements and lime infused water mixed with honey once every week for a duration of 4 months. Data collection on consumption compliance uses an observation form combined with video calls by midwives. For the intervention consumption schedule, the Google Calendar setting on the respondent smartphone was used as a reminder alarm. Measurement of hemoglobin levels before and after intervention using a digital hemoglobinometer.

The research implementation stage begins with directing midwives who become enumerators in providing counseling to adolescent girls about how or the rules for taking iron supplements once a week for 4 months. As for reducing the effects of nausea when taking iron supplements, it can be told to drink at night before going to bed and consumed with lime infusion water and honey. The steps in making lime and honey infused water refer to the results of research by (Asiyah & Susilowati, 2019), including the following: 1) Provides 180

ml of warm water in a glass, 2) Wash the lime as much as one fruit then cut it into several pieces (not too thin). Squeeze lime into a measuring container with a composition of 20 ml. Pouring the squeezed lime that have been accommodated previously into the glass, and 3) Put one tablespoon of honey in a glass and stir until well mixed. Ready to drink.

The next stage is once a week to observe the adherence of adolescent girls in consuming interventions, namely iron supplements and infused water lime and honey through the alarm system 'PERMISI GANDU' combined with video calls to see directly respondents consuming interventions. After 16 weeks of intervention, hemoglobin levels of adolescent girls were re-examined as a posttest study to see if there was an increase in hemoglobin levels after the intervention. The research data were analyzed descriptively to describe each variable. Wilcoxon test to assess differences in adherence to iron supplements consumption and hemoglobin levels before and after intervention.

RESULTS

Table 1.
Frequency distribution of respondent characteristics (n=36)

Respondent Characteristics	f	%
Age		
15 years	2	5.6
16 years	13	36.1
17 years	11	30.5
18 years	6	16.6
19 years	2	5.6
20 years	2	5.6
Level of education		
Junior high school	2	5.6
Senior high school	32	88.8
University	2	5.6

Table 1 shows that the majority of respondent characteristics are based on age, namely at the age of 16 years were 13 respondents (36.1%), while based on the category level of education the majority of respondents are at the senior high school level were 32 respondents (88.8%).

Table 2.
Frequency distribution of adherence to iron supplement consumption before intervention (n=36)

Adherence Level	f	%
Compliant (if taking 16 tablets of iron supplements)	2	5.6
Non-compliant (if taking iron supplements less than 16 tablets)	34	94.4

Table 2 shows that the majority of respondents were non-compliant in taking iron supplements (less than 16 tablets) before the intervention was given were 34 respondents (94.4%).

Table 3.
Frequency distribution of adherence to iron supplement consumption after intervention (n=36)

Adherence Level	f	%
Compliant (if taking 16 tablets of iron supplements)	36	100
Non-compliant (if taking iron supplements less than 16 tablets)	0	0

Table 3 shows that all respondents who adherently took iron supplements and had taken 16 tablets within 4 months of intervention were 36 respondents (100%).

Table 4.
Frequency distribution of respondent hemoglobin levels before intervention (n=36)

Hemoglobin Levels	f	%
≥ 12 gr/dl (Non anemia)	0	0
< 12 gr/dl (anemia)	36	100

Table 4 shows that all respondents indicated anemia (hemoglobin level less than 12 g/dl) before intervention were 36 respondents (100%).

Table 5.
Frequency distribution of respondent hemoglobin levels after intervention (n=36)

Hemoglobin Levels	f	%
≥ 12 gr/dl (Non anemia)	35	97.2
< 12 gr/dl (anemia)	1	2.8

Table 5 shows that the majority of respondents were no longer anemia (hemoglobin levels more than 12 g/dl) after getting intervention were 35 respondents (97.2%).

Table 6.
Data normality test results

	Statistic	df	Sig
Before giving 'PERMISI GANDU'	0.766	18	0.001
After giving 'PERMISI GANDU'	0.733	18	0.000

The requirement before parametric statistical tests in experimental research is that data normality tests are carried out first using the Shapiro-Wilk test. Based on table 6, the value of Sig. in the Shapiro-Wilk column has a value of less than 0.05, namely before the 'PERMISI GANDU' alarm intervention of 0.001 and after the 'PERMISI GANDU' alarm intervention of 0.000. The conclusion is that the data is not normally distributed. Therefore, a test used to determine the average difference in variables before and after the intervention in the same group used the Wilcoxon test.

Table 7.
The effectiveness of telemidwife-based 'PERMISI GANDU' alarm for monitoring adherence to iron supplements consumption and increased hemoglobin levels in anemia adolescent

Variable	Wilcoxon signed rank test	n = 36		Mean difference	*p-value*
		Pre	Post		
Adherence level	Mean	1.10	2.16	1.06	0.000
	Standard deviation	0.41	0.38		
Hemoglobin levels	Mean	1.45	2.85	1.4	0.010
	Standard deviation	0.605	0.366		

Based on table 7 shows that there is a difference in the average level of adherence of adolescent girls in taking iron supplements before and after the intervention with a mean difference of 1.06 and the results of the Wilcoxon test obtained p-value = 0.000. In addition, there was also a difference in the average hemoglobin levels of adolescent girls before and after the intervention with a mean difference of 1.4 and the results of the Wilcoxon test obtained p-value = 0.010. The results of this statistical analysis show that the telemidwife-based 'PERMISI GANDU' (Pengatur Minum Suplemen Zat Besi Gabung Nipis dan Madu) alarm was effective in increasing compliance with iron consumption and hemoglobin levels in anemia adolescent.

DISCUSSION

The results of the research showed that the telemidwife-based 'PERMISI GANDU' (Pengatur Minum Suplemen Zat Besi Gabung Nipis dan Madu) alarm was effective in increasing compliance with iron consumption and hemoglobin levels in anemia adolescent. The effectiveness of the telemidwife-based 'PERMISI GANDU' alarm is influenced by the intensity of midwives as enumerators when observing compliance with iron supplement consumption in anemia adolescents through the 'PERMISI GANDU' system combined directly with video calls, as well as because of reminder alarms set in Google Calendar on smartphones to prevent adolescents from forgetting to take iron supplements. The innovation in this research is in line with previous research that conducted telenursing-based monitoring of medication adherence in malaria patients as a health promotion approach by reminding to take medication. Providing education about the importance of complete treatment and even side effect information can be done through telenursing on smartphones (Berwulo et al., 2020).

Intensive supervision causes adolescent girls to be compliant taking iron supplements combined with lime and honey once a week for 4 months so that adolescent girl hemoglobin levels can increase. Based on the results, of measuring hemoglobin levels after the intervention, there was one respondent who was still anemia. After being traced, it turned out that respondents consumed less protein, namely the frequency of protein consumption, especially animal protein, less than twice per week. The intervention provided is only as adjuvant therapy so that respondents must still need to meet daily nutrition according to a balanced nutritional menu. In adolescent often found nutritional problems related to iron deficiency. This condition is due to iron deficiency so that the formation of red blood cells and other functions in the body is disrupted (Cairo et al., 2014). Anemia is a condition of decreased red blood cell count that can interfere with all metabolic activities in the body related to hemoglobin levels. Lack of red blood cells can harm the body because red blood cells function as a means of transporting nutrients and oxygen needed in physiological and biochemical processes in every body tissue (da Silva Lopes et al., 2021). Iron deficiency results from a lack of iron intake, reduced iron in the diet and an increased need for iron. If this goes on for a long time, it will lead to iron deficiency anemia (Kapil et al., 2019).

Adolescent girls need to be informed about anemia and its effects. Adolescent girls will lose a lot of iron during menstruation (Deivita et al., 2021). As a result, the body needs to produce more red blood cells so that iron needs also increase. Anemia in adolescents has a negative impact on decreasing immunity, concentration to learning achievement and adolescent productivity (Ariani et al., 2023). If anemia is not treated, it will have a more serious impact, considering that adolescent girls are prospective mothers who give birth to a baby, increasing the risk of maternal death during childbirth, premature birth and low birth weight (Shi et al., 2022). Midwives should prevent anemia in adolescents by providing consultations about the consumption of foods high in iron, folic acid, vitamin C and providing iron supplements (da Silva Lopes et al., 2021).

Global recommendations recommend that iron supplements in adolescent girls be given once a week (Lopez de Romaña et al., 2023). Previous research revealed that weekly iron tablets had an effect on increasing hemoglobin by 0.9±0.6 (g/dl). Consumption of iron supplements along with vitamin C effectively helps the absorption of iron in the body (Mansour et al., 2021). Related to the effect of the combination of iron tablets and vitamin C on hemoglobin levels showed an increase in hemoglobin as much as 0.79 higher than iron tablets without vitamin C (Aini & Safitri, 2021). Therefore, to prevent anemia it is more effective to give iron

tablets accompanied by vitamin C. In this research, iron supplements were consumed along with lime and honey infused water (200 ml).

Infused water is water mixed with sliced fruits or herbs so that the water makes a certain taste and is beneficial for health. Ingredients that are commonly used as infused water for daily consumption are from fresh fruits, one of which is lime (Sitawati, 2023). During several hours of soaking the fruit, nutrients, especially vitamins, will dissolve and mix with water, so that infusion drinks are useful for increasing vitamin intake in liquid form (Hsieh et al., 2021). Therefore, the consumption of iron supplements is very effective given along with this infused water liquid because of the acidic atmosphere and the presence of reducing agents such as vitamin C contained in infused water can help iron absorption (Pagliosa et al., 2021).

Iron supplements combined with vitamin C effectively increase hemoglobin levels (Li et al., 2020). Research by (Asiyah & Susilowati, 2019) found that pregnant women who used lime juice when taking iron supplements increased hemoglobin levels by 9 respondents (45%) from a total of 20 respondents. Other studies reveal about vitamin C which is a dominant factor in increasing hemoglobin levels. Giving vitamin C is proven to help iron absorption, but if vitamin C is not routine consumed it will not have a significant impact. Increased hemoglobin levels in anemia respondents who were not given treatment consuming iron supplements using lime juice can be seen that the increase in hemoglobin levels in the control group relatively did not experience an increase in hemoglobin levels (Guntur, 2014). This condition shows that without treatment consumption of iron supplements with food sources that contain vitamin C such as using fruit juice, the increase in hemoglobin levels becomes slower or even does not increase (Monárrez-Espino et al., 2011).

Research by (Rusmiati, 2019) says that hemoglobin levels in the body depend on iron absorption, including iron absorption or enhancers from vitamin C sources. Vitamin C converts ferrous into ferrous so that it is easily absorbed by the small intestine. Adequate nutrition balanced with adequate vitamin C and consumed at the right time, namely when the stomach is acidic (two hours after eating and consumed together with a source of vitamin C) will help the absorption of iron. In line with research conducted by (Hariyadi et al., 2015) that the group of pregnant women who were only given iron supplements without the addition of vitamin C in one month only increased hemoglobin levels by 0.63 gr%. Other studies say that consumption of vitamin C is proven to help increase hemoglobin levels. Consumption of vitamin C does not depend on the amount but more on the regularity of consumption (Lane & Richardson, 2014). The regularity of vitamin C consumption showed a significant relationship (ρ=0.000). The results of the linear regression test obtained that consumption of vitamin C as much as one time can increase hemoglobin levels by 0.06 g/dl (Guntur, 2014). In conclusion, if someone often consumes vitamin C, hemoglobin levels will increase (Li et al., 2020).

CONCLUSION

Implementation of the telemidwife-based 'PERMISI GANDU' (Pengatur Minum Suplemen Zat Besi Gabung Nipis dan Madu) alarm was effective in increasing compliance with iron consumption and hemoglobin levels in anemia adolescent. It is hoped that the health service can adopt this innovation for the sustainable execution of the iron supplementation program.

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