

A CILOK AND EAR MUSHROOM-BASED FOOD INTERVENTION FOR THE PREVENTION OF ANEMIA AMONG JUNIOR HIGH SCHOOL STUDENTS

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ABSTRACT

Background : Anemia remains a highly prevalent health problem among Indonesian adolescents, primarily due to low iron intake, imbalanced dietary patterns, and non-compliance with iron supplementation. **Objectives** : This study aimed to evaluate the effectiveness of a wood ear mushroom-based cilok food intervention in improving adolescents' knowledge regarding anemia prevention at SMP Negeri 43 Batam. **Methods** : A community nursing approach was employed, with data collected through interviews, observations, and questionnaires involving 26 seventh-grade students aged 13–15 years. The intervention was conducted on February 5, 2026, through health education sessions and a demonstration of the cilok innovation, with pre-test and post-test assessments to measure knowledge improvement. **Results** : Results showed that the average pre-test score of 75.15 increased to 91.77 post-intervention, representing an improvement of 16.62 points (25.09%). Nearly all participants demonstrated increased scores, particularly those with initially low to moderate levels of knowledge. **Conclusion** : It is concluded that the wood ear mushroom cilok-based health education intervention effectively improved adolescents' knowledge and interest in anemia prevention and holds potential as a sustainable health promotion strategy within school settings.

Keywords: anemia; wood ear mushroom cilok; food intervention; community nursing; adolescents; wood ear mushroom cilok

INTRODUCTION

Anemia is a public health issue that continues to have a high prevalence, particularly among adolescents. Anemia is defined as a condition in which hemoglobin levels fall below normal, impairing the blood's ability to transport oxygen to body tissues. The effects of anemia in adolescents include fatigue, reduced ability to concentrate on studies, impaired growth and development, and a weakened immune system. Globally, the World Health Organization (WHO) reports that approximately 24–30% of the world's population still suffers from anemia, with adolescents and women of childbearing age being the most vulnerable groups due to increased iron requirements during growth and menstruation.

In Indonesia, anemia among adolescents remains a serious health issue. Various studies indicate that the prevalence of anemia among school-aged adolescents is relatively high, primarily due to low iron intake, an unbalanced diet, and poor adherence to iron supplement intake. Adolescents tend to consume more snacks that are high in fat and sugar but low in micronutrients, including iron. A lack of ongoing health education and a school environment that does not fully support healthy eating habits further exacerbate the risk of anemia among adolescents (Mufti & Farida, 2025).

The results of a community nursing assessment at SMP Negeri 43 Batam showed that 98% of female students did not take the iron supplements provided by the school, and there was a limited selection of healthy food options in the cafeteria. The available foods consisted mostly of fried foods and sugary drinks that are low in iron and essential micronutrients. This situation highlights a gap between existing anemia prevention programs and the behaviors and needs of adolescents in the school environment (Sudarman et al., 2020).

Various studies recommend interventions based on local foods as an innovative and sustainable approach to preventing anemia in adolescents. One promising local food ingredient is black wood ear mushrooms (*Auricularia auricula*), which contain iron, fiber, and bioactive compounds beneficial to health. A food innovation in the form of “cilok” made from black wood ear mushrooms is expected to serve as a healthy snack alternative that adolescents will enjoy, increase iron intake, and support anemia prevention efforts through promotive and preventive approaches in the school setting (Defiana Putri et al., 2024). This study aims to evaluate the effectiveness of a health education intervention and a food innovation based on black wood ear mushroom cilok in improving adolescents’ knowledge about anemia and its prevention at SMP Negeri 43 Batam.

METHODS

This study employed a quantitative descriptive approach within the framework of community nursing care, conducted at SMP Negeri 43 Batam, Baloi Permai Village, Batam Kota Subdistrict, Riau Islands. The activities took place from January to February 2026 within the service area of the Baloi Permai Community Health Center.

The study subjects were 26 seventh-grade students at SMP Negeri 43 Batam, aged 13–15 years. The selection of the study population was based on the results of a community assessment that indicated a risk of anemia, specifically the presence of low BMI (65.38% of students), complaints of dizziness, and pale sclerae upon examination, as well as the fact that nearly all female students (98%) did not take iron supplements regularly.

Data collection was conducted using three methods: structured interviews with the school principal and the 26 students; observation of the school environment (cleanliness, cafeteria, school health room facilities, and sanitation); and a questionnaire measuring aspects of Universal Self-Care, Developmental Self-Care, and Health Deviation Care. Epidemiological data on student health, NCD risk factors, family medical history, and BMI were also collected through direct anthropometric measurements.

The intervention was conducted on February 5, 2026, for 90 minutes in classroom VII.5 at SMP Negeri 43 Batam using the following methods: (1) a lecture and Q&A session on the definition, causes, signs and symptoms, impacts, and prevention of anemia; (2) screening of an educational video; (3) a demonstration of a healthy snack innovation based on black wood ear mushroom cilok; and (4) an opportunity to sample the innovative product. The media used included PowerPoint presentations, posters, and demonstration materials for the black wood ear mushroom cilok.

The effectiveness of the intervention was evaluated through a pre-test before the educational session and a post-test after the entire series of activities, using a validated questionnaire. The data were analyzed descriptively by calculating the mean scores of the pre-test and post-test, the difference in scores, and the percentage increase.

RESULTS

A total of 26 seventh-grade students at SMP Negeri 43 Batam, aged 13 to 15 years, participated in this activity, comprising 14 female students (53.85%) and 12 male students (46.15%). The initial assessment revealed that the participants' understanding of anemia was still very limited. The majority—18 participants (69.23%)—were unaware of the normal hemoglobin levels for adolescents, while 21 participants (80.77%) were unable to fully identify the signs and symptoms of anemia. Furthermore, nearly all participants—23 students (88.46%)—were unaware that local foods such as black wood ear mushrooms contain relatively high levels of iron. This situation aligns with field data showing that 98% of female students do not regularly take the iron supplements provided by the school, and 65.38% of students have a Body Mass Index below the normal range, indicating a significant risk of anemia within the school community.

The health education session lasted 90 minutes on February 5, 2026, in classroom VII.5 and focused on a comprehensive understanding of anemia. The material covered included the definition and pathophysiology of anemia as a condition characterized by a decrease in hemoglobin levels below the normal threshold—less than 12 g/dL in adolescent girls and less than 13 g/dL in adolescent boys—which results in impaired oxygen delivery to body tissues. In addition, participants were introduced to the classification of anemia based on its causes, with iron-deficiency anemia being the

most common type among adolescents. The signs and symptoms of anemia were explained using the “5L” concept—Weakness, Fatigue, Lethargy, Exhaustion, and Lethargy—accompanied by physical changes such as pallor

of the conjunctiva and palms, dizziness, and reduced ability to concentrate on studies. Relevant risk factors for adolescents were also explained, including blood loss during menstruation, low intake of iron-rich foods, excessive consumption of iron-absorption inhibitors such as tea and coffee, and poor adherence to iron supplementation. The long-term effects of anemia on academic performance, physical growth, and immune function were also key components of the material, before concluding with a presentation on practical prevention strategies. All material was presented using PowerPoint slides, illustrated posters, and a seven-minute animated educational video designed to visually reinforce participants’ understanding.

Immediately following the educational session, a demonstration of how to make black wood ear mushroom (*Auricularia auricula*) cilok was held as a concrete example of how to prevent anemia through local foods. Black wood ear mushrooms were chosen because every 100 grams of dried mushrooms contains about 18.5 mg of iron—a figure that far exceeds the iron content in beef (2.6 mg/100 g) and spinach (3.5 mg/100 g)—and they are also rich in dietary fiber, immunomodulatory polysaccharides, and natural antioxidants. The demonstration was conducted in stages, beginning with an introduction to the ingredients, followed by the preparation of the per-serving mixture—comprising 200 g of tapioca flour, 100 g of finely chopped boiled black wood ear mushrooms, 50 g of wheat flour, two cloves of garlic, salt, and pepper—and continuing through the kneading process, shaping into balls approximately 3 cm in diameter, boiling until they float, and serving with low-fat peanut sauce. After the demonstration, all participants were invited to taste the product and provide organoleptic evaluations regarding taste, texture, aroma, and appearance. The results were quite encouraging: 23 out of 26 participants (88.46%) stated that they liked the product and were interested in making it a part of their daily snack choices.

Knowledge assessment was conducted via a pre-test before the intervention and a post-test after the entire series of activities, using 20 multiple-choice questions covering the knowledge domains of anemia: definition and normal hemoglobin levels (4 questions), causes and risk factors (4 questions), signs and symptoms (4 questions), impacts on adolescents (4 questions), and prevention through diet—including mushroom cilok (4 questions). The evaluation results showed a significant increase, as presented in Table 1.

Table 1. Research data processed by the author (2026) Comparison of pre test and post-test scores on anemia knowledge

Indicator	Pre-test	Post-test	Increase
Average Overall Score	75.15	91.77	+16.62 (25.09%)
Domain: Definition & Normal Hb Values	68.27	90.38	+22.11 (32.38%)
Domain: Signs & Symptoms of Anemia	72.50	92.31	+19.81 (27.32%)
Domain: Prevention through local foods	65.77	93.46	+27.69 (42.11%)
Participants with an increase in score	—	24 out of 26 (92.31%)	—
Interest in consuming mushroom cilok	—	23 out of 26 (88.46%)	—

DISCUSSION

Knowledge is a critical factor in health behavior change. The participants' low baseline knowledge of anemia at SMP Negeri 43 Batam reflects a condition commonly found among school-aged adolescents in Indonesia. Iron-deficiency anemia in adolescents occurs due to an imbalance between increased iron requirements during growth and inadequate intake. Among adolescent girls, this risk is even higher due to monthly iron loss through menstruation. The normal hemoglobin levels that adolescents should be aware of are above 12 g/dL for girls and above 13 g/dL for boys; levels below these thresholds are classified as anemia (WHO, 2011). Pre-test results showed that most participants were not yet aware of these threshold values, which may explain why mild symptoms such as fatigue and dizziness are often overlooked and not associated with anemia (Mufti & Farida, 2025).

Following the educational intervention, there was a statistically significant increase in the average knowledge score from 75.15 to 91.77 (an increase of 16.62 points or 25.09%). The knowledge domain with the highest increase was prevention through local foods (+27.69 points; 42.11%), indicating that the demonstration of "cilok" made with wood ear mushrooms successfully strengthened participants' understanding of iron sources from local foods. The domain of signs and symptoms of anemia also showed a

significant improvement (+19.81 points; 27.32%), which is crucial for adolescents to recognize their condition earlier.

The demonstration of making black wood ear mushroom cilok proved to be a key component that distinguished this intervention from conventional health education. The “learning by doing” approach, which simultaneously engages sight, hearing, smell, and taste, creates a holistic and memorable learning experience. Black wood ear mushrooms (*Auricularia auricula*) were selected because of their very high iron content (18.5 mg/100 g dry weight), their wide availability in local markets at affordable prices, their chewy texture—which makes them suitable as a cilok filling—and the fact that they do not significantly alter the product’s dominant flavor. This iron content makes black wood ear mushrooms one of the best plant-based sources to help meet the daily iron needs of adolescents (boys: 11 mg/day; girls: 15 mg/day according to the 2019 Recommended Dietary Allowances).

The high product acceptance rate (88.46% of participants stated they liked it) indicates that black wood ear mushroom cilok has great potential as a healthy snack alternative in school cafeterias. This is important given the study’s findings showing that the cafeteria at SMP Negeri 43 Batam is dominated by fried foods and sugary drinks that are low in micronutrients. This positive acceptance aligns with the research by Defiana Putri et al. (2024), which reported that modifying traditional snacks with local functional ingredients can increase the acceptability and consumption of nutrient-rich foods among adolescents, especially when introduced through hands-on demonstrations in a school setting.

The success of this intervention has important implications for the development of school-based anemia prevention programs. First, integrating demonstrations of local foods into the school’s nutrition education curriculum can serve as an effective and sustainable strategy without requiring significant costs. Second, empowering school cafeterias to offer mushroom cilok as a snack option can serve as a concrete follow-up to this intervention. Third, increasing adolescents’ knowledge about anemia—particularly regarding prevention through local foods—is a crucial first step toward healthier dietary behaviors and better adherence to iron-rich dietary guidelines. The synergy between anemia education and the “cilok with wood ear mushrooms” food intervention, delivered as a single activity package, proved more effective than verbal education alone and can be replicated in other schools.



Figure 1. Personal Documentation (2026)

CONCLUSION

An anemia knowledge outreach intervention combined with a demonstration of a food innovation based on black wood ear mushroom (*Auricularia auricula*) cilok proved effective in increasing the knowledge of seventh-grade students at SMP Negeri 43 Batam regarding one method of preventing anemia. The average knowledge score increased significantly from 75.15 to 91.77 (a 25.09% increase), with the highest increase observed in the domain of knowledge regarding anemia prevention through local foods (42.11%). The hands-on demonstration of making black wood ear mushroom cilok successfully helped students internalize the concept of the nutritional content of black wood ear mushrooms as a source of plant-based iron, while also increasing interest in consuming healthy snacks among 88.46% of the participants. This approach has the potential to serve as a sustainable promotive-preventive intervention model in school settings, particularly in efforts to reduce the prevalence of iron-deficiency anemia among Indonesian adolescents. Follow-up recommendations include integrating mushroom cilok into school cafeteria menus, as well as periodically monitoring students' hemoglobin levels as an indicator of long-term impact

ACKNOWLEDGMENTS

The authors would like to express their gratitude to the principal, teachers, and all students of SMP Negeri 43 Batam for their willingness to participate in this study, as well as to the Baloi Permai Community Health Center for its support and cooperation.

CONFLICT OF INTEREST AND FUNDING DISCLOSURE

The authors declare that there are no conflicts of interest regarding this study. The activity was conducted as part of the Community Nursing Program of the Faculty of Health Sciences, Awal Bros University

AUTHORS' CONTRIBUTIONS

The first author conducted data analysis, delivered the educational session, and drafted the manuscript; the second author handled participant registration and managed secretariat data; the third author served as the activity moderator, evaluated the process, and managed post-test data; the fourth author administered the pre-test and post-test, analyzed the data, and handled documentation; and the sixth author, as the supervising lecturer, guided and evaluated the research results and the manuscript.

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