Original Article

Comparison of the nutrient-based standards for school lunches among South Korea, Japan, and Taiwan

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Nutritional standards are important guidelines for providing students with nutritionally-balanced school meals. This study compared nutrient-based school lunch standards regulated by South Korea, Japan, and Taiwan. The data were collected from relevant literature and websites of each country during September 2014. The number of classification groups of target students was 8, 5, and 5 for South Korea, Japan, and Taiwan, respectively. Gender was considered across all age groups in South Korea but only for high school students in Taiwan. Gender was not considered in Japan. Along with energy, the number of nutrients included in the standards for South Korea, Japan and Taiwan was 9, 12, and 4, respectively. The standards for all three countries included protein and fat among macronutrients. The standards for South Korea and Japan included vitamin A, B-1, B-2, and C, while the standards for Taiwan did not include any vitamins. Calcium was the only mineral commonly included in the three standards. The proportions of recommended daily intakes as reference values for each nutrient differed among the countries. Japan differentiated the proportions among 33%, 40%, or 50%, reflecting the target students' intake status of the respective nutrients. Taiwan differentiated either two-fifths or one-third of the recommended daily intakes. South Korea applied the proportion of recommended daily intake as one-third for all selected nutrients. This study could be valuable information for countries in developing nutrient-based standards for school lunches and for South Korea, Japan, and Taiwan in the process of reforming nutrient-based standards.

Key Words: school lunch program, nutrient-based standards, South Korea, Japan, Taiwan

INTRODUCTION

Childhood and adolescence are critical periods for physical growth and eating habit development. School lunches could play an important role. Existing studies worldwide have supported evidence that school lunches provided balanced nutrients and influenced the development of healthy eating habits for children and adolescents. A cross-sectional study using the 24-hour dietary recall data from the School Nutrition Dietary Assessment-Ⅲ in the U.S. reported that participants in school lunch programs tended to have less energy-dense foods in comparison to non-participants.[1] An internet survey with 11−16 year old students in Finland showed that the intake of nutritionally-balanced school lunches were associated with regular meal patterns and healthier food choices.[2] A cross-sectional survey in France revealed that participating in school lunch programs was generally related to healthier eating habits.[3]

Nutritional standards for school lunches are one of several important tools to ensure nutritional quality of school lunches. The case of the UK shows that the nutritional composition of school lunches has improved since nutritional standards were implemented in school lunch programs.[4-6]

Nutritional standards for school lunches are developed through measures such as physique, nutrient intakes, and nutritional problems of target students. Such standards could be nutrient-based and/or food-based. The nutrient-based standards present the reference values of nutrients and the food-based standards present the frequencies and amounts of food groups that are provided via school lunches. As of 2014, countries such as the U.S., England, and Taiwan had both types of standards and other countries such as South Korea and Japan had nutrient-based standards only.[7-11] The nutritional standards for school lunches of Asian countries share a common food culture, which could be meaningful to compare. To the best of our knowledge, South Korea, Japan, and Taiwan among Asia

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are the only countries that have legislated nutrient-based standards for school lunches. Therefore, this study comparatively examined nutrient-based standards for school lunches among these three particular countries.

DATA COLLECTION AND ANALYSIS

Nutrient-based standards for school lunches regulated by law were collected from the Ministry of Education websites of South Korea, Japan, and Taiwan during September 2014.[7-9,12] Additional data such as the percentage of schools operating school lunch programs and the history of school lunch programs were collected from relevant websites and literature.

In the case of Taiwan, the percentage of schools operating school lunch programs was not found in relevant websites and literature. Hence, e-mail and telephone surveys were conducted during September 2014. As a result, 21 of the 22 local ministries of education responded. Although high school students were included as the target groups of the nutritional standards for school lunches in Taiwan, the Ministry of Education was not in charge of the school lunch programs for high schools. Therefore, the number of high schools operating school lunch programs was not included in the responses to the surveys.

The data collected from each country were translated into English by bilingual graduate students on our research team and then used for analysis. The nutrient-based standards for school lunches among the three countries were compared on the basis of the following aspects: classification of the target students, number and kinds of selected nutrients, and nutrients' proportions of corresponding recommended daily intakes used to determine the reference value for each nutrient in the standards.

RESULTS AND DISSCUSSION

General characteristics of the school lunch programs

Table 1 shows the general characteristics of school lunch programs of South Korea, Japan, and Taiwan. In all three countries, the education-related departments in the central government were in charge of the school lunch programs. The education-related departments in the central governments of New Zealand, Slovakia, and England were also in charge of the school lunch programs.[13] Departments not related to education were in charge of the school lunch programs in the U.S., Poland, Hungary, Ireland, and Luxembourg. State or local governments were in charge of the school lunch programs in Germany, Sweden, Spain, Italy, France, and Finland.[13]

School lunch programs in South Korea

As of 2013, 100% of the 11,575 elementary, middle, high and special needs schools operated school lunch programs, and 99.6% of the students attending these schools participated in the programs.[14] In 1953 after the Korean War, school lunch programs started by providing underfed children with powdered milk donated by Canada.[15]

The School-Meals Act, which introduces the nutritional standards for school lunches, was enacted in 1981.[15] The nutritional standards for school lunches were revised to be consistent with the reference values of the 2005 DRIs for Koreans in 2007.[16] The standards for vitamin D and niacin were also excluded from the revised nutritional standards.[16] As of 2014, South Korea had nutrient-based standards, but not food-based standards. The nutrient-based standards were enforced to comply, and therefore, a fine would be imposed to schools that do not meet the standards. [16]

School lunch programs in Japan

As of 2013, 91.5% of the 33,014 elementary, middle, night high, and special needs schools operated school lunch programs. 89.6% of the students attending the schools participated in the programs.[17] A school lunch program was started by a private elementary school in a self-supporting way in 1889, but stopped during World War II, and then restarted with aid from the Licensed Agency for Relief of Asia after the war.[18] However, the school lunch programs were either suspended or defaulted due to the lack of funds, resulting in a demand for legislation on school lunch programs.[18]

The School-Meals Act was enacted in 1954 and the nutritional standards for school lunches were also announced at the same time.[19] Japan has continuously amended the nutritional standards. The standards have also been updated to be consistent with the changes in DRIs. The nutritional standards for school lunches were revised to be consistent with the reference values of the 2010 DRIs for Japanese in 2013.[20] Japan had used food-based standards until the revision of the nutritional standards for school lunches in 2003.[21,22] However, Japan had only nutrient-based standards as of 2014.

School lunch programs in Taiwan

The survey results in this study showed that 96.9% of the 3,364 elementary and middle schools had operated school lunch programs as of 2013. According to the survey of the Taiwan Cancer Foundation in 2007, nearly 96% of the students attending the elementary schools participated in the school lunch programs.[23] In 1951 after the Chinese Civil War, school lunch programs started in the 151 selected schools by providing needy children with powdered milk donated by UNICEF.[24]

The School-Health Act, which includes articles on school lunches, was enacted in 2002.[24] However, nutritional standards for school lunches were not included in the School-Health Act.[25] Although the nutrient-based and food-based standards for school lunches had been practically utilized by the Ministry of Education in Taiwan since 1997,[26] the standards had not been included in the School-Health Act until 2013 when the act was amended. The standards were established to be consistent with the reference of the 2011 DRIs for Taiwanese.[27] Taiwan had both food-based and nutrient-based standards as of 2014.

General characteristics of the nutrient-based standards for school lunch programs

Table 2 shows the general characteristics of the nutrient-based standards for school lunches of South Korea, Japan, and Taiwan. The number of classification groups of target students for South Korea, Japan and Taiwan were 8, 5 and 5, respectively, revealing that South Korea had the most detailed classifications. The age/grade classification for the three countries was established according to the levels of the schools (i.e., elementary, middle, and high

Table 1. General characteristics of school lunch programs of South Korea, Japan, and Taiwan

Characteristics	South Korea	Japan	Taiwan
Government organizations in charge of school lunch programs	Ministry of Education	Ministry of Education, Culture, Sports, Science, and Technology	Ministry of Education
Percentage of schools operating school lunch programs	100% out of elementary/ middle/high/ special needs schools[†]	91.5% out of elementary/middle/night high/ special needs schools[‡]	96.9% out of elementary/middle schools[§]
Percentage of students participating in school lunch programs	99.6% out of elementary/ middle/high/ special needs schools[†]	89.6% out of elementary/middle/night high/ special needs schools[‡]	96% out of elementary schools[¶]
Governing law of school lunch programs	School-Meals Act	School-Meals Act	School-Health Act
Historical years of school lunch programs			
Beginning of school lunch programs	1953	1889	1951
Enactment of the law for school lunch programs	1981	1954	2002
Implementation of the nutrition teacher system	2007	2005	-
The newest amendment of the nutritional standards	2007	2013	2013
Establishment of the nutritional standards			
Nutrient-based standards	Yes	Yes	Yes
Food-based standards	No	No	Yes

[†]Ministry of Education. Status of implementation of school lunch programs. 2013.
[‡]Ministry of Education, Culture, Sports, Science and Technology. Statistics of school lunch programs. 2013.
[§]The results of the survey conducted in the current study via email and telephone. 2013.
[¶]Lai JM. The report of survey on elementary school lunch in Taiwan. Formosa Cancer Foundation. 2007.

Table 2. General characteristics of the nutrient-based standards for school lunches of South Korea, Japan, and Taiwan

	South Korea[†]	Japan[‡]	Taiwan[§]
Grouping criteria of target students			
Age	Yes	Yes	Yes
Gender	Yes	No	No for elementary and middle schools and Yes for high schools
Number of groups of target students			
Elementary school students	4 (2 age groups & 2 gender groups)	3 (3 age groups)	2 (2 age groups)
Middle school students	2 (1 age group & 2 gender groups)	1 (1 age group)	1 (1 age group)
High school students	2 (1 age group & 2 gender groups)	1 (1 age group)[¶]	2 (1 age group & 2 gender groups)
Total	8	5	5
Number of nutritional components			
Energy and macronutrients	4	4	3
Vitamins	4	4	0
Minerals	2	5	2
Total	10	13	5

[†]Ministry of Education, School-Meals Act, Nutritional Standards for School Lunches. 2007.
[‡]Ministry of Education, Culture, Sports, Science and Technology. School-Meals Act, School Meals Performance Standards. 2013.
[§]Ministry of Education. School-Health Act, Standards for Food and Nutrition Facts of School Lunch Programs. 2013.
[¶]Ministry of Education, Culture, Sports, Science and Technology. School-Meals Act, School Meals Performance Standards for night high schools. 2013.

Table 3. Selected nutrients and their proportions of corresponding recommended daily intakes in the nutrient-based standards for school lunches of South Korea, Japan, and Taiwan

Nutrients	South Korea†	Japan‡	Taiwan§
Energy and macronutrients			
Energy	1/3 EER (1/3±10% EAR)	33% EER	2/5 mean of low active and active EER
Carbohydrates	55-70% total calories	-	-
Protein	≥1/3 RNI (7-20% total calories)	15% total calories (12-20% total calories)	16% total calories
Fat	15-30% total calories	25-30% total calories	≤30% total calories
Dietary fiber	-	8 g/1,000 kcal	-
Vitamins			
Vitamin A	≥1/3 EAR, ≥1/3 RNI	40% RDA for elementary school students and 33% RDA for middle school students	-
Vitamin B-1	≥1/3 EAR, ≥1/3 RNI	40% RDA	-
Vitamin B-2	≥1/3 EAR, ≥1/3 RNI	40% RDA	-
Vitamin C	≥1/3 EAR, ≥1/3 RNI	33% RDA	-
Minerals			
Calcium	≥1/3 EAR, ≥1/3 RNI	50% RDA	1/3 AI
Iron	≥1/3 EAR, ≥1/3 RNI	33% RDA	-
Sodium	-	<33% target amount	2/5 target amount
Magnesium	-	50% RDA	-
Zinc	-	33% RDA	-

EER: Estimated Energy Requirement; EAR: Estimated Average Requirement; RNI: Recommended Nutrient Intake; RDA: Recommended Dietary Allowance; AI: Adequate Intake.
RNI in South Korea corresponds to RDA in other countries.
For vitamins and minerals, South Korea established mandatory standards using EAR in addition to recommended standards using RNI.
†Ministry of Education. School-Meals Act, Nutritional Standards for School Lunches. 2007.
‡Ministry of Education, Culture, Sports, Science and Technology. School-Meals Act, School Meals Performance Standards. 2013.
§Ministry of Education. School-Health Act, Standards for Food and Nutrition Facts of School Lunch Programs. 2013.

schools). The age/grade classifications of the nutrient-based standards for school lunches were grades 1-3 and 4-6 for elementary, middle, and high schools in South Korea and Taiwan, and ages 6-7, 8-9, 10-11, and 12-14 for elementary, middle, and night high schools for Japan.[12] These classifications were established with regard to the age classification of DRIs in each country.[28-30]

For the DRIs of South Korea, Japan, and Taiwan, the gender of the target population was considered across all age groups. However, in the nutrient-based standards for school lunches, not all countries had gender groups within the age categories. Gender was used for classification of the target students within all age groups in South Korea and only for high school students in Taiwan. In the case of Japan, gender was not used for classification of the target students.

The number of selected nutrients in the standards differed among the three countries. Along with energy, the number of selected nutrients for South Korea Japan, and Taiwan was 9, 12 and 4, respectively, revealing that Japan had the greatest variety of nutrients. The number of selected vitamins in the standards for both South Korea and Japan was 4, while Taiwan included none of the selected vitamins. The number of selected minerals for South Korea, Japan, and Taiwan was 2, 5 and 2, respectively.

Selected nutrients and the basis of the reference value in the nutrient-based standards for school lunches

Table 3 shows the kinds of nutrients included in the nutrient-based standards for school lunches and the nutrients' proportions of corresponding recommended daily intakes that serve as a basis of the reference values for each nutrient. South Korea, Japan, and Taiwan commonly included energy, protein, and fat in the nutrient-based school lunch standards. England also included energy, protein, and fat in the standards for school lunches.[10] However, the U.S. did not include protein and fat, but instead saturated fat and trans fat in the nutrient-based standards.[11]

In the case of vitamins, the standards included vitamin A, B-1, B-2, and C in South Korea and Japan. However, Taiwan did not include any vitamins. Calcium was the only mineral commonly included in all of the standards. The proportions of recommended daily intakes as reference values for each nutrient differed among the three countries. Japan and Taiwan differentiated the proportions of recommended daily intakes of nutrients, but South Korea uniformly applied the proportion of recommended daily intakes as one-third for all selected nutrients.

Japan and Taiwan established standards for vitamins and minerals using Recommended Daily Allowance (RDA), Adequate Intake (AI), or target amounts by nutrients. South Korea established mandatory standards using Estimated Average Requirement (EAR) in addition to recommended standards using Recommended Nutrient Intake (RNI). RNI in South Korea corresponds to RDA in other countries. EAR is the average level of daily nutrient intake that meet the requirements for half of the healthy individuals in a life stage and gender group. EAR is estimated from the median intake of requirement distribution of the population.[28] Therefore, the reference value set using EAR could cause the risk that half of the individuals within the target students do not meet the EAR. Considering such risk, the reference values of nutrients should approach RNI/RDA or AI, but not EAR when planning menus for institutional food services.[28,29]

Energy and macronutrients

Along with energy, protein, and fat, South Korea included carbohydrates and Japan included dietary fiber in their school lunch standards. The reference value for carbohydrates was set as 55-70% of the total calories in South Korea and that of dietary fiber was set as 8 g per 1,000 kcal in Japan. The report "Establishing of the Standards of School Lunch Intake in 2011" for Japan showed that dietary fiber was included in the standards to encourage the intakes of dietary fiber-rich foods.[31]

The reference values of energy in South Korea and Japan were established as one-third and 33%, respectively, of the Estimated Energy Requirements (EER). However, the reference value of energy for Taiwan was established differently. The reference values of energy recommended in the 2011 DRIs for Taiwanese were divided into sedentary, low active, active, and very active types, according to the activity levels of daily lives.[30] The intake ratio of the Taiwanese breakfast, lunch, and dinner was reported in the proportion of 1:2:2.[32] The energy intake from snacks was 10% per day.[32] Based on these factors, the reference value of energy for school lunch standards was calculated to 90% of two-fifths of the mean for low active and active EERs in Taiwan.[32]

As for protein, the standards for South Korea included two conflicting values: one-third of the RNI and 7-20% of the total calories. By age group, one-third of the RNI equals 6.3-9.0% of the total calories. The reference values for Japan and Taiwan were established as 15% and 16% of the total calories, respectively. For Japan, the reference value of protein changed to 15% of the total calories upon the amendment of the nutrient-based standards for school lunches in 2013. The old reference value of protein was 50% of RDA.[33] This change resulted from a sufficient intake status of most students and consideration of an Acceptable Macronutrient Distribution Range (AMDR) value for protein.[20,34]

The maximum levels of the standards for fat were set as 30% of the total calories for all three countries. In the case of the minimum levels of the standards for fat, South Korea was set as 15% of the total calories. Japan set the minimum levels as 25% of the total calories in order to increase the absorption rate of fat-soluble vitamins or carotenoids and to encourage milk consumption for calcium intake.[31] Taiwan did not specify minimum levels of the standards for fat. According to the Nutrition and Health Survey in Taiwan, actual fat intake accounted for 31% of the total calories for elementary school students,[35] 34% for middle school students,[36] and 33% for high school students.[37] It seems that Taiwan did not specify the minimum levels of the standard for fat due to the sufficient fat intake status of students.

Notably, Taiwan considered milk when calculating the amounts of protein and fat intakes from school lunches.[32] The reference values of protein and fat for school lunches were established by excluding three-fifths of the protein and fat amounts per serving of milk since students were provided with milk three times in five days.

Vitamins

South Korea and Japan included vitamin A, B-1, B-2, and C in the nutrient-based standards for school lunches. When comparing the proportions of recommended daily intakes, vitamin C for South Korea was one-third of the RNI, which is similar to 33% of the RDA for Japan. Also, vitamin A, B-1 and B-2 were one-third of the RNI for South Korea, which is a little lower than 40% of the RDA for Japan. South Korea applied one-third of the RNI to all of the selected vitamins, which is based on the presumption that one out of three meals per day came from school lunches.[16] However, Japan set the proportions of recommended daily intakes, reflecting the actual intake status of such vitamins. The proportions of RDA for vitamin A were 33% for elementary school students and 40% for middle school students, which is based on the survey results that vitamin A intake was insufficient only for middle school students.[20] As for vitamin B-1 and B-2, the proportions were established as 40% of the RDA for both elementary and middle school students, reflecting insufficient intakes.[20]

For Taiwan, vitamins were not included in the nutrient-based standards. Instead, the food-based standards for Taiwan included the 'target reference value' and the 'intermediate reference value' for fruits and vegetables as the main sources of vitamins. The target reference value means the optimum amount of nutritional intake. The intermediate reference value is the amount of nutritional intake, which should be met in a practically difficult situation for reaching the target reference value. For example, in the case of elementary school grades 1-3, the target reference value of fruits was established as one portion at five times per week and the intermediate reference value was established as one portion at two times per week.[9] As for vegetables, both the target and intermediate reference values were set to one and one-half portions at five times per week.[9] Although the U.S. had vitamins in the nutritional standards for school lunches, the new 2012 standards excluded vitamins. The 2012 standards combined nutrient-based and food-based standards.[11]

Minerals

Calcium was the only mineral that South Korea, Japan, and Taiwan commonly included in the standards. The reference values of calcium were established as one-third of the RNI and AI for South Korea and Taiwan, respectively. However, the reference values of calcium were established as 50% of the RDA for Japan, reflecting the students' insufficient calcium intake at home.[33] These results are derived from the Dietary Status Survey[38] and the Status of Dietary Life Survey.[34]

South Korea and Japan included iron in the standards. However, Taiwan did not include iron. The reference values for iron were established as one-third of the RNI and 33% of the RDA for South Korea and Japan, respectively. Iron was not included in the nutrient-based standards for Taiwan probably because students generally had enough iron intakes. Actual iron intakes as a percentage of the RDA in Taiwan were 123% for male and 112% for female elementary school students,[35] 121% for male and 104% for female middle school students,[36] and 133% for male and 102% for female high school students.[37]

The deficiencies in calcium and iron are well known and their symptoms are easy to recognize in a relatively short period. Thus, caution is necessary for the intakes of

calcium and iron.[29] For England, the proportions of recommended daily intakes for calcium and iron were established in the nutrient-based school lunch standards.[10]

Japan and Taiwan listed the reference values of sodium in the standards. However, South Korea did not list sodium values. Japan and Taiwan determined the reference values of sodium as 33% and two-fifths of the target amounts, respectively. The target amounts per day for Japan were set by age and gender at 2,400-3,400 mg and for Taiwan by age at 2,000 or 2,400 mg.[29,32]

The Korea Health Statistics (2012) revealed the status of sodium over-intake. The percentages of children and adolescents in South Korea with sodium intakes over 2,000 mg per day were 79% for 9-11 year olds and 85% for 12-18 year olds.[39] According to the study, the average sodium intakes from a school meal were 40% and 53% of 2,000 mg for elementary and middle school students, respectively.[40] Therefore, including sodium in the school lunch standards might be necessary in the next revision of standards in South Korea.

Additionally, Japan included magnesium and zinc in the standards because of students' insufficient intakes of these minerals.[31] Japan established the reference value of magnesium as 50% of the RDA in order to maintain a balance between magnesium and calcium intakes and to reflect the results from the Status of Dietary Life Survey, which showed that the average amounts of students' magnesium intake were less than the RDA.[31,34] On the other hand, South Korea and Taiwan did not include magnesium in the nutrient-based standards. Countries such as the U.S. and England also did not include magnesium in the nutrient-based standards.[10,11] In addition, Japan established the reference value of zinc as 33% of the RDA. This was based on the fact that the intakes of zinc could easily become insufficient under dietary circumstances because the Japanese consume a lot of foods made of refined flour such as white bread, Udon noodle, or spaghetti.[31]

Conclusions

There are similarities and differences in the nutrient-based standards for school lunches among South Korea, Japan, and Taiwan. The nutrient-based standards varied considerably among the three countries in terms of classification of the target students, selected nutrients, and nutrients' proportions of corresponding recommended daily intakes, which serves as the basis of the reference values. Both Japan and Taiwan had good examples for setting the proportions of recommended daily intakes for each nutrient. Japan and Taiwan tended to consider the actual status of nutrient intakes among target students in school lunch programs and reflect the actual status when establishing reference values of each nutrient. Japan differentiated the proportions of recommended daily intakes among 33%, 40%, or 50% by nutrients. Taiwan differentiated the proportions of recommended daily intakes by either two-fifths or one-third. The processes in Japan and Taiwan appear to be a desirable model for other countries.

Recently, the concept of Nutrient Targets was developed to serve as a guide for setting standards for menu planning of school lunches in the U.S.[41] Nutrient Targets could provide a scientific basis for the standards for menu planning of school lunches.[41] Therefore, the concept of Nutrient Targets might serve as an alternative strategy for setting the standards.

Each country could learn some strategies from other countries for improving their own nutrient-based standards. The results of this study could be also used as valuable information for other countries to develop nutrient-based standards for school lunches.

AUTHOR DISCLOSURES

There is no conflict of interest in this study.

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Appendix table 1. Nutrient-based standards of school lunches of South Korea

Gender	School level	Energy (kcal)	Protein (g)	Vitamin A (μg RE)		Vitamin B-1 (mg)		Vitamin B-2 (mg)		Vitamin C (mg)		Calcium (mg)		Iron (mg)	
				EAR	RNI	EAR	RNI	EAR	RNI	EAR	RNI	EAR	RNI	EAR	RNI
Men	Elementary schools Grades 1-3	534	8.4	97	134	0.20	0.24	0.24	0.30	13.4	20.0	184	234	2.4	3.0
	Elementary schools Grades 4-6	634	11.7	127	184	0.27	0.30	0.30	0.37	18.4	23.4	184	267	3.0	4.0
	Middle schools	800	16.7	167	234	0.34	0.40	0.44	0.50	25.0	33.4	267	334	3.0	4.0
	High schools	900	20.0	200	284	0.37	0.47	0.50	0.60	28.4	36.7	267	334	4.0	5.4
Women	Elementary schools Grades 1-3	500	8.4	90	134	0.17	0.20	0.20	0.24	13.4	20.0	184	234	2.4	3.0
	Elementary schools Grades 4-6	567	11.7	117	167	0.24	0.27	0.27	0.30	18.4	23.4	184	267	3.0	4.0
	Middle schools	667	15.0	154	217	0.27	0.34	0.34	0.40	23.4	30.0	250	300	3.0	4.0
	High schools	667	15.0	167	234	0.27	0.34	0.34	0.40	25.0	33.4	250	300	4.0	5.4

EAR: Estimated Average Requirement; RNI: Recommended Nutrient Intake.
Nutrient-based standards for school lunches present the reference value per meal. These standards should be used with flexibility considering the individual health, physical activities and variation across regions. School lunches were evaluated through the average daily amount for consecutive 5-day school week every season. Allowance range is as follow: 1) Allowance of energy was up to ±10%. Energy composition ratio of carbohydrates, protein, and fat should be aligned with 55-70%: 7-20%: 15-30%. 2) Provision amounts of protein should be more than reference value. The proportion of protein from total calories should be less than 20%. 3) In the case of vitamin A, B-1, B-2, and C, calcium, iron, recommended amounts are equal to RNI or more than RNI. Also, mandatory amounts are at least equal to EAR or more than EAR.
RNI in South Korea corresponds to RDA in other countries.
Source: Ministry of Education. School-Meals Act, Nutritional Standards for School Lunches. 2007

Appendix table 2. Nutrient-based standards for school lunches of Japan

	Reference value				
	6-7 yr	8-9 yr	10-11 yr	12-14 yr	Night high schools
Energy (kcal)	530	640	750	820	820
Protein (g)	20	24	28	30	30
Range (g)	16-26	18-32	22-38	25-40	25-40
Fat (%)			25-30% of total calories		
Sodium (sodium chloride equivalent) (g)	Less than 2	Less than 2.5	Less than 2.5	Less than 3	Less than 3
Calcium (mg)	300	350	400	450	380
Iron (mg)	2	3	4	4	4
Vitamin A (μg RE)	150	170	200	300	300
Vitamin B-1 (mg)	0.3	0.4	0.5	0.5	0.5
Vitamin B-2 (mg)	0.4	0.4	0.5	0.6	0.6
Vitamin C (mg)	20	20	25	35	35
Dietary fiber (g)	4	5	6	6.5	6.5

In addition to the nutrients included in this table, other nutrients also should be considered for the intake, it is as follows: Magnesium: 6-7 yr 70 mg, 8-9 yr 80 mg, 10-11 yr 110 mg, 12-14 yr 140 mg. Zinc: 6-7 yr 2 mg, 8-9 yr 2 mg, 10-11 yr 3 mg, 12-14 yr 3 mg.
Since this table shows the national average after adjustment considering the individual health, physical activities and variation across regions, these standards should be used with flexibility and taking in account these adjustments.
Source: Ministry of Education, Culture, Sports, Science and Technology. School-Meals Act, School Meals Performance Standards. 2013 and School Meals Performance Standards for night high schools. 2013

Appendix table 3. Nutrient-based standards for school lunches of Taiwan

	Elementary schools		Middle schools	High schools	
	Grades 1-3	Grades 4-6		Male	Female
Energy (kcal)	670	770	860	970	750
Reference value for energy: 2/5 of the mean for low active and active calories of DRIs in males and females					
Protein (g)	22	26	30	34	25
Reference value for protein: 16% of the mean for the total calories					
Fat (g)	20	23	26	30	23
Reference value for fat: lower than 30% of the mean for the total calories					
Calcium (mg)	270	330	400	400	400
Reference value for calcium: 1/3 of the mean for the DRIs in males and females					
Sodium (mg)	800	800	960	960	960
Reference value for sodium: 2/5 of recommended amounts					

Source: Ministry of Education. School-Health Act, Standards for Food and Nutrition Facts of School Lunch Programs. 2013