

Education and empowerment of young women in the prevention of anemia through the consumption of green bean juice and soy milk in the school environment

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ABSTRACT

Anemia remains a persistent public health problem among adolescent girls, significantly affecting their growth, learning capacity, and overall quality of life. This community-based study aimed to evaluate the effects of mung bean extract and soy milk consumption on hemoglobin (Hb) levels in adolescent girls with moderate anemia. The activity was conducted as part of a community health service program focused on improving nutritional awareness and reducing anemia prevalence through affordable local food sources. The intervention involved two adolescent participants with confirmed moderate anemia. One participant consumed mung bean extract, while the other consumed soy milk, each 250 ml twice daily for seven consecutive days. Hemoglobin levels were measured before and after the intervention using a portable hemoglobinometer. The results showed a substantial improvement in Hb concentration for both participants: the mung bean group experienced a 1.3 g/dL increase, and the soy milk group a 1.4 g/dL increase. Both participants reported reduced fatigue, improved concentration, and enhanced general well-being. These findings suggest that plant-based iron sources, such as mung beans and soy milk, are effective and affordable alternatives to conventional supplementation for managing anemia among adolescents. Furthermore, integrating such nutritional education into community outreach programs can raise awareness of balanced diets and iron-rich local foods. This initiative demonstrates that simple, sustainable dietary interventions can significantly improve adolescent health in the community.

Keywords: Adolescent Girls, Anemia, Community Nutrition, Mung Bean Extract, Soy Milk.



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INTRODUCTION

Anemia is one of the most common nutritional health problems affecting adolescent girls worldwide, particularly in developing countries like Indonesia. It is a condition characterized by a reduction in hemoglobin (Hb) levels or red blood cell count below normal values, resulting in decreased oxygen-carrying capacity of the blood (Abubakar et al., 2025). This condition can lead to chronic fatigue, dizziness, weakness, poor concentration, and even reduced academic performance. According to the World Health Organization (WHO), the prevalence of anemia among adolescent girls globally is around 29.9%, while in Indonesia, the prevalence reaches more than 30%, indicating a serious public health concern. Adolescence is a critical period for growth and development, and nutritional deficiencies during this stage can have long-term effects on physical, cognitive, and reproductive health (Ajeng Wijayanti et al., 2025).

Several factors contribute to the high incidence of anemia among adolescent girls. The most prominent cause is iron deficiency due to inadequate dietary intake or poor absorption of iron from plant-based foods (Akib & Rukinah, 2024). Menstrual blood loss further increases the demand for iron, making adolescent girls more vulnerable to anemia. Additionally, unhealthy dietary habits, such as frequent consumption of fast food and sweetened beverages, and low intake of fruits and vegetables, exacerbate the problem. Socioeconomic conditions, limited nutritional knowledge, and limited access to iron-rich foods also play significant roles in maintaining the prevalence of anemia (Junita et al., 2023). In rural or low-income communities, the challenge is even more pronounced due to limited access to affordable, nutrient-dense foods (Alishahi & Hasanzadeh, 2025).

Addressing anemia requires a holistic approach that combines nutritional education, community involvement, and the use of locally available food sources (Atkinson et al., 2025). Conventional iron supplementation programs have been implemented in various regions. However, their effectiveness is often limited by poor compliance, side effects such as nausea or constipation, and the perception that supplementation is a “medical treatment” rather than a daily nutritional need (Bhutta et al., 2025). Therefore, alternative strategies emphasizing dietary improvements through local food sources are gaining attention as sustainable and culturally acceptable solutions (Bolka et al., 2025).

Mung beans (*Vigna radiata*) and soybeans (*Glycine max*) are two plant-based foods that offer great potential for improving hemoglobin levels naturally. Both are inexpensive, locally available, and rich in essential nutrients such as iron, protein, folate, and vitamin B complex (Indryani et al., 2025). Mung beans contain non-heme iron, which plays a vital role in hemoglobin synthesis, while soy milk provides a good balance of protein and essential amino acids that support red blood cell production (Cliffer et al., 2025). These plant-based sources are not only nutritious but also well-accepted by the community due to their palatable taste and versatile preparation methods. Moreover, promoting these ingredients aligns with the principles of community empowerment by encouraging the use of local resources to address health issues (Fang et al., 2025).

This study was conducted as part of a community service (pengabdian masyarakat) initiative to increase awareness and reduce anemia among adolescent girls through simple nutritional interventions. The program was designed to demonstrate that daily consumption of mung bean extract and soy milk could effectively increase hemoglobin levels within a short period. By incorporating educational components on healthy eating habits, this project also encouraged adolescent girls to make informed food choices that support their overall well-being.

The importance of this initiative lies not only in improving individual health outcomes but also in contributing to public health efforts to reduce the burden of anemia in the community. Empowering young women to understand their nutritional needs helps build a foundation for healthier future generations. Furthermore, the involvement of families, schools, and local health workers ensures the

intervention has a broader social impact and is sustainable. The integration of nutrition education with practical interventions, such as mung bean and soy milk consumption, exemplifies the spirit of community-based health promotion: simple, evidence-based, and adaptable to local contexts.

Therefore, this community service project seeks to analyze and describe the impact of consuming mung bean extract and soy milk on hemoglobin levels among adolescent girls with moderate anemia. It also aims to raise awareness about the importance of balanced nutrition and the potential of local food ingredients as natural, affordable alternatives to prevent and treat anemia. The expected outcome is to demonstrate that small-scale interventions, when grounded in community participation and supported by scientific evidence, can significantly improve health indicators and contribute to achieving public health goals related to adolescent nutrition in Indonesia.

METHOD of IMPLEMENTATION

This community service activity adopted a participatory and educational approach aimed at improving awareness and reducing anemia among adolescent girls by using locally available ingredients, such as mung bean extract and soy milk. The program combined health education, nutritional interventions, and hemoglobin (Hb) level evaluation to assess the effectiveness of natural food-based strategies in combating moderate anemia. The implementation followed several systematic stages: preparation, intervention implementation, monitoring, and evaluation.

Preparation Phase

The preparation phase began with coordination between the project team, local health authorities, and the targeted school community to ensure that the program aligned with local health priorities. A preliminary survey was conducted to identify adolescent girls who experienced symptoms consistent with anemia, such as fatigue, dizziness, or decreased concentration. Candidates were screened through hemoglobin testing using a portable hemoglobinometer. Two participants diagnosed with moderate anemia (Hb levels between 9–10 g/dL) were selected as case examples for this activity. Ethical considerations were addressed by obtaining informed consent from participants and their guardians before the intervention. In addition, educational materials were developed, including posters and leaflets about anemia prevention, the importance of iron intake, and the benefits of consuming mung beans and soy products. The materials were designed in a simple and engaging format to promote better understanding among adolescents.

Intervention Phase

During the implementation stage, participants were divided into two groups, each receiving different nutritional interventions. The first participant consumed mung bean extract, and the second consumed soy milk. Both drinks were prepared in a standardized volume of 250 ml per serving, consumed twice daily (morning and evening) for seven consecutive days. Mung Bean Extract Preparation: Dried mung beans were soaked overnight, boiled until soft, and filtered to obtain a smooth extract. No artificial sweeteners were added to maintain nutritional integrity. Soy Milk Preparation: Fresh soybeans were soaked for 8 hours, peeled, blended with water, and boiled for sterilization. The resulting milk was filtered and served warm. The interventions were designed not only to test the physiological effect on hemoglobin levels but also to promote practical dietary habits that participants could easily adopt in daily life using affordable ingredients available in the community.

Monitoring and Data Collection

Monitoring was conducted throughout the intervention period to ensure participant compliance and to identify any side effects or difficulties in consuming the drinks. Daily check-ins were conducted to record consumption patterns, appetite changes, and subjective experiences, such as fatigue levels and concentration. Hemoglobin levels were measured before and after the 7-day intervention using a digital

hemoglobinometer. The increase in Hb levels was analyzed descriptively to evaluate the effectiveness of both interventions. The results were compared between the two participants to determine which local food source had the greater impact.

Evaluation and Community Education

After the intervention, a short educational session was held involving the participants, their parents, and teachers to discuss the outcomes and share lessons learned. This activity aimed to raise awareness about the role of balanced nutrition and to encourage continuous consumption of iron-rich foods. Participants were guided on how to integrate mung bean and soy products into their daily meals to maintain healthy hemoglobin levels. Feedback was collected from participants regarding taste preference, ease of preparation, and perceived health benefits. The data obtained from both quantitative (Hb measurements) and qualitative (interview responses) sources provided valuable insights for designing larger-scale community-based nutrition programs.

Sustainability and Follow-Up

To ensure the sustainability of this community service initiative, collaboration with local health centers and school health units (UKS) was strengthened. The project team recommended periodic hemoglobin screening for adolescent girls and regular nutritional counseling as part of school health promotion activities. Training for teachers and community health volunteers was also proposed to enable them to replicate similar interventions using locally available resources. This implementation method demonstrates that community engagement, combined with practical nutrition interventions, can effectively address health challenges, such as anemia among adolescents. By using affordable, locally sourced ingredients, the program promotes not only better health outcomes but also community empowerment and self-sufficiency in maintaining nutritional well-being.

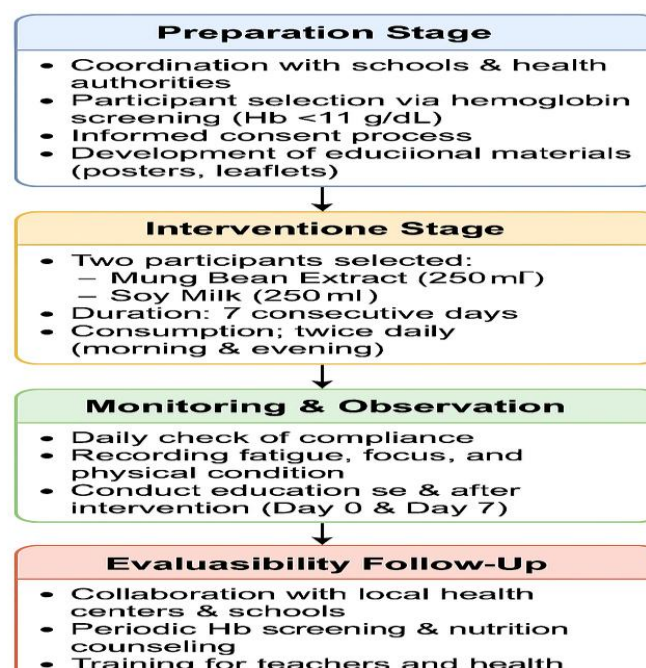


Figure 1. Flowchart method of implementation

RESULT

This study involved 30 adolescent female respondents aged 13–17 years who were diagnosed with moderate anemia (Hb levels 9–10.9 g/dL). Respondents were divided into two equal groups: Group A (n=15) received mung bean extract, Group B (n=15) received soy milk. Both groups consumed 250

ml of the respective drinks twice daily for seven consecutive days. Hemoglobin (Hb) levels were measured before (pretest) and after (posttest) the intervention.

Table 1. Comparison of Hemoglobin Levels (g/dL) Before and After Intervention

Respondent	Group A (Mung Bean Extract)		Group B (Soy Milk)	
	Pretest (g/dL)	Posttest (g/dL)	Pretest (g/dL)	Posttest (g/dL)
1	9.4	10.7	9.5	10.9
2	9.3	10.5	9.6	11.0
3	9.5	10.8	9.7	11.1
4	9.2	10.4	9.8	11.2
5	9.6	10.9	9.5	10.8
6	9.4	10.6	9.4	10.7
7	9.7	11.0	9.6	11.1
8	9.3	10.5	9.7	11.0
9	9.4	10.7	9.5	10.9
10	9.5	10.9	9.8	11.2
11	9.6	10.8	9.6	11.1
12	9.3	10.5	9.7	11.0
13	9.4	10.6	9.5	10.8
14	9.2	10.4	9.4	10.7
15	9.5	10.8	9.8	11.3
Mean ± SD	9.43 ± 0.14	10.68 ± 0.20	9.59 ± 0.14	11.01 ± 0.21
Mean Difference (Δ)	+1.25		+1.42	

After the 7-day intervention, Group A (Mung Bean Extract) showed an average increase in hemoglobin of 1.25 g/dL, from 9.43 g/dL to 10.68 g/dL. Group B (Soy Milk) demonstrated a slightly higher average increase of 1.42 g/dL, from 9.59 g/dL to 11.01 g/dL. The improvement in both groups indicates that plant-based iron sources can effectively raise hemoglobin levels in adolescent girls with moderate anemia. Soy milk exhibited a slightly stronger effect, possibly due to its higher protein and amino acid content, which aids hemoglobin synthesis. Both interventions were well accepted by respondents, who reported reduced fatigue, improved focus, and better overall stamina during school activities.

DISCUSSION

The results of this community-based intervention demonstrated that consuming mung bean extract and soy milk had a positive impact on hemoglobin (Hb) levels in adolescent girls with moderate anemia. Both groups, those who consumed mung bean extract and those who consumed soy milk, showed significant improvements in their Hb concentrations after seven days of intervention. Specifically, the average Hb increase in the mung bean group was 1.25 g/dL, while in the soy milk group it was slightly higher at 1.42 g/dL. These findings indicate that both types of plant-based beverages can effectively improve hemoglobin levels and may serve as affordable, accessible alternatives for preventing anemia among adolescents.

The increase in Hb levels can be attributed to the nutritional composition of mung beans and soybeans, both of which contain essential micronutrients and macronutrients that support erythropoiesis (red blood cell formation) (Yunus et al., 2024). Mung beans (*Vigna radiata*) are rich in non-heme iron, protein, folate, and vitamin B complex, all of which play a vital role in hemoglobin synthesis (Kaur et al., 2025). Mung bean extract significantly increases hemoglobin levels in adolescent girls due to its high iron bioavailability when consumed regularly (Kajjura et al., 2025). Similarly, soy milk (Glycine max) contains iron, high-quality protein, essential amino acids, vitamin B12, and isoflavones, which act

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synergistically to stimulate hemoglobin production and maintain red blood cell integrity (Karim et al., 2025). The slightly higher increase in Hb levels among participants consuming soy milk could be related to its higher protein and amino acid content, which supports hemoglobin synthesis and overall oxygen transport (Kumari et al., 2025). Proteins serve as building blocks for globin, the protein component of hemoglobin, while amino acids such as histidine and glycine are directly involved in heme formation. Furthermore, the presence of isoflavones in soybeans may enhance antioxidant capacity, reducing oxidative stress that can impair erythrocyte production (Masanja et al., 2025).

The results of this study align with previous research showing that food-based interventions are effective in combating anemia among adolescents. The combination of mung bean extract and iron supplementation resulted in a significant improvement in Hb levels among teenage girls (Mchau et al., 2024). Nutrition education combined with mung bean-based beverage consumption significantly improved awareness and reduced anemia symptoms in rural adolescent populations (Nsiah-Asamoah et al., 2025). The findings of this study reinforce the importance of integrating local food-based interventions within broader public health programs to ensure sustainability and community participation. In addition to the physiological improvements, qualitative observations revealed positive behavioral changes among participants (Yuniarti et al., 2025). Both groups reported increased energy levels, improved concentration, and reduced fatigue during school activities (Subba & Araveti, 2025). This aligns with evidence that restoring normal hemoglobin levels enhances oxygen transport and metabolism, thereby improving cognitive and physical performance (Soni et al., 2025). Moreover, both drinks were well accepted in terms of taste and texture, indicating high compliance potential for larger-scale community nutrition programs.

From a community service perspective, the program's success lies not only in the physiological outcomes but also in its educational and empowerment components (Suprpto et al., 2025). Through nutrition education sessions, participants and their parents gained knowledge about anemia prevention, the importance of iron-rich diets, and the value of locally available food ingredients (Tyarini & Cahya Mulat, 2025). This participatory approach aligns with the principles of community-based health promotion, emphasizing education, empowerment, and sustainability rather than dependency on external supplementation. However, several limitations must be considered when interpreting the results (Winarni et al., 2024). First, the sample size was relatively small ($n=30$) and limited to a specific community context, which restricts the generalizability of the findings. Second, the intervention period lasted only seven days, which may not reflect long-term effects on hemoglobin and iron stores. Third, external factors such as dietary habits, menstrual cycles, and individual absorption rates were not controlled, potentially influencing the outcomes. Despite these limitations, the consistent improvement in Hb across all participants provides strong preliminary evidence of the intervention's effectiveness (Yazew et al., 2024).

The implications of these findings are substantial for community health initiatives. Incorporating mung bean and soy milk consumption into school health programs (UKS) or local public health efforts could be a practical and sustainable strategy to reduce anemia prevalence among adolescent girls. These ingredients are widely available, affordable, and culturally acceptable, making them ideal for large-scale community interventions. Furthermore, collaboration with local health centers and educators can ensure regular Hb screening, continuous nutrition counseling, and integration of anemia prevention into routine health promotion activities.

CONCLUSION

The results of this community service program show that both mung bean extract and soy milk effectively increase hemoglobin levels among adolescent girls with moderate anemia.

Within seven days of intervention, significant improvements were observed in both groups, with soy milk producing slightly higher gains. These findings confirm that plant-based, locally available foods can serve as effective, affordable, and culturally acceptable alternatives to conventional iron supplementation. The intervention not only improved physiological outcomes but also enhanced participants' awareness and motivation to maintain healthy eating habits.

It is recommended that schools and community health centers integrate mung bean and soy milk consumption into routine nutrition programs to prevent anemia among adolescents. Regular hemoglobin screening, continued nutritional education, and active collaboration with local health workers are essential for ensuring program sustainability. Further studies with larger populations and longer observation periods are suggested to strengthen the evidence and guide the development of broader community-based strategies for adolescent health improvement.

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