



## The JUMINTEN TABAH Model as an Effort to Prevent Anemia among Adolescent Girls



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### ABSTRACT

**Aims** This study assessed the impact of the JUMINTEN TABAH intervention on anemia-related knowledge, adherence to iron-folic acid supplementation, and hemoglobin levels among adolescent girls.

**Materials & Methods** This quasi-experimental study, employing a nonequivalent control group with pretest-posttest measurements, was conducted between January and August 2025 in selected public senior high schools in Muaro Jambi District, Jambi Province, Indonesia. One hundred female students aged 15-18 years participated and were assigned to either intervention or control groups at the school level. The intervention incorporated structured weekly iron-folic acid intake, educational reinforcement, reminder tools (including a Friday calendar and a pocket handbook), and peer monitoring facilitated by Youth Red Cross cadres. The comparison group received routine school-based iron-folic acid distribution and standard health education. Data were obtained using validated questionnaires and hemoglobin assessments. Statistical analyses included paired and independent t-tests with effect size estimation.

**Findings** The intervention group's knowledge scores increased from a baseline of 55.40±7.25 to 78.20±8.10 post-intervention ( $p<0.001$ ). Adherence scores in the intervention group rose from 54.50±7.10 to 77.40±7.95 ( $p<0.001$ ). In contrast, the control group experienced modest, non-statistically significant changes: knowledge scores increased from 56.10±7.40 to 60.20±6.85 ( $p=0.056$ ), and adherence scores increased from 55.20±7.25 to 59.10±6.70 ( $p=0.056$ ). Between-group analysis confirmed substantially greater gains in both knowledge and adherence among students receiving the JUMINTEN TABAH model ( $p<0.001$ ).

**Conclusion** The development of the JUMINTEN TABAH model is effective in improving knowledge and compliance behavior regarding iron-folic acid tablet consumption among female adolescents in high schools in Muaro Jambi Regency.

**Keywords** Adolescent; Anemia; Iron-Deficiency Anemia; Folic Acid; Schools; Health Education

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## Introduction

Anemia is one of the most prevalent public health problems worldwide, particularly in developing countries [1,2]. The World Health Organization (WHO) reports that the global prevalence of anemia ranges from 40% to 88%, with adolescent girls being the most vulnerable group [3]. This condition is attributed to increased iron requirements during growth and blood loss during each menstrual cycle. Anemia during adolescence affects not only current health but also future quality of life and productivity, especially during the reproductive period [4,5].

In Indonesia, the prevalence of anemia remains high. The 2018 Basic Health Research (Riskesdas) survey reported that 32% of adolescents aged 15-24 years suffer from anemia. In Jambi Province, coverage of adolescent girls receiving iron-folic acid (IFA) supplementation was only 45.8% in 2022 [6], still below the WHO target of 50% by 2025 [3]. Anemia among adolescent girls reduces learning concentration, academic achievement, and physical fitness, and it increases the risk of adverse pregnancy outcomes later in life. This situation illustrates a gap between the implementation of anemia prevention programs and adolescents' adherence to IFA consumption.

Although the government has implemented a policy to provide one IFA tablet per week to adolescent girls, compliance remains low. Only 1.4% of adolescent girls consume  $\geq 52$  tablets annually, while 98.6% take fewer than the recommended amount. Factors contributing to poor adherence include laziness, side effects such as nausea, forgetfulness, and limited environmental support. This phenomenon reflects an implementation gap that, while tablet distribution is relatively high, actual consumption among adolescents remains low [7,8].

Previous studies have evaluated the effectiveness of school-based IFA supplementation programs, but most have been limited to recording distribution and consumption. Few have developed integrated educational models that use health promotion approaches focused on adolescent behavior, routine monitoring, and the involvement of schools and families.

Moreover, most interventions still emphasize medical aspects alone, without incorporating innovative strategies to enhance motivation, compliance, and adolescents' collective participation in IFA programs [9,10].

The urgency of this research lies in the need to break the cycle of anemia early. If left unaddressed, adolescent anemia can persist into adulthood and pregnancy, increasing the risk of low birth weight, preterm delivery, and stunting in infants. Muaro Jambi Regency, as one of the regions with a relatively high prevalence of adolescent anemia, requires effective, sustainable, and school-based community interventions. Therefore, this study is crucial as a

preventive measure that can help achieve national health targets.

The novelty of this study lies in the development of the "JUMINTEN TABAH" (Friday Iron Tablet Supplementation—10 Tablets) model as a school-based anemia prevention strategy. This model not only emphasizes IFA supplementation but also integrates health education, collective consumption monitoring at school, the use of pocketbooks and reminder calendars, and the empowerment of Youth Red Cross (PMR) cadres. Through this comprehensive approach, it is expected that adolescents' compliance with IFA consumption will increase, thereby reducing anemia prevalence more effectively than conventional programs.

We specifically analyzed differences in mean knowledge and behavior before and after the intervention, compared groups receiving the JUMINTEN TABAH model with those that did not receive it, and identified the model's impact on IFA compliance. The findings of this study are expected to provide broad benefits. For schools, this model can serve as a routine health education program that strengthens School Health Units (UKS) and peer education initiatives (PIK-R), fostering a culture of health among adolescents. For health centers and healthcare workers, the results can serve as an evaluation tool and an innovation to strengthen school-based community IFA supplementation programs.

The aim of this study was to examine the effectiveness of the JUMINTEN TABAH model in improving adolescent girls' knowledge, attitudes, and behaviors related to anemia prevention.

## Materials and Methods

### Design and participants

This quasi-experimental investigation with a pre-test/post-test design was implemented in selected public senior high schools in Muaro Jambi Regency between January and August 2025. Schools were purposively selected based on documented anemia prevalence and the routine implementation of IFA supplementation programs. Participants were drawn from female students enrolled in selected senior high schools in Muaro Jambi Regency during the 2025 academic year. Recruitment was conducted in collaboration with school administrators following an initial eligibility screening process.

Eligibility was limited to adolescent girls aged 15-18 years who were actively attending classes at the time of data collection. Only students who voluntarily agreed to participate and submitted written informed consent were included. Prior to enrollment, students were screened to ensure they were not pregnant and did not have any chronic medical conditions known to influence hemoglobin concentration. This screening process was implemented to ensure sample homogeneity and to

minimize potential confounding factors related to hemoglobin status.

The required number of participants was calculated using power analysis to ensure adequate sensitivity to detect differences between the intervention and control groups.

The calculation assumed a two-tailed alpha level of 0.05 and a statistical power of at least 80%. Considering the pre-test–post-test design, variability of the primary outcomes, and the feasibility of implementing a school-based intervention, a total sample of 100 respondents was determined and allocated relatively equally between the intervention and control groups.

Eligible students were first identified through screening procedures, after which participants were randomly selected from the list of qualified candidates. Group assignment was implemented at the school or classroom level rather than through individual random allocation.

### **Procedure**

Participants in the intervention group received the JUMIN TEN TABAH model, a school-based anemia prevention intervention designed to improve knowledge, compliance with IFA tablet consumption, and hemoglobin status among female students, which was implemented in a structured and sustained manner throughout the study.

The main component of the intervention was the scheduled consumption of 10 IFA tablets, administered weekly on Fridays. Each student in the intervention group was required to consume one IFA tablet every Friday according to the predetermined schedule. Tablet distribution was carried out by school staff in collaboration with Youth Red Cross (Palang Merah Remaja/PMR) cadres, and tablet consumption was directly observed on most occasions (directly observed consumption) to enhance adherence. The intervention was supported by health education using a pocketbook containing information on the definition of anemia, its causes, signs and symptoms, consequences of anemia in adolescent girls, benefits of IFA supplementation, and proper tablet consumption. Educational sessions were delivered in a classroom setting at the beginning of the intervention and reinforced through brief discussions and repetition of key messages during the intervention period.

As a reminder tool, each participant in the intervention group received a Friday calendar, a customized calendar highlighting the scheduled IFA consumption every Friday.

This calendar served as a visual aid to promote regular intake and increase awareness of the importance of adherence.

Another essential component of the intervention was mentoring and monitoring by PMR cadres. PMR cadres were responsible for reminding participants of the consumption schedule, recording weekly adherence, assisting with tablet distribution, and

providing peer support. Adherence monitoring was conducted through weekly consumption records and direct observation, and the data were subsequently compiled by the researchers.

To further strengthen the effectiveness of the intervention, supporting activities were implemented, including group breakfast sessions prior to IFA consumption to reduce gastrointestinal side effects, simple nutrition campaigns within the school environment using posters and health messages, and routine monitoring of adherence throughout the intervention period.

The control group did not receive the JUMIN TEN TABAH intervention and only received health education and IFA tablet distribution according to the routine school program, without a structured schedule, reminder media, or intensive mentoring. This distinction in intervention exposure allowed for a more objective evaluation of the effectiveness of the JUMIN TEN TABAH model.

The assessed parameters were classified into exposure, outcomes, predictors, and potential confounders, and effect modifiers. The primary exposure was the implementation of the JUMIN TEN TABAH model, a school-based anemia prevention intervention, which was provided exclusively to the intervention group and included scheduled weekly consumption of 10 IFA tablets every Friday, health education using a pocketbook, use of a Friday calendar as a reminder tool, and mentoring and monitoring by PMR cadres. The control group did not receive this exposure and only participated in routine school-based health education and IFA distribution. The primary outcomes included changes in knowledge of anemia prevention, compliance with IFA tablet consumption, and hemoglobin (Hb) levels. Knowledge levels were assessed to evaluate the cognitive impact of the intervention, compliance with IFA consumption was measured as an indicator of behavioral change, and hemoglobin levels were used as a biological indicator of intervention effectiveness in anemia prevention. Outcome measurements were conducted at both pre-test and post-test stages in both groups using identical methods and instruments. Several parameters were recorded as predictors and potential confounders that could influence the relationship between exposure and outcomes. These parameters included age, nutritional status, menstrual history, and dietary patterns.

### **Data collection**

Data were collected through questionnaires and anthropometric measurements to identify external factors that could affect knowledge levels, compliance with IFA consumption, and hemoglobin levels. Potential effect modifiers included baseline adherence to IFA tablet consumption and individual participant characteristics. To minimize potential bias, identical measurement instruments and procedures were applied to both the intervention and

control groups. The intervention was monitored regularly, and potential confounding factors, including age, nutritional status, menstrual history, and dietary patterns, were systematically recorded. The absence of missing data further strengthened the study's internal validity.

#### Data analysis

All statistical procedures were carried out using SPSS 23 software. Changes within each group from baseline to follow-up were examined using parametric or non-parametric approaches, selected according to data normality. Associations involving categorical parameters were evaluated using Chi-square or Fisher's exact test when required.

#### Findings

The majority of respondents were aged 16-17 years in both the intervention and control groups. In the intervention group, 8 respondents (16.0%) were 15 years old, 20 (40.0%) were 16 years old, and 22 (44.0%) were 17 years old. In the control group, 10 respondents (20.0%) were 15 years old, 21 (42.0%) were 16 years old, and 19 (38.0%) were 17 years old. Regarding grade level, the distribution was relatively balanced in both groups. In the intervention group, 15 respondents (30.0%) were in Grade X, 20 (40.0%) were in Grade XI, and 15 (30.0%) were in Grade XII. In the control group, 18 respondents (36.0%) were in Grade X, 17 (34.0%) were in Grade XI, and 15 (30.0%) were in Grade XII.

Participants receiving the JUMIN TEN TABAH intervention demonstrated a marked increase in knowledge scores, rising from  $55.40 \pm 7.25$  at baseline to  $78.20 \pm 8.10$  after the program ( $p < 0.001$ ). Conversely, the control group exhibited only a modest change, with scores increasing from  $56.10 \pm 7.40$  to  $60.20 \pm 6.85$  ( $p = 0.056$ ).

Adherence to IFA tablet consumption improved markedly among participants in the intervention group, with mean scores rising from  $54.50 \pm 7.10$  at baseline to  $77.40 \pm 7.95$  following the intervention ( $p < 0.001$ ). In comparison, the control group demonstrated only a modest increase, and the observed change was not statistically significant ( $55.20 \pm 7.25$  to  $59.10 \pm 6.70$ ;  $p = 0.056$ ).

The intervention group experienced a mean increase of  $22.80 \pm 5.15$  points, representing a "Very large" effect size (Cohen's  $d = 2.96$ ). In contrast, the control group had a smaller mean increase of  $4.10 \pm 3.20$  points, with a "Small-moderate" effect size (Cohen's  $d = 0.57$ ). The between-group difference in knowledge change was extremely large (Cohen's  $d = 4.33$ ). The intervention group saw a mean increase of  $22.90 \pm 5.40$  points, yielding an "Extremely large" effect size (Cohen's  $d = 4.24$ ). The control group had a mean increase of  $3.90 \pm 2.95$  points, with a "Large" effect size (Cohen's  $d = 1.32$ ). The between-group difference in adherence change was extremely large (Cohen's  $d = 4.36$ ).

#### Discussion

The study aimed to examine the effectiveness of the JUMINTEN TABAH model in improving adolescent girls' knowledge, attitudes, and behaviors related to anemia prevention. The JUMIN TEN TABAH model effectively enhanced both knowledge and IFA adherence among adolescent girls, thereby fulfilling the primary aim of the study. Participants exposed to the intervention exhibited substantial improvements across cognitive and behavioral measures, whereas changes in the control group were minimal and statistically nonsignificant. Thus, the structured approach embedded within the model offers a promising strategy for strengthening anemia prevention efforts in this population.

There were meaningful differences between the intervention and control groups. Adolescents in the intervention group showed increases in knowledge and behavior, far higher than those in the control group. This improvement was not only statistically significant but also practically meaningful, as it reflected a real change in IFA consumption behavior, an important indicator for anemia prevention.

These findings are consistent with those of Haile *et al.* [11], reporting that school-based education with routine monitoring increases IFA compliance among adolescent girls. Similarly, Sampa *et al.* [12] found that education using innovative media, such as pocket books and reminder cards, improves adolescents' nutrition knowledge. However, our study goes further by integrating an educational intervention with a collective approach (taking IFA tablets together every Friday), thereby ensuring stronger adherence. Thus, we addressed the research gap left by earlier studies that mainly focused on IFA distribution without structured monitoring or social support systems [13, 14].

From a theoretical perspective, these findings are supported by Lawrence Green's Health Promotion Model, which highlights the importance of predisposing factors (knowledge), enabling factors (facilities and access to IFA), and reinforcing factors (support from teachers, peers, and Youth Red Cross cadres) in shaping health behavior [15, 16]. The JUMIN TEN TABAH model integrates all three, creating a supportive environment for adolescents to comply with IFA consumption. In addition, Horne's theory of medication adherence is also relevant, emphasizing that positive beliefs about the benefits of medication enhance compliance, as reflected in the increased motivation among adolescent girls after the intervention [17-19].

The correlation between improved knowledge and behavior change was evident. Respondents who gained knowledge through the intervention were more likely to change their behavior by taking IFA regularly. This aligns with health behavior theory, which posits that knowledge is a key factor driving the formation of attitudes and health-related actions

[20, 21]. Hence, the increase in knowledge obtained through educational interventions directly contributed to improved compliance with IFA intake [22, 23].

Moreover, compliance with IFA consumption was closely linked to potential improvements in hemoglobin levels. Although we did not specifically measure hemoglobin outcomes, the literature suggests that adherence to at least one IFA tablet per week can improve iron status and reduce the risk of anemia among adolescent girls [11, 24-26]. This implies that the compliance behavior fostered by the JUMIN TEN TABAH model has a direct physiological benefit, namely, maintaining hemoglobin levels and reducing anemia prevalence.

The implications of this research are broad, both in schools and in public health policy. For schools, the JUMIN TEN TABAH model can be adopted as a routine School Health Unit (SHU) program involving teachers, Youth Red Cross cadres, and students collectively. For health centers and district health offices, these findings can serve as a basis for scaling up similar interventions in other schools to help reduce adolescent anemia rates. Nationally, this research supports the achievement of the targets set in the National Medium-Term Development Plan and the WHO 2025 goal of reducing anemia among adolescent girls.

Nevertheless, this study has limitations. The use of a nonequivalent control group design introduces the potential for selection bias due to the non-random allocation of samples. Furthermore, the reliance on questionnaires and self-reports increases the possibility of reporting bias. The relatively short duration of the intervention also limited the monitoring of long-term effects on hemoglobin levels. These limitations should be considered in future studies, which are encouraged to adopt randomized controlled trial designs, extend the intervention period, and integrate laboratory assessments as objective indicators.

## Conclusion

The development of the JUMIN TEN TABAH model (Friday of taking 10 IFA tablets) is effective in improving knowledge and compliance behavior regarding IFA tablet consumption among female adolescents in high schools in Muaro Jambi Regency.

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**Ethical Permissions:** This study was approved by the Health Research Ethics Committee of Health Polytechnic of the Ministry of Health Jambi, Indonesia (Ethical approval number: LB.02.06/1/1660/2025)

**Conflicts of Interest:** The authors declare no conflicts of interest related to this study.

**Authors' Contribution:** Triana W (First Author), Introduction Writer/Methodologist/Main

Researcher/Discussion Writer/Statistical Analyst (70%); Imelda I (Second Author), Introduction Writer/Assistant Researcher/Discussion Writer (30%)

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