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School environment and adherence to school meals among Brazilian public-school adolescents

Ambiente escolar y adherencia a las comidas escolares entre adolescentes de escuelas públicas brasileñas

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ABSTRACT

Objective: To assess whether the school environment is associated with adherence to school meals among adolescent students in Brazilian public schools. Methods: Data from the 2015 National School Health Survey were analyzed. The provision of school meals was assessed according to student report and adherence through the frequency of weekly consumption, classified as adherence (≥ 3 x/week), unsatisfactory adherence (≤ 2 x/week), and non-adherence (none). The following characteristics of the school environment were considered: availability of a properly functioning kitchen and dining hall, cafeteria, and alternative outlets inside or outside schools, and sale of unhealthy food in the cafeteria and alternative outlets. Prevalence estimates were calculated considering the sample's complex design. Results: 86.5% of public schools offered school meals, to which 31.3% of students adhered, 37.9% had unsatisfactory adherence, and 30.8% did not adhere to school meals. Adherence to school meals was higher among schoolchildren in the Midwest Region, from non-capitals, and rural area, while less adherence was observed among students from schools with a cafeteria, an alternative food outlet, and a cafeteria selling soft drinks. Conclusions: Low adherence to school meals is associated with the school geography and food environment. These results can support the formulation of actions to improve the school environment and help the universality of participation in the School Nutrition and Food Policy.

Keywords: Adolescents; Meals; Public policy; School; School-based survey.

RESUMEN

Objetivo: Evaluar si el ambiente escolar está asociado con la adherencia a las comidas escolares entre los estudiantes adolescentes de las escuelas públicas brasileñas. **Métodos:** Se analizaron datos de la Encuesta Nacional de Salud Escolar de 2015. La provisión de comidas escolares se evaluó de acuerdo con el informe del estudiante y la adherencia a través de la frecuencia de consumo semanal, clasificada como adherencia ($\geq 3x/\text{semana}$), adherencia insatisfactoria ($\leq 2x/\text{semana}$) y no adherencia (ninguna). Las características del entorno escolar consideradas fueron: la disponibilidad de una cocina y comedor, quiosco y punto alternativo de venta de alimentos dentro o en la entrada de la escuela, y la venta de alimentos no saludables en el quiosco y en los locales alternativos. Las estimaciones de la prevalencia se calcularon considerando el complejo diseño de la muestra. **Resultados:** 86.5% de las escuelas públicas ofrecieron comidas escolares, a las cuales se adhirió 31.3% de los estudiantes, 37.9% tuvo adherencia insatisfactoria y 30.8% no se adhirió a las comidas escolares. La adherencia a las comidas escolares fue mayor entre los escolares de la Región Centro-Oeste, de las no capitales y del área rural, mientras que se observó una menor adherencia entre los estudiantes de las escuelas con cafetería, un punto de venta de comida alternativa y una cantina que vende refrescos. **Conclusiones:** La baja adherencia a las comidas escolares se asocia con variables geográficas de la escuela, así como con el entorno alimentario escolar. Por tanto, estos resultados pueden apoyar la formulación de acciones que tengan como objetivo mejorar el entorno escolar y ayudar a la universalidad de la asistencia a la Política de Nutrición y Alimentación Escolar.

Palabras clave: Adolescentes; Comidas; Escuelas; Encuesta basada en la escuela; Política pública.

INTRODUCTION

Eating habits acquired in childhood and adolescence generally remain in adulthood^{1,2}. High consumption of ultra-processed foods and low consumption of fruits and vegetables prevail among Brazilian adolescents, which is considered a significant risk factor for the early onset of obesity and other chronic non-communicable diseases, bringing serious repercussions in adulthood^{1,3}, and contributing negatively to school performance⁴.

The environment has a significant influence on the eating habits of adolescents, emphasizing the school environment⁵ because students remain at school for a considerable period of the day in most countries. Thus, at least one daily meal is consumed at school^{6,7}. However, while the school is a strategic place for promoting healthy eating habits⁸, students are predominantly exposed to the sale of unhealthy foods in the school food environment^{9,10,11,12}. According to the Food and Agriculture Organization of the United Nations (FAO), the school food environment corresponds to the available spaces and infrastructure where food can be obtained, purchased, or consumed in and around schools. Thus, depending on the availability, access, and types of food sold, this environment can be an essential factor in obesity in children and adolescents¹³.

In Brazil, in order to meet student nutritional needs during their school stay, public schools provide food to all students of primary education throughout the school year under the National School Feeding Program (PNAE), which, in turn, aims to contribute to the growth, biopsychosocial development, learning, and academic performance of students, and promote the consolidation of healthy eating habits, through food and nutrition education interventions¹⁴. Brazilian students can benefit from one or up to three meals a day, depending on their age and how long they stay in school, and the distribution times are defined by the responsible technical nutritionist¹⁵. However, the achievement

of this program's objectives may be impaired due to the low adherence to school meals among adolescents, ranging from 20 to 60%^{16,17,18,19,20,21,22}.

Considering that the food environment of Brazilian schools has obesogenic features^{9,10,11,12} and that this may be contributing to low adherence to school meals^{17,22}, this study aims to evaluate adherence to school meals according to the characteristics of the school environment among adolescent students in Brazilian public schools.

METHODS

This is a descriptive, cross-sectional study with data from the 2015 National School-based Health Survey (PeNSE), through a partnership between the Brazilian Institute of Geography and Statistics (IBGE) and the Ministry of Health, with support from the Ministry of Education. The study was approved by the National Research Ethics Commission (CONEP), on March 30, 2015 (registration N° 1.006.467).

PeNSE is carried out every three years. However, the 2015 edition is the last available. Study data were obtained through a survey carried out with 9th-grade school students enrolled in the 2015 school year and regularly attending public and private schools in urban and rural areas throughout the national territory. The sample size allowed us to estimate the parameters for each of the 26 states and the Federal District, including capitals and municipalities in the Brazilian inland region. More detailed information on sample size can be found in another publication²³.

Data were collected from April to September 2015 using a smartphone containing a structured and self-administered questionnaire divided into thematic modules. For this study, questions related to geographical characteristics, the school's administrative type, and food were used. PeNSE 2015 evaluated a total of 102,072 students from public (81,154) and private schools (20,918). However, considering that this study aimed to assess adherence to school meals for students

served by the National School Feeding Program (PNAE), namely, those enrolled in the public primary education network¹⁴, only public schools that offered school meals were analyzed (67,881).

The provision of school meals was analyzed through the question, “does your school offer food (school meals/lunch) to students in your class?” answered by students. Adherence to school meals was assessed based on the question “do you usually eat the food (school meals/lunch) offered by the school?”, with answers categorized into: (1) adherence: “yes, every day”; and “yes, 3 to 4 days a week”, (2) unsatisfactory adherence: “yes, 1 to 2 days a week” and “rarely” and (3) non-adherence: “no”.

The following variables were considered for geographical characteristics and school’s administrative type: school’s administration type (federal, state, and municipal); regions (North, Northeast, Southeast, South, and Midwest); federative units; school’s municipality type (capital and non-capital) and school’s geographical location (urban and rural).

The school environment was assessed by a questionnaire answered by school principals. The selected questions were: (1) Does the school have a kitchen in good condition? (2) Does the school have a dining hall in good condition? (3) Does the school have a cafeteria? (4) Are there alternative outlets selling food products inside or at the school’s entrance? (e.g., street vendor). All of these questions established dichotomous variables (“yes” and “no”). The following answer options were available for questions regarding the kitchen and cafeteria: “there is no kitchen”, and “there is no cafeteria”. Therefore, these answers were grouped in the “no” category.

Schools that had a cafeteria and an alternative outlet were evaluated for the sale of the following foods: soft drinks, sugar-sweetened beverages, fried salty snacks, bagged salty snacks (processed), biscuits or cookies (salty or sweet), and sweets (sweets, candies, chocolate, and others). These foods were selected from the food groups frequently available in cafeterias and alternative points of sale²³ and considered ultra-processed foods per NOVA classification²⁴. Brazilian adolescents mainly consume these foods^{25,26,27}, and the sale of these foods in the school environment is positively associated with their intake among adolescent students¹⁰.

Percentages of adherence to school meals and their respective 95% confidence intervals (95% CI) were estimated according to the geographical characteristics, school administration type, and characteristics of the school environment. The bivariate association was identified by the non-overlapping of the intervals. The SPSS version 23.0 for Windows was used to perform the analyses, considering the sample’s complex design.

RESULTS

Of the 81,154 public schools included in the study, 86.5% offered school meals in 2015. The percentage of students benefited by the provision of school meals was higher in state (88.0%; 95% CI: 87.0; 89.0) compared to

municipal schools (84.4%; 95% CI: 83.3; 85.5). The South (93.4%; 95% CI: 92.3; 94.3) and Southeast (91.6%; 95% CI: 90.4; 92.7) regions had higher proportions of school meals compared to the North and Northeast regions, of 78.2% (95% CI: 76.3; 80.0) and 78.3% (95% CI: 77.0; 79.5), respectively. Schools in rural areas (77.4%; 95% CI: 75.3; 79.4) had a lower proportion of school meals than those in the urban area (87.4%; 95% CI: 86.7; 88.2) (Table 1).

Among the 67,881 students enrolled in public schools offering school meals, 31.3% (95% CI: 30.0; 32.7) showed adherence to school meals, 37.9% (95% CI: 37.1; 38.7) showed unsatisfactory adherence and 30.8% (95% CI: 29.4; 32.2) did not adhere. Adherence to school meals was significantly higher among students living in the Midwest (40.4%; 95% CI 38.3; 42.5) and South (35.7%; 95% CI 33.0; 38.6), in non-capitals (33.2%; 95% CI 31.6; 34.6), and those who attended rural schools (42.4%; 95% CI 39.0; 45.8) (Table 2).

The states with the most significant supply of food were Santa Catarina (94%), Rio Grande do Sul (94%), Espírito Santo (93%), Rondônia (93%), and Paraná (93%). Regarding adherence to school meals, the highest percentage was found in Tocantins (53%), Goiás (50%), Espírito Santo (43%), and Rio Grande do Sul (43%) (Figure 1).

As for the characteristics of the school environment, 96.1% (95% CI 95.6; 97.6) of the students attended school with a kitchen in good conditions, 63.1% (95% CI 57.6; 64.2) with a dining hall in conditions of use, 34.2% (95% CI 29.3; 36.9) with cafeteria and 29.4% (95% CI 27.4; 33.5) with an alternative food-selling outlet. When analyzing adherence to school meals according to these characteristics, adherence was higher among students who attended schools without a cafeteria (34.3%; 95% CI 32.7; 36.0) and no alternative sale outlet (32.7%; 95% CI 31.0; 34.5) (Table 3).

Almost half of the students attended public schools with a cafeteria that sold soft drinks (41.9%; 95% CI 33.7; 50.5). Also, adherence to school meals was significantly lower in this group (21, 2%; 95% CI 17.6; 25.3) than those in schools with a cafeteria that did not sell soft drinks. Of the students with access to the cafeteria inside the school, 30.6% (95% CI 22.3; 39.5) were significantly exposed to the sale of sugar-sweetened drinks, 30.5% (95% CI 23, 8; 39.8) fried salty snacks, 34.8% (95% CI 27.8; 44.1) biscuits or cookies (salty or sweet), and 32.4% (95% CI 25.8; 41.4) sweets.

As for the sale of unhealthy foods by an alternative sale outlet, 68.0% (95% CI 25.8; 41.4) of students were exposed to soft drinks, 42.2% (95% CI 34.9; 46.7) to sugar-sweetened beverages, 66.5% (95% CI 61.8; 73.6) to fried salty snacks, 71.5% (95% CI 66.1; 76.1) to bagged salty snacks (industrialized), 38.7% (95% CI 32.6; 44.1) to biscuits or cookies (salty or sweet), and 58.5% (95% CI 32.6; 44.1) to sweets. No statistical difference was observed for any item (Table 4) when analyzing the relationship between selling these foods through alternative sale outlets and adherence to school meals.

Table 1. Students benefited by the provision of school meals in public schools, according to administrative type and geographical characteristics. Brazil, 2015.

Variable	Total			Offered school meals	
	N	%	95% CI	%	95% CI
Administrative type	81,154	85.5	83.4-87.5	86.5	85.7-87.1
Federal	288	0.1	0.0-0.3	71.7	28.7-94.1
State	49,462	56.5	53.0-59.9	88.0	87.0-89.0
Municipal	31,404	43.4	39.9-46.9	84.4	83.3-85.5
Region					
North	21,349	10.2	9.5-11.0	78.2	76.3-80.0
Northeast	27,244	27.5	25.9-29.1	78.3	77.0-79.5
Southeast	13,492	42.4	40.1-44.8	91.6	90.4-92.7
South	7,925	12.4	11.5-13.5	93.4	92.3-94.3
Midwest	11,144	7.4	6.8-8.1	87.0	85.4-88.4
Municipality location					
Capital	36,324	19.6	18.2-21.1	87.2	86.2-88.2
Non-capital	44,830	80.4	78.9-81.8	86.3	85.4-87.1
School location					
Urban	72,984	90.3	88.8-91.7	87.4	86.7-88.2
Rural	8,170	9.7	8.3-11.2	77.4	75.3-79.4

95%CI: 95% confidence interval.

Table 2. Adherence to school meals according to the administrative type and geographical characteristics of public schools that offered school meals, Brazil 2015.

Variable	Adherence		Unsatisfactory adherence		Non-adherence	
	%	95% CI	%	95% CI	%	95% CI
Total						
School meals	31.3	30.0-32.7	37.9	37.1-38.7	30.8	29.4-32.2
Administrative type						
Federal	28.2	18.9-39.8	38.8	32.6-45.4	33.0	20.1-49.0
State	30.8	28.9-32.7	38.2	37.1-39.4	31.0	29.0-33.0
Municipal	32.1	30.2-34.0	37.4	36.3-38.6	30.5	28.6-32.4
Region						
North	27.4	25.3-29.7	37.1	35.4-38.8	35.5	32.9-38.2
Northeast	29.7	27.9-31.6	37.5	36.2-38.8	32.8	31.0-34.7
Southeast	30.2	27.7-32.9	37.9	36.4-39.4	31.9	29.2-34.7
South	35.7	33.0-38.6	38.7	36.7-40.6	25.6	23.0-28.4
Midwest	40.4	38.3-42.5	39.2	37.7-40.7	20.4	18.9-22.1
Municipality location						
Capital	23.8	22.1-25.5	39.4	38.0-40.9	36.8	34.4-39.2
Non-capital	33.2	31.6-34.6	37.5	36.6-38.5	29.3	27.7-30.9
School location						
Urban	30.3	28.9-31.7	38.1	37.3-39.0	31.6	30.1-33.1
Rural	42.4	39.0-45.8	35.5	33.2-37.8	22.2	19.4-25.3

95%CI: 95% confidence interval.

Figure 1: Percentage of schools offering school meals and adherence by federal unit, Brazil. PeNSE 2015.

Table 3. Adherence to school meals, according to characteristics of school environment among public schools that offered school meals, Brazil, 2015.

Variable	Total			Adherence		Unsatisfactory adherence		Non-adherence	
	n	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Functional kitchen									
Yes	65,133	96.1	95.6-97.6	31.3	30.0-32.7	37.8	36.9-38.6	30.9	29.5-32.3
No	2,620	2.9	2.4-4.4	32.2	28.3-36.3	40.3	36.2-44.5	27.6	23.1-32.5
Functional dining hall									
Yes	40,043	63.1	57.6-64.2	31.1	29.3-32.9	37.8	36.8-38.8	31.1	29.4-32.9
No	27,756	36.9	35.8-42.2	31.7	29.7-33.8	38.1	36.7-39.5	30.2	27.9-32.6
Presence of a cafeteria									
Yes	22,143	34.2	29.3-36.9	27.2	24.8-29.6	37.3	35.8-38.8	35.5	32.9-38.2
No	45,656	65.8	63.1-70.7	34.3	32.7-36.0	37.5	36.5-38.6	28.1	26.7-29.6
Alternative outlet									
Yes	24,005	29.4	27.4-33.5	28.1	26.1-30.1	37.9	36.4-39.5	34.0	31.8-36.3
No	43,794	70.3	66.5-72.6	32.7	31.0-34.5	37.9	36.9-38.8	29.4	27.7-31.2

95%CI: 95% confidence interval.

Table 4. Adherence to school meals, according to the products sold in the cafeteria and at an alternative sale outlet in public schools that offered school meals, Brazil, 2015.

Variable	Total			Adherence		Unsatisfactory adherence		Non-adherence	
	n	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Sale of foods at the school cafeteria									
Soft drinks									
Yes	10,044	41.9	33.7-50.5	21.2	17.6-25.3	36.4	33.3-39.5	42.5	37.4-47.7
No	9,531	58.1	49.5-66.3	29.7	25.9-33.8	37.9	35.9-39.9	32.4	28.5-36.6
Sugar-sweetened beverages									
Yes	5,829	30.6	22.3-39.5	24.2	17.9-31.8	37.3	33.5-41.2	38.5	31.6-46.0
No	13,746	69.4	60.5-77.7	27.0	24.2-30.0	37.2	35.4-39.0	35.9	32.4-39.3
Fried salty snacks									
Yes	8,416	30.5	23.8-39.8	21.2	18.1-24.7	37.0	33.0-41.1	41.9	37.4-46.5
No	11,159	69.5	60.2-76.2	28.3	24.6-32.3	37.4	35.7-39.1	34.3	30.3-38.6
Bagged salty snacks									
Yes	10,669	50.7	41.9-59.0	23.9	19.4-29.1	35.7	33.1-38.3	40.4	35.4-45.7
No	8,906	49.3	41.0-58.1	28.4	25.4-31.6	38.9	36.7-41.0	32.7	29.1-36.5
Biscuits or cookies (salty or sweet)									
Yes	7,551	34.8	27.8-44.1	25.6	21.6-30.1	36.1	34.3-37.9	38.3	33.4-43.4
No	12,024	65.2	55.9-72.2	26.4	22.8-30.5	37.8	35.5-40.3	35.7	31.6-40.0
Sweets									
Yes	8,430	32.4	25.8-41.4	26.3	21.7-31.4	36.3	34.4-38.4	37.4	31.7-43.5
No	11,145	67.6	58.6- 4.2	26.1	22.6-29.9	37.7	35.4-40.0	36.3	32.4-40.3
Sale of foods at the alternative outlet									
Soft drinks									
Yes	16,010	68.0	62.4-72.9	28.8	25.4-32.5	36.9	34.6-39.2	34.3	31.3-37.5
No	7,782	32.0	27.1-37.6	28.9	26.4-31.6	38.9	36.5-41.4	32.2	28.8-35.7
Sugar-sweetened beverages									
Yes	9,001	42.2	34.9-46.7	25.9	22.6-29.6	36.7	34.7-38.7	37.4	33.4-41.7
No	14,791	57.8	53.3-65.1	31.0	27.6-34.6	38.1	35.6-40.8	30.9	28.4-33.5
Fried salty snacks									
Yes	16,899	66.5	61.8-73.6	29.5	26.3-32.9	36.6	34.7-38.6	33.9	31.1-36.9
No	6,893	33.5	26.4-38.2	27.7	24.2-31.5	39.3	36.0-42.7	33.0	29.0-37.3
Bagged salty snacks									
Yes	16,249	71.5	66.1-76.1	29.1	25.8-32.6	37.2	35.0-39.5	33.7	30.7-36.8
No	7,543	28.5	23.9-33.9	28.3	25.4-31.5	38.2	35.7-40.8	33.4	30.1-37.0
Biscuits or cookies (salty or sweet)									
Yes	8,592	38.7	32.6-44.1	29.8	24.7-35.4	36.3	33.7-39.0	33.9	29.6-38.4
No	15,200	61.3	55.9-67.4	28.3	26.0-30.7	38.3	36.1-40.5	33.4	30.8-36.2
Sweets									
Yes	13,637	58.5	53.1-64.5	29.0	25.4-32.9	37.0	35.0-39.0	34.0	30.8-37.3
No	10,155	41.5	35.5-46.9	28.6	25.7-31.8	38.3	35.3-41.4	33.0	29.7-36.5

95%CI: 95% confidence interval.

DISCUSSION

This study's results showed that adherence to school meals is associated with the school's geographical characteristics and environment. Adherence showed a low value despite the high percentage of schools offering food to students. Schoolchildren in the North and Northeast regions, capitals, and urban areas showed lower school meal adherence. Regarding the characteristics of the internal environment, attending schools with a cafeteria and an alternative food sale outlet adversely interferes in adherence to school meals.

PNAE is a universal program that aims to provide healthy food to students in Brazilian public schools, and all students must regularly consume school meals. However, this study shows that adherence to school meals is low, corroborating the findings of Locatelli et al.¹⁹, who found low regular consumption of school meals among students assessed in PeNSE 2012 (22.8%). An integrative review that evaluated school meals programs in Brazil and the United States found a similar result, showing a low adherence and acceptance in both programs²⁸.

The national literature shows that the factors associated with low adherence to school meals among adolescents are both at the individual level, such as gender, age, race, maternal education, having a paid job, and socioeconomic conditions^{16,17,18,19,20,21}, and the school context^{17,22}. The presence of a cafeteria^{17,22} and poorer student perception of the physical structure of the cafeteria²¹ were negatively associated with adherence to school meals. However, the characteristics of the school environment are still poorly explored at the national level^{17,22}.

This study's results showed that schoolchildren from the Midwest and South regions who do not live in the capital and attend schools in the rural area showed greater adherence to school meals. However, there was a more generous supply of food in schools in the urban area and the South and Southeast regions, with no difference between capital and non-capital municipalities. Thus, it can be said that adherence to school meals is not influenced only by the food supply.

It is known that the external food environment, which are food sale physical spaces, including schools and informal vendors, influences the food choices of adolescents⁵. When evaluating the food environment of Brazilian public schools, Carmo et al.¹⁰ did not identify differences in the supply of school meals between the Brazilian macro-regions. However, they identified that schools in the North Region had the most obesogenic food environment. A higher proportion of informal vendors was observed at or around the school gates in the North region compared to the Southeast, South, and Midwest regions, which may explain the higher adherence to school meals observed among adolescents in the Midwest and South, reinforcing the hypothesis that the school food environment interferes with adherence to school meals.

Locatelli et al.¹⁹ also found that students from the Midwest Region who did not live in capitals had a higher

prevalence of regular intake of school meals. Hoffmann¹⁸ studied the consumption data for school meals from the National Household Sample Survey (PNAD) of 2004 and 2006 and found greater consumption, which is favorable to the affirmative answer to the question about the consumption of food offered by the school among adolescents in the North, Northeast and Midwest regions and residents of rural areas.

Adequate adherence (consumption 4 to 5 times a week) of school meals was also higher in rural schools than in urban schools in a study carried out with 492 adolescents enrolled in the state schools of Lapa (PR), carried out by Cesar et al.¹⁶. The authors attributed this result to the longer commuting time to the rural residents' school, thus making the time interval until the next meal longer, besides the eating habits of rural families being closer to the menus offered by the school compared to students in the urban area¹⁶. Rural households have greater availability and consumption of fresh or minimally processed food than urban households^{29,30}. Therefore, the habits and food culture of adolescents in rural areas may be contributing to greater adherence to school meals.

The shorter distance and higher density of establishments selling unhealthy foods around schools are associated with poorly nutritious food choices among adolescents³¹. Thus, another possible explanation for the greater adherence to school meals among students in the rural area may be related to the greater adherence observed among schoolchildren without a cafeteria and point of sale, which can contribute to the lower availability of competing foods, which are not included in schools' menus.

Besides the geographic characteristics of the school, the results of this study indicate that adherence to school meals is also associated with the characteristics of the school environment, as students from schools with a cafeteria and an alternative food-selling outlet had less adherence to food. Similarly, Sturion et al.¹⁷ evaluated 2,678 schoolchildren from the 1st to the 8th grade of elementary education in ten Brazilian municipalities, two from each geographic region, and found that commercial cafeterias in schools are inversely associated with daily adherence to the PNAE. Therefore, the availability and advertising of ultra-processed foods in the school environment influence the adolescents' food choices⁵ and can be considered determining factors in the adherence to the food offered by the school, since it has been previously identified that adolescents who regularly buy food from the cafeteria are less likely to adhere to school meals²⁰.

School menus and adolescent food consumption were not evaluated in this study. However, a study that used the same sample as PeNSE 2015 found that those who attended schools in the capitals were more likely to regularly consume ultra-processed snacks and soft drinks than those who attended schools in non-capitals, which is possibly related to the greater availability of alternative sale outlets or cafeterias inside or near schools³². Similarly,

it is suggested that the lower adherence to school meals by students from the capitals in this study may be associated with food preferences and the school environment, which generally has a higher availability of competitive foods.

When evaluating the sale of unhealthy foods in the school environment, lower adherence to school meals was observed only among students exposed to the sale of soft drinks in cafeterias, although a higher prevalence of adolescents exposed to soft drinks and other markers was observed in places with alternative sale outlets. Regular consumption of soft drinks is inversely associated with adherence to school meals^{10,22}, reinforcing the findings of this study regarding the negative influence of soft drink sales in the school environment on adherence to school meals.

Furthermore, the preference for foods with low nutritional value and high energy density is reasonably common among adolescents³³, as such options are not included in school meals because the PNAE legislation requires the supply of fruits and vegetables, limits the supply of ultra-processed sweets and purchases, and prohibits the offering of sugar-sweetened drinks¹⁵, which, associated with easy access to these foods in the school environment, can influence the level of adherence¹⁶. In a study conducted with adolescents from 23 public schools in Colombo (PR), Valentim et al.²¹ found a high prevalence of competitive food consumption during their stay at school. Thus, the authors uncovered that the hypothesis of school meals not meeting students' preferences seems to have been confirmed.

According to Carmo et al.¹⁰, the school environment can be obesogenic, depending on the foods sold in cafeterias and their surroundings. On the other hand, positive effects on Brazilian students' eating habits who consume the meals offered by the school have already been evidenced.

In the USA, studies have shown that policies and regulations related to food sales in schools have resulted in improved eating habits among schoolchildren⁷. In Brazil, less than half of the states have a legal provision (ordinance, resolution, decree, or law) related to the sale of food in the school environment¹⁰. Also, many school cafeterias fail to comply with food marketing rules^{28,34}. In this study, despite the high percentage of students benefiting from school meals in public schools, approximately half of the Brazilian states showed adherence below 30%. Therefore, the State must adopt measures to restrict or even prohibit the sale of unhealthy foods in and around the school environment throughout Brazil. Also, monitoring and inspection are essential to ensure compliance.

In this context, it is essential to highlight the importance of Food and Nutrition Education within the scope of the PNAE, which aims to encourage the voluntary adoption of healthy food practices and choices to promote learning, student good health, and individual quality of life¹⁵. Still, through food and nutrition education actions, it is possible to stimulate the consumption of school meals, thus favoring the achievement of one of the principles of the PNAE, universal service.

The acceptability of the menu and the consumption of other foods in the cafeterias and around the school were not evaluated in this study, which can interfere with adherence to school meals²⁸. Moreover, it is worth mentioning that the

questions regarding the sale of food in the school environment were answered by school principals, who, in turn, do not make up the target audience of these establishments. Thus, the possible unawareness of the directors regarding items sold may have interfered with this result. On the other hand, using a nationwide database with a high response rate is a strength of this study²³.

CONCLUSION

Thus, we conclude that adherence to school meals is influenced by geographic characteristics and the school environment, emphasizing the negative association of a cafeteria and alternative outlet of sale with adherence to food offered by the school. Therefore, it is essential to adopt measures that prevent the sale of unhealthy foods in the school environment. It is also considered that, for the PNAE to achieve universal service, it is necessary to promote effective nutritional education actions involving the entire school pedagogical staff to foster the adoption of healthy habits and strengthen and improve the program.

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