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Article

Influence of Canteens on the Eating Behavior of Private School Students

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Abstract: The school food environment is a suitable place to promote healthy habits, as it is a space for learning and constant social interaction, where children spend at least a third of their day, and have one to two meals. This study aimed to analyze the sale of food in the canteens of private schools in a capital in the Northeast of Brazil and verify the influence of it on students' eating behavior. A cross-sectional, quantitative, multicenter study was carried out, taking place simultaneously in twenty capitals in Brazil. A checklist with 87 questions was applied to those responsible for the canteens in a representative sample of schools in each city. Frequencies and associations were performed using Pearson's Chi-Square test. The analysis of the foods sold, was based on the NOVA food classification from the Dietary Guidelines for the Brazilian Population, regarding the degree and extent of processing. Latent Class Analysis was carried out to group the canteens into similar response patterns, modeled with covariates, and association was calculated with the Kruskal-Wallis and Duun tests, or Fisher's Exact test. The results showed that students were very frequently offered ultra-processed, sugar-rich foods with low nutritional value; 88.7% of such foods had been chosen by managers as part of the menu because they are "students' food preferences". There is an average of only 2.3 fresh foods in canteens compared to 7.5 varieties of ultra-processed foods. There must be stricter control over what is sold, to minimize student's exposure to unhealthy foods.

Keywords: school feeding; school health services; child nutrition; adolescent nutrition; nutrition programs and policies

1. Introduction

Brazil makes constant efforts to promote Adequate and Healthy Eating (AHE) in different environments, in line with the Brazilian Dietary Guidelines [1]. The places where we live, work, live and study form the food environment, and impose factors such as the availability and price of products; these in turn directly influence the purchase of food, which can facilitate or hinder AHE, in addition to being permeated by advertisements and social media, also negatively associated with eating habits [2–4]. The assessment of food environments is extremely important to understand the determinants of habits and the behaviors.

According to the Food and Agriculture Organization (FAO), the school food environment covers all spaces (school canteens, classrooms, courtyards, external areas, cafeterias, self-service machines, street vendors, and others), and the infrastructure in and around schools in which food is offered, purchased and consumed, as well as its form, advertising and price (marketing, advertisements, brands, labels, and food packaging) [5]. This environment is a suitable place to promote healthy habits, as it is a training and learning space for students, in addition to having a very expressive community of actors: parents, teachers, students, and other employees [4].

The creation of healthy eating habits must begin in childhood with family members, and must continue in the school environment, where the child spends at least a third of the day and eats one to two meals. This is an important opportunity to encourage consumption of adequate and healthy

foods which are essential for physical, psychosocial and academic growth and development, in addition to improving the feeling of well-being and promoting quality of life that is essential in adulthood [6,7].

Among Brazilian efforts, we highlight the National School Feeding Program (*Programa Nacional de Alimentação Escolar – PNAE*), which has existed since the 1950s for public schools throughout Brazil, with emphasis on offering school meals. It serves more than 40 million students, decentralized in 5,570 Brazilian municipalities, and follows the Brazilian Dietary Guidelines [1,8]. Another highlight is Interministerial Ordinance #1.010, published in 2006; this ordinance is focused on promoting national nutrition education actions in schools, considering the cultural differences of each state and recommending monitoring the nutritional and dietary status of students, implementation of good food handling practices and restriction of the sale of fatty foods and foods with high salt and sugar content in schools [9]. Then Decree #11.821 was published in 2023, providing principles, objectives, strategic axes and guidelines which guide actions to promote AHE in the school environment [10].

Despite these initiatives, Brazil's territorial extension and diversity require assessments and monitoring that have not yet been achieved by the competent bodies. According to the 2019 National School Health Survey (*Pesquisa Nacional de Saúde do Escolar – PeNSE*), 96.2% of private schools and 27.9% of public schools had commercial school canteens, despite these establishments being prohibited in the public network. PeNSE also showed the sale of soft drinks (75%), industrialized snacks (68.3%) and fried snacks (72.4%) around schools. The presence of soft drinks in canteens was reported in more than half of the sample surveyed, despite their sale already having been discouraged for almost two decades (2006) [11]. The supply of these foods has a significant impact on students' eating choices and behavior, with a strong association with the development of excess weight in children and adolescents. Sweetened beverages are responsible for approximately 10% of childhood obesity and ultra-processed foods (UPF) are related to elevated total and LDL cholesterol levels and increased waist circumference in children [12]. Therefore, it is important to carry out research that analyzes exposure to these foods in order to propose timely changes.

The study "Food Marketing in Brazilian Schools" (*Comercialização de Alimentos em Escolas Brasileiras – CAEB*) was carried out in private schools in 19 of the 27 Brazilian capitals. Aracaju, the capital of Sergipe, has only one study on the adequacy of *PNAE* menus [13], and another on commercial canteens in public schools in the state [14], with this being pioneering research in the city. Therefore, the objective of this study was to analyze the sale of food in private school canteens, verifying exposure and influence on students' eating behavior.

2. Methods

This is an analytical cross-sectional study carried out in Aracaju, which is the capital city of one of the nine states in the Northeast region of Brazil. It has a population of 672,614 inhabitants [15], has 161 private schools, 110 of which are at the preschool level, 128 at the primary level, and 61 at secondary level [16].

The canteens of private primary and secondary schools in the capital were researched to characterize the schools' food environment. The sample universe was defined based on the School's catalog of the National Institute of Educational Studies and Research Anísio Teixeira (Inep) from 2021. The simple random probabilistic sampling method was used, with primary and secondary education schools being selected. Verification of the canteens' eligibility was carried out by local researchers through telephone contact and/or other means of communication. After this screening contact, schools that did not have canteens, deactivated schools, schools that were not possible to contact and pre-school education schools were excluded, as they had fewer canteens. Of the 189 private schools in Aracaju, 71 confirmed that they have a school canteen. The replacement method adopted was reverse sampling due to the lack of information regarding the presence of canteens on the Inep list and the expectation that the percentage of schools with a canteen varies between cities, aiming to guarantee the randomness of replacement throughout the data collection. The minimum sample size was 54 schools, and in the end 71 schools participated in the study from October to December 2022.

After contact, the name of the person responsible for carrying out data collection was requested, respecting the location's workflow, availability and acceptance to participate in the study. For this stage, a company specialized in carrying out the study, *Vox Populi*, was hired, which was responsible for collecting data from all states participating in the study. The collection in Aracaju also included volunteer students from the nutrition course at the Federal University of Sergipe (UFS) who participated in prior training on the instrument and the data collection procedure, as well as on the confidentiality of the information collected and reliable recording of the data.

The data collection instrument used was developed by the national study team based on the NOVA food classification, and consists of a checklist of 87 questions. The questions extracted for use in this study refer to the profile and identification of the school, information about the canteen, the meals offered (section 1), the food sold (section 2), the production form (whether homemade or industrialized), the reason for choosing these foods for sale, and the presence or absence of a nutritionist and educational materials to promote adequate and healthy eating (section 3).

Frequencies and associations were performed using Pearson's Chi-Squared test. The analysis of the foods sold was based on the NOVA food classification from the Dietary Guidelines for the Brazilian Population regarding the degree and extent of processing [1]: *in natura*, animal or vegetable origin, which are taken from nature, and distributed for consumption without any alteration; minimally processed, with minimal changes for consumption, such as cutting and drying; processed, made with the addition of oil, salt, sugar or vinegar, to make them last longer; and ultra-processed foods (UPFs), made with many ingredients and generally have additives for exclusively industrial use [1]. After classifying the degree of processing, the foods sold were quantified and categorized according to the variety present in schools: sales of less than five types and more than six types of food in each category.

An analysis of the canteens' profile was also carried out using Latent Class Analysis (LCA) [17]. This statistical procedure sought to group canteens according to similar response patterns modeled with covariates, forming classes with greater homogeneity and interclass heterogeneity. The latent classes were generated from 45 variables that describe the characteristics of the establishments. Models were created and tested in the construction of this latent variable, with different numbers of categories until finding the ideal model to describe this variable. The following criteria were observed for this choice: Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC) and adjusted Bayesian Information Criterion (adjusted BIC), always observing the lowest values when comparing the current model with the previous one.

The Kruskal-Wallis [18] and Duun [19] tests were used to test the association of latent classes with the independent variables when crossing with quantitative variables, and the Fisher's Exact test [20] when crossing with qualitative variables. The Shapiro-Wilk test [21] was used to evaluate the adherence of quantitative variables to the Normal distribution. Statistical analyzes were performed using R version 4.3.2 program [22]. The significance level adopted throughout the work was 5%.

3. Results

The majority of those responsible/managers of the school canteen participated in the study (78.9%), followed by the owners (21.1%), 80.7% of whom were female, with an average age of 29 years ($SD \pm 16.6$). Moreover, 57.9% had completed secondary education, and 42.1% had completed higher education.

A total of 69.8% of participating schools in Aracaju had fewer than five employees, serving an average of 262 students ($SD \pm 265.3$). Of these, 50.7% are managed by the school itself in a self-management system, and essentially offer snacks (100%) (Table 1).

Table 1. Characterization of canteens in the Private Food Sales survey in Aracaju, Sergipe, Brazil, 2024. (n=71).

Variables	n	%
Type of administration		
Outsourced	33	46.5
Self-managed	36	50.7
Other	2	2.8
Meals offered in the canteen		
Breakfast	3	4.2
Lunch	9	12.7
Snacks	71	100.0
Dinner	1	1.4
Presence of nutritionist	30	42.3
Criteria for choosing the foods sold		
Student preference	65	91.5
Possibility of production or acquisition	36	50.7
Best-selling foods	55	77.5
Higher profit percentage	43	60.6
Recommendation of the school	44	62.0
Nutritionist's menu	31	43.7
State/municipal legislation	23	32.4
Existence of educational material on healthy eating in the canteen	7	9.9
Responsible for preparing educational material		
Canteen	6	8.5
Nutritionist	3	4.2
Direction	2	2.8
Students	1	1.4
Carrying out educational activities to encourage healthy eating	8	11.8
Food production site		
Canteen	40	56.3
Employee's house	6	8.5
Seller's house	11	15.5
Factory/Production center	49	69.0
Features of food marketing		
Nutritional information not available	32	45.1
Available in all preparations	25	35.2
Available in some preparations	14	19.7
Availability of special purpose foods*	23	32.4
Availability of table/counter for meals	46	64.8
Prohibition of the sale of any food/product	15	21.1
Combo offer (food and beverage) at a lower price	5	7.0
Food and beverage promotion	9	12.7
Selling food by others (students, teachers, parents)	3	4.2

Note: (*) Allergies, intolerances and/or illnesses, such as diabetes.

Only 9.9% of schools produce educational materials on healthy eating and those responsible for their preparation are those responsible for the canteens, nutritionists, students and school management. The canteens presented an average of 2.3 ($SD \pm 1.2$) types of food in the fresh or minimally processed category, 2.1 ($SD \pm 1.5$) varieties classified as processed and an average of 7.5 types of UPFs ($SD \pm 4.0$). In total, 98.6% of canteens have less than 5 types of fresh or minimally processed foods as an option for students, compared to 66.2% of canteens which have more than 6 types of UPFs in their canteens (Table 2).

Table 2. Types of food sold in private schools in Aracaju, Sergipe, Brazil, 2024. (n=71).

Food classification	n (%)
<i>In natural or minimally processed</i>	
≤ 5 types of food	70 (98.6)
≥ 6 types of food	1 (1.4)
Processed	
≤ 5 types of food	67 (94.4)
≥ 6 types of food	4 (5.6)
Ultra-processed	
≤ 5 types of food	24 (33.8)
≥ 6 types of food	47 (66.2)

The presence of a nutritionist on site was associated with the characteristics of the canteens and demonstrated a statistically significant association with the nutritional information available ($p<0.001$), with the choice of food based on legislation ($p=0.022$) and with the existence of educational material on healthy eating in the canteen ($p=0.038$), as shown in Table 3.

Table 3. Association between the presence of a nutritionist in canteens and characteristics of food sales in private schools in Aracaju, Sergipe, Brazil, 2024. (n=71).

Variables	Presence of nutritionist		P-value
	Yes n (%)	No n (%)	
Nutritional information available			
Not available	5 (16.1)	27 (67.5)	
Available in all preparations	16 (51.6)	9 (22.5)	<0.001
Available in part of preparations	10 (32.3)	4 (10.0)	
Marketing of foods for special purposes			
Yes	14 (45.2)	9 (22.5)	0.072
No	17 (54.8)	31 (77.5)	
Availability of table/counter for meals			
Yes	20 (64.5)	26 (65.0)	0.581
No	11 (35.5)	14 (35.0)	
Food choice criteria based on state/municipal legislation			
Yes	15 (48.4)	8 (20.0)	
No	16 (51.6)	32 (80.0)	0.022
Educational action to encourage healthy eating			
Yes	6 (19.2)	2 (5.0)	0.072
No	25 (80.6)	38 (95.0)	
Existence of educational material on healthy eating in the canteen			
Yes	6 (19.4)	1 (2.5)	
No	25 (80.6)	39 (97.5)	0.038
Prohibition of the sale of any food/product			
Yes	5 (16.7)	10 (25.0)	0.558
No	25 (83.3)	30 (75.0)	
Combo offer (food and beverage) at a lower price			
Yes	2 (6.5)	3 (7.5)	1.000
No	29 (93.5)	37 (92.5)	
Food and beverage promotion			
Yes	5 (16.1)	4 (10.0)	0.490
No	26 (83.9)	36 (90.0)	
Selling food by others (students, teachers, parents)			

Yes	2 (6.5)	1 (2.5)	0.577
No	29 (93.5)	39 (97.5)	

The sale of UPFs in canteens had a statistically significant association with all criteria for choosing foods to be offered in canteens (Table 4), except the nutritionist's decision ($p=0.410$). The canteen profiles were stratified into four options (described in the supplementary material), and were correlated with the criteria for choosing the foods sold, number of customers served and type of food sold (Figure 1) and demonstrated statistical significance in all associations ($p < 0.05$). Figure 2 shows the analysis of the four profiles generated in association with the degree of food processing. Profiles 1 and 4 are characterized by the high probability of having nutritionists and having nutrition education actions shared and materials distributed, and presented a statistical difference from profile 2. These specific probability-based differences were observed for fresh foods.

Table 4. Association between the amount of ultra-processed foods and the criteria for choosing foods sold in private schools in Aracaju, Sergipe, Brazil, 2024. (n=71).

Variable	Ultra-processed foods		P-value
	≤ 5 n (%)	≥ 6 n (%)	
Student preference			
Yes	18 (75.0)	47 (100.0)	<0.001
No	6 (25.0)	0	
Best-selling foods			
Yes	12 (50.0)	43 (91.5)	<0.001
No	12 (50.0)	4 (8.5)	
Possibility of production or acquisition			
Yes	20 (83.3)	16 (34.0)	<0.001
No	4 (16.7)	31 (66.0)	
Higher profit percentage			
Yes	6 (25.0)	37 (78.7)	<0.001
No	18 (75.0)	10 (21.3)	
School recommendation			
Sim	21 (87.5)	23 (48.9)	0.002
Não	3 (12.5)	13 (51.1)	
Nutritionist's menu			
Yes	13 (54.2)	18 (38.3)	0.410
No	11 (45.8)	29 (61.7)	
State or municipal legislation			
Yes	17 (70.8)	6 (12.8)	<0.001
No	7 (29.2)	41 (87.2)	

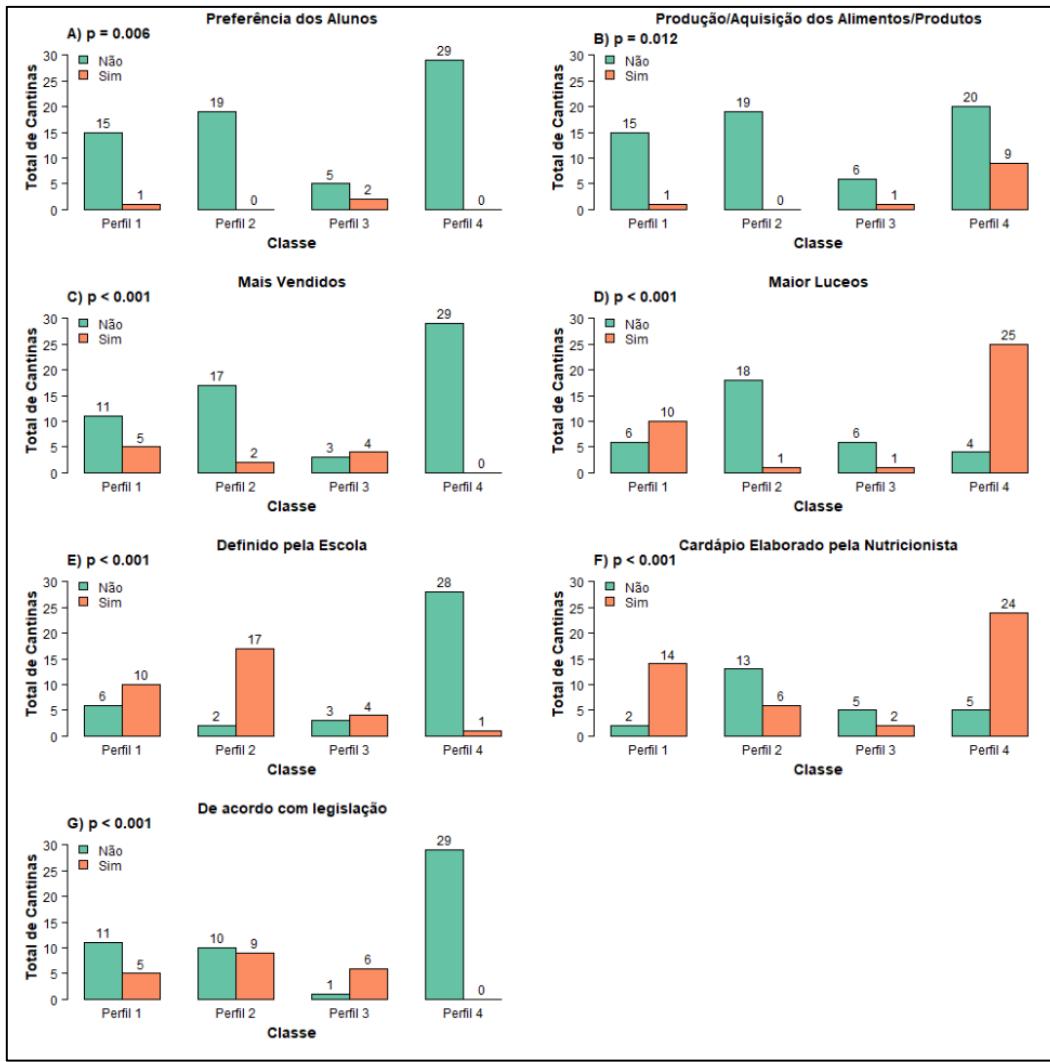


Figure 1. Association between canteen profiles and the criteria for choosing food sold in private schools in Aracaju, Sergipe, 2024. (n=71).

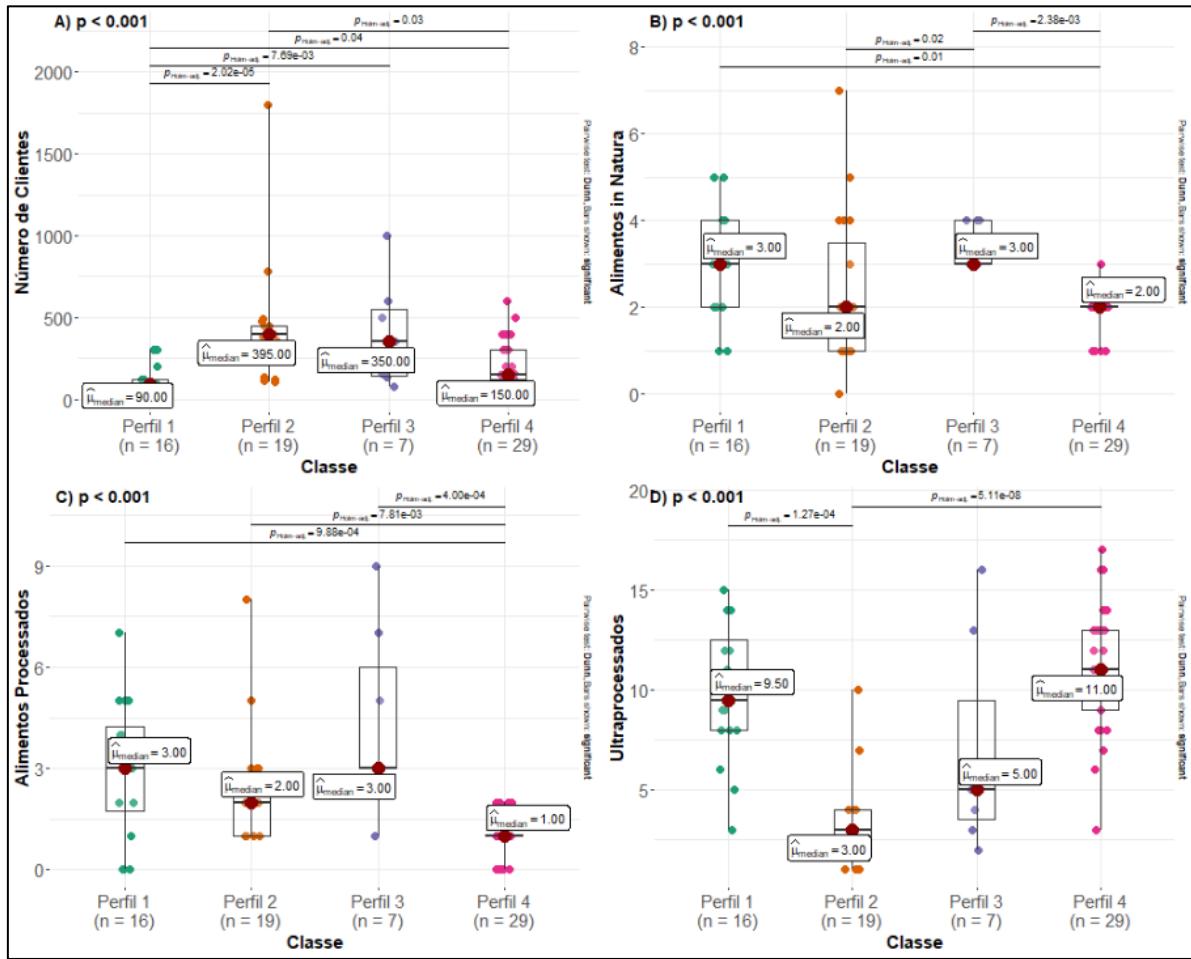


Figure 2. Association between canteen profiles and number of customers and foods by processing level that are sold in private schools in Aracaju, Sergipe. 2024. (n=71).

4. Discussion

The Brazilian Dietary Guidelines advises that the diet should be predominantly composed of fresh and minimally processed foods, with limits consumption of processed foods and that UPFs should be avoided [1]. This recommendation is strongly related to the prevention of an obesogenic food environment in school canteens. To this end, changes must be made to the supply and availability of food. It is possible and recommended to replace UPFs with culinary preparations, such as replacing industrialized juice and soda with natural fruit juice, and baked cakes instead of packaged snacks and sweets made in the canteens themselves. When these preparations combine fresh, minimally processed foods, and culinary ingredients (oils, sugar and salt), they are healthier, more economical, sustainable and in line with food culture [1].

A high availability of UPFs was observed among the foods sold in the evaluated sample (Table 2). This result was similar to that found in the evaluation of 19 state public school canteens in Aracaju in 2017 [14], and to the findings of other studies in Brazilian states, which showed high sales of processed foods and UPFs in school canteens [23–29]. These foods are related to the increased incidence of chronic diseases which are frequently observed in adults and older adults, and with an increase in young people [1].

Providing quality food is essential for students to make good food choices. In the case of the sample evaluated, a small percentage of schools (32.4%) responded that the menu choice was based on state legislation, Law #8178-A, which prohibits the sale of foods that negatively affect the prevalence of childhood obesity, and provides that this commercialization meets the nutritional quality necessary to maintain the health of students [30]. This result demonstrates a probable lack of knowledge about the existence and importance of legislation for the school community. It is worth

mentioning that there was a statistically significant association between the presence of a nutritionist and the criterion for choosing the menu based on legislation ($p=0.022$). Regarding the association with the amount of UPFs, no statistical significance was found with the menu prepared by this professional ($p=0.410$).

Congruent with this, research carried out with data from the Study of Cardiovascular Risks in Adolescents (*Estudo dos Riscos Cardiovasculares em Adolescentes – Erica*) showed an association between schools that follow the laws that regulate food marketing, restricting the sale of food and drinks, and a lower chance of obesity in children and adolescents enrolled in public and private schools. This study also points out the need for the country to establish national regulations regarding the sale of food in school canteens, which goes further and improves local instruments so that they become clearer and more efficient [31].

It was observed that the administration forms were almost proportional, with a slight inclination towards canteens administered by self-management. According to Wognski et al. [23], schools with self-managed canteens prioritize offering healthier foods with better nutritional value due to greater concern for the well-being and development of students, but to the detriment of profit. On the contrary, profit is often prioritized in canteens with outsourced management due to the low level of interference from the school community (management and parents), with the consequent commercialization of more practical and caloric foods. However, regardless of management, some studies state that private schools are more likely to sell unhealthy foods when compared to public schools [32–34].

Einloft et al. [35] assert that students' food choices are related to autonomy and empowering behavior, which is important for this stage of life. However, when they have financial resources to purchase food, those chosen are generally UPFs with high energy density, such as cookies, candies and soft drinks [23–26]. These foods are hyperpalatable, can compromise the feeling of satiety and cause an addictive relationship [36]. Furthermore, greater exposure to UPFs is associated with adverse health effects, mainly cardiometabolic and mental disorders and mortality [37].

With regard to public schools in Brazil, the existence of *PNAE*, which is the largest and most comprehensive school feeding program in the world, meets the needs of students, exclusively offering adequate and healthy food [8,38]. However, the marketing of food in private schools is the responsibility of their managers, who as a rule, tend to prioritize profit over the nutritional quality of the food, offering low quality food [23]. This scenario is also in line with Decree #11,821 [10] of the federal government, which has the prioritization of fresh and minimally processed foods in the sale of food and drinks in the school environment as one of its guidelines.

The development of nutrition education actions, as well as implementation of the good practices' manual, specific assistance to schoolchildren with associated illnesses and disabilities, and the development of menus in these locations, is the responsibility of the local nutritionist [39,40]. In this study, more than half of the school canteens evaluated did not have a nutritionist (57.7%), and only 43.7% followed the menu prepared by this professional. Although the presence of nutritionists was scarce, the availability of nutritional information about food, the occurrence of nutrition education actions and educational materials on healthy eating were more prevalent in schools where the professional was present, especially regarding to the availability of nutritional information about food ($p<0.001$) and educational materials on healthy eating ($p=0.038$).

Healthier food choices promote a feeling of self-care and promote autonomous and voluntary practice of habits. In this process of strengthening autonomy to make choices, nutrition education actions, the principles of autonomy and self-care aim to make people agents of their own health through the creation of skills and absorption of knowledge necessary for healthy food choices.

It is important to highlight some limitations that were observed in the study, such as the lack of food pricing in canteens in this capital city, which is essential information to understand the influence that value has on students' food choices and eating behavior. However, with the data obtained it is possible to observe the pattern of food trade in private schools in Aracaju, and thus envisage new actions and research to delve deeper into the topic in order to improve the food environment in

schools. It is also recommended that research be carried out to directly evaluate the food consumption of schoolchildren.

5. Conclusions

It was observed that the sale of food in the canteens of private schools in Aracaju is inadequate from using the Brazilian Dietary Guidelines and current state legislation as an analysis parameter. There is a clear need to create public policies with the aim of promoting a healthier food environment in schools, with an emphasis on food sales. Nutrition education actions are essential for disseminating knowledge to the school community, allowing students greater autonomy in relation to good food choices. Stricter control over compliance with state legislation that regulates school meals is also necessary, as well as the improvement of existing legislation. Furthermore, the importance of the presence of the nutritionist as responsible technician is highlighted to develop healthier menus with the purpose of contributing to the healthy eating behavior of students, meeting nutritional needs, and helping to prevent noncommunicable chronic diseases in schools.

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Conflicts of Interest: The authors declare no conflicts of interest.

Ethics Statements: Approved by the Research Ethics Committee of the Federal University of Sergipe, under Opinion #5,531,874, and all participants signed the free and informed consent form.

Data Availability Statement: The datasets used and analyzed in this study are available to anyone for further analysis.

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