The effect of the *Aksi Bergizi* program on hemoglobin levels in adolescent girls at a junior high school

Sumiati Sumiati, Viky Indra Yanti

Departement of Nursing, Institut Teknologi Kesehatan dan Sains (ITKES) Wiyata Husada Samarinda, Indonesia

Abstract

The Nutritional Action initiative, launched by UNICEF Indonesia, addresses low compliance with iron supplement consumption among adolescent girls and the high prevalence of anemia. This program was first implemented in Klaten and West Lombok districts in 2018 and expanded nationwide in 2022-2023. The purpose of this quantitative study is to evaluate Nutritional Action's impact on hemoglobin levels in seventh-grade girls at junior high school using a pre-experimental, one-group pretest-posttest design. A stratified random sampling technique was applied, resulting in 44 respondents meeting the inclusion criteria of seventh-grade girls aged 12-14 years. Data analysis included univariate and bivariate analyses, with the Wilcoxon test used for significance testing. Among the participants, 37 (84%) experienced an increase in hemoglobin levels, while 7 (16%) showed no change in levels before and after the intervention. The analysis yielded a p-value of 0.0001, indicating a significant effect of Nutritional Action on the hemoglobin levels of seventh-grade girls at junior high school.

Correspondence: Sumiati Sumiati, Departement of Nursing, Institut Teknologi Kesehatan dan Sains (ITKES) Wiyata Husada Samarinda, Indonesia.
E-mail: sumiati@itkeswhs.ac.id

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Introduction

Adolescents currently account for more than one-fifth of Indonesia's population, providing a significant potential for national productivity. Addressing adolescent nutrition issues is crucial to achieving the Sustainable Development Goals (SDGs).[1] According to the World Health Organization (WHO), a nutritional problem becomes a major public health concern when the prevalence is between 30-39%, and it is severe if it exceeds 40%. In Indonesia, 23% of adolescents are affected by anemia. Globally, anemia cases have increased from 1.42 billion in 1990 to 1.74 billion in 2019, with a prevalence rate of 29.9% among non-pregnant women of reproductive age (15-49 years).[1-4]

WHO estimates that approximately 30% of adolescent girls worldwide are anemic, with the highest rates in South Asia and sub-Saharan Africa.[5,6] Anemia can significantly impact physical, cognitive, and emotional development in adolescent girls.[7,8] Physically, it can lead to fatigue, lethargy, and shortness of breath, affecting academic performance and daily activities. It can also worsen menstrual symptoms such as cramps, headaches, and mood swings, further impacting quality of life.[9] Additionally, anemia increases the risk of future pregnancy complications, such as preterm birth and low birth weight.[10] Cognitive functions like attention, memory, and learning can also be impaired by anemia, potentially affecting academic achievement and long-term earning potential.[11] Socially and emotionally, anemia has been linked to anxiety, depression, and reduced self-esteem, which may exacerbate socioeconomic challenges and hinder their potential.[12,13]

According to the 2018 Indonesian Basic Health Research (Riskesdas) data, anemia affects 32% of adolescents aged 15-24 and 26.8% of those aged 5-14, indicating that roughly three in ten Indonesian children suffer from anemia.[14] Compliance with iron supplement tablets among adolescent girls and pregnant women remains low;[15,16] only 1.4% of young women take more than 52 iron supplement tablets as recommended, while 98.6% take fewer than this.[14] Data from the North Penajam Paser Regency as of December 2023 revealed that 478 female students, or 20% of the total, had anemia. Of the 267 female students tested at the Petung Community Health Center, 149 were found to be anemic. Additionally, November 2023 data indicated that 1,034 toddlers in the region were classified as "very short" or "short," with 32 cases reported at the Petung Community Health Center. This data was collected through Indonesia's Electronic Community-Based Nutrition Recording and Reporting (E-PPBGM) application before its discontinuation in 2023.

Research indicates that anemia in adolescent girls is often influenced by factors such as physical activity, menstrual patterns,

socioeconomic status, nutritional awareness, and dietary habits.[4] Key factors include breakfast habits, menstrual status, history of infectious diseases, iron and protein intake, vitamin C intake, and maternal education level. However, a study conducted at a senior high school (SMAN 9 Mataram) found no significant association between anemia and attitude.[17] A separate study in Klaten examined the impact of adherence to The United Nations Children's Fund (UNICEF) nutritional action program, focusing on iron supplement tablets intake and nutritious breakfast, on hemoglobin levels among adolescent girls. The findings revealed a significant relationship, indicating that adherence to iron supplement tablet intake requirements positively impacts hemoglobin levels in students participating in the *Aksi Bergizi* or nutrition action program.[18]

The *Aksi Bergizi* initiative was started in 2018 by UNICEF in response to the low compliance with iron supplement tablets use among adolescent girls. To attain this purpose, three key treatments were implemented. The first is a weekly breakfast and iron supplement drink together at the school or a similar madrasah. The second is nutrition education across sectors, which tries to promote exercise and a healthy diet. The third type of communication is about changing behavior in a broad and pertinent way.[19] One of the government's initiatives to stop teenage anemia and stunting before pregnancy is the nutritional action movement.[20]

Preliminary observations by authors indicated that many female seventh-grade students at junior high school were unfamiliar with anemia, regularly replaced meals with junk food and snacks, and had not taken iron supplement tablets. Many were unaware of anemia and its effects. Since 2018, the Petung Health Center has been implementing anemia prevention activities following the Ministry of Health's guidelines. However, low compliance with iron supplement tablet consumption and a high anemia rate (67%) among seventh-grade girls in the 2022-2023 school year reduced the effectiveness of these efforts. This study aimed to determine the impact of the Nutritional Action intervention on hemoglobin levels in seventh-grade female students at junior high school. Specifically, it will measure hemoglobin levels before and after the intervention, assessing the effectiveness of the Nutritional Action initiative in this population.

Materials and Methods

Research design

This study utilized a quantitative approach with a pre-experimental design, specifically a one-group pre-post-test format. This design is particularly useful for examining cause-and-effect relationships within a single group of subjects. Initially, the group was observed before the intervention, and subsequent measurements were taken after the intervention. A pre-test was conducted prior to the intervention, followed by the administration of the treatment. After the treatment, another round of measurements was taken to assess the impact of the intervention. The comparison of pre-and post-test results serves as the basis for testing causality in this research.

Study participants

The study population consisted of female adolescents in seventh grade (class VII) at junior high school, with a total of 95 female students. The sampling technique employed was stratified random sampling to ensure that the sample was homogeneous within each stratum.[13] This method ensured that the characteristics of each group were considered during the selection process, leading to a balanced and representative sample. The inclusion criteria for the study were adolescent females in the seventh grade, aged between 12 and 14 years, who were willing to participate as respondents. Exclusion criteria included participants with a history of chronic illness or haematological conditions, as well as those currently using iron supplements or medications such as antibiotics, chemotherapy agents, nonsteroidal anti-inflammatory drugs (NSAIDs), or anti-malarial drugs, which could affect red blood cell counts. Additionally, individuals who were unwilling to participate were excluded from the study.

Variable, instrument, and data collection

The dependent variable in this study was the hemoglobin levels of adolescent females, while the independent variable was the *Aksi Bergizi* (Nutrition Action) intervention. Pre-test measurements of hemoglobin levels were taken during the initial visit with the respondents. Following this, the intervention was conducted over four consecutive Wednesdays, with a post-test administered on the fourth Wednesday. The primary data collected included several components: sample identity information such as name, age, class, complete address, and medical history; a consent form signed by each respondent; hemoglobin measurements taken before the intervention; nutrition action cards used to record each respondent's progress; and hemoglobin measurements taken after the intervention. Standard operating procedures (SOPs) were followed for both the nutrition action activities and the hemoglobin meter checks. In addition to the primary data, secondary data were collected from journals, guidelines, technical instructions, and school records, including coordination with the school's health staff and the principal of the junior high school where the research was conducted. This information ensured the study adhered to local regulations and protocols.

Research implementation

The implementation of the research was conducted in three stages. The first stage, the pre-intervention stage, involved coordination with the junior high school where the research was conducted and teachers to plan the technical aspects of the study. A team of five members from the School Health Unit (UKS), nutrition, counseling team, health promotion, and the research program holders worked together to determine the number of potential respondents and to randomly select participants. The stratified random sampling method was applied, using class VII attendance data to select participants. The Picker Wheel online application was used to randomly assign students to groups, ensuring the sample was representative across class levels (VII-1 to VII-6). The second stage, the intervention stage, involved the delivery of the Nutrition Action intervention. The researcher explained the components of the "Nutrifying Action" agreement, which were displayed on a PowerPoint presentation. Each point of the agreement was then explained in detail to the respondents. Following this, an Energizer exercise was demonstrated, and the respondents were divided into small groups of 7-8 students. These small groups participated in a shared healthy breakfast session following the "Fill My Plate" model. After breakfast, each student was given one iron supplement tablet, which they were instructed to take once a week on Wednesdays. The final stage, the post-intervention stage, involved collecting the nutrition action cards and conducting a post-test to measure the respondents' hemoglobin levels. The hemoglobin check was carried out using a quick test method, and the session concluded with a closing statement to the respondents.

Data analysis

Data analysis was conducted using univariate and bivariate analysis with the SPSS statistical software. The normality of the data was tested using the Shapiro-Wilk test to determine whether it followed a normal distribution.

Ethical clearance

This study received ethical approval from the Health Research Ethics Commission, as indicated by the ethical certificate DP.04.03/F.XLII.25/0453/2024.

Results

This study's participants were seventh-grade students who participated in the *Aksi Bergizi* intervention program every Wednesday for four weeks. A total of 44 respondents were involved, and the characteristics of the participants are summarized in Table 1. As shown in Table 1, the predominant age group among the respondents was 13 years, with 33 individuals (75%). The 12-year-olds accounted for 8 participants (18.2%), while the least represented age group was 14 years, with only 3 participants (6.8%). The univariate analysis was performed to examine the hemoglobin levels before and after the *Aksi Bergizi* intervention among adolescent girls. Hemoglobin levels were assessed prior to the intervention on Tuesday, June 14, 2024, at 11:30 WITA, involving all 44 respondents. The results are shown in Table 2. As shown in Table 2, the average hemoglobin level before the intervention was 11.39, with a standard deviation of 1.11. The lowest recorded hemoglobin level was 8.7 mg/dl, and the highest was 14.0 mg/dL. As indicated in Table 3, the average hemoglobin level after the intervention was 12.86, with a standard deviation of 1.36. The lowest hemoglobin level was 8.8 mg/dL, and the highest was 15.4 mg/dL. Additionally, a univariate test was performed to assess the effect of the *Aksi Bergizi* intervention on hemoglobin levels in adolescent girls. Table 4 shows that, out of the 44 respondents, 7 experienced a decrease in their hemoglobin levels (negative ranks), while 37 respondents showed an increase in their levels (positive ranks). A Wilcoxon signed-ranks test was used to determine if there was a significant difference between the pre-test and post-test results, as the data were not normally distributed. Table 5 indicates that the significance value is 0.0001, which is less than 0.05. Therefore, it can be concluded that there is a significant difference between the pre-test and post-test results. There is an effect of the nutritional action intervention on hemoglobin levels in class VII adolescent girls in junior high school.

Discussion

The study's findings reveal that the average hemoglobin level among class VII adolescent girls before the intervention was 11.39 mg/dL, with a minimum of 8.7 mg/dL and a maximum of 14.0 mg/dL. Hemoglobin, a protein found in red blood cells, is responsible for transporting oxygen from the lungs to other parts of the body.[21] This result suggests that many of these young girls are at higher risk for anemia, which aligns with prior research by Yuanti (2020),[22] who found that young women had an average hemoglobin level of 10.59 mg/dL before iron (Fe) supplementation, indicating widespread anemia. This is especially relevant for class VII girls transitioning from elementary to junior high school, as they may lack awareness of anemia prevention.[23]

Following the *Aksi Bergizi* intervention, which included four sessions based on the nutrition module, the average hemoglobin level increased to 12.8 mg/dL, with a standard deviation of 1.36, a minimum of 8.8 mg/dL, and a maximum of 15.4 mg/dL. The increase in hemoglobin levels highlights the program's effectiveness. In the "Plan Your Future" sessions, students were guided to identify and commit to positive health actions, encouraging health-conscious behaviors.[24] The findings align with Zaddana *et al.* (2019),[25] who observed that dietary habits and nutritional intake significantly influence anemia prevalence. Many students in the intervention and control groups showed low levels of essential nutrients, such as iron and protein, indicating that young girls are often unaware of nutritional needs, which can affect hemoglobin

Table 1. Distribution of respondents categorized by age.

Age		Frequency	Percent	Valid percent	Cumulative percent
Valid	12	8	18.2	18.2	18.2
	13	33	75	75	93.2
	14	3	6.8	6,8	100
	Total	44	100	100	

Table 2. Hemoglobin levels of class VII adolescent girls before being given the *Aksi Bergizi* intervention.

	Mean	Minimum	Maximum	Std. deviation	N
Pre-test check Hemoglobin Level	11.397	8.7	14.0	11.089	44
Valid N (listwise)					44

Table 3. Hemoglobin levels of class VII teenage girls after being given the *Aksi Bergizi* intervention.

	Mean	Minimum	Maximum	Std. deviation	N
Post-test check Hemoglobin Level	12.864	8.8	15.4	13.599	44
Valid N (listwise)					44

Table 4. Pre-test rank test and post-test examination of hemoglobin levels for adolescent girls.

		Mean rank	Sum of ranks	N
Post-test – Pre-test	Negative ranks	8.71	61.00	7[a]
	Positive ranks	25.11	929.00	37[b]
	Ties			0[c]
	Total			44

[a]Posttest < Pretest; [b]Post-test > Pre-test; [c]Posttest = Pretest

Table 5. Wilcoxon test output results.

	Z	p
Post-test – Pretest	-5.067b	0.0001

[a]Wilcoxon Signed Ranks Test. [b]Based on negative ranks.

levels.[26] Additionally, similar studies found low compliance with Fe supplementation among adolescent girls due to limited knowledge of anemia and its benefits.[16] Statistical analysis revealed a significant difference in hemoglobin levels before and after the intervention, confirming the impact of the *Aksi Bergizi* program. Of the 44 participants, 37 showed improved hemoglobin levels, while 7 experienced a decrease.[27] The initial low levels of knowledge regarding anemia prevention and the benefits of Fe tablets may have contributed to low pre-intervention hemoglobin levels.[28,29] The findings of this study emphasize the importance of multi-sectoral collaboration among schools and health professionals to foster adaptive health behaviors. Similar research by Khoirunnabila *et al.* (2018)[18] reported a significant relationship between hemoglobin levels and Fe supplementation adherence. Likewise, Zaddana *et al.* (2019)[25] noted that after receiving nutrition education, participants' knowledge of anemia increased from an average score of 69.21 to 85.43. Hevandari (2023)[27] also found that compliance with the *Aksi Bergizi* intervention improved significantly, as demonstrated by increased adherence to health guidelines in class VIII girls.

A limitation of this study is its duration. Conducted every Wednesday for four weeks, the third session coincided with an absence due to illness, which required follow-up via WhatsApp. Additionally, the class schedule only allowed for 30 minutes of physical activity on Wednesdays instead of the typical Friday, limiting exercise participation. A few students did not adhere to nutritional guidelines by consuming two carbohydrate sources, such as rice and noodles, highlighting the need for reinforced education on balanced meals.

Conclusions

In conclusion, this study found a significant difference in hemoglobin levels among female teenagers before and after the intervention. A higher number of respondents showed elevated hemoglobin levels post-intervention, indicating that the nutritional action youth program positively impacted their health outcomes. The observation underscores the substantial effect of this intervention on the hemoglobin levels of class VII teenage girls in junior high school. However, the study's limited sample size may affect the generalizability of these results to a wider population. Additionally, the short duration of the study may not capture the potential long-term effects of the nutritional interventions. Furthermore, the use of a single metric (hemoglobin levels) may not fully represent the comprehensive effects of the intervention on participants' health.

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