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Effect of school-based interactive nutrition promotion on knowledge and attitudes toward the free Nutritious Meal Program (MBG) among junior high school students in West Aceh

Pengaruh promosi gizi interaktif berbasis sekolah terhadap pengetahuan dan sikap tentang program Makan Bergizi Gratis (MBG) pada siswa sekolah menengah pertama di Aceh Barat

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Abstract

School-based nutrition promotion is essential for improving adolescents' knowledge and attitudes toward healthy eating and government-supported nutrition programs. However, junior high school students have a limited understanding of and less favorable attitudes toward the Free Nutritious Meal Program (MBG). This study aimed to evaluate the effect of a six-week school-based interactive nutrition promotion intervention integrated into the MBG on students' knowledge and attitudes in West Aceh, Indonesia. A quasi-experimental pretest–posttest design with a control group was conducted among 277 students in grades VII–IX at the State Junior High School 3 Meulaboh. Participants were selected using proportionate stratified random sampling and assigned to the intervention (n = 140) and control (n = 137) groups. The intervention group received structured interactive nutrition education sessions, whereas the control group received only MBG. Knowledge and attitudes were measured using validated questionnaires, before and after the intervention. Data were analyzed using the Wilcoxon signed-rank and Mann–Whitney U tests. The results showed significant improvements in knowledge and attitude scores in the intervention group compared to the control group ($p < 0.001$). Integrating interactive nutrition promotion into school meal programs effectively enhances students' understanding and attitudes, supporting the educational value and sustainability of the MBG.

Keywords: Adolescents, nutrition education, school-based intervention, free nutritious meal program, knowledge, attitude.

Abstrak

Promosi gizi berbasis sekolah berperan penting dalam meningkatkan pengetahuan dan sikap remaja terhadap pola makan sehat serta program gizi yang didukung pemerintah. Namun, keterbatasan pengetahuan dan sikap yang kurang mendukung terhadap Program Makan Bergizi Gratis (MBG) masih ditemukan pada siswa sekolah menengah pertama. Penelitian ini bertujuan untuk mengevaluasi pengaruh promosi gizi interaktif berbasis sekolah yang terintegrasi dengan MBG terhadap pengetahuan dan sikap siswa di Kabupaten Aceh Barat. Penelitian ini menggunakan desain kuasi-eksperimental dengan pretest–posttest dan kelompok kontrol yang melibatkan 277 siswa kelas VII–IX di SMP Negeri 3 Meulaboh. Sampel dipilih menggunakan teknik proportionate stratified random sampling dan dibagi menjadi kelompok intervensi (n = 140) dan kontrol (n = 137). Kelompok intervensi menerima sesi edukasi gizi interaktif terstruktur selama enam minggu, sedangkan kelompok kontrol hanya menerima program MBG. Pengetahuan dan sikap diukur

menggunakan kuesioner tervalidasi sebelum dan sesudah intervensi. Analisis data dilakukan menggunakan uji Wilcoxon dan Mann–Whitney. Hasil menunjukkan peningkatan pengetahuan dan sikap yang signifikan pada kelompok intervensi dibandingkan kelompok kontrol ($p < 0,001$). Integrasi promosi gizi interaktif dalam program makan sekolah efektif meningkatkan pemahaman dan sikap siswa terhadap MBG.

Kata Kunci: Pendidikan gizi, intervensi berbasis sekolah, makanan bergizi gratis, pengetahuan, sikap

Introduction

Nutrition remains a serious public health issue, especially during adolescence, a stage of development characterized by rapid physical growth, hormonal maturation, cognitive development, and formation of long-term eating habits. Inadequate nutrient intake during this critical period can hinder linear growth, reduce academic achievement, and increase the long-term risk of non-communicable diseases, such as obesity, type 2 diabetes, and cardiovascular disease (Parajuli & Prangthip, 2025; WHO, 2025). In Indonesia, national health survey data continue to show persistent nutritional challenges among adolescents, including anemia, malnutrition, and an increase in the prevalence of overweight and obesity (Azizah et al., 2023; Kemenkes RI, 2025; Riskesdas, 2018). These findings highlight the urgent need for structured, evidence-based nutritional interventions targeting school-aged populations.

Globally, low and middle-income countries face the double burden of malnutrition, characterized by undernutrition and overnutrition within the same population (Davis & Engle-stone, 2020; The World Bank, 2019). According to the 2024 Global Hunger Index, Indonesia ranks 77th out of 127 countries and is categorized as a country with moderate hunger levels (GHI, 2025). Although school feeding programs have been widely implemented to improve students' nutritional intake, evidence shows that food provision alone does not automatically lead to sustainable improvements in nutrition knowledge or healthy eating behaviors without complementary educational strategies (FAO, 2019; Pramesthi et al., 2025).

In response to these challenges, the Indonesian government launched the Free Nutritious Food Program (MBG) nationwide in early 2025, under the coordination of the National Nutrition Agency. This program aims to improve the nutritional intake of school children and pregnant women through the provision of balanced meals every day. With an initial allocation of approximately Rp71 trillion and plans for expansion, the MBG represents a large-scale national investment in nutrition improvement (Mebra & Mauleny, 2025; Rosidin et al., 2025). However, the effectiveness and sustainability of MBG depend not only on food distribution but also on students' knowledge, attitudes, and acceptance of nutritious foods.

National data show that a significant proportion of Indonesian adolescents have limited nutritional knowledge and exhibit suboptimal dietary behaviors, including frequent consumption of high-calorie but low-nutrient foods, influenced by peer pressure and media exposure (Azzahra et al., 2025; Khomsan et al., 2025). Studies conducted in Aceh Province also reported low acceptance of balanced school meals and a preference for snacks high in sugar and salt (Anwar & Mauliza, 2025). These findings suggest that without structured health promotion, MBG primarily functions as a food provision initiative rather than a behavioral change intervention.

Previous studies on school-based nutrition education in Indonesia have generally shown short-term improvements in knowledge after education sessions. However, many studies use a single-group pre–post design without a comparison group, which limits causal conclusions and internal validity (Veri et al., 2025; Al Rahmad & Annisa, 2025; Yanti, 2025). Furthermore, few studies have integrated interactive nutrition promotion directly into the framework of the national food provision programs. Existing research in Aceh has mostly emphasized the logistical aspects of food provision rather than analyzing behavioral determinants such as students' knowledge and attitudes toward school meals (Fadli et al., 2026; Xu et al., 2021). No prior study has evaluated the integration of interactive nutrition promotion into the MBG using a quasi-experimental approach in West Aceh. This represents a clear methodological and contextual gap in the research.

This study is theoretically based on the Health Belief Model and Health Promotion Model. In this study, the constructs of the Health Belief Model were operationalized as students' perceptions of their vulnerability to health problems related to nutrition and their perceptions of the benefits of consuming a balanced diet provided through the MBG. The constructs of the Health Promotion Model were operationalized as nutritional knowledge, perceptions of independence in choosing healthy foods, and positive attitudes toward MBG foods. These constructs were measured quantitatively using a structured questionnaire that assessed knowledge and attitude scores towards MBG, thereby explicitly linking behavioral theory with measurable research variables (Nardi et al., 2023; Sari et al., 2025).

At the local level, State Junior High School 3 Meulaboh has implemented the MBG; however, structured and sustainable nutrition education components have not been formally integrated into the program. Initial observations indicated that students often equated feeling full with nutritional adequacy and expressed doubts about some MBG menus. These findings highlight the need for strengthened structured education to improve understanding and acceptance of nutritious foods.

Therefore, this study aimed to analyze the effect of a six-week school-based interactive nutrition promotion intervention integrated into the Free Nutritious Meal Program (MBG) on changes in mean nutrition knowledge and attitude scores among students at Junior High School Negeri 3 Meulaboh, West Aceh, Indonesia.

Methods

Research Design

This study used a pre-test–post-test quasi-experimental design with a control group to evaluate the impact of a six-week school-based interactive nutrition promotion intervention integrated into the Free Nutritious Food Program (MBG) on adolescents' knowledge and attitudes. Participants were divided into intervention group (FNP + structured nutrition promotion), and control group (FNP only).

A true randomized controlled trial was not possible because of administrative and ethical limitations in the school setting, where class schedules and program implementation could not be randomized. Therefore, a quasi-experimental design was selected as a practical alternative.

Although this design is more susceptible to threats to internal validity, such as history and maturation effects, the addition of a control group and baseline measurements helped reduce this risk by allowing comparison of score changes between groups over the same period of time (Wajdi et al., 2024).

Setting and Duration

This study was conducted at State Junior High School 3 Meulaboh, located in West Aceh Regency, Aceh Province, Indonesia. The research was conducted over a six-week period from September to October 2025.

The study design consisted of an initial baseline measurement (pre-test) conducted in week 0, followed by weekly intervention sessions from weeks 1 to 6. An immediate post-test assessment was performed at the end of Week 6 to evaluate the intervention outcomes. No follow-up assessments were performed beyond the post-intervention evaluation period.

Population and Sampling

The target population comprised 900 students enrolled in Grades VII to IX at the study site. The required sample size was determined using Slovin's formula, with a 95% confidence level and a 5% margin of error.

This approach was selected because the total population size was known, the study aimed to obtain a representative sample within practical and logistical constraints, and preliminary data on population variance were not available to support the power-based sample size estimation. Based on this calculation, the minimum required sample size was 277.

A proportional stratified random sampling technique was employed to ensure adequate representation from each grade level (VII, VIII, and IX). The sampling procedure involved obtaining a complete list of enrolled students from the school administration, stratifying students according to grade level, and assigning each student a unique identification number. Participants were selected proportionally from each stratum using a computer-generated random number sequence.

Following selection, students were allocated to the intervention and control groups

according to their existing classroom clusters. This cluster-based allocation was implemented to minimize the risk of contamination between groups while maintaining a natural classroom structure.

Variable Measurement

The independent variable in this study was a six-week interactive nutrition promotion intervention integrated into the MBG program. The intervention was delivered through structured weekly sessions designed to improve students' understanding of balanced nutrition principles and foster positive attitudes toward healthy eating practices within the MBG framework.

The primary dependent variables were nutritional knowledge and attitudes toward the MBG. Nutrition knowledge was assessed using a 10-item true/false questionnaire developed based on the Indonesian Balanced Nutrition Guidelines and adapted from previous school-based nutrition education studies. Each correct response was scored as 1 and each incorrect response was scored as 0, resulting in a total possible score ranging from 0 to 10. Higher total scores indicate better nutritional knowledge.

Attitudes toward MBG were measured using a 10-item Likert-scale questionnaire adapted from a validated adolescent nutrition attitude instrument, modified to reflect the specific context of the MBG program. Responses were rated on a five-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). The total attitude score ranged from 10 to 50, with higher scores indicating a more positive attitude toward the MBG.

The content validity of both instruments was evaluated by two experts in public health nutrition to ensure the relevance, clarity, and appropriateness of the items. Construct validity was examined using an item-total correlation analysis. Internal consistency reliability demonstrated good performance, with Cronbach's alphas of 0.82 and 0.87 for the knowledge and attitude scales, respectively, indicating satisfactory reliability for both instruments.

Data Analysis

All data were analyzed using IBM SPSS Statistics version 26 (IBM Corp., Armonk, NY, USA). Descriptive statistics were computed to summarize participants' demographic characteristics, as well as the mean and standard deviation (SD) of nutrition knowledge and attitude scores at baseline (pre-test) and after the intervention (post-test).

Prior to inferential analysis, the normality of data distribution was assessed using the Kolmogorov–Smirnov and Shapiro–Wilk tests. Given that the sample size in each group exceeded 50 participants, the Kolmogorov–Smirnov test was used as the primary reference for assessing the normality of the data. Variables with p-values < 0.05 were considered to deviate significantly from the normal distribution. Accordingly, parametric tests were applied for normally distributed variables, whereas non-parametric alternatives were used for variables that did not meet normality assumptions.

Within-group differences between pre- and post-test scores were analyzed using the paired t-test for normally distributed variables and the Wilcoxon signed-rank test for non-normally distributed variables. To evaluate the effectiveness of the intervention between groups, individual change scores (Δ = posttest minus pretest) were calculated for each participant. Differences in change scores between the intervention and control groups were examined using the independent t-test for normally distributed data and the Mann–Whitney U test for non-normally distributed data. All statistical tests were two-tailed, and a p-value of < 0.05 was considered statistically significant.

Effect sizes were calculated to determine the magnitude of the intervention effects. Cohen's d was used for parametric analyses, whereas effect size (r) was calculated for non-parametric tests using the formula $r = Z / \sqrt{N}$. Effect sizes were interpreted as small (0.2), medium (0.5), and large (≥ 0.8) for Cohen's d.

Result and Discussion

Respondent Characteristic

This study involved 277 students from the State Junior High School 3 Meulaboh. The participants were aged between 12 and 15 years, with a mean age of 13.6 years. Female students (52.7%) slightly outnumbered their male counterparts (47.3%). The mean body weight was 44.2 kg, mean height was 150.6 cm, and mean Body Mass Index (BMI) was 19.3 kg/m^2. Based on age-adjusted BMI classification, the majority of students had normal nutritional

status (71.8%), while 15.9% were underweight, and 12.3% were overweight or obese. Participants were proportionally distributed across grade levels, with 33.9% in grade VII, 34.3% in grade VIII, and 31.8% in grade IX.

Table 1 Respondent characteristics

Characteristic	n	% / Mean ± SD
Age (years)	277	13.6 ± 1.1
Sex		
Male	131	47.3
Female	146	52.7
Body weight (kg)	277	44.2 ± 8.7
Height (cm)	277	150.6 ± 7.9
BMI (kg/m^2)	277	19.3 ± 3.1
Nutritional status (BMI-for-age)		
Underweight	44	15.9
Normal	199	71.8
Overweight/Obese	34	12.3
Grade		
VII	94	33.9
VIII	95	34.3
IX	88	31.8

Normality Test

The normality of the data distribution was assessed using the Kolmogorov–Smirnov test with Lilliefors correction. The results indicated that most knowledge and attitude variables were not normally distributed ($p < 0.05$), except for the pretest attitude scores in both groups ($p > 0.05$). Therefore, non-parametric statistical tests were used in subsequent analyses.

Table 2. Normality test results (Kolmogorov–Smirnov test)

Variable	Group	p-value
Pretest Knowledge	Experimental	0.000
	Control	0.000
Posttest Knowledge	Experimental	0.000
	Control	0.000
Pretest Attitude	Experimental	0.081
	Control	0.069
Posttest Attitude	Experimental	0.034
	Control	0.022

Effect of Nutrition Promotion Intervention

The findings (Table 3) demonstrate a statistically significant improvement in both nutrition knowledge and attitudes following the six-week interactive nutrition promotion intervention. The mean knowledge scores increased from 5.38 ± 1.76 to 7.56 ± 1.35, while the mean attitude scores increased from 33.11 ± 4.95 to 40.56 ± 3.92 (both $p < 0.001$). The 95% confidence intervals for the mean differences did not cross zero, further confirming the robustness of these observed changes.

Importantly, the magnitude of these effects was large, with Cohen's d values of 1.01 for knowledge and 1.03 for attitude. These effect sizes indicate that the intervention produced not only statistically significant but also practically meaningful improvements. From a public health perspective, the results suggest that integrating interactive nutrition education into school-based programs can substantially enhance adolescents' knowledge and positively influence their attitudes toward healthy eating.

Table 3. Summary of changes in knowledge and attitude scores before and after intervention (n = 277)

Variables		Mean	SD	Δ Mean ± SD	95% CI (Lower–Upper)	p-value	Cohen's d
Knowledge	Before	5.38	1.76	1.31 ± 1.30	1.16 – 1.46	<0.001	1.01
	After	7.56	1.35				
Attitude	Before	33.11	4.95	3.94 ± 3.84	3.49 – 4.39	<0.001	1.03
	After	40.56	3.92				

This study demonstrated that the six-week school-based interactive nutrition promotion intervention had a statistically significant effect on improving students' nutrition knowledge and attitudes. These findings align with previous research, indicating that structured nutrition education can effectively enhance adolescents' understanding and perceptions of healthy eating. Consistent with the present results, a recent quasi-experimental study in Nepal found that tailored nutrition education significantly improved adolescents' nutrition knowledge and attitudes compared with a control group (Raut et al., 2024).. This suggests that interactive educational strategies, such as participatory discussions and visual presentations, may

effectively facilitate learning processes and cognitive engagement in this age group of students.

Similarly, a recent online nutrition education intervention among junior high school students reported significant improvements in both knowledge and attitude scores following a structured educational session using multimedia materials (Amalia & Putri, 2022; Rahmad & Shavira, 2024). These findings collectively support the idea that diverse nutrition education approaches (in-person or online) can yield positive outcomes for adolescent nutrition competence.

Furthermore, systematic evidence from a meta-analysis indicates that nutrition education interventions generally produce positive effects on knowledge, attitudes, and dietary practices among school-aged adolescents, with greater improvements observed in intervention groups than in control groups (Septiani et al., 2025; Zahrah et al., 2024).

Despite these consistent patterns, the quasi-experimental design of the current study, although stronger than a single-group pre–post design, still has limitations. The possible influence of testing effects (participants becoming familiar with the measurement instrument), maturation (natural developmental changes over time), and external historical events, remains a threat to internal validity. Therefore, the interpretation of the results should focus on the measured outcomes (knowledge and attitudes), rather than causal claims about broader behavioral changes. Previous studies have similarly emphasized cautious interpretation when studies lack random assignment or long-term follow-up (Putra et al., 2025; Aisyah et al., 2025; Raut et al., 2024). Additionally, while improvements in attitude may suggest readiness for behavioral change, actual changes in dietary behavior were not assessed in this study and should not be directly inferred.

This study had several limitations, particularly related to the quasi-experimental design, which may introduce potential bias and limit the ability to fully control for confounding factors. In addition, the relatively short intervention period without long-term follow-up did not allow for the assessment of the sustainability of changes in knowledge and attitudes or their translation into measurable behavioral outcomes. Therefore, future research employing randomized controlled trials with longer follow-up periods is needed to confirm the consistency and durability of the intervention effects.

Conclusion

This study demonstrates that a structured, school-based nutrition promotion intervention is associated with significant improvements in students' knowledge and attitudes toward the Free Nutritious Meals Program. The large effect sizes observed indicate that interactive and participatory educational approaches can meaningfully enhance adolescents' understanding and foster positive engagement with school meal initiatives. These findings underscore the value of integrating nutrition education into existing school feeding programs to strengthen their educational impact and student acceptability.

From a practical standpoint, schools should consider incorporating age-appropriate, standardized nutrition education modules into routine academic activities, particularly as part of meal program implementation in the future. Training teachers to deliver interactive nutrition sessions, embedding key messages within the school curriculum, and aligning educational content with daily meal provision may enhance program sustainability and reinforce healthy dietary behavior. Collaboration between the education and health sectors is also recommended to ensure the consistency of messages and program quality.

Nevertheless, given the quasi-experimental design and the contextual scope of this study, the findings should be interpreted with caution. Further research involving larger and more diverse populations, longer follow-up periods, and randomized controlled designs is warranted to confirm the generalizability and long-term impact of these interventions and to inform broader policy implementation.

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