(iD) Silvia Haruka Tsutsumi do Carmo[1]

(iD) Aline de Piano Ganen[1]

(iD) Adriana Garcia Peloggia de Castro[1]

[1] Centro Universitário São Camilo RÖR, Curso de Nutrição, Mestrado Profissional em Nutrição do Nascimento à Adolescência. São Paulo, SP, Brasil.

Correspondence
Aline de Piano Ganen
aline.depiano@gmail.com

Assistant Editor
(iD) Letícia Ferreira Tavares

Nutritional quality of menus offered in schools in Brazil and Japan

Qualidade nutricional de cardápios ofertados em escolas do Brasil e do Japão

Abstract

Introduction: Japan, like Brazil, is facing the loss of its traditional dietary background due to the growing adoption of a Western diet in school menus, which can putmany children at nutritional risk. *Objective:* To compare the energy density, glycemic load, frequency of ultra-processed foods served, and description of food groups found in   menus offered by a Japanese and Brazilian school. *Methods:* This was a cross-sectional, descriptive and quantitative study using menus offered to preschoolers at a foreign school in Yamanashi-ken, Japan, and a private school in São Paulo, Brazil. Quantitative analysis was performed using the Diet Smart® software, version 12.1.2. Energy density, glycemic load, ultra-processed foods, and food groups were analyzed descriptively. The Kolmogorov-Smirnov test was used to test for normality of variables, and the Student's t-test was used for parametric variables and the Mann-Whitney test for non-parametric variables. *Results:* The Brazilian lunch menu had higher energy density and glycemic load as well as a greater presence of legumes, roots and tubers, fruits, eggs, and fish, while the Japanese menu had a greater presence of red meat and pork. The Brazilian afternoon snack menus had a higher energy density and a greater supply of roots and tubers, vegetables, red meat, and poultry. The Japanese menu, on the other hand, had a greater supply of cereals, eggs, and ultra-processed foods. *Conclusions:* Both menus contained ultra-processed foods and exceeded the recommended energy density.

Keywords: Preschool. School Food. Menu Planning. Food Guides. Ultra-processed Foods. Food Consumption.

Resumo

Introdução: O Japão, assim como o Brasil, enfrenta a perda de suas bases alimentares tradicionais devido à adoção crescente de uma dieta ocidental nos cardápios escolares, o que coloca muitas crianças em risco nutricional. *Objetivo*: Comparar a densidade energética, carga glicêmica, frequência de alimentos ultraprocessados e presença de grupos alimentares de cardápios ofertados por escola estrangeira japonesa e brasileira. *Métodos*: Estudo transversal, descritivo e quantitativo, desenvolvido com a utilização de

cardápios oferecidos a pré-escolares de escola estrangeira de Yamanashi-ken-Japão e de escola particular de São Paulo-Brasil. A análise quantitativa foi feita com o *software* Diet Smart®, versão 12.1.2. Densidade energética, carga glicêmica, alimentos ultraprocessados e grupos alimentares foram analisados descritivamente. Realizou-se o teste de normalidade das variáveis por meio do teste de Kolmogorov-Smirnov e foram utilizados teste *t* de Student para variáveis paramétricas e o teste Mann Whitney para não-paramétricas. *Resultados*: O cardápio do almoço brasileiro apresentou maior densidade energética, carga glicêmica e maior presença dos grupos de leguminosas, raízes e tubérculos, frutas, ovos e pescados, enquanto nesta mesma refeição no cardápio japonês a maior presença foi de carne vermelha e suína. Os cardápios do lanche da tarde brasileiro apresentaram maior densidade energética e oferta de raízes e tubérculos, legumes e verduras, carne vermelha e aves. Já no cardápio japonês destaca-se a maior oferta de alimentos dos grupos de cereais, ovos e alimentos ultraprocessados. *Conclusões*: Foram constatados em ambos os cardápios presença de alimentos ultraprocessados e valores excedentes em densidade energética.

Palavras-chave: Pré-Escolar. Alimentação Escolar. Planejamento de Cardápio. Guias Alimentares. Alimentos Ultraprocessados.Consumo Alimentar.

INTRODUCTION

With the expansion of urbanization in both developed and developing countries, dietary patterns have changed. Countries like Brazil and Japan have experienced a growth in the consumption of ultra-processed, refined foods, and fats, as well as a reduced fiber food and fish intake, and a higher consumption of red meat,[1-3] leading to an imbalance in nutritional intake and excessive caloric intake.[4,5] Furthermore, there has been a change in family patterns, with women becoming more professionally active and the children admitted in early school; this causes the mothers' sharing with the school the responsibility for introducing food.[4] Therefore, early childhood education also becomes responsible for food and nutritional security and the formation of early childhood eating habits.[5]

To ensure an adequate school meal, a colorful food menu with high nutritional value, having textures and consistencies appropriate for the age group is required; it ought to be inserted in the cultural context, safe from a hygienic-sanitary point of view and financially feasible for the institution.[6] On the other hand, the inclusion of refined foods with high energy density (ED) and glycemic load (GL) should be avoided, such as ultra-processed foods in the form of sweets, sugar-sweetened beverages, sausages, canned foods, among others.[7] Foods high in sugar, saturated fats, trans fats and sodium contribute to the development of inflammatory processes in the body, since they are pro-inflammatory products; they also weaken cultural diversity and population dietary identity, and cause an increased risk of obesity, which has been reaching alarming figures (124 million children and adolescents with obesity in the world).[7]

The importance of evaluating the nutritional quality of menus offered in the two schools located in the Eastern and Western hemisphere respectively, is essential in order to suggest interventions that improve food quality, reduce nutritional irregularities, emphasize the importance of preserving traditional diets and ensure food security for preschool children.[8,9] In this connection, the objective of this study was to compare the energy density, the glycemic load, the presence of ultra-processed foods and food groups in the menus offered by a Brazilian private school and a foreign school in Japan.

METHODS

Study design

This was a cross-sectional study.

Sample characteristics

The sample consisted of one-month menus offered to preschoolers in the municipalities of the State of São Paulo, Brazil, and Chuo-Yamanashi, Japan, and was characterized as convenience and non-probabilistic. The menus for the first half of April and May 2022 from the Japanese school and the menu for April 2022 from the Brazilian school were analyzed qualitatively and quantitatively.

The menus for the first two weeks of two consecutive months at the Japanese school were selected, since the school duplicates the food preparations used in the first two weeks for the remaining two weeks of the month. Thus, the five days of the week—Monday through Friday—were evaluated, totaling 20 monthly menus offered to the students. The days of the week were represented by numbers from 1 to 5 for each week assessed.

The school that participated allowed the use of the menus, formalized through signed, scanned, and emailed correspondence.

The selection criteria included menus of two daily meals— lunch and afternoon snack—for children aged 2 years to 2 years and 11 months.

Characteristics of the study sites

A prefectural school serving children aged 0-2 years and 11 months was selected in Japan; it is located in Chuo-Yamanashi City, Japan. The school attends children full-time; they are served lunch and afternoon snacks in the school. School meals in Japan abide to the government guidelines established by the Ministry of Health, Labor and Welfare and the Ministry of Agriculture, Forestry and Fisheries, which regulate the nutritional composition and meal planning, promoting healthy eating habits through the Food Education Law (*Shokuiku*) and the *Japanese Food Guide (Spinning Top)*.[10-12] The school meal system ensures nutritionally balanced menus, planned by nutritionists and prepared with local, seasonal ingredients.[12]

In the Japanese school assessed, typical Japanese dishes are offered for lunch, but twice a month Brazilian dishes are served, without cultural adaptations, for children of other nationalities. Traditional Brazilian food is prevalent in snacks, such as bread and eggs, cheese or *pâtés*, smoothies, juices and popcorn.

On the other side, the Brazilian private school selected serves children aged 0-4 years and 11 months and is located in the southern region of the city of São Paulo. The school offers a hybrid education model, combining half-day and full-day schedules, in which children who opt for lunch and afternoon snacks eat these meals in the school. Being a private school, it does not follow the rules of the *Programa Nacional de Alimentação Escolar* (PNAE, National School Feeding Program), but it does have internal guidelines for menu offerings, such as fresh or pulp juice and seasonal products. Specifically, regarding afternoon snacks, the school offers a variety of soups, such as *canja* (chickensoup), bean soup, and meat and vegetable soup

Assessment of meal composition

The quantitative analysis of nutrients for each meal offered was performed using the DietSmart® software, version 12.1.2.

Based on the raw *per capita* quantities provided by the schools, the foods were adjusted according to cooking indices, as described by Guimarães & Galisa,[13] before being converted into portions. After the conversion, the foods were organized according to food group (legumes, cereals, roots and tubers, vegetables, fruits, nuts, milk and cheese, beef, eggs, fish, poultry, and pork), obtaining the consumption for each day of the week in the form of portions.

After digitalization of all the food data into the software, the nutritional value of the meals was calculated. To estimate the Total Energy Value (TEV) of the meals, the total amounts (g) of carbohydrates, proteins, and lipids were used, multiplied by their respective energy values to obtain the data in kilocalories (kcal).

The nutritional composition of foods was based on the *Tabela Brasileira de Composição de Alimentos* (TACO, Brazilian Food Composition Table), 4th edition,[14] besides data sources from IBGE and the United States nutrient database (USDA National Nutrient Database for Standard Reference).[15] Those tables were chosen due to their comprehensiveness and availability of detailed information on the nutritional composition of various foods.

Although Standard Tables of Food Composition in Japan do exist, we chose to use the tables available in the software; they were used to compare the menus as we observed the absence of some significant

differences between the analyses. The software included complete information on all the foods in the Japanese recipes used in the local school, ensuring consistency in the analysis and eliminating potential bias.

To evaluate the Energy Density (ED) of meals, the method of including all solid foods and beverages, except water (ED1), described by Cox & Mela, was chosen.[16] The ED was calculated considering the TEV value and the total weight in grams of the meals described in the menu, according to Equation 1.

$$ED = \frac{Total\ Energy\ Value\ (kcal)}{Total\ weight\ of\ food\ (g)}$$

The results obtained were compared to the recommendations of the *Instituto Nacional do Câncer* (INCA, National Cancer Institute),[17] which recommends an average of 1.25 kcal/g ED for meals. INCA was selected based on its credibility and recommendations applicability to preschool children, considering its guidelines for a balanced diet, which favors healthy growth and helps prevent both malnutrition and the risk of obesity.

After descriptively analyzing the ED of the menusin Brazil and Japan, the weekly averages for lunch and afternoon snacks were compared between the two countries. To do this, the average ED of each meal (lunch and afternoon snack) was calculated for each week assessed, considering the days from Monday to Friday.

The menu database was tabulated in the Microsoft Excel 2010 software and the information was organized as follows: menu of the corresponding school; menu week, weekly average, minimum and maximum, ED and GL of lunch and snack, frequency of ultra-processed foods and presence of food groups.

The Glycemic Load (GL) of the diet was assessed using the formula[18]

$$GL = \frac{Portion\ of\ available\ carbohydrate\ x\ GI}{100}$$

The criteria of Cornejo-Monthedoro et al. were used for classifying the GL:[19] values: < 80, low; between 80 and 119, moderate; and > 120 high GL. Vegetables and greens were excluded from this calculation, as the relevant values are not enteredin the reference tables used. The GL data obtained using the DietSmart® software, version 12.1.2 were reported separately by meal (lunch and snack).

Assessment of ultra-processed foods and food groups

The evaluation of ultra-processed foods in the school menus in Japan and Brazil was carried out according to the NOVA classification,[6] based on an analysis of the frequency per meal (lunch and snack), as well as through a comparison between the menus of the two countries. Furthermore, the presence (yes or no) of different food groups (legumes, cereals, roots and tubers, vegetables, fruits, nuts and seeds, milk and cheese, red meat, eggs, fish, poultry and pork) on the menus was evaluated, in accordance with the Food Guide for the Brazilian Population.[5] This Guide recommends a varied and balanced diet and is used as a reference for categorizing foods and analyzing dietary diversity in the menus evaluated.[5,7]

Statistical analysis

The collected variables were entered into a Microsoft Excel 2010 database. For the descriptive statistics, the mean was used in this study, considering the standard deviation, median, and range to describe the data distribution. The data collected were reviewed using tables and descriptive measures.

The normality of the variables was tested using the Kolmogorov-Smirnov test to identify which ones presented a normal distribution.

To compare ED and GL, the Student's *t*-test was applied for the parametric variables, and the Mann-Whitney test for non-parametric variables.

The statistical analyses were performed using the Statistica software version 6.0 for Windows, using a p≤0.05 significance level.

RESULTS

In the lunch menus, the typical Brazilian school meal included rice, beans, a salad starter, a protein dish alternating chicken, fish, and beef and vegetables as side dish, fruit for dessert, and fresh fruit juices as beverages. The Japanese school menu, in turn, included typical Japanese and Brazilian staples, including Japanese rice, fermented soybean soup, fish, pork, chicken, or beef protein, seasoned with Eastern and/or Western seasonings such as curry, shoyu, mirin saké, butter, and herbs, greens and vegetables in salads, and fruit juices or desserts. For the afternoon snacks, the Brazilian school offered a variety of soups (such as *canja* or bean soup), while the Japanese school served snacks with juices or processed teas and bread and egg, pâtés, gelatin, pies, and popcorn.

The ultra-processed foods identification process in school menus revealed that, on the Brazilian menu, the main ultra-processed foods were gelatins, while in the Japanese school menu, foods such as processed breads, pasta mixes, processed condiments, and processed food preparations predominated. These meals were analyzed based on the NOVA classification, which categorizes foods into groups according to their degree of processing.

The comparative analysis of the energy density (ED) of the two meals served in the schools assessed revealed that the Brazilian meals had significantly higher ED values compared to the Japanese meals (Table 1).

With regard to the distribution of ED frequency for lunches and snacks served in the schools evaluated, the Brazilian and Japanese lunches revealed the greatest rate of low ED frequency, at 95% and 90%, respectively. No lunches with high ED frequency were found in either school. As to snacks, a higher frequency of moderate ED frequency was observed in the Brazilian school and a higher frequency of low ED in the Japanese school food. Meals in Japan had very low ED frequency, while in Brazil this classification was absent (data not reported in the table).

According to the frequency of GL values classification distributed according to the meals served in early childhood education units in Brazil and Japan, it was found that all menus of the two schools assessed presented low GL in both meals.

The comparative analysis of GL between Brazil and Japan showed that the Brazilian lunch had a significantly higher GL value. On the other hand, the GL of the afternoon snack was higher in the Japanese menu, with a significant difference in relation to Brazil (Table 1).

Table 1. Energy density and glycemic load values, in the meals served in two early childhood education unitsin Brazil and in Japan. São Paulo-SP, 2022.

Snack	Brazil	Japan	p value
Lunch Energy Density*	Average (minimum - maximum) 1.25 (0.93-1.65)	Average (minimum - maximum) 1.17 (0.66-1.51)	0.004
Glycemic Load	27.1 (22-55)	3 (0-23)	0.000
Afternoon snack Energy Density*	1.54 (1.03-1.72)	0.92 (0.47-1.57)	0.000
Glycemic Load	5 (0.0-14.0)	10 (0.0-17.0)	0.000

*Energy density recommendation according to INCA (2009) = 1.25
Source: The authors.

Table 2 describes the frequency of ultra-processed (UP) foods contained in the lunch and afternoon snack menus of the two schools assessed. The Japanese menu included a higher number of UP foods, with 30% of lunches containing at least one ultra-processed food. Among the meals containing UP foods, six contained one UP food, four contained two UP foods, and one meal contained four UP foods. In contrast, most Brazilian meals did not include ultra-processed foods, with the exception of four lunches containing a UP food (gelatin). In addition, Brazilian menus did not include ultra-processed foods in their afternoon snacks. Conversely, at the Japanese school, most snacks included at least one UP food and, specifically, a single snack (processed juice, UP sliced bread, and processed condiment) contained three UP foods).

Table 2. Frequency in number (n) and percentage (%) of ultra-processed foods in lunch and afternoon snack menus in two early childhood education unitsin Brazil and in Japan. São Paulo-SP, 2022.

| | Snack | | | |
| | Brazil | | Japan | |
Frequency of ultra-processed foods	Lunch n (%)	Afternoon snack n (%)	Lunch n (%)	Afternoon snack n (%)
0	16(80)	20(100)	9(45)	4 (20)
1	4 (20)	-	6(30)	12(60)
2	-	-	4(20)	3(15)
3	-	-	-	1(5)
4	-	-	1(5)	-

Source: The authors.

Table 3 presents the food groups served at lunch in preschools in Brazil and Japan, across the 20 menus reviewed. Lunches in the Brazilian school featured a greater presence of legumes, roots and tubers, fruits, eggs, and fish; and in the Japanese school, red meat and pork were more frequently served, whereas in Brazil, pork was not included during the month evaluated. It is important to observe that nuts and nut groups were absent from both menus, while milk and cheese, cereals, vegetables, and poultry food groups were included equally in the school meals of both countries.

Table 3. Frequency in number (n) and percentage (%) of the absence and presence of food groups in the lunch of preschoolers in two early childhood education units in Brazil and in Japan, based on the *Food Guide for the Brazilian Population*. São Paulo-SP, 2022.

Food groups	Brazil		Japan	
	Absence n (%)	Presence n (%)	Absence n (%)	Presence n (%)
Legumes	5(25)	15(75)	8(40)	12(60)
Cereals	0(0)	20(100)	0(0)	20(100)
Roots and tubers	6(30)	14(70)	8(40)	12(60)
Vegetables	0(0)	20(100)	0(0)	20(100)
Fruits	0(0)	20(100)	2(10)	18(90)
Chestnuts and nuts	20(100)	0(0)	20(100)	0(0)
Milk and cheese	17(85)	3(15)	17(85)	3(15)
Red meat	12(60)	8(40)	11(55)	9(45)
Eggs	13(65)	7(35)	16(80)	4(20)
Fish group	16(80)	4(20)	17(85)	3(15)
Poultry group	16(80)	4(20)	16(80)	4(20)
Pork group	20(100)	0(0)	17(85)	3(15)

Source: The authors.

Table 4 indicates that among the 20 menus reviewed, roots and tubers, legumes, red meat, and poultry were most frequently found in Brazilian school afternoon snacks while cereals and eggs were most common in the Japanese afternoon snacks. Fruit, milk, cheese, and fish were present in the Japanese afternoon snacks (50%, 70%, and 10%, respectively), but were not found in any Brazilian afternoon snack. Legumes were present in 25% of the Brazilian school snacks assessed, while they were not included in the Japanese school snacks. Furthermore, nuts, walnuts, and pork were absent from the school snacks of both countries.

Table 4. Frequency in number (n) and percentage (%) of the absence and presence of food groups in the afternoon snack of preschoolers in two early childhood education units in Brazil and in Japan, based on the *Food Guide for the Brazilian Population*. São Paulo-SP, 2022.

Food Groups	Brazil		Japan	
	Absence n (%)	Presence n (%)	Absence n (%)	Presence n (%)
Legumes	15(75)	5(25)	20(100)	0(0)
Cereals	8(40)	12(60)	1(5)	19(95)
Roots and tubers	1(5)	19(95)	18(90)	2(10)
Vegetables	0(0)	20(100)	17(85)	3(15)
Fruits	20(100)	0(0)	10(50)	10(50)
Nuts and nuts	20(100)	0(0)	20(100)	0(0)
Milk and cheese	20(100)	0(0)	6(30)	14(70)
Red meat	12(60)	8(40)	18(90)	2(10)
Eggs	18(90)	2(10)	8(40)	12(60)
Fish group	20(100)	0(0)	18(90)	2(10)
Poultry group	12(60)	8(40)	19(95)	1(5)
Pork group	20(100)	0(0)	20(100)	0(0)

Source: The authors.

DISCUSSION

Comparison between the school menus of a Japanese school and those of a Brazilian private school revealed significant differences in the nutritional characteristics of the meals offered to preschoolers. Both schools, adapted meals to their cultures, but showed high levels of ED and the presence of ultra-processed foods, factors that contribute towards children nutritional risk. The Brazilian menu stood out for its higher ED and glycemic load, in addition to the predominance of food groups such as legumes, roots, and tubers, reflecting   continuation of more traditional dietary practices. On the other hand, the Japanese menu had a

higher concentration of red meat and pork, as well as a higher frequency of ultra-processed foods in the meals, suggesting a growing trend toward adopting more Westernized dietary patterns. These results reflect the nutritional challenges existing in both countries, especially regarding the impact of the Westernized diet on children's health and the preservation of local food traditions.

It was found that the menus of the two schools assessed had a higher frequency of low ED, which may be due to the presence of fresh foods in the meals, such as fruits and vegetables, which are fiber-rich, as seen in the school lunches and in the snacks in the Brazilian menu. Dietary fiber is a key nutrient for reducing ED, as its contribution to the caloric value is lower than its contribution to the weight of the meal.[20-22]

According to the Dietary Guidelines for the Brazilian Population,[5,7] regular consumption of fresh foods, such as fruits, vegetables, and legumes, is essential for a balanced and healthy diet that can promote a socially and environmentally sustainable food system. International guidelines also enhance this recommendation, such as the Japanese Dietary Guidelines, which emphasize the importance of consuming vegetables and minimally processed foods for maintaining health.[10] Furthermore, guidelines issued by the Japanese Ministry of Agriculture, Forestry, and Fisheries highlight the need for appropriate meal planning, encouraging the inclusion of these foods in daily habits.[11] Therefore, it is important to plan for the inclusion of these foods when developing menus for preschoolers.[9]

A previous study indicates that, in recent years, there has been a shift reducing vegetable intake and increasing meat consumption by the Japanese population, which directly influences the overall characteristics of children's diets. Researchers have assessed the relationship between vegetable intake at the beginning of a meal and the consumption of other food groups among preschool children in Tokyo, Japan. Cross-sectional data from 135 preschool-age children were collected at daycare centers. By serving vegetables at the beginning of meals, a significant increase in fruit and fish consumption was observed, while bread consumption was reduced. This strategy proved effective in promoting vegetable consumption among preschool children and reducing the consumption of foods with higher ED.[21]

Despite the importance of ED as an indicator of preschool feeding quality, there is a shortage of research investigating the preschooler population; in fact, the investigation has been more frequently focused on the feeding of certain population groups, such as workers served by Food and Nutrition Units,[22] hospital patients served by Nutrition and Dietetic Services,[23] and a recent study carried out in Ghana, which evaluated the ED of school children's meals.[24] Considering the potential benefits for promoting a balanced diet and preventing childhood obesity, the use of ED levels as a dietary guidance tool is feasible and important and should be further explored in preschoolers.

Scholars at INCA suggest that the meals ED should have an average value of 1.25 kcal/g.[17] In our study, this value was observed to be below the average found in Brazilian snacks (1.54 kcal/g), as well as in other studies retrieved in the literature.[20,22]

In our study, all meals were considered to be low in GL. A previous study states that adopting a low-GL menu carries several benefits to the individuals, including a feeling of satiety and gastric fullness, decreased hormonal release against proteolytic regulators, stimulation of protein synthesis, and reduced postprandial insulin secretion.[18,25-27] Furthermore, it can result in decreased LDL and triglyceride levels, increased HDL-C levels, improved colonic flora fermentation, and the presence of slowly digestible and indigestible substrates. These factors contribute to a slow and gradual glycemic response.[25,26]

The cross-sectional study by Silva et al.[26] investigated the association between the diet glycemic index and the glycemic load on the risk of overweight and adiposity in a cohort of 232 five-year-old children living in Diamantina, Minas Gerais. It was observed that overweight children consumed a significantly higher

amount of carbohydrates, due to the high frequency of consumption of sugar-sweetened beverages.[26] Those foods are rich in simple carbohydrates and, therefore, contribute to increase dietary GL.

Dietary strategies consider consumption of food low in GI and GL as adequate; in addition fiber should be included, especially soluble fiber, to impact the body's glycemic response.[27,28]

The analysis of ultra-processed foods revealed that the Japanese school menu stood out in terms of frequency of UP foods offerings compared to the Brazilian menu; actually the Japanese schoolserved four ultra-processed foods in one lunch. The increasing replacement of fresh or minimally processed foods with ultra-processed foods is a global trend, driven by urbanization, cultural shifts, marketing, and the economic advantages offered by the food industry.[29,30]

The early introduction of ultra-processed foods into children's diets and inadequate consumption of fresh or minimally processed foods can have negative impacts on children's health. A previous longitudinal study with 308 children, conducted in Porto Alegre, Brazil, aimed at studying trends in ultra-processed food consumption and determining their impact on serum lipids the investigators found that the proportion of total energy intake from ultra-processed foods increased from 43.4% in young children with three years of age to 47.7% with six years of age, and was associated with higher blood lipid levels in children living in a low-income community.[29,31]

Therefore, the consumption of fresh foods should be given priority, as the body will benefit from those foods' nutrients and their anti-inflammatory and antioxidant action; in addition, fresh foods help avoiding exposure to the substances that are harmful to health.[31] Hence health promotion is a fundamental subject.

In Brazil, several programs aimed at public schools that encourage healthy eating in childhood are in place such as the National School Feeding Program (PNAE),[32] which can positively influence children's good eating habits and nutritional status, as concluded in a recent study by Bandoni & Canella,[33] who aimed to review the influence of the origin of food consumed at school and children's nutritional status. Using data from the Household Budget Survey covering children under 10 years of age, linear methods (such as Body Mass Index - BMI-for-age) and logistic methods (to assess overweight and obesity) were employed. These methods indicated that 90.6% of children consumed food provided by the school through the school feeding program, and consumption of food provided by the school reduced BMI-for-age and the risk of obesity. This demonstrated the importance of school meal service programs that offer healthy foods.

According to Resolution No. 6 dated May 8, 2020, funds allocated to the acquisition of ultra-processed foods for school meals are limited to a maximum 20%, which can be allocated to the acquisition of processed and ultra-processed foods.[32] A cross-sectional study with secondary data from 2016, from the *Sistema de Gestão de Prestações de Contas* (SiGPC, Accountability Management System) of the *Fundo Nacional de Desenvolvimento da Educação* (FNDE, National Fund for Education Development), found that 25.8% of the funds were used to acquire processed and ultra-processed foods in more than a third of the municipalities evaluated.[34] This is considered detrimental because the greater energy contribution of ultra-processed foods has been consistently associated with poorer diets' nutritional quality.

Although the schools assessed are not formally included in the National School Feeding Program (PNAE),[32] this program guidelines appear to indirectly influence dietary practices, especially in Brazilian schools. The PNAE gives priority to fresh and minimally processed foods, restricting the offering of ultra-processed foods; this policy reflects in the minor presence of these products in the menus assessed. During childhood, adequate energy and nutrition are essential for healthy growth and for the prevention of future illnesses, besides contributing to the development of good eating habits. Thus, even beyond its direct scope,

the PNAE demonstrates how public policies can promote child health, positively influencing the quality of school meals in different institutional contexts.[33,35]

Regarding the food groups, it was found that vegetables were equally included in the lunch menu of the two schools; however, in the Brazilian snacks, this food group was present during the whole month, due to the adoption of soups which is a snack more similar to a light dinner, while Japan stood out with a higher incidence of other food groups, such as grains and proteins which are foods with higher ED. In Japan, lunch featured a higher presence of red meat and pork, and the Brazilian lunch featured a higher presence of legumes, roots and tubers, fruits, eggs, and fish.

In a previous Brazilian study, the consumption of food groups by children receiving public health care in the municipality of Aracaju, Sergipe, was analyzed using the 24-hour recall (R24h). The results indicated that children between 24 and 35 months of age consumed more cereals, sugars, sweets, oils, and fats. The conclusion was that preschoolers' diets tend to be monotonous and influenced by family habits; in addition excessive consumption of high-calorie foods can restrain dietary variety.[36]

Although the menus reviewed in this study represent a convenience sample, it is important to highlight that this approach allowed for rapid and efficient data collection in a difficult-to-access country like Japan, where permission for conducting research can be bureaucratic and time-consuming. However, it is important to recognize that convenience data have limitations. Therefore, we suggest that future studies adopt more comprehensive and inclusive approaches, such as the use of random or stratified sampling, to ensure representativeness of the study population.

In this connection, the comparison of ED and GL levels, presence of ultra-processed foods, and the kind of food groups in the two school countries with distinct dietary cultures presents an innovative approach and contributes to the advancement of knowledge in the field of nutrition. Based on the results obtained, a reduced adoption of traditional foods was observed in both schools assessed, especially in the Japan sample, due to the adoption of processed foods, and offers a local perspective for a foreign school in Japan. This trend reflects a global shift toward a reduction in the consumption of traditional and local foods, with cultural and environmental implications. Therefore, the importance of ensuring a balanced diet in order to provide the necessary nutrients for a healthy child development is emphasized.

CONCLUSION

Both the Brazilian and Japanese school menus showed inadequate nutritional characteristics, considering the high energy density foods and the ultra-processed foods they serve. The Brazilian menus had higher energy density and glycemic load, but a greater supply of legumes, roots, tubers, fruits, eggs, and fish. In contrast, the Japanese menus stood out for their greater offer of red meat and pork, as well as a greater supply of ultra-processed foods and cereals. These findings indicate that, despite cultural and dietary differences, both school systems are adopting Western-style eating practices that can compromise children's nutritional health.

REFERENCES

1. Tanabe FH, Drehmer M, Neutzling MB. Consumo alimentar e fatores dietéticos envolvidos no processo saúde e doença de Nikkeis: revisão sistemática. Ver Saúde Pública 2013;47(3):634-46. https://doi.org/10.1590/S0034-8910.2013047003377

2. Schwingel A, Nakata Y, Ito LS, Zajko WJ, Erb CT, Shigematsu R, et al. Central obesity and health-related factors among middle-aged men: a comparison among native Japanese and Japanese-Brazilians residing in Brazil and Japan. J Physiol Anthropol 2007;26(3):339-47. https://doi.org/10.2114/jpa2.26.339

3. Soares LD, Petroski EL. Prevalência, fatores etiológicos e tratamento da obesidade infantil. Ver Bras Cineantropom Desempenho Hum 2003;5(1):63-74. https://doi.org/10.1590/%25x

4. Almeida BCT, Marin T. Mudanças dos hábitos alimentares da população brasileira. Rev Terra Cult 2022;38(74):75-84. https://doi.org/10.1590/S0034-89101994000600007

5. Brasil. Ministério da Saúde. Guia alimentar para a população brasileira: promovendo a alimentação saudável. Brasília: Normas e manuais técnicos; 2014.

6. Yen CE. Food and nutrient provision in preschools: Comparison of public and private preschools. Nutr Health 2021;27(1):9-15. https://doi.org/10.1177/0260106020942430

7. Brasil. Ministério da Saúde. Guia alimentar para crianças menores de 2 anos. Brasília: Ministério da Saúde; 2021.

8. Bertin RL, Karkle ENL, Ulbrich AZ, Stabelini Neto A, Bozza R, Araujo IQ, et al. Estado nutricional e consumo alimentar de adolescentes da rede pública de ensino da cidade de São Mateus do Sul, Paraná, Brasil. Rev Bras Saúde Matern Infant 2008;8(4):435-43. https://doi.org/10.1590/S1519-38292008000400009

9. Issa RC, Moraes LF, Francisco RRJ, Santos LC, Anjos AFV, Pereira SCL. Alimentação escolar: planejamento, produção, distribuição e adequação. Rev Panam Salud Publica. 2014;35(2):96-103.

10. Japão. Ministério da Agricultura, Floresta e Pesca (MAFF). Diretrizes alimentares para japoneses: Guia Alimentar Japonês Spinning Top [Internet]. 2005 [citado 2022 maio 13]. Disponível em: https://www.maff.go.jp/j/balance_guide/b_use/pdf/eng_reinasi.pdf

11. Japão. Ministério da Agricultura, Floresta e Pesca (MAFF). Pesquisa de educação nutricional infantil [Internet]. 2019 [citado 2022 maio 13]. Disponível em: https://www.maff.go.jp/

12. Japão. Ministério da Agricultura, Floresta e Pesca (MAFF). What is Shokuiku? [Internet]. 2021 [citado 2023 jun 21]. Disponível em: https://www.maff.go.jp/

13. Guimarães AF, Galisa MS. Cálculos nutricionais: conceitos e aplicações práticas. São Paulo: M. Books; 2008.

14. Tabela Brasileira de Composições de Alimentos (TACO). 4th ed. Campinas: NEPA–UNICAMP; 2011.

15. US Department of Agriculture. Agriculture Research Service. USDA National Nutrient Database for Standard Reference, 2012.

16. Cox DN, Mela DJ. Determination of energy density of freely selected diets: methodological issues and implications. Int J Obes 2000;24(1):49-54. https://doi.org/10.1038/sj.ijo.0801084

17. Instituto Nacional do Câncer. Políticas e ações para prevenção do câncer no Brasil: alimento, nutrição e atividade física. Rio de Janeiro: INCA; 2009.

18. Brand-Miller J, Foster-Powell K. Diets with a low glycemic index: from theory to practice. Nutr Today 1999;34(2):64-72.

19. Cornejo-Monthedoro A, Negreiros-Sánchez I, Del Aguila C, Ysla-Marquilld M, Mayta-Tristán P. Associação entre carga glicêmica da ingestão alimentar e síndrome metabólica em crianças e adolescentes obesos. Arch Argent Pediatr 2017;115(4):323-30.

20. Marchioni DML, Mendes A, Gorgulho B, Stella RH, Fisberg RM. Densidade energética da dieta e fatores associados: como está a população de São Paulo? Arq Bras Endocrinol Metab 2012;56(9):638-45. https://doi.org/10.1590/S0004-27302012000900007

21. Yang J. Eating vegetables first at start of meal and food intake among preschool children in Japan. Nutrients 2020;12(6):1762. https://doi.org/10.3390/nu12061762

22. Canella DS, Bandoni DH, Jaime PC. Densidade energética de refeições oferecidas em empresas inscritas no programa de alimentação do Trabalhador no município de São Paulo. Rev Nutr 2011;24(5):715-24. https://doi.org/10.1590/S1415-52732011000500005

23. Bergjohann P, Adami FS, Fassina P. Densidade energética das refeições oferecidas pelo serviço de nutrição e dietética de um hospital. Cad Pedagógico 2016;13(3):37-46. http://doi.org/10.22410/issn.1983-0882.v13i3a2016.1108

24. Liguori J, Amevinya GS, Holdsworth M, Savy M, Laar A. Nutritional quality and diversity in Ghana's school feeding programme: a mixed-methods exploration through caterer interviews in the Greater Accra Region. BMC Nutr. 2024 Sep 27;10(1):127. http://doi.org/10.1186/s40795-024-00936-9. PMID: 39334452

25. Santos MS. Índice glicêmico: importância e aplicação clínica. Dissertação [Mestrado em Nutrição],Universidade Regional do Noroeste do Estado do Rio Grande do Sul, Ijuí, 2011.

26. Silva KC, Nobre LN, Vicente SECF, Moreira LL, Lessa AC, Lamounier JA. Influence of glycemic index and glycemic load of the diet on the risk of overweight and adiposity in childhood. Rev Paul Pediatr 2016;34(3):293-300. https://doi.org/10.1016/j.rppede.2015.12.009

27. Guttierres APM, Alfenas RCG. Efeitos do índice glicêmico no balanço energético. Arq Bras Endocrinol Metab 2007;51(3):382-8. https://doi.org/10.1590/S0004-27302007000300005

28. Xavier ECS, Freitas FMNO. Manejo dietético e suplementar na fisiopatologia da síndrome dos ovários policísticos. Res Soc Dev 2021;10(15). http://doi.org/10.33448/rsd-v10i15.22975

29. Cainelli EC, Gondinho BVC, Palacio DC, Oliveira DB, Reis RA, Cortellazzi KL, et al. Consumo de alimentos ultraprocessados por crianças e fatores socioeconômicos e demográficos associados. Rev Einstein 2021;19:1-8. https://doi.org/10.31744/einstein_journal/2021AO5554

30. Costa CS, Sattamini IF, Steele EM, Louzada MLC, Claro RM, Monteiro CA. Consumo de alimentos ultraprocessados e associação com fatores sociodemográficos na população adulta das 27 capitais brasileiras (2019). Rev Saúde Pública 2021;55(47):1-9. https://doi.org/10.11606/s1518-8787.2021055002833

31. Leffa PS, Hoffman DJ, Rauber F, Sangalli CN, Valmórbida JL, Vitolo MR. Longitudinal associations between ultra-processed foods and blood lipids in childhood. Br J Nutr 2020;124(3):341-8. https://doi.org/10.1017/S0007114520001233

32. Brasil. Ministério da Educação. Fundo Nacional de Desenvolvimento da Educação. Resolução/CD/FNDE nº 6, de 08 de maio de 2020. Dispõe sobre o atendimento da alimentação escolar aos alunos da educação básica no âmbito do Programa Nacional de Alimentação Escolar-PNAE. 2020.

33. Bandoni DH, Canella DS. Can eating food offered by schools have a positive influence on nutritional status of children? An Example from Brazil. Health Behav Policy Rev 2021;8(3):202-11. https://doi.org/10.14485/HBPR.8.3.2

34. Azevedo ABC, Bandoni DH, Amorim ALB, Canella DS. Evaluation of food purchasing in the Brazilian School Feeding Programme: feasibility of the requirements and recommendations. Public Health Nutr. 2023 Dec; 26(12):3331-3342. http://doi.org/10.1017/S136898002300229X.

35. Silva JA, Oliveira T, Ribeiro I, Fernandes MSS, Santos G. Adequação dos cardápios escolares e exigências do programa nacional de alimentação escolar: uma revisão sistemática. Rev. Bras. Saúde Matern. Infant. 2023, 23: e20220131. https://doi.org/10.1590/1806-93042023000000131-en

36. Filha EO, Araújo JS, Barbosa JS, Gaujac DP, Santos CF, Silva DG. Consumo dos grupos alimentares em crianças usuárias da rede pública de saúde do município de Aracaju, Sergipe. Rev Paul Pediatr 2012;30(4):529-36. https://doi.org/10.1590/S0103-05822012000400011

Contributors