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The effect of the school meal program on knowledge, attitudes, and practices of balance nutrition among adolescent girls

Efek pemberian program makan bergizi terhadap pengetahuan, sikap, dan praktik gizi seimbang pada remaja putri

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Abstract

Anemia among adolescent girls remains a public health concern in Indonesia and is linked to low dietary diversity and inadequate nutrient intake. Despite existing school meal programs, evidence of their effects without formal nutrition education remains limited. This study aimed to evaluate the impact of a school meal program on knowledge, attitudes, and practices (KAP) related to balanced nutrition, anemia, and hygiene among female students. A quasi-experimental one-group pre–post test design was conducted with 80 grade-10 students at the State Vocational High School 1 Bogor, selected purposively during a four-week period from July to August 2025. KAP scores were collected using validated questionnaires and analyzed using the Wilcoxon test. The results showed a significant increase in knowledge (mean score 6,0 to 7.0; p= 0,043) and attitudes (median 8,0 to 10,0; p= 0,020) after one month of intervention, while practices remained unchanged (mean score 24,0 to 24,0; p= 0,371). Exposure to school meals and external nutritional information, particularly from social media, likely contributed to the improvement in knowledge and attitudes. However, unchanged practices may be due to short intervention duration, low household income, and limited access to diverse healthy foods. In conclusion, these findings highlight that free school meals can enhance knowledge and attitudes even without direct education; however, sustained behavioral change requires longer interventions, supportive environments, and parental involvement.

Keywords: Adolescent girls, nutrition attitude, nutrition knowledge, nutrition practice, school meal program.

Abstrak

Anemia pada remaja putri masih menjadi masalah kesehatan masyarakat di Indonesia, terkait dengan rendahnya keragaman pangan dan asupan gizi. Meskipun program makan bergizi di sekolah telah diterapkan, bukti mengenai pengaruhnya tanpa edukasi gizi formal masih terbatas. Penelitian bertujuan untuk mengevaluasi dampak program makan bergizi gratis terhadap pengetahuan, sikap, dan praktik (KAP) gizi seimbang, anemia, dan perilaku hidup bersih sehat pada siswi. Penelitian menggunakan desain kuasi eksperimen dengan rancangan one group pre–post tes pada 80 siswi kelas 10 SMKN 1 Bogor yang dipilih secara purposive selama 4 minggu dari bulan Juli hingga agustus 2025. Data skor KAP dikumpulkan melalui kuesioner tervalidasi dan dianalisis menggunakan uji Wilcoxon. Hasil penelitian menunjukkan peningkatan signifikan pada pengetahuan (skor rata-rata 6,0 menjadi 7,0; p=0,043) dan sikap (median 8,0 menjadi 10,0; p=0,020) setelah satu bulan intervensi, sedangkan praktik tidak mengalami perubahan (skor rata-rata 24,0 menjadi 24,0; p=0,371). Paparan menu bergizi di sekolah dan informasi gizi dari media sosial diduga berkontribusi pada peningkatan pengetahuan dan sikap. Tidak berubahnya praktik kemungkinan disebabkan durasi intervensi yang singkat, pendapatan keluarga rendah,

dan akses terbatas terhadap pangan sehat. Kesimpulan, temuan ini menunjukkan bahwa program makan bergizi dapat meningkatkan pengetahuan dan sikap meski tanpa edukasi formal, namun perubahan perilaku berkelanjutan memerlukan intervensi lebih lama dan dukungan dari lingkungan.

Kata Kunci: Pengetahuan gizi, praktik gizi, program makan sekolah, sikap gizi, remaja putri

Introduction

Adolescence is a period of rapid physical, mental, reproductive growth, and development. During this time, there is an increased nutritional demand to support puberty and establish long-term health status. Adolescent girls, in particular, are vulnerable to nutritional problems such as chronic energy deficiency and anemia due to the increased need for iron during growth and menstruation (Salam et al., 2016; UNICEF Indonesia 2021). According to the World Health Organization (WHO), the adolescent age range is 10–19 years, and significant nutritional challenges are observed within this age group. Data show that the prevalence of anemia among adolescents aged 15–24 years increased from 18,4% in 2013 to 32% in 2018 (Ministry of Health RI, 2013; 2018), although it decreased to 15,5% by 2023 (Ministry of Health RI, 2023). At the local level, for example, in Bogor City, the prevalence of anemia among adolescents remains significantly high at 16,3% (Bogor City Health Office, 2024).

Anemia among adolescent girls is closely associated with dietary patterns that lack variety, high consumption of processed foods and sugary drinks, and low intake of animal protein, fruits, and vegetables, which are the main sources of iron and other essential micronutrients (Agustina et al., 2021; Wijayanti & Fitriani, 2019). The tendency to skip breakfast and dinner also contributes to inadequate energy intake and insufficient levels of key nutrients, such as iron and folic acid (Aisyaroh et al., 2023). Poor knowledge, attitudes, and practices related to nutrition are determining factors in the selection of food types and the development of unhealthy eating habits (Gonete et al., 2018; Sari et al., 2022). Therefore, intervention approaches are needed that not only focus on improving nutritional intake but also on enhancing nutritional literacy and promoting healthy eating behaviors.

One potential intervention to address nutritional problems and anemia among adolescent girls is the provision of school meals or "Makan Bergizi Gratis (MBG)" at schools. This program is one of the government's efforts to improve the nutritional status of communities by increasing access to balanced and nutritious foods. The School Meal Program in Indonesia, called "Makan Bergizi Gratis (MBG), " is expected to improve energy and micronutrient intake, enhance physical endurance, increase preference for nutritious local foods, and promote clean and healthy living behaviors among Indonesian children.

School meal programs are often designed to improve students' nutritional intake, particularly among children and adolescents who are vulnerable to malnutrition. School meal programs can also serve as an educational platform to promote healthy eating habits, thereby becoming part of a healthy lifestyle aimed at enhancing cognitive function and influencing the prevalence of stunting among children (Oostindjer et al., 2017).

This program has been implemented in several countries and has been proven to improve nutrient intake, hemoglobin levels, and healthy eating behaviors (Adelman et al., 2019; Kusumawati et al., 2019). In Indonesia, similar programs have effectively increased the intake of protein, iron, and vitamin C, as well as improved nutrition-related knowledge, attitudes, and practices among students (Rimbawan et al., 2023). In addition to enhancing nutritional status, the School Meal Program also functions as a nutrition education platform that shapes better dietary behaviors through social and behavioral change communication (SBCC) involving schools, families, and communities (UNICEF, 2021).

Given the high prevalence of anemia and unbalanced dietary patterns among adolescent girls, the School Meal Program is highly relevant for this population. This is expected to increase nutritional literacy, encourage healthy eating practices, and improve the overall nutritional status of adolescents. Therefore, this study aimed to explore the impact of the School Meal Program on the nutrition-related knowledge, attitudes, and practices of adolescent girls, with results

intended to support policies for improving adolescent nutrition to achieve the Golden Generation 2045 vision of a healthy, intelligent, and productive future generation.

Methods

This research used a quasi-experimental, one-group, pre-post test study was conducted at the State Vocational High School 1 Bogor. Data were collected for 1-month from July to August 2025. The research site was purposively selected based on the school's status as a recipient of the School Meal Program and its large student population, which was greater than that of other high schools in the area. Sample size calculations were based on Lameshow (1997). The minimum sample size required for subgroup analysis was based on the sample size calculated to detect a minimum change of 0,7 g/dL in the participants' hemoglobin levels, with a standard deviation (SD) of 1,31 g/dL, a 95% confidence interval, and a statistical power of 0,90. This resulted in the inclusion of a minimum of 74 participants in the study. A total of 80 participants were included to account for anticipated dropouts.

$$n = \frac{(Z\frac{\alpha}{2}+Z\beta)^2 \text{ x } (2\sigma^2)}{\delta^2}$$

n : sample size
Zα : 1 – α, α = 5% (Zα = 1,96)
Zβ : 1- β, β = 90% (Zβ = 1,28)
σ : standard deviation= 1,31 (Mohapatra et al., 2023)
δ : minimum detectable mean difference = 0,70 (Mohapatra et al., 2023)

Participants were included if they did not have chronic illnesses that could affect hemoglobin levels (such as tuberculosis, dengue fever, malaria, or typhoid), had not undergone a blood transfusion in the past month, and were willing to participate by signing an informed consent. The exclusion criteria were absence from school for more than one week, severe bleeding during the study period, and previous participation in the school meal program.

Data, including demographic information (age, menstrual cycle, menstrual duration, nutrition education, household income, and parental education), were collected using questionnaires. Data on nutrition knowledge, attitudes, and practices related to nutrition, anemia, and hygiene were collected through interviews and questionnaires. The questionnaire consisted of 10 items covering balanced diet, hygiene, and anemia knowledge. Knowledge items were answered with "yes" or "no," attitude items with "agree" or "disagree," and both were scored by the number of correct responses. The practice items were assessed based on the frequency of behaviors using a 5-point scale, with responses scored as follows: "always" = 4 points, "frequently" = 3 points, "sometimes" = 2 points, "rarely" = 1 point, and "never" = 0 points. The maximum achievable score for practice was 40. The correct responses were summed to obtain the total scores for knowledge, attitude, and practice. Scores were then averaged and categorized as 'good' if the percentage of correct answers was ≥ 80%, 'moderate' for 60–79%, and 'poor' for <60% (Khomsan, 2021).

The questionnaire on balanced nutrition, anemia, and hygiene was previously tested for validity and reliability by the researcher, yielding the following Cronbach's alpha coefficients: nutrition knowledge (p= 0,644), nutrition attitudes (p= 0,708), and nutrition practices (p= 0,658). The Normality of the data was tested using the Kolmogorov-Smirnov test. Bivariate analysis was conducted using the Wilcoxon signed-rank test to assess differences before and after the intervention. This study was approved by the Research Ethics Committee (REC) of Poltekkes Kemenkes Aceh (approval number: DP.04.03/12.7/300/2025).

Result and Discussion

The subjects of this study were 10th-grade female students at State Vocational High School 1 Bogor, with the majority being 15 years old (Table 1). The participants fell within the late adolescent age range of 15–19 years, as defined by the World Health Organization (WHO, 2014). Most subjects exhibited normal menstrual cycles, defined as 21–35 days, accounting for 72,5%, while 27,5% experienced abnormal cycles of less than 21 days or more than 35 days in length. Regarding menstrual duration, the majority of participants experienced menstruation lasting 5–7 days (72,5%), and 27,5% reported durations of less than 5 days.

In terms of nutrition education exposure, 71,3% of the participants had previously

received nutritional information, whereas 28,7% had not. The sources of nutritional information known to the participants included social media, public service advertisements, and healthcare facilities.

Family income was categorized based on the City Minimum Wage, with 82,5% of families falling below this threshold. Regarding parental education, the highest level attained by fathers was high school graduation (52,2%), whereas for mothers, it was the most common (48,8%).

Table 1. Subject's characteristics

Characteristic	n	%
Sex		
Female	80	100,0
Grade		
X (10th grade)	80	100,0
Age		
14	6	7,5
15	63	78,8
16	11	13,8
Menstrual Cycle		
Cycle length 28-35 days	58	72,5
Less than 28 days or more than 35 days	22	27,5
Duration of menstruation		
Less than 5 days	22	27,5
5-7 days	58	72,5
Nutrition education		
Yes	57	71,3
No	23	28,7
Household income		
Below regional minimum wage	66	82,5
Above regional minimum wage	14	17,5
Father's education		
Finished elementary school	12	15
Finished junior high school	21	26,3
Finished senior high school	41	51,2
Finished higher education	6	7,5
Mother's education		
Finished elementary school	13	16,3
Finished junior high school	24	30
Finished senior high school	39	48,8
Finished higher education	4	5

The results shown in Table 2 indicate that prior to the school meal program intervention, most participants exhibited low levels of nutrition-related knowledge (42,5%), while attitudes towards nutrition were predominantly positive (73%) and dietary practices were moderately healthy (52,5%). Following the one-month intervention, significant improvements were observed in both knowledge and attitudes, demonstrating the effectiveness of the program in enhancing awareness and favorable perceptions related to balanced nutrition, anemia, and hygiene. Specifically, the knowledge level shifted from a largely low category to a moderate category for nearly half of the participants (48,8%), whereas the proportion of participants with good attitudes increased to 82,5%. However, despite these cognitive and affective gains, no significant change was found in the participants' self-reported practices, which remained mostly moderate (57,5%).

The observed improvement in knowledge and attitudes affirms that the school meal program intervention can successfully enhance nutritional literacy and motivation among adolescent girls in the future. Sustained moderate practice scores suggest the need for continued efforts, such as ongoing education, behavioral reinforcement, and community support, to translate these positive cognitive and attitudinal changes into consistently healthy dietary behaviors. This underscores the importance of integrating nutrition education with practical, sustained behavioral interventions to achieve meaningful improvements in the nutritional status and health outcomes of adolescents.

Table 2. Effect school meal program on knowledge, attitude and practice

Variable	Category	Baseline	Endline	p-value*
		n (%)	n (%)	
Knowledge	Good (>80%)	20 (25%)	22 (27,5%)	0,043
	Moderate (60-80%)	26 (32,5%)	39 (48,8%)	
	Low (<60%)	34 (42,5%)	19 (23,8%)	
	Median (min - max)	6 (2 - 10)	7 (2 - 10)	
Attitudes	Good (>80%)	73 (91,3%)	66 (82,5%)	0,020
	Moderate (60-80%)	7 (8,8%)	12 (15%)	
	Low (<60%)	0 (0%)	2 (2,5%)	

Practice	Median (min - max)	8 (6;10)	10 (5;10)	
	Good (>80%)	5 (6,3%)	1 (1,3%)	0,371
	Moderate (60-80%)	42 (52,5%)	46 (57,5%)	
	Low (<60%)	33 (41,3%)	33 (41,3%)	
	Median (min - max)	24 (14 - 34)	24 (9 - 33)	

**wilcoxon; significant if p<0,05*

Table 3 shows the response rates for the knowledge and attitude items in the KAP test at baseline and endline. In the knowledge section, there was an increase in the proportion of students who correctly identified key concepts, such as consuming meat, fish, tempeh, tofu, and eggs as rich protein sources (from 52,5% to 100%) and recognizing cassava, sweet potatoes, or potatoes as substitutes for rice (from 17,5% to 30%). However, the percentage of students who reported weekly iron supplement intake decreased (from 56,3% to 45%), while their knowledge about proper handwashing improved (from 55% to 63,7%).

For attitudes, most items showed high scores at both baseline and endline. For instance, almost all students reported having breakfast before school (88,8% at both time points) and followed the recommended portion of "My Plate" (98,8% at both time points). Slight decreases were observed in limiting high-sodium snacks (68,8%–62,5%) and daily iron supplement intake during menstruation (58,8%–55%).

Regarding practices, small improvements were observed in several areas, such as the consumption of protein-rich foods (47,5% to 53,8%) and balanced meals (22,5% to 22,5%, unchanged but stable), while other practices remained low, including eating carbohydrate-rich foods for energy (40% to 42,5%) and replacing rice with alternative staples (27.5% to 22,5%). Practices related to iron supplementation were particularly low, with only 1,3% of the students reporting weekly intake at both the baseline and endline.

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Table 3. The response rate of knowledge and attitude in the KAP test at baseline and endline

Category	Themes	Questions	Baseline	Endline
Knowledge	Balance nutrition	The consumption of a variety of foods aims to improve body health.	80	82,5
		Eating balanced meals based on the quantity and type of food.	86,3	85
		Consuming meat, fish, tempeh, tofu, and eggs is beneficial because they are rich in protein.	52,5	100
		Eating carbohydrate-containing foods provides energy to the body.	30	36,3
		Having breakfast can improve concentration while studying.	40	41,3
		To replace rice, one can consume cassava, sweet potatoes, or potatoes.	17,5	30
		Sweet foods and drinks that are high in sugar can cause obesity.	83,8	85
	Anemia	Eat according to the recommended portion of "My Plate."	67,5	72,5
		Iron supplements were administered once daily.	56,3	45
	Hygiene	I always wash my hands before eating food.	88,8	83,8
		Wash hands before eating with soap and running water.	55	63,7
Attitudes	Balance nutrition	Consume food consisting of staple foods, side dishes, vegetables, and fruits.	100	98,8
		Drink plain water instead of flavored or sugary drinks.	100	100
		Eat vegetables.	92,5	92,5
		They have breakfast before attending school.	88,8	88,8

		Eat according to the recommended portion of "My Plate."	98,8	98,8
		I drink according to the recommendation, which is eight glasses per day.	97,5	98,8
		Limit snacks high in sodium.	68,8	62,5
	Anemia	I consume iron supplements daily, during menstruation.	58,8	55
	Hygiene	I consume iron supplements once a week when I am not menstruating.	100	98,8
		Eating balanced meals based on quantity and type of food.	22,5	20
		Consuming meat, fish, tempeh, tofu, and eggs is beneficial because they are rich sources of protein.	47,5	53,8
		Eating carbohydrate-containing foods provides energy to the body.	48,8	42,5
	Balance nutrition	Eating breakfast can improve concentration while studying.	50	46,3
Practices		To replace rice, one can consume cassava, sweet potatoes, or potatoes.	27,5	22,5
		Sweet foods and drinks that are high in sugar can cause obesity.	37,5	38,8
		Eat according to the recommended portion of "My Plate."	1,3	1,3
	Anemia	Iron supplements were administered once a week.	2,5	1,3
		I always wash my hands before eating the food.	0	3,8
	Hygiene	Consuming a variety of foods aims to improve health.	83,8	77,5

In Japan, school meal programs are provided to students at the kindergarten, elementary, junior high, and senior high school levels. This study evaluated the impact of the School Meal Program intervention by assessing changes in Knowledge, Attitude, and Practice (KAP) test scores. This study focused on changes in KAP scores related to balanced nutrition, anemia, and clean and healthy lifestyle behaviors.

To explore the most effective aspects of the program without accompanying education, we examined the components of "balanced nutrition," "water consumption," and "handwashing," all of which showed significant improvements in correct response rates. These high-scoring components are likely attributable to the participants' direct exposure to school lunch menus.

Similarly, a study conducted in Chinese schools found that nutrition education significantly improved knowledge scores and positively influenced food consumption behaviors. In contrast, without nutrition education, the improvement in healthy behaviors was suboptimal despite the provision of healthy food (Xu et al., 2022).

Shared meals in the school environment provide a strong example and motivation for students to consistently adopt healthy eating patterns, such as consuming fruits, vegetables, and other nutritious foods. The school's social environment, including the availability of healthy food and behaviors modeled by teachers and peers, plays an important role in reinforcing balanced changes in dietary behavior. This is because shared meals create a social setting that enables students to learn through observation and interaction, while simultaneously fostering sustainable positive habits.

Studies have shown that school-based shared meal programs not only increase fruit and vegetable consumption but also reduce food waste, indicating greater awareness and acceptance of healthy food. A supportive school eating environment encourages students to consume nutritious foods more frequently and develop healthier eating patterns (Diana et al., 2025). In addition, a health-promoting school environment through policies, the availability of nutritious foods, and school-based health promotion efforts helps children develop better

eating habits, which, in turn, positively impacts long-term health outcomes (Chaudhary et al., 2020). This social and environmental support complements the improvements in knowledge and attitudes observed in the school meal program, reinforcing the importance of nurturing school settings to translate awareness and motivation into consistent healthy dietary behaviors among adolescent girls.

Eating together in the school environment primarily serves as a social stimulus and a supportive setting for the formation of positive habits. When students eat together at school, they have the opportunity to socialize with their peers and develop friendships. This socialization creates an enjoyable mealtime atmosphere and reduces stress, making students feel more comfortable eating and more likely to consume the food provided. Peers can act as motivators to try new or healthier foods because of the influence of group norms and positive reinforcement. For example, children tend to eat better when they observe their friends consuming healthy foods (Chapman et al., 2025).

The School Meal Program in Indonesia implements the principle that shared meals at school, as a social stimulus and conducive environment, can foster positive eating habits in children. This program focuses on providing access to healthy foods to support sustainable changes in food consumption behaviors for a healthier and smarter generation in Indonesia.

The findings of this study demonstrated an increase in students' nutrition knowledge and attitudes, even though the intervention consisted solely of a school meal program without formal education. Repeated exposure to nutritious foods served at school helped students recognize various types of healthy foods, their benefits, and proper ways to consume them. This exposure implicitly contributed to improvements in nutritional knowledge despite the absence of formal education.

These results contrast with much of the existing literature, which suggests that improvements in nutritional knowledge and attitudes generally require structured educational interventions (Contento, 2007). However, in this study, improvements were still observed, indicating the role of other factors. One likely factor is the high exposure to nutritional information through social media. Currently, platforms such as TikTok, Instagram, and YouTube are widely used by adolescents to access content related to healthy lifestyles, nutritious foods, and nutritional tips. Exposure to nutritional information on social media significantly influences Indonesian adolescents' nutritional knowledge. Although formal education was not provided in this program, the school environment offering healthy meals, combined with external exposure to nutritional information, especially through social media, created a synergistic effect that led to enhanced nutritional knowledge and attitudes among students (Rarastiti & Hidayat, 2025; Palimasari et al., 2023). One factor contributing to the increase in nutritional knowledge may be the role of social media as an accessible source of health information for adolescents. Recent evidence shows that social media platforms can broaden adolescents' knowledge of nutrition and dietary practices (Ansar et al., 2024). However, the quality and reliability of the information obtained from these platforms vary. Kreft et al. (2023) emphasized that much of the nutrition-related content on social media is user-generated and may lack scientific accuracy.

The persistence of moderate dietary practices observed in this study suggests that improving nutritional knowledge alone is insufficient to foster behavioral change. Peer influence and family support are well-documented determinants of adolescents' food choices (Risti et al., 2021). Without reinforcement from social and environmental factors, adolescents may struggle to consistently adopt healthier dietary behaviors. Furthermore, practical barriers, such as limited food availability at home and personal preferences (e.g., disliking vegetables or skipping breakfast because of time constraints), were also reported by participants, consistent with findings from similar interventions in other contexts (Wahyuningtyas et al., 2021).

The overall average knowledge score increased significantly after the intervention. The correct response rate for knowledge items was consistently higher than that for attitudes and practices, both pre-and post-intervention. However, nutritional practices are influenced by multiple factors, such as social and economic environments, established habits, and food accessibility. Although knowledge and attitudes can improve quickly, changes in eating practices represent actual behaviors that require time to adjust and reinforce in daily life contexts (Lima et al., 2023). The absence of a significant

improvement in practice scores after the intervention may be due to the short data collection period of only one month. Keller (2021) found that health habits, including healthy eating patterns, generally take a median duration of 59 to 66 days (approximately two months) to form, and can take more than three to five months depending on the complexity of the behavior and individual factors. Interventions shorter than one month are often insufficient to establish consistent automaticity in healthy behaviors (Singh et al., 2024). Behavioral changes in adolescent nutrition are not solely determined by knowledge but also by external determinants, such as family involvement in supporting dietary habits, peer group interactions that may influence food choices, and socioeconomic conditions that potentially limit students' access to nutritious and balanced foods (Nurlaila et al., 2023).

The results shown in Table 3 indicate the response rates of knowledge and attitude in the KAP test at baseline and endline. Based on the results of interviews with selected respondents, to gain deeper insights into the decrease observed in the final responses, there was a decline in the percentage of correct answers regarding the understanding of balanced nutrition.

"I have heard about it before… but I was afraid to choose the wrong answer". (Student AR)

There was also a decrease in knowledge regarding hemoglobin levels, with students admitting that they were still uncertain when answering the questions.

"I wasn't sure whether my previous answer was right or wrong." (Student DN)

The decline in attitudes and practices related to consuming nutritious and varied foods was due to their limited availability at home.

"Yes, sometimes it's not available at home, and I also don't like vegetables." (Student AR)

Regarding attitudes and practices related to consuming iron supplements, some students mentioned that it was because there was no supply at home.

"I don't have any of the medicine at home." (Student D)

However, another student provided a different reason.

"I don't like the smell." (Student AR)

Regarding the decline in handwashing practices:

"The handwashing area is far; we have to go down to the first floor." (Student AR)

The same applies to skipping breakfast, which occurs due to time constraints.

"I'm in a rush and afraid of being late for school." (Student AA)

Based on the interview results, several factors were identified as contributing to the decline in knowledge, attitudes, and nutritional practices among adolescent girls. Although some students reported having previously received information on balanced nutrition, they still expressed doubt and fear of providing incorrect answers, reflecting their low self-confidence in applying their nutritional knowledge to patients. This finding is consistent with previous research, which indicates that adolescents' nutritional knowledge remains limited and is often accompanied by uncertainty (Uhlmann et al., 2023).

A decrease in the understanding of hemoglobin was also evident, as some respondents stated that they were unsure whether their earlier responses were correct. This supports evidence suggesting that improving knowledge regarding iron and hemoglobin levels requires intensive and continuous education (Al Rahmad & Annisa, 2025). The home environment was also found to have a significant effect. Several respondents reported that the consumption of nutritious foods was constrained by limited food availability and personal preferences, particularly a dislike of vegetables. This is in line with prior studies that demonstrated that the availability of healthy foods at home is a key predictor of adolescent dietary quality (Pearson et al., 2009). (Yani et al., 2023).

Challenges have also been reported in adherence to iron supplementation have also been reported. Respondents cited a lack of stock at home and aversion to the tablet's odor as reasons for non-compliance. These findings are consistent with evidence that availability, palatability, and perception are the primary determinants of low adherence to iron supplementation programs (Silitonga et al., 2023).

A decline in handwashing practices was also observed, which was attributed to limited access to handwashing facilities located at considerable distances. This finding is consistent with research indicating that physical barriers reduce the likelihood of proper hand hygiene (Fitriyah, 2020). In addition, the tendency to skip breakfast among many respondents was

primarily associated with limited time in the mornings before leaving for school (Lakmali et al., 2022).

The lack of change in nutritional practices may also be linked to income constraints that limit families' ability to purchase high-quality, healthy, and nutritious foods. Healthy foods often cost more than less nutritious or processed alternatives, causing low-income families to choose cheaper but less healthy options to meet their daily caloric needs (Beck et al., 2019). Low income not only reduces food quantity but also impedes the quality and diversity of food consumed, negatively affecting balanced nutrition practices and potentially leading to both undernutrition and overnutrition, especially in families with children undergoing growth (Laraia et al., 2017).

Beyond financial factors, parental education significantly impacts balanced nutrition practices within the family by increasing nutrition knowledge, attitudes, and healthy food selection behaviors, and by fostering a supportive home environment (Phyo et al., 2021). Parents with higher educational attainment tend to have better nutritional knowledge, which enhances their ability to choose healthy, balanced, and nutritious foods for their families. Studies have shown that mothers with higher educational levels more frequently restrict unhealthy food intake for their children and consistently provide fruits, vegetables, and healthy breakfasts. Maternal education plays a crucial role in creating a home environment conducive to adopting balanced nutritional practices (Umoke et al., 2020). Therefore, nutritional intervention programs should also aim to enhance parental nutrition literacy, especially among parents with lower educational backgrounds, to effectively improve family dietary habits.

Conclusion

The findings of this study indicate that the provision of a School Meal Program can improve knowledge and attitudes but does not lead to significant improvements in nutritional practices among female students. Continuous monitoring and evaluation of target schools are necessary to encourage the consumption of a balanced and nutritious diet, improve food quality, prevent anemia, and increase awareness of clean and healthy living behaviors. Schools should integrate meal programs with structured nutrition education and involve parents in supporting healthy eating at home. Policymakers should strengthen school-based nutrition policies to ensure the sustainability of meal programs and provide access to diverse nutritious foods.

Future research should incorporate nutritional education programs to support knowledge related to balanced nutrition guidelines, the importance of iron supplementation in preventing anemia, and clean and healthy lifestyle practices to prevent anemia. Longitudinal studies and multi-component interventions are recommended to better capture long-term behavioral changes and the combined effects of school meals, education, and family involvement on BMI.

This study has several limitations. First, it did not include a control group, making it difficult to isolate the effect of the intervention from external factors such as exposure to nutrition information on social media. Second, the intervention duration was only one month, which is relatively short to induce sustainable behavioral changes. Third, there is a potential selection bias because the schools and participants were purposively selected, which limits the generalizability of the findings. Future research should therefore consider including a control group, extending the duration of the intervention, employing randomized sampling or randomized controlled trial designs to minimize bias and strengthen causal inference, and applying more objective assessment interventions (e.g., 24-hour food recall, food diaries, or direct observation). Future research should, therefore, consider including a control group, extending the duration of the intervention, employing randomized sampling or randomized controlled trial designs to minimize bias and strengthen causal inference, and applying more objective assessment methods such as 24-hour food recall, food diaries, or direct observation.

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References

Adelman, S., Gilligan, D. O., Konde-Lule, J., & Alderman, H. (2019). School feeding reduces anemia prevalence in adolescent girls and other vulnerable household members in a cluster randomized controlled trial in Uganda. *Journal of Nutrition, 149*(4), 659–666. https://doi.org/10.1093/jn/nxy305

Agustina, R., Wirawan, F., Sadariskar, A. A., Setianingsing, A. A., Nadiya, K., Prafiantini, E., Asri, E. K., Purwanti, T. S., Kusyuniati, S., Karyadi, E., et al. (2021). Associations of knowledge, attitude, and practices toward anemia with anemia prevalence and height-for-age z-score among Indonesian adolescent girls. *Food and Nutrition Bulletin, 42*(1), S92–S108. https://doi.org/10.1177/0379572121101136

Aisyaroh, N., Kusumaningsih, M., & Rahman, R. (2023). Malnutrisi menjadi indikasi anemia pada remaja putri: Literature review. *Media Publikasi Promosi Kesehatan Indonesia, 6*(6), 1057–1064.

Al Rahmad, A. H., & Annisa, S. F. (2025). Video animasi sebagai media penyuluhan dapat meningkatkan pengetahuan dan sikap remaja tentang bahaya fast food. *Media Penelitian Dan Pengembangan Kesehatan*, *35*(1), 11–18. https://doi.org/10.34011/jmp2k.v35i1.2054

Ansar, A., Hartini, D. A., Bahja, B., Faisal, E., Dewi, N. U., & Aiman, U. (2024). The influence of social media-based nutrition education on adolescents' nutritional knowledge and body image perception. *Poltekita: Jurnal Ilmu Kesehatan, 18*(2), 178–182.

Beck, L., Quinn, E. L., Hill, H. D., Wolf, J., Buszkiewicz, J., & Otten, J. J. (2019). Low-income workers' perceptions of wages, food acquisition, and well-being. *Translational Behavioral Medicine, 9*(5), 942–951. https://doi.org/10.1093/tbm/ibz048

Chapman, L. E., Gosliner, W., Olarte, D. A., Zuercher, M. D., Ritchie, L. D., Orta-Aleman, D., & Cohen, J. F. (2025). Impact of mealtime social experiences on student consumption of meals at school: A qualitative analysis of caregiver perspectives. *Public Health Nutrition, 28*(1), e55. https://doi.org/10.1017/S1368980024000153

Chaudhary, A., Sudzina, F., & Mikkelsen, B. E. (2020). Promoting healthy eating among young people—A review of the evidence of the impact of school-based interventions. *Nutrients, 12*(9), 2894. https://doi.org/10.3390/nu12092894

Contento, I. R. (2007). *Nutrition education: Linking research, theory, and practice*. Jones & Bartlett Learning.

Diana, R., Setyaningtyas, S. W., & Arimbi, A. N. (2025). Food preferences, eating habits, and nutritional status of full-day school students in urban areas. *Amerta Nutrition, 9*(1). 169–175

Dinas Kesehatan Kota Bogor. (2024). Dinas kesehatan melakukan monitoring RAN PIJAR dan aksi bergizi bersama RISE Foundation. https://dinkes.kotabogor.go.id/berita/474

Gonete, K. A., Tariku, A., Wami, S. D., & Derso, T. (2018). Prevalence and associated factors of thinness among adolescent girls attending governmental schools in Aksum Town, Northern Ethiopia. *Archives of Public Health, 76*, 79. https://doi.org/10.1186/s13690-018-0339-y

Indonesian Ministry of Health. (2014). *Pedoman gizi seimbang*. Badan Penelitian dan Pengembangan Kesehatan Kementerian RI. https://repository.badankebijakan.kemkes.go.id/id/eprint/3514/

Indonesian Ministry of Health. (2019). *Hasil riset kesehatan dasar (Riskesdas) 2018*. Badan Penelitian dan Pengembangan Kesehatan Kementerian RI. https://repository.badankebijakan.kemkes.go.id/id/eprint/3514/

Keller, J., Kwasnicka, D., Klaiber, P., Sichert, L., Lally, P., & Fleig, L. (2021). Habit formation following routine-based versus time-based cue planning: A randomized controlled trial. *British Journal of Health Psychology, 26*(3), 807–824. https://doi.org/10.1111/bjhp.12500

Khomsan, A. (2021). *Teknik pengukuran pengetahuan gizi*. IPB Press.

Kreft, M., Smith, B., Hopwood, D., & Blaauw, R. (2023). The use of social media as a source of nutrition information. *South African Journal of Clinical Nutrition, 36*(4), 162–168.

Kusumawati, D., Rimbawan, & Ekayanti, I. (2019). Pengaruh program makan siang terhadap asupan makanan, status anemia dan perilaku gizi santri perempuan. *Media Kesehatan Masyarakat Indonesia, 15*(1), 7–17. https://doi.org/10.30597/mkmi.v15i1.5769

Lakmali, S. S., Moirangthem, R., Mahant, Y., Devi, N. P., Sharma, T. R., & Kumar, T. P. (2022). Importance of breakfast in teenagers. *International Journal of Health Sciences, 6*(S3), 4709–4726. https://doi.org/10.53730/ijhs.v6nS3.6938

Laraia, B. A., Leak, T. M., Tester, J. M., & Leung, C. W. (2017). Biobehavioral factors that shape nutrition in low-income populations: A narrative review. *American Journal of Preventive Medicine, 52*(2), S118–S126. https://doi.org/10.1016/j.amepre.2016.08.003

Lemeshow, S., & David, J. (1997). *Besar sampel dalam penelitian kesehatan*. Gadjah Mada University Press.

Lima, S. C., Melo, G. R. D. A. E., Schincaglia, R. M., Souza Lopes, A. C., & Toral, N. (2023). Stages of change and self-efficacy are related to consumption of food markers among Brazilian adolescents and young adults. *Frontiers in Public Health, 10*, 1006898. https://doi.org/10.3389/fpubh.2022.1006898

Mohapatra, M. K., Pradhan, A., Tiwari, D., Yunus, S., Patro, B. K., Behera, B. K., et al. (2023). Effectiveness of fortified mid-day meal in reducing anemia among school children in Dhenkanal, Odisha: A quasi-experimental study. *Food and Nutrition Bulletin, 44*(2), 79–87. https://doi.org/10.1177/03795721231172253

Nurlaila, M., Maidar, M., & Ahmad, A. (2023). Analisis faktor risiko kebiasaan makan pada mahasiswa kebidanan di Banda Aceh. *Nasuwakes: Jurnal Kesehatan Ilmiah, 14*(1), 1–6.

Oostindjer, M., Aschemann-Witzel, J., Wang, Q., Skuland, S. E., Amdam, G. V., Schjøll, A., … Van Kleef, E. (2017). Are school meals a viable and sustainable tool to improve the healthiness and sustainability of children's diet and food consumption? A cross-national comparative perspective. *Critical Reviews in Food Science and Nutrition, 57*(18), 3942–3958. https://doi.org/10.1080/10408398.2016.1197180

Pamilasari, T., Desi, D., & Purba, J. S. R. P. (2022). Pengaruh edukasi gizi melalui media aplikasi TikTok terhadap pengetahuan gizi seimbang pada remaja putri SMAN 1 Dedai Kabupaten Sintang. *Pontianak Nutrition Journal, 5*(1), 141–145.

Pearson, N., Biddle, S. J. H., & Gorely, T. (2009). Family correlates of fruit and vegetable consumption in children and adolescents: A systematic review. *Public Health Nutrition, 12*(2), 267–283. https://doi.org/10.1017/S1368980008002589

Phyo, W. Y., Khin, O. K., & Aung, M. H. (2021). Mothers' nutritional knowledge, self-efficacy, and practice of meal preparation for school-age children in Yangon, Myanmar. *Makara Journal of Health Research, 25*(1). https://doi.org/10.7454/msk.v25i1.1262

Rarastiti, C. N., & Hidayat, U. (2025). Hubungan frekuensi pembelian makanan online, pengetahuan gizi, dan asupan energi terhadap status gizi remaja siswa SMP Negeri 8 Kota Semarang. *Ghidza: Jurnal Gizi Dan Kesehatan, 9*(1), 72–78.

Rimbawan, R., Nurdiani, R., Rachman, P., Kawamata, Y., & Nozawa, Y. (2023). School lunch programs and nutritional education improve knowledge, attitudes, and practices and reduce the prevalence of anemia: A pre-post intervention study in an Indonesian Islamic boarding school. *Nutrients, 15*(4), 1055. https://doi.org/10.3390/nu15041055

Risti, K. N., Pamungkasari, E. P., & Suminah, S. (2021). Relationship of peer influence and family eating habits on healthy food choices in overweight adolescents in Surakarta. *Media Gizi Indonesia, 16*(2), 124–129. https://doi.org/10.20473/mgi.v16i2.124-129

Salam, R. A., Hooda, M., Das, J. K., Arshad, A., Lassi,

Z. S., Middleton, P., & Bhutta, Z. A. (2016). Interventions to improve adolescent nutrition: A systematic review and meta-analysis. *Journal of Adolescent Health, 59*(4 Suppl), S29–S39. https://doi.org/10.1016/j.jadohealth.2016.06.022

Silitonga, H. T. H., Salim, L. A., Nurmala, I., & Wartiningsih, M. (2023). Compliance of iron supplementation and determinants among adolescent girls: A systematic review. *Iranian Journal of Public Health, 52*(1), 37-48. https://doi.org/10.18502/ijph.v52i1.11664

Singh, B., Murphy, A., Maher, C., & Smith, A. E. (2024). Time to form a habit: A systematic review and meta-analysis of health behaviour habit formation and its determinants. *Healthcare, 12*(23), 2488. https://doi.org/10.3390/healthcare12232488

Uhlmann, K., Ross, H., Buckley, L., & Lin, B. B. (2023). Food in my life: How Australian adolescents perceive and experience their foodscape. *Appetite, 190*, 107034. https://doi.org/10.1016/j.appet.2023.107034

Umoke, M., Umoke, P. C., Onyeke, N. G., Victor-Aigbodion, V., Eseadi, C., Ebizie, E. N., … Folorunsho, R. O. B. (2020). Influence of parental education levels on eating habits of pupils in Nigerian primary schools. *Medicine, 99*(43), e22953. https://doi.org/10.1097/MD.0000000000022953

UNICEF Indonesia. (2021). *Meningkatkan gizi remaja di Indonesia*. https://www.unicef.org/indonesia/media/924

Wahyuningtyas, R., Wisnusanti, S. U., & Kusuma, M. T. P. L. (2021). Factors associated with food choice motives of adolescents in Yogyakarta Special District. *Jurnal Gizi Klinik Indonesia, 18*(2), 86–96. https://doi.org/10.22146/ijcn.63152

Wijayanti, E., & Fitriani, U. (2019). Profil konsumsi zat gizi pada wanita usia subur anemia. *Media Gizi Mikro Indonesia, 11*(1), 39–48. https://doi.org/10.22435/mgmi.v11i1.2166

Xu, Y., Bi, X., Gao, T., Yang, T., Xu, P., Gan, Q., & Zhang, Q. (2022). Effect of school-based nutrition and health education for rural Chinese children. *Nutrients, 14*(19), 3997. https://doi.org/10.3390/nu14193997

Yani, M., Azhari, A., Al Rahmad, A. H., Bastian, F., Ilzana, T. M., Rahmi, C. R., Andriaty, S. N., Chanda, A., & Salsabila, S. (2023). The relationship between menarche and nutritional status in Junior High School students in Aceh Besar. A study from 30 years of armed conflict area, Aceh, Indonesia. *AcTion: Aceh Nutrition Journal*, *8*(4), 635–641. https://doi.org/10.30867/action.v8i4.1310