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Original Research

Optimizing Hemoglobin Levels in Adolescent Girls Using Iron Tablets and Mung Bean Juice

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ABSTRACT

Background: *Anemia is predominantly attributed to blood loss, particularly in adolescent girls during menstruation, and insufficient consumption of iron-rich foods. Iron-rich food sources include almonds, leafy greens, and red meat. Pharmacological interventions to address low hemoglobin levels in teenagers included the weekly intake of iron tablets, whilst non-pharmacological strategies involved the daily ingestion of mung bean juice. This study sought to assess the impact of iron tablet and mung bean juice administration on hemoglobin level enhancement in adolescent girls at a Junior High School in Samarinda.*

Methods: *The research employed a quasi-experimental approach featuring a nonequivalent control group. The sampling strategy employed a non-probability method via purposive sampling. The researcher established the sampling according to the inclusion and exclusion criteria utilizing the Federer formula, resulting in 18 individuals in both the control and intervention groups. The treatment group received mung bean juice for a duration of 14 days. Paired t-tests and independent t-tests were used to analyze the differences in hemoglobin levels before and after therapy.*

Results: *The analysis produced a p-value < 0.001, which is less than 0.05, leading to the conclusion that the intervention group exhibited a greater increase in hemoglobin levels compared to the control group.*

Conclusion: *The administration of Fe tablets and mung bean juice effectively increased hemoglobin levels in teenage girls at the Junior High School in Samarinda. Regular administration of iron tablets and mung bean juice is recommended as a measure to increase hemoglobin levels in adolescent girls.*

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INTRODUCTION

While 29.9% of women aged 15–49 suffer from anemia (WHO, 2022), the rate is 28.9% among pregnant women aged 15–54 in Indonesia, with 84.6% of cases occurring in the 15–24 age bracket. In 2017, the incidence of anemia in Indonesia was 37.1% and the prevalence among the 15–24 age group was 18.4%; nevertheless, there has been an increase in the incidence compared to 2017 (Kemenkes RI, 2020).

Microcytic and hypochromic erythrocytes on peripheral smears are the hallmarks of anemia, which affect half the world's population. Fatigue and dyspnea with exercise are common nonspecific symptoms reported by individuals with anemia. Depending on factors such as age, gender, and socioeconomic status (SES), the cause of anemia might vary. Iron deficiency anemia may develop due to insufficient iron intake, poor iron absorption, or bleeding (Warner & Kamran, 2024).

Blood loss, particularly in menstruating teenage girls, and insufficient intake of iron-rich foods are the main causes of iron deficiency anemia, according to Barnett et al., (2023). Iron may be found in foods like nuts, dark vegetables, and red meat. Dietary improvement measures to fight anemia should target teenage girls since their systemic iron needs are higher during growth and pregnancy (Kemenkes RI, 2020).

Kemendagri (2023) reports that between 2022 and 2023, the percentage of East Kalimantan teenage females who sought out anemia status examination services increased from 2.1% to 17.7%. Anemia status assessment services were utilized by 89.9% of the female adolescents in the Sambutan District in 2023, compared to 36.9% in the Samarinda City region. A preliminary study carried out in October 2023 at a Junior High School in Samarinda found that thirteen out of fifteen first-grade female pupils had hemoglobin levels below eleven g/dl, and that their average iron consumption was inadequate to fulfill the need.

Young women (those aged 10–19) should consume 15–18 mg of iron daily, as stated in the Peraturan Menteri Kesehatan Republik Indonesia Nomor 28 Tahun 2019 Tentang Angka Kecukupan Gizi Yang Dianjurkan Untuk Masyarakat Indonesia (2020). Finding out whether the groups of junior high school girls given iron tablets and mung bean juice by Samarinda had a rise in hemoglobin levels is the main objective of the study.

Previous studies have primarily focused on the effectiveness of iron supplementation or dietary interventions, such as the consumption of iron-rich foods, as separate strategies to address anemia (Everett, 2025; Masanja et al., 2025; Pamalka et al., 2026; Živanović et al., 2025). However, these individual approaches often fail to address the synergistic effect of combining medical supplementation with natural, locally available food sources to optimize iron absorption and sustainability. This study proposes a combined intervention of iron tablets and mung bean juice to fill this gap, offering a novel and more holistic dietary approach to effectively increasing hemoglobin levels among adolescent girls.

This study aimed to determine the effect of combined iron tablet supplementation and mung bean juice consumption on increasing hemoglobin levels among first-grade junior high school girls in Samarinda. This study provides scientific evidence on the effectiveness of simple nutritional interventions in preventing anemia in adolescent girls. The results of this study can also serve as a basis for the development of school health programs to improve hemoglobin levels and adolescent health in a sustainable manner.

MATERIALS AND METHOD

This study employed a quasi-experimental approach with a nonequivalent control group design to evaluate causal relationships between variables. This design was chosen because it is suitable for evaluating the effectiveness of iron tablets and mung bean juice as practical nutritional interventions in improving the hemoglobin status of adolescent girls. The research was conducted from March to May 2024 at a Junior High School in Samarinda.

The study population consisted of seventy-four first-grade female students, from which a sample was drawn using a non-probability purposive sampling method based on specific inclusion and exclusion criteria (Hardani et al., 2020). The research included seventy-four female students in the first grade at Samarinda Junior High School. The sample size was determined using the Federer formula, $(t-1)\ (n-1) \geq 15$, to ensure sufficient degrees of freedom for statistical validity in experimental research, resulting in 18 participants each for the intervention and control groups.

The independent variables in this study were the administration of iron tablets and consumption of mung bean juice as forms of nutritional intervention in adolescent girls. The dependent variable was the hemoglobin level of adolescent girls, which was measured before and after the intervention. Data were analyzed using a dependent (paired) t-test to compare hemoglobin levels before and after the intervention because the data were normally distributed. An independent t-test was used to examine differences in mean hemoglobin changes between the intervention and control groups (Widakdo et al., 2023).

The intervention group received 180 ml of mung bean juice daily for 14 days alongside weekly iron tablet supplementation, while the control group received only the weekly iron tablets. Hemoglobin levels were measured in both groups as a pre-test before the intervention and a post-test following the 14-day treatment. Hemoglobin concentration was assessed using a digital Hemoglobinometer (EasyTouch GCHb) via the cyanmethemoglobin method. To ensure data accuracy, the device was calibrated using a code chip specific to each strip container, and measurements were performed by a trained laboratory technician using standardized capillary blood sampling procedures.

The intervention was conducted during the initial school break to avoid disrupting academic activities, with direct observation by the researcher to ensure compliance. First-grade students were specifically selected to avoid the scheduling conflicts faced by second and third-grade students due to graduation exams and extracurricular commitments.

The study was conducted in accordance with ethical standards, having received approval from the Poltekkes Kemenkes Kalimantan Timur Research Ethics Committee (No. DP.04.03/F.XLII.89/0030/2024), with informed consent obtained from all participants. The research was conducted with the utmost respect for the principles of confidentiality, anonymity, and the participants' right to refuse or withdraw at any time without consequences. In addition, all research procedures were conducted safely and did not pose any harmful risks to the participants.

RESULTS

The results of this study present changes in haemoglobin levels in adolescent girls after intervention in the form of a combination of iron tablets and mung bean juice. The analysis was conducted by comparing haemoglobin values before and after intervention in the treatment group and comparing them with the control group. These findings provide

an overview of the effectiveness of simple nutritional interventions in improving haemoglobin status in adolescent girls.

Table 1. Baseline Characteristics of Respondents in the Intervention and Control Groups (n = 36)

Variable	Category	Group			
		Intervention (n = 18)		Control (n = 18)	
		n	%	n	%
Age (year)	12 years old	7	38.9	9	50
	13 years old	11	61.1	9	50
Daily iron intake	Adequate (>15 mg/day)	0	0	0	0
	Inadequate (<15 mg/day)	18	100	18	100

The data shows that most respondents in the intervention group were 13 years old (61.1%), while in the control group, the distribution of ages 12 and 13 was balanced (50% each). All respondents in both groups had inadequate daily iron intake (<15 mg/day) and there were no respondents with adequate intake (>15 mg/day).

Table 2. Mean Hemoglobin Levels Before and After Intervention in the Intervention and Control Groups (n = 36)

Group	Measurement	Min–Max	Mean ± SD	Mean Increase (ΔHb)
Intervention (n = 18)	Pretest	9.10–11.01	10.13 ± 0.50	**1.86**
	Posttest	11.90–12.05	11.99 ± 0.04	
Control (n = 18)	Pretest	9.00–11.05	10.07 ± 0.63	**0.81**
	Posttest	10.00–11.90	10.88 ± 0.60	

Note: SD = Standard Deviation

The intervention group, which received combined iron supplementation and mung bean juice, showed a more pronounced improvement in hemoglobin concentration compared to the control group. Specifically, the intervention group achieved a mean increase of 1.86 g/dl, whereas the control group, receiving only iron tablets, showed a smaller increase of 0.81 g/dl. These results indicate that the addition of mung bean juice significantly enhanced the recovery of hemoglobin levels in the study participants.

Table 3. Paired Analysis of Hemoglobin Levels in the Intervention and Control Groups (n = 36)

Group	Measurement	Mean ± SD	Mean Difference	95% CI	p-value*
Intervention (n = 18)	Pretest	10.13 ± 0.50	**1.86**	**1.62–2.10**	**<0.001**
	Posttest	11.99 ± 0.04			

Group	Measurement	Mean ± SD	Mean Difference	95% CI	p-value*
Control (n = 18)	Pretest	10.07 ± 0.63	**0.81**	**0.65–0.97**	**<0.001**
	Posttest	10.88 ± 0.60			

Note: SD = Standard Deviation; *paired T-test

The statistical analysis reveals a significant increase in hemoglobin levels within the intervention group, with a p-value of < 0.001 (p < 0.05). The 95% confidence interval suggests that the true mean increase in the population likely falls between 1.62 and 2.10 g/dl, confirming that the combined administration of iron tablets and mung bean juice is a highly effective strategy for improving iron status in female adolescents.

The analysis confirms a statistically significant increase in hemoglobin levels for the control group (p-value = <0.001). While the intervention was effective, the 95% confidence interval (0.65 to 0.97 g/dl) indicates a narrower and lower range of improvement compared to the intervention group. This suggests that while iron tablets alone are beneficial, their efficacy is significantly enhanced when combined with mung bean juice.

Table 4. Comparison of Mean Hemoglobin Increase Between Intervention and Control Groups (n = 36)

Group	Mean Increase ± SD (g/dL)	Mean Difference	95% CI	p-value*
Intervention (n = 18)	1.86 ± 0.63	1.05	0.82–1.28	<0.001
Control (n = 18)	0.81 ± 0.55			

Note: SD = Standard Deviation; *t-independent

The results demonstrate a statistically significant difference between the two study arms (p-value = <0.001). The intervention group achieved a mean hemoglobin increase that was 1.05 g/dl greater than that of the control group. With a 95% confidence interval of 0.82 to 1.28 g/dl, the data strongly supports the conclusion that combining mung bean juice with iron tablets is superior to iron supplementation alone for elevating hemoglobin levels in female adolescents.

DISCUSSION

The findings of this research provide exceptionally robust evidence that a combined intervention strategy—consisting of the daily administration of mung bean juice alongside weekly iron tablet supplementation—is significantly more effective at increasing hemoglobin levels in adolescent girls compared to the standard protocol of iron supplementation alone. In this study, the intervention group achieved a substantial and statistically superior mean hemoglobin rise of 1.93 g/dL, elevating their average levels from an initial 10.13 g/dL on the pretest to a post-treatment average of 12.06 g/dL.

In contrast, the control group, which received only the weekly iron tablets, demonstrated a notably lower increase of just 0.81 g/dL, rising from a pretest reading of 10.07 g/dL to 10.88 g/dL. This highly significant statistical difference, confirmed by a P-value of 0.000 < 0.05, proves that the integration of a nutrient-dense, plant-based food

source like mung bean juice creates a powerful biochemical synergy that accelerates the body's recovery from anemia. These results are firmly aligned with the findings of Puspikawati et al. (2021) and Haya et al. (2025), which emphasize that treating anemia effectively involves a dual approach of giving iron supplement pills alongside eating meals that are high in iron, as this integration with additional micronutrients is more successful in enhancing hemoglobin production than single-dose iron supplementation alone (Kemenkes RI, 2020).

The biological plausibility of this superior outcome is deeply rooted in the unique and concentrated nutritional profile of mung beans (*Vigna radiata* L.), which are categorized as secondary crops common in tropical regions (Hakim et al., 2021) and contain approximately 6.74 mg of iron per 100g (Hou et al., 2021). Crucially, the presence of vitamin C (4.8 mg per 100 g of mung beans) acts as a vital biochemical catalyst; organic acids like vitamin C significantly enhance the absorption of non-heme iron by converting ferric iron to the more soluble and bioavailable ferrous state, which can quadruple iron absorption (Barnett et al., 2023; Juffrie et al., 2020).

Furthermore, the high concentration of folic acid present in mung beans—625 mg per 100 grams—plays an indispensable role in strengthening red blood cell production, optimizing hemoglobin function, and mitigating cellular damage (Ghatpande et al., 2022; Juffrie et al., 2020). By delivering these specific nutrients in an easily digestible liquid form, which facilitates consumption and enhances absorption in the gastrointestinal tract (Chunkao et al., 2020), the intervention ensures that participants can fulfill roughly 50% of their daily iron requirement as per the AKG (2019) for adolescents, which is 15-18 mg (Hou et al., 2021). This directly addresses the necessity of maintaining adequate red blood cell levels to avert the detrimental impacts of anemia on general health, concentration, and academic performance (Agiratama & Kurniasari, 2023; Putri et al., 2024).

However, the interpretation of these results must be balanced against certain methodological limitations. While iron is an essential component for the synthesis of hemoglobin (Scricciolo et al., 2020), and absorption escalates during developmental phases marked by fast growth (Warner & Kamran, 2024). This study's findings are based on a specific demographic in Samarinda. The significant elevation of Hb levels post-intervention underscores the importance of mitigating iron deficiency via a dual approach of supplementation and education on iron-rich foods, but continuous monitoring is crucial to ensure adolescents sustain these levels (Chandra et al., 2022).

Adolescents must prioritize their health and well-being to avert long-term consequences such as premature birth, heightened mortality risk during childbirth, low birth weight (LBW), and stunting (Juffrie et al., 2020; Putri et al., 2024). Therefore, this combined approach of mung bean extract and iron tablets serves as an effective way to address iron-deficiency anemia in women of reproductive age (Haya et al., 2025), and further research is required to investigate the potential advantages of integrating these findings into broader public health initiatives designed to enhance iron levels in vulnerable groups (Kemenkes RI, 2020; Rani et al., 2024).

The practical implications of these findings are particularly relevant for nursing practice and school-based health programs (UKS). Nursing interventions in community and school settings should shift from a focus on single-dose supplementation toward a more holistic, food-based approach. Incorporating mung bean juice as a daily dietary requirement in schools offers a cost-effective, culturally acceptable, and highly efficacious strategy to mitigate the long-term risks of anemia, such as diminished

cognitive function, impaired academic performance, and future reproductive complications like stunting and low birth weight.

Future research should build upon these findings by implementing randomized controlled trials with larger, more diverse sample sizes to enhance the generalizability of the results. Directions for further study include extending the intervention duration beyond 14 days to assess the long-term sustainability of iron stores (ferritin levels) and exploring dosage variations of mung bean extract to determine the optimal intake for maximum iron absorption. Additionally, investigating the impact of this combined therapy on cognitive concentration and academic outcomes would provide deeper clinical and public health insights into the benefits of holistic anemia management in adolescents.

CONCLUSION

The findings of this study demonstrate that combining iron (Fe) tablet supplementation with mung bean juice provides a significant comparative advantage over the administration of iron tablets alone. While both groups showed improvements, the intervention group achieved a substantially higher mean hemoglobin increase (1.93 g/dL) compared to the control group (0.81 g/dL). This indicates that the micronutrients in mung beans—including iron, vitamin C, and folic acid—work synergistically with medical supplementation to accelerate the recovery of hemoglobin levels in adolescent girls. It is recommended that a combination of iron tablets and mung bean juice be administered regularly as part of school health programs for adolescents as an effective strategy to accelerate hemoglobin levels and prevent anemia in adolescent girls.

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CONFLICT OF INTERESTS

The author declares that there is no conflict of interest in this research.

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