

**Original****Improvement of the Vietnamese school lunch menu**

Nguyen Van Diep<sup>1</sup>, Nguyen Mai Phuong<sup>1</sup>, Nguyen Huong Giang<sup>1</sup>, Ta Thi Ngoc<sup>1</sup>, Ngo Thi Thu Hien<sup>1</sup>,  
 Nguyen Thu Trang<sup>1</sup>, Le Thi Huong<sup>2</sup>, Yamamoto Shigeru<sup>1</sup>

<sup>1</sup> *Jumonji University, Saitama, Japan*

<sup>2</sup> *Hanoi Medical University, Hanoi, Vietnam*

**ABSTRACT:** *Background and purpose:* School lunch programs have been developed and implemented in various countries with the purpose of contributing to healthy mental and physical development of children. In Vietnam, primary school lunch program started in 1980 but effects of this program are still limited. At present, in public schools in Vietnam, there is no school dietitian, so school lunches are not well-planned and not attractive to children. As a result, there is a large amount of food waste, especially vegetables, and many children do not eat lunch at school. From our previous experiences, we thought that factors for poor taste were; 1) lack of food materials and 2) rough cutting. In this study, we made new menus by improving such points while maintaining cost and evaluated acceptability of students. *Methods:* The study was conducted by cross-over design at a public primary school in a suburb of Hanoi, Vietnam. Fifty students in 5th grade were randomly divided into 2 groups. Five new best menus were developed by increasing variety of materials and choosing suitable cutting methods. To maintain the cost, we reduced quantity of each material but still guaranteed that energy, nutrients, and total amount of vegetables were similar between the 2 menus. One group ate the new menus in first week (5 days) and ate the current menus in second week 2 (5 days). The other group had menus vice versa. Food intake survey and sensory test were conducted every day. *Results:* With the sensory test, the new menus had higher scores for all features: color, smell, taste, texture, and overall ( $p < 0.05$ ). Compared to the current menus, by the new menus, food waste was significantly decreased. Intakes with the current menu and new menus were: energy 509 and 592 (kcal), protein 20.9 and 25.6 (g), lipid 16.7 and 20.1 (g), carbohydrates 69 to 77 (g), fiber 1.1 and 1.9 (g), and vegetables 54.7 and 79.0 (g), respectively. We increased the variety of food ingredients, but by reducing the amount, we could keep the similar cost. The work of cooks increased, but the children enjoyed the food, which encourage cooks to work harder within the working time and the cost did not increase. *Conclusion:* By increasing the variety of food and choosing suitable cutting methods, we were able to make the meals tastier and more attractive with similar cost, and the food consumption of children was increased. We recognized from this study that the placement of school dietitian is the key to improve school lunch.

**Keywords:** School lunch, menu, food variety, food consumption.

**INTRODUCTION**

School lunch programs have been developed and implemented in various countries with the purpose of contributing to the healthy mental and physical development of children. In Vietnam, the primary school lunch program was started in 1980 but the effects of this program are still limited because of difficulties in terms of society and human resources. One of these difficulties is the lack of qualified dietitians to design meals that could provide balanced and tasty meals. At public schools, meals are prepared based on the experiences of the kitchen staff members. However, kitchen staff members are not fully trained in nutrition; they receive only basic knowledge of nutrition and food hygiene from short-term training courses or learn by themselves from textbooks (1). Therefore, although the meals usually consist of 5 dishes such as: a staple food, 2 main dishes, a side dish and a soup, the dishes are monotonous, use a small number of food materials, and have poor food combinations. According to a study comparing school lunches in Vietnam and Japan, while both countries have a similar number of

school lunches about 200 times, Vietnam used only 53 different ingredients but 376 ingredients were used in Japan (2). As a result, with the simple meals and frequent repetition, children tend not to eat well and to waste food, especially vegetables. Moreover, for the same reason, many children decide not to have lunch at school.

Eating a variety of foods is one factor that has been shown to increase food intake (3–6). In addition, food variety is considered a good indicator of nutritional adequacy; it ultimately increases the range of nutrients consumed and the likelihood that a well-balanced diet is achieved. Combining various foods may help to improve school meals in Vietnam. However, in Vietnam, parents must pay for all the school meals and don't receive supports from government. Besides, in each locality, the local government has its own policy on what materials are allowed to be used. Hence, when planning menus, these aspects need to be considered.

In this situation, we thought that if it were possible to combine more food materials to make new menus but still maintain costs and the allowed materials then the school could adopt it and students would consume more. With this hypothesis, we tried to develop some new menus and this study was

\*To whom correspondence should be addressed:  
[nvdiiep.hmu@gmail.com](mailto:nvdiiep.hmu@gmail.com)

conducted to evaluate the acceptability by students at a public primary school in a suburb of Hanoi.

### METHODS

This was a crossover study performed between September and October 2020 at one public primary school in Dong Anh district – suburban of Hanoi, Vietnam.

**Participants:** Fifty students in 5th grade

From a list of 5<sup>th</sup> grade students who ate the school lunch, we randomly chose 50 children and divided them into 2 groups; each group had 25 children. Written informed consent was obtained from parents, and verbal assent obtained from the children.

#### Procedure

##### Step 1: Developing new menus

We collected the current menus and the list of the ingredients that the school allows us to use. Based on this, we developed 10 new menus by increasing the variety of materials (more than 10 kinds/meal) and choose suitable cutting methods to make new food combinations (vegetables with meat/egg/fish, vegetables with rice, and meat/egg). We still used the same seasonings with current menus. To maintain the cost, we reduce the quantity of each material but still guarantee that the energy, nutrients, and total amount of vegetables are unchanged between the 2 menus. After that, we conducted a sensory test with 5 students and chose the best 5 menus.

##### Step 2: Intervention

One group ate new menus for study week 1 (5 days) and ate the current menus for study week 2 (5 days). The other group had menus vice versa.

All the ingredients were provided from the same suppliers for the school in the morning and then were cooked in the school kitchen. The two groups ate lunches in different rooms. After lunch, food waste measurement and a sensory test for both menus were conducted.

#### Instrumentation

##### *Nutrient intake and vegetable consumption:*

A total of 5 data collectors, who were graduate students in the nutrition field, were trained to conduct food measurements for the study. For each day of measurement, each ingredient of each dish was weighed after dividing into the same portions and after eating by a digital kitchen scale (Tanita KD-160) with an accuracy of 0.1g. Energy, protein, fat, carbohydrate, and dietary fiber intake were calculated based on the Vietnam Food Composition table 2007 by Microsoft Excel 2016.

##### *Sensory test:*

Sensory tests were conducted while the new menus were being developed and also during the intervention using a Hedonic 5 point scale. Color, Smell, Taste, Texture, and Overall were evaluated.

#### Data Analysis

IBM SPSS Statistics 26 was used to analyze the data. The normality test was used. The variables were compared by unpaired Student *t*-test and the Mann-Whitney U test. P-values less than 0.05 were considered statistically significant for all the analyses.

**Table 1. Examples of a current menu and a new menu**

<u>Current Menu</u>		<u>New Menu</u>	
Dishes	Ingredients	Dishes	Ingredients
White rice	Rice 130g	Mixed rice	Rice 110g Egg 17g Chayote 10g Carrot 10g
Fried egg	Egg 40g	Meat ball	Minced meat 35g Onion 5g Carrot 5g Tomato 15g Scallion 2g
Stir-fried chicken	Chicken 75g	Stir-fried chicken and vegetables	Chicken 30g
Stir-fried vegetable	Choysum 85g		Choysum 30g Carrot 15g
Soup	Spinach 15g	Soup	Spinach 8g

### RESULTS

Table 2 shows the comparison of the cost and number of food materials between current menus and new menus. Both menus had a similar price, about 14,000 VND but the new menus had more kinds of food materials.

Figure 1 shows the comparison of vegetable intake in the current and new menus. In both menus, we served 100g of vegetables but in the current menu, children only consumed 54.7g vegetables while in the new menu consumed 79g vegetables.

The comparison of the energy and nutrient supply and intake in the current menu and the new menu is presented in Table 3. The amount of supply

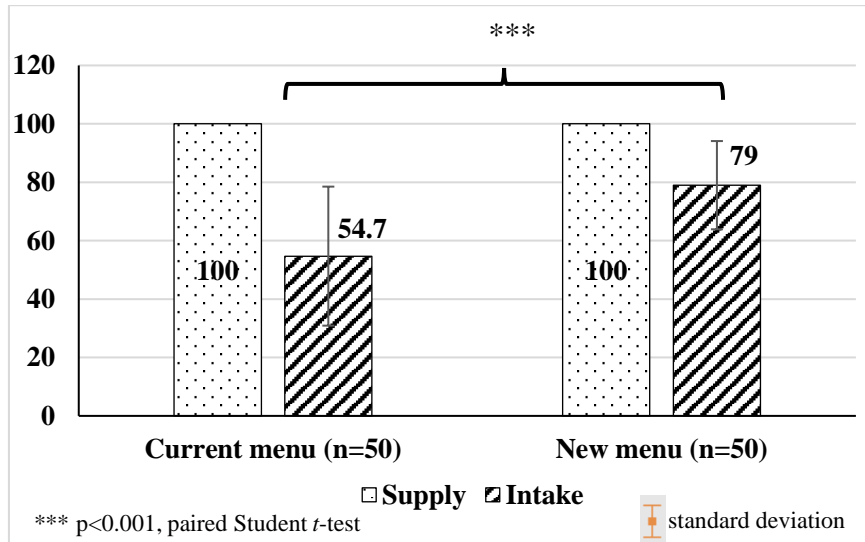
between current menus and new menus had not significantly difference. However, protein, lipid, and carbohydrate intake in the new menu were higher than in the current menu. As a result, the energy intake in the new menu was also higher. The fiber intake in the current menu was  $1.1 \pm 0.3$ g, lower than  $1.9 \pm 0.2$ g in the new menu. All the data had significantly difference.

Figure 2 shows the average scores of the sensory test for both menus. The average scores are the score of 5 menus so the sample sizes (n) is 5. All the features of the new menus were evaluated significantly higher than the current menus.

**Table 2. Comparison of cost and number of food materials between 5 current menus and 5 new menus**

	Current menus (Mean ± SD) (n=5)	New menus (Mean ± SD) (n=5)
Cost (VND)	14021 ± 1528	14320 ± 937
Food materials (number)	5.8 ± 0.4	10.8 ± 0.8*

\*  $p < 0.05$ , paired Student  $t$ -test

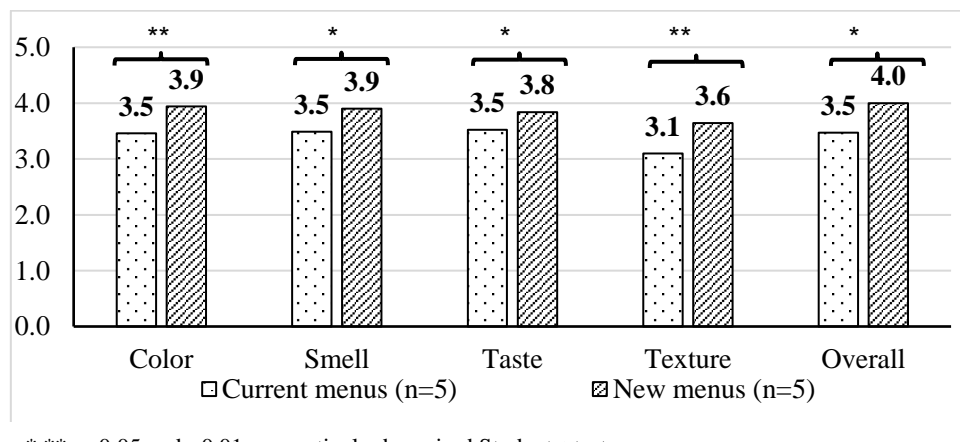


**Figure 1. Comparison of vegetable intake in the current and new menus**

**Table 3. Comparison of energy and nutrient supplies and intakes in the current and new menus**

	Supply		Intake	
	Current menu (Mean ± SD) (n=50)	New menu (Mean ± SD) (n=50)	Current menu (Mean ± SD) (n=50)	New menu (Mean ± SD) (n=50)
Energy (kcal)	612 ± 34	639 ± 32	509 ± 64	592 ± 40*
Protein (g)	25.5 ± 2.4	27.7 ± 4.1	20.9 ± 2.2	25.6 ± 1.5*
Lipid (g)	20.0 ± 3.8	20.7 ± 2.2	16.7 ± 0.9	20.1 ± 0.5*
Carbohydrate (g)	82.4 ± 4.3	85.4 ± 7.5	69.1 ± 13.6	77.2 ± 8.0*
Fiber (g)	1.7 ± 0.6	2.2 ± 0.4	1.1 ± 0.3	1.9 ± 0.2*

\*  $p < 0.05$ , paired Student  $t$ -test



**Figure 2: Average scores of the sensory test for current menus and new menus**

## DISCUSSION

This study has found that students in the new menu group had higher energy, nutrients, and vegetable intakes than the current menu group, suggesting that improving menus by increasing the number of food materials and changing the way of cutting but still maintain the cost to increase the food consumption for children is feasible.

Leftover food from school lunches is a major problem in Vietnam at present. Children waste a lot of food, mainly vegetables. The reason is taste. Although there are 5 dishes in each meal: a staple food, 2 main dishes, a side dish and a soup, the dishes were very simple and monotonous: only 5-6 types of ingredients are used for the whole meal; meat and vegetable are almost always cooked separately; and over-all the appearance of the meals is not eye-catching. Hence, students don't like school meals and tend not to eat well. Moreover, instead of eating at school, many children go home for lunch. With the aim of improving the above limitations, our research group, who are dietitians, designed new menus but still kept the similar price and used ingredients from the list that the school allows to use. We learnt some recipes and food combinations from Japanese school meals, and adapted them to the Vietnamese school.

First, we made the meals more varied, or in other words, we increased the number of food materials. In one meal, we used more vegetables, and increased the total ingredients in the whole meal to more than 10, in accordance with the recommendations of Vietnam National Institute of Nutrition. Food variety is important for the ingestion of a good balance of nutrients and variety within a meal is known to be one of the most powerful ways to increase energy intake. Some studies have explained this behavior by the mechanism of sensory-specific satiety: in a situation with variety, the new foods will be relatively more pleasant than the foods already eaten and thus relatively more is consumed (3,4,7,8). In addition, Wilkinson has argued that variety may affect the cognitive representation of food quantities, which in turn may increase the portions served (9). Similarly, Rolls has shown that having a variety of foods presented in succession during a meal enhances intake, and the more different the foods are the greater the enhancement is likely to be (3). For vegetables, Mennella, Parizel, and Meengs have shown that offering a variety of vegetables in a meal can increase vegetable acceptance compared to offering only one vegetable (10–12).

Secondly, along with the diversity of ingredients, we made more food combinations. Some kinds of vegetable were mixed together and/or mixed with meat/ fish/ egg in the staple food, main dishes and side dishes. The increase in acceptance of food combinations might have been caused by offering a variety of foods differing in color, flavor and texture compared to offering a single food only. Food combinations are emphasized in Japanese school lunches and it has been specified in the School Lunch Act (13) that the combination of foods should always be improved when preparing menu. The newest combination we made was a combination in the staple food that we learnt from Japanese school lunches. In Vietnam, normally the staple food is plain rice only; we changed this to mixed rice, like

“mazegohan” in Japan. We mixed rice with meat or egg and vegetables and then added some spice. This dish provided children with a new sensation; they could taste not just rice but also many assorted flavors and textures blended together. Children were really excited with this dish and ate a lot. Next, De Moura has suggested that even disliked vegetable might become acceptable when they are part of a tasty mixture(14). Thus, we mixed vegetable with some favorite foods of children like meat balls or fried eggs and as a result, students definitely enjoyed them. Baxter has found that size affects children's acceptance of vegetables: small vegetables were preferred to large varieties (15), so in our study, vegetables were cut into small pieces made them easier to eat and they could be hidden inside the meat/egg, or mixed well with other food and spices, making the food more delicious and eye catching. Moreover, Zeinstra has shown that children prefer crunchiness in vegetables (16), so we tried to combining crunchy vegetables like carrots or chayote with a non-crunchy vegetables to increase acceptance. Also, when cooking, we tried to keep the crunchiness of vegetables or to make them crunchier by making tempura.

Last but not least, we had to find suitable cutting methods for each food combination. "Cut" means to make the ingredients easy to cook and eat. Depending on how you cut it, the way the fire passes, the texture, and the way it tastes will change, so we need to choose the cutting method that suits the type and purpose of the dish. If the size is uniform, it will look beautiful and delicious. For vegetables, the taste changes depending on whether they are "cut along the fiber" or "cut off the fiber". For example, in the case of bell peppers, if you slice them horizontally to cut off the fibers, the cells will break and the bitterness will be more likely to occur, and if you cut along the fibers, the bitterness will be suppressed. In the case of onions, the opposite is true. If you cut the fibers so that they are cut off, the area that comes into contact with the air is large, so the spiciness is easily removed, and if you cut along the fibers, the spiciness remains. Thus, for each dish, we tried many cutting methods to choose the best one. Furthermore, Baxter has found that size affects children's acceptance of vegetables: small vegetables were preferred to large varieties (15), so in our study, vegetables were cut into small pieces made them easier to eat and they could be hidden inside the meat/egg, or mixed well with other food and spices, making the food more delicious and eye-catching.

When applied those points to improve the meals, people might think the cost of the meals will increase. However, we could maintain it. In terms of food materials, to increase the number of materials, we reduced the quantity of each kind but still ensure that the energy and nutrients intake and the total amount of vegetables were the same. For example, both menus used 100g of vegetables, but in the current menus, they only used 2 kinds of vegetables with a big amount, while in the new menus we divided into 6-7 kinds and the amount of each kind was little. In terms of labor, it is certain that the cooking staff needed more time than before to prepare and cut the materials thoroughly. However, the extra time was still within their working time, and they were happy

and enthusiastic to do the work when they saw that children ate more, and the leftover was reduced. Therefore, the labor cost remained the same.

After changing the menus, both menus provided an equal amount of vegetables, but the amount of vegetables consumed in the new menu group was 25.7g higher than in the current menu group. This proved not only the effectiveness of the new menus but also the effort of the dietitians in improving the quality and quantity of the diet for children. On the other hand, in both groups, children still wasted food, especially vegetables. This is similar to the study by Gray: children only eat about 79% of the vegetables on the tray (17). However, children in the current menu group wasted more vegetables than the new menu group did, similar to Sharma's results: while the children in the control group wasted 74.6g of vegetables and fruits, the children in the menu intervention group wasted 63.0g of vegetables and fruits (18). These results provide additional evidence that schools should focus on the diversification of ingredients as well as increasing appetizing foods to increase nutrient intake by children.

School lunch has been considered as a factor in controlling obesity rates in children in Japan. School lunch not only provides well-balanced lunch for children but also conveys an understanding of portion size, meal balance, and gratitude for the food and for the people who make it (13,19,20). Therefore, school lunch may be important in controlling overweight. Especially important is the role of the dietitian in the school, not only to develop menus for children but also to develop educational programs to teach children (13). However, at present, in public schools in Vietnam, there is no school dietitian, so school lunches are not well-planned and not attractive to children. It is desirable to improve, spread school lunches and establish a school dietitian system in Vietnam so that all children can enjoy nutritious school lunches and have a good nutrition education by a dietitian to change food consumption behavior.

The limitation of this study was the short intervention time. We had only assessed student acceptance of the new menus but did not observe whether schools can adopt these menus. Hence, a study with a longer time is needed to evaluate how school applies those menus and how long they can apply, as well as establish more menus and expand to more school.

### CONCLUSIONS

By increasing the variety of food and choosing suitable cutting methods, we were able to make the meals tastier and more attractive with similar cost, and the food consumption of children was increased. We recognized from this study that the placement of school dietitian is the key to improve school lunch.

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