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The Effectiveness of Nutrition Education on Anthropometric Indices and Eating Behaviour among Students at Primary Schools in Vietnam

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ABSTRACT

Background: Malnutrition, overweight, and obesity are growing issues among primary school-aged children in Vietnam, with rising rates of obesity and unhealthy eating behaviors, highlighting the need for effective nutrition education programs. Therefore, the study aims to examine the effectiveness of nutrition education on the eating behavior and anthropometric indices among students at two primary schools, in Nam Dinh city, Vietnam in 2024. **Methods**: A quasi-experimental study was conducted with 600 students (300 in the intervention group and 300 in the control group), aged 6-11, at two primary schools in Nam Dinh city. A nutrition education program, led by trained teachers, was implemented over two months, with 7–15-minute sessions each week during class activities, science lessons, and lunch breaks. Additionally, before mealtimes, the homeroom teacher guides the children on food choices and dishes, encourages them to eat vegetables, enjoy a variety of foods, and limit unhealthy options. Data on eating behavior and anthropometric index were collected at baseline and two months after the intervention. **Results**: After the 2-month intervention, there was a statistically significant improvement in the nutritional practices of participants in the intervention group compared to the control group ($P<0.05$). However, no statistically significant differences were found in anthropometric indices (Weight and Height) between the two groups at both pre- and post-intervention time points ($P<0.05$). **Conclusions**: The school-based nutrition education program was effective in improving students' eating behavior. Schools should implement and expand nutrition education programs to promote healthier eating behaviors among students.

Introduction

The global burden of malnutrition is increasingly shifting from undernutrition to the dual challenges of under- and over-nutrition, particularly in school-aged children. In Vietnam, the rate of overweight and obesity among primary school students rose from 8.5% in 2010 to 19.0% in 2020, with urban areas reporting as high as 26.8% compared to only 6.9% in mountainous regions (Ministry of Health, 2020). This trend is largely driven by lifestyle changes, particularly increased access to processed foods and a decline in traditional eating habits (Harris *et al.*, 2020).

Primary school age represents a critical window for growth and development. Nutrition during this

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period plays a foundational role in determining physical development and establishing lifelong eating behaviors (Shaikh *et al.*, 2015, Spinelli *et al.*, 2019). Poor dietary practices in childhood are strongly associated with an increased risk of non-communicable diseases in adulthood (World Health Organization, 2022). Addressing nutrition during this formative stage through targeted education is, therefore, essential.

Globally, numerous studies have shown that nutrition education interventions in schools can positively influence children's dietary knowledge, attitudes, and behaviors (Collado-Soler *et al.*, 2023). For example, Rasheed found that nutritional interventions significantly improved students' ability to make healthier food choices (Rasheed, 2023). Similar outcomes were observed in rural populations across various age groups, including children and older adults (Cusquisibán-Alcantara *et al.*, 2024). Additionally, school-based programs have demonstrated improvements in both nutritional knowledge and anthropometric outcomes such as Weight and Height among young children (Baten and Blum, 2014, Bidira *et al.*, 2022, Majamanda *et al.*, 2014).

One promising model is Japan's nationally implemented "Shokuiku" program - an integrated nutrition education strategy that promotes healthy eating habits through formal and informal learning channels (Ministry of Health Labor and Welfare, 2019). The program has achieved considerable success in reducing unhealthy behaviors among Japanese children (Miyoshi *et al.*, 2012). Recognizing its potential, Vietnam's National Institute of Nutrition has supported the contextual adaptation of "Shokuiku" for implementation in Vietnamese schools.

Despite these global and regional efforts, there remains a gap in empirical research on the effectiveness of school-based nutrition education among primary school students in Vietnam. Existing studies are either limited in scope or lack culturally tailored content aligned with Vietnamese dietary habits and health needs. Therefore, this study was designed to evaluate the effectiveness of a structured school-based nutrition education program - adapted from the Japanese "Shokuiku" model - on improving dietary behavior and anthropometric outcomes among primary school students in Nam Dinh City, Vietnam. The findings from this research aim to contribute to the growing body of evidence supporting early-life nutrition education and offer insights into scalable, culturally appropriate interventions that can be applied across similar low- and middle-income context.

Materials and Methods

Participants, research design

A quasi-experimental study was conducted on students aged 6-11 year at two primary schools in Nam Dinh city from March to May, 2024.

Sample size and sampling techniques

The formula was applied to calculate the sample size to evaluate changes in anthropometric indices:

$$\boldsymbol{n = \frac{2C}{((\mu_1 - \mu_2)/\sigma)^2}}$$

Where n: Sample size for one group; C: Constant related to type 1 and type 2 errors. For a type 1 error of 5% and a type 2 error of 10%, C=10.51; μ_1: Average Z-score of students in the intervention group, μ_1=-1.12; μ_2: Average Z-score of students in the control group, μ_2=-1.38; σ: Standard deviation of the Z-score students in the control group, σ=0.83

The sample size for each study group was 214 students. Adding a 30% dropout allowance and rounding up gave a final sample size of 300 students per study group. Therefore, the total sample size needed for a study with one intervention group and one control group was 600 students. Each school selected 300 students (**Figure 1**).

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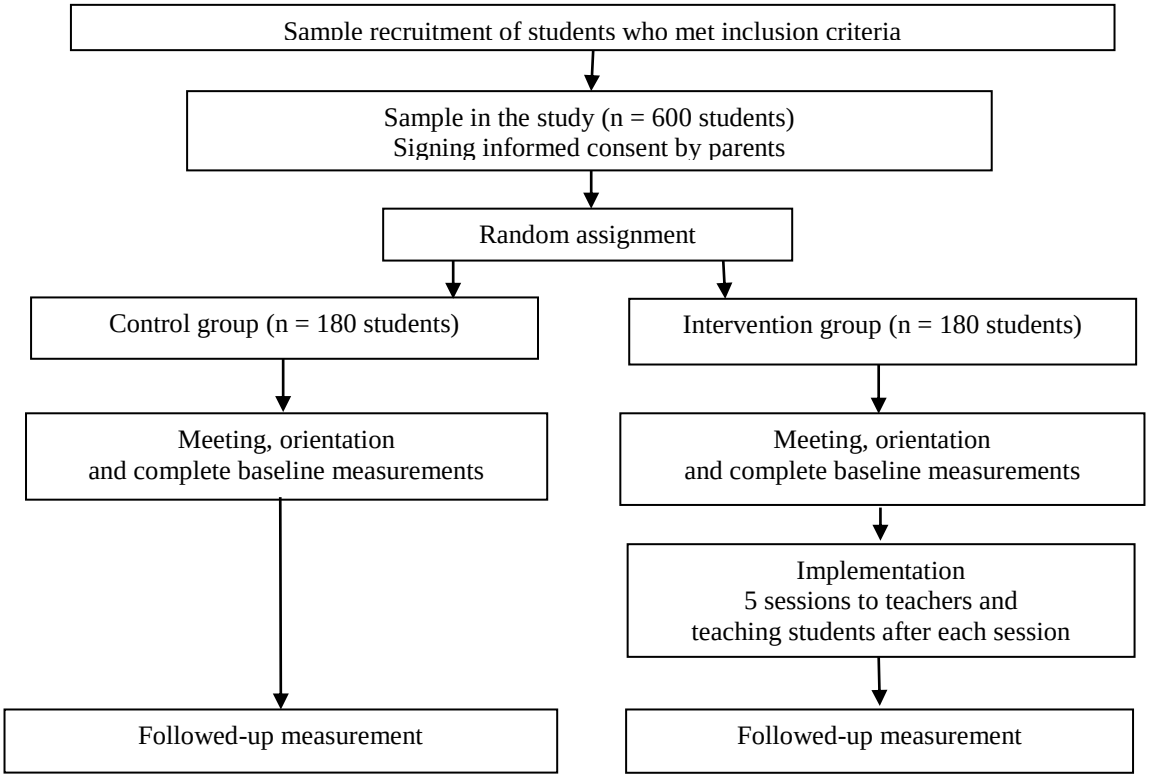

Figure 1. Study process

A list of 27 primary schools in Nam Dinh city was obtained. Only two primary schools were purposively selected because these schools share similarities in terms of educational and socio-economic conditions. These two schools were then randomly assigned to the control and intervention groups.

Sampling for anthropometric change assessment: Grades 1-5 (600 students from 2 schools): A list of classes for each grade was created, and for both the baseline and endline surveys, two classes from each grade were randomly selected to undergo anthropometric assessment.

Sampling for knowledge and practice assessment: Grades 3-5 (360 students from 2 schools): All students in grades 3–5 who had their weight and height measured during the baseline survey were selected and interviewed about their eating behavior.

Nutrition education program

After completing the baseline data collection, a two-month nutrition education program was implemented for all intervention groups following five key steps.

Step 1; Teacher training: The first step involved teacher training to enhance their capacity for organizing and implementing school nutrition education. Over five consecutive weeks (March 13, 2024, to April 13, 2024), teachers participated in five training sessions focused on developing and delivering nutrition education for children. The training covered essential topics such as calculating nutritional components, ensuring food hygiene and safety, organizing meals, and food management. This initiative aimed to equip teachers with the necessary skills to sustain the school nutrition education program independently after the project concluded. To ensure fidelity of training delivery, session attendance was recorded, training manuals were distributed, and a pre- and post-training assessment was conducted to evaluate teacher understanding.

Step 2; Nutrition education delivery: Trained teachers, subsequently, implemented weekly 7–15-

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minute nutrition lessons in class activities, science lessons, and during lunch breaks. Lessons included content such as the benefits of breakfast, healthy snacks, and making friends with vegetables. Teachers of grades 1–3 and 4–5 used age-appropriate, expert-developed materials. To monitor adherence and instructional quality, lesson delivery checklists were completed weekly by teachers and reviewed by school coordinators. Random classroom observations were also conducted by project staff.

Step 3; Integration and reinforcement: Teachers provided daily guidance on healthy food choices and reinforced messages during lunch. Students were encouraged to try a variety of vegetables and limit unhealthy foods. Schools were also encouraged to establish vegetable gardens, creating experiential learning opportunities. Parents received take-home flyers and were invited to participate in nutrition-themed school events, reinforcing school-home collaboration.

Step 4; Ongoing support and quality assurance: Throughout the two-month program, continuous support was provided by a team of trainers and nutrition specialists from the Institute of Nutrition and the university. Biweekly meetings with teachers were held to address challenges, share progress, and ensure consistent message delivery. An intervention logbook was maintained at each school to document activities and reflections.

Step 5; Evaluation and knowledge dissemination: In the second half of May 2024, a post-intervention evaluation was conducted using the same survey tools from the baseline phase. This final step assessed the effectiveness of the intervention by comparing students' eating behavior before and after the program.

Blinding procedures

To reduce bias during data collection and ensure the objectivity of outcome assessment, blinding procedures were implemented at several levels. First, the data collectors responsible for administering both the pre- and post-intervention surveys were not involved in delivering the intervention and were blinded to the group assignments (intervention vs. control). They were trained to follow standardized protocols and were unaware of the specific objectives of the intervention. Second, participants (students and their parents) were not informed explicitly about the study hypothesis or their group status, which helped minimize response bias. Last, data analysis was conducted using anonymized group codes, and the statistician was blinded to group identities during the initial phase of data processing. These procedures aimed to enhance the internal validity and reliability of the study findings.

Measurements

Data was collected using several instruments: children's gender, anthropometric measurement and assessment of students' eating behavior.

Weight measurement: An electronic scale was used to weigh the child. The child was dressed in light clothing, without shoes or sandals. He/she was instructed to stand in the center of the scale with both feet together and his/her eyes looking straight ahead. The weight was recorded to the nearest 0.1 kg.

Height measurement: A 2-piece wooden ruler was used to measure the child's standing height. The ruler was placed on a flat, firm surface and against a wall. The child was asked to stand barefoot on the ruler's base, with their feet slightly apart. It was ensured that the heels, calves, buttocks, shoulder blades, and occiput were in contact with the vertical plate of the ruler. An assistant gently held the child's knees and heels to keep them upright and prevent tiptoeing. With the child's head in the correct position, the other hand was used to move the head plate to the top of the child's head, gently pressing to flatten the hair. The child's height was recorded to the nearest 0.1 cm.

A body mass index (BMH) from -2 SD to +1 SD was classified as normal. Children with a BMI below -2 SD to -3 SD were categorized as having moderate wasting malnutrition, while those below -3 SD were classified as having severe wasting malnutrition. A BMI above +1 SD was indicated as overweight, and a BMI above +2 SD was classified as obesity (World Health Organization, 2022).

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Students' eating behavior: The school-age children's eating behavior questionnaire was developed based on recommendations from the Vietnam National Institute of Nutrition. The questionnaire consisted of 25 questions covering five key domains: meal frequency, food variety, consumption of fruits and vegetables, intake of sugary and processed foods, and eating habits. Each question was scored on a Likert scale from 0 to 4, corresponding to "Never" to "Always," with higher scores indicating healthier eating behaviors. The total score was classified into three levels: poor (0–49), moderate (50–74), and good (75–100). The questionnaire demonstrated high reliability, with a Cronbach's alpha coefficient of 0.85, ensuring consistency in assessing children's eating behaviors.

Data analysis

The data was analyzed using SPSS 16.0. Descriptive statistics, including frequency, percentage, mean, standard deviation, median, range, minimum, and maximum, were employed to summarize the key variables of interest. A paired t-test was used to compare the intervention group and the control group both before and after the intervention.

Ethical considerations

The study received approval from the scientific committee of Nam Dinh University of Nursing, as well as consent from the parents of the children involved. All students were thoroughly informed about the purpose and details of the study and provided their consent to participate. The information of all students was kept confidential and used solely for research purposes.

Results

Anthropometric characteristics of children

The **Table 1** presents anthropometric characteristics by gender among students. In terms of Weight, 88.8% of students had a normal Weight, while 10.7% were overweight and only 0.5% were underweight. Overweight prevalence was notably higher in male students (9.5%) compared to females (1.2%), but no statistically significant differences was found (P>0,05). Regarding Height, 99.2% of all students were classified as having normal Height, and only 0.8% were stunted, with no substantial gender differences in height observed (P>0,05). The **Table 1** shows that the rates of obesity and overweight are higher among male students than females, with statistically significant differences (P<0.001 and P<0.05, respectively). Most students in both genders had normal BMI (61.8%), and the proportion of moderate malnutrition was very low (2.2%).

Table 1. Anthropometric indices of children.

Indices	Boys		Girls		Total		P-value
	N	%	N	%	N	%	
Weight							
Overweight	57	16.6	7	2.7	64	10.7	>0.05[b]
Normal	286	82.6	247	97.3	533	88.8	
Underweight	3	0.8	0	0	3	0,5	
Height							
Normal	345	99.4	250	98.8	595	99.2	>0.05[b]
Stunting	2	0.6	3	1.2	5	0.8	
BMI classification							
Obese	82	23.7	13	5.1	95	15.8	<0.001[a]
Overweight	64	18.5	57	22.4	121	20.2	<0.05 [a]
Normal	192	55.5	179	70.5	371	61.8	>0.05 [a]
Moderate malnutrition	8	2.3	5	2.0	13	2.2	>0.05 [a]
Total	346		254		600		

[a]: *Chi-squared test;* [b]*: Fisher's Exact test*; ***BMI****: Body mass index.*

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Effect of nutritional education on anthropometric index and eating behavior

The results of the paired *t-test* on anthropometric indices before and after the 2-month intervention are presented in **Table 2**. While slight changes in weight and height were observed within both the intervention and control groups, these differences were not statistically significant (P>0.05). It is important to note that the short duration of the intervention may have limited the ability to detect meaningful changes in anthropometric measures.

The **Table 2** also presents the comparison of nutritional practice scores between the intervention and control groups before and after the two-month intervention. At baseline, there was no statistically significant difference between the two groups (*P*=0.2). However, after the intervention, the intervention group showed a significantly higher mean score (22.50±1.29) compared to the control group (20.30±1.94), with a t-value of 11.64 and *P*<0.001, indicating a meaningful improvement in nutritional practices, following the intervention.

Table 2. The comparison of mean weight, hieght and eating behavior score of student before and after of intervention in two groups.

Variables	Intervention group	Control group	P-value[a]
Weight (kg)			
Before intervention	30.95±9.90[c]	31.09±9.80	0.85
After 2 months intervention	31.16±9.70	31.26±9.70	0.91
P-value[b]	<0.05	<0.05	
Height (cm)			
Before intervention	131.01±10.83	130.63±10.08	0.65
After 2-months intervention	131.89±10.05	131.88±8.90	0.99
P-value	<0.05	<0.05	
Eating behavior score			
Before intervention	16.8 ± 2.38	17.0 ± 2.14	0.2
After 2-months intervention	22.5 ± 1.29	20.3 ± 1.94	<0.001
P-value	<0.001	<0.05	

[a]: Student t-test; [b:] Paired t-test; [c]: Mean±SD.

Discussion

The aim of the study was to examine the effectiveness of a nutrition education intervention provided by trained teachers on the anthropometric indices and nutritional practice among students at 2 primary schools in Nam Dinh city, Vietnam.

The study found that the sample was relatively balanced in terms of gender distribution, with 57.7% male and 42.3% female students. This distribution is consistent with findings from the 2019 National Health and Nutrition Survey by the Ministry of Health, Labor, and Welfare, which reported similar gender ratios in school-based nutritional studies (Ministry of Health Labor and Welfare, 2019). However, some previous research, such as the Shokuiku program in Japan, has shown a higher proportion of female participants in nutrition-related interventions, possibly due to greater interest and engagement in health-related activities among female students (Miyoshi *et al.*, 2012).

The slight male predominance in this study may be influenced by factors such as school enrollment trends, parental perceptions of nutrition education, or cultural influences on dietary habits (Benavides *et al.*, 2021, Benítez-Andrades *et al.*, 2020). To ensure a more balanced representation in future studies, targeted recruitment strategies should be considered, including encouraging female students' participation through school campaigns and parental involvement. Additionally, gender-specific approaches to nutrition education should be explored to enhance engagement and effectiveness for both boys and girls.

The study results indicate that 10.7% of children

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are overweight, with a higher prevalence in males (9.5%) than in females (8.3%). Additionally, only 0.5% of children were underweight, and 0.8% were stunted. The BMI further revealed that 20.2% of children were overweight, 15.8% were obese, and 2.2% exhibited moderate malnutrition. These findings suggested a shifting nutritional trend, with a higher prevalence of overweight and obesity than undernutrition. This trend aligns with previous studies in Vietnam, such as research conducted by Trang *et al*., which found increasing rates of overweight and obesity among school-aged children in Hanoi (Tran Thi Huyen Trang *et al.*, 2017). Additionally, global reports from UNICEF indicated that many developing countries are experiencing a nutrition transition, where traditional undernutrition concerns are now accompanied by rising childhood obesity rates (UNICEF, 2018). Similar patterns have been observed in European countries, where severe obesity among primary school children varies across different regions, as highlighted by Spinelli *et al*. (Spinelli *et al.*, 2019).

The increasing prevalence of overweight and obesity can be attributed to multiple factors, including shifts in dietary patterns, reduced physical activity, and urbanization-related lifestyle changes. Studies on Vietnam's nutrition transition have shown that increased consumption of processed foods, higher calorie intake, and reduced engagement in outdoor activities contribute to this issue (Harris *et al.*, 2020). To address these concerns, multifaceted interventions are required, including school-based nutrition education, parental involvement, and policy measures promoting physical activity and balanced diets.

The study revealed a significant improvement in students' eating behavior following the 2-month school-based nutrition education intervention. This aligns with the findings by Raut *et al* (Raut *et al.*, 2024) who observed improved dietary quality among adolescents aged 12–19 after structured education. Similarly, Cotton *et al*. emphasized the effectiveness of teacher-led nutrition programs in positively influencing elementary school children's eating habits (Cotton *et al.*, 2020). These results underscore the important role of school-based interventions in modifying dietary behavior early in life.

Behavior changes in children likely occurred through multiple mechanisms, including improved knowledge, repeated exposure to healthy food messages, reinforcement by teachers during meals and classroom activities, and peer influence. Role modeling by both teachers and classmates also likely contributed to greater acceptance of vegetables and healthy choices. For example, students were encouraged to try new foods, select nutritious options, and reduce junk food intake through interactive weekly lessons and practical meal guidance. These strategies are consistent with findings from interventions in Ghana (Antwi *et al.*, 2020) and Peru (Cusquisibán-Alcantara *et al.*, 2024), which highlighted the importance of increasing knowledge, improving attitudes, and engaging both school and family environments to achieve behavior change.

Despite improvements in eating behavior, the study found no statistically significant changes in anthropometric indices (weight and height) between the intervention and control groups at pre- and post-intervention (P>0.05). This result contrasts with prior research by others (Bidira *et al.*, 2022, Majamanda *et al.*, 2014) which demonstrated measurable improvements in growth following longer-term interventions. One plausible explanation is the short duration of this study - only two months - which may not have allowed sufficient time for physiological changes to manifest (Puentes *et al.*, 2016). Anthropometric indices such as BMI and height often require sustained nutritional changes over several months to reflect meaningful improvements. For example, Hall *et al*. noted weight and height gains only after a 17-month program among Vietnamese school children (Hall *et al.*, 2007). As such, the present study may have been underpowered to detect small but meaningful changes in growth over a short timeframe. This highlights a potential Type II error, where true effects exist but were not detected due to insufficient follow-up duration.

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The BMI classification results, however, do offer important insights into the nutritional transition occurring in Vietnamese children. The data showed that 20.2% of participants were overweight and 15.8% were obese, while only 2.2% exhibited moderate malnutrition. Boys showed a higher prevalence of overweight and obesity than girls (Tran Thi Huyen Trang *et al.*, 2017, UNICEF, 2018). These results reflect a broader trend of rising childhood obesity, also observed in Europe (Spinelli *et al.*, 2019), driven by lifestyle changes, increased consumption of processed food, and reduced physical activity (Harris *et al.*, 2020).

One limitation of this study was the relatively short intervention and follow-up period, which likely restricted the ability to detect significant changes in anthropometric outcomes. Future studies should be extended the intervention duration to six months or longer and incorporate periodic follow-ups to assess sustainability of behavioral and physiological changes. Additionally, greater integration of family and community participation could enhance long-term impact, as supported by Majamanda *et al*. (Majamanda *et al.*, 2014).

Finally, policymakers should consider incorporating structured nutrition education into national school curricula, training teachers on content delivery, and fostering stronger school–parent collaboration. These findings support global recommendations from the WHO and UNICEF advocating for consistent, long-term interventions to address the dual burden of malnutrition and obesity in school-aged populations (UNICEF, 2018, World Health Organization, 2022).

Conclusion

This study shows that a well-structured nutrition education program can improve children's eating behavior. The findings emphasize the importance of equipping educators with comprehensive training and resources to teach nutrition effectively. By implementing this program in schools, it could have a lasting positive effect on the healthy eating habits of Vietnamese children, potentially benefiting them throughout their lives.

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Authors' contribution

All authors involved to conceptualization, data curation, analysis, investigation, validation, writing original draft & editing of manuscript. Also, all of them approved the final version of it for publication.

Conflict of interest

The authors declared no conflict of interest.

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