Original Article

Effectiveness of the Kalkulating Platform (Stunting Detection Calculator) for Increasing Hemoglobin Levels in Adolescents

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Jurnal Keperawatan Komprehensif (Comprehensive Nursing Journal)

Volume 11 (3), 495-501
https://doi.org/10.33755/jkk.v11i3

Article info

Received : June 19, 2025
Revised : July 28, 2025
Accepted : July 29, 2025
Published : July 31, 2025

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Citation
Suminar, R., Perdana, I. M., Mulayana, R., Heriyanti, S. W., & Hindiarti, Y. I. (2025). Effectiveness of the Kalkulating platform (stunting detection calculator) for increasing hemoglobin levels in adolescents. *Jurnal Keperawatan Komprehensif (Comprehensive Nursing Journal)*, 11(3), 461–466.

Website
https://journal.stikep-ppnijabar.ac.id/jkk

p-ISSN : 2354 8428
e-ISSN: 2598 8727

Abstract

Background: Anemia in adolescents is one of the contributing risk factors to stunting in early adulthood. Early detection and community-based interventions are essential for promotive and preventive efforts, particularly within school settings. One strategy implemented is the use of the adolescent stunting risk detection feature in the Kalkulating platform, applied by the Youth Information and Counseling Center (PIK R) at SMAN 1 Baregbeg.
Objective: This study aimed to determine the effectiveness of the adolescent stunting risk detection feature in reducing anemia cases among adolescents.
Methods: This study employed a quantitative descriptive design with a pre-post intervention approach. The subjects were students from SMAN 1 Baregbeg actively engaged in PIK R activities. Hemoglobin (Hb) levels were measured twice by the Baregbeg Public Health Center (Puskesmas Baregbeg), in October 2024 and May 2025. Initially, 44 adolescents were identified with anemia. After interventions including education and routine monitoring using the Kalkulating feature, a follow-up test showed only 10 cases of anemia.
Results: There was a reduction of 34 anemia cases from a total of 44, indicating an effectiveness rate of 77.27% and Cohen's 3,34. According to the effectiveness classification based on percentage change, this intervention falls under the effective category.
Conclusion: The implementation of the adolescent stunting risk detection feature in the Kalkulating platform was effective in reducing anemia rates among adolescents. This model can be replicated in school-based health programs with multisectoral support, including primary healthcare providers such as community health centers.

Keywords: Adolescent, anemia, effectiveness, kalkulating, stunting

INTRODUCTION

Background: Stunting remains a significant public health issue that affects the long-term quality of human resources. Although stunting is commonly associated with early childhood, nutritional interventions during adolescence are crucial as this stage represents the second window of opportunity to improve nutritional status before reaching reproductive age. One major risk factor for stunting that can emerge during adolescence is anemia. Adolescents, particularly females, who suffer from prolonged nutritional deficiencies such as anemia, are more likely to give birth to stunted children in the future. According to the (1) , approximately 30% of adolescent girls worldwide suffer from anemia. In Indonesia, the prevalence reaches 32% (2), and in Ciamis Regency, Baregbeg Primary Health Center reported that 44 adolescents were diagnosed with anemia in the first semester of the 2024/2025 academic year.

The innovative stunting risk detection instrument for adolescents is part of the stunting detection calculator, a multidimensional indicator-based measurement tool designed to identify stunting risk factors in adolescents early (3). This instrument is systematically developed through an evidence-based approach and integrated into a self-assessment-based digital platform to encourage promotive and preventive measures before adolescents enter the premarital and preconception phases or become prospective parents. The indicators for this detection are Body Mass Index (BMI), Hemoglobin Level, Upper Arm Circumference, History of Iron Tablet Consumption Compliance, Nutritional Intake Patterns, Availability of Clean Water Sources & Sanitation, Stress Levels, & History of Chronic Diseases.

Literature Review:
Previous studies have shown a significant relationship between adolescent anemia and the risk of stunting in offspring (4–6). Regular monitoring of hemoglobin levels is an essential strategy in the early prevention of stunting. Digital tools like Kalkulating, developed as a self-screening platform based on stunting risk indicators, offer an innovative approach to early detection. However, studies assessing the effectiveness of community-based digital tools for anemia screening in adolescents as a predictor of stunting remain limited.

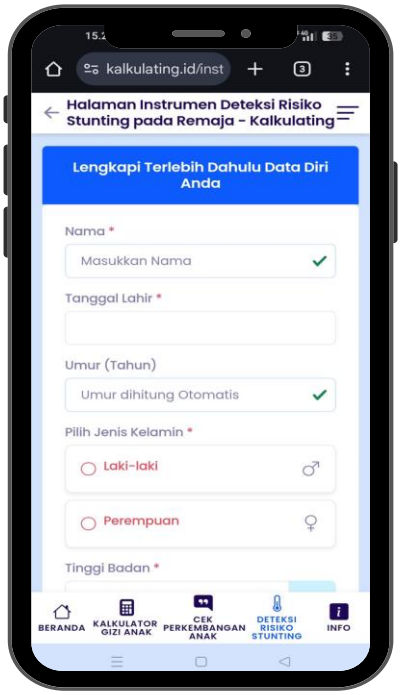
Objective:
This study aims to evaluate the effectiveness of using the Kalkulating platform to detect stunting risk through anemia screening among adolescents at PIK-R SMAN 1 Baregbeg.

Research Contibution:
This research provides valuable insights into preventive, technology-based, and community-driven approaches. The findings are expected to inform the development of school-based early detection models and contribute to promotive-preventive policy frameworks, particularly in reducing stunting rates through adolescent interventions.

METHODS

Study Design

This study employed a quasi-experimental design with a pre-test and post-test without a control group. This design was chosen as it is appropriate for evaluating the effectiveness of the Kalkulator Deteksi Stunting (Kalkulating) intervention in increasing hemoglobin levels among adolescents through anemia screening, without randomization. The study was descriptive quantitative in nature and utilized an effectiveness rate approach to assess pre- and post-intervention changes.



Participants
The study population included all active members of PIK-R SMAN 1 Baregbeg during the odd and even semesters of the 2024/2025 academic year. Inclusion criteria were female adolescents aged 15–18 years who participated in the anemia screening program conducted by Baregbeg Public Health Center (Puskesmas Baregbeg) and were willing to complete the full intervention cycle. Exclusion criteria included students who did not complete the follow-up screening in the second semester. The sample consisted of 44 participants in the first semester and 10 participants in the second semester, with a total of 34 students showing improved hemoglobin levels. Control group from other schools with manual-based measurement interpretation.

Intervention protocol
The intervention involved the use of the Kalkulating tool via the "Skrining Risiko Anemia Remaja" (https://www.kalkulating.id/insting) menu to assist in identifying stunting risk associated with anemia. The intervention was reinforced with digital health education and the promotion of healthy lifestyles through regular PIK-R activities. Hemoglobin screenings were conducted by healthcare professionals from Puskesmas Baregbeg. The intervention was implemented in two cycles: October 2024 (semester one) and May 2025 (semester two).

The educational component and introduction to Kalkulating were facilitated by the tool's developer (founder) and supported by PIK-R faculty advisors. Anemia screening was conducted by trained healthcare personnel from Puskesmas Baregbeg. The intervention was delivered directly at the school through digital media and interactive sessions. The intervention was conducted over two semesters, with measurements taken at the beginning and end of the intervention period. The activities were held at SMAN 1 Baregbeg. Participants' screening data were manually recorded by the faculty advisor and verified by Puskesmas staff.

Instrument for quantitative study
The primary instrument was a digital hemoglobin (Hb) testing device used by certified medical personnel in accordance with standard operating procedures. Additional data were collected via the Kalkulating platform. The Hb measurement device has been clinically validated. The Kalkulating tool has undergone expert content validation. An Hb level below 12 g/dL was categorized as anemia. Results from each semester were compared to evaluate intervention effectiveness. In this study, most baseline Hb levels ranged from 8–9 g/dL, indicating moderate anemia. Each student's measurement was completed in approximately 5–10 minutes by trained health professionals. Data were collected directly at the school during two screening periods. Hemoglobin test results were recorded by Puskesmas staff and stored both manually and digitally. Participant recruitment was conducted in collaboration with teachers and the PIK-R student leader. Data were securely stored by the school and the Kalkulating implementation team following confidentiality protocols.

Interview guideline for qualitative study
In the Methods section of a qualitative study, the interview guideline (or interview protocol) is a critical component that demonstrates the rigor and structure of your data collection process. What to Include in the Interview Guideline Subsection: Briefly explain the purpose of the interview guide and how it aligns with the research questions or objectives. Describe how the interview guide was developed (e.g., based on literature review, pilot testing, or expert consultation). Explain the organization of the guide (e.g., opening questions, main questions, probing questions, closing questions). Specify the types of questions included (e.g., open-ended, semi-structured, or structured). Mention how the questions were designed to elicit rich, detailed responses. Indicate whether the interview guide was pilot-tested and how feedback was used to refine the questions. Mention how the interview guide ensured ethical considerations, such as avoiding leading questions or sensitive topics.

Data Collection procedure
Data were collected directly at the school during two screening periods. Hemoglobin test results were recorded by Puskesmas staff and stored both manually and digitally. Participant recruitment was conducted in collaboration with teachers and the PIK-R student leader. Data were securely stored by the school and the Kalkulating implementation team following confidentiality protocols.

Data Analysis
Data were analyzed descriptively using the effectiveness rate formula:

Effectiveness Rate (%) = (Number of participants with increased Hb / Initial number of participants) × 100%

Additionally, a paired t-test was performed to examine the statistical significance of differences in hemoglobin levels between the two periods. The analysis was conducted using SPSS version 26 with a significance level of $p < 0.05$.

Ethical Considerations:
This study was ethically approved by the Health Office of Ciamis Regency, with the recommendation letter number: 440/PKM-BBG/2024. Informed consent was obtained orally through school and parental permission. Participant identities were anonymized, and all data were securely stored. Participation was voluntary, and students could withdraw at any time without penalty.

RESULTS

This study aimed to evaluate the effectiveness of utilizing the Stunting Detection Calculator (Kalkulating) in adolescent anemia screening. Hemoglobin (Hb) levels were measured at two time points: the first semester (October 2024) and the second semester (May 2025). Data were collected from 44 students during the first screening, from a total of 44 students there was an increase in Hb levels in 34 students and only 10 students experienced anemia during the follow-up screening in the second semester.

A total of 34 out of 44 students showed an improvement in their hemoglobin levels after the intervention. The average Hb level in the first semester ranged from 8 to 9 g/dL, which increased to above 12 g/dL in the second semester.

Table 1. Comparison of Hemoglobin Levels Before and After the Intervention

Parameter	Semester 1 (Oct 2024)	Semester 2 (May 2025)	Change	p-value	Cohen's
Number of rescreened participants	44	44	-	-	-
Mean Hb (g/dL) ± SD	8.84 ± 0.49	10.32 ± 0.39	+1.48	0,00	3,34
Participants with Hb improvement	-	34/44 (77.3%)	+34 students	-	-

As for the control group, the following changes were made:

Table 2. Comparison of Hemoglobin Levels Before and After the Intervention Control Group

Parameter	Semester 1 (Oct 2024)	Semester 2 (May 2025)	Change	p-value	Cohen's
Number of rescreened participants	44	44	-	-	-
Mean Hb (g/dL) ± SD	8.84 ± 0.49	8.95 ± 0.50	+0.15	0,082	0,28
Participants with Hb improvement	-	14/40 (35.0%)	+14 students	-	-

DISCUSSION

This study shows that the use of the Stunting Detection Calculator application through the "Stunting Risk Screening in Adolescents" menu is effective in increasing hemoglobin (Hb) levels in PIK-R students at SMAN 1 Baregbeg. Of the 44 students screened during the first semester, 34 (77.3%) showed an increase in Hb levels in the second semester screening. Many factors influenced this, including increased consumption of iron tablets, changes in nutritional intake patterns, stress management patterns, hygiene patterns, and activity patterns. The initial average Hb ranged from 8–9 g/dL, which increased to >10 g/dL, with a statistically significant result ($p < 0.05$). These findings address the research objective of evaluating the effectiveness of a community-based digital intervention in mitigating anemia, a known risk factor for stunting in adolescents (7–9). This occurs because of changes in adolescent perception after detection, resulting in a higher level of awareness and greater compliance in consuming iron tablets, maintaining nutritional intake, controlling stress, and monitoring anthropometric measurements, including height, weight, and upper arm circumference (10,11).

The findings are consistent with previous studies that suggest community-based educational interventions are effective in enhancing health awareness and behaviors among adolescents, particularly in anemia prevention. For example, a study by Septiana, Lusiana et al. (6) found that combining digital education with direct intervention significantly improved adherence to iron supplementation and healthy dietary practices. This study adds further evidence that technological tools like Kalkulating can enhance screening outcomes and educational effectiveness, especially when used iteratively and in coordination with local health services (12,13).

Differences from studies reporting less effective outcomes may be attributed to weak sectoral integration or inconsistent implementation. The success of this intervention can be linked to the strong collaboration between the application developer (Kalkulating), the school community, and Baregbeg Public Health Center (Puskesmas) as the health service provider. Active engagement of both students and teachers in the educational process also contributed to the sustained impact of the intervention (14–16).

The practical implications of this study are noteworthy. It suggests that integrating digital education tools into adolescent health programs, such as PIK-R, can serve as a strategic approach to reduce anemia prevalence (17,18). When widely implemented, such strategies could support national stunting reduction initiatives through early prevention. Theoretically, the findings reinforce the proposition that community-based promotive-preventive strategies are more sustainable when supported by accessible and contextually relevant technology (6,19).

However, this study has several limitations. First, the second-semester sample size was relatively small as only a subset of students participated in the follow-up screening. Second, the lack of a control group limits the ability to isolate the specific effects of the intervention. Third, dietary intake and adherence to iron supplementation were not systematically monitored. Future studies with more robust experimental designs and larger samples are recommended to validate these findings (20,21)

In conclusion, this study shows that the use of Kalkulating in adolescent anemia screening significantly improves hemoglobin levels and can be considered a viable preventive strategy against stunting from an early age. The study also opens up avenues for further development, such as the digitization of follow-up screening, integration with health center reporting systems, or multi-targeted school-based interventions. Therefore, these findings may serve as a basis for formulating scalable community-based digital health education policies.

CONCLUSION

This study aimed to evaluate the effectiveness of the Kalkulating digital innovation in screening adolescent anemia as a risk factor for stunting at PIK-R SMAN 1 Baregbeg. The primary objective was to assess the improvement in hemoglobin levels following the implementation of the adolescent anemia risk screening tool over two academic semesters.

The findings revealed a substantial increase in hemoglobin levels among participating students, with 34 out of 44 individuals showing improvement. The effectiveness rate reached 77.27%, and the result was statistically significant based on paired t-test analysis ($p < 0.05$). These outcomes indicate that the

integration of the Kalkulating tool, supported by structured health education and collaboration with local health services, can significantly enhance early detection and management of anemia among adolescents. The limitations of this study are the sample and control group, interpretation based on anemia screening results alone which will be further examined in the future with other indicators such as Body Mass Index (BMI), Hemoglobin Levels, Upper Arm Circumference, History of Compliance with Iron Supplement Tablet Consumption, Nutritional Intake Patterns, Availability of Clean Water Sources & Sanitation, Stress Levels, & History of Chronic Diseases.

The implications of this study are multifaceted. It underscores the critical role of digital health innovations in adolescent health promotion and the prevention of long-term nutritional issues such as stunting. Furthermore, the success of this school-based intervention highlights the importance of multisectoral partnerships—between schools, health centers, and community-based youth organizations—in advancing public health goals. This model has the potential to be replicated in other regions, contributing to broader national strategies aimed at reducing anemia and stunting prevalence in Indonesia, and recommend RCT or mixed-methods follow-up to validate and understand mechanisms.

Acknowledgement

The authors would like to express their sincere gratitude to the Head of Baregbeg Health Center and the midwives who provided technical assistance and hemoglobin screening during both cycles of the intervention. We also extend our appreciation to the school principal, the PIK-R advisors, and the students of SMAN 1 Baregbeg for their enthusiastic participation and support in implementing this program. Special thanks to the development team of Kalkulating for enabling digital innovation to be applied effectively in adolescent health screening. This work was supported by a collaboration grant between the Baregbeg Public Health Center and the community health program initiated by the Kalkulating team.

Conflict of Interest

The authors declare that there are no financial, personal, or professional conflicts of interest that could be perceived as influencing the results or interpretation of this study. The use of Kalkulating in this research was solely for academic and public health purposes, and no commercial or financial gain was involved in its implementation.

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