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Effectiveness of Experiential Learning-Based Food Label Education on Nutritional Literacy and Reading Skills

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Abstract

High consumption of packaged foods among children highlights the need for early food label education to improve nutritional literacy and healthy consumption behaviors. This study aimed to evaluate the effectiveness of experiential learning-based food label education on nutritional literacy and food label reading skills among elementary school students. A quasi-experimental pre-test and post-test design with a control group was conducted involving 82 students in grades IV and V, with 41 students per group. The intervention group participated in direct observation of packaged foods, group discussions, food label interpretation exercises, and reflective learning, while the control group received lecture-based education. Within-group changes were analyzed using paired t-tests or Wilcoxon tests, and between-group differences were assessed using independent t-tests. In the experiential learning group, mean scores increased slightly for knowledge (7.29 to 7.49), attitude (33.24 to 33.37), behavior (27.71 to 28.51), and food label reading skills (5.41 to 5.88), with negligible to small effect sizes (d = 0.02–0.28). However, post-test scores did not differ significantly between groups across any domain (all p > 0.05). These findings indicate that experiential learning-based food label education is feasible in elementary schools but was not more effective than lecture-based education. Longer and more intensive interventions may be needed to improve nutritional literacy and food label reading skills among children.

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1. INTRODUCTION

Nutritional literacy is one of the important aspects in shaping healthy eating behavior from an early age, especially in elementary school students who are at the stage of cognitive development and habit formation. Nutritional literacy is part of health literacy that includes information and understanding of nutrition and is able to make decisions related to nutrition-related issues (Sanlier et al., 2024). Nutritional literacy plays a role in shaping overall eating habits (Li et al., 2022) and is a simple, economical, and effective first step in improving health status through nutrition promotion (Zhang et al., 2022). In its development, nutritional literacy includes the integration of knowledge, skills, and practices in the process of selecting, obtaining, managing, preparing, and consuming food in a healthy manner (Silva, 2023). Although nutrition literacy and the broader concept of food literacy have been defined in various ways, both emphasize the ability to obtain, understand, and apply nutrition information when making food choices (Krause et al., 2018; Vidgen & Gallegos, 2014).

The ability to read and understand food labels is an important part of nutrition literacy because it helps students make healthier food choices in their daily lives. Food labels contain various information such as composition, nutritional value, serving size, and expiration date that serve as the basis for consumption decision-making. In Indonesia, the presentation of nutritional value information has been regulated through Regulation of the Indonesian Food and Drug Authority (BPOM) No. 26 of 2021 on Nutrition Value Information on Processed Food Labels (Badan Pengawas Obat dan Makanan, 2021), so that education on reading food labels becomes not only relevant in terms of health, but also as part of consumer literacy from an early age. Several studies have shown that food labels have a positive effect on attitudes and behaviors in choosing food (Zafar et al., 2022) and serve as an important source of information for consumers (Capasso et al., 2023). Food labels are an efficient and easy-to-follow method for consumers to get nutritional information (Jankowski & Zarnowski, 2022). However, many consumers find nutrition labels difficult to understand, particularly their numerical information, which limits their usefulness without adequate education (Campos et al., 2011; Cowburn & Stockley, 2005).

Currently, the level of nutritional literacy in elementary school students is still relatively low, especially in understanding information on food labels. Many students do not have adequate skills to read and interpret nutritional value information on food packaging. Conventional educational methods such as lectures tend to be less effective in improving students' practical skills because they are one-way. The lack of an interactive and applied learning approach causes students to have difficulty in relating knowledge to daily practice. This shows the gap between theoretical knowledge and practical skills in nutrition literacy. Systematic reviews have shown that nutrition education for school children is more effective when it uses active, hands-on, and age-appropriate strategies rather than passive instruction (Dudley et al., 2015; Murimi et al., 2017).

The experiential learning approach provides opportunities to overcome these problems through an active and experiential learning process. Experiential learning is a learning process that occurs through concrete experience, reflective observation, abstract conceptualization, and active experimentation (Kolb, 1984). Through these stages, students not only gain knowledge but also develop reading skills and use information on food labels in real-world situations. Thus, this approach has the potential to increase nutrition literacy more comprehensively.

This research offers an experiential learning-based food label education approach as a more interactive and applied method for elementary school students. The novelty of this research lies in the integration of improving nutritional literacy and food label reading

skills in one structured and experience-based learning intervention. This approach is expected to not only improve knowledge but also practical skills that can be applied in daily life, as well as contribute to the development of effective and sustainable nutrition education models in elementary school environments. This study aims to analyze the effectiveness of experiential learning-based food label education on nutritional literacy and food label reading skills in elementary school students.

2. METHODS

This study used a quasi-experimental pre-test and post-test design with a control group to determine the effectiveness of experiential learning-based food label education on nutritional literacy and food label reading skills in elementary school students. The study was conducted at SD Negeri 60 Lembang, Majene Regency, West Sulawesi, from June to July 2026. The population comprised all grade IV and V students at SD Negeri 60 Lembang (N = 102). All students in the population were invited to participate, and those who were willing to become respondents and completed the entire series of activities (pre-test, intervention, and post-test) were included. The sampling technique was therefore non-probability (convenience) sampling based on voluntary participation, rather than purposive sampling. Twenty students were not included because 8 students (or their parents) declined to participate, 7 were absent during one or more intervention sessions, and 5 did not complete the post-test. The final sample consisted of 82 students, who were allocated to the intervention group (experiential learning, n = 41) or the control group (lecture, n = 41) by simple random assignment within each grade using a lottery. The flow of participants is shown in Figure 1.

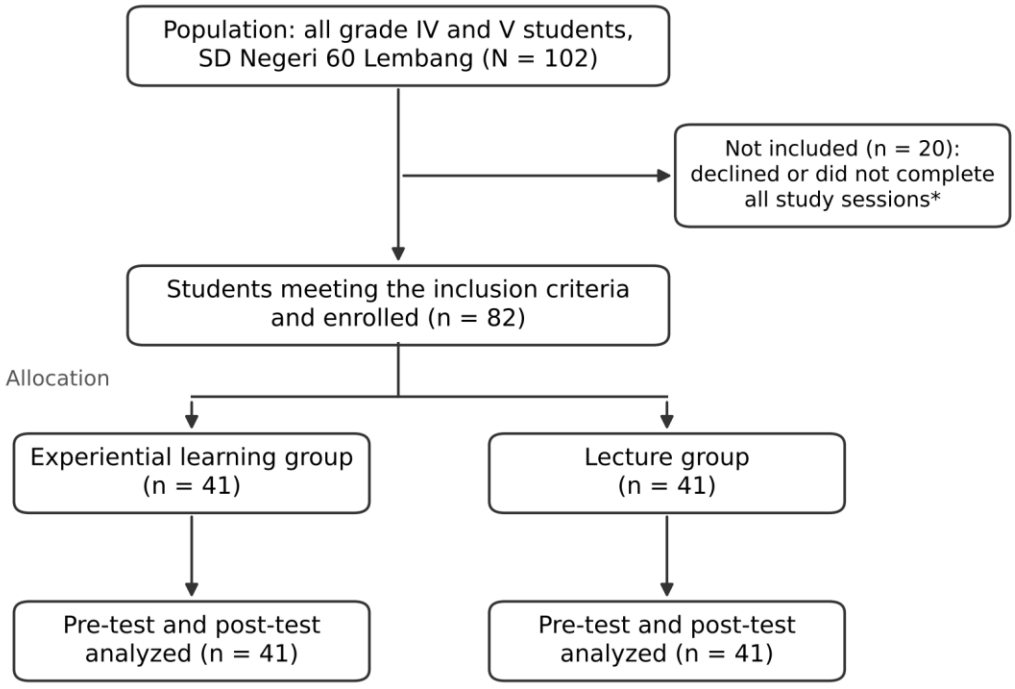


Figure 1. Flow of participants from the study population to group allocation and analysis. The text describes the reasons for non-inclusion.

The independent variable was experiential learning-based food label education. The dependent variables were knowledge, attitudes, behaviors, and food label reading skills. Knowledge, attitudes, and behaviors were measured using a structured questionnaire, and food label reading skills were measured using a practical test in which students read and interpreted the labels of real packaged food products and answered questions about the information on them. The knowledge section consisted of 10 multiple-choice items (score range 0 to 10), the attitude section of 10 items on a 4-point Likert scale (score range 10 to 40), the behavior section of 10 items on a 4-point frequency scale (score range 10 to 40), and the skills test of 8 items (score range 0 to 8). Before use, the instruments were tested on 30 students from another elementary school in Majene Regency with similar characteristics who were not included in the study sample. Validity was assessed using Pearson item-total correlation, and all items had r > r-table (0.361; n = 30, α = 0.05), and reliability was assessed using Cronbach's alpha (knowledge α = 0.74; attitude α = 0.81; behavior α = 0.78; skills α = 0.72).

Both groups completed a pre-test before the intervention. The intervention group then received experiential learning-based food label education in three sessions of 60 minutes held once a week, following Kolb's experiential learning cycle: concrete experience (directly observing the labels on packaged food products), reflective observation (group discussions), abstract conceptualization (interpreting label information such as composition, nutritional value, serving size, and expiration date), and active experimentation (practicing reading labels and choosing products). The structure of the intervention activities is illustrated in Figure 2. The control group received the same food label content through the lecture method in three sessions of 60 minutes. After the intervention, both groups completed a post-test using the same instruments.

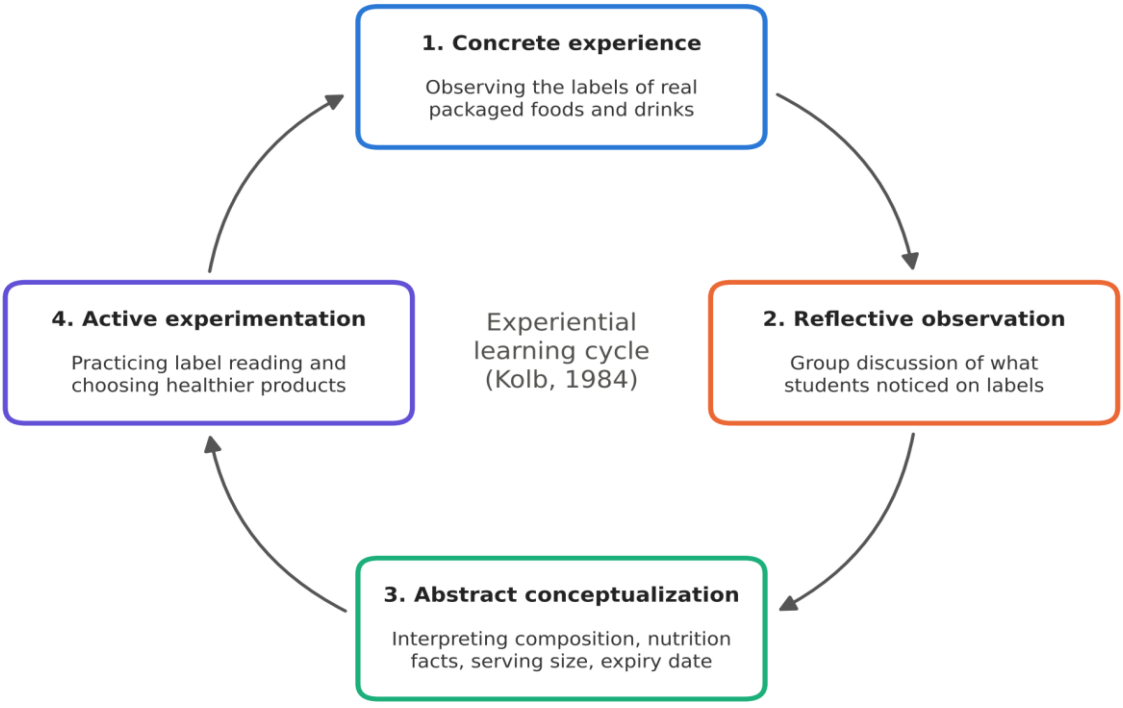


Figure 2. Experiential learning activities: schematic of the four stages of Kolb's experiential learning cycle and the corresponding food label learning activities.

Data were analyzed using SPSS version 26. Univariate analysis was used to describe the characteristics of the respondents. Data normality was assessed using the Shapiro–Wilk test. Within-group differences between pre-test and post-test scores were analyzed separately for each of the four variables using the paired t-test or, for non-normally distributed data, the Wilcoxon signed-rank test. Between-group differences in pre-test and post-test scores were analyzed using the independent t-test. Effect sizes were reported as Cohen's d; for within-group changes, d was calculated as the mean change divided by the average of the pre-test and post-test standard deviations (Lakens, 2013), and for between-group comparisons, the pooled standard deviation was used. Values of 0.2, 0.5, and 0.8 were interpreted as small, medium, and large effects, respectively (Cohen, 1988). The significance level was set at $p < 0.05$.

This study was approved by the Health Research Ethics Commission of the Regional Management of the Indonesian Association of Public Health Experts (IAKMI) of Southeast Sulawesi Province (No. 79/KEPK-IAKMI/VI/2026). Before data collection, all participants signed an informed consent form, and written consent was obtained from their parents or guardians.

3. RESULTS AND DISCUSSION

This study involved 82 students in grades IV and V of SD Negeri 60 Lembang. The characteristics of the respondents showed that the age distribution in both groups was relatively balanced. In the experiential learning group, most of the respondents were 10 years old, namely 21 people (51.2%), while in the lecture group, 26 people (63.4%) were dominated by 11-year-olds. The proportion of 12-year-old respondents in both groups was relatively small, namely 7.3% in the experiential learning group and 12.2% in the lecture group.

Based on gender, the majority of respondents in both groups were women. In the experiential learning group, female respondents amounted to 26 people (63.4%), while in the lecture group there were 24 people (58.5%). Meanwhile, the proportion of male respondents in the experiential learning group was 36.6%, and in the lecture group was 41.5%. This shows that the sex distribution in both groups is relatively balanced.

Table 1. Characteristics of respondents by age and gender

Respondcent Characteristis	Experiential Learning		Lecture	
	n	%	n	%
Age				
10 Years	21	51.2	10	24.4
11 Years	17	41.5	26	63.4
12 Years	3	7.3	5	12.2
Gender				
Male	15	36.6	17	41.5
Female	26	63.4	24	58.5
Grade				
Grade IV	21	51.2	28	68.3
Grade V	20	48.8	13	31.7

Based on grade level, in the experiential learning group, respondents were almost evenly distributed between grade IV (51.2%) and grade V (48.8%). On the other hand, the lecture group was dominated by grade IV students, namely 28 people (68.3%), compared with 13 people (31.7%) in grade V. Although there was a slight difference in proportion at

the grade level, in general the characteristics of respondents in the two groups did not show a marked difference.

Overall, the characteristics of respondents between the experiential learning group and the lecture group were relatively homogeneous, so the two groups could be compared in the subsequent analysis related to the effectiveness of food label educational interventions.

Table 2. Previous exposure to food label information.

Have been informed about food labels before	Experiential Learning		Lecture	
	n	%	n	%
Yes	19	46.3	28	68.3
No	22	53.7	13	31.7

Based on Table 2, some respondents in both groups had previous experience with food label information, but with different proportions. In the lecture group, the majority of respondents stated that they had received information about food labels, namely 28 people (68.3%), while in the experiential learning group, only 19 people (46.3%) did. On the other hand, respondents who had never received food label information were more commonly found in the experiential learning group, namely 22 people (53.7%), compared to the lecture group of 13 people (31.7%). This difference in distribution showed that the lecture group had a higher level of initial exposure to food label information than the experiential learning group.

Table 3. Frequency of buying food/beverages in 1 week.

Usually buy packaged food/drinks within 1 week	Experiential Learning		Lecture	
	n	%	n	%
Never	0	0	3	7.3
1-2 Times	6	14.6	12	29.3
3-4 Times	16	39.0	11	26.8
>5 Times	19	46.3	15	36.6

Based on Table 3, most respondents in both groups had the habit of buying packaged food or drinks more than three times in one week. In the experiential learning group, the majority of respondents bought packaged food/beverages more than five times in one week, namely 19 people (46.3%), followed by 16 people (39.0%) 3–4 times. Meanwhile, in the lecture group, respondents were also dominated by the frequency of purchases more than five times at 36.6%, and 3-4 times at 26.8%.

Respondents with low purchasing frequency (1-2 times per week) were more present in the lecture group, which was 29.3% compared to the experiential learning group of 14.6%. Respondents who never bought packaged food or drinks were only found in the lecture group by 7.3%, while in the experiential learning group there were no respondents in this category.

These findings suggest that most students have a fairly high level of exposure to packaged foods or drinks. The high frequency of purchases indicates that students are a relevant group as the target of food label educational interventions, because they routinely interact with labeled products. Thus, improving nutritional literacy and food label reading skills are very important so that students are able to make healthier consumption choices in their daily lives.

Table 4. Within-group changes in knowledge, attitudes, behaviors, and food label reading skills in the experiential learning and lecture groups.

Variable	Group	Pre-test Mean ± SD	Post-test Mean ± SD	Mean change	d	p-value
Knowledge	Experiential learning	7.29 ± 1.327	7.49 ± 1.287	+0.20	0.15	0.280
	Lecture	7.24 ± 1.338	7.37 ± 0.968	+0.13	0.11	0.447
Attitude	Experiential learning	33.24 ± 5.638	33.37 ± 5.638	+0.13	0.02	0.870
	Lecture	33.71 ± 5.051	33.56 ± 5.385	−0.15	−0.03	0.838
Behavior	Experiential learning	27.71 ± 3.124	28.51 ± 3.421	+0.80	0.24	0.089
	Lecture	28.37 ± 3.315	28.27 ± 2.829	−0.10	−0.03	0.819
Food label reading skills	Experiential learning	5.41 ± 1.936	5.88 ± 1.435	+0.47	0.28	0.063
	Lecture	5.68 ± 1.680	6.32 ± 1.128	+0.64	0.46	0.004

Note: *n = 41 per group. d = Cohen's d (mean change divided by the average of the pre-test and post-test SDs). p-values are from the paired t-test or Wilcoxon signed-rank test performed separately for each variable.*

Table 4 shows that, in the experiential learning group, mean scores increased in all four variables after the intervention: knowledge from 7.29 ± 1.327 to 7.49 ± 1.287, attitude from 33.24 ± 5.638 to 33.37 ± 5.638, behavior from 27.71 ± 3.124 to 28.51 ± 3.421, and food label reading skills from 5.41 ± 1.936 to 5.88 ± 1.435. The effect sizes of these changes were small for behavior (d = 0.24) and skills (d = 0.28) and negligible for knowledge (d = 0.15) and attitude (d = 0.02).

In the lecture group, mean scores increased for knowledge (7.24 ± 1.338 to 7.37 ± 0.968) and food label reading skills (5.68 ± 1.680 to 6.32 ± 1.128; d = 0.46), whereas attitude (33.71 ± 5.051 to 33.56 ± 5.385) and behavior (28.37 ± 3.315 to 28.27 ± 2.829) decreased slightly. The results of the within-group test for each variable are presented in Table 4. Only the increase in food label reading skills in the lecture group was statistically significant (p = 0.004); in the experiential learning group, the increases in behavior (p = 0.089) and skills (p = 0.063) did not reach statistical significance, and the changes in knowledge and attitude were not significant in either group (p > 0.05).

These findings indicate that the experiential learning group improved in all four domains, particularly in behavior and food label reading skills, whereas the lecture group improved mainly in knowledge and skills. However, the magnitude of change in both groups was small.

Table 5. Comparison of pre-test and post-test scores between the experiential learning and lecture groups.

Variable	Experiential learning Mean ± SD	Lecture Mean ± SD	Mean difference	t (df = 80)	p-value	d
Pre-test						
Knowledge	7.29 ± 1.327	7.24 ± 1.338	0.05	0.170	0.866	0.04
Attitude	33.24 ± 5.638	33.71 ± 5.051	−0.47	−0.398	0.692	−0.09

Variable	Experiential learning Mean ± SD	Lecture Mean ± SD	Mean difference	t (df = 80)	p-value	d
Behavior	27.71 ± 3.124	28.37 ± 3.315	−0.66	−0.928	0.356	−0.20
Food label reading skills	5.41 ± 1.936	5.68 ± 1.680	−0.27	−0.674	0.502	−0.15
Post-test						
Knowledge	7.49 ± 1.287	7.37 ± 0.968	0.12	0.477	0.635	0.11
Attitude	33.37 ± 5.638	33.56 ± 5.385	−0.19	−0.156	0.876	−0.03
Behavior	28.51 ± 3.421	28.27 ± 2.829	0.24	0.346	0.730	0.08
Food label reading skills	5.88 ± 1.435	6.32 ± 1.128	−0.44	−1.544	0.127	−0.34

Note: *Independent t-test; n = 41 per group. Mean difference = experiential learning minus lecture. d = Cohen's d based on the pooled SD.*

Table 5 shows that the two groups did not differ significantly at baseline in any variable (all p > 0.05), indicating comparable initial scores. After the intervention, post-test scores also did not differ significantly between the experiential learning and lecture groups for knowledge (p = 0.635), attitude (p = 0.876), behavior (p = 0.730), or food label reading skills (p = 0.127), and all between-group effect sizes were negligible to small (d = 0.03 to 0.34). For food label reading skills, the lecture group had a slightly higher post-test score than the experiential learning group.

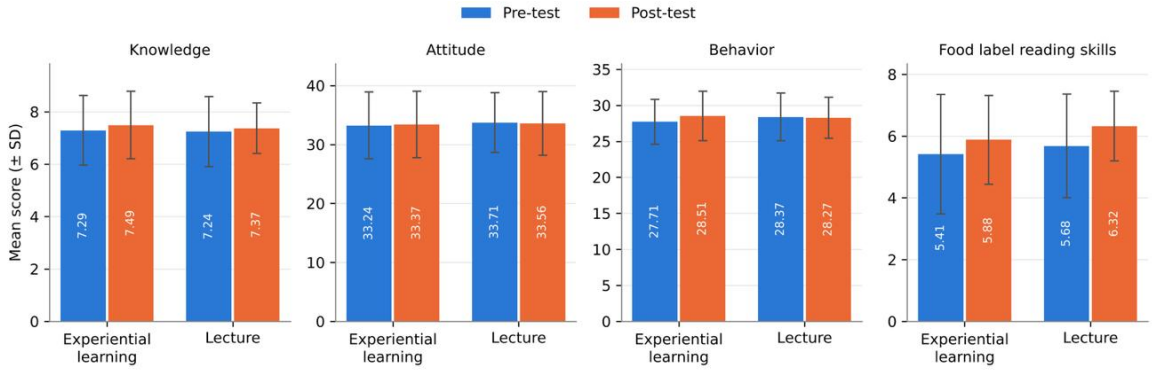


Figure 3. Pre-test and post-test mean scores (± SD) for knowledge, attitude, behavior, and food label reading skills in the experiential learning and lecture groups (n = 41 per group).

Taken together, the within-group and between-group results show that the experiential learning group improved slightly in all four domains, but the improvement was not significantly greater than that achieved with the lecture method. Therefore, the present data do not demonstrate that experiential learning was superior to the lecture method in this short intervention.

In this study, experiential learning-based food label education was followed by small improvements in knowledge, attitudes, behaviors, and food label reading skills, but these improvements were not significantly greater than those in the lecture group. The direction

of change in the experiential learning group is in line with the systematic review by Varman et al. (2021), which reported that experiential learning-based interventions such as cooking, games, and role-play improve knowledge, attitudes, and healthy eating behaviors in elementary school children. However, the effects observed in the present study were smaller, possibly because of the short duration and low intensity of the intervention.

Lier et al. (2024) evaluated an experiential learning program based on field visits, cooking workshops, and meal activities and found significant long-term improvements in attitudes toward health and in fruit and vegetable consumption. In the present study, the change in attitude was very small. This difference is likely related to the duration of the intervention: the program evaluated by Lier et al. (2024) was delivered regularly with long-term exposure, whereas the present intervention was conducted over a much shorter period.

Studies using experiential cooking programs have also reported improvements in self-efficacy and vegetable consumption among school children (Hersch et al., 2014; Pierre et al., 2024). In the present study, the largest within-group changes in the experiential learning group were observed for behavior and food label reading skills, which is consistent with the view that the active experimentation component of experiential learning supports behavior change. Nevertheless, food label reading skills also improved in the lecture group, suggesting that both methods conveyed the basic content of food labels.

Other research based on school gardening as a form of experiential learning also showed consistent results in improving healthy consumption behavior in students (Davis et al., 2021). The Texas Sprouts program, a cluster randomized controlled trial study, reported that interventions that integrated gardening, nutrition education, and cooking practices significantly increased vegetable consumption in elementary school children compared to the control group. The hands-on learning approach in this program has been shown to strengthen student engagement and encourage healthier eating behaviors, although no significant changes were found in anthropometric indicators such as body mass index (Davis et al., 2021).

This research has a uniqueness compared to previous studies, which focus on food label reading skills as part of nutritional literacy. Previous studies have focused more on fruit and vegetable consumption, while this study adds aspects of practical cognitive ability in understanding information on food packaging. This is important because food label literacy is an essential skill in food consumption decision-making in the modern era.

The characteristics of respondents who show high consumption of packaged foods reinforce the urgency of food label education from an early age. Recent research shows that low nutritional literacy is still a global problem that impacts children's consumption behavior and long-term health quality (Zeng et al., 2022). Understanding food labels is one of the key components in nutrition literacy that plays a role in shaping healthy consumption behaviors (Kamarudin et al., 2025). This ability not only supports effective nutrition communication, but also assists individuals in choosing foods more rationally, thus contributing to the prevention and control of non-communicable diseases, including obesity (Oswald et al., 2022).

Although the experiential learning group had less prior exposure to food label information than the lecture group (46.3% vs. 68.3%), its scores improved in all four domains, and its post-test scores were comparable to those of the lecture group. This may indicate that experiential learning is useful for students with lower initial exposure, although this interpretation requires confirmation. Systematic review evidence also indicates that experiential learning approaches generally have positive effects on children’s nutrition-related knowledge, attitudes, and behaviors (Varman et al., 2021).

This study has several limitations. First, students were not randomly selected or allocated, and the 20 students who did not participate may differ from those who did, which may introduce selection bias. Second, the intervention was short, which may have limited the magnitude of change, as the duration and intensity of nutrition education are known to influence its effectiveness (Murimi et al., 2017). Third, outcomes were measured immediately after the intervention, so long-term effects could not be assessed. Fourth, the study was conducted in a single school, which limits generalizability. Future studies should use randomized designs, longer and more intensive interventions, and follow-up measurements, and should compare groups using change scores or analysis of covariance adjusted for baseline scores.

4. CONCLUSION

In sum, the high frequency of packaged food purchases among the students indicates a need to strengthen nutritional literacy and food label reading skills from an early age. Experiential learning-based food label education was followed by small improvements in knowledge, attitudes, behaviors, and food label reading skills among elementary school students. However, post-test scores did not differ significantly from those of students who received lecture-based education, so this study did not demonstrate that experiential learning was more effective than the lecture method over a short intervention period. Experiential learning remains a promising and feasible approach for nutrition education in elementary schools because it actively engages students through direct experience, reflection, and practice. Longer and more intensive experiential programs, evaluated with randomized designs and follow-up measurements, are recommended to determine their effectiveness in improving children's ability to understand food labels and make healthier food choices.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

ETHICAL CONSIDERATIONS

This study was approved by the Health Research Ethics Commission of the Regional Management of the Indonesian Association of Public Health Experts (IAKMI) of Southeast Sulawesi Province (No. 79/KEPK-IAKMI/VI/2026). Before data collection, all participants signed an informed consent form, and written consent was obtained from their parents or guardians.

AUTHOR CONTRIBUTIONS

Masniati contributed to conceptualization, methodology, data collection, formal analysis, and writing of the original draft. Muhammad Taufik Page contributed to methodology, supervision, and writing (review and editing). Rahmaniah contributed to data collection, data curation, and writing (review and editing). All authors read and approved the final version of the manuscript.

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DECLARATION OF ARTIFICIAL INTELLIGENCE USE

The authors declare that claude as the artificial intelligence (AI) tools were used solely to assist with language editing, grammar checking, and improving the clarity and readability of the manuscript. AI tools were not used to generate research data, conduct data analysis, interpret the results, or make scientific decisions. The authors remain fully responsible for the accuracy, originality, and final content of the manuscript.

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