Current Status and Future Prospects of *Shokuiku* (Food and Nutrition Education): Utilization of the School Lunch by Nutrition Teachers in Japan

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Abstract: Recently, with the globalization of food, the increasing prevalence of diseases such as obesity and lifestyle-related diseases, which are primarily influenced by diet, has become a common problem in the world. Furthermore, climate change and geopolitical conflicts have had a significant impact on food production and food supply chains worldwide. Due to this situation, food and nutrition education is needed worldwide to help people learn "What," "How much," and "How to eat," develop appropriate food-related decision-making skills, and achieve a healthy diet throughout their lives. In Japan, a school lunch system for children has been in place for many years, and, since 2005, Food and Nutrition Education, known as *Shokuiku*, has been promoted through school lunches, mainly by nutrition teachers. In Japan, the *Shokuiku* is considered part of education, and the cooperation between schools, families, and communities contributes to raising interest in food and health issues not only among schoolchildren but also among parents and local people, as well as to the realization of sustainable food by linking it to the use of local products. Despite these excellent efforts, this is not well known outside Japan. Therefore, one aim of this paper is to give a comprehensive report on this issue to the global audience. Furthermore, we will discuss the issues regarding the "verification of the effectiveness" of *Shokuiku* through school lunches by nutrition teachers, which have emerged from current specific examples of *Shokuiku*.

Keywords: *Shokuiku, food and nutrition education, school lunch, food sustainability, inheritance of food culture*

1. Introduction

The increase in obesity and lifestyle-related diseases has become a universal challenge. Dietary habits have a significant impact on the development of these diseases, which can also be prevented or improved through proper dietary choices. Therefore, food and nutrition education is necessary for all generations, but it is especially important for children because it affects not only their physical and mental growth, but also their personality development, and this effect lasts throughout their lives.

In addition, the globalization of food in recent years has led to an increase in obesity in many countries (An et al. 2019), and it is undeniable that changes in traditional dietary patterns, such as women's advancement into the workforce, may have indirectly influenced this increase in obesity and lifestyle-related diseases. In fact, the Japanese people's dietary habits have changed

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over the past 50 years. For example, one of the traditional dietary habits that has been registered as a UNESCO Intangible Cultural Heritage is *osechi*, specially prepared boxed dishes that are eaten during the Japanese New Year celebrations. In 2015, a web-based survey of 1,000 men and women aged 20 to 60 showed that 16.7% of respondents did not eat *osechi* while 14.0% said they occasionally ate it. According to a 2015 JA Nationwide survey, this indicates a trend away from *osechi*, especially among younger generations. Thus, an important issue in Japan is how to pass on the traditional diet to the next generation. In the past, knowledge of what to eat and how to eat it, as well as local and seasonal foods, was nurtured at home, but nowadays, school lunches have become an important opportunity for children to learn about local specialties and traditional foods.

Moreover, considering the continuing instability in global food production caused by climate change in recent years and the growing demand for food due to global population growth, it has become imperative not only to achieve a healthy diet but also to work toward food sustainability. Therefore, it has become necessary to consider the carbon footprint, which indicates the environmental impact from the procurement of raw materials to their disposal. Furthermore, the ongoing geopolitical conflicts in the world have affected the food supply chain, making it difficult to ensure food safety in terms of both quantity and quality. This situation underscores the importance of local production for local consumption in considering food sustainability in the future. In Japan, the food self-sufficiency rate for fiscal year 2021 is 38% (estimated on a calorie basis), which is remarkably low compared to other developed countries. In addition to maintaining and improving the health of its people, Japan is required to aim for food sustainability, including its environmental, economic, and food culture perspectives. To achieve these goals, Japan enacted the Basic Law on Food and Nutrition Education (The Basic Act on *Shokuiku* in Japanese) in 2005. This law aims to seamlessly support and promote lifelong mental and physical health at the family, school, childcare center, and community levels. *Shokuiku* is primarily the responsibility of the family, but as mentioned above, the social environment is changing, and eating habits are undergoing significant change. As a result, parents alone may not always be able to take on sufficient responsibility for their children's *Shokuiku*. *Shokuiku* in schools is therefore becoming increasingly important. For this reason, this paper primarily focuses on *Shokuiku* as taught by nutrition teachers through school lunches. This is because school lunches have a long history in Japan of being used as a *Shokuiku* living/teaching tool for food and nutrition education. Furthermore, we believe that *Shokuiku*, which is led by nutrition teachers and experienced by almost all Japanese children through school lunches, is a wonderful system that Japan can be proud of.

Thus, I will first outline the historical changes of *Shokuiku* through school lunches and then, based on specific examples of "food education" in today's Japan, discuss future challenges and prospects.

One of the aims of this paper is to address the challenge of conveying the success and high standards of *Shokuiku* in Japan to an international audience, overcoming language barriers and enhancing global recognition and understanding of Japan's food education initiatives. Therefore, it is hoped that this paper will contribute to food and nutrition education not only in Japan but also in other countries.

2. A Brief History of School Lunch and *Shokuiku* in Japan

(1) School Lunch in Japan

The history of school lunches in Japan dates from 1889, when they were provided for poor children at a private elementary school in the town of Tsuruoka, Yamagata Prefecture. Then, in

1923, school lunches were recommended for improving children's nutrition.

The 1932 notice on "Temporary Institutional Methods for School Lunches" states that "the implementation of school lunches should pay careful attention to the preparation without giving the impression that it is done as poverty relief" (Kishiyama and Kurotaki 2021). In Japan, unlike in other countries, school lunches are generally provided for all students in compulsory education (from elementary to junior high school). This is not only because it is part of the educational process, but also noteworthy as a consideration to prevent discrimination based on poverty.

There was an interruption due to World War II, and then in 1947, due to the serious shortage of food, school lunches began again in urban areas when the U.S. provided skimmed milk powder to supplement children's lunches. From 1950, complete school lunches were provided using flour donated by the U.S. Then, in the early 1970s, as the Japanese economy developed, the financial condition of families and the food situation got better, and the physical development of children also improved. So, at that time, there was even a discussion about abolishing school lunches. However, economic stagnation after the 2020 COVID-19 pandemic and rising food prices due to inflation have once again led to discussion of the role of school lunches in supporting children's health and growth.

In 1976, rice was officially introduced to school lunches. At the time of its introduction, it was only once a month at most, but today, in order to pass on to children a "Japanese-style diet" with rice as the staple food, rice lunches are recommended, and in FY 2018, all schools that offered a "complete meal"[1] provided rice lunches an average of 3.5 times per week. The Ministry of Agriculture, Forestry and Fisheries (MAFF) has been supplying free government stockpiled rice as a portion of the rice used in school lunches since FY1998, with the aim of promoting dietary education through "rice meals."

(2) *Shokuiku* (Food and Nutrition Education) in Japan

According to Morita (2004), the term *Shokuiku* (which means "food and nutrition education") had already been used in the Meiji period publications. In *Shoku yojo ho* (Food Education), Ishizuka Sagen,[2] in 1898, stated that the source of human life is food. The body and mind are nourished by food. The basis of life should be a proper diet. He taught that inappropriate food is the cause of illness in the body and mind, so illness can be cured by eating the right food. Also, in 1903, Murai Gensai,[3] in his cooking book *Shoku-doraku*, insisted on the need for nutrition education, saying that nutrition education is the basis of all education. The book also details the procedures and quantities for preparing dishes that take advantage of seasonal ingredients and feature unique Western and Chinese origins. In an age when male domination of women was the norm, he was one of the first to preach what is taken for granted today, that married couples should cooperate and enjoy delicious

1 There are three types of school lunches: a "complete meal" that includes a staple meal (e.g., rice, bread, noodles,), main dishes, and milk; a "supplementary meal" in which each student brings his or her own staple food (rice or bread) and is served with main dishes and milk; and a "milk meal" in which only milk is served.

2 (石塚 左玄, Ishizuka Sagen, March 6, 1850–October 17, 1909) studied Chinese medicine. He was a doctor and pharmacist in the Imperial Japanese Army who pioneered the concepts of *Shokuiku* (food and nutrition education) and the macrobiotic diet, and has described the importance of *Shokuiku* as the basis of physical education, intellectual education, and talent education.

3 In his novel Gensai Murai (1864–1927), stated that nutrition education should come before moral, intellectual, or physical education. Murai's novel includes recipes for over 600 Japanese, Western, and Chinese dishes with instructions for selecting the best ingredients. Murai's book was a best seller, selling over 100,000 copies, and his dietary concepts were very popular.

and nutritious food at home. Both these authors' intentions were to nurture people's minds and bodies by deepening their knowledge of food and providing them with good food. They asserted the importance of dietary education as a foundation to support intellectual development and physical education. In Morita's opinion, their ideas did not take root among the public at that time. However, in the 1980s, the term *Shokuiku* (food and nutrition education) was increasingly used by people interested in and concerned with food.

In addition, since 2000, issues such as unbalanced nutrition, irregular meals, increase in obesity and lifestyle-related diseases, excessive slimming, food mislabeling (e.g., changing the expiration date or prefecture of origin), and excessive dependence on imported food have become more apparent. These problems are thought to be influenced by the diversification of dietary habits caused by the population shift to nuclear families, the increase in the number of working women, economic disparities, and food globalization. Furthermore, problems with children's eating habits, such as skipping breakfast and not getting enough nutrition, were pointed out. Since dietary habits have a significant impact on future health, it has become necessary for children to make their own decisions based on correct knowledge about nutrition and eating habits, and to acquire the ability to self-manage their own eating behavior and develop desirable eating habits.

1) Nutrition Teachers

In the past, *Shokuiku* was provided at home. However, with rapid economic development, the standard of living has improved, the social environment surrounding food has changed dramatically, and people's values and lifestyles regarding eating have diversified. Along with these changes in people's awareness, it has become difficult to provide *Shokuiku* in the home alone due to changes in household structure and various living conditions. To address these problems, the Basic Act on *Shokuiku* was enacted in 2005. Thus, in April 2005, the School Meal Law was revised, and a school system introducing nutritional teachers (= "nutrition teachers") who played a central role in promoting *Shokuiku* at schools was established as follows:

> Primary schools and junior high schools will be assigned nutrition teachers who must be certified, licensed Registered Dietitians or Nutritionists with a combination of nutritional expertise and educational qualifications. Nutrition teachers, as the educators responsible for the nutritional guidance and management of students, will use their expertise to demonstrate a central role in the overall planning and practice of food-related instruction. Furthermore, in the management of school meals, they are also expected to work on nutritional management and hygiene control and play a key role in cooperation and coordination among teachers and staff in the school, as well as with families and the community.
>
> The criteria for the assignment of nutrition teachers (NT) are as follows:
> a) Schools with their own lunch service
> There will be one NT for every four schools with fewer than 550 students receiving school lunches.
> There will be one NT in each school for schools with more than 550 students.
> One NT shall be assigned to each municipality with less than three schools serving fewer than 550 students.
>
> b) Centralized kitchen (Supplying several schools)
> If the number of students in the schools supplied by the centralized kitchen is 1,500 or less, one NT will be assigned per kitchen.

If the number of students is between 1,500 and 6,000, two NTs will be assigned per kitchen.
If the number of students is over 6,000, 3 NTs per kitchen will be assigned.

There are 6,924 nutrition teachers in Japan (as of May 1, 2024, according to the Basic School Survey by the Ministry of Education, Culture, Sports, Science and Technology). However, in reality, the number of nutrition teachers varies from region to region, and the number of schools for which each nutrition teacher is responsible varies as well. The highest number is Hokkaido (471 persons), the lowest is Tottori prefecture (24 persons). There are large disparities in the placement of nutrition teachers by prefecture.

2) *Shokuiku* System Centered on a Nutrition Teacher

The nutrition teacher plays a key role such as a supervisor in coordination and collaboration among teachers and staff within the school, as well as with the family and the community. As shown in Figure 1, of the three instructional situations related to *Shokuiku* (lunch time, lessons for each subject domain, and individual instruction and counseling), lunch time is mainly supervised by the homeroom teacher, while *Shokuiku* in each subject is supervised by the subject homeroom teacher or nutrition teacher based on plans and materials prepared by the nutrition teacher. As for individual instructions, the nutrition teacher provides tailor-made instructions for each child and also their families on obesity, thinness, food allergies, and other important dietary issues.

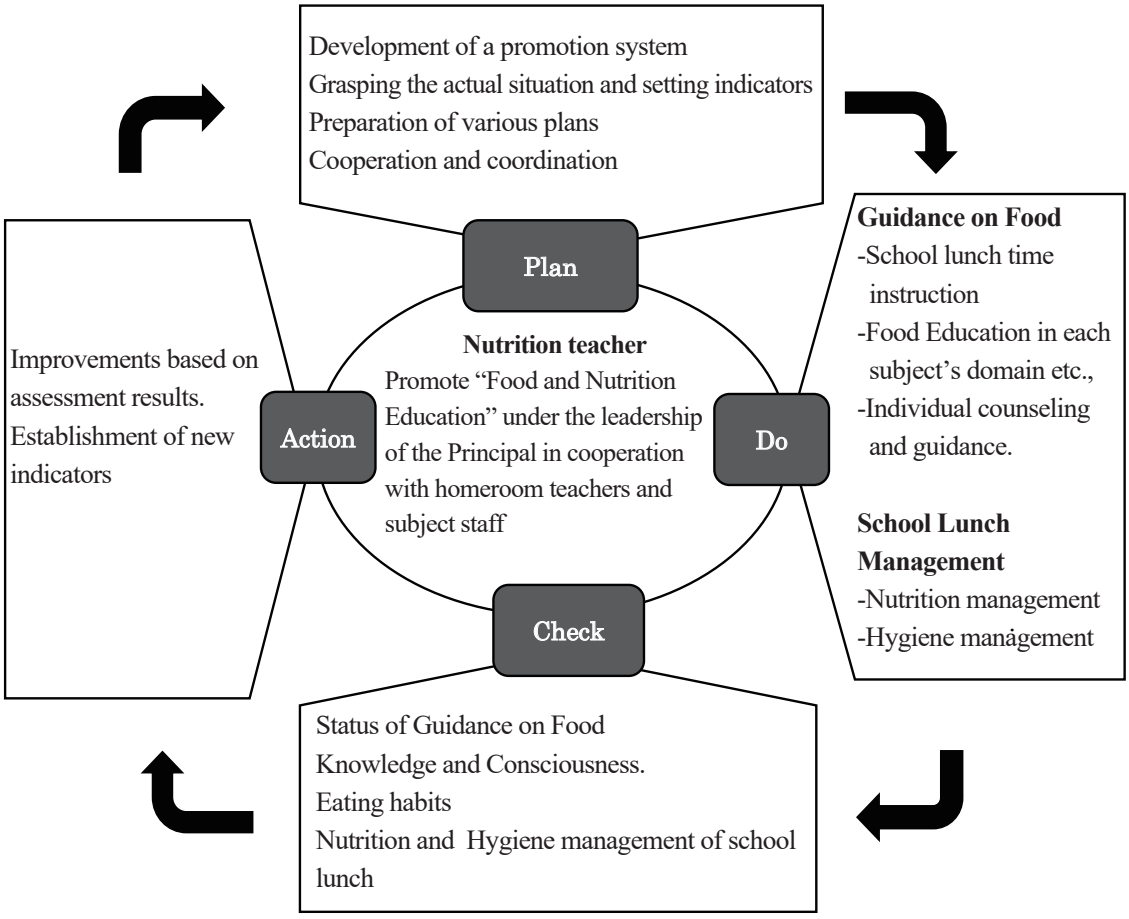

Figure 1. Image of promotion of Food and Nutrition Education in Japan
Source: Modified and quoted from "Nutrition Education in Schools in the Future with Nutrition Teachers at the Core," Ministry of Education, Culture, Sports, Science and Technology (March 2017).

Nutrition teachers work with classroom teachers and subject teachers to develop plans and drafts for food instruction. The main instructional situations at school are expected to include lunch time, integrated learning time, each subject (science, social studies, health and physical education, home economics, moral education, etc.), and other class activities, school events, and club activities. It is also assumed that all educational activities at school will be involved. In addition, the nutrition teachers should also draft a plan for the management of the school lunch program, making use of their own expertise. To implement *Shokuiku* more effectively through school lunches, nutrition teachers investigate the issues facing their schools, plan nutrition education activities in line with the curriculum guidelines, prepare teaching materials, and work with class teachers to resolve these issues. To do this, nutrition teachers organize issues and understand the actual situation of children based on the results of various surveys, such as dietary surveys and school health statistics surveys. Next, they create a draft plan by linking the annual education plan for each subject to the overall food education plan. In this process, they usually use the ingredients from the above-mentioned plan in their menus to enhance the educational effect. The instruction plan for “Shokuiku” is linked to the study of each subject from the first grade to the sixth grade, so that children can learn continuously throughout their six years of education.

Table l. Goals for food and nutrition education according to the developmental stage of each grade level

Objectives of developmentally appropriate guidance on food at each grade level.												
			1st to 2nd grade			3rd to 4th grade			5th to 6th grade			Senior high school
			○ Connecting with others through food and eating ○ Knowing that we are given the lives of other living beings.			○ Knowing how food works and thinking about our own health. ○ Learning about the links between community, food, and eating.			○ Learning about the diversity of Japanese and foreign food cultures and trying to understand and value each other's food cultures. ○ Understanding food production and distribution and thinking about food-related topics such as food loss and environmental issues and being aware of them in real life. ○ Thinking about the challenges of our own lives and being able to consider and implement desirable dietary and lifestyle changes.			○ Identifying issues in our own lives, thinking about desirable eating habits and lifestyle improvements, and how to maintain and promote our own health. ○ Learning to build a rich mind and desirable relationships through food.	
			April	May	June	July	September	October	November	December	January	February	March
			○ School Lunch Promise ○ Manners at mealtime ● Let's all get along and enjoy eating together.		○● Name of food ○● Let's chew our food well.		○ Promise of school lunch duty ○ Let's eat without liking or disliking. ● Doing our duty well and quickly. ● Let's eat everything and build a strong body		○ Let's eat gratefully. ○ Let's learn about food from different countries. ● Let's enjoy the pleasure of eating		○ Thinking about school lunches. ○ Let's make lunchtime fun! ● Let's learn about school lunches ● Let's make school lunch fun!		○● Reflections on school lunches
Special Activities	Teaching about food	1st	Let's discover the secrets of school lunches. Let's eat without likes and dislikes. Chewing our food well										
		2nd	Let's eat food with care. Learning about vegetables and learning about the three-color categories of food.										
		3rd	Thinking about how to eat sweets. Let's learn how to use chopsticks correctly. Let's learn about the function of soya.										
		4th	Let's chew our food well. Learning about seasonal foods. Learning about food self-sufficiency										
		5th	Learning about the importance of staple foods. Let's think about the dietary requirements during development. Let's learn about the functions of vegetables.										
		6th	Thinking about soft drink consumption. Let's prevent lifestyle-related diseases. Let's think about what kind of diet is suitable for junior high school students.										
			1st grade		2nd grade		3rd grade		4th grade		5th grade		6th grade
	Japanese language						Thinking about how to explain Theme: Soya beans changing shape						
School lunches and their relationship to the each subjects.	Science and social studies				Observing plants. Learning about our city and finding the lovely points.		Let's grow plants. Learn about work and how it relates to our everyday lives		About Kyoto prefecture: Learning about Uji city, a city with a long tradition of thriving industry. Seasons and creatures. Our bodies and exercise.		Our lives and food production. Food for school lunches. Food and us. About the areas where the fishing industry is well established. The Link of Life.		Japanese history. Japan in the world. The future of the world and Japan's role. The relationship between plant growth and water.
Cooperation with families and communities	Home economics										Miso soup with rice. Aim to be an expert shopper.		A healthy day starts with breakfast. Leave it to me to make today's meal.
	Physical Education				Everyday life and health				Our growing body.				Prevention of disease
	morality		Finding out what regular life looks like.		Protecting Japanese culture								A sustainable society
	Crop Cultivation		cherry tomato		rice, vegetables		sweet potato				rice		
	Family and community		School lunch tasting (Jun. Feb.) Studying cooking on Saturday School lunch news, etc.										

Source: The author quoted from records prepared when Takakura Elementary School in Kyoto City received the Minister of Agriculture, Forestry and Fisheries Award for its 4th Food Education Activities Award.

3. Examples of *Shokuiku* through the School Lunch Planned by Nutrition Teachers and Their Limitations

(1) Learning through the School Lunch Menu

Through the school lunch menu, children can learn about: a) the content and quantity of a well-balanced meal, b) seasonality of foods (vegetables, fish and fruits, etc.), c) ingredients used in cuisines and their nutrients, and d) Traditional foods and cuisines according to season and local.

Table 2: Usage status of Local and Domestic products in school lunches

	2012	2017	2018	2019	2021	2022
Local products	25.1%	26.4%	26.0%	52.7%	56.0%	58.5%
Domestic products	76.8%	76.7%	77.1%	87.0%	89.0%	89.2%

Source: Adapted by the Author from the Ministry of Agriculture, Forestry and Fisheries website

Of course, the use of local produce in school meals is desirable. However, there are cases where utilization is difficult. For example, if the sizes are not consistent, it requires more time to prepare them. Additionally, in the case of centralized kitchens, the quantity required is higher because they cater to multiple schools simultaneously. This makes it difficult for small-scale farmers to supply large quantities simultaneously, even if they are willing to participate in this initiative. Furthermore, depending on the weather conditions, it may suddenly become impossible to secure the planned harvest volume. Producers and nutrition teachers share a desire to use locally produced ingredients as much as possible, but they also face challenges, mainly in terms of procurement. (From an unpublished interview with nutrition teachers in Kusatsu city by the author).

(2) Learning with Unique Learning Materials.

1) Three-Color Food Groups

The “Three-Color Food Groups” shown in Figure 2 is the most famous teaching material in Japan. The characteristics of this teaching material are that even young children can easily understand the function of nutrients, and that there is a simple categorization of each nutrient, with no evaluation of good or bad (for example, as is generally the case, vitamins are good, or fats are bad for the body, etc.). Moreover, the menu list is distributed to every household each month, including the names of the dishes and the ingredients used, and these ingredients are divided into red, yellow, and green groups, respectively, as shown in Figure 2, according to the following rules:

Descriptions for each color group:

The Yellow group includes foods rich in carbohydrates and fats such as rice, bread, potatoes, butter and mayonnaise, which are sources of energy.

The Red group includes foods rich in protein, such as meat, fish, eggs, and soy products, which are the sources for building blood, muscle, and bone.

The Green group includes foods rich in vitamins and minerals, such as vegetables, fruits, and seaweed, which tone the body’s condition.) The best thing about these three-color food groups is that they do not judge each nutrient as good or bad but simply explain what each nutrient does.

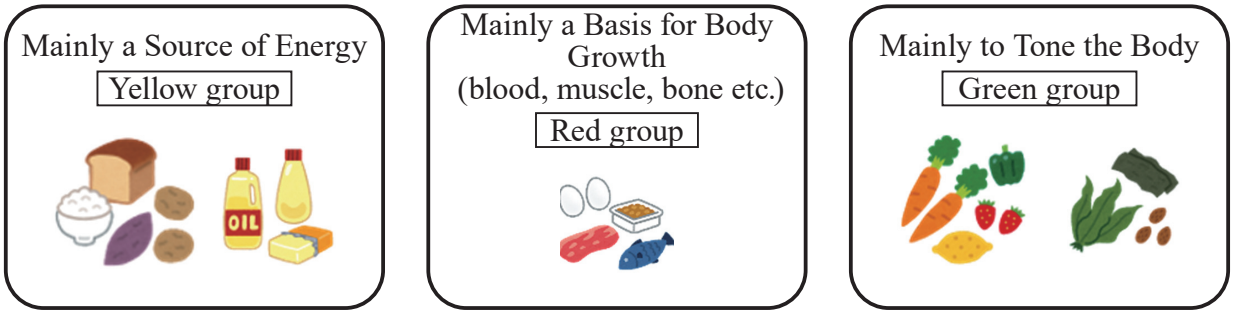

Figure 2. Example of a "Three Color Food Groups" diagram
Source: Created by the author based on a textbook for dietary improvement instructors

In this way, both the children and their parents naturally learn how the food they eat every day works in their bodies. In addition, menus are based on the overall and annual food-related teaching plans, and are deliberately linked to school events and subjects, and local products and local cuisine are actively used to deepen understanding of local food culture and traditions (Tables 1, 3, and 4). These initiatives are the reason why school lunches are regarded as a living teaching tool in Japanese food and nutrition education, i.e., *Shokuiku*.

2) Daily Education by Classroom Teachers during Lunchtime

School lunches are served approximately 190 times a year, and lunchtime is also used as an important opportunity for *Shokuiku*. In Japan, children are responsible for everything from preparing their own meals to putting away their dishes by themselves. Through the instruction they receive during these activities, they learn how to wash their hands, serve food, arrange the dishes, and have proper table manners. As mentioned above, the school lunch is also a place for education using the menu as teaching material, such as for learning about the origins and nutritional characteristics of food, as well as reviewing the foods and what has been covered in subjects like science, geography or home economics and so on. However, in most cases, the time for school lunch is about 45 to 50 minutes in elementary schools, including preparation, eating, and clearing away dishes. It is impossible for a nutrition teacher to visit all the classrooms and provide education during this time, so education here is provided by each classroom teacher.

For these reasons, nutrition teachers prepare teaching materials, and the actual instruction during lunch time is carried out by each class teacher using those materials. Taking into account classroom teachers' motivation and knowledge level regarding *Shokuiku*, nutrition teachers devise materials that are easy for homeroom teachers to use and explain to students. Recently, some of them use a QR code, and media such as video apps, and some are made in English in collaboration with English learning (From a closed interview with a member of the Kusatsu City Board of Education).

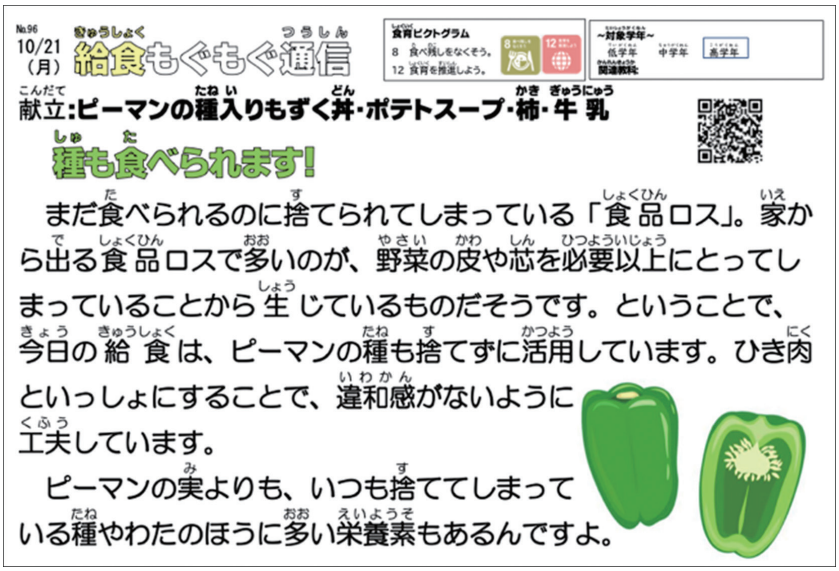

Figure 3. Example of Nutrition education materials used at Senzoku Elementary School in Tokyo.
Note: The homeroom teacher simply reads the QR code and a PDF document like the one above with information on the day's school lunch is presented on the classroom electronic blackboard. In this case, the theme of the day was food loss. It explained that one of the most common food losses from households is caused by throwing away more vegetable peels and cores than necessary. It then tells how, in today's school lunch, the seeds of the peppers were also utilized instead of being thrown away, and how they were mixed with minced meat so that there was no sense of discomfort.
Source: From the Tokyo Taito Ward Senzoku Elementary School Lunch Memo

3) School Lunch Newsletters

School lunch newsletters and menu lists are part of efforts to deepen children's understanding of *Shokuiku* at home. The school lunch newsletter explains the relationship between health and nutrients in a simple and easy-to-understand manner, using illustrations and other materials. Table 3 shows an example of a school lunch menu list from the June 2024 menu of Otsu City, Shiga Prefecture. The menu lists are distributed to each family every month and include the names of the dishes and the ingredients used, and these ingredients are divided into red, yellow, and green groups, according to the rules as mentioned above. This labeling allows both children and their families to naturally learn what the foods that they eat every day do in their bodies. Recently, simple instructions on how to make them are often included.

Table3. Example of a Day's Menu

day	Day of week	Menu	Main ingredients				Energy(kcal), protein(g), fat(g)	
			Red	Yellow	Green	others	Elementary school	Junior high school
3	Mon	*Omi udon**, milk, fried smelt, pumpkin and minced chicken stew, mixed vegetable soup	*Omi udon*, starch, rapeseed oil, brown sugar	Milk, smelt (one of small fish), minced chicken, pork, fried tofu	Pumpkin, bean sprouts, cabbage, green onions, carrots	Mainly seasonings are listed.	554 kcal 25.1g 20.9g	704kcal 31.1g 24.9g

Omi udon*: Local udon developed with 100% wheat produced in Shiga Prefecture.
Source: Adapted by the Author based on a report from Otsu City, Shiga Prefecture

One of the goals of promoting *Shokuiku* for children is to reduce the percentage of children who skip breakfast from 4.4% in 2019 to 0% by 2025. Foods and health, and not only breakfast but also the relationship between meals and health, are taught using various educational materials, but unfortunately, according to the Fiscal Year 2023 White Paper on *Shokuiku*, the rate of breakfast skipping among elementary and junior high school students worsened to 6.1% for elementary school students and 8.7% for junior high school students in 2023.

(3) Learning through Experience

1) Farming Experience

Regarding the farming experience, it is not uncommon for a school to have a field on its grounds where each grade level grows and harvests age-appropriate crops to be used in school lunches. Nishi and Okada (2013) define "food and agriculture education" as the acquisition of knowledge that "agriculture is an industry that nurtures life" through farming experiences. Specifically, by emphasizing the relationship between food, agriculture, and local nature, and valuing the process by which agricultural products nurture life and growth, the aim is to raise interest in food and broaden and deepen understanding of its importance. By appreciating the role of agriculture in supporting food, we can better understand the relationship between our own lives and the activities of society, including local food culture and the value of life and health. Furthermore, this initiative aims to link food production with agriculture and communities with agricultural cooperatives. It seeks to consider what should be eaten, how it should be produced, and how farming should be conducted in the future, thereby maintaining a sustainable food supply. For example, how it can be sustained beyond using the existing concepts of the past, such as by adopting AI or converting farms into joint-stock companies?

Furthermore, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) has stated that the expected effects of this kind of food and agriculture education through agricultural experiences in which schools and local communities collaborate include: (1) for children, it provides an opportunity to exercise various abilities such as "feeling," "discovering," "knowing," "thinking," "eating," "making," and "interacting." (2) For the local communities, the program provides an opportunity to deepen understanding of agriculture and farming villages not only for the children who actually experience it, but also for their parents, families, teachers, and other adults through the children.

Yamada (2006), however, points out that, in reality, the expected effects are not always achieved, and in many cases, it is a matter of trial and error. She also points out that there are cases where teachers who do not have the knowledge and skills related to farm work are teaching without understanding, or are left to their own devices, relying on the cooperation of farmers. Furthermore, as Yamada (2006) points out, most of the studies on agricultural experiences are case studies, and there are very few studies that empirically analyze the educational effects, as can be seen from the Ministry of Agriculture, Forestry and Fisheries' website. According to the MAFF's website, there are several papers listing the benefits of agricultural experiences, but few of them use behavioral indicators as outcome measures; e.g., "actual food intake increased" (Kanno and Murayama 2011), "frequently eat locally produced foods" (Taniguchi and Akamatsu 2010). Most of them measure outcomes based on questionnaires, but when using this method, the influence of social desirability is undeniable. Thus, even if the subjects indicate a change in consciousness, such as a desire to try to eat more vegetables (Yingge and Yabe 2014), it is unclear whether their behavior has actually changed or not.

2) Practical Examples from the "*Shokuiku*: Promotion Project" that the Ministry of Education, Culture, Sports, Science and Technology Had Entrusted to Prefectures across the Country.

In 2009, MEXT published a summary of the most distinctive examples of successful teaching practices related to food by nutrition teachers in Japan (MEXT 2009). Some of these are presented below. For example, at Hachiken Elementary School (370 children, 12 classes) in Sapporo, Hokkaido, a high percentage of boys were severely obese, and there was also a high tendency towards obesity among lower grades, as well as a large amount of leftover food in vegetable dishes. The aim was therefore to make it a habit to eat vegetables, thereby stimulating the sense of taste, broadening preferences and improving dietary skills to prevent lifestyle-related diseases. To further educate children about food circulation, the initiative has collaborated with the Sapporo City Board of Education and the Environment Bureau to launch the Sapporo School Lunch Food Recycling Project. This project was integrated into the school curriculum, with nutrition education centered on the "food cycle," linking food and nutrition education with environmental education.

Thus, in this experience, aimed to a) create life through crop production activities, b) link to life through hands-on cooking activities, c) protect life through hands-on processing and preservation activities, and d) link to the next step through compost making. (See Table 4)

Table 4. Main food and nutrition education linked to educational activities, in 2007

	a) Crop Production Activities	b) Cooking-Activities	c) Preservation and processing experience	d) Making Compost <comprehensive>
1st	Corn <life science> Grow vegetables Let's grow our own vegetables!	Popcorn		
2nd	Cucumber <life science> Let's grow our own vegetables!	Making pickles overnight <life science>		
3rd	Cabbage <Science > Caterpillar <Maths > Weight comparison *Edamame* (green soybeans) <Japanese Language> Soybeans changing shape	Ingredients for school lunches	Making soy flour <comprehensive> Observe potato rice cake making <comprehensive>	Making soil with fallen leaves and rice bran
4th	Potato <science> <comprehensive> *Daikon* (white radish) <comprehensive>	Making potato rice cake <comprehensive>	Starch Making <science> *tsuchi muro* (Holes made by digging in the ground) <comprehensive> Observation of dried radish production and pickle making <comprehensive>	Making soil with fallen leaves and rice bran
5th	Pumpkin <comprehensive> Green beans <comprehensive>	Ingredients for school lunches Pumpkin dishes <home economics>	Green beans <comprehensive>	Making soil with fallen leaves and rice bran
6th	*Edamame* <comprehensive> Potato <comprehensive>	Potato <home economics>	Making *Tofu* <comprehensive>	Making soil with fallen leaves and rice bran

In order to gain knowledge about foods and to value and establish the significance of what children could experience through hands-on activities, opportunities were provided to link them

to classroom activities, integrated learning time, home economics, life sciences, science, social studies, language arts and mathematics. Furthermore, crops grown by the children were used as ingredients in school lunches to make the children more deeply aware of the meaning of life and to instill in them a habit of connecting it to their own lives (See Table 4). These efforts have resulted in a reduction in the quantity of leftovers from school lunches, especially vegetables.

As the results above demonstrate, *Shokuiku* education provided not only during school lunch time but also in line with the learning content taught at each grade level, has shown a certain level of effectiveness. However, it has not actually been confirmed whether these changes were statistically significant. Despite the fact that such excellent efforts have been made, I consider the issue is that there has been insufficient objective verification of their effectiveness through statistical data analysis.

4. Issues Related to the Verification of the Effectiveness of *Shokuiku* by Nutrition Teachers That Has Been Done so Far

In Japan, as mentioned earlier, there are many initiatives in which children grow their own local foods and use them in school lunches, or eat fresh produce and seafood provided by local producers (farmers, fishermen, etc.) in school lunches while listening to explanations from the producers. However, according to Waida and Kawamura (2020), there have hardly been any reports of systematic reviews that provide a detailed organization and analysis of intervention contents and methods regarding the utilization of *Shokuiku* and teaching materials during school lunches.

In addition, to promote and enhance school lunch programs, MEXT gives awards to schools and community kitchens, as well as individuals and organizations that have achieved outstanding results in the implementation of such programs, but I could not find any specific details of these awards on the website. In addition, the "Report on the Results of the Project to Promote *Shokuiku* with Nutrition Teachers at the Core" is published on the MEXT website for each regional block. However, it is not easy to review the more than 400 pages of reports from all 42 prefectures, and since they are all in Japanese, it would be difficult to use or share these materials outside of Japan.

Further, Yamagami (2009), regarding educational activities centered on school lunch since the enactment of the Basic Act on *Shokuiku* in 2005, notes that "Educational research on school lunch is most often reported as a bulletin in Japanese." As shown above, the fact that most of the studies and reports are written in Japanese is probably one of the obstacles to making this proud Japanese initiative known to the world.

Also, during the three years from 2014 to 2016, the Super *Shokuiku* School (SSS) projects were implemented. In the SSS projects, nutrition teachers worked in cooperation with external experts and collaborated with universities, companies, government agencies and producers. The multifaceted effects of *Shokuiku* were verified based on scientific data, with the aim of further enhancing *Shokuiku*. In 2014, 33 projects (42 schools), in 2015, 30 projects (35 schools) and in 2016, 24 projects (29 schools) were initiated and implemented for one year each. The implementation report for this project can be found on the MEXT website (but only in Japanese). Hijikata et al. (2017), who reviewed the implementation of the project in 2014 and 2015, mentioned that for the verification of the effect, the most common method of assessment was a questionnaire on eating habits and diet, but also included anthropometric measurements, body composition measurements, blood and urine tests, and measurement of intestinal flora, as well as some physical fitness tests and step counts. However, unfortunately, despite the goal of "verifying the multifaceted effects of nutrition education based on scientific data," Hijikata et al. (2017) noted that in many cases, there were no numerical

descriptions or statistical analyses in the description of the results. Instead, for example, "results were seen" or "improvements were made," etc., was written. I consider that the verification of effectiveness should not be subjective, but objective and based on statistical analysis. However, the findings from these previous studies show that this perspective is lacking.

Also, the survey commissioned by the MEXT on the effectiveness of nutrition teacher placement, published in 2021 (MEXT 2021), focuses on highly individualized issues related to personal health that are difficult for classroom teachers and families to handle alone, such as obesity or thinness, food allergies, picky eating, and sports-playing children and students, that number among other nutrition teachers' duties. This means that they did not focus on the effectiveness, in general, for children as a whole. Furthermore, the effects of *Shokuiku* in school lunches have so far been mostly reported by nutrition teachers at individual elementary schools, and, to the author's knowledge, there have been no studies on whether there is a difference in the effects of *Shokuiku* depending on whether or not nutrition teachers are assigned to the schools. As mentioned above, the placement of nutrition teachers varies greatly depending on the region, and according to a 2022 survey by the MEXT, just under 50% of nutrition teachers are in charge of multiple schools (MEXT 2022). Murakami and Arai (2006) point out that when nutrition teachers are in charge of multiple schools, there is a possibility that advanced meetings to arrange collaborative lessons may not be conducted sufficiently, and Katafuchi et al. (2009) argue that nutrition teachers should be assigned exclusively to one school. In examining these points, we believe it is necessary to consider the differences in the content of instruction and efforts, and the differences in their effectiveness, depending on whether or not a nutritionist is always present at the school.

On the other hand, in recent years, the number of papers that have been published in English on *Shokuiku* in Japan is increasing, little by little. As of August 5, 2024, a PubMed search using the keywords "Food and Nutrition Education," "School Lunch," "in Japan," filtered for full text, yielded seven hits. However, these studies differ in perspective from those describing the role of nutrition teachers in *Shokuiku* through school meals. For example, "The number of obese young people in Japan is low thanks to school lunches" (Miyawaki et al. 2019), "Calcium is difficult to obtain in Japanese food, but the school lunch menu is designed to cover 33-50% of the recommended intake. Therefore, bone density is higher when milk is present in school lunches" (Kohri et al. 2016), and "Comparison of the nutritional value of school lunches provided in Korea, Japan and Taiwan" (Kim et al. 2017). To the author's knowledge, Hosoyamada and Miyahara (2018) is the only review of the literature on *Shokuiku* using school lunches in Japan since the Basic Act on *Shokuiku* was enacted in 2005.

5. Conclusion and Future Prospects

Since there is a lack of research papers on nutrition education related to using the school lunch in Japan, particularly in the English language, this paper has focused on sharing the knowledge gained to date on the excellent efforts of nutrition teachers in Japan, with a view to disseminating it globally. Another purpose of this paper was to raise the issue of the insufficient verification of the effectiveness of *Shokuiku* initiatives led by nutrition teachers that have been implemented to date.

The objectives of *Shokuiku* in Japan, which is led by nutrition teachers and uses school lunches as "living teaching materials," are diverse (for example, enabling students to acquire proper knowledge about food, practice desirable eating habits, and improve their health, as well as promoting local production for local consumption and understanding one's own food culture). *Shokuiku* is not only provided at school but also at home, and since these factors are intricately intertwined, it is not easy to verify its effectiveness. However, through daily menus, school lunch

newsletters, lunchtime instruction, farming experiences, etc., there is no doubt that children are achieving the above goals.

Currently, as Hijikata et al. (2017) and others have demonstrated, children and parents often respond to self-administered questionnaires; however, when using this method, the influence of social desirability is undeniable. Therefore, it is necessary to examine the use of indicators that are less susceptible to such influences. For example, since changes in the amount of leftovers are now already being investigated, it would be useful to consider this in conjunction with the initiatives of each school. Many schools are experimenting with using crops that children have grown themselves during farming experiences as ingredients for school lunches. Therefore, by comparing the amount of leftovers on days when such vegetables are used and days when they are not, it may be possible to determine whether a certain educational effect is being observed. The fact that there are currently no standardized items in place for verification is likely also making it difficult to verify the effectiveness. One of the goals of *Shokuiku* is to acquire the ability to choose "food," which is fundamental to life, and to develop the ability to practice healthy eating habits. However, it is unclear whether the experience of receiving *Shokuiku* from a nutrition teacher during childhood and adolescence will affect eating habits and lifestyle habits in adulthood. According to a questionnaire survey conducted by Tanaka (2022), some respondents reported that after the instruction, children left less food uneaten, started discussing food at home, and began helping with making lunches and cooking; however, the effects of this instruction in *Shokuiku* only lasted from one to two weeks to two months.

As mentioned above, there are concerns that whether or not a nutrition teacher is on-site (always in school) may affect the frequency and content of education, but to the author's knowledge, there have been few studies that have examined this point. In a questionnaire survey of three public elementary schools in the Kinki region, Mizokami (2020) suggested that the instruction provided by nutrition teachers and the method of providing school lunches (in school or in a central kitchen) affect children's attitudes toward school lunches. However, this study also suggests that there is a limitation in that the details of the instructional contents are unknown and cannot be generalized. Therefore, since it is believed that whether or not a nutrition teacher is on-site has a large impact on the frequency and content of instruction, it is necessary to conduct a nationwide survey on this point in the future.

Although it is primarily desirable to provide *Shokuiku* for children at home, it is significant that they eat these dishes in school lunches, as the younger generation of parents is no longer able to cook traditional dishes. Because these dishes use local ingredients, there is the possibility that eating them will heighten interest in agriculture, industry, and even sustainable food. The goal of *Shokuiku* is to develop the ability to practice healthy eating habits by acquiring knowledge about food and the ability to choose well-balanced meals. Until now, whether or not children have acquired knowledge about food through *Shokuiku* has been examined through questionnaires and other methods. It is believed that we have now reached the stage where we will be examining whether or not children will become able to choose foods and practice healthy eating habits themselves.

Bowel habits and the incidence of infectious diseases are considered to be health indicators, and a balanced diet and healthy eating habits have an impact on these indicators. Therefore, we propose that bowel habits and infectious disease incidence, which are currently being investigated, be used as objective indicators to examine health status.

I hope that Japan's *Shokuiku* efforts, evaluated using such objective indicators, will be of assistance to food education efforts in other countries around the world.

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