

Always Open, Seven-Eleven: Education Targeting Healthier Food Choices in a High Convenience Store Density Area in Taipei

Chia-Liang Dai^{1,*}, Ching-Ying Chen², Ziying Wang³ and Cheng-Liang Chang²

¹University of Nevada, Las Vegas, 4505 S Maryland Pkwy, Las Vegas, NV 89154, USA

²University of Taipei, New Taipei City, Taiwan

³University of Macau, Macau

Abstract: To enhance children's health, the promotion of nutrition literacy in school is vital as it helps prevent the development of health conditions and diseases and maintain healthy lifestyles. Taiwan features the top highest ratio of convenience stores per population density. Convenience stores, an increasingly popular dining place, were linked to the development of eating behavior and body weight issues in children. An eight-week classroom-based nutrition intervention, employing the Traffic Light Diet as a framework, targeting children's perception of and intention to visit the convenience store was implemented. The study conducted a quasi-experimental pretest-posttest research design with a comparison group. A total of 49 students participated in the study, with 25 in the intervention and 24 in the comparison group. Data were collected by utilizing surveys, interviews, and observations. The study's findings demonstrated the positive trajectory of the impact of this intervention on increasing food-and-nutrition-related knowledge and improving healthier diet choices at convenience stores among children. One main theme was identified in coding interviews: parent involvement in meal preparation may reduce convenience store use and increase consumption of vegetables among children. Assessing the influence of parental support for healthy dietary choices, eating nutritious foods at home, and involving the family in meal preparation is an area for future research.

Keywords: Child health, corner store, eating behavior, healthy eating, nutrition education, nutrition literacy, skill-based, Traffic Light Diet.

INTRODUCTION

The prevalence of childhood obesity has remained high worldwide [1] and is a major health concern in Taiwan as well. The latest national health data in 2020 showed that the prevalence of overweight and obesity among Taiwanese elementary school students was 25.4% [2]. Obesity has far-reaching negative impacts on physical and psychosocial health outcomes. Overweight and obesity are associated with the development of chronic diseases, such as hypertension, diabetes, breathing problems, cardiovascular disease, and musculoskeletal discomfort [3, 4]. Children who are overweight are at risk for psychological comorbidities, including decreased neurocognitive functioning, low self-esteem, depression, and emotional and behavioral disorders [5, 6]. Obesity may be chronic, as research has indicated that children who are obese are likely to be obese and face the aforementioned chronic health conditions as adults [7].

Several environmental and behavioral variables are related to an "obesogenic lifestyle." Chief among these are overeating high-calorie foods [3]. Frequent "dining out" and eating "fast foods" are key determinants of overweight and poor nutrition for children [8]. The

dining-out rate remains high in Taiwan, with a fairly recent study finding that more than 60% of children were dining out for breakfast and dinner regularly [9]. Moreover, the environment is rich in fast-food access, as Taiwan features among the top highest ratio of convenience stores per population density in the world (roughly one per 2,300 citizens), and this ratio has been increasing annually [10]. Convenience stores, an increasingly popular place for dining due to their quick service and easy access, have been linked to the development of unhealthy eating behavior and body weight issues in children [11]. Yoon and Shon [11] suggested that convenience stores typically offer food options like high-fat fast food, salted or sugar-added snacks, and sugary drinks, and children who frequently patronize convenience stores tend to develop unhealthy diet patterns and eating behaviors. In turn, this contributes to being overweight. Interventions teaching children about healthy eating may help them in learning healthy good choices so that they can make healthier food choices at convenience stores or eat at home more often. Improving healthy eating behaviors is vital in preventing childhood obesity and improving children's health in Taiwan.

Dietary habits formed in childhood have a profound impact on weight-related outcomes in adulthood [12]. Schools may be optimal settings for implementing health education interventions to educate children

*Address correspondence to this author at the University of Nevada, Las Vegas, 4505 S Maryland Pkwy, Las Vegas, NV 89154, United States; Tel: 702-895-1388; E-mail: chia-liang.dai@unlv.edu

about nutrition and healthy lifestyle choices [13]. Jung *et al.* reported that the delivery of nutrition education in schools facilitated knowledge change and healthy eating among youth [14]. Similarly, A review of research in the field demonstrated that nutrition programs offered in schools or alteration of the food environment in schools were associated with increased fruit and vegetable consumption among students [15].

The Traffic Light Diet [16] is a healthy eating program in which children learn the caloric and fat value of foods using a stoplight, categorizing foods into "green" or "go" foods (e.g., broccoli, tomatoes, oranges, foods that are high in vitamins, fiber, and minerals, and low in fat, which one can eat frequently), "yellow" or "slow down" foods (e.g., dairy foods, pasta, which should be eaten in moderation), and "red" or "stop" foods (e.g., cookies and fried foods that are high in calories and low in nutrients and should be eaten with consideration). Prior studies promoting healthy eating in the context of the school had demonstrated the feasibility and effectiveness of the application of the Traffic Light Diet in nutrition education interventions [17-19]. In the current study, the concept of Traffic Light Diet was intertwined within the lesson units in this intervention (Table 1) to disseminate and reinforce healthy eating choices in children.

The current study examined an application of the Traffic Light Diet [16], with weekly lessons reviewing this program, which was delivered in classrooms for students in the third grade in Taipei, Taiwan. The current study aimed to (1) determine if there was a change in knowledge related to program participation, (2) evaluate whether children's perceptions of convenience stores changed after participating in the program, and (3) assess children's intention to shop for food at convenience stores after participating in the intervention.

METHODS

Participants

The current study recruited 49 third-grade students from an elementary school in Taiwan using the convenience sampling method. The comparison group consisted of 24 students (12 boys and 12 girls) who were recruited from a class at the same grade level as the intervention group. A total of 25 students (15 boys and 10 girls) participated in the intervention, ranging in age from 9 to 10 years. Of these participants, six participants resided in low-income families in receipt of government subsidies of breakfast coupons for their

use at convenience stores; eight participants reported living in a single-parent household.

Intervention

Sessions were delivered once per week for eight weeks. Activities focused on disseminating information from the Traffic Light Diet [16]. Lessons featured information on the nutritional value of different foods, recognizing processed ("fast foods") versus foods with nutritional value, learning to review food labels to assess nutritional value, and reviewing the calories and fat in different types of foods. Categorizing food into green, yellow, and red foods based on each food's nutritional value, understanding that food additives are not healthy (Table 1). During the lessons, students also reviewed the school lunch menus and learned about the nutritional value of these meals. The group leader also discussed ideas for the preparation of healthy meals at home during educational sessions. Children had an opportunity to practice making a healthy purchase at a convenience store. Additionally, children planted and grew vegetables, including bean sprouts, and planted bok choy, cherry tomatoes, and other vegetables. Children took their produce home to be included in their meals.

Procedures

The study was approved by a university-based Institutional Review Board. Parental consent and child assent were required for study participation. Children in the intervention and comparison groups attended one elementary school in Taipei, Taiwan, located within an area with many nearby convenience stores. Children in the intervention group were in a classroom identified by teachers, and they received one 40-minute lesson per week for eight weeks (see Table 1 for educational topics). The objectives of weekly lesson plans were aligned with city health education curriculum standards. Children in the comparison were recruited from other classes in the same school, and they did not participate in an educational intervention related to improving nutrition knowledge. Children completed questions on teaching materials (writing answers) to different questions. Children also completed post-intervention surveys and post-intervention interviews.

Measures and Data Collection

Data were collected by employing surveys and interviews. Participants' answers to teaching handouts also were analyzed using qualitative methods. The data collection tools were developed based on relevant

Table 1: Overview of Weekly Nutrition Lesson Plan of the Intervention

Week/Lesson	Lesson Topic	Content and Activities
1	Overview of Traffic Light Diet	Children viewed video clips to learn about the Traffic Light Diet. Children practiced classifying green/red/yellow light foods.
2	Traffic Light Diet	Children reviewed healthy foods and eating habits using the concept of green/red/yellow light foods. Children discussed their eating behaviors and areas for improvement.
3	Convenience Store Field Trip - Nutrition Label	Children took a field trip at the convenience store. Children learned about reading nutrition labels on the food package they had purchased.
4	Convenience Store - Processed Food	Children learned about the concept of food additives. Children practiced distinguishing processed food and natural food they observed in the convenience store. Children engaged in planting vegetables in class.
5	Balanced Diet - MyPlate	Children viewed video clips of the healthy eating pyramid and MyPlate. Children discussed balanced diets in small groups.
6	Application of Traffic Light Diet - Meal Preparation	Children reviewed the concept of the Traffic Light Diet and the MyPlate. Children applied the learned nutrition literacy to plan a weekly healthy breakfast menu.
7	Healthy Vegetable Planting	Children visited the school farm/garden and observed the plants at the farm. Children partook in the vegetable planting activity.
8	Reflection	Children reflected on what they had learned in the Traffic Light Diet by writing or drawing pictures. Children engaged in planting activities (e.g., sprouting mung beans) and sharing their experiences.



literature in the field and previous research assessing consumers' perceptions of buying food at convenience stores [20]. Nine questions examined participants' perceptions of food at convenience stores (see Appendix A for survey items). Participants rated their responses on three-point scales (0 = disagree, 1 = neutral, 2 = agree). Higher scores indicated more

favorable perceptions of the food and shopping for food at convenience stores. Seven items assessed intentions to purchase food at convenience stores (see Appendix), and ratings were made on a three-point scale from disagreeing to agree. Again, higher scores indicated a higher level of intention to purchase foods at a convenience store. Another question examined the

reported number of times participants visited a convenience store in the last week. Also, there was an open-ended question in the questionnaire asking participants what they plan to purchase at convenience stores if they receive NT\$50 (see Appendix).

A semi-structured interview (Appendix) was conducted to explore participants' food preparation at home and eating behaviors outside the school (e.g., breakfast and dinner), as well as their food preferences. These interviews intended to understand students' daily eating behaviors and further probe into the underlying reasons for such eating habits. Sample questions of the interview include: "Who prepares breakfast for you on school days? What kind of food do you usually eat for breakfast? What is your favorite dish in your family's cooking? Are there any other foods you prefer not to eat?"

Data Analysis

Statistical analyses were completed using SPSS Statistics version 28 software, and alpha levels were set at $p < 0.05$. Repeated measures ANOVAs were utilized for quantitative data analysis to compare pre- and post-intervention perceptions of and intentions to visit the convenience store for the intervention versus the comparison group. Three researchers reviewed transcripts of the interviews using an open coding process to determine themes in the data; disagreements were resolved using consensus [21]. Children's responses to class assignments (e.g., handouts or worksheets with written answers for reflection questions and journaling) were analyzed as a second source for triangulation purposes.

RESULTS

Results did not show statistically significant differences in students' perceptions of convenience stores and intention to visit the convenience stores at the end of the intervention between intervention and comparison groups (Table 2). As for children's reliance on convenience stores, we found a very close frequency of visits to convenience stores during the pre and post-assessments. However, some improvements in food-and-nutrition-related knowledge, eating, and purchasing behaviors were found in the intervention group participants at the end of the intervention. For example, pre-assessment data showed that only 28% of participants reported fresh food is what they buy at convenience stores, while this proportion increased to 40% at the post-assessment. Compared to the pre-assessment, the percentage of students patronizing convenience stores for daily meals on weekends dropped from 48% to 36% at post-assessment. On weekends, the proportion of dining out at convenience stores decreased from 48% to 40% at post-assessment. We also observed that the percentage of participants who disagreed that convenience stores are a good choice for breakfast increased from 36% to 52% post-assessment. Last, 44% of participants in the intervention group disagreed that the foods at the convenience stores were healthy at the pre-assessment, compared to 52% at the post-assessment.

From interview data, the main theme was that parents' involvement in meal preparation reduced participants' use of convenience stores and out-of-home eating. Meal preparation at home was also

Table 2: Changes in the Perception of and Intention to Visit Convenience Stores in the Intervention and Comparison Group

Variables	Intervention (n = 25)		Comparison (n = 24)		Group x Time p-value
	M	SD	M	SD	
Perception					
Pre-intervention	12.96	3.45	11.5	3.15	0.13
Post-intervention	12.28	3.16	11.42	3.46	0.37
Change mean scores	-0.68		-0.08		
Intention					
Pre-intervention	5.48	3.16	4.25	2.66	0.15
Post-intervention	5.04	3.17	4.17	2.55	0.29
Change mean scores	-0.44		-0.08		

Note. M = mean; SD = standard deviation; alpha level $p < 0.05$ was used to indicate statistical significance between intervention and comparison groups; scored on a scale ranging from 0 to 2.

0 = disagree, 1 = neutral, 2 = agree; higher scores indicates more favorable perception of convenience stores.

0 = never, 1 = sometimes, 2 = often; higher score indicates higher intention to visit convenience stores.

related to increased green light foods consumption. However, for some children eating at the convenience store meant they could have larger portions that tasted better. For example, S12 said in her interview: "I can eat two bowls of rice along with dishes if I eat outside home. However, I can only eat one bowl at home because I think away-from-home meals are much more delicious than those my grandma cooked at home." The other common reason for not eating at home was that parents were not able to prepare meals at home because they were too busy or unable to cook. One participant, S8 said:

"I go out to buy myself dinner most of the time. My dad is a policeman whose schedule is irregular. He has to work a twelve-hour shift, so he can only have dinner with me on holidays. My mom is a shop manager who always comes home late and cannot prepare dinner for me. Sometimes I want to wait for her to come back home and cook for me, but she just doesn't have time. So we have to eat out."

Another participant, S18 had to dine out as her mother was not physically able to prepare meals. She elaborated:

"My mom hasn't prepared meals for me since my childhood because my dad wouldn't let her do so due to her illness. So on school days, I just get bread at convenience stores for breakfast. Then on weekends, my family eats out or orders take-out."

Participants whose parents simply gave them money for daily meals rather than prepared food for them were more likely to establish unhealthy eating habits. For example, participant S4 revealed his irregular breakfast pattern in the interview:

"My mom gives me NT\$30 per day for breakfast. I usually skip breakfast for two days and save the money for the third day to spend it all at once. As such, I would have enough to buy a single nice breakfast. Like I will buy some potstickers, mini sausage, pork balls, and Oden. On days I skip breakfast, I get very hungry, so I eat a big lunch (free lunch is provided by the school)."

On the other hand, if parents were involved in meal preparation, children tended to eat healthier. For

example, participant S6, whose mother often made different meals for breakfast, reported he liked the food, including scallion pancakes, fried noodles, onigiri, or traditional-style breakfast foods that may be considered old-fashioned as congee. Likewise, participant S16 expressed her preference for eat-at-home:

"My dad is not used to eating out, so I don't like eating out either. My family prefers to have meals at home, and I have only gone out for breakfast twice so far. I think all the food my parents have cooked for me is very tasty and wonderful!"

Participants also discussed vegetable consumption. Green pepper, eggplant, and bitter melon were three of the least favored vegetables. Participants S9 and S18 expressed their dislike for green pepper: "I think green pepper tastes weird." Similarly, S2, S12, and S19 said they didn't like eggplant as it tastes rather soft and rotten, which was nauseating to them. As for bitter melon, most participants reported it was too bitter to eat. Children who reported liking the taste of bitter melon preferred it in a diluted form, saying they would prefer eating it if it was prepared in soup or salad (with sugar on it).

DISCUSSION

Childhood obesity remains an alarming health threat to school students. Continued prevention efforts and effective interventions delivery that can help ameliorate this school health issue are warranted. A highly associated factor with childhood obesity is unhealthy eating behaviors which are modifiable. The current study aimed to implement a brief classroom-based nutrition education intervention designed to promote children's healthy eating behaviors and healthier food choices at convenience stores among elementary school students and further evaluate the effectiveness of this intervention. Specifically, the researchers delivered eight nutrition lessons centered on Traffic Light Diet once per week infused into the health education curriculum, emphasizing nutrition knowledge associated with convenience store purchase behaviors. The current study utilized surveys and interviews in the intervention procedure to better understand children's daily eating behaviors and the potential factors that underlie their reliance on convenience stores.

The statistically significant differences were not found in children's perceptions of convenience stores and purchasing behaviors at convenience stores at

post-assessment between intervention and comparison groups. Perhaps it is uneasy about reducing children's reliance on convenience stores, given that such a high density of convenience stores is available [10]. However, the results from pre-and post-assessments revealed the intervention's positive trajectory of impact on children's awareness of healthy food choices and food-and-nutrition-related knowledge at the end of the intervention. Notably, the study's findings observed that primary caregivers' involvement in meal preparation is linked to children's healthy eating habits and food choices.

Results were consonant with previous research highlighting the importance of parents or caregivers to children's dietary patterns [22]. Although convenience stores have become popular as a daily meal option, most foods provided at convenience stores contain high levels of fat, salt, sugar, or chemical additives [11]. We found that children whose parents prepared at-home meals for them reported performing healthy dietary habits, including less processed food consumption at convenience stores, less food fussiness, and more regular meal frequency. The rising trend of dual-income households may lead to the lack of parent involvement in at-home-meal preparation and increased use of dine-out in children [23]. Future research could involve parents and other family members in learning about nutrition literacy in hopes of leading to healthy eating behaviors in children.

In the intervention, children learn about traffic light foods and how to apply these concepts to differentiate healthy vs. unhealthy foods and processed vs. natural foods at convenience stores. Children showed reduced favorability toward convenience stores after intervention participation emphasized the discussion of food and product at convenience stores. Further, with nutrition knowledge and skills mastery, children also practiced meal preparation to reduce their reliance on convenience stores. These positive changes in nutrition-related literacy and healthy dietary behaviors were consistent with findings of previous school-based interventions, in which the Traffic Light Diet was adopted and implemented in children [18, 19]. Teaching children about food and nutrition knowledge via a traffic light analogy may help them assess their food choices.

Scholars have suggested that health literacy is an essential skill that influences children's motivation to maintain health [24]. Healthy eating and nutrition literacy programs delivered in the school context have improved children's eating behaviors like informed food

choices, healthy food purchases, elevated consumption of fruit and vegetables, and increased diet quality [25]. Instructing skill-based nutrition education that relates to children and applies to their daily life may promote children's healthy behaviors learning. This intervention offered opportunities for children to employ knowledge learned in the management of dietary-related behaviors and decision-making on food choices in an authentic context. For example, planting/gardening activities provided a cultivation process that connected children with natural food. Convenience stores field trips allowed children to practice applying nutrition-related knowledge and skills at convenience stores. The researchers observed that these skill-based interactive nutrition education activities are well attended by children, in which children's interests in natural foods increased, and children's competence in differentiating natural and processed foods at convenience stores was enhanced.

LIMITATIONS

Some limitations were inherent in the current study. First, this study only focused on a small-size convenience sample in a school, which may generate selection bias and limit the generalizability of the current study's findings. Future research may consider increasing the sample size by recruiting more participants from different grades or schools to boost the representativeness and generalizability of findings and to unveil the potential age and gender differences in behavior changes associated with intervention participation. Second, the study utilized a quasi-experimental design, including a comparison group with age-matched participants. Future research conducts rigorous study designs like randomized controlled trials are needed. Multiple data collection time points should also be conducted in future studies to assess the lasting effect of the intervention on targeting outcomes.

CONCLUSION AND IMPLICATIONS

The intervention integrates a skills-based approach that allows children to apply learned nutrition knowledge to practice dietary-related activities and behaviors. Policies that promote nutrition-related activities and nutrition-infused curricula in schools are essential to provide children with access to healthy eating concepts and practices. The profound effects of parent involvement in children's eating behaviors are identified in this study. Children whose parents prepare meals at home tend to depend less on convenience

stores for daily meals. It is vital to engage parents in nutrition education programs and encourage them to learn about nutrition literacy which may increase the program's effectiveness as well as the healthy eating patterns in children.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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APPENDIX. SURVEY AND INTERVIEW

Survey: Assessments regarding participants' perception of convenience stores

Items

1. I feel that the service offered at the convenience store is friendly
2. I feel that the convenience store is very clean
3. I feel that the convenience store offers low prices on goods
4. I feel that the convenience store offers good quality goods
5. I feel that the convenience store offers a variety of goods
6. I feel that the commercial for the convenience store is very attractive
7. I feel that the convenience store offers nutritious food
8. I feel that the convenience store offers tasty food
9. I feel that the convenience store satisfies my needs

Survey: Assessments regarding the participants' purchase intention in convenience stores

Items

1. I think purchasing breakfast in the convenience store is quick

2. I dine in or take out my breakfast at the convenience store
3. I shop at the convenience store after school
4. I dine in or take out at the convenience store during the weekend
5. I am willing to wait in line at the convenience store
6. When I don't know what to eat, I choose to visit the convenience store
7. I like to hang out with friends at the convenience store

Interview questions concerning food preparation and eating behaviors at home:

1. Who prepares breakfast for you on school days? What kind of food do you usually eat for breakfast? What about your breakfast on weekends and holidays? Who prepares breakfast for you? Or do you go out to eat? Who prepares dinner for you on school days? What kind of food do you usually eat for dinner?
2. What is your favorite dish in your family's cooking? Do you eat green pepper, eggplant, or bitter melon? Other than these vegetables, is there any other food you prefer not to eat?

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