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ARTICLE

Is the local food environment associated with excess body weight in adolescents in São Paulo, Brazil?

O ambiente alimentar local está associado ao excesso de peso em adolescentes em São Paulo, Brasil?

¿El ambiente alimentario local está asociado al exceso de peso en adolescentes en São Paulo, Brasil?

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Abstract

The obesogenic environment stimulates an inadequate diet by hampering healthy choices. This cross-sectional study evaluated the association between the local food environment and the prevalence of overweight and obesity in a representative sample population of adolescents living in the city of São Paulo, Brazil, using multilevel logistic regression models. Among the adolescents, 29.6% were overweight/obese. There were no significant differences between food environment and adolescents' weight status. However, the presence of fast food restaurants near their home increased the chances of being overweight or obese (OR = 2.53; 95%CI: 1.02-6.27). Results suggest the need to intensify food and nutrition policies, development of culinary skills, and the reduction in prices of healthy foods to facilitate access to these foods, so that adolescents have options in locations to socialize with friends and family.

Feeding Behavior; Adolescent; Body Mass Index; Fast Foods

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Introduction

Overweight and obesity are conditions involving abnormal or excessive fat accumulation, potentially impairing health by increasing the risk of chronic non-communicable diseases [1]. Pediatric obesity is one of the most critical public health issues worldwide, with 107.7 million children and adolescents affected by this condition [2]. Given that among Brazilian adolescents in 2015, 17.1% were overweight and 8.4% were obese, Brazilian youth are not impervious to this global public health crisis [3]. Specifically, in the city of São Paulo, data showed an increase in prevalence over 2003-2008 and 2008-2015 [4]. The prevalence of overweight and obesity in adolescents was 16.2% and 3.7% in 2003, 16.1% and 5.9% in 2008, and 19.5% and 7.6% in 2015 [3], respectively.

While non-modifiable mechanisms play a role in youth obesity, the influence of modifiable factors such as physical activity, sedentary behaviors [5], and dietary intake [6] has also been proven [7]. In the past 5 years, the diet of Brazilian adolescents has been characterized by foods high in energy, added sugars, solid fatty acids, and sodium, but with lower quantities of fruits, vegetables, and other food sources of vitamins, minerals, and fibers [8]. Inappropriate eating and lifestyle behaviors such as physical inactivity and more time spent doing sedentary activities are the environmental factors that result in excess energy intake and reduced energy expenditure [9,10]. All these factors, with exception at the individual level, are risk factors for obesity in children and adolescents and are known to constitute the obesogenic environment [9,11].

Food environments are the collective physical, economic, policy, and sociocultural surroundings, opportunities, and conditions that play an important role on an individual's food and beverage choices and weight status [12]. The local food environment has been classified and assessed based on different types of food venues, including supermarkets, street markets, fast food restaurants, restaurants, and convenience stores, available to individuals near their residence [10]. International studies have shown that living far from grocery stores and farmer markets [13], and in areas with fewer sit-down restaurants [14], is associated with a higher body mass index (BMI). These studies have also shown that sex [14] and income status [10,13] play an important role on teenagers' food choices and weight status. Moreover, the built, socioeconomic and social characteristics of a neighborhood environment co-occur [13].

Few Brazilian research studies have simultaneously investigated the relationship between food environment and adolescent obesity. A study performed on children (aged 7-10 years) and adolescents (aged 11-14 years) from public schools in Juiz Fora, Minas Gerais State, showed that the lowest deprivation level had a higher density of establishments predominantly selling unhealthy foods (e.g., candy shops, cafeterias, fast food restaurants, and corner stores) [15]. An inverse association was found between the density of supermarkets and the presence of obesity. Another study conducted in the coastal area of São Paulo [16] examined the association between local food environment and mothers' purchase of ultra-processed foods. Results showed a significant inverse association between the higher availability of a variety of fresh produce in supermarkets and the odds of ultra-processed foods purchase. After adjusting for sociodemographic variables, higher odds of minimally processed food acquisition were associated with frequent use of other markets to buy fruits and vegetables, walking to buy food, and perceived availability of fresh produce in participants' neighborhood. Purchasing ultra-processed foods was positively associated with the use of automotive transportation for food shopping and negatively associated with perceived availability of fresh produce in the neighborhood.

The objective of this study was to explore the association between the local food environment and the prevalence of overweight and obesity in a representative sample population of adolescents living in the city of São Paulo.

Materials and methods

Cross-sectional analyses were conducted using data obtained from adolescents aged from 12 to 19 years, who participated in the 2015 *Health Survey in São Paulo City* (acronym in Portuguese is 2015 ISA-Capital). This study was approved by the Institutional Review Board (IRB) of the School of Public Health, University of São Paulo (CAAE n. 65228317.1.0000.5421). Parents and caregivers provided written informed consent prior to the adolescents' participation in this study.

Study sample

The 2015 ISA-Capital is a household population-based survey done on a representative probabilistic population sample of individuals aged 12 years and more, living in the city of São Paulo. This survey is conducted on an average of every five years (i.e., 2003, 2008, and 2015), and is aimed at evaluating health status, lifestyle, and health services usage [17]. A sub-sample of the 2015 ISA-Capital has been designed with a focus on nutrition (2015 ISA-Nutrition) and is aimed at evaluating the association of lifestyle-related risk factors with biochemical and genetic markers, and the environmental factors related to non-communicable diseases [18].

Samples size calculation of this study was stratified into five sets of census tracts based on the municipality's geographical areas of health assistance: North, Central, Southeast, South, and East. Initially, 30 urban census tracts were randomly selected from each geographical area, adding up to 150 primary sampling units in the municipality. Secondly, private households were systematically selected in each census tract, considering the demographic domains used for sample planning: geographical area for health assistance, district/sector, age group, and sex. The individuals in the selected households, in alignment with the demographic domains, were invited for interviews. A total of 4,059 interviews were carried out in the 2015 ISA-Capital (with 865 adolescents, 2,169 adults, and 1,025 elderly individuals). Additional details on the 2015 ISA-Capital can be found elsewhere [17].

The sub-sample, 2015 ISA-Nutrition was maintained for representativeness, resulting in a sample that allows estimates of proportions of 0.50, with a sampling error of seven percentage points, considering a 95% confidence level and a delineation effect of 1.5. Data collection was conducted from February 2015 to 2016. Further details of 2015 ISA-Nutrition can be found elsewhere [18]. In total, 1,737 individuals older than 12 years participated in this sub-sample. This study used only the data from adolescents. In the ISA-Nutrition, 553 adolescents participated. However, only 504 adolescents with complete answers for weight and height in the structure questionnaire, recorded from at least one 24-h dietary recall, and geocoded residence addresses, were included in this analysis.

Data collection and processing

Demographic, socioeconomic, and lifestyle behaviors were assessed using a structured questionnaire applied by trained interviewers at the participant's residence. For this study, the following variables were used: (i) age (categorized as ages 12-15 years and 16-19 years); (ii) sex (male and female); (iii) race (white and non-white); and (iv) family income per capita (≤ 1 minimum wage, more than 1 minimum wage, or no response).

Perception of violence in the living area was assessed using the question, "How would you classify the area in which you live, in terms of violence and security?". The violence in the living area variable was categorized as: totally safe, kind of safe, kind of violent, and totally violent. Data about the length of residence at the house was collected using the question, "How long have you been living in this house?". This variable was categorized as ≤ 5 or > 5 years of living in the same house.

Information on physical activity was obtained using the long-version *International Physical Activity Questionnaire* – IPAQ [19], adapted to Brazilian conditions [20]. IPAQ assesses physical activity in different contexts or domains, related to occupation, daily living routines (e.g., domestic activities, active commuting), and leisure (e.g., recreational activities, exercise, and sports) [21]. For adolescents of ages 17 years and below, the variables leisure (recreational activities) and transportation (active commuting) were evaluated and categorized as follows: does not meet the recommendation (< 420 min/week) and meets the recommendation (≥ 420 min/week). For adolescents of ages 18 and 19 years, these variables were categorized as: does not meet the recommendation (< 150 min/week) and meets the recommendation (≥ 150 min/week). These recommendations were set according to *World Health Organization Physical Activity Guidelines* [22].

The intra-municipal Human Development Index (HDI) was obtained from the United Nations Development Program Atlas for Brazil [23], which addresses three dimensions: income, longevity, and education. The intra-municipal HDI uses intra-municipal data to estimate the HDI for human development units such as groups of census tracts with homogeneous urban, social, and economic features. Given the wide range of HDI in the city of São Paulo, from 0.625 (medium) to 0.965 (very high), the

intra-municipal HDI was treated as a continuous variable for adjustment, in order to attenuate the differences among city neighborhoods.

Study variables

- **Weight status**

Weight and height data were self-reported. Weight was recorded in kilograms or grams. Height was recorded in meters or centimeters. The BMI of each participant was calculated using the standard formula, which is weight in kilograms (kg) divided by height squared in meters (m^2), in order to classify weight status according to the World Health Organization (WHO) percentiles for age and sex. Adolescents were classified as not overweight (< percentile 85th) and as overweight or obese (≥ percentile 85th) [24]. The BMI estimated from self-reported measures of weight and height was validated previously in this population, with high sensitivity (91.7%) and specificity (97.7%) [25].

- **Local food environment and households**

The geocodes of the participants' residence addresses were generated using the program Google Earth Pro version 7.1, operated by the geographic coordinate system (latitude/longitude coordinate system (SRC – WGS84). The geocodes were validated by geographic operation in the QGIS version 2.16.1 (https://qgis.org/en/site/) program, based on the overlapping of the geographic coordinates obtained with the census tracts in 2015 ISA-Capital. The map was produced in the projected coordinate system reference UTM SIRGAS 2000/23 S.

Locations of food establishments were obtained from the Municipal Registry of Health Surveillance, with street markets and other whole food establishments, being exceptions. This information was obtained from the Municipal Department of Labor and Entrepreneurship available on GeoSampa website [26].

Food establishments were classified, considering Brazilian conditions into five groups: (i) fast food restaurants (e.g., McDonald's, Bob's, Burger King, Pizza Hut, and Habib's [Brazilian-Arabic fast food chain]); (ii) markets, supermarkets and grocery stores (retail and wholesale stores); (iii) bakeries and cafeterias; (iv) restaurants (did not include fast food restaurants); (v) pizzerias; (vi) street markets and whole food markets (i.e., establishments selling natural food sources, such as fruits, vegetables, meats, and cereals/grains). Initial screening was performed based on the establishment's name. In cases where name-based classification could not be performed, an additional search using the National Registry of Legal Entities (acronym in Portuguese CNPJ) was conducted. When more than one activity had taken place, the broader National Economy Activity Classification was considered.

In order to determine the proximity of these establishments to the adolescents' homes, areas of influence (buffers) with radii of 500 meters were created. The density of the establishments was counted in the buffer. A buffer of 500m is equivalent to a 10-minute walk [27]. These estimates were performed using the program QGIS version 2.16.1.

Data analyses

Descriptive statistics for lifestyle and socioeconomic variables were obtained as relative and absolute frequencies. Pearson's chi-square test was used to determine the differences between weight status (i.e., being overweight and not being overweight) and lifestyle and socioeconomic variables. The distribution of adolescents, based on weight status and the number of food establishments within a buffer of 500m, was given by absolute and relative frequencies and the differences were calculated using Pearson's chi-square test.

Multilevel logistic regression models with fixed effects were used to determine the chances of being overweight and the presence of food establishments within a buffer of 500m to the adolescent's home. Presence of food establishments (yes/no) was the independent variable, and weight status was the dependent variable (not being and being overweight). Different models were used for each food establishment category. The models considered two levels: (1) adolescents participating in the

study, and (2) living area (census tract). The census tract was included in the analysis as a second level variable, in order to account for the study design, considering the intra-class correlation among participants living in the same area. Modeling was performed in two steps. For model 1, the covariates were sex and living area, while for model 2, the covariates were sex, race, violence in the neighborhood, years of residence in the same house, physical activity, and the intra-municipal HDI (second level variable). Selection of co-variates was based on the literature or when p-value was < 0.20 in the univariate analysis. Hausman test was used to select between the random and the fixed effects models. Results were presented as odds ratios (OR) and 95% confidence intervals (95%CI). All analyses were performed using Stata software version 13.0 (https://www.stata.com) with a significance at 5% ($p < 0.05$) for the tests performed.

Results

Descriptive analyses of the lifestyle and the socioeconomic variables according to weight status are presented in Table 1. The data distribution of adolescents was such that 51.4% were aged 12-15 years, 51.4% were male, 56.9% were non-white, and 58.8% had a family per capita income of ≤ 1 minimum wage (equivalent to USD 236.00/month, according to 2015 currency conversation rate). In total, 54.9% of the participants reported living in a safe area and 64.5% had been living in the same house for more than five years. The mean of the inter-municipal HDI of the adolescents' living area was 0.755 (i.e., average HDI). Regarding the physical activity from leisure and transportation, 67.7% of the participants did not meet WHO recommendations. Of the 504 adolescents, 29.6% were classified as being overweight or obese, but no significant differences were found between the variables presented in Table 1.

In total, São Paulo had 20,679 food establishments registered in the Municipal Registry of Sanitary Surveillance and Municipal Department of Labor and Entrepreneurship. Among these, 2,064 were in the 500m buffer zone. Of the total food establishments, 57.1% were restaurants, 18.8% were markets, supermarkets, and grocery stores, 4.5% were street markets and whole food markets, 4.3% were bakeries and cafeterias, 3.5% were fast food restaurants, 2.8% were pizzerias, and 9% were not classified. In this 9% (1,880 establishments), only 972 were in the buffer map. After a manual search of the 972 venues, only 63 (3.1%) remained unclassified.

Figure 1 presents the types of food establishments in the buffer zone. The distribution of weight status according to the presence of food establishments is presented in Table 2. There was no significant difference between the weight status and the presence of food establishments. Most of the adolescents did not have residences near fast food restaurants (93.9%), bakeries and cafeterias (89.5%), and pizzerias (76.8%). However, 85.5% of the adolescents had markets, supermarkets and grocery stores, 75.6% had restaurants, and 50.6% had street markets and whole food markets closer to their residences. Adolescents were questioned about where they had their meals, and 72 (14.3%) of them reported consuming at least one meal at some type of restaurant.

Multilevel logistic regression models are presented in Table 3. The presence of fast food restaurants within the 500m buffer zone was positively associated with being overweight (OR = 2.53, 95%CI: 1.02-6.27, p = 0.04), when adjusted for covariates in model 2. For other food venues, no significant associations were found.

Discussion

This study showed that the presence of fast food restaurants in a 500m buffer zone near residential areas was positively associated with overweight/obesity in a population sample of adolescents from the city of São Paulo. Several studies on adult populations have demonstrated positive associations between exposure to fast foods outlets and weight gain [28,29,30,31]. There is a paucity of studies on children and adolescents in this context, but research has rapidly been increasing in Brazil [15,16,32]. However, the methodology used to assess food environment varies between studies. Surveys performed in Juiz de Fora and Florianópolis, Santa Catarina State, used a school-based sample popula-

Table 1

Descriptive analysis of adolescents living in the city of São Paulo, Brazil, according to weight status. *Health Survey in São Paulo City* (ISA-Capital), 2015.

Variables	Total population	Not overweight/ Obese	Overweight/Obese	p-value
	n (%)	n (%)	n (%)	
Age (years, n = 504)				0.07
12-15	259 (51.4)	173 (66.8)	86 (33.2)	
16-19	245 (48.6)	182 (74.3)	63 (25.7)	
Sex (n = 504)				0.28
Male	259 (51.4)	188 (72.6)	71 (27.4)	
Female	245 (48.6)	167 (68.2)	78 (31.8)	
Race (n = 501)				0.50
White	216 (43.1)	156 (72.2)	60 (27.8)	
Other races	285 (56.9)	198 (69.5)	87 (30.5)	
Family income per capita (n = 480)				0.58
≤ 1 MW	282 (58.8)	194 (68.8)	88 (31.2)	
> MW	119 (24.8)	85 (71.4)	34 (28.6)	
No answer	79 (16.5)	59 (74.7)	20 (25.3)	
Perception of violence in the living area (n = 499)				0.22
Safe	274 (54.9)	199 (72.6)	75 (27.4)	
Violent	225 (45.1)	152 (67.6)	73 (32.4)	
Length of residence at the house (n = 504)				0.07
≤ 5 years	179 (35.5)	135 (72.4)	44 (24.6)	
> 5 years	325 (64.5)	220 (67.7)	105 (32.3)	
Physical activity (n = 505)				0.43
Does not meet with the recommendations	342 (67.7)	244 (71.5)	97 (28.5)	
Meets with the recommendations	163 (32.3)	111 (68.1)	52 (31.9)	

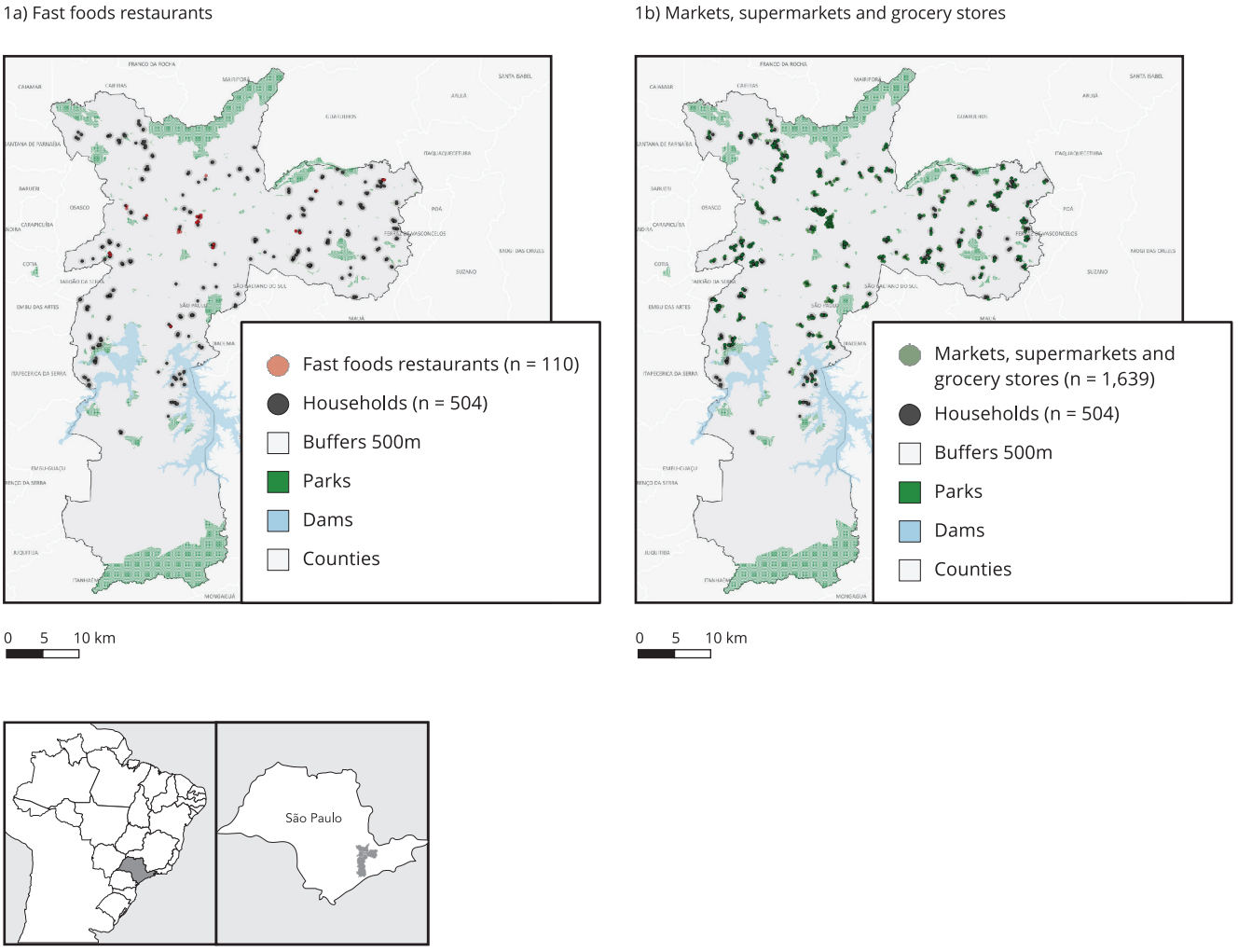
MW: minimum wage (USD 236.00 quotation in 2015).

tion to investigate the environment near an adolescent's residence. Both studies detected associations between food environment characteristics and weight status. In Juiz de Fora, an inverse association was found between the density of supermarkets and hypermarkets and the prevalence of obesity [15], while in Florianópolis, adolescents' families that used "public markets and greengrocers" and had restaurants near residences presented higher likelihoods to be overweight or obese [32]. A national school-based survey investigated the food environment in schools and found that schools that offered meals prepared on the school premises had lesser obesity rates for students [33]. The methodology used to classify food environment exposure varies widely. The present study, similar to studies performed by Corrêa at al. [32] and Vedovato et al. [16], used food shopping venues to classify food environment exposure, while some studies have classified the establishments based on the foods sold predominantly [15]. These differences, in addition to the particularities in each place of study, illustrate the complexity of characterizing the food environment and may explain the diverse findings.

Although there is no consensus on the definition of fast food, evidence from a systematic review [34] (p. 231) defined fast food as *"easily prepared, processed food served in snack bars and restaurants as a quick meal or to be taken away"*. Industrial foods such as canned foods or snacks may also be considered as fast food [34]. These types of foods are sources of energy, solid fats, added sugars, and sodium, and may be associated with unhealthy weight gain. Restaurants that sell these types of foods may contribute to the settings of the so-called obesogenic environment [35,36]. A study on the association between fast food consumption and diet quality in more than 5,000 individuals in the United States, found that fast food consumption and neighborhood fast food exposure were associated with a poorer diet (e.g., fats and oils, high-fat and processed meats, fried potatoes, savory snacks, and sweets) [37]. Moreover,

Figure 1

Spatial distribution of the types of food establishments in the buffer zone. *Health Survey in São Paulo City* (ISA-Capital), São Paulo, Brazil, 2015.



(continues)

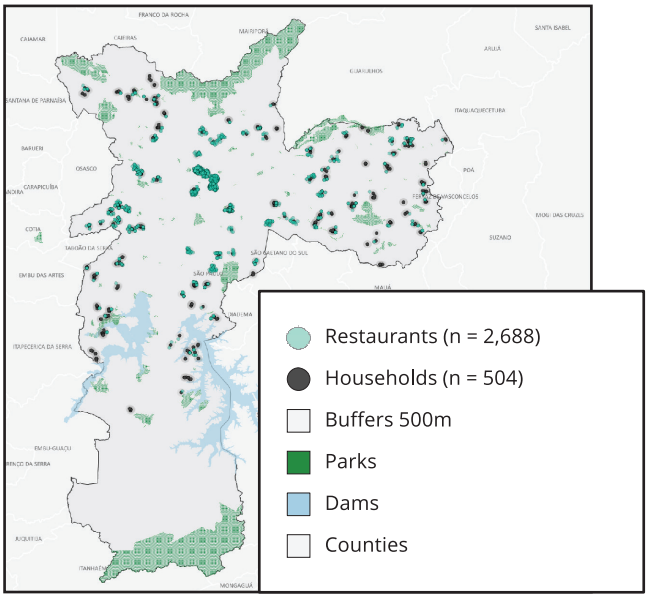
another study on a population in India, has demonstrated that residing in areas closer to fast food restaurants was associated with decreased consumption of meat, fish, eggs, fruits [35], and other low-energy, nutrient-dense food sources.

Although most of the studies were conducted on adults, adolescents and young adults are the primary fast food consumers [38], which may explain the observed association. Low-cost is one of the key determinants of fast food consumption in this population [39]. Systematic review found that foods with high energy and low nutrients, i.e., of poorer diet quality, are associated with a reduced price [40]. Moreover, the preference for choosing fast food restaurants may be influenced by the time spent with family and peers, lack of culinary skills, and easy access to such food outlets [39,41].

A cross-sectional study conducted in 36 countries, including Brazil, observed a higher prevalence of eating in fast food restaurants [42]. Among adolescents, 38.7% reported eating at these establishments once or twice a week and 12.6%, three or more times per week [42]. Although in Brazil most meals are prepared in a family environment, eating away-from-home has increased and so have the

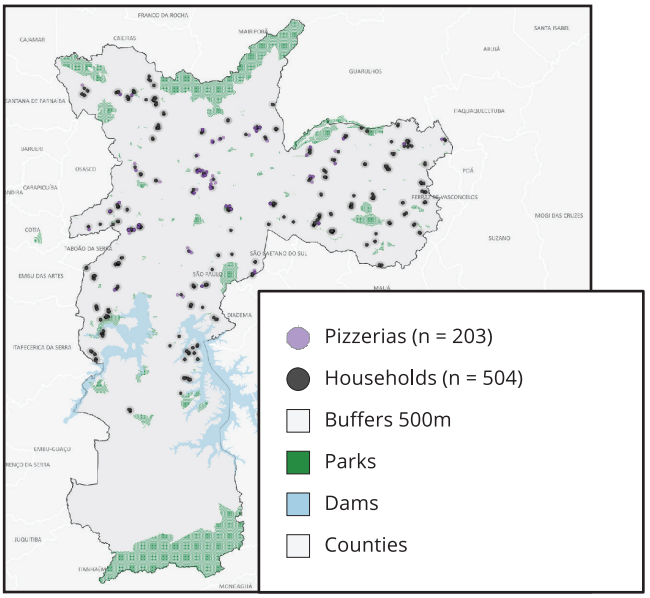
Figure 1 (continued)

1c) Restaurants



0 5 10 km

1d) Pizzerias



0 5 10 km

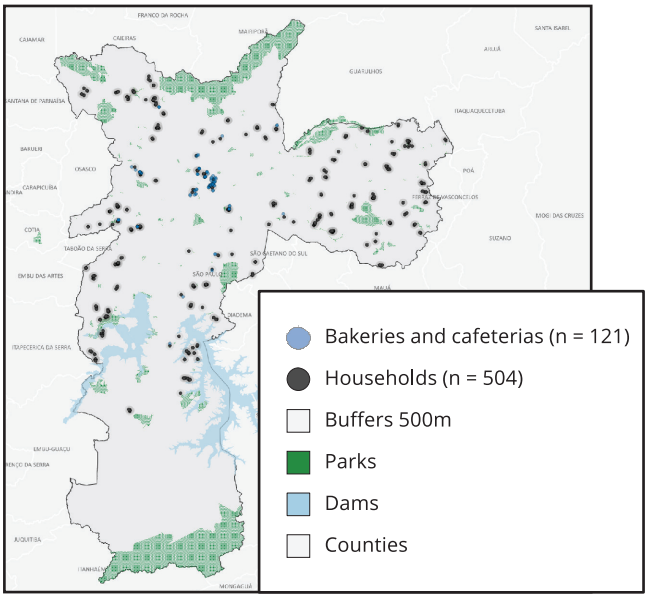
(continues)

food expenses [43]. According to Bezerra et al. [44], young adults living in urban areas in the South and Southeast of Brazil are consuming more foods away-from-home daily, with a higher frequency at restaurants. Moreover, the consumption of fruit and vegetables were lower, with a decrease in the frequency of purchasing at markets [43].

In the present study, no associations were observed between being overweight/obese and other food establishments (with an exception of fast food restaurants) close to the adolescents' home. Markets and supermarkets are known to commercialize both protective foods such as fruits and vegetables, and risk foods that are associated with weight gain, such as soft drinks and processed meats [45]. Since we did not assess the establishment where foods consumed were bought from, this can justify our null findings. Although some studies reported associations between healthy eating and access to supermarkets [46,47,48], other studies conducted in Brazil showed that foods from supermarkets present low nutrition quality and are major sources of daily caloric intake, representing 49% of the total energy intake [43,48].

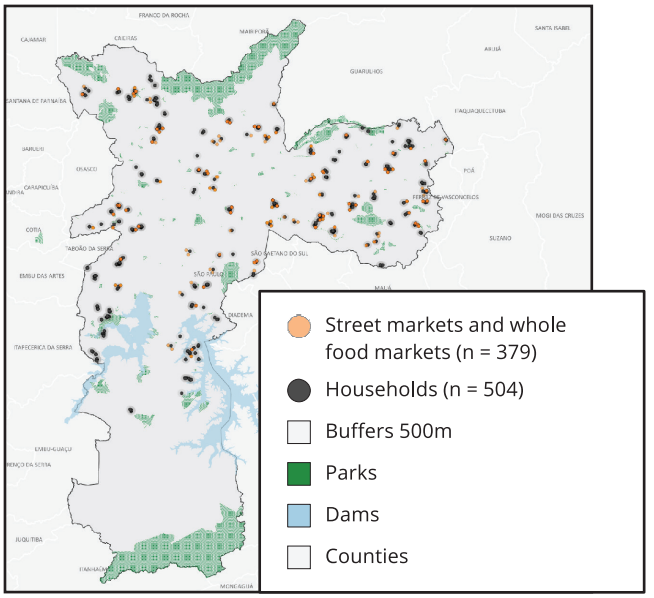
Figure 1 (continued)

1e) Bakeries and cafeterias



0 5 10 km

1f) Street markets and whole food markets



0 5 10 km

Despite the null association observed with pizzerias, we chose to categorize this type of establishment as a single category because of its relevance to the State of São Paulo. According to a study performed by a food service consultancy, the State of São Paulo is responsible for the purchase of 53% of the 800,000 pizzas sold daily in Brazil [49].

Although most of the adolescents included in this study lived near street markets, they did not prefer buying foods from these public spaces. They choose to buy industrialized rather than in natura foods [50,51,52,53]. The same may apply to other types of non-fast food restaurants. As shown by Bezerra et al. [43], individuals who eat at restaurants usually have a better education and income status. The adolescent phase of life is characterized by increased independence from their parents and family, where they begin to make their own choices, including what to eat [54,55]. Therefore, children and adolescents should be targeted in obesity prevention programs [56], including nutrition component food planning and food preparations in families [57,58].

It is worth mentioning that, in Nutritional Epidemiology, the lack of significant results is insufficient to confirm the nonexistence of an association [59]. It is possible that the lack of an association between overweight/obesity and other types of establishments could be due to insufficient number of

Table 2

Presence of food sales establishments around the residence of adolescents living in the city of São Paulo, Brazil. *Health Survey in São Paulo City* (ISA-Capital), 2015.

Presence of establishments	Total		Not overweight/ Obese		Overweight/ Obese		p-value	Unadjusted OR	95%CI
	n	%	n	%	n	%			
Fast food restaurants									
No	473	93.9	336	71.0	137	28.9	0.25	1.00	0.90-5.61
Yes	31	6.1	19	61.3	12	38.7		2.25	
Markets, supermarkets and grocery stores									
No	73	14.5	53	72.6	20	27.4	0.71	1.00	0.71-2.77
Yes	431	85.5	302	70.0	129	30.0		1.40	
Bakeries and cafeterias									
No	451	89.5	315	69.8	136	30.2	0.39	1.00	0.36-2.18
Yes	53	10.5	40	75.5	13	24.5		0.88	
Restaurants									
No	123	24.4	87	70.7	36	29.3	0.93	1.00	0.40-2.05
Yes	381	75.6	268	70.3	113	29.7		0.91	
Pizzerias									
No	387	76.8	270	69.8	117	30.2	0.55	1.00	0.61-1.95
Yes	117	23.2	85	72.6	32	27.4		1.09	
Street markets and whole food markets									
No	249	49.4	175	70.3	74	29.7	0.94	1.00	0.68-1.70
Yes	255	50.6	180	70.6	75	29.4		1.07	

95%CI: 95% confidence interval; OR: odds ratio.

adolescents with investigated establishments within the 500m buffer zone. Another possibility could be that the alterations in nutritional status were not yet detectable by BMI classification when the study was performed, and adolescents may be gaining weight but might develop detectable changes in BMI in the future. Finally, possible unmeasured confounding variables could also have contributed to the lack of association observed. The impossibility of using data related to school and workplace food environment is a limitation, considering that 76.2% and 22.3% of the adolescents were studying and working, respectively (data not shown). As a result, adolescents may consume foods sold by food establishments beyond the vicinity of their homes, which might explain the lack of association with other establishments [60]. Therefore, the use of a 500m buffer near adolescents' residence may not be the best approach to assess their food environment. Tests using buffers of 1,000 and 1,500m have been conducted, but no associations were observed between the local food environment and the weight status. These results corroborate other studies that show the importance of proximity to spaces close to residential area, especially in the city of São Paulo [50,61,62].

In addition, the lack of subjective measurements to identify food environments, such as perception of the availability, use of these establishments, or current places to purchase food items, may have attenuated the associations [60]. In order to address this issue, the variable "perception of violence in the living area" was included in the multiple model, because it may be used as a proxy measurement to the use of local living space. Also, the variable "length of residence in the same house" was added, since it can reveal the individual's knowledge of the territory.

Given the nature of this study design, it is not possible to infer a cause and effect relationship. Individuals may either seek to live closer to certain types of establishments or food establishments may be set up in certain locations due to the population profile of the location. Moreover, data on street

Table 3

Odds ratios (OR) for associations between being overweight/obese and the presence of food establishments. *Health Survey in São Paulo City* (ISA-Capital), São Paulo, Brazil, 2015.

Presence of establishments	Model 1		Model 2	
	OR (95%CI)	p-value	OR (95%CI)	p-value
Fast food restaurants				
No	1.00	0.08	1.00	0.04
Yes	2.23 (0.90-5.58)		2.53 (1.02-6.27)	
Markets, supermarkets and grocery stores				
No	1.00	0.31	1.00	0.28
Yes	1.42 (0.72-2.81)		1.45 (0.74-2.82)	
Bakeries and cafeterias				
No	1.00	0.28	1.00	0.98
Yes	0.41 (0.02-2.08)		0.99 (0.44-2.22)	
Restaurants				
No	1.00	0.65	1.00	0.51
Yes	1.13 (0.67-1.92)		1,19 (0,71-2,01)	
Pizzerias				
No	1.00	0.73	1.00	0.55
Yes	1.11 (0.62-1.99)		1.19 (0.67-2.14)	
Street markets and whole food markets				
No	1.00	0.68	1.00	0.49
Yes	1.10 (0.69-1.76)		1.18 (0.74-1.87)	

95%CI: 95% confidence interval.

Note: model 1 – adjusted by sex and census tract; model 2 – further adjusted by race, neighborhood violence, years of residence, physical activity and the intra-municipal Human Development Index (HDI).

food and other informal food trades, which are not registered in the Sanitary Surveillance, is unavailable. Previous research studies have found that these establishments are used by 4.6% of Brazilians [43].

Finally, it is not possible to conduct a qualitative analysis of the food establishments listed. The use of a public list may not reflect the reality, because the list might be outdated and, considering the dynamics of the city of São Paulo, many establishments may have been opened or closed in a short period of time. However, using data from establishments in São Paulo that were generated in the year of survey (2015-2016) was possible. Thus, temporal compatibility is a strength of the present study. The combined use of establishments considered healthy and unhealthy, according to the literature, is another strength of this study. Moreover, this study enabled the investigation of complex associations between youth overweight and local food environment in the city of São Paulo in Brazil, considered a low- to middle-income country where such studies are still scarce.

Conclusion

The presence of fast food restaurants was positively associated with excess body weight in adolescents in the city of São Paulo. Results suggest the need to intensify food and nutrition policies, development of culinary skills, and the reduction in prices of healthy foods to facilitate access to these foods, so that adolescents will have options in locations to socialize with friends and family.

Future studies in Brazil should verify the associations between weight status and food environment, especially fast food restaurants. This will enable comparisons between countries and will offer future directions to prevent obesity and other chronic non-communicable diseases earlier in life.

Contributors

L. R. Nogueira and M. M. Fontanelli conceptualized the idea, analyzed the data, and led the writing. B. S. Aguiar and M. A. Failla contributed with analysis anda revised of the manuscript A. A. Florindo, A. C. Leme and J. P. A. S. Barbosa contributed with critical revisions to include important intellectual content. R. M. Fisberg was involved in the conception and design of the study, data interpretation, and critical revisions of the manuscript for important intellectual content.

Additional informations

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Resumo

O ambiente obesogênico estimula uma dieta inadequada, ao dificultar escolhas alimentares saudáveis. Este estudo transversal avaliou a associação entre o ambiente alimentar local e a prevalência de sobrepeso e obesidade em uma amostra representativa da população de adolescentes residentes na cidade de São Paulo, Brasil, usando modelos de regressão logística multinível. Entre os adolescentes, 29,6% apresentavam sobrepeso ou obesidade. Não houve diferenças significativas entre o ambiente alimentar e o status de peso dos adolescentes. Entretanto, a presença de restaurantes de fast food próximos ao domicílio aumentava a probabilidade de apresentarem sobrepeso ou obesidade (OR = 2,53; IC95%: 1,02-6,27). Os resultados sugerem a necessidade de intensificar as políticas de alimentação e nutrição, o desenvolvimento de habilidades culinárias e a redução nos preços dos alimentos para facilitar o acesso a eles, de maneira que os adolescentes disponham de opções saudáveis em locais para socializar com amigos e familiares.

Comportamento Alimentar; Adolescente; Índice de Massa Corporal; Fast Foods

Resumen

El ambiente obesogénico estimula una dieta inadecuada, al dificultar elecciones alimentarias saludables. Este estudio transversal evaluó la asociación entre el ambiente alimentario local y la prevalencia de sobrepeso y obesidad en una muestra representativa de la población de adolescentes residentes en la ciudad de São Paulo, Brasil, usando modelos de regresión logística multinivel. Entre los adolescentes, un 29,6% presentaban sobrepeso u obesidad. No hubo diferencias significativas entre el ambiente alimentario y el estado de peso de los adolescentes. No obstante, la presencia de restaurantes de fast food cercanos al domicilio aumentaba la probabilidad de presentar sobrepeso u obesidad (OR = 2,53; IC95%: 1,02-6,27). Los resultados sugieren la necesidad de intensificar las políticas de alimentación y nutrición, el desarrollo de habilidades culinarias y la reducción de los precios de los alimentos para facilitar el acceso a ellos, de forma que los adolescentes dispongan de opciones saludables en lugares para socializar con amigos y familiares.

Conducta Alimentaria; Adolescente; Índice de Masa Corporal; Comida Rápida

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