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# Health Education and Hemoglobin Screening as a Strategy for Anemia Prevention among Ninth-Grade Female Students

**Angga Pratama Putra[1*], Agnes Cecilia[1], Zahra Fa'atin Hasanah[1], Yuwita Laudya Christy[1]**

[1] Medical Laboratory Technology Study Program, Faculty of Medicine, Palangka Raya University, Yos Sudarso Street, Palangka Raya, Central Kalimantan, Indonesia 73112.

## ABSTRACT

***Background:*** *Anemia is a common health problem among adolescent girls that may affect their health and academic performance. Health education and hemoglobin screening can support anemia prevention and early detection.*

***Methods:*** *This community service program was conducted on May 30, 2026, at MTs Darul Amin Palangka Raya, Central Kalimantan, Indonesia, involving 31 ninth-grade female students. Activities included pre-test and post-test assessments, health education through presentations and interactive discussions, anthropometric measurements, and hemoglobin screening using the Point-of-Care Testing (POCT) method.*

***Results:*** *Participants showed enthusiasm and active involvement throughout the activities. Post-test scores were higher than pre-test scores, with 28 students (90.32%) achieving a score of 100 after the intervention, compared with 19 students (61.29%) before the intervention. Hemoglobin screening identified one student with a level below the normal range, while most participants had normal hemoglobin levels.*

***Conclusion:*** *The program was associated with improved knowledge of anemia prevention and supported early identification of students with low hemoglobin levels. Similar programs should be extended to other schools and include follow-up monitoring and nutritional counseling to support sustained improvements in health knowledge and behaviors among adolescent girls.*

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**CONTACT**
Angga Pratama Putra
anggapratama@mhs.upr.ac.id
Medical Laboratory Technology Study Program, Faculty of Medicine, Palangka Raya University. Yos Sudarso Street, Palangka Raya, Central Kalimantan, Indonesia 73112.

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## INTRODUCTION

Anemia remains one of the major nutritional health problems, particularly among adolescents (1). Anemia is a condition characterized by hemoglobin and erythrocyte levels below the normal range (2). Globally, the prevalence of anemia among adolescents is approximately 15%, with higher rates reported in developing countries (27%) than in developed countries (6%) (3). The prevalence of anemia in Indonesia also remains high.

According to the 2018 Basic Health Research (*Riskesdas*), the prevalence of anemia among adolescent girls reached 48.9%. Based on age groups, the prevalence was 26.4% among individuals aged 5–14 years and increased to 57% among those aged

15–24 years. In several regions, including Central Kalimantan, the prevalence of anemia was reported to be 12.7%, indicating a relatively high burden compared with the national average (4). These data demonstrate that anemia continues to be a common health problem among Indonesian adolescents (5).

Adolescent girls are particularly vulnerable to anemia because this stage of life is characterized by rapid growth and development, which increase the body's iron requirements (6). This condition may manifest as fatigue, reduced energy levels, and anxiety symptoms (7). One of the primary factors contributing to anemia among adolescent girls is the monthly menstrual cycle, which causes regular blood loss (8). The risk becomes greater when it is accompanied by limited knowledge about anemia and inadequate dietary iron intake (9). Iron plays a crucial role in supporting the growth and development of adolescent girls. Their iron requirements are also higher because they must compensate for iron loss during menstruation (10).

Anemia in adolescent girls not only affects physical health but may also impair learning performance and daily productivity (11). Low hemoglobin levels can reduce concentration, cause fatigue, and weaken the immune system, making adolescents more susceptible to health problems (12). If left untreated, anemia may persist into adulthood and increase the risk of future reproductive health complications (13). Therefore, early prevention is essential to minimize these long-term consequences.

Efforts to prevent anemia among adolescents include improving knowledge of nutrition and health, adopting a balanced diet, and conducting early detection through hemoglobin (Hb) testing (14). Health education plays an important role in enhancing adolescents' understanding of the causes, symptoms, impacts, and prevention of anemia (15). In addition, hemoglobin testing serves as a useful method for assessing anemia status, enabling early intervention when necessary (16).

Anemia remains a significant health problem among adolescent girls, including female students, due to increased iron requirements during growth and development and blood loss during menstruation. Early detection and appropriate treatment are necessary to prevent complications, while health education can improve students' understanding of anemia prevention and the importance of adequate nutritional intake. Therefore, a community service program entitled "Health Education and Hemoglobin Screening as a Strategy for Anemia Prevention among Grade IX Female Students" was implemented.

## METHODS

This community service program was conducted on Saturday, May 30, 2026, at Madrasah Tsanawiyah Darul Amin in Palangka Raya, Central Kalimantan, Indonesia. The program focused on anemia prevention among adolescent girls and involved collaboration between lecturers and university students who served as the implementation team. A total of 31 female students participated in the program.

The program consisted of three stages: preparation, implementation, and evaluation. The preparation stage began with coordination between the implementation team and the school to arrange the schedule, the target participants, and the technical requirements of the activity. The team then identified the participants' educational needs regarding anemia in adolescents, which served as the basis for determining the topics of the educational session. Based on these needs, the team prepared the educational materials in the form of PowerPoint presentations, the pre-test and post-test questionnaire, and the equipment required for the health examinations, namely body

height and body weight measuring devices and a Point-of-Care Testing (POCT) device for hemoglobin (Hb) screening.

The educational materials were delivered by two speakers. The first speaker presented "Examination and Prevention of Anemia in Adolescents," which covered the definition of anemia, hemoglobin examination and the places where it can be performed, iron-rich foods, the role of vitamin C in iron absorption, and the use of iron–folic acid tablets with adequate water intake. The second speaker presented "Early Symptoms Commonly Experienced by Adolescents," which covered the signs and symptoms of anemia, such as fatigue, dizziness, pallor, difficulty concentrating, and palpitations, as well as its impact on learning achievement and unhealthy habits, such as skipping breakfast, that may trigger anemia.

During the implementation stage, participants completed a pre-test questionnaire to assess their baseline knowledge of anemia. The questionnaire consisted of 10 multiple-choice questions, each with four answer options (A–D) and one correct answer. The questions were knowledge-based and were developed from the educational materials presented by the speakers. The questions covered the definition of anemia, hemoglobin examination and the place where it can be performed, the signs and symptoms of anemia, its impact on learning achievement, unhealthy habits that may trigger anemia, and its prevention through iron-rich foods, vitamin C, iron–folic acid tablets, and adequate water intake. Following the pre-test, the speakers delivered educational sessions using PowerPoint presentations, followed by a question-and-answer discussion to encourage participant engagement and improve understanding. After the educational sessions, participants completed a post-test using the same questionnaire to assess changes in their knowledge following the educational intervention.

In addition to the educational activities, health examinations were conducted for all participants. The examinations included measurements of body height and body weight, followed by hemoglobin (Hb) screening using a Point-of-Care Testing (POCT) device. These examinations were conducted as part of the program's health assessment and early detection activities.

Program evaluation was conducted by calculating questionnaire scores based on the number of correct answers and comparing the pre-test and post-test results. This comparison was used to assess changes in participants' knowledge of anemia prevention following the educational intervention. All implementation data were subsequently compiled and organized into a scientific manuscript for publication in an academic journal.

## RESULTS

The community service program entitled Health Education and Hemoglobin (Hb) Screening as a Strategy for Anemia Prevention among Grade IX Female Students was successfully implemented. The program received a highly positive response from the participants. The students demonstrated great enthusiasm during the educational sessions, actively participated in discussions, and communicated effectively throughout the health examination activities.

All participants in this community service program were school-aged adolescent girls. Additionally, faculty members (lecturers), teachers, and the school principal were also present to supervise and support the program, ensuring it ran smoothly and provided appropriate guidance throughout the activities. Based on age characteristics,

most participants were 14 years old, accounting for 17 respondents (54.8%). This group was followed by participants aged 13 years, who accounted for 12 respondents (38.7%), and participants aged 12 years, who accounted for 2 respondents (6.5%). These findings indicate that the majority of the student participants were in the middle adolescent age group, which is considered a vulnerable period for the development of anemia due to increased nutritional and iron requirements associated with growth and development.

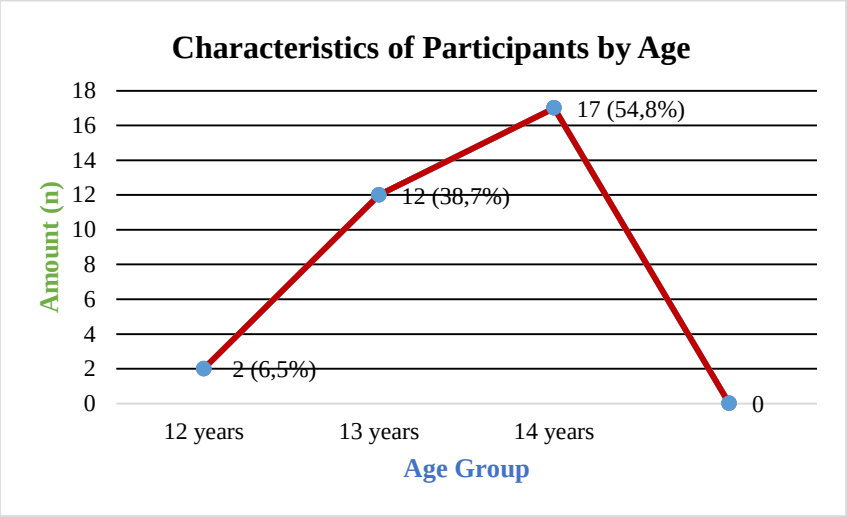



**Figure 1.** Age Distribution of Participants

The results of Hb screening using the POCT method showed that the majority of the 31 female students had hemoglobin levels within the normal range. A total of 25 participants (80.65%) were classified as having normal Hb levels. Meanwhile, 4 participants (12.90%) had Hb levels above the normal range, and 1 participant (3.23%) had Hb levels below the normal range. These findings indicate that most participants had adequate hemoglobin status, although a small proportion of students exhibited abnormal Hb levels that may require further monitoring and evaluation.

**Table 1.** Hemoglobin Screening Results of the Participants

| Category | n | Percentage | Interpretation |
|---|---|---|---|
| <12 g/dL | 1 | 3,23% | Low |
| 12 g/dL – 16 g/dL | 25 | 80,65% | Normal |
| >16 g/dL | 4 | 12,90% | High |
| **Total** | **31** | **100%** | |

**Table 2.** Pre-Test and Post-Test Assessment Results of Students' Knowledge on Anemia Prevention

| Variable | Nilai | Amount (n) | Percentage |
|---|---|---|---|
| Pre-Test | 100 | 19 | 61,29% |
| | 90 | 4 | 12,90% |
| | 80 | 4 | 12,90% |
| | 70 | 4 | 12,90% |
| **Total** | | **31** | **100%** |
| Post-Test | 100 | 28 | 90,32% |
| | 90 | 3 | 9,68% |
| **Total** | | **31** | **100%** |

The participants' knowledge regarding anemia prevention was assessed through pre-test and post-test questionnaires consisting of several questions prepared by the organizing committee. The results demonstrated an improvement in knowledge scores following the educational intervention. The anemia prevention education program conducted at MTs Darul Amin Palangka Raya provided comprehensive information on anemia and its prevention. However, before the intervention, the students' detailed understanding of self-managed anemia prevention remained relatively limited. Through this interactive educational approach, the material focused on the importance of consuming iron-rich foods and regularly monitoring hemoglobin levels to reduce the risk of anemia during adolescence.

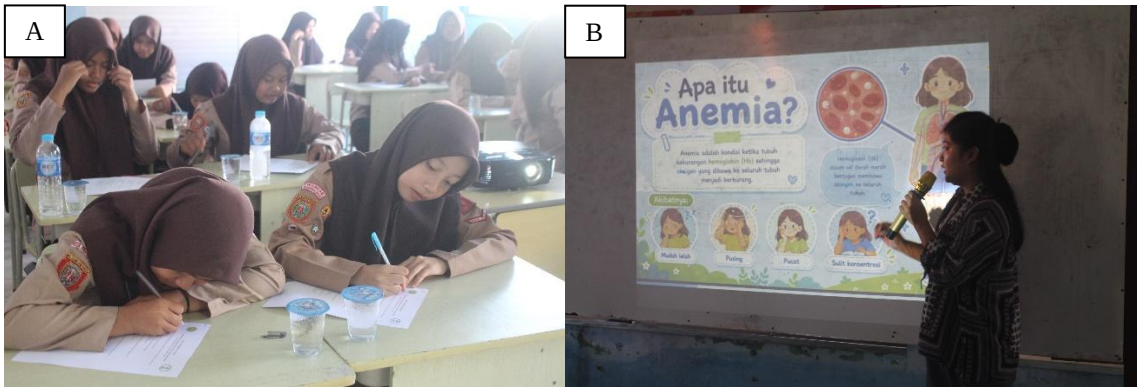



**Figure 2.** Implementation of Health Education and Hemoglobin Screening among Grade IX Female Students at MTs Darul Amin Palangka Raya. The figure shows (A) the administration of the pre-test and post-test assessments during the educational session and (B) the delivery of educational material on anemia screening and prevention among adolescents



**Figure 3.** Hemoglobin level screening among the female students

## DISCUSSION

The objective of this community service program was to improve students' knowledge regarding anemia prevention while simultaneously conducting early detection through hemoglobin level screening. Based on the results obtained, this objective can be considered successfully achieved. The increase in post-test scores compared with pre-test scores indicated that the health education intervention effectively enhanced the participants' understanding of anemia, particularly regarding its risk factors, symptoms, consequences, and prevention strategies. These findings suggest that the interactive delivery of educational materials, combined with discussion

and question-and-answer sessions, effectively helped participants understand health information relevant to their condition as adolescent girls.

The improvement in knowledge following the intervention can be explained by the fact that participants received information that they had not previously understood comprehensively, particularly regarding the importance of consuming iron-rich foods, preventing iron loss during menstruation, and regularly monitoring hemoglobin levels. During adolescence, individuals generally possess a good capacity to receive and process health information. Therefore, direct educational interventions can effectively increase awareness of the importance of maintaining nutritional status and reproductive health. Furthermore, the active participation of students throughout the program supported the learning process and facilitated better understanding and retention of the information provided.

The hemoglobin screening results showed that most participants had hemoglobin levels within the normal range. This finding indicates that the majority of students had adequate hemoglobin status. Nevertheless, at least one participant exhibited hemoglobin levels below the normal threshold, indicating a potential risk of anemia. This finding reinforces the importance of implementing hemoglobin screening as part of early detection efforts because anemia often does not present clear symptoms during its initial stages (17). By identifying hemoglobin status at an early stage, participants can receive further education and make improvements in dietary habits and health-related behaviors to prevent the development of more severe anemia.

The combination of health education and hemoglobin screening in this program provided more comprehensive benefits than either intervention alone. Health education contributed to increasing participants' knowledge and awareness, whereas hemoglobin screening provided information regarding their actual health status (18). This approach enabled participants not only to understand the theoretical concepts of anemia prevention but also to recognize their own health condition, thereby encouraging more meaningful behavioral changes.

The findings of this program are consistent with those reported by various adolescent health education initiatives that have demonstrated improvements in knowledge following anemia-related educational interventions. Several previous community service programs have also shown that hemoglobin screening combined with health education can increase adolescents' awareness of the importance of anemia prevention (19). However, the proportion of participants with low hemoglobin levels in this program was relatively lower than that reported in several other studies. This difference may be attributed to variations in participant characteristics, dietary patterns, nutritional status, health conditions, and school environments.

Despite its positive outcomes, this program had several limitations. First, the number of participants was relatively small and limited to a single school; therefore, the findings may not represent the overall condition of adolescent girls in Palangka Raya. Second, knowledge evaluation was conducted immediately after the educational intervention, making it difficult to assess the long-term sustainability of knowledge improvement and behavioral change. Third, hemoglobin screening was performed only once, which prevented the monitoring of changes in participants' hemoglobin status over time. Therefore, future programs should involve a larger and more diverse participant population and include follow-up assessments of health behaviors and hemoglobin status to provide a more comprehensive evaluation of program impact.

Overall, the findings indicate that health education combined with hemoglobin screening is an effective strategy for improving knowledge and awareness of anemia prevention among adolescent girls. This program has the potential to serve as a sustainable promotive and preventive intervention within school settings to support adolescent health and reduce the risk of anemia from an early age.

## CONCLUSIONS AND SUGGESTIONS

The community service program involving health education and hemoglobin screening improved students' knowledge regarding anemia prevention, as demonstrated by higher post-test scores compared with pre-test scores. In addition, hemoglobin screening identified one student with hemoglobin levels below the normal range, while most participants had normal hemoglobin levels. However, since the program involved participants from only one school and the evaluation was conducted on a single occasion, the findings should be interpreted with caution. Therefore, similar community service programs should be expanded to other schools and incorporate follow-up monitoring sessions and nutritional counseling to support sustained improvements in health knowledge and behaviors among adolescent girls.

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## CONFLICT OF INTERESTS

The authors declare that there are no conflicts of interest related to this community service program. All stages of the program, including planning, implementation, data collection, data analysis, and report preparation, were conducted independently and transparently. Funding for this program was obtained through a grant awarded by the Dean's Office of the Faculty of Medicine, University of Palangka Raya. The funding provider had no involvement in the implementation of the activities, data processing, data analysis, or the preparation of this manuscript. The authors also confirm that they have no affiliations, financial interests, or personal relationships that could have influenced the outcomes of this program. Therefore, all processes and findings presented in this report can be fully justified from both academic and ethical perspectives.

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