



Analysis of the nutritional quality of school menus according to different methods

Análise da qualidade nutricional de cardápios escolares segundo diferentes métodos

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ABSTRACT

The objective of this study was to use different methods to analyze the nutritional quality of lunches offered at seven School Nutrition and Food Units (SNFU) in a Brazilian municipality. The analysis of the food portions was performed using the Brazilian Food Composition Table and the results were compared with the recommendations of the National School Feeding Program (NSFP). The Quality Indicator for School Feeding Menus (QISFM) was used and the data were presented in scores. Qualitative Evaluation of Menu Preparations (QEMP) was also used and the results were classified from very satisfactory to very unsatisfactory. Most of the nutritional averages were above the recommendations and the absence of fresh vegetable foods was also observed in most of the menus. The results demonstrated the importance of analyzing school menus in order to define strategies for their adaptation towards the recommendations and guidelines of the NSFP.

Keywords: Menu planning. Public policy. School feeding.

RESUMO

O objetivo deste trabalho foi utilizar diferentes métodos para analisar a qualidade nutricional de almoços oferecidos em sete Unidades de Alimentação e Nutrição Escolares (UANEs) de um município brasileiro. A análise das porções alimentares foi realizada utilizando a Tabela Brasileira de Composição dos Alimentos e os resultados foram comparados com as recomendações do Programa Nacional de Alimentação Escolar (PNAE). Utilizou-se o Indicador de Qualidade para Cardápios da Alimentação Escolar (IQCAE) e os dados foram apresentados em escores. Utilizou-se também o método Avaliação Qualitativa das Preparações de Cardápios (AQPC) e os resultados foram classificados de muito satisfatório a muito insatisfatório. A maioria das médias nutricionais mostrou-se acima das recomendações e também se observou a ausência de alimentos vegetais *in natura* na maioria dos cardápios. Os resultados demonstraram a importância da análise dos cardápios escolares com vistas à definição de estratégias para sua adequação em direção às recomendações e diretrizes do PNAE.

Palavras-chave: Alimentação escolar. Planejamento de cardápio. Política pública.

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INTRODUCTION

In recent decades, Brazil has undergone several political, economic, social and cultural changes that have shown modifications in the population's way of life. If previously, the diseases that most affected Brazilians were infectious, nowadays Chronic Noncommunicable Diseases (CNCD) have been gaining prominence and attention. The frequent consumption of ultra-processed foods has been shown to be one of the main causes of the increase in cases in all age groups and, especially, in the child population^{1,2}.

Public policies play an important role in promoting adequate and healthy food, and should encourage and facilitate this practice. Also, it is necessary to protect individuals and populations from factors and situations that lead to food choices that promote food and nutritional insecurity³.

In this context, through a national policy on Food and Nutrition Security (FNS), aligned with other related programs and strategies, such as the National School Feeding Program (known in Brazil by the Portuguese acronym, PNAE), the State must respect, protect, promote and provide for the Human Right to Adequate and Healthy Food (known in Brazil by the Portuguese acronym, DHAAS) to ensure students' health⁴.

Regarding the guidelines and objectives of the PNAE, the provision of adequate, healthy and sustainable meals during the school period to promote the school's biopsychosocial growth and development, in addition to the development of healthy eating practices⁵ stands out. It is worth mentioning that, since 2006, the Program includes the professional nutritionist as the Responsible Technician (RT), whose duties include, among others, the planning of the school menu, which, in turn, should reflect the presence of foods and food preparations in line with the PNAE⁶ recommendations, objectives and guidelines.

Therefore, the attention and monitoring of the nutritional quality of the food offered to students

become extremely important, as it directly impacts the reach of DHAAS and FNS; in this sense, they pose a challenge to school managers and social actors involved in the Program.

To monitor this quality, quantitative and qualitative instruments for analyzing school menus are highlighted. Knowing that each one can be guided by legislation of the National Fund for Educational Development (known in Brazil by the Portuguese acronym, FNDE), manuals and documents from the Ministries of Health and Education, international recommendations and/or results of recent scientific studies, the common point between these different instruments lies in the fact that they must converge to prioritize fresh and minimally processed foods as a mechanism to achieve DHAAS and ensure FNS to the school population. In addition, the use of different methods of analyzing school menus, when applied in an integrated manner, can contribute to a broader diagnosis of their quality, taking into account that the limitations and weaknesses of one method can be overcome by the use of another.

Therefore, the objective of this study was to use different methods to analyze the nutritional quality of the lunch menus offered in schools in a city in the state of Rio de Janeiro (RJ).

METHODOLOGY

An exploratory, descriptive and quantitative study was carried out to analyze the nutritional quality of lunches offered at School Food and Nutrition Units (SFNUs), members of a school center with seven schools, in a municipality in the state of Rio de Janeiro, Brazil, in 2017. Schools were selected for convenience because the center is already a place for the development of various teaching, research and extension activities linked to a federal university in Rio de Janeiro since 2011.

In this municipality, the menus for large meals are planned by a technical team of RT nutritionists and must present the following food preparations: side

dishes (rice and beans), main course (beef, chicken or fish), vegetable side dishes (vegetables, tubers and derivatives) and dessert (fruit).

The analysis of nutritional quality was conducted with a view to a global assessment of the meals offered at this center and the choice of lunch meals, served to students aged 6 to 10 years, occurred considering Resolution No. 26/2013 of FNDE⁵ which provides nutritional reference values to be met by the PNAE from one or more meals for the school population.

NUTRITIONAL ANALYSIS OF LUNCH MEALS

The nutritional analysis of meals was carried out through an exploratory study, with the technique of direct observation of the portioning of food preparations for lunches conducted by food handlers. Thirty meals were considered in each of the seven SFNUs, totaling 210 evaluated. Each SFNU was visited only once by a researcher previously trained to use and fill in the information, using their own forms, at a time compatible with the preparation and distribution of lunches to the students.

The following steps were carried out in this method:

- 1). Before the distribution of meals, the portions of lunch food preparations were weighed in triplicate, using the Plenna[®] digital scale, with a capacity of 2 kg, using kitchen utensils as a base (ladle and skimmer), which are used by the food handlers to determine the average weight (g) of the portions of each food preparation in two household measures (small (SM) and large (LM)). Taking the food preparation "black beans" as an example, three weighings of a large ladle and three weighings of a small one were carried out, with the food preparation, to determine the average weights in the LM and SM, respectively.
- 2). Monitoring the distribution of lunches to schoolchildren and recording the household measures used in portioning the food

preparations of 30 lunch meals in a specific form, in each SFNU visited.

- 3). Determination of the nutritional intake of each lunch meal offered based on information from the Brazilian Food Composition Table (known in Brazil by the Portuguese acronym, TACO)⁷. The nutrients analyzed in this study were chosen according to the nutritional recommendations of PNAE⁵ when offering a school meal, namely: total energy value (Kcal), proteins (g), lipids (g), carbohydrates (g), dietary fibers (g), vitamin C (mg), iron (mg) and sodium (mg). The data, examined using a Microsoft Excel[®] spreadsheet, were expressed as mean, standard deviation (SD) and coefficient of variation (CV) and compared with nutritional recommendations for schoolchildren aged 6 to 10 years⁵ when offering a meal.

QUALITY INDEX FOR SCHOOL FEEDING MENUS (QISFM)

The lunch menus offered to schoolchildren were also analyzed using the Quality Index for School Feeding Menus (QISFM), according to Belik and Domene⁸, modified. The original method provides for a weekly assessment of meals in each SFNU; however, in adapting this study, it was used to examine a lunch meal offered at each SFNU.

The method is based on the positive score of school menus according to the presence of six food groups (1.0 total) and when there is compatibility between the time and the type of meal served (0.04). On the other hand, the offer of sweets, formulated foods and sausages scored negatively (-0.2 each) (Chart 1).

Chart 1. Scoring by nutritional quality index for analyzing lunch menus offered in schools in a city in the state of Rio de Janeiro in 2017

Group of cereals / tubers	0.1
Group of legumes	0.1
Group of vegetables	0.2
Group of fruits	0.2
Group of meat and eggs	0.2
Group of milk/cheese/yogurt	0.2
Time compatible with the meal	0.04
Use of sweets as a meal	- 0.2
Use of sausages	- 0.2
Use of sweets as dessert	- 0.2
Use of formulated food	- 0.2

Source: Belik; Domene⁸

To score the menu by the QISFM, any dessert, simple or elaborated, with added sugar or something similar, was considered sweet, whether based on fruit or not, including fruit paste candies, fruit in syrup and candied, industrialized or not⁹. Formulated foods, on the other hand, are processed and ultra-processed foods, according to the Dietary Guidelines for the Brazilian Population¹⁰, and sausages, processed animal foods (red meat or poultry, viscera or meat by-products such as blood), that is, transformed, either by fermentation, by the addition of chemicals, by smoking, or by any technique aiming to enhance flavor and improve its conservation¹¹.

The score data previously described resulted in the score of the lunches offered in each SFNU that was used to identify any differences in quality between the analyzed menus.

QUALITATIVE EVALUATION OF MENU PREPARATIONS (QEMP)

The methodology proposed by Veiros and Proença¹² was adopted and modified by Ginani¹³ to evaluate school lunch menus. Taking into account that the purpose of this study was to analyze school menus and the possibility of correlation with other instruments, a score was used, considering the characteristics of the menu. According to the compliance or not with the determinations established

by the QEMP method, the items were scored when the statement was affirmative; otherwise, the assigned value was zero¹³.

The determinations established for the application of this method were: absence of fried foods; absence of industrialized or prepared sweets⁹; absence of fatty meats^{14,15}; absence of sweets and fried food simultaneously; absence of two or more sulfurized or difficult to digest foods⁹; the absence of preserves integrating salads¹⁶; offering salads with raw leafy vegetables and fruits for dessert; non-occurrence of duplicity in the use of the cooking method in two preparations, not considering the side dishes; non-repetition of ingredients in different preparations that could compromise acceptance, for making the menu monotonous; and absence of two or more preparations/ingredients with similar colors between vegetable side dishes, starter, dessert and drink.

For the application of the instrument, the foods and food preparations that made up the menus of school lunches were recorded in a specific form, specifying the ingredients and cooking methods used. For each evaluation item using the modified QEMP method, the preparations were analyzed together and their scores were assigned.

Ten items analyzed were considered, and the results were expressed in percentages of determinations with affirmative statements by SFNU and in percentages of affirmative answers by determination, taking into account the seven Units. As an instrument that evaluates sensory and nutritional aspects together and based on scores that verify the acceptance of products through affective tests with a hedonic scale, the following parameters were used in this study as criteria: very satisfactory (when the percentage of meeting the criteria exceeds 85%); satisfactory (when it met 60 to 84.9%); unsatisfactory (when the percentage is 50 to 59.9%); and very unsatisfactory (when it met 0 to 49.9%)¹³.

To maintain the ethical principle of this study, the name of the municipality of the State of Rio de Janeiro was not disclosed, to avoid possible constraints due to the political importance of the PNAE.

RESULTS

Table 1 shows the results of the average nutritional intake of the 210 lunches offered to schoolchildren (6-10 years old) in seven SFNUs in a municipality in the state of Rio de Janeiro in the small

and large household measures. It was found that all the averages of the nutritional parameters analyzed, in the large homemade measures, were shown to be superior to those obtained in the small ones. Means higher than the PNAE⁵ recommendations were also identified, except for the lipid and sodium parameters, in both measures, and energy, in the small household measure.

Table 1. Average nutritional intake of lunches offered to schoolchildren (6-10 years) based on the portioning of food preparations in small and large household measures. Municipality of the State of Rio de Janeiro, 2017 (n = 210)

Nutritional parameters	Small household measure			Large household measure			Brazil (2013) ⁵
	Mean	Standard Deviation	Coefficient of variation	Mean	Standard Deviation	Coefficient of variation	
Energy (kcal)	280,73	79,94	0,27	626,97	237,48	0,38	300
Protein (g)	14,59	4,38	0,30	33,1	7,47	0,23	9,4
Lipid (g)	2,79	0,98	0,35	7,56	2,73	0,36	7,5
Glycide (g)	55,20	25,52	0,46	93,58	45,42	0,49	48,8
Vit C (mg)	19,09	17,42	0,91	41,87	38,61	0,92	7,0
Iron (mg)	2,82	1,34	0,47	3,91	1,59	0,41	1,8
Fiber (g)	7,00	1,14	0,16	11,56	4,28	0,37	5,4
Sodium (mg)	37,89	21,03	0,55	83,88	49,40	0,59	< 400

Source: Research data.

Table 2 shows the results of the evaluation of school menus according to Belik and Domene⁸ (modified). It was found that SFNU 1 had the lowest score (0.3), while SFNU 2, 4 and 7 achieved the highest scores (0.8 point). The absence of fruit was also verified in some SFNUs (1, 3, 5 and 6), the absence of milk/cheese/yogurt, sweets and sausages in all Units, in addition to the presence of food formulated in two SFNUs (1 and 3) and compatible time in a SFNU (5).

Table 2. Evaluation of the lunch menus offered to schoolchildren (6-10 years) in seven School Food and Nutrition Units according to Belik and Domene⁸ (modified). Municipality of the State of Rio de Janeiro, 2017 (n = 7)

Evaluation components ⁸	1*	2*	3*	4*	5*	6*	7*
Cereals/tubers	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Legumes	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Vegetables	0	0.2	0.2	0.2	0.2	0.2	0.2
Fruits	0	0.2	0	0.2	0	0	0.2
Meat and egg	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Milk/cheese/yogurt	0	0	0	0	0	0	0
Compatible time	0	0	0	0	0.04	0	0
Sweets (meal)	0	0	0	0	0	0	0
Sausages	0	0	0	0	0	0	0
Sweets (dessert)	0	0	0	0	0	0	0
Use of formulated food	-0.1	0	-0.1	0	0	0	0
Total	0.3	0.8	0.5	0.8	0.64	0.6	0.8

* School Food and Nutrition Unit.

Source: research data.

Table 3 shows the results of the analysis of school menus according to the QEMP method proposed by Veiros and Proença¹² and modified by Ginani¹³. SFNUs 2 and 7 presented “very satisfactory” parameters (100% and 90% of positive responses, respectively), whereas in the others (SFNU 1, 3, 4, 5 and 6) they were “satisfactory” - they ranged from 60 to 80% of positive responses.

Regarding the percentage of affirmative

answers for each determination, taking into account the seven SFNUs, the lowest values were found for the presence of leafy vegetables (42.86%), fruits (42.86%) and fatty meats (57.14 %). For the determinations absence of equal cooking methods, absence of fried foods, absence of sweets and absence of fried foods/sweets, 100% of the SFNUs presented positive responses.

Table 3. Evaluation of the lunch menus offered to schoolchildren (6-10 years) in seven School Food and Nutrition Units according to the modified Qualitative Evaluation of Menu Preparations method^{12,13}. Municipality of the State of Rio de Janeiro, 2017 (n = 7)

Determinations ^{12,13}	1*	2*	3*	4*	5*	6*	7*	% of affirmative answers in the seven SFNUs
Presence of leafy vegetables	0	1	1	0	0	0	1	42.86
Presence of fruits	0	1	0	1	0	0	1	42.86
Absence of similar colors	1	1	1	0	1	1	1	85.71
Absence of canned foods	1	1	0	1	1	1	1	85.71
Absence of sulphurous foods	1	1	0	0	1	1	1	71.43
Absence of fatty meat	0	1	0	1	1	1	0	57.14
Absence of the same cooking methods	1	1	1	1	1	1	1	100
Absence of fried foods	1	1	1	1	1	1	1	100
Absence of sweets	1	1	1	1	1	1	1	100
Absence of fried foods /sweets	1	1	1	1	1	1	1	100
% of affirmative answers for the determinations in each SFNU	70	100	60	70	80	80	90	

* School Food and Nutrition Unit.

Source: research data.

DISCUSSION

The findings of this study indicated that the averages of the nutritional parameters of glycidic, iron and fibers, in the large household measures, exceeded between 40% and 70% those obtained in the small measures. For the other nutrients, in the large measures, these averages were more than twice higher than those found, for the same parameters, in the small ones, as shown in Table 1. Regarding the averages of sodium and lipids, in both measures, it is worth mentioning that the results are underestimated

due to the non-consideration of salt and vegetable oil, as food ingredients, in the dietary calculation of lunch meals. This is justified by the fact that the table of food composition used in this study does not take into account their presence in determining the nutritional value of food preparations.

As for the average nutritional values in disagreement with the PNAE recommendations⁵ (Table 1), in addition to the absence of Technical Preparation Sheets (FTPs), as a standardizing tool in the production process of meals, one can also point out as possible causal factors for the results found in

this study those related to the lack of adequate utensils and training of handlers for the distribution of meals, by each student, in an adequate amount. According to the literature, it is common for these professionals to portion the preparations according to their judgment about the child's demand or request. In other words, students who usually eat more tend to receive or ask for more of each food preparation than those who are believed to eat less^{17,18}. It is known that the supply of excess calories can contribute to weight gain, obesity and associated comorbidities¹⁹.

For both household measurements, the protein averages in the lunch meals were above the recommendation, results that are in agreement with the literature¹⁷. These findings justify the average results of the mineral iron, in both measures, higher than established, since most of the food sources of protein are also found in this micronutrient²⁰ (Table 1).

Fung et al.²¹ analyzed food consumption by schoolchildren in Canada before and after the implementation of The Food and Nutrition Policy for Nova Scotia Public School. The results showed higher consumption of energy from carbohydrates and proteins and a decrease in lipids, as in the present study. The authors also observed a decrease in the average intake of sodium and sugary drinks with the implementation of that program. They also found a decrease in energy consumption with an increase in the quality of the diet, while in the present study an increase in the average energy supply in the large household measure was evidenced. López et al.²², in research developed in Costa Rica in 2012, also identified the presence of the energy parameter of lunches offered to students above the recommendations.

Regarding the presence of food and food preparations, in the present study, some weaknesses were verified that hinder the fulfillment of the PNAE recommendations and guidelines, such as the absence of fruits and leafy vegetables in most school lunch menus (Tables 2 and 3). The lack of foodstuffs in the SFNU stock - due to the delay or non-delivery by suppliers - for the preparation of the planned menus,

added to unscheduled changes made arbitrarily by the school management or by the handlers on the planned menus, can lead to understanding the absence of foods of plant origin in some SFNUs²³. It is known that these unforeseen changes can lead to decreased nutritional and sensory quality²³. According to Robinson-O'Brien et al.²⁴, school menus play an important role in stimulating and contributing to the daily intake of fruits and vegetables (FLV), especially among children, considered a vulnerable group from the point of socioeconomic view.

On the other hand, despite the absence of fruits and leafy vegetables in the school menus of some SFNUs (Tables 2 and 3), the average results, for both measures, of dietary fiber and vitamin C were higher than the nutritional recommendations (Table 1). The presence of legumes (black beans) in all menus (Table 2) contributed to a high supply of dietary fibers (Table 1), while vegetables, with the exception of SFNU 1 (Table 2), can also explain the high average results of vitamin C (Table 1). It is known that an adequate supply of FLV in school meals is reflected in its nutritional quality, considering that these foods are the main sources of fiber and various vitamins and minerals necessary for child development¹⁴.

The use of the QEMP method to analyze the nutritional quality of school menus identified the absence of leafy vegetables in more than half of the menus (Table 3). These findings can also be explained by the fact that many SFNUs do not have a specific physical area designed to wash and clean vegetables, limiting their inclusion during the menu planning stage. According to Soares et al.²³, it is common for school kitchens to have characteristics that are much more similar to household kitchens than industrial ones. On the other hand, it is important to highlight the presence of vegetables, by means of legumes, in almost all SFNUs, except for 1 (Table 2). In 2015, Soares et al.²³ found that leafy vegetables were present in only 25% of the lunch menus offered to students in a city in the state of Rio de Janeiro.

In Spain, Castro et al.²⁵, analyzing the evolution of the school menu in public and private schools, using the guidelines of the *Programa Piloto*

Escolar de Referencia para la Salud y el Ejercicio, contra la Obesidad (Reference School Pilot Program for Health and Exercise against Obesity), found a low supply of fruits, vegetables and legumes in most of them. As for nutrients, the authors observed a supply of proteins and lipids above the recommendations, and carbohydrates, below them. They also identified greater adequacy in public schools when compared to private ones, in relation to the Program.

Regarding the presence of food on the menus, in SFNUs 1 and 3 formulated foods were found, such as canned tuna (Table 2). The Dietary Guidelines for the Brazilian Population¹⁰ prioritizes the consumption of fresh foods and the restriction of processed and ultra-processed foods, such as canned foods, due to the high levels of sodium, saturated fats and sugars, in addition to the low nutritional value²⁶. Canned tuna appears on the school menus of the present study on Mondays, probably due to the lack of required pre-preparation and preparation steps, when compared to other fresh and minimally processed protein foods. Measures such as increasing the number of food handlers in the SFNUs and/or readjusting the processes of planning purchases and deliveries of chilled, cleaned and cut meat by suppliers on Mondays can be effective measures to replace canned tuna for minimally processed foods and, consequently, to the contribution of adequate meals.

On the other hand, a positive finding verified in this work concerns the absence of fried preparations and sweets in the analyzed menus (Tables 2 and 3). According to Brazilian legislation, the presence of sweets is not completely prohibited - two servings per week are allowed¹. However, as data collection was performed once in each SFNU, it cannot be said that this procedure is also constant on other days of the week. It is known that the offer of sweets and fried foods in the diet is associated with a higher risk of NCDs, such as diabetes, obesity and dyslipidemia²⁷.

Finally, in addition to the nutritional value and the food and preparations of school menus, a limiting factor to the promotion of healthy eating practices in the school space refers to the inadequacy between the time and the meal offered²⁸. In this work, it was

observed that only one SFNU served the lunch meal from 11 am, while in the others it happened at around 9:30 am. In general, the time when school meals are offered directly impacts not only the adherence and acceptance of school meals, but also the promotion of adequate and healthy eating habits²⁸. As for the limitations of the present study, it is possible to mention the fact that the SFNUs were chosen for convenience, taking into account the development of teaching, research and extension activities in the school units of the center prior to this study. In this sense, although the SFNUs are not representative of all the centers, the planned and executed menus must be the same; therefore, the results obtained can be considered for the diagnosis of the quality of school meals in the municipality.

The lack of determination of the amounts of kitchen salt and vegetable oil used in the preparation of school meals was also a limiting factor for obtaining average results, relative to the parameters sodium, lipids and energy, in line with the reality practiced in the municipality.

Finally, the method by Belik and Domene⁸ takes into account the group of milks, cheese and yogurts for scoring school menus. However, as a large meal was analyzed in this work, it was already expected that none of the lunch menus would reach the maximum score by the tool proposed by the authors⁸. On the other hand, it is important to highlight that the presence of milk and dairy products in large meals is associated with a decrease in the bioavailability of the mineral iron, which is of great relevance for the school audience and one of the main micronutrients to be offered in large meals²⁹.

CONCLUSION

The analysis of the nutritional support of school lunches offered in a city in the State of Rio de Janeiro proved to be essential in pointing out their inadequacies from the quantitative point of view; however, this method required more time to be performed when compared to the qualitative methods QISFM and QEMP, which are faster and easier to be carried out. Also, the latter were equally important in

identifying weaknesses related to the absence of fresh vegetable foods, in most menus, and to the presence of processed foods in some school lunches.

Therefore, the results of this study, when analyzed together, should be used by the RT nutritionist in the (re) definition and (re) design of strategies that impact the execution of school menus and, consequently, the continuous improvement and achievement of objectives of the Program in the municipality.

This work represents an important contribution about the profile of the nutritional quality of lunches offered in a city in the State of Rio de Janeiro, through different methods that pointed out the main agreements and oppositions of the menus according to the recommendations and dietary and nutritional guidelines of the PNAE. It is also important to note that the present study was limited to analyzing the menus of the lunches served, using different tools, and did not aim to identify and understand factors that influence their quality.

Thus, further research to evaluate the quality of school menus becomes necessary for scientific collaboration in the area, using, for example, the nutritional reference parameters defined in a new FNDE Resolution³⁰, published in 2020, as well as those aimed at determining the conditions for planning and executing school menus. In this sense, the identification and analysis of the processes of institutional purchase of foodstuffs, of the work of food handlers and RT nutritionists should be studied in addition to the assessment of the physical structures of the SFNUs that directly impact the planning, offer and quality of menus.

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