

Research Article

Effectiveness of nutrition education using posters and songs on knowledge and attitudes: A pre-post study in primary school students

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Abstract

Unhealthy dietary behaviors, including skipping breakfast and inadequate fruit and vegetable consumption, contribute to the rising prevalence of childhood obesity and poor nutritional status. Nutrition education using engaging and age-appropriate media is essential to improve children's knowledge and attitudes toward healthy eating. This study aimed to analyze the effect of nutrition education using a combination of posters and songs on knowledge and attitudes regarding breakfast and fruit and vegetable consumption among primary school students. A quantitative pre-experimental study with a one-group pretest–posttest design was conducted among 44 fourth- and fifth-grade students in Surabaya, Indonesia, selected through purposive sampling. The intervention was delivered over four weeks using poster-based and song-based educational media. Data were collected using a validated and reliable questionnaire and analyzed using the Wilcoxon signed-rank test with a significance level of $p < 0.05$. The results showed a significant improvement in knowledge, with the proportion of respondents in the good category increasing from 11.4% to 95.5%, and the mean score rising from 1.70 ± 0.668 to 2.95 ± 0.211 ($p < 0.001$). Positive attitudes also increased from 63.6% to 88.6%, with the mean score improving from 1.64 ± 0.487 to 1.89 ± 0.321 ($p = 0.001$). In conclusion, nutrition education using a combination of posters and songs effectively improves knowledge and attitudes among primary school students. However, longer and more sustained interventions are needed to support long-term behavioral change, as short-term educational methods may not be sufficient to ensure that students retain and apply their knowledge about nutrition over time.

1. INTRODUCTION

A well-balanced diet is important for children's growth, development, and overall health. Worldwide dietary patterns have shifted toward higher intake of energy-dense, nutrient-poor foods, which has contributed to the rise in childhood overweight and obesity rates (Baratto et al., 2025; Emmett & Jones, 2015). According to recent studies, around 390 million children and adolescents aged 5 to 19 are overweight, with approximately 160 million classed as obese (Phelps et al., 2024). Obesity has exceeded underweight as the most common cause of malnutrition among school-aged children worldwide. These changes are significantly connected with less healthy dietary choices, particularly skipping breakfast and insufficient intake of fruits and vegetables (Pop et al., 2021; K. Wang et al., 2023). Breakfast is essential for maintaining children's nutritional health and cognitive performance. Regular breakfast eating has been linked to increased concentration, memory, and academic achievement as well as improved energy regulation and weight control (Mameli et al., 2014; Rampersaud et al., 2005). Globally, 20–30% of school-aged children skip breakfast (Rampersaud et al., 2005). In Indonesia, 26% of children just consume water for breakfast, and 44.6% do not fulfill the necessary 15–30% of daily energy consumption. There are persistent gaps in the quality and quantity of breakfast intake (Kemenkes RI, 2023).

Low consumption of vegetables and fruits remains a serious worldwide and national issue. The World Health Organization suggests a daily calorie intake of 400 g to prevent noncommunicable diseases (Kalmipourtzidou et al., 2020). However, over 80% of the world's population does not achieve this recommendation (Hall et al., 2009). In Indonesia, inadequate fruit and vegetable intake reaches

95.5% among individuals aged ≥ 5 years (Kemenkes RI, 2018). This condition increases the risk of obesity and noncommunicable illnesses because of low fiber intake, which affects satiety, glycemic regulation, and lipid metabolism (Slavin & Lloyd, 2012). Nutrition education is a key strategy to address these issues, as children's dietary behavior is influenced by modifiable factors such as knowledge and attitudes (Bagherniya et al., 2018). Evidence shows that school-based nutrition education can improve knowledge, attitudes, and dietary behaviors; however, the magnitude and sustainability of these effects vary considerably. Systematic reviews further indicate that while such interventions are widely implemented, their impact on actual dietary intake is often inconsistent or only modest. The conventional approaches may not be sufficiently engaging or effective in producing meaningful behavioral change (Fathi et al., 2024; Raut et al., 2024; D. Wang & Stewart, 2013).

The effectiveness of nutrition education is highly dependent on the methods and media used. Multimedia and multisensory approaches have been shown to enhance learning outcomes by improving engagement and cognitive processing. For instance, music-based interventions have demonstrated positive effects on knowledge, attitudes, and practices related to healthy eating, while visual media such as posters effectively improve comprehension and recall of health information (Houts et al., 2006). Moreover, recent evidence suggests that multi-component interventions combining different educational strategies yield better outcomes compared to single-method approaches, although such combinations remain underexplored (Hahnrahts et al., 2022). Despite these advances, several critical gaps remain. First, most existing studies focus on single or partially integrated educational media, limiting the potential of fully optimized multimodal learning approaches. Second, evidence on the combined use of simple, scalable, and low-cost media such as posters and songs is still limited, particularly in low- and middle-income settings like Indonesia. Third, current literature highlights inconsistent and often short-term effects of school-based interventions, indicating a need for innovative strategies that enhance both engagement and retention. This study aims to analyze the effect of nutrition education using a combination of posters and songs on knowledge and attitudes regarding breakfast and fruit and vegetable consumption among elementary school students in Surabaya. This study is expected to contribute to the development of practical, scalable, and evidence-based multimodal nutrition education strategies in school settings.

2. MATERIALS AND METHODS

2.1 Materials

This study involved fourth- and fifth-grade students from Iskandar Said Elementary School in Surabaya, Indonesia. The total population was 110 students, with 44 respondents selected from purposive selection method. The inclusion criteria included an intention to participate until the study was completed, good health, and the ability to communicate well. Students who became ill or missed more than one intervention session were excluded. The sample size was estimated using the Lemeshow formula with a 95% confidence level and 80% power, yielding a minimum of 35 participants, plus an additional 20% for anticipated dropouts. Data were acquired using a standardized questionnaire based on previously validated investigations. The instrument had acceptable internal consistency, with a Cronbach's alpha coefficient greater than 0.70. Knowledge was categorized as good (76–100%), sufficient (56–75%), and poor ($\leq 55\%$), while attitudes were classified as positive and negative based on the mean score.

2.2 Experimental Design and Procedures

This study used a quantitative pre-experimental design with a one-group pretest-posttest method. The intervention was administered over four weeks by professional facilitators, with each session averaging about 30–45 minutes. In the first week, respondents took a pre-test before receiving poster-based nutrition education on breakfast. The second week's poster-based education focused on the eating of fruits and vegetables. In the third and fourth weeks, education was delivered through songs about the same topics. At the conclusion of the fourth week, a post-test was given to assess changes in knowledge and attitudes. The independent variable was nutrition education using posters and songs, while the dependent variables were knowledge and attitudes around breakfast and fruit and vegetable consumption.

2.3 Data Analysis

The data were analyzed using SPSS version 26. Univariate analysis was used to describe respondent characteristics. Prior to performing inferential analysis, the data was checked for normality. Because

the data were not normally distributed, the Wilcoxon signed-rank test was used to evaluate differences between pre-test and post-test results. Statistical significance was determined at $p < 0.05$. This study was approved by Nahdlatul Ulama University Surabaya's Health Research Ethics Committee (No. 0367/EC/KEPK/UNUSA/2024). All respondents provided informed consent, and the study remained confidential and anonymous throughout.

3. RESULTS AND DISCUSSION

3.1 Respondent Characteristics

This study involved 44 fourth- and fifth-grade students from Iskandar Said Elementary School, Surabaya. As shown in Table 1, most respondents were female (61.4%) and aged 10 years (47.7%). The majority of participants came from families with incomes below the Regional Minimum Wage (68.2%), and none had previously received nutrition education (100%).

Table 1. Respondent Characteristics (n = 44)

Variable	Category	n	%
Sex	Male	17	38.6
	Female	27	61.4
Age (years)	9	12	27.3
	10	21	47.7
	11	11	25.0
Father's Occupation	Self-employed	7	16.0
	Private employee	29	65.9
	Others	8	18.1
Mother's Occupation	Self-employed	3	6.8
	Private employee	12	27.3
	Housewife	26	59.1
	Others	3	6.8
Parental Income	< Minimum wage	30	68.2
	≥ Minimum wage	14	31.8
History of Nutrition Education	Ever	0	0.0
	Never	44	100.0

These findings suggest that respondents had limited exposure to dietary information, which could explain their relatively poor baseline knowledge. Previous research has found that socioeconomic status and restricted access to health information are linked to lower nutritional literacy. School-based treatments are critical for improving knowledge among children from low-income families (Hahnrahs et al., 2022).

3.2 Effect of Nutrition Education on Knowledge

The results showed a significant improvement in respondents' knowledge after the intervention (Table 2). The proportion of respondents with good knowledge increased from 11.4% to 95.5%, while the mean score rose from 1.70 ± 0.668 to 2.95 ± 0.211 ($p < 0.001$).

Table 2. Differences in Knowledge Before and After Intervention (n = 44)

Knowledge Level	Pre-test n (%)	Post-test n (%)	Mean ± SD (Pre)	Mean ± SD (Post)	p-value
Poor	18 (40.9)	0 (0.0)			
Fair	21 (47.7)	2 (4.5)			
Good	5 (11.4)	42 (95.5)			
Total	44 (100.0)	44 (100.0)	1.70 ± 0.668	2.95 ± 0.211	0.000*

*Wilcoxon test, $p < 0.05$ indicates a significant difference.

This significant change suggests not only statistical importance, but also considerable practical value in enhancing students' comprehension of breakfast and fruit and vegetable eating (Slavin & Lloyd, 2012). From a theoretical perspective, this effect can be explained by dual coding theory, which holds that information delivered through both visual and auditory channels improves cognitive processing and memory retention. The inclusion of posters and songs in this study most likely aided deeper encoding

by engaging various sensory pathways, which is especially successful in school-aged children who benefit from multisensory learning environments (Linnemann et al., 2015). Furthermore, multimodal learning approaches have been demonstrated to lower cognitive load while improving comprehension when compared to single-mode instruction (D. Wang & Stewart, 2013). Compared to previous research, the extent of knowledge increase found in this study appears to be greater than that frequently reported in school-based nutrition education programs (Hahnrahts et al., 2022). Most previous studies used a single teaching media, however the current study incorporates both visual and audio components. This offers support to the argument that multimodal interventions outperform unimodal techniques in terms of learning outcomes. However, it is crucial to note that the observed benefit may be due to novelty and enhanced engagement rather than the intervention material itself (Hidi & Renninger, 2006).

Despite these promising results, multiple methodological constraints must be recognized. The use of a one-group pretest-posttest design with no control group raises potential challenges to internal validity, such as testing effects and the Hawthorne effect, which may lead to an overestimation of the intervention's effectiveness. Furthermore, the intervention's brief duration limits the ability to assess long-term information retention, since immediate post-test improvements may represent short-term recollection rather than persistent learning (Gallotta et al., 2016; Rosales et al., 2023). From an applied perspective, while the findings support the effectiveness of multimodal nutrition education in improving short-term knowledge, their implications for long-term behavioral change remain uncertain. Previous studies suggest that knowledge improvement alone is insufficient to produce sustained dietary behavior change, as this process is influenced by environmental and social determinants (Bagherniya et al., 2018). Therefore, future research should incorporate controlled study designs, longer follow-up periods, and behavioral outcome measures to better evaluate the sustainability and real-world impact of such interventions (Gallotta et al., 2016).

3.3 Effect of Nutrition Education on Attitudes

The intervention also significantly improved respondents' attitudes (Table 3). The proportion of positive attitudes increased from 63.6% to 88.6%, with the mean score increasing from 1.64 ± 0.487 to 1.89 ± 0.321 ($p = 0.001$).

Table 3. Differences in Attitudes Before and After Intervention (n = 44)

Attitude	Pre-test n (%)	Post-test n (%)	Mean $\pm$ SD (Pre)	Mean $\pm$ SD (Post)	p-value
Negative	16 (36.4)	5 (11.4)			
Positive	28 (63.6)	39 (88.6)			
Total	44 (100.0)	44 (100.0)	1.64 ± 0.487	1.89 ± 0.321	0.001*

*Wilcoxon test, $p < 0.05$ indicates a significant difference.

This result indicates that the intervention was effective in influencing students' affective responses toward breakfast and fruit and vegetable consumption, although the magnitude of change was smaller compared to knowledge gains (Hahnrahts et al., 2022). The relatively modest improvement in attitudes suggests that attitude formation requires a more complex and gradual internalization process than knowledge acquisition. Attitudes are shaped not only by cognitive understanding but also by emotional, social, and environmental influences. According to the Knowledge Attitude Practice (KAP) framework, knowledge serves as an initial driver of change; however, the progression from knowledge to attitudes and eventually to behavior is not linear and is often mediated by contextual factors. This is supported by previous studies showing that increases in knowledge do not always translate proportionally into changes in attitudes or behaviors (Lomira et al., 2021; Raut et al., 2024).

The effectiveness of this intervention can be explained through dual coding theory and multisensory learning principles. The integration of visual (posters) and auditory (songs) stimuli enhances engagement and facilitates information processing by activating multiple cognitive pathways. Visual media have been shown to improve comprehension and attention, while auditory elements such as songs promote memory retention through repetition and emotional engagement. However, while such approaches are effective in increasing awareness and initial attitude shifts, they may not be sufficient to produce deeper attitudinal change without sustained reinforcement (Hahnrahts et al., 2022).

Compared with previous research, the findings of this study are consistent with evidence indicating that educational interventions tend to produce stronger effects on knowledge than on

attitudes or behaviors. This highlights the inherent complexity of modifying affective domains, which are more resistant to short-term interventions and require repeated exposure and supportive environments. The use of combined visual and auditory media represents a feasible, low-cost, and engaging strategy for improving children's nutritional literacy in school settings. However, to achieve sustained attitude and behavioral change, interventions should be extended over longer periods and integrated with environmental support systems, including family involvement and school policies (Gallotta et al., 2016; Rosales et al., 2023). Future studies should incorporate longitudinal designs and behavioral outcome measures to better capture the long-term impact of such interventions and to understand how initial attitude changes translate into actual dietary practices

3.4 Study Limitations

This study has several limitations. The use of a one-group pretest-posttest design without a control group limits causal inference. The relatively short duration of the intervention may not capture long-term changes in knowledge and attitudes. In addition, potential biases such as recall bias and repeated testing effects may influence the results. Despite these limitations, this study provides valuable insights into the effectiveness of multimodal nutrition education in real-world school settings.

4. CONCLUSION

This study found that nutrition education using a combination of posters and songs significantly improved students' knowledge and, to a lesser extent, their attitudes toward breakfast and fruit and vegetable consumption. These findings demonstrate that integrating visual and auditory media enhances the effectiveness of school-based nutrition education. This study contributes to the growing evidence on multimodal learning approaches by showing that combining different educational media can optimize knowledge acquisition among primary school children. This highlights the importance of engaging multiple sensory pathways to strengthen learning outcomes in nutrition education. The use of posters and songs represents a simple, low-cost, and scalable strategy that can be easily implemented in school settings to improve children's nutritional literacy. However, to achieve sustained behavioral change, future interventions should incorporate longer durations, reinforcement strategies, and supportive environmental factors.

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