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Nutrition education and changes in knowledge and attitudes among children aged 9–12 years

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ABSTRACT

Background: Pola makan tidak seimbang pada anak usia sekolah masih menjadi masalah kesehatan masyarakat yang dapat memengaruhi status gizi, pertumbuhan, dan perkembangan anak. Anak usia sekolah membutuhkan pemahaman mengenai gizi seimbang untuk mendukung pembentukan pola makan sehat. Objective: This study aims to describe changes in nutrition-related knowledge and attitudes before and after the provision of education to children aged 9–12 years in Pakkat Dolok Village, Indonesia. Method: This study employed a pre-experimental design using a one-group pre-test post-test approach without a control group. dilaksanakan pada Mei–Juli 2026. Sebanyak 32 anak dipilih secara purposive sampling dari populasi 143 anak. Education was delivered through material presentations, interactive discussions, and the use of visual aids, covering topics such as balanced nutrition, the importance of breakfast, nutrients, and healthy food choices. Knowledge and attitudes were assessed before and after the activity using a questionnaire that had undergone prior validity and reliability testing. Analisis deskriptif dilakukan berdasarkan distribusi kategori pengetahuan dan sikap. Results: The study results show that the proportion of children with a good level of knowledge increased from 25.0% to 84.4%, while the proportion of children with a positive attitude increased from 43.8% to 84.4%. Conclusion: Temuan ini menunjukkan adanya perbedaan deskriptif antara pengukuran sebelum dan sesudah edukasi. The small purposive sample, absence of a control group, and use of ordinal category codes limit causal and statistical interpretation. Future controlled community health studies should assess validated scores, food choices, and persistence of change.

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INTRODUCTION

Balanced nutrition supports children's growth, learning, and health during the school years. Developmental changes during primary school shape how children respond to food information (Sinta Zakiyah dkk., 2024). Children aged 9–12 years increasingly make food choices at home and

in their community, yet understanding a balanced diet does not necessarily translate into positive attitudes or healthier choices (Retno Setiyowati dkk., 2026). Educational activities can build nutrition knowledge and address attitudes when the content and delivery fit children's developmental stage (Angga dkk., 2023). Recent reviews have reported that school-based nutrition interventions can improve nutrition knowledge and selected dietary outcomes among children, although the magnitude of change varies according to intervention components, duration, delivery methods, and contextual factors (Chan dkk., 2022). Studies have also shown that structured nutrition education can improve knowledge and selected attitudes among primary school children (Adeoya dkk., 2023a). Reviews focusing on school gardens, nutrition literacy, and intervention components likewise report improvements in knowledge (Kurniawan dkk., 2025) and attitudes but emphasize variation in activities, duration, and family involvement (Esse Puji Pawenrusi dkk., 2023).

Recent intervention studies provide more specific comparisons (Helsa Nasution dkk., 2025). A Dutch programme combining classroom and experiential learning improved children's knowledge and attitudes toward fruit and vegetables in the short term (Hahnraths dkk., 2022). A controlled programme in Ghana improved nutrition knowledge and fruit consumption (Mogre dkk., 2024), while a school-based programme in China improved knowledge and several reported dietary behaviours (Yu dkk., 2024). In Nigeria, education about school meals was associated with improved knowledge and attitudes (Adeoya dkk., 2023a). A controlled Malaysian trial also assessed changes in both outcomes among primary-school pupils with overweight or obesity (Raut dkk., 2024). A controlled adolescent study also reported changes in knowledge and diet quality, but its older age range limits direct comparison (Raissha Anandita & Nur Anna ChNur Anna Chalimah Sadyahalimah Sadyah, 2026). These studies used different populations, comparison groups, and intervention lengths; their estimates should not be transferred directly to a brief village activity.

Other studies suggest that delivery and setting matter. Video-based lessons in Cameroon improved pupils' nutrition knowledge compared with conventional teaching (Collishaw dkk., 2024). A pilot programme in Palau combined education with fruit and vegetable provision and found greater knowledge but more modest attitudinal change (Liao dkk., 2025). A dietitian-led controlled trial reported gains in knowledge and attitudes after classroom and parent education (Akçalı dkk., 2026). An Indonesian vitamin A education study found increased knowledge but no statistically significant attitudinal change, illustrating why both outcomes should be reported separately (Syafidawati & Noerfitri, 2024). Indonesian studies have likewise documented changes in knowledge or attitudes after nutrition education in elementary-school settings (Nurhayati dkk., 2025). However, evidence from these programmes does not establish what happens in the specific community setting of Pakkat Dolok Village. Although various prior studies have demonstrated the positive impact of nutrition education on children's knowledge, attitudes, and eating behaviors, there remain research gaps that warrant attention. Most previous studies were conducted through school-based programs involving structured interventions, multi-stakeholder engagement, and support from the educational environment (Hahnraths et al., 2022; Mogre et al., 2024; Yu et al., 2024). Conversely, there is a need to expand the evidence regarding changes in nutrition knowledge and attitudes resulting from simple educational activities for school-aged children in rural areas—particularly at the village level in Indonesia. Differences in social characteristics, environmental factors, access to nutrition information, and educational delivery methods may lead to variations in outcomes between previous studies and community-based educational activities. Furthermore, given the diversity of approaches, durations, and measurement indicators used in prior research, contextual evidence is required to characterize changes in knowledge and attitudes among groups of children living in different environmental contexts.

A preliminary survey in Hamlet I of Pakkat Dolok Village identified 143 children aged 9–12 years. Some children encountered in the survey reported limited understanding of their

nutritional needs and no prior nutrition education. This local concern motivated an assessment of a community-based activity delivered through explanation, discussion, and visual media (Murti & Dian Ramadan Lazuardi, 2024). The present study aimed to determine whether nutrition knowledge and attitudes differed before and after the activity among participating children in 2026. Unlike previous studies that largely focused on structured, school-based intervention programs, this study describes the implementation of nutrition education within a village community setting, utilizing a combination of content delivery and interactive discussions. A single-group pre-test/post-test approach was employed to document changes in these indicators among the same participants. Although this design does not allow for conclusions regarding causality, the findings are expected to provide preliminary information on children's nutrition knowledge and attitudes at the community level and serve as a foundation for developing and evaluating community-based nutrition education programs using more robust research designs.

RESEARCH METHOD

This study used a quantitative quasi-experimental design with the pre-experimental design employs a one-group pre-test and post-test design without a control group. The study was conducted in Pakkat Dolok Village, Hamlet I, Doloksanggul District, Humbang Hasundutan Regency, from May to July 2026. Desain ini digunakan untuk mengidentifikasi perbedaan pengetahuan dan sikap mengenai gizi sebelum dan sesudah pelaksanaan edukasi pada kelompok responden yang sama. Namun, tidak adanya kelompok kontrol membatasi kemampuan penelitian dalam menyimpulkan bahwa perubahan yang diamati sepenuhnya disebabkan oleh kegiatan edukasi. Penelitian sebelumnya juga menggunakan pengukuran sebelum dan sesudah intervensi, meskipun desain dengan kelompok kontrol (Adeoya et al., 2023; Raut et al., 2024).

The inclusion criteria were children aged 9–12 years, registered as students in the research area, willing to participate, obtaining parental or guardian consent, able to read and understand the questionnaire, and willing to participate in the nutrition education intervention and the complete research procedure. Respondents who were absent, did not complete the intervention, did not complete the questionnaire, withdrew from the study, or were unable to complete the research procedure were excluded. Thus, determining the sample size is based on the suitability of respondents to the research criteria and participant availability, not based on statistical sample size calculations before the research. The independent variable was nutrition education, which consisted of information about balanced nutrition, healthy foods, the benefits of nutrients, the importance of breakfast, and healthy food choices. The dependent variables were knowledge and attitudes regarding nutrition.

Data were collected using a 20-item knowledge questionnaire and an attitude questionnaire administered before and after the intervention. The 20-item knowledge questionnaire and an attitude questionnaire were administered before and after the educational intervention. The knowledge questionnaire covered indicators of understanding regarding balanced nutrition principles, nutrient functions, breakfast habits, and healthy food choices. Meanwhile, the attitude questionnaire was used to assess respondents' views and inclinations regarding the adoption of a healthy diet. Prior to distribution, validity and reliability tests were conducted on the research instruments, and all instruments were confirmed to be valid and reliable.

Data were edited, coded, entered, checked, and tabulated. Frequencies and percentages described characteristics and categories. The source analysis compared paired coded category values with a paired-sample t-test at $\alpha = 0.05$. The reported mean values of 1.66–2.78 for knowledge and 1.44–1.84 for attitude indicate category codes rather than raw 20-item totals. Because these codes are ordinal, the reported tests warrant confirmation against the underlying paired observations, preferably using an ordinal-appropriate sensitivity analysis.

RESULTS AND DISCUSSIONS

Characteristics of Respondents

A total of 32 children aged 9–12 years participated. Their age and sex are shown in Table 1.

Table 1. Respondent characteristics

Characteristics	Frequency (n)	Percentage (%)
Age		
9 years	6	18.8
10 years	14	43.8
11 years	8	25.0
12 years	4	12.5
Total	32	100.0
Sex		
Male	21	65.6
Female	11	34.4
Total	32	100.0

The results showed that the largest proportion of respondents was 10 years old, consisting of 14 respondents (43.8%), followed by 11 years old with 8 respondents (25.0%), 9 years old with 6 respondents (18.8%), and 12 years old with 4 respondents (12.5%). Based on sex, most respondents were male (21 respondents; 65.6%), while 11 respondents (34.4%) were female.

The distribution indicates that most respondents were in the middle of the 9–12-year age range. At this age, children are experiencing continued physical and cognitive development and are increasingly exposed to different food choices both at home and in their surrounding environment. Therefore, nutrition education is relevant for strengthening children's understanding of healthy food choices and balanced nutrition (Fitria Budi Utami dkk., 2025).

Knowledge Before and After Nutrition Education

Table 2 presents the knowledge categories before and after nutrition education.

Table 2. Knowledge categories before and after education

Knowledge Level	Pre-test n (%)	Post-test n (%)
Good	8 (25.0)	27 (84.4)
Fair	5 (15.6)	3 (9.4)
Poor	19 (59.4)	2 (6.2)
Total	32 (100.0)	32 (100.0)

Before the intervention, most respondents had poor nutrition knowledge, with 19 respondents (59.4%) categorized as having poor knowledge. Only 8 respondents (25.0%) had good knowledge, while 5 respondents (15.6%) had fair knowledge. After the nutrition education intervention, there was a substantial shift in the distribution of knowledge levels. The number of respondents with good knowledge increased to 27 (84.4%), while only 3 respondents (9.4%) remained in the fair category and 2 respondents (6.2%) were categorized as having poor knowledge. The mean coded knowledge category also increased from 1.66 (SD = 0.865) before the intervention to 2.78 (SD = 0.553) after the intervention. This descriptive change indicates an improvement in respondents' knowledge following the nutrition education intervention.

Attitudes Before and After Nutrition Education

Table 3 presents the attitude categories before and after nutrition education.

Table 3. Attitude categories before and after education

Attitude category	Pre-test n (%)	Post-test n (%)
Positive	14 (43.8)	27 (84.4)
Negative	18 (56.2)	5 (15.6)

Attitude category	Pre-test n (%)	Post-test n (%)
Total	32 (100.0)	32 (100.0)

Before the intervention, 18 respondents (56.2%) had negative attitudes toward nutrition, while 14 respondents (43.8%) had positive attitudes. Following the nutrition education intervention, the proportion of respondents with positive attitudes increased to 27 (84.4%), while the proportion with negative attitudes decreased to 5 (15.6%).

The mean coded attitude category increased from 1.44 (SD = 0.504) before the intervention to 1.84 (SD = 0.369) after the intervention. These findings indicate a descriptive improvement in respondents' attitudes toward healthy and balanced nutrition after receiving the education.

Knowledge Before and After Nutrition Education

The reported paired comparison of coded knowledge categories is shown in Table 4.

Table 4. Paired comparison of coded knowledge categories

Knowledge category	n	Mean	SD	t	df	p-value
Pre-test	32	1.66	0.865	-6.313	31	< 0.001
Post-test	32	2.78	0.553			

The mean coded knowledge category increased from 1.66 before the intervention to 2.78 after the intervention. The paired sample t-test showed a t-value of -6.313 with a p-value below 0.001 ($p < 0.05$). Thus, there was a statistically significant difference between knowledge scores before and after nutrition education.

These findings indicate that nutrition education was associated with a significant improvement in nutrition knowledge among children aged 9–12 years in Pakkat Dolok Village. The increase was also reflected in the categorical distribution, where the proportion of respondents with good knowledge increased from 25.0% to 84.4%.

The direction of the change agrees with studies among Indonesian elementary pupils (Syafidawati & Noerfitri, 2024) and with controlled studies in China and Ghana that found improved nutrition knowledge (Mogre dkk., 2024). Evidence from a video-based programme suggests that the format of instruction may also influence how children understand nutritional information (Collishaw dkk., 2024). These comparisons support the plausibility of learning after education, while the present one-group design cannot exclude testing effects or outside influences.

The present findings suggest that nutrition education can provide children with information about healthy food choices, the benefits of balanced nutrition, breakfast, and the potential consequences of inappropriate food consumption. The educational material in this study was delivered in a manner appropriate to the children's level of understanding, which may have supported their ability to receive and understand the information provided.

Attitudes Before and After Nutrition Education

The reported paired comparison of coded attitude categories is shown in Table 5.

Table 5. Paired comparison of coded attitude categories

Attitude category	n	Mean	SD	t	df	p-value
Pre-test	32	1.44	0.504	-4.605	31	< 0.001
Post-test	32	1.84	0.369			

The mean coded attitude category increased from 1.44 before the intervention to 1.84 after the intervention. The paired sample t-test produced a t-value of -4.605 with a p-value below 0.001 ($p < 0.05$), indicating a statistically significant difference in attitudes before and after the nutrition education intervention.

The categorical results also showed a marked change. The proportion of respondents with positive attitudes increased from 43.8% before the intervention to 84.4% after the intervention, whereas negative attitudes decreased from 56.2% to 15.6%.

The observed attitudinal change is consistent with findings from nutrition education interventions among school-age children in other settings. However, these studies used controlled or longer-duration interventions, whereas the present study used a one-group pre-test post-test design. Therefore, the observed change should be interpreted as a pre-post difference rather than definitive evidence of a causal intervention effect. A study involving street children also reported improvements in attitudes after education (Arabbadvi dkk., 2023). Nevertheless, a pilot in Palau found stronger knowledge gains than attitudinal change, illustrating that these outcomes do not necessarily move together (Liao dkk., 2025).

The educational material addressed familiar decisions about breakfast, fruits, vegetables, sugary foods and drinks, water, and physical activity. Such concrete examples may help children connect factual information to preferences and choices. Evidence from experiential and family-supported nutrition education also suggests that interventions extending beyond a single educational encounter may improve children's nutrition-related knowledge, attitudes, and practical skills (Ng dkk., 2022). In the present study, the intervention was delivered through explanation, discussion, and visual media without a documented follow-up period. Therefore, whether the observed changes can be maintained over time remains uncertain (Hahnraths dkk., 2022).

The higher post-test attitude categories should therefore be understood as a short-term association after the activity. Whether the change persists or influences eating practices remains an open question.

Overall Discussion

This study demonstrated existence of descriptive differences in nutrition-related knowledge and attitudes children aged 9–12 years following nutrition education. Before the intervention, most respondents had poor knowledge and negative attitudes toward nutrition. Following the intervention, most respondents were categorized as having good knowledge and positive attitudes. These findings provide an initial overview of changes in these two indicators among school-age children in a rural community context.

The improvement in knowledge was particularly evident from the increase in the proportion of respondents with good knowledge, from 25.0% before the intervention to 84.4% after the intervention. The change of 59.4 percentage points indicates a substantial descriptive difference in the distribution of respondents' knowledge categories**.** The mean knowledge score increased from 1.66 to 2.78, These results indicate that learning emphasizes the importance of receiving, processing, and organizing information in the construction of knowledge. Delivering nutritional information through explanations, interactive discussions, and visual media can theoretically help children connect new knowledge with their daily experiences—such as breakfast habits, fruit and vegetable consumption, and healthy food choices. This interpretation also aligns with the cognitive development perspective, which emphasizes that learning is influenced by the interaction between individual, behavioral, and social-environmental factors.

A similar pattern was observed for attitudes. The proportion of respondents with positive attitudes increased from 43.8% to 84.4%, while negative attitudes decreased from 56.2% to 15.6%. The mean attitude score increased from 1.44 to 1.84, a 40.6-percentage-point change in the positive attitude category indicates a noteworthy descriptive difference in children's nutrition education. Changes in attitude are a crucial aspect of understanding health-related behaviors.

The results of this study align with several previous studies reporting positive changes in nutrition-related knowledge and attitudes following the implementation of health education programs. Recent syntheses indicate that nutrition education can improve knowledge, but effects on food consumption vary across programmes and settings (Medeiros et al., 2022; Omidvar et al.,

2023; Karpouzis et al., 2025). A UK cluster trial assessing food literacy and cooking skills underlines the value of separately measuring behavioural outcomes (Vaughan et al., 2025). The present study measured knowledge and attitude categories only; it cannot establish changes in actual dietary intake.

The observed differences may reflect children's engagement with familiar examples of breakfast, healthy food choices, vegetables, fruit, and water. However, the extent to which short-term learning persists is uncertain. A broader curriculum review identified gains in knowledge and attitudes when nutrition lessons were supported by other activities (Balderas-Arteaga et al., 2024). An Italian programme likewise highlighted the practical challenges of translating educational exposure into sustained results (Basilico et al., 2025). Interpretation is limited by the one-group design, the 32 purposively selected respondents, and the lack of follow-up. Maturation, repeated testing, and other exposures cannot be excluded. The intervention dose, instrument validity, and category thresholds were not recorded in the available manuscript. Furthermore, the reported t-tests use coded ordinal categories; analysis of the underlying paired data is needed to confirm statistical robustness. The findings therefore describe pre-test to post-test differences in this sample rather than a definitive causal effect or evidence of dietary behaviour change (., 2026).

CONCLUSION

This study reveals descriptive differences in nutrition-related knowledge and attitude categories between pre- and post-education measurements among 32 children aged 9–12 in Pakkat Dolok Village. The proportion of respondents with "good" nutrition knowledge shifted from 25.0% at the pre-test to 84.4% at the post-test, while the proportion with a positive attitude rose from 43.8% to 84.4% over the same period. These differences reflect changes in the distribution of knowledge and attitude categories within the study group but cannot be interpreted as definitive proof that the nutrition education directly caused these changes. Furthermore, the use of a relatively small purposive sample, limited documentation regarding instrument validity and reliability, and the use of ordinal category coding in statistical analysis constrain the strength of the findings' interpretation. Nevertheless, these findings provide preliminary descriptive data on the nutrition knowledge and attitudes of school-aged children in a rural setting, offering insights for the development of community-based nutrition education programs that engage both schools and families. Future research should employ a control group design, a more representative sample size, validated instruments, and follow-up assessments to more comprehensively evaluate the sustainability of changes in knowledge, attitudes, and eating behaviors.

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