Original

Evaluating a School-Based Nutrition Education Program to Improve Breakfast Habits Among Sixth-Grade Students: Efforts Targeting the Transition Period Between Elementary to Junior High School in Osaka, Japan

Taro Nishi[1], Risa Hatanaka[2], Tomoko Okita[3], Ashleigh Pencil[1], Natsumi Motokawa[1], Katsushi Yoshita[1], Tomoe Fukumura[1], Naomi Hayami[1*]

[1]*Graduate School of Human Life and Ecology, Osaka Metropolitan University, Osaka, Japan*
[2] *Takaishi Municipal Kamo Elementary School, Takaishi, Japan*
[3]*Osaka Municipal Higashishoji Elementary School, Osaka, Japan*

ABSTRACT *Background and purpose.* Breakfast consumption is crucial for children's health and academic performance. However, the tendency to skip breakfast increases during the transition from elementary to junior high school. Despite existing efforts to encourage breakfast consumption, few programs have successfully integrated nutritional education into the transition period. This study evaluated a school-based nutrition education program designed to improve breakfast habits among sixth-grade students. *Methods*. A pre–post intervention study was conducted with 119 students from two public elementary schools in Osaka, Japan. The program included three lessons on the importance of breakfast, balanced meal compositions, and strategies for maintaining healthy eating habits. Breakfast records and self-administered questionnaires were used to assess the changes in breakfast intake, composition, knowledge, self-efficacy, and attitude. *Result*. While breakfast-skipping rates showed no significant change, breakfast records indicated increased consumption of staple foods ($p = 0.041$) and side dishes ($p < 0.001$). Self-efficacy in preparing a balanced breakfast ($p = 0.045$) and willingness to improve breakfast habits ($p = 0.044$) also improved. The results of classroom evaluations demonstrated that the program was well understood and perceived as highly useful by the participants, supporting the effectiveness and practical relevance of the instructional approach. The program effectively improved the students' breakfast quality and self-efficacy, thus supporting school-based nutrition education as a strategy to promote healthier eating habits. However, long-term interventions and evaluations may be required for sustained behavioral changes.
Keywords: nutrition education, breakfast habits, school-based intervention, self-efficacy, dietary behavior

INTRODUCTION

Breakfast consumption is a fundamental lifestyle behavior that supports children's daily energy requirements and contributes to a well-balanced nutrient intake essential for growth and development (1,2). Numerous studies have demonstrated that children who regularly consume breakfast have improved physical, cognitive, and psychosocial aspects (3-7). For example, breakfast consumption has been reported to positively influence academic performance, attention, problem-solving ability, and memory (3,4). On the other hand, skipping breakfast has been associated with obesity, an increased risk of lifestyle-related diseases, and a decline in self-efficacy (5-7).

In Japan, skipping breakfast is recognized as a critical issue in children's health. The Ministry of Agriculture, Forestry and Fisheries, in its "Fourth Basic Plan for the Promotion of Shokuiku," has set a national goal of reducing the breakfast-skipping rate among children from 4.6% in 2019 to 0% by 2025 (8). Moreover, the rate of skipping breakfast among those aged 15–19 years was 21.5% in 2020, with the aim of lowering it to less than 15% by 2025 (8).

A survey of Japanese elementary and junior high school students found a significant increase in breakfast-skipping with age (9). While the rates among 5th and 6th graders were 7.6% for boys and 8.9% for girls, these figures increased to 16.8% and 17.1% respectively, among junior high school students. This trend may be attributed to multiple factors, including lifestyle changes during adolescence, family environment, and differences in self-care capabilities (10,11).

In Japan's elementary school curriculum, students in the 4th grade learn about the relationship between food and health, and those in the 6th grade study the importance of breakfast (12). However, no corresponding curriculum exists for junior high schools. This discontinuity in educational content may hinder the continuation of dietary education. Given that the rate of breakfast-skipping increases during the transition from elementary to junior high school, the importance of interventions during this period has been suggested (13,14).

Previous studies have reported the effectiveness of interventions that promote breakfast consumption.

School-based programs, family involvement, and the incorporation of self-monitoring have been identified as key factors in enhancing the program impact (15). Individuals with high self-efficacy, as proposed by Bandura (1997) (16), are less likely to skip breakfast (17). According to the PRECEDE-PROCEED model developed by Green et al., to improve breakfast consumption behavior, programs should incorporate self-checking and self-monitoring strategies that foster self-efficacy, which is closely related to motivation for behavioral changes (18). In addition, these programs should aim to enhance children's decision-making and goal-setting skills.

A nutrition education program for upper-grade elementary school students was developed based on the PROCEED-PRECEED MODEL (19). The program aims to foster life skills, which are psychosocial abilities that enable individuals to cope effectively and constructively with the demands and challenges of everyday life, as defined by the World Health Organization (20). They argued that improving self-efficacy contributes to the enhancement of life skills such as decision-making and goal setting, which in turn can lead to increased self-esteem and improvements in both the frequency and quality of breakfast consumption (19,21).

This study aimed to evaluate the effectiveness of the elementary school component of a school-based breakfast nutrition education program that was collaboratively developed and implemented by elementary and junior high schools within the same administrative district. This empirical study focused on changes in breakfast intake, breakfast composition, and self-efficacy among elementary school students. Sixth-grade students were selected as the target group because the prevalence of breakfast skipping tends to increase upon transition to junior high school.

MATERIALS AND METHODS

Study Design

A before-and-after comparative design was implemented among 119 sixth-grade students from two public elementary schools in Osaka City, Japan, between June and December 2022. The intervention was designed as a nutrition education program for sixth-grade elementary school students. The intervention was conducted in two elementary schools within the same administrative district of Osaka City that provided consent to participate. Anonymous self-administered questionnaires were administered to the participants before and after the intervention in the classroom and were collected by the researchers after completion. Additionally, the students recorded their breakfast intake and composition for five days before and after the intervention.

Instrument

The original questionnaire developed for this study included three main sections: habits related to breakfast intake and actual breakfast composition; knowledge, self-efficacy, and attitudes related to breakfast intake and composition; and classroom process evaluation (post-intervention only).

Breakfast composition was defined as the presence of staple food, main dish, and side dish. The habits related to breakfast intake and composition section covered the frequency of breakfast preparation per week, morning appetite, and the percentage of intake of staple foods, main dishes, and side dishes. To assess the percentage of intake, the participants were asked whether they habitually consumed staple foods, main dishes, or side dishes during breakfast. Breakfast records were used to calculate the average consumption of these components based on five-day records maintained by the students.

For breakfast scores, one point was assigned for the consumption of each component (staple food, main dish, and side dish), resulting in a total score ranging from 0 to 3 for each questionnaire and recording. The knowledge, self-efficacy, and attitudes related to breakfast intake and the composition section assessed multiple aspects, including knowledge of the benefits of breakfast, perceived importance of daily breakfast consumption, and various dimensions of self-efficacy (e.g., eating breakfast daily, independently preparing breakfast, planning a nutritionally balanced menu, and prepar-ing a balanced meal, including staple foods, main dishes, and side dishes). Additionally, the willingness to improve breakfast habits was evaluated. The test scores for the five macronutrients measured the students' knowledge of their functions and nutritional content.

The classroom process evaluation section included items on the overall comprehension of the lessons, clarity of instructional materials, perceived usefulness of the three lessons in daily life, and the application of learned concepts and was conducted incorporating the concept of life skills (19). The questionnaire was reviewed in collaboration with schoolteachers and revised to ensure clarity and appropriateness for student comprehension. Homeroom teachers distributed the questionnaires and supervised questionnaire completion in classrooms, with an estimated completion time of approximately 20 mins.

Intervention

The program content was developed in collaboration with nutrition teachers from the target elementary schools, based on the findings of the pre-survey. Three classes were conducted between July and November 2022. The schedules and content of these classes are listed in Table 1. The results of the questionnaire and breakfast records before and after the intervention were compared.

The classes comprised of three key components: discussing the importance of breakfast, reflecting on a

balanced breakfast, and exploring methods to maintain a balanced breakfast. The program was designed to enhance students' self-efficacy through a stepwise approach across three sessions, incorporating self-directed learning and worksheet-based activities. The specific class content and teaching materials used are listed in Table 1. Each 45-minute session was structured into two segments: the first focused on knowledge dissemination, and the second involved interactive and creative activities.

Ethical Considerations

This study was approved by the Ethics Committee of the Graduate School of Human Life Science, Osaka City University (Approval No. 22-18).

The importance of breakfast

In Japanese nutrition education, fourth-grade students learn about the significance of breakfast and its role in daily life. The intervention class (targeting sixth-grade students) aimed to review this knowledge and empower students to convey the importance of breakfast to their peers as senior students. Specifically, they participated in the creation of Karuta (a traditional Japanese card game), with each student responsible for two of the 50 hiragana characters. The completed works were compiled on decorative paper, displayed at school for all students to view, and showcased at a district health exhibition. Examples of the Karuta cards are presented in Figure 1, featuring messages such as "Morning has come, eat your breakfast, and feel full of energy!", "Go to bed early tonight, wake up early tomorrow, and have breakfast."Reflecting on a balanced breakfast

The students explored the concept of a nutritionally balanced breakfast, defined as a meal consisting of staple foods, main dishes, and side dishes. Working in groups of four or five, participants brainstormed various examples of each meal component and recorded their ideas. Subsequently, they reviewed their breakfast records to identify any missing components necessary to achieve a balanced meal.

Methods to maintain a balanced breakfast

Students engaged in a brainstorming session to discuss strategies for consistently consuming a well-balanced breakfast and incorporating staple foods, main dishes, and side dishes as group work activities. At the conclusion of the session, participants established personal goals to enhance their breakfast habits and sustain a nutritious dietary routine.

Statistics Analysis

Descriptive statistics were calculated for each item using Wilcoxon's signed-rank test for ordinal data and McNemar's test for nominal data among the 77 participants who completed both pre- and post-surveys. Breakfast scores and recorded intakes of staple foods, main dishes, and side dishes were analyzed to compare participants' consumption percentages per day before and after the intervention using paired t-tests.

Classroom process evaluations were conducted with the 97 students who participated in the post-survey. As no significant sex differences were observed, all analyses were performed using a combined sample. Statistical analyses were conducted using SPSS Statistics 27.0 (IBM), with the significance level set at 5%.

RESULTS

Questionnaire Collection Rate

There were 107 (89.9%) valid questionnaire responses in the pre-survey period and 104 (87.4%) in the post-survey period. The number of valid responses and collection rates for breakfast records were 113 (95.0%) in the pre-test survey and 105 (88.2%) in the post-test survey. The pre- and post-surveys were compared using data from the 77 participants (64.7%) who provided complete responses to the questionnaire and breakfast records

Habits Related to Breakfast Intake

As shown in Table 2, a difference was observed in the percentage of participants who skipped breakfast before (18.2%) and after (15.6%) the intervention. However, this difference was not statistically significant ($p = 0.625$). No significant changes were observed in the frequency of breakfast preparation per week before or after the intervention ($p = 0.687$). Similarly, there was no significant difference in participants' morning appetite before and after the intervention ($p = 0.518$).

The analysis of breakfast records revealed significant improvements after the intervention. The percentage of students consuming staple foods increased from 80.4% to 88.4% ($p = 0.041$), and side dish consumption increased from 22.1% to 36.3% ($p < 0.001$). Although no significant change was observed in main dish consumption ($p = 0.739$), the overall breakfast scores based on the records increased significantly from 1.36 to 1.69 ($p < 0.001$). By contrast, the questionnaire results indicated no significant changes in the intake of staple foods ($p = 0.500$), main dishes ($p = 0.383$), or side dishes ($p = 0.248$). Similarly, questionnaire-based breakfast scores showed a non-significant increase from 2.13 to 2.31 ($p = 0.099$).

Table 1. Flow and contents of the intervention

Intervention lesson details	Month	Theme	Topics	Tools
Pre-intervention	June			Questionnaire (Pre) Breakfast records for five days.
First lesson (45 minutes)	July	The importance of breakfast	Functions of breakfast, setting lifestyle goals (to have breakfast every day), creation of Japanese Karuta to emphasize the importance of breakfast intake.	PowerPoint materials, handouts, Japanese card game (*Karuta*).
Second lesson (45 minutes)	September –October	Reflecting on a balanced breakfast	Review staple foods, main dishes, and side dishes; brainstorm and write down examples of staples, main dishes, and side dishes; check their own breakfast records and think about personal barriers to a balanced breakfast.	PowerPoint materials, handouts, food models, brainstorming and poster preparation.
Third lesson (45 minutes)	November	Methods to maintain a balanced breakfast	Reviewing the results of the pre-survey questionnaire (percentage of staple foods, main dishes, and side dishes); ideas to include staples, main dishes, and side dishes for breakfast; setting personal lifestyle goals to improve breakfast habits.	PowerPoint materials, handouts, food models.
Post-intervention	December			Questionnaire (Post) Breakfast records for five days

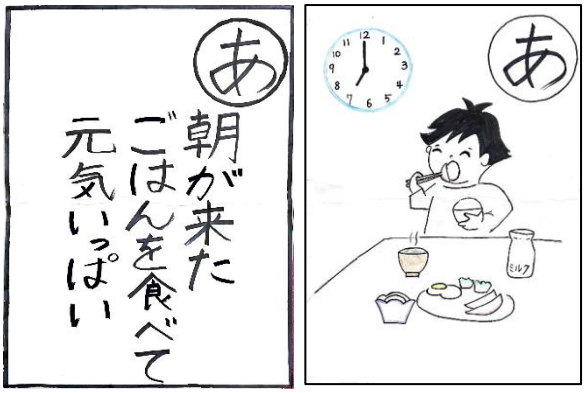

Figure 1. Example of *Karuta*

(Left: Reading card, right: Picture card for “Morning has come, eat your breakfast, and feel full of energy!")

Knowledge, Self-Efficacy, and Attitudes Related to Breakfast Intake

Significant improvements were observed after the intervention with regards to knowledge of the benefits of breakfast ($p < 0.001$), self-efficacy in preparing breakfast with staple, main, and side dishes ($p = 0.045$), and willingness to improve breakfast habits ($p = 0.044$). However, no significant differences were found in the other items (Table 3).

Classroom Process Evaluation

Regarding the overall understanding of the class, 98.9% of the respondents indicated that they understood the class "very much" or "to some extent." Similarly, for ease of understanding the class handouts, 98.9% of the students responded that they found the materials "very easy" or "somewhat easy" to understand. Concerning the perceived usefulness of the lessons, 94.8% answered "very much" or "to some extent" to the statement "The three intervention topics will be useful in life." Additionally, 88.7% of students reported that they reviewed the content learned in class (Table 4).

Table 2. Habits related to breakfast intake (n=77)

Question items and options	Pre-intervention		Post-intervention		*p*-value
How often do you eat breakfast?*					
Everyday	63	(81.8)	65	(84.4)	0.625
Sometimes	14	(18.2)	12	(15.6)	
How often do you prepare breakfast in a week?†					
Everyday	5	(6.5)	6	(7.8)	0.687
4~6 days/week	4	(5.2)	8	(10.4)	
2~3 days/week	20	(26.0)	12	(15.6)	
< 2 days/week	48	(62.3)	51	(66.2)	
Appetite in the morning†					
Very much	22	(28.6)	16	(20.8)	0.518
A little	31	(40.3)	37	(48.1)	
Not much	18	(23.4)	20	(26.0)	
Not at all	6	(7.8)	4	(5.2)	
Percentage of intake of staple foods, main dishes, and side dishes					
Questionnaire*					
Staple foods	74	(96.1)	76	(98.7)	0.500
Main dishes	51	(66.2)	56	(72.7)	0.383
Side dishes	39	(50.6)	46	(59.7)	0.248
Dietary record (percentage of students consuming per day)‡					
Staple foods	62	(80.3)	68	(88.4)	0.041
Main dishes	34	(44.5)	34	(44.5)	0.739
Side dishes	17	(22.1)	28	(36.3)	< 0.001
Breakfast scores‡					
Questionnaire	2.13	(0.864)	2.31	(0.847)	0.099
Dietary record	1.36	(0.655)	1.69	(0.722)	< 0.001

*McNemar's test

†Wilcoxon signed-rank test

‡*t*-test with correspondence (average [standard deviation])

Table 3. Knowledge, self-efficacy, and attitudes toward breakfast intake (n=77)

Question items and options	Pre		Post		*p*-value
Test scores on the five macronutrients*	5.9	(2.5)	6.2	(2.5)	0.171
Knowledge of breakfast benefits†					
Know a lot	27	(35.1)	42	(54.5)	< 0.001
Know a little	36	(46.8)	31	(40.3)	
Don't know much	11	(14.3)	4	(5.2)	
Don't know at all	3	(3.9)	0	(0)	
Perceived importance of eating breakfast every day†					
Very much	51	(66.2)	58	(75.3)	0.217
A little	21	(27.3)	14	(18.2)	
Not much	5	(6.5)	5	(6.5)	
Not at all	0	(0)	0	(0)	
Self-efficacy in eating breakfast every day†					
Very much	57	(74.0)	58	(75.3)	0.415
A little	9	(11.7)	11	(14.3)	
Not much	10	(13.0)	7	(9.1)	
Not at all	1	(1.3)	1	(1.3)	
Self-efficacy in preparing breakfast independently every day†					
Very much	13	(16.9)	14	(18.2)	0.567
A little	35	(45.5)	38	(49.4)	
Not much	22	(28.6)	17	(22.1)	
Not at all	7	(9.1)	8	(10.4)	
Self-efficacy in planning a menu with staple, main, and side dishes†					
Very much	7	(9.1)	7	(9.1)	0.061
A little	25	(32.5)	34	(44.2)	
Not much	31	(40.3)	29	(37.7)	
Not at all	14	(18.2)	7	(9.1)	
Self-efficacy in preparing one's own breakfast with staple, main, and side dishes†					
Very much	4	(5.2)	5	(6.5)	0.045
A little	26	(33.8)	29	(37.7)	
Not much	29	(37.7)	34	(44.2)	
Not at all	18	(23.4)	9	(11.7)	
Willingness to improve breakfast habits†					
Very much	24	(31.2)	31	(40.3)	0.044
A little	31	(40.3)	32	(41.6)	
Not much	20	(26.0)	13	(16.9)	
Not at all	2	(2.6)	1	(1.3)	

**t*-test with correspondence (average [standard deviation])

†Wilcoxon signed-rank test

Table 4. Intervention process evaluation (n=72)

Question items and options	*n*	%
Overall understanding of the intervention program		
Very much	55	76.4
A little	17	23.6
Not much	0	-
Not at all	0	-
Ease of understanding the handouts		
Very much	56	77.8
A little	15	20.8
Not much	1	1.4
Not at all	0	-
The three intervention topics will be useful in life		
Very much	55	76.4
A little	13	18.1
Not much	3	4.2
Not at all	1	1.4
Will you practice what you have learned?		
Yes	64	88.9
No	8	11.1

DISCUSSION

This study suggests that the breakfast improvement program implemented in collaboration between elementary and junior high schools contributed to the improvements in breakfast composition among sixth-grade students through increased knowledge and self-efficacy related to breakfast consumption. Analysis of students' breakfast intake habits revealed that the program had a positive impact, particularly in improving breakfast composition through enhanced self-efficacy. Notably, there was a significant increase in the actual intake of staple foods and side dishes, as confirmed by the one-week breakfast records. This suggests that the instructional sessions contributed to better breakfast composition. Furthermore, classroom process evaluations indicated that the lesson content and materials were well-suited for sixth-grade students. These findings provide preliminary evidence that the program may promote positive dietary behaviors. A strength of this study is that, despite common recruitment barriers in pragmatic intervention research, it implemented a breakfast-improvement program across two schools within one district and grade level. While the absence of a control group presents a methodological limitation, it is nevertheless significant that the implementation of nutrition education in Japanese schools demonstrated potential to improve children's dietary behaviors.

In terms of predisposing and enabling factors, there was an improvement in "Knowledge of breakfast benefits," indicating increased awareness of the importance of breakfast. Additionally, there was an upward trend in "Self-efficacy in planning a menu with staple, main, and side dishes," and a notable improvement in "Self-efficacy in preparing one's own breakfast with staple, main, and side dishes." These results imply that the program successfully enhanced the students' confidence in designing and preparing a well-balanced breakfast. There was also an increase in "Willingness to improve breakfast habits," suggesting that the program helped reduce the perception of breakfast as a burden. These results suggest that the program successfully enhanced the students' confidence in designing and preparing a well-balanced breakfast. This aligns with the concept of self-efficacy, which plays a crucial role in behavior change (16). However, the questionnaire results indicated no significant changes in the frequency of breakfast consumption, breakfast preparation, or morning appetite over a week. Given that the questionnaire assessed habitual behaviors, these results imply that the improvements observed in breakfast composition did not translate into sustained habitual changes. The relatively short intervention period of

approximately three months and the limited number of instructional sessions may not have been sufficient to induce long-term behavioral changes, as supported by previous studies indicating that short-term interventions often fail to produce substantial modifications (21,22). In contrast, programs implemented multiple times per year yielded more significant improvements (23,24).

Although no statistically significant changes were observed in breakfast consumption frequency, the percentage of students eating breakfast daily increased from 81.8% before the intervention to 84.4% after the intervention. This compares favorably with the national average of 81.4% (25). The high baseline adherence to breakfast consumption in the target group may have contributed to the lack of significant changes. Nevertheless, as the primary objective of this program was to prevent an increase in breakfast-skipping rates as students transitioned to the next grade level, the absence of significant deterioration suggests that this goal was achieved.

A previous study using self-administered questionnaires targeting sixth-grade students reported intake rates of 91.7%, 53.1%, and 44.8% of staple foods, main dishes, and side dishes, respectively (26). Participants in the present study exhibited similar or relatively high intake frequencies of these food groups before the intervention. Regarding breakfast balance, the questionnaire results indicated no significant changes in the intake of these components. However, breakfast records over a one-week period demonstrated significant increases in the intake of staple foods and side dishes, highlighting the short-term effectiveness of the instructional sessions (27,28). While the questionnaire captured habitual dietary behavior, the records reflected actual consumption, suggesting that although breakfast composition improved temporarily, these changes had not yet become habitual (29).

Similarly, regarding breakfast scores, no significant changes were found in the questionnaire responses. However, significant improvements were observed in the scores based on breakfast records. This pattern, which is consistent with the results for breakfast balance, suggests that the instructional sessions led to temporary improvements in breakfast composition. However, these did not develop into long-term habitual modifications. This again implies that, although students improved their breakfast composition immediately following the instructional sessions, these changes did not lead to sustained behavioral modifications (30,31).

Regarding the evaluation of the instructional process, classroom observations and student feedback indicated that the clarity of the lessons and materials was appropriate for sixth-grade students. However, some students reported that they found the lessons to have limited applicability to their daily lives or that they had not reviewed the materials after class (32,33). These responses suggest the need for more relatable and engaging content to enhance the program's impact.

Future interventions should consider increasing the frequency of sessions and integrating practical components to enhance the perceived relevance and sustainability of breakfast-related behavior changes (34). Implementing such programs in a coordinated manner across elementary and junior high schools may further enhance their impact. Employing a controlled study design will also be important to more accurately evaluate the effectiveness of the program. Sustained or repeated exposure to such programs within the same community is expected to promote healthy breakfast habits in children.

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CONFLICT OF INTEREST

The authors no conflict of interest to disclose.

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