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Can food education in public schools improve knowledge about food and promote the acceptance of meals planned by the National School Feeding Program?

Educação alimentar em escolas públicas pode melhorar o conhecimento sobre alimentação e favorecer a aceitação das refeições planejadas pelo Programa Nacional de Alimentação Escolar?

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Abstract

Introduction: The National School Feeding Program, one of the oldest among Brazilian public policies for food supplementation, has, among its goals, keeping children fed in school and promoting food and nutrition education. The students' adhesion to school feeding, however, does not meet the goals of the Program. *Objective*: This study aimed to assess whether specific food education activities in public schools could improve food knowledge and promote the acceptance of meals planned by the National School Feeding Program. *Methods:* Interventional study in which three schools with classes of grades 3rd through 5th of elementary school were selected, due to their low performance in games, to have their knowledge about healthy eating and low acceptance of school feeding assessed through the leftovers/ingestion index and through the hedonic scale, totaling 243 students of ages 8 to 13. Data regarding anthropometric measurements, adherence to and acceptance of school feeding were obtained. Educational practices included cooking workshops and classroom activities. *Results:* Nutritional assessment showed obesity in 10% of the students, most of whom consumed school meals, even though they purchased unhealthy foods to eat during mealtime in school. The performance in the games, after the intervention, showed significant improvement through the results obtained with the leftovers/ingestion and the hedonic scale. *Conclusion:* Educational activities promoted an improvement in the students' knowledge about healthy eating and their acceptance of school meals.

Keywords: School Feeding. Food and Nutritional Education. Health Education.

Resumo

*Introdução***:** O Programa Nacional de Alimentação, um dos mais antigos dentre as Políticas Públicas do Brasil para suplementação alimentar, tem como objetivos manter as crianças alimentadas no período em que frequentam a escola e promover a educação alimentar e nutricional. A adesão dos alunos à alimentação escolar, entretanto, não corresponde às metas do Programa. *Objetivo:* O estudo teve como objetivo avaliar se atividades de educação alimentar, em escolas públicas, poderiam melhorar o conhecimento sobre alimentação e favorecer a aceitação das refeições planejadas pelo Programa Nacional de Alimentação Escolar. *Métodos:* Estudo intervencional no qual foram selecionadas três escolas com turmas do 3º a 5º ano do Ensino Fundamental, com baixo desempenho em jogos, para avaliar o conhecimento sobre alimentação saudável e baixa aceitação da alimentação escolar pelo índice resto-ingestão e por escala hedônica, totalizando 243 alunos de idades entre oito a 13 anos. Foram obtidos dados antropométricos, de adesão e de aceitação da alimentação escolar. As práticas educativas incluíram oficinas culinárias e atividades em sala de aula. *Resultados:* A avaliação nutricional mostrou presença de obesidade em 10%; a maioria consumia a alimentação escolar, embora adquirisse alimentos não saudáveis para consumo nas refeições servidas. O desempenho nos jogos, após a intervenção, demonstrou melhora significativa nos resultados obtidos com o resto-ingestão e a escala hedônica. *Conclusão:* As atividades educacionais promoveram a melhoria do conhecimento sobre alimentação saudável e da aceitação das refeições escolares pelos alunos.

Palavras chave: Alimentação Escolar. Educação Alimentar e Nutricional. Educação em Saúde.

Introduction

The National School Feeding Program (PNAE) is one of the oldest among Brazilian public policies for food supplementation. Its goal is to enable the development of healthy food practices by students, through food and nutritional education actions, as well as the supply of meals which fulfill their nutritional needs throughout the schoolyear.[1]

PNAE recommends that the menus are developed by certified dietitians, respecting local eating habits, tradition and culture.[1] However, the students' adherence to school eating falls short of the National School Feeding Program's guidelines, due to several reasons, such as: meal time different

than the usual; available food dismissed by the students; change of eating patterns by Brazilians who go through nutritional transitioning, amongst others.[2,3]

The school environment is perceived as a place conducive to the development of several types of knowledge, since most Brazilian children in a school age are enrolled at education institutions, remaining therein for a period of time long enough to establish relationships of friendship and trust.[4]

The school is also an environment wherein to approach Nutritional and Food Education (EAN),although such a practice should not be limited to conveying information in a precise and restricted manner. Subjects related to education towards healthy eating are pointed out in the document published by the Ministry of Social Development in 2012.[5]

This study aimed to assess whether food education activities in public schools could provide better knowledge of food and enable the acceptance of meals planned by the National School Feeding Program.

Material and Methods

A longitudinal, interventional study was conducted between February 2013 and December 2014, with 243 students at the 3rd, 4th and 5th grades in elementary school, 58% of which were boys and 42% of which were girls, from three different public schools in Duque de Caxias- RJ, two of them located downtown and one of them at the district of Imbariê. The students were underage, so their legal guardians were asked to sign the Free Enlightened Consentment Term.

Children were assessed regarding their nutritional anthropometric state through BMI in the beginning of the study, answered a questionnaire about the frequency and acceptance of school feeding, underwent a knowledge assessment step regarding healthy eating, through validated games. The consumption of meals offered in school was also analyzed. After that evaluation step, the intervention took place, with cooking workshops and educational activities in the classroom, and the games were readministered.

The project has been approved by the Research Ethics Committee at Rio de Janeiro Federal University's Institute of Studies in Collective Health, under report 121/2009, proc. 29/2009.

Assessment of the students' nutritional state

Nutritional assessment has been implemented in order to draw the sample and was carried out on all of the students, through weighing and height measurement in order to calculate the Body Mass Index (BMI), according to the methodology described by Mahan and Escott-Stump.[6]

The data obtained were compared to the ones by the World Health Organization (WHO)[7] and the Ministry of Health,[8] in order to classify the students according to their nutritional state.

Assessment of the knowledge about foods and healthy eating

The students' knowledge evaluation went on through the administration of two games, the Plate Game and the Food Pyramid Game, both selected and adapted from specific textbooks.[9,10] The Plate Game consisted on a print of an empty plate, and its wording asked the children to draw a large, healthy meal. The plates considered as adequate were the ones in which were drew one food from each group: vegetable, meat and/or egg, grain and legume, according to the National School Feeding Program guidelines.[1] Each right answer added up to 2,5 points, with a total of 10 points.

The instructions for the Pyramid Game, a print showing the food pyramid, with each food group, were to paste the picture onto the corresponding group; that way, each student received an envelope containing the eight pictures and each right answer represented 1,25 points, which, times the eight groups, amounted to the 10 points.

Frequency and acceptance of school feeding questionnaire

The questionnaire was administered by the researchers individually, with questions regarding: the frequency in which the student had the school meal or how many times a week the student accepted the school meal, with options ranging from none to 5 days a week; the favorite foods and the least favorite ones, and, also, if they purchased any foods to complement the meal served at school.

Assessment of the acceptance of school feeding

The research team visited each one of the three schools throughout six days, three days in each of the two weeks. During those visits, the team selected, during mealtime, 10% of the amount of students in each class to have their plates weighed. Afterwards, the plate was weighted with the leftovers, on an electronic scale from the brand SF400®, with a 5 kg capacity and 1g graduation.

The student was invited to answer the hedonic scale with five facial expressions, which ranged from "I hated it" to "I loved it".[1] The desired result from the leftovers/ingestion should amount to 90% of the meal, and, in the hedonic scale, to an 85% prevalence of the options "liked" and "loved".[1] The hedonic scale also contained the following questions: "Tell us what you enjoyed the most about the preparation", "Tell us what you enjoyed the least about the preparation".

Intervention with educational practices

Four cooking workshops took place at each class, with the duration of one class period, once a week, for a month. The preparations selected for the workshops were suited for small meals (snacks), with ingredients identified as of low acceptance by the students in the questionnaire of adhesion to school feeding. After the preparation of the recipe, the students tasted them and, in the last event, each one of them received a print with all the recipes executed during the cooking workshops. Teaching material validated by the DAFEE Laboratory[11] was employed on the educational activities about food and healthy eating, on the interval between the workshop and the tasting.

Data Treatment

The software used to build the database was Microsoft Excel, and the one used to analyze the data was R, Project for Statistical Computing.[12]

In order to assess the questionnaires of frequency and acceptance of school feeding, simple frequency was employed. The *t* Test (p-value ≤ 0.05) was employed to compare the results both in the game and in the acceptance of school feeding, before and after the intervention.

Results

Anthropometric Nutritional Assessment

The 243 students were assessed through anthropometric measurements, and the results were the following: 71% of the students were eutrophic; 17% were overweight; 10% were obese and 2% were underweight.

School feeding acceptance and adhesion questionnaires

Table 1 presents the results related to the adhesion to and acceptance of school feeding, as well as the purchase of foods to be ingested during mealtime at school. Most of the students consume the school meals from four to five times a week, but the ratio of children who actually accept it is comparable to the ratio of students who have the school meal but also purchase other foods.

Table 1. Frequency of adhesion to school feeding and food purchase. Duque de Caxias-RJ, 2014.

STUDENTS ACCEPT SCHOOL FEEDING			Yes	No	Total
			81%	19%	100%
NUMBER OF DAYS OF ACCEPTANCE OF SCHOOL FEEDING IN A WEEK		1 day	2 to 3 days	4 to 5 days	Total
		17%	37%	46%	100%
STUDENTS HAVE THE SCHOOL MEAL AND BUY OTHER FOODS			Yes	No	Total
			83%	17%	100%
NUMBER OF DAYS WHEN STUDENTS BUY OTHER FOODS	1 day	2 to 3 days	4 to 5 days	NSR/NR	Total
	19%	42%	31%	31%	100%

Analysis of school menus

We conducted the weighting of 182 lunches and 30 breakfasts. We observed that there was no standardized portions at school lunches, since the variation coefficient was 25,7%. This was the analysis of the composition of the menu, which also helped standardizing the portions for the leftovers/ingestion phase. We analyzed the acceptance of the meals by 10% of the students, per school visit. That way, about 60% of the students were analyzed.

Chart 1 contains the description, along with the respective percentage, of the foods mentioned in the food frequency questionnaire and in the hedonic scale as the students' favorites and least favorites, as well as the most purchased products to be consumed during school hours. Among the foods in the vegetable group, only lettuce and tomato were accepted, while most of the items in this food groups were among the dismissed ones. The most frequently purchased products to be consumed along with school feeding are *guaraná* beverages and packaged corn snacks.

Chart 1. Most accepted, dismissed and purchased foods to be consumed during the school mealtime. Duque de Caxias-RJ, 2014.

FOODS USED IN THE SCHOOL MEAL					
ACCEPTED (%)		DISMISSED (%)		PURCHASED (%)	
STEAK	5	SWEET POTATO	3	YOGURT	4
GROUND BEEF	6	SQUASH	4	SOY BEVERAGE	4
FRUIT	11	ZUCCHINI	4	CAKE	4
TOMATO AND LETTUCE SALAD	13	CANNED PEAS	4	HOT DOG	5
POTATOES	14	LIVER	7	BAKED PASTRIES	7
BEEF (CHOPPED)	15	CARROTS	10	APPLE	8
PASTA	29	FISH	11	CANNED JUICE	12
CHICKEN	35	CHAYOTE	18	SODA	20
RICE	57	BEETS	28	CORN SNACKS	42
BEANS	57	-		SUGAR-SWEETENED BEVERAGES	60
BREAKFAST				-	-
MILK WITH BANANA	5	COFFEE WITH MILK	6	-	-
WHITE BREAD WITH CHEESE	5	-	-	-	-

Those informations were obtained through the hedonic scale and the frequency and adhesion to school feeding questionnaire, respectively, since both instruments contained questions regarding the students' favorite and least favorite foods, and only the questionnaire contained the question regarding purchased foods.

Chart 2 describes nutritional adequacy of school menus by age range according to the National School Feeding Program and the results of the menus from the three schools included in this study, with the identification of schedules, types of meal offered and students' age range. The supply of macronutrients at each school menu was above the Program's guidelines, while the supply of calcium was much below the recommended amount in all education institutions.

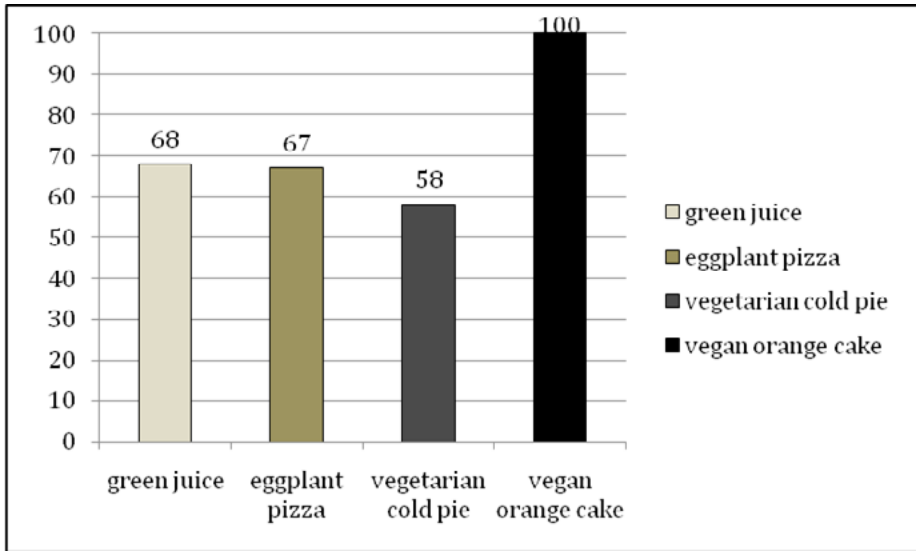
Chart 2. Nutritional analysis of school menus, according to the National School Feeding Program guidelines. Duque de Caxias-RJ, 2014.

30% OF NUTRITIONAL RECOMMENDATION (2 MEAL SUPPLY)		AGES	TEV (kcal)	CH (g)	PTN (g)	FAT (g)	FIBER (g)	Vitamin A (μg)	VitamiN C (mg)	Ca (mg)	Fe (mg)	Mg (mg)	Zn (mg)
		6 – 10	450	73,1	14	11,3	8	150	11	315	2,7	56	2
		11 - 15	650	105,6	20,3	16,3	9	210	18	390	3,2	95	2,7
SCHOOL(meals)	SCHEDULE	AGES	TEV (kcal)	CH (g)	PTN (g)	FAT (g)	FIBER (g)	VitaminA (μg)	VitaminC (mg)	Ca (mg)	Fe (μg)	Mg (mg)	Zn (mg)
MJS (breakfast/lunch)	1º	8 - 12	1090**	166,2**	43,6**	29,1**	22**	2399**	42**	271*	7,8**	206**	5,8**
20% OF NUTRITIONAL RECOMMENDATION (1 MEAL SUPPLY)		AGES	TEV (kcal)	CH (g)	PTN (g)	FAT (g)	FIBER (g)	VitaminA (μg)	VitaminC (mg)	Ca (mg)	Fe (mg)	Mg (mg)	Zn (mg)
		6 - 10	300	48,8	9,4	7,5	5,4	100	7	210	1,8	37	1,3
		11 - 15	435	70,7	13,6	10.9	6.1	140	12	260	2.1	6.3	1,8
SCHOOL(meals)	SCHEDULE	AGES	TEV (kcal)	CH (g)	PTN (g)	FAT (g)	FIBER (g)	VitaminA (μg)	VitaminC (mg)	Ca (mg)	Fe (mg)	Mg (mg)	Zn (mg)
AA (lunch)	2º	10 - 13	519**	77,9**	19,5**	13,3**	10**	900**	18**	208*	6**	74**	2,35**
CDA (lunch)	3º	8 - 13	568**	81,3**	27,9**	14,6**	14**	206**	12	75*	3,1**	91**	3,1**

*below the values recommended by the National School Feeding Program; **above the values recommended by the National School Feeding Program

Cooking Workshops

Four types of recipes were executed at all schools, using some of the foods mentioned at the food frequency questionnaire and the hedonic scale. The preparations were: green juice; eggplant pizza; vegetarian cold pie and vegan orange cake. The steps of the preparation that could offer some sort of risk, such as chopping, sanitizing and the cooking itself, were executed by the research group. The students took part in the tasting of each preparation by the end of the event and reported their main preferences: 68% preferred the green juice; 67%, the eggplant pizza; 58%, the vegetarian cold pie; and 100%, the vegan cake (picture 1).



Picture 1. Global percentage of preferences reported by the students for the preparations during the cooking workshops. Duque de Caxias-RJ, 2014.

After the educational activities, the students' performance in the games saw a significant increase, with the average score going from 7.0 to 8.5 at the Plate Game (p-value of 4,16E-0,5) and from 6.5 to 9.0 at the Pyramid Game (p-value of 8.69-22; table 2), the same way it went with the acceptance results, assessed through the hedonic scale (79 x 91; p-value 0.0032). As for the leftovers/ingestion index, an increase of the average value post-intervention has been observed, although it had no statistical significance (table 2).

Table 2. Results of the games and acceptance of school feeding before and after the intervention. Duque de Caxias-RJ, 2014.

SCHOOLS	PLATE GAME (AVG)			PYRAMID GAME (AVG)			HEDONIC SCALE (%AVG)			LEFTOVERS/INGESTION (%AVG)		
PERIOD	BEFORE	AFTER	p-value	BEFORE	AFTER	p-value	BEFORE	AFTER	p-value	BEFORE	AFTER	p-value
AA	6	8,3	*** $4{,}16^{-5}$	6,5	9,25	*** $8{,}69^{-22}$	99	85	*** 0.003	85	87	0,731
MJS	8,35	9		6,7	9,3		78	96		79	83	
CDA	6,7	8,1		6,3	8,5		76	91		81	87	

Discussion

The result of the nutritional assessment endorses the studies conducted with the same population by da Silva et al.,[11] which showed a majority of eutrophic students and an inversion of nutritional indicators with a decrease of underweight subjects and an increase of overweight ones.[11]

It has been pointed out, at the frequency and adhesion to school feeding questionnaire (table 1), that the majority of the students, 81% of them, ate the meal provided by the school. The frequency of acceptance was the highest at the range of two or three days - 37%; and four or five days - 45%. The research conducted by Sturion et al.[12] showed similar results when assessing twenty schools in ten Brazilian cities, in five demographic regions, showing an average acceptance index of 90%, which is considered satisfactory, and a ratio of 45% of students who ate the school meals from four to five days a week.[12]

The offer of the preparations for the students during school feeding did not meet standardized portions, since at each school a different utensil was employed to serve the same preparation, which caused variations, even in the same school facility. The variation coefficient of 25,7%, when the ideal value is below 10%,[13] indicated that the weight of the meals ranges between different values. This fact may contribute to the excessive supply of foods which necessarily would not be consumed by the students,[14] and concurs to the waste of food. Flavio et al.[15] have pointed out how fundamental it is to standardize the portions offered in school meals for students enrolled at education institutions according to the different age ranges (children and teenagers) and considered, after their study, which took place in the city of Lavras-MG, that such uniformization is far from the reality of school feeding.[15]

The vegetables on the menu regarded as the students' favorites were lettuce and tomato, with 13% of mentions about salad with those vegetables; at the meat group, it was chicken, with 35%; among grains, it was rice, with 57%; and pasta, with 29%. As for breakfast, the preferred option

was cheese on bread, with 18%. On the other hand, the dismissed foods were, for the most part, vegetables and protein-based dishes containing liver and fish.

The mention of rice and beans for lunch and milk and fruit for breakfast as the students favorite foods is positive, since those foods are considered to be part of a healthy diet[4,16] and classified as protective against non-transmissible chronic diseases. Matihara et al. have also found greater acceptance of grains such as rice, with 66%; pasta prepared three different ways, with an average of 62%; beans, with 56%; and low frequency of mentions for vegetables, just like in the present study.[17]

The students reported buying other foods to eat during mealtime at school, which added up to 83% of all students, and between 34% and 43% of whom purchased such products from two to three times a week, and four times, respectively. Vargas et al.[18] found, in a study with 331 teenagers enrolled at public schools in Niterói-RJ, that the preference for snacks over school meals existed for most of the assessed sample, amounting to 70% before the educational intervention, which corroborates the result of the present survey.[18] The purchased foods most frequently mentioned by the students represent unhealthy options, such as *guaraná* beverages, popularly known as "natural *guaraná*", representing 60%, and the corn snacks, with 15%, followed by soda, with 20%, and juice boxes, with 12%.

Story et al.,[19] in a study conducted with North-American students, have considered the foods purchased by them to be consumed during the school mealtime as foods which compete with the school food supply and inadequate to their health, due to the high energetic value and low nutritional value. They reported in their study that the sale of such competitive foods occurs through vending machines available at almost every school in the United States. The authors also point out that the students' preferences are for sugar-sweetened beverages and packaged snacks, just like in this study.[19]

Leme et al.[20] have also identified, in a public school in São Paulo, through a research with 83 teenagers, that the preference during snack time in school was for competitive foods (AC), purchased close to the school facilities and/or brought from home. However, school meals are consumed by many students since there is no cafeteria inside the school featured in the study.[20]

Briefel et al.[21] suggest, on a research with a sample of 2.314 children enrolled at 287 schools, that, in order to contribute to the improvement of the students' food practices, continuous changes should be adopted, such as preventing the children from having access to the competitive foods in the school environment, which may be an efficient strategy to reduce their consumption.[21]

Due to the increasing prevalence of overweight students,[20] and considering the habitual consumption of unhealthy items found throughout this study, it is mandatory to implement some control over school cafeterias, so that they start to offer healthier snacks.[21] It is also noteworthy

that only one school in this study had a cafeteria, which shows us that some of the students brought such foods from their homes. Therefore, it is of utmost importance to offer food education to the household.

The second knowledge assessment with the Plate Game (table 2), after the intervention, in the present study, showed a statistically significant increase in the average score. The Pyramid Game was the one which offered greater difficulty for the students in the first part of the research, since in all of the schools the students had an average score under 7.0. After the intervention, however, the average scores saw a significant increase. Da Silva et al.[11] had the same result, in both games, on their study with 171 students from public schools in Duque de Caxias-RJ, after their educational intervention.[11, 22] An educational process which employs ludic activities, with situations that can be identified as a part of the learners' day to day, can establish a greater sense of identity and acceptance.[22]

The evaluation of acceptance through the hedonic scale showed significant results when the numbers before and after the educational intervention were compared. It also showed scores 4 and 5, corresponding to "liked" and "loved", complying with the National Program of School Feeding guidelines, which are 85% for these two categories of acceptance.[1] Although no statistical significance has been observed, the results of the evaluation through the leftovers/ingestion index showed that the acceptance was close to the Program's requirements, which are at least 90%, and that the average values on all three schools went from 83 to 86%.[1]

All of the schools met the percentage of macronutrients prescribed by the National Program of School Feeding. The amounts of fiber, vitamins A and C, as well as the minerals iron, inc and magnesium, conversely, exceed the Program's recommendations, in most of the days when the menus were analyzed.

The participation in the cooking workshops was very much enjoyed by the students. The self-hygiene procedures were met by the majority of them, as well as the classroom activities which took place on the intervals during the food preparation, while the recipe executed by the class was finished. Activities which stimulate the subjects' integration into familiar contexts are usually pleasant and learning-inducing.[11,22-25]

The tasting of the preparations by the end of each workshop was a moment of relaxation and socializing, with an active participation and demonstration of interest on the activity by the student.

The global percentage of the students' reported preferences at the cooking workshops showed better levels of acceptance for the green juice, eggplant pizza and vegetarian cold pie, with close percentual values – 66%, 65% and 64%, respectively. The most preferred recipe in all of the classes was the vegan orange cake, made without any animal ingredients (100%).

The use of the cooking workshops as a method for food education reaffirms the guidelines of the *Food Guide for the Brazilian Population*, which emphasizes the importance of using recipes that have, as their ingredients, natural or minimally processed foods, stimulating the consumption of "actual food".[26]

Conclusion

The introduction of educational activities in the schools of Duque de Caxias-RJ has been successful, leading to an improvement of the results regarding the students' performance at the games employed to retain their knowledge about healthy eating, as well as a greater acceptance of school feeding by the students. In that sense, the school environment can also contribute to the adoption of healthy eating practices.

We suggest greater participation of registered dietitians in the school day to day, in order to fully meet the National School Feeding Program guidelines and ensure the students' rights to balanced and safe meals, at most days throughout the school year.

Collaborators

Silva MX took carried out the article's bibliographic review and writing; Brandão BCO performed the statistical analysis of the work; Accioly reviewed the manuscript; Pierucci APTR and Pedrosa C participated on the outline of the study.

Conflict of Interest: The authors hereby declare having no conflict of interests.

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