ORIGINAL

Rice Facilitates Salt Control in Japanese School Lunches

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ABSTRACT *Background and purpose*. Japanese dietitians exert considerable influence over the nation's school lunch program. Because of the well-recognized relationship between nutrition and children's health, increasing attention has been directed at the high salt content of school lunches in Japan. *Methods.* We examined school lunch menus from all prefectures, and 34 municipalities, focusing on the salt content of included menu items. We examined the relationship between salt values and the frequency with which certain foods (rice, seafood dishes, soup, and fruits or jelly) were served. Five municipalities complied with Japan's preestablished salt content standards (<2.0 g average per month). *Results.* According to linear regression analysis, salt values were independently negatively associated with the number of rice servings (P = 0.003). The adjusted R-squared for this linear regression model was 0.305. Many elementary schools remain non-compliant with recommended salt content, as established by the school lunch program's nutritional standards; however, these schools could comply by increasing the frequency with which rice is served in schools. *Conclusion.* Our results may have been biased due to the small number of menus that included average salt values. Elementary schools in Japan should publish their lunch menu's average salt values to further improve the nutrition of the Nation's schoolchildren.

Keywords: salt, rice, school lunch, elementary school, Japan

INTRODUCTION

Japanese school lunches have existed for more than 100 years. Free school lunches were introduced in 1889 in the Yamagata Prefecture to assist poor families. The 1954 School Lunch Act positioned school lunches as a key educational component. Later, after a period of rapid economic growth, rice lunches were introduced in 1976, and in 2009, the Revised School Lunch Act added *Shokuiku*, a Japanese philosophy of nutritional awareness, to school lunch objectives. Article 8 of the School Lunch Act establishes menu criteria which are used by dietitians for menu planning. In Japan today, approximately 190 school lunches are served throughout the country each year.

Japanese schoolchildren enjoy better nutrition on days when school lunches are provided (1). However, school lunches are often high in salt. Reducing salt and tobacco product intake is important for reducing the prevalence of non-communicable diseases (NCDs) *(2)*. The 2019 National Health and Nutrition Survey found that Japanese citizens consume an average of 10.1 g of salt per day. While this issue is widely recognized, many Japanese still exceed the recommended daily salt intake (3).

Japan requires school lunch programs to meet the recommended daily intake levels for 13 nutrients. These nutritional standards were revised in 2018, when the recommended daily salt intake was reduced from <2.5 g per serving to <2.0 g per meal *(4)*. Meanwhile, according to the Ministry of Education, Culture, Sports, Science and Technology (MEXT) School Meal Nutrition Report, the salt intake of elementary school students in 2019 was 2.3 g (5). This makes it necessary to find out what kind of school lunch is being served; however, little is known about how much salt is contained in Japanese school lunches (6). This study examined school lunch menu conformance with Japan's school lunch program nutritional standards. The results generate examples and recommendations for planning school lunch menus that better meet Japan's nutritional guidelines.

MATERIALS AND METHODS

Study design. Historically, school lunch menus were only distributed to the students' families. Recently, these menus have been placed on school websites and are available to all. Despite this, there are no rules regarding the format or the labeling of nutritional information. We examined school lunch menus that list the average salt equivalent per month or day. The menu collection procedure is shown in **Figure 1**. The menu list was obtained using a web search between November 29 and December 3, 2021. The author calculated the one-month average if only daily salt values were listed. Since the average monthly salt intake would be skewed during months with fewer school lunches, we used October (rather than November or December) menu lists closer to the search date. We attempted to eliminate regional bias by sampling one menu item list from all prefectures in Japan. The survey began with "city," and the search keywords were "~city AND elementary school AND menu list." The next municipality was searched if the menu list was not found after scrolling down to the second page. If a school lunch menu was found for a municipality (including towns) other than the one searched, it was still adopted. Once a school lunch menu was identified within a prefecture, the next prefecture was searched. A similar search for towns was conducted if the menu list was not found after searching for all cities in a prefecture using the search terms. If a school lunch menu containing salt information was still not found, the search proceeded to the next prefecture and did not search villages.

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These procedures were used to examine all 47 prefectures. Since this study did not involve human subjects, and all menu lists obtained were publicly available on the Internet and accessible to anyone, and were not obtained privately from nutrition teachers or others, this study was considered exempt from ethics committee review. Out of an abundance of caution, municipality names are not disclosed.

Analysis method. To identify which menus complied with the recommended salt content per Japanese nutritional standards. We used multiple regression analysis with salt as the objective variable and menu items as the dependent variable. First, explanatory variables were selected for multiple regression analysis. Seasonings account for 56% of Japanese salt intake, followed by seafood, soups, noodles, pickles, and bread (7). Using this as a reference, we identified the number of times seafood was the main ingredient in a menu item. We additionally counted the number of times noodles and bread were served; however, because some municipalities serve a combination of bread and pasta or rice and udon on the same day, the count was bracketed by the number of times rice was served (otherwise, bread or noodles or bread and noodles were served on the same day). If rice and noodles were served on the same day, they were counted as rice. Fruits and jellies were also included in the analysis because they do not contain salt. Thus, the four explanatory variables were rice, soup, seafood dishes, and fruit or jelly. We counted the number of times each menu list included these four variables. The author determined which dish corresponded to which dish from the name on the menu list. Stew, clam chowder, and pot-au-feu were counted as soups. Pork beans and oden were excluded from soups. When seafood was only part of the dish—such as Ishikari nabe and salmon gratin—the dish was not considered a "seafood dish." We used statistical analysis software HAD (8) for all analyses and a two-tailed significance level of 5%.

RESULTS

Menu lists were obtained from municipalities in 34 prefectures. Of these, 15 municipalities prepared school lunches at the schools themselves, while 19 municipalities prepared them in central kitchens. Five municipalities complied with salt standards (<2.0 g per serving). The median salt values were 2.2 [2.03–2.40] g. Similarly, rice was served 14.0 [13.0–17.0] times, soup 14.0 [11.0–15.0] times, seafood dishes 5.0 [3.25–8.0] times, and fruit or jelly 3.0 [2.0–5.5] times. (**Table 1**)

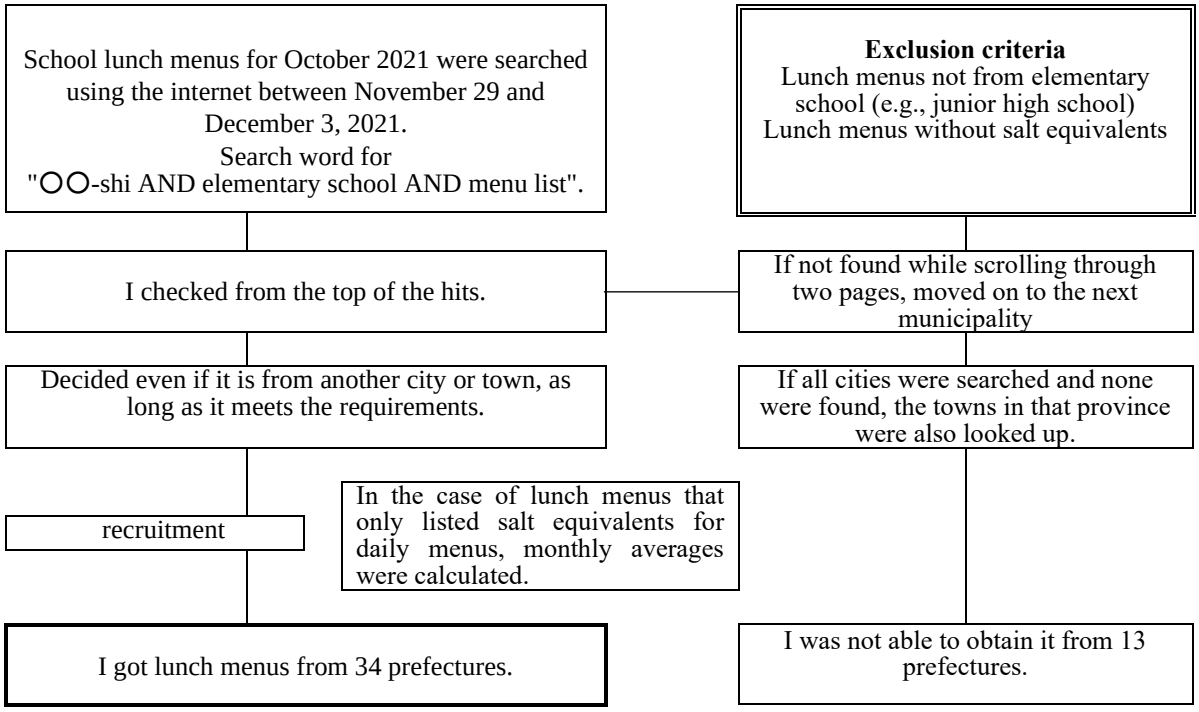

Figure 1. Process for obtaining lunch menus with salt equivalents

Table 1. Characteristics of municipalities that supplied school lunch menus for this study

prefectures*	average salt per month(g)	meal counts per month	number of dishes served				
			rice†	bread or noodles	soup‡	seafood dishes	fruits or jelly
No.1	2.9	18	10	8	11	3	4
No.2	2.2	21	17	4	19	9	8
No.3	2.8	19	12	7	16	7	3
No.4	2.3	21	15	6	15	5	8
No.5	2.2	20	14	6	16	6	2
No.6	2.4	18	10	8	15	6	1
No.7	2.0	20	16	4	15	8	2
No.8	2.2	20	16	4	16	8	6
No.9	2.1	18	17	1	8	4	3
No.10	2.3	19	11	8	15	8	4
No.11	2.3	21	13	8	12	6	3
No.12	1.7	21	16	5	12	9	6
No.13	2.2	21	17	4	14	1	7
No.14	1.9	21	20	1	12	10	2
No.15	2.4	21	17	4	12	8	6
No.16	2.4	21	13	8	10	8	3
No.17	1.9	21	21	0	19	9	2
No.18	2.1	21	17	4	9	2	4
No.19	2.0	21	13	8	8	2	1
No.20	2.4	20	11	9	14	5	4
No.21	2.5	20	13	7	11	5	2
No.22	1.9	21	16	5	11	6	8
No.23	2.4	20	12	8	16	5	6
No.24	2.5	21	13	8	15	9	6
No.25	2.0	21	17	4	10	4	2
No.26	2.1	21	13	8	14	3	0
No.27	2.5	21	13	8	16	4	3
No.28	1.9	21	17	4	6	5	2
No.29	2.2	20	15	5	8	3	2
No.30	2.1	21	20	1	14	9	2
No.31	2.5	20	14	6	11	4	3
No.32	2.0	20	11	9	11	3	3
No.33	2.4	21	13	8	14	3	3
No.34	2.3	20	12	8	14	3	1
Mean	**2.24**	**20.3**	**14.6**	**5.8**	**12.9**	**5.6**	**3.6**

*Fifteen municipalities prepared school lunches in the schools, while 19 municipalities prepared them in central kitchens.

†If rice and noodles were served together, I counted it as rice.

‡ Pot-au-feu and stew counted.

The multiple regression analysis results are shown in Table 2, including the average amount of salt per month as the objective variable and the number of menu items that were served (rice, soup, seafood dishes, fruit or jelly) as the explanatory variable. Salt values decreased significantly on menus where rice was served more frequently ($P = 0.003$). The coefficient of determination for this multiple regression analysis was 0.389 (adjusted $R2 = 0.305$). Finally, a scatter plot of salt content and the number of times rice was served is depicted in **Figure 2**. The number of times rice was served was significantly associated with salt content ($R = -0.614$, $P < 0.01$).

Table 2. Linear regression analysis results of average salt per month and the number of menu items served

Explanatory variable	Partial regression coefficient	95% CI		P-value	
Intercept	2.732	2.137	3.327	0.000	
Rice	−1.069	−1.735	−0.404	0.003	**
Soup	0.425	−0.159	1.009	0.148	
Seafood dishes	−0.143	−0.924	0.638	0.712	
Fruit or jelly	0.204	−0.567	0.974	0.593	

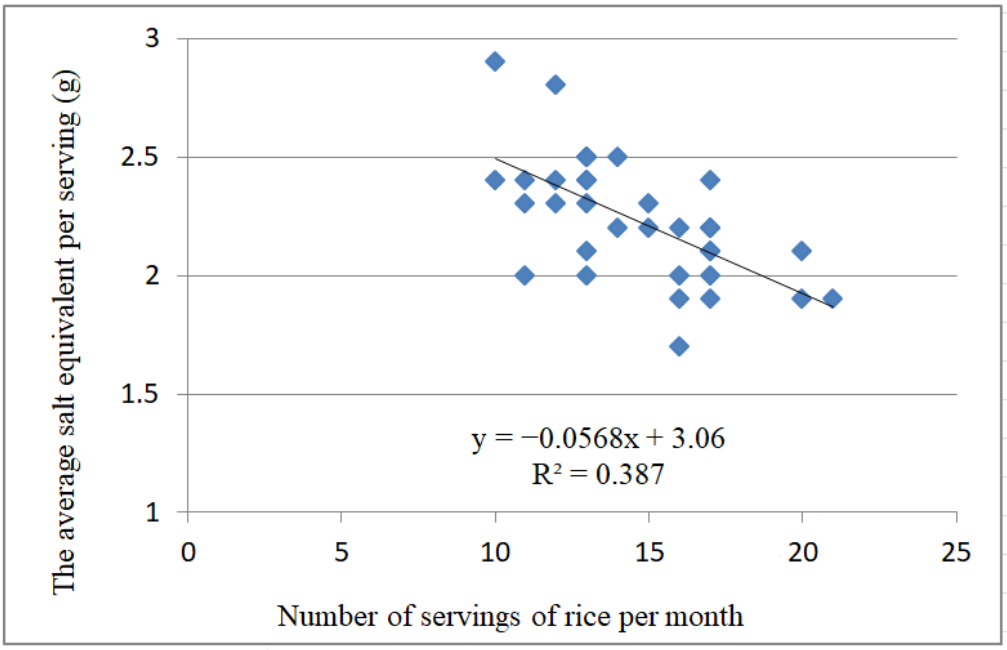

Figure 2. Correlation between average salt content and number of times rice was served during the month. HAD was used for statistical analysis.

DISCUSSION

Japan's school lunch nutritional standards were revised over three years ago. Although many municipalities could meet the previous standard of <2.5 g, only five had met the current standard of <2.0 g. Compared to similar prepared meals that are common in Japan, vegetable-focused prepackaged lunches from convenience stores had 484 kcal (±115) of energy and 5.0 g (±1.2) of *salt (9).* Meanwhile, junior high school lunches had 637 kcal (±43.51) and 2.7 g (±0.34) of salt (10). Both meals exceeded the recommended salt content established by the Japanese government. Looking at other countries, lunches served to Finnish preschoolers contained 1.37 MJ (±0.51) of energy and 1.6 g (±0.7) of salt *(11).* In South Korea, a typical school lunch for a fourth grader includes 2.44 g (±0.73) of salt (12), higher than recommended. Compared to other nutrients, it can be more difficult to meet salt standards established for school lunches (13). In Japan, seafood is the second-most-common ingredient (after seasonings) responsible for high dietary salt (7); however, the average amount of salt per serving did not increase even when seafood dishes were served more frequently. Thus, cooks and dietitians can find ways to limit dietary salt, even for dishes where fish is the main ingredient.

School lunch nutrition attracted increasing attention in Japan, even before national nutrition standards were introduced. Recommendations that elementary and junior high school meals contain <4 g salt emerged in 1995 (14). On the other hand, school lunches also play a role in Japan's food culture. For example, it would be difficult to strictly limit miso and soy sauce (both of which are high in salt), given the importance of these ingredients to the Japanese diet. MEXT, in its 2011 report "Establishment of School Meal Intake Standards," recognized the need to acclimate young children and adolescents to less-salty menu items without substantially limiting the use of miso and soy sauce, critically important to the nation's food culture (15). Unfortunately, if

dieticians don't set out to reduce salt content of school menu items, such improvements may be limited.

Since rice has been served in school lunches since 1976, the percentage has been gradually increasing; in 2009, MEXT announced its promotion of rice lunches at schools. According to the MEXT School Lunch Survey, in fiscal year (FY) 2021, Japanese schoolchildren are, on average, served rice in school 3.5 times per week. In-compliance municipalities included rice in their school lunches 3.8–5.0 times per week. Thus, options other than increasing the number of rice servings are available. However, since it is difficult to comply with recommended salt standards if rice is only served a few times per week, rice should be added to reduce the salt content of school lunches in Japan.

According to the Tables of Food Composition in Japan (8th revision), 100 g of bread or cobbler bread contain 1.2 g and 1.3 g of salt equivalent, respectively. Since approximately 70 g is given to third- and fourth-grade students in Japan, we estimate that each piece of bread provides ~0.8 g of salt equivalent. On the other hand, according to the United Kingdom's Food Composition tables, 100 g of bread would contain 380–400 mg of sodium, a salt equivalent of 0.96–1.1 g (16), about 20% less than in Japan. The United Kingdom has reduced the salt content of bread by about 20% over 10 years. In 2001, the salt content in 100 g of bread was 1.23 ± 0.19 g (17). A similar could help Japanese schools comply with Japan's revised nutritional standards.

The Japanese Food Labeling Law controls what information is included on food labels. Since 2015, pre-packaged processed foods must display nutritional information, including salt equivalent content. On the other hand, there are no rules governing what is included in school menus; each local government has its own rules. Consequently, the menus varied widely in energy, protein, fat, salt, and calcium. Some listed no nutrients at all. Notably, we failed to obtain menu lists from 13 prefectures with nutritional labels for salt. Today, school lunches serve as "living teaching materials" that can help schoolchildren learn about nutrition while providing additional information to families. We tried to obtain school lunch menus from across the country; however, the results may be biased because only some of the menus included average salt values. However, given the lack of prior school lunch menu studies, our results will likely inform future efforts to reduce the salt content of school lunch menu items. Future, large-scale studies are needed to advance this area of research. In Japan, our results may encourage more municipalities to publish the nutritional information from school lunches.

CONCLUSION

Five municipalities complied with salt standards (< 2.0 g one-month average). The amount of salt was significantly negatively correlated with the number of rice servings. The results suggest that although many elementary schools are still not in compliance with the salt standards for school lunches, it may be possible to achieve this by increasing the number of rice servings.

CONFLICTS OF INTEREST

The author has no conflict of interest to declare.

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REFERENCES

1. Asakura K, Sasaki S. School lunches in Japan: their contribution to healthier nutrient intake among elementary-school and junior high-school children. Public Health Nutr 20: 1523–1533. 2017.Wardle J. Parental influences on children's diets. Proc Nutr Soc 54:747-758. 1995.
2. Beaglehole R, Bonita R, Horton R, et al. Priority actions for the non-communicable disease crisis. Lancet 377: 1438–1447. 2011.
3. Fauzi M, Kartiko-Sari I, Poudyal H. Trends of dietary intakes and metabolic diseases in Japanese adults: assessment of national health promotion policy and national health and nutrition survey 1995-2019. J Clin Med 11: 2350. 2022.
4. Ministry of Education, Culture, Sports, Science and Technology, Japan: Partial recision of Criteria for Provision of School Lunches. (July, 31, 2018). (in Japanese). https://www.mext.go.jp/content/20210212-mxt_kenshoku-100003357_1.pdf (Accessed January, 12, 2023)
5. Ministry of Education, Culture, Sports, Science and Technology, Japan: School Lunch Nutrition Report (FY) 2019. (in Japanese). https://www.mext.go.jp/content/20200619-mxt_kenshoku-000008019_1.pdf (Accessed February, 4 2023)
6. Nagura H, Yamazaki Y, Kurisaki J, et al. Examination of the quality control of 5 school lunch menus. J Jpnese Soc Shokuiku 11: 25–34. 2017.
7. Asakura K, Uechi K, Masayasu S, et al. Sodium sources in the Japanese diet: difference between generations and sexes. Public Health Nutr 19: 2011–2023. 2016.
8. Hiroshi S. An introduction to the statistical software HAD: Suggestions to improve teaching, learning and practice data analysis. JMIC. 1: 59–73. 2016.
9. Namba T, Kushida O, Murayama N. The relationship between amount of vegetables energy, percentage energy from fat, and sodium chloride equivalent in the boxed meals soled in the convenience stores. Niigata J Health Welf 12: 28–34. 2012.
10. Horinishi E, Maruyama S: The study of make lunch environmental for femalestudent at junior high school –Salt distribution of Lunch box-. Treatises Stud Fac Kinjô Gakuin Univ 17–22. 2019.
11. Korkalo L, Nissinen K, Skaffari E, et al. The contribution of preschool meals to the diet of finnish preschoolers. Nutrients. 11: 1531. 2019.
12. Ahn S, Park S, Kim JN, et al. Salt content of school meals and comparison of perception related to sodium intake in elementary, middle, and high schools. Nutr Res Pract. 7: 59–65. 2013.
13. Crepinsek MK, Gordon AR, McKinney PM, et al.

Meals offered and served in US public schools: do they meet nutrient standards? J Am Diet Assoc. 109: S31–S43. 2009.
14. Morimoto K, Miyahara K. Nutritional management implemented at school lunch programs in Japan based on the changes in criteria for provision of school Lunches. Jpn J Nutr Diet Suppl 1: S23–S37. 2018.
15. Research Study Collaborator Conference on Formulation of Dietary Reference Intake of School Children in School Lunch Program: Formulation of the School Lunch Intake Standards (Report). Ministry of Education, Culture, Sports, Science and Technology, Japan. (2011). (in Japanese). https://www.mext.go.jp/b_menu/hakusho/nc/__icsFiles/afieldfile/2013/03/21/1332086_2.pdf (Accessed January, 12, 2023)
16. Composition of foods integrated dataset (CoFID): https://www.gov.uk/government/publications/composition-of-foods-integrated-dataset-cofid.
17. Brinsden HC, He FJ, Jenner KH, et al. Surveys of the salt content in UK bread: progress made and further reductions possible. BMJ Open 3: 1–7. 2013.