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The effect of iron tablet consumption monitoring cards on increasing hemoglobin levels in female adolescents

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Abstract

Anemia in adolescent girls (rematri) is a serious health problem that affects academic performance and increases the risk of anemia during pregnancy, potentially disrupting fetal growth and development. The government is trying to address this by providing iron tablets to all adolescent girls to meet their iron intake. This study aims to analyze the effect of using iron tablet consumption monitoring cards on increasing hemoglobin levels in adolescent girls at SMPN 03 Sadaniang, Mempawah Regency. This study used a quantitative approach with a pre-experimental method and a pre-and post-test design without a control group. The sampling technique used was total sampling on 31 adolescent girls. The results showed an increase in hemoglobin levels after the intervention. Before the treatment, the respondents' hemoglobin levels ranged from 7.9 mg/dl to 11.8 mg/dl, with an average of 11 g/dl. After the intervention using the monitoring card, hemoglobin levels increased to 11.2 g/dl to 14.1 g/dl, with an average of 12.91 g/dl. It was concluded that there was a significant effect of the use of iron tablet consumption monitoring cards on the increase in hemoglobin levels among female students at SMPN 03 Sadaniang, Mempawah Regency.

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INTRODUCTION

Anemia is a major nutritional problem worldwide, particularly in developing countries such as Indonesia (Manikam, 2021). It affects various age groups, including toddlers, adolescents, pregnant women, and the elderly. According to the World Health Organization, the global prevalence of anemia among women aged over 15 years is approximately 30.2%, or 4686 million individuals, while in Southeast Asia, the prevalence reaches 45.7%, affecting about 182 million people (World Health Organization, 2025). Furthermore, 44% of these women live in developing countries, including Indonesia (Permanasari, Mianna, & Wati, 2020). This high prevalence demonstrates that anemia remains a persistent public health problem requiring continuous attention and intervention.

The impact of anemia among adolescent girls is particularly concerning. It can lead to decreased concentration, fatigue, and poor academic performance, and if left untreated, may increase the risk of anemia during pregnancy later in life. This condition contributes to suboptimal fetal growth and development, increasing the likelihood of complications during pregnancy and childbirth, as well as maternal and infant mortality (Kementerian Kesehatan Republik Indonesia, 2020). The prevalence of anemia among women of reproductive age (15–49 years) was 29.9%, while the 2018 Basic Health Research (Balitbangkes) in Indonesia reported that 27.2% of adolescent girls aged 15–18 years were anemic (Badan Penelitian dan Pengembangan Kesehatan, 2019). The main cause of anemia in this group is iron deficiency related to menstrual blood loss, resulting in symptoms such as dizziness, lethargy, and decreased learning achievement (Kementerian Kesehatan Republik Indonesia, 2020).

To address this, the Indonesian government has implemented a national policy through Circular Letter NUMBER HK.03.03/V/0595/2016, which mandates the provision of iron tablets to adolescent girls and women of reproductive age. Each adolescent girl is recommended to take one iron tablet per week as prevention, or one tablet per day as treatment (Kementerian Kesehatan Republik Indonesia, 2015; Kementerian Kesehatan Republik Indonesia, 2018; Kementerian Kesehatan Republik Indonesia, 2020). Compliance monitoring is conducted using record cards to ensure that tablets are consumed regularly. The long-term goal of this program is to improve adolescent girls' nutritional status, prevent stunting, and prepare them for a healthy and productive reproductive period. The addition of antioxidant-rich fruits and vegetables, especially those high in vitamins A, C, and E, is also recommended to enhance iron absorption and maintain optimal hemoglobin levels.

However, despite these national programs, adherence to iron tablet consumption among adolescent girls remains low, particularly in rural areas. In Mempawah Regency, the prevalence of anemia among female adolescents in junior and senior high schools between 2021 and 2022 remained high at 34.12%. Specifically, in the Sadaniang Community Health Center (Puskesmas) working area, hemoglobin tests conducted on 89 adolescent girls revealed that 28 (31.46%) were anemic (Dinas Kesehatan Provinsi Kalimantan Barat, 2022). This condition is concerning, as noncompliance with iron tablet consumption programs weakens the effectiveness of government interventions and increases the long-term risk of complications such as maternal mortality, preterm birth, and low birth weight (Mawaddah, 2019).

This situation highlights a gap in monitoring and adherence behavior among adolescent girls regarding iron tablet consumption. While national programs and guidelines exist, few studies have specifically examined the implementation and monitoring of iron tablet consumption through the School Health Program (UKS), especially in rural or community health center contexts like Sadaniang. The novelty of this study lies in its focus on assessing the compliance of female students in consuming iron tablets by verifying their monitoring cards, offering an evidence-based perspective on how school-based interventions can improve hemoglobin levels. Therefore, this study aims to determine the

compliance of adolescent girls in consuming iron tablets and its relationship with increased hemoglobin levels in the working area of the Sadaniang Community Health Center.

METHOD

This study employed a quantitative approach using a pre-experimental design with a one-group pretest–posttest design. The purpose of this design was to determine the effect of monitoring cards on compliance with iron tablet consumption and the subsequent increase in hemoglobin levels among adolescent girls. Hemoglobin levels were measured before and after the intervention to assess the effect of using monitoring cards each time the respondents took iron tablets.

The population in this study consisted of all female adolescents with anemia at SMPN 03 Sadaniang, totaling 31 students. Based on the initial hemoglobin examination, 21 students had mild anemia, 9 had moderate anemia, and 1 had severe anemia. Because of the small population size, all students who met the inclusion criteria were included as the study sample using a total sampling technique.

The instruments used in this study included monitoring cards to measure the level of compliance with iron tablet consumption, a digital hemoglobin meter to measure hemoglobin levels before and after the intervention, observation sheets to record the results of hemoglobin measurements, a blood pressure monitor to measure blood pressure, and anthropometric tools such as scales, height measuring devices, and measuring tapes to obtain physical data such as body weight, height, and mid-upper arm circumference. These instruments were selected to ensure the accuracy and consistency of the data obtained.

Data collection was conducted through several systematic stages. The researcher began by explaining the objectives, procedures, and benefits of the study to all respondents and obtained their consent to participate. The initial stage involved measuring hemoglobin levels to identify adolescents who met the criteria for inclusion in the study. The intervention phase was then carried out by distributing monitoring cards and iron tablets to the respondents. Each time the participants took an iron tablet, they recorded it on the monitoring card. Iron tablets were consumed once a week every Monday after the school ceremony, or the following day if Monday was a holiday. For students who were menstruating, the dosage was one tablet per day during menstruation. This intervention and monitoring process lasted for one month under the supervision of teachers and health center staff. After the intervention period ended, hemoglobin levels were remeasured to determine any changes resulting from the use of monitoring cards. All collected data were then compiled, verified, and entered into a computer program for analysis, followed by interpretation, discussion, and conclusion drawing.

Data analysis consisted of univariate and bivariate analyses. Univariate analysis was performed to describe the characteristics of the respondents, including age, menarche status, body weight, height, body mass index, mid-upper arm circumference, blood pressure, and hemoglobin levels before and after the intervention. Bivariate analysis was used to test the effect of monitoring cards on hemoglobin levels among adolescent girls before and after treatment. Data analysis was performed using the Wilcoxon signed-rank test.

RESULTS AND DISCUSSION

Table 1. Descriptive Respondents based on age, grade, menarche, weight, height, LILA, Systolic, and Diastolic.

Descriptive	n	Min	Maximum	Mean	Std. Deviation
Age	31	12	14	13.06	0.727
Menarche	31	11	12	11.61	0.495
Body weight	31	34	56	41.03	4.834
Height	31	139	155	146.06	4.218
BMI	31	15.4	24.2	19.27	2,430
LILA	31	18	29	22.26	2.366
Systolic	31	90	140	102.90	11.887
Diastolic	31	60	90	68.71	7.184
Hb Before treatment	31	7.9	11.8	11.0	0.745
Hb After treatment	31	11.2	14.1	12.91	0.596

Table 1 presents the descriptive characteristics of respondents based on age, menarche age, body weight, height, body mass index (BMI), mid-upper arm circumference (LILA), systolic and diastolic blood pressure, and hemoglobin (Hb) levels before and after treatment. The results show that the respondents were female adolescents aged between 12 and 14 years, with an average age of 13.06 ± 0.73 years. The mean age at menarche was 11.61 ± 0.50 years, indicating that most of the respondents had already experienced menarche.

The respondents' average body weight was 41.03 ± 4.83 kg, with a minimum of 34 kg and a maximum of 56 kg. Their average height was 146.06 ± 4.22 cm, ranging from 139 cm to 155 cm. Based on these measurements, the mean body mass index (BMI) was 19.27 ± 2.43 , which falls within the normal nutritional status category. The average mid-upper arm circumference (LILA) was 22.26 ± 2.37 cm, suggesting that the majority of respondents had adequate nutritional status and were not undernourished.

In terms of blood pressure, the mean systolic value was 102.90 ± 11.89 mmHg, and the mean diastolic value was 68.71 ± 7.18 mmHg, both of which fall within the normal range for adolescents. This indicates that the respondents were generally in good cardiovascular condition at the time of data collection.

The average hemoglobin level before treatment was 11.0 ± 0.75 g/dL, with values ranging from 7.9 to 11.8 g/dL. This shows that most respondents were classified as having mild anemia. After one month of intervention using the monitoring card to improve iron tablet compliance, the mean hemoglobin level increased to 12.91 ± 0.60 g/dL, with a range of 11.2 to 14.1 g/dL. This increase demonstrates a significant improvement in hemoglobin levels following the intervention.

Overall, the descriptive results indicate that the respondents were early adolescents with normal nutritional status and blood pressure, and that the use of monitoring cards was effective in improving compliance with iron tablet consumption, as reflected by the increase in mean hemoglobin levels after treatment.

Table 3. Analysis of the Effect of Iron Tablet Consumption Monitoring Cards on Hemoglobin Level Improvement in Female Adolescents at SMPN 03 Sadaniang, Mempawah Regency.

Hemoglobin Levels	n	Mean	Median	p-value
Before treatment	31	11.00	11.200	0.000
After treatment	31	12.91	12,900	

Based on Table 2, the test results show that the use of iron tablet consumption monitoring cards has an effect on increasing hemoglobin levels in adolescent girls at SMPN 03 Sadaniang, Mempawah Regency, with a p-value of 0.000.

DISCUSSION

Erythrocytes are the most abundant blood cells in the human body and function to transport oxygen to body tissues through the bloodstream. These cells contain hemoglobin, a biomolecule capable of binding oxygen. The red color of erythrocytes is derived from hemoglobin, which is composed of iron. In humans, red blood cells are produced in the bone marrow and form biconcave discs that facilitate gas exchange (Cheng, 2020). Iron tablets contain both iron and folic acid, which are essential not only for the formation of hemoglobin but also for the prevention of birth defects in adolescent girls who later become pregnant. It is recommended that all adolescent girls take 48 iron tablets per year at a dosage of one tablet per week, consumed after meals with water and vitamin C-rich fruits to enhance absorption. Red blood cell formation takes approximately 5–9 days, and each cell has a lifespan of about 120 days in a healthy body. Hemoglobin levels should ideally be checked every six months, preferably on the sixth day after menstruation, with supplementation starting from menarche, typically around the age of 11.

Erythropoiesis, the process of red blood cell formation in the bone marrow, begins with multipotent stem cells differentiating into unipotent stem cells that subsequently form erythrocytes. These cells undergo mitosis and differentiation under the stimulation of erythropoietin, which promotes the maturation of promonoblasts, basophilic normoblasts, and polychromatic normoblasts (Luciana, 2019). The formation of erythrocytes from promonoblasts to normoblasts and polychromatic erythrocytes takes about 2–4 days, while the transformation of reticulocytes into mature erythrocytes requires an additional 2–3 days. Thus, the complete erythrocyte maturation process under normal conditions takes 5–9 days. When adequate anti-anemic therapy is provided, an increase in reticulocyte count is usually observed within 3–6 days, indicating a positive response to treatment. Blood pressure also plays an important role in the circulatory system, as deviations from normal levels may lead to hypertension or hypotension, both of which can affect overall oxygen distribution (Luciana, 2019).

The findings of this study are supported by previous research. Wahyuningsih (2019) reported a significant increase in hemoglobin levels from 11.76 g/dL (SD = 1.78) before treatment to 12.36 g/dL (SD = 1.59) after consuming iron tablets, with a mean difference of 0.6 g/dL and a p-value of 0.000. Similarly, Yunarsih (2017) found an increase in mean hemoglobin levels from 10.8 g/dL to 12.38 g/dL after intervention. Research by Jaelani, Simanjuntak, and Yuliantini (2019) also demonstrated a significant improvement in hemoglobin levels among adolescent girls, from an average of 12.76 g/dL before iron tablet administration to 13.14 g/dL afterwards ($p = 0.002 \leq 0.05$), indicating a statistically significant effect of iron supplementation. These findings confirm that consistent iron tablet consumption effectively increases hemoglobin levels in adolescent girls with anemia.

Regular consumption of iron tablets plays a crucial role in preventing anemia and improving reproductive health in adolescent girls. Behavioral factors such as compliance and regular consumption according to schedule are key to the success of anemia prevention programs. By adhering to supplementation schedules, adolescent girls can better prepare for optimal reproductive health and reduce the risk of anemia-related complications, including stunted growth (Silitonga et al., 2023). However, studies indicate that compliance with iron tablet consumption remains low among adolescents. Research at SMAN 2 Banguntapan Bantul found that adolescents' awareness of anemia prevention efforts was still limited (Lestari, Widardo, & Mulyani, 2019). Similarly, studies by Sab'ngatun and Riawati (2021) and Pamangin (2023) revealed that many adolescent girls do not consume iron tablets regularly or dislike taking them.

The present study found that the use of iron tablet consumption monitoring cards significantly increased compliance and hemoglobin levels among adolescent girls at SMPN 03 Sadaniang, Mempawah Regency ($p = 0.000 < 0.05$). This indicates that the monitoring

card intervention had a positive impact on adolescent health behavior. Physiologically, hemoglobin levels are known to be higher in males than in females due to the effects of prostaglandins and androgens, which stimulate erythropoiesis, while estrogen tends to inhibit it (Cheng, 2020). Therefore, adolescent girls are more vulnerable to anemia, especially during periods of rapid growth and menstruation. Anemia in adolescence can lead to reduced immunity, decreased physical fitness, lower academic achievement, and decreased productivity (Pamangin, 2023). Providing iron tablets at the recommended dosage of one tablet per day or weekly is an effective measure to prevent anemia and improve iron reserves in the body.

Prior to this intervention, all adolescent respondents stated that they had not received a compliance monitoring card as a reminder tool. Health center staff also confirmed the absence of a standardized form to monitor compliance. This finding aligns with studies by Sab'ngatun (2021) and Pamangin (2023), which reported irregular iron tablet consumption among adolescents. Therefore, this study introduced a monitoring card that helped students track their tablet intake more consistently. The significant increase in hemoglobin levels after one month of using the card demonstrates the importance of monitoring tools in improving compliance and health outcomes.

Other studies have shown similar associations between compliance and anemia reduction. Research by Putra, Munir, & Siam (2020) among adolescent girls at SMP Negeri 1 Tapen, Bondowoso Regency, reported a significant relationship between compliance and anemia incidence ($p=0.007 \leq 0.05$). Likewise, Yuniarti, Rusmilawaty, and Tunggal (2019) found a significant association between iron tablet compliance and anemia incidence at MA Darul Imad, Banjar Regency, based on chi-square test results. Knowledge plays a vital role in this behavior; adolescents who understand the benefits of iron supplementation are more likely to take tablets regularly (Samputri & Herdiani, 2022; Wahyuningsih, 2019). Therefore, improving health education about anemia and iron supplementation is crucial in shaping positive attitudes and compliance among adolescent girls.

Compliance with iron tablet consumption requires the collaboration of teachers, students, parents, and health workers. Strengthening this cooperation can enhance knowledge and awareness about the importance of iron tablets, supported by peer encouragement and accurate information on proper consumption methods (Anjarwati, & Ruqoiyah, 2020). Effective coordination between schools and community health centers is essential. In addition to improving distribution systems, regular monitoring through methods such as monitoring cards, direct supervision, and digital reporting (e.g., WhatsApp groups) can further increase adherence and ensure the sustainability of the program.

This study, however, has certain limitations. The research was conducted in a limited area with a relatively small sample size, which may affect the generalizability of the findings. The intervention period was also relatively short, lasting only one month, which might not fully capture long-term compliance behavior. Additionally, external factors such as dietary habits, family support, and socio-economic conditions were not analyzed in depth. Future research is recommended to include larger samples, longer intervention periods, and a broader assessment of behavioral and environmental factors influencing compliance with iron tablet consumption.

CONCLUSION

It was concluded that there was a significant effect of the use of iron tablet consumption monitoring cards on the increase in hemoglobin levels among female students at SMPN 03 Sadaniang, Mempawah Regency.

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