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Education program for adolescent girl anemia to improve adherence to iron supplementation in remote areas

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Abstract

Background: One factor influencing the health behavior of teenagers is their level of knowledge. Utilizing applications or digital media in health education can deliver information in a more engaging and easily understandable way for teenagers. This approach helps enhance their understanding of health issues like anemia. Digital interactions enable teenagers to access more detailed knowledge and follow information more effectively.

Purpose: To increase the attitudes and behavior of teenagers towards the regular consumption of iron tablets and the prevention of anemia.

Method: A quasi-experimental design with a post-test-only control group approach was conducted in the Enggano Island area, North Bengkulu Regency, from January to October 2023. The research examined the relationship between compliance with iron tablet consumption (independent variable) and outcomes such as menstruation duration, age of menarche, and nutritional status (dependent variables). Using purposive sampling, 70 participants were selected and divided into two groups: 35 in the treatment group and 35 in the control group, based on specific inclusion and exclusion criteria. Data analysis included univariate tests to assess the frequency distribution of participant characteristics, followed by bivariate analysis using Wilcoxon, Paired T-Test, Mann-Whitney, Independent Sample T-Test, and MANCOVA.

Results: The MANCOVA test results demonstrated that the Chatting Mira education intervention significantly influenced adolescents' knowledge, behavior, compliance with consuming iron supplement tablets, and Hb levels. This was supported by a p-value of 0.000, which was below the α threshold of 0.05, indicating statistical significance at a 95% confidence level.

Conclusion: The Chatting Mira education intervention effectively influences teenagers' attitudes and behaviors toward iron tablet consumption and anemia prevention. By utilizing peer-led education and structured activities, this program raises awareness, fosters healthy habits, and encourages adherence to iron supplementation, ultimately reducing the risk of anemia in adolescents.

Keywords: Adolescent; Anemia; Chatting Mira; Fe Tablets; Menstruation.

INTRODUCTION

The global incidence of anemia ranges from 30% to 50% in developing countries, with adolescents being among the most affected groups. In Indonesia, 22.7% of women aged 15 years and older suffer from anemia, though prevalence rates vary widely by

region. For instance, Denpasar City reports a 45% prevalence, while Bengkulu Province reaches 62% (Ministry of Health of the Republic of Indonesia, 2023). This highlights a particularly high anemia burden among adolescents, especially adolescent

girls, who are at greater risk due to menstrual blood loss. This vulnerability can lead to complications such as low birth weight (LBW) babies and stunted growth in future pregnancies.

To combat anemia, targeted nutritional interventions have been implemented as part of anemia control programs. These initiatives aim to prevent and manage anemia by promoting iron-rich diets, providing iron tablet supplementation, and fortifying foods with essential nutrients. One prominent program involves distributing iron supplements to adolescent girls in schools, with a goal of one tablet per week (Safitri, 2022). However, program adherence remains low, largely due to insufficient education, lack of monitoring, and inadequate compliance evaluation. To enhance effectiveness, it is crucial to raise awareness through comprehensive educational campaigns and enforce consistent follow-up strategies to improve adherence and achieve lasting results (Adyani, Apriliana, & Susilowati, 2024).

In remote, island, and border regions like Enggano Island in Bengkulu Province, adherence challenges are compounded by geographical barriers, poor infrastructure, limited access to information, insufficient human resources, and a lack of appropriate educational tools. Studies show that 56.6% of adolescent girls in these areas do not consume the iron tablets provided through schools (Ministry of Health of the Republic of Indonesia, 2023). Addressing these challenges requires tailored approaches to improve knowledge and compliance with iron supplementation programs.

Compliance with completing the full course of iron tablets remains below 50%, primarily due to factors such as parents' educational and employment status and adolescents' limited knowledge and awareness of the benefits of these supplements. Addressing these barriers requires comprehensive anemia education programs that stress the importance of iron tablets, explain their advantages, and ensure a steady and reliable supply. Parental involvement and peer support networks are essential for enhancing awareness and adherence. Innovative, tailored educational approaches are needed to effectively reach adolescents in remote and low-income areas (Putri, Dary, & Mangalik, 2022).

These approaches should incorporate interactive and engaging methods, such as peer-led sessions, local community campaigns, and culturally relevant media. Additionally, regular monitoring of iron tablet consumption, alongside active engagement from peer groups, can significantly improve adherence rates among adolescent girls. By integrating these strategies into community health programs, a more supportive environment can be created, ultimately enhancing the nutritional status and overall health outcomes for young women in underserved areas (Shofiana, Widari, & Sumarni, 2018).

RESEARCH METHOD

A quasi-experimental design, specifically a post-test-only control group approach was conducted from January to October 2023 in the Enggano Island area of North Bengkulu Regency. The research examined the impact of compliance with iron tablet consumption (independent variable) on menstruation duration, age of menarche, and nutritional status (dependent variables).

A total of 70 participants were selected through purposive sampling and divided into two groups: 35 in the treatment group and 35 in the control group. The participants in this study were female junior high school students from Enggano Island, who met specific inclusion criteria, such as being willing to participate until the study's completion and having basic literacy skills. Exclusion criteria included severe or chronic illnesses, blood disorders, or moderate to severe anemia.

Chatting Mira, an abbreviation for Prevent Stunting through Adolescent Anemia, is a smartphone application that aims to overcome anemia in adolescents as well as prevent anemia in pregnant women who are at risk of giving birth to stunted children. This application provides information, education, as well as monitoring and evaluating compliance with the consumption of blood supplement tablets, supporting digital health transformation that makes access easier without being limited by distance and time.

The intervention included structured educational sessions led by peer educators and the provision of one iron tablet weekly and an additional tablet daily during menstruation for three months. Peer educators

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also supervised and ensured compliance with the regimen. Measurements included hemoglobin levels, adherence to Fe tablet consumption, and data on menstruation duration, age of menarche, and nutritional status. The treatment group received the Mira Progress Package, consisting of classroom-based educational sessions delivered by peers. Each participant received one iron tablet every Sunday and one daily during their menstrual periods, totaling consistent supplementation for three months.

Data analysis involved univariate testing to determine the frequency distribution of participant characteristics, followed by bivariate analysis using Wilcoxon, paired t-tests, Mann-Whitney, independent sample t-tests, and MANCOVA. All analyses were conducted using SPSS version 24. Ethical approval for this research was obtained from the Research Ethics Committee of the Polytechnic of Health, Ministry of Health Bengkulu (No. KEPK.BKL/593/2024).

RESEARCH RESULTS

Table. 1. Characteristics of the Participants (N=70)

Variable	Group	
	Intervention (n = 35)	Control (n = 35)
Age (n/%) (Mean±SD)(Range)(Year)	(13.60±0.619)(12-14)	
12 years old	3/8.57	2/5.71
13 years old	11/31.43	7/20.00
14 years old	21/60.00	26/74.29
Parents' Occupation (n/%)		
Farmer	12/34.29	5/14.29
Fisherman	14/40.00	11/31.43
Merchant	5/14.29	10/28.57
Civil Servant	4/11.42	9/25.71
Menarche (n/%)		
≤11 years old	6/17.14	4/11.43
12-13 years old	11/31.43	9/25.71
≥14 years old	18/51.43	22/62.86
Birth Order (n/%)		
The first	9/25.71	13/37.14
The second	16/45.72	14/40.00
≥ The third	10/28.57	8/22.86
Household Income (n/%)		
< 2,000,000	8/22.86	5/14.29
2,000,000 to <5,000,000	21/60.00	18/51.43
≥ 5,000,000	6/17.14	12/34.28

Table 1 illustrates that the characteristics of participants show an average age of 13.60 years with a standard deviation of 0.619 and an age range of 12-14 years. The majority of participants were 14 years old, totaling 21 individuals (60.0%) in intervention group, and 26 individuals (74.29%) in control group. The majority of parents in both the intervention group (40%) and the control group (31.43%) are fishermen. In the intervention group, most

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participants had their first menstruation at the age of 14 or older (51.43%), which was also the case for the control group (62.86%). Regarding birth order, the majority of participants in both groups were the second child, with percentages of 45.72% in the intervention group and 40.00% in the control group. Family income predominantly fell within the range of 2,000,000 to <5,000,000, with 60.00% in the intervention group and 51.43% in the control group.

Table 2. Hb Levels, Knowledge, Compliance and Behavior of Adolescents (N=70)

Variable	Intervention Group (n=35) (Median (Mean±SD)(Range))	p-value	Control Group (n=35) (Median (Mean±SD)(Range))	p-value
Hb				
Before	10.3 (10.14±0.68) 8-10	0.000	10.4 (9.93±1.86) 8-10	0.000
After	12 (11.65±1.18) 9-13		12 (11.95±1.03) 8-13	
Knowledge				
Before	50 (47.71±15.55) 20-80	0.000	70 (68.57±12.4) 40-90	0.000
After	70 (61.47±15.68) 30-100		60 (59.71±17.57) 10-90	
Compliance				
Before	3 (3.46±1.84) 1-8	0.000	4 (3.34±1.43) 1-6	0.000
After	8 (6.86±1.73) 2-8		3 (3.14±1.83) 0-8	
Behavior				
Before	17 (16.54±2.74) 8-22	0.000	20 (20.11±4.12) 13-29	0.000
After	20 (20.11±3.62) 12-30		19 (19.94±4.03) 13-30	

Table 2 demonstrate significant improvements in the intervention group compared to the control group across various variables. In the intervention group, post-intervention averages showed increased Hb levels (11.65), knowledge (61.47), compliance (6.86), and behavior (20.11). The intervention group also exhibited statistically significant changes in Hb levels, knowledge, compliance, and behavior ($p < 0.05$ for all). In contrast, the control group showed smaller changes, with compliance not achieving statistical significance ($p = 0.0586$). These findings highlight the effectiveness of the intervention in improving adolescent health outcomes.

Table 3. Differences in Hb Levels, Knowledge, Compliance and Behavior

Variable	Method	Mean Difference	p-value
Hb	Chatting Mira Education	1.8	0.000*
	Conventional education packages	1.4	
Knowledge	Chatting Mira Education	19.91	0.000*
	Conventional education packages	8.8	
Compliance	Chatting Mira Education	3.4	0.042*
	Conventional education packages	0.2	
Behavior	Chatting Mira Education	3.5	0.000**
	Conventional education packages	0	

*Mann Whitney

**Independent Sample T-Test

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Table 3 indicates significant differences between the Chatting Mira Education group and the Conventional Education Package across all evaluated variables. For Hb levels, the Chatting Mira Education group showed an average increase of 1.8, compared to 1.4 in the Conventional group ($p = 0.000$). In terms of knowledge, the Chatting Mira Education group had an average increase of 19.91, while the Conventional group saw an increase of 8.8 ($p = 0.000$). For compliance, the Chatting Mira Education group showed an average increase of 3.4, compared to just 0.2 in the Conventional group ($p = 0.042$). Regarding behavior, the Chatting Mira Education group saw an average increase of 3.5, while the Conventional group showed no change ($p = 0.000$). These findings confirm that the Chatting Mira Education group experienced significant improvements across all variables when compared to the Conventional Education Package.

Table 4. Effect of Chatting Mira Education and Iron Tablets Intake Adherence to Increase Hb, Knowledge, Compliance and Behavior

Independent Variable	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	p-value
Chatting Mira Education	Knowledge	13.720	1	13.720	33.525	0.000
	Behavior	223.214	1	223.214	15.020	0.000
	Compliance	226.800	1	226.8	41.458	0.000
	Hb	2.268	1	2.268	4.025	0.049

*Mancova

Table 4 presents the results of the MANCOVA test, indicating that the Chatting Mira Education Intervention significantly impacts adolescents' knowledge, behavior, compliance with iron tablet consumption, and Hb levels. This is demonstrated by a p-value of 0.000, which is below the α threshold of 0.05, confirming significance at the 95% confidence level.

DISCUSSION

In the intervention group, knowledge levels showed a significant increase, rising from an average of 47.71 to 61.47, while the control group experienced a slight decrease, from 68.57 to 59.71. Similar findings were reported regarding the influence of health education on adolescents' knowledge about anemia, where education led to a notable improvement, with an average increase of 10 to 15 points. These results highlight that educational interventions have a more substantial effect on enhancing knowledge in the intervention group compared to the control group (Mahdiah, Zahara, & Oppusunggu, 2022).

This study highlights a pronounced difference between the intervention and control groups, underscoring the greater effectiveness of the

interventions. A key factor influencing adolescents' health behaviors is their knowledge. When adolescents understand the adverse effects of anemia and are aware of preventive measures, they are more likely to adopt healthier behaviors, reducing the risks and consequences associated with anemia. These behavioral changes can contribute to a decrease in anemia prevalence among adolescents (Aji & Kurniawati, 2024).

The findings demonstrate that the MIRA Chat program significantly improved knowledge and increased iron tablet consumption among adolescents ($p=0.000$). Anemia is caused by various factors, including poor nutrition, inadequate dietary iron intake, malabsorption, excessive blood loss during menstruation or childbirth, and chronic illnesses such as tuberculosis, intestinal worms, and malaria. Adherence to iron tablet consumption among adolescents plays a critical role in preventing anemia. Therefore, consistent compliance with iron supplementation is vital for addressing this issue in this vulnerable group (Susilawati, Suryanti, Artika Sar, & Murtiyani, 2021).

Table 4 reveals that the Chatting Mira Education intervention led to a significantly greater improvement in knowledge (mean increase of 19.91) compared to

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the Conventional Education Package (mean increase of 8.8), supported by a p-value of 0.000. This emphasizes the effectiveness of using applications or digital media in health education, as these tools deliver information in a more engaging and easily understandable manner for adolescents. Digital interactions allow adolescents to access more detailed and interactive content, enhancing their comprehension and retention of health knowledge, including information on anemia (Saraswati, 2019).

In this study, the intervention group experienced an average increase in hemoglobin (Hb) levels from 10.14 to 11.65, while the control group showed a slightly greater improvement, rising from 9.93 to 11.95. Despite the smaller increase in the intervention group, educational interventions paired with iron supplementation have been shown to significantly enhance Hb levels among adolescents, with average increases of 1.5 to 2 points (Setiawati & Rumintang, 2019). The variation in results may be attributed to differences in the type or duration of the interventions.

This research highlighted that the Chatting Mira application effectively motivated and educated adolescents about anemia prevention, leading to increased Hb levels (Syahrina, Gambir, & Petrika, 2020). Android-based applications have proven successful in improving adherence to iron tablet consumption, which directly contributes to higher Hb levels. These tools are especially valuable for healthcare providers and midwives aiming to enhance compliance with iron supplementation programs. Monitoring the number of tablets consumed, adherence to recommendations, and consumption frequency ensures that educational interventions achieve meaningful health improvements (Rohani & Diniarti, 2022).

Table 4 further demonstrates that the Chatting Mira Education method resulted in a higher Hb level increase (mean difference of 1.8) compared to the Conventional Education Package (mean difference of 1.4), with a statistically significant p-value of 0.000. Previous studies have established that digital platforms, such as chat applications or social media, effectively boost adolescents' knowledge and motivation to follow health recommendations.

Application-based or social media-based interventions have significantly enhanced teenagers'

awareness of the importance of consuming iron tablets, leading to improved Hb levels. These findings underscore the superiority of application-based education over conventional methods (Elsharkawy, Abdelaziz, Ouda, & Oraby, 2022). Digital tools also build trust among adolescents regarding the benefits of iron supplementation, promoting better adherence and ensuring effective distribution. Consistent with these results, studies have shown that knowledge, compliance, and Hb levels were significantly higher in intervention groups using applications compared to control groups. For instance, programs utilizing platforms like WhatsApp to deliver structured and continuous education have been effective in managing anemia among adolescents (Chapparo & Suchdev, 2019).

The Chatting Mira application aims to provide direct education to adolescents with anemia. Given the ubiquitous use of smartphones, the application sends daily reminders and short messages through WhatsApp to encourage the regular consumption of iron tablets. This approach is designed to increase adolescents' knowledge about anemia and inspire behavioral changes, transforming indifferent attitudes into proactive ones. It educates teenagers on the benefits of iron supplementation for growth and the potential consequences of failing to take iron tablets regularly, thereby improving compliance and health outcomes (Karyuni, Bungawati, & Baculu, 2020).

The intervention group showed an improvement in behavior, with scores increasing from 16.54 to 20.11, while the control group experienced a slight change, with scores decreasing slightly from 20.11 to 19.94. A study related to a healthy lifestyle found that health education interventions could improve adolescent behavior, with an average increase of about 3 to 4 points (Ajani, 2023).

Educational and health promotion interventions effectively improved adolescent behavior related to anemia. However, the difference between the intervention and control groups is more pronounced in this study, indicating the greater effectiveness of a more comprehensive approach. A lack of knowledge about anemia significantly influences adolescent health behaviors. Inadequate knowledge can lead to insufficient health practices, making it harder for teenagers to prevent anemia. Adolescents with limited

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understanding of anemia may fail to consume iron-rich foods simply because they are unaware of their benefits (Wulandari, 2018).

Conversely, teenagers who are well-informed about the importance of iron supplementation are more likely to comply with consuming iron tablets regularly. A person's actions are largely shaped by their knowledge or cognition, which is a critical foundation for behavior. Research and practical experience show that behavior based on solid knowledge is more sustainable compared to behavior arising from ignorance. Therefore, fostering a strong knowledge base among adolescents is essential for promoting positive and long-lasting health behaviors that can prevent anemia and its associated risks (Hadsah, Fitriani, & Fatiyani, 2023).

Based on the research results, it was found that the Chatting Mira application significantly influenced behavioral changes, particularly in increasing iron tablet consumption among adolescents ($p < 0.001$). The study also concluded that knowledge is one of the key factors influencing the occurrence of anemia. In addition to knowledge, compliance with iron tablet consumption is a critical health behavior among adolescents. A high level of compliance has been shown to reduce the prevalence of anemia in this group (Maulidayanti, & Sahiratmadja, 2023).

The flexibility and consistent interaction provided by digital platforms facilitate better engagement and understanding. Continuous education through data-driven applications makes it easier for adolescents to access reliable information regularly, thereby promoting changes in their attitudes and behaviors related to iron tablet consumption and anemia prevention. These findings emphasize the effectiveness of digital education tools like the Chatting Mira application in addressing anemia-related challenges among adolescents, fostering healthier habits and better compliance (Nadila, & Rustam, 2024).

CONCLUSION

Chatting Mira education can effectively change the attitudes and behaviors of teenagers regarding the consumption of iron tablets and the prevention of anemia. This program leverages peer-led education and structured interventions to increase awareness,

promote positive health habits, and ensure adherence to iron supplementation, thereby reducing the risk of anemia among adolescents.

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