

Food environment of the economic capital of the Northeast: social and territorial disparities in the availability of food stores

Ambiente alimentar da capital econômica do Nordeste: disparidades sociais e territoriais da disponibilidade dos comércios de alimentos

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ABSTRACT

Objective

Characterize the community food environment through the different types of food outlets in the city of *Fortaleza* and associate their distribution according to sociodemographic indicators.

Methods

This is an ecological study carried out in the city of *Fortaleza* in which data from the Health Surveillance Service were used with the location of all licensed food stores in the city in the years 2018 and 2019. Georeferenced maps were set up to illustrate the spatial distribution of the establishments. Correlation analyses were performed to verify the association between food outlets and socioeconomic data. Values of $p \leq 0.005$ were considered significant.

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Results

We identified a greater concentration of food stores in the neighborhoods with better socioeconomic levels. Snack bars (n=2051; 27.7%) and restaurants (n=1945; 26.3%), were in greater quantity and exhibited a positive correlation with the Human Development Index and average income. Supermarkets and hypermarkets (n=288; 3.9%) and street markets (n=81; 1.1%) were in a smaller number and had the worst spatial distribution.

Conclusion

We observed socioeconomic inequalities in the distribution of different types of food outlets. The little diversity and the limited number of establishments in peripheral neighborhoods, besides the centralization of outlets that sell food that is harmful to health, constitute obstacles for the population to make healthy food choices.

Keywords: Fast foods. Food supply. Healthy food. Social environment.

RESUMO

Objetivo

Caracterizar o ambiente alimentar comunitário por meio dos diferentes tipos de estabelecimentos de venda de alimentos existentes na cidade de Fortaleza e relacionar sua distribuição de acordo com indicadores sociodemográficos.

Métodos

Trata-se de um estudo ecológico realizado na cidade de Fortaleza em que foram utilizados dados da Vigilância Sanitária com a localização de todos os comércios de alimentos licenciados para funcionamento no município nos anos de 2018 e 2019. Foram construídos mapas georreferenciados para ilustrar a distribuição espacial dos estabelecimentos. Análises de correlação foram realizadas para verificar associação entre os estabelecimentos de venda de alimentos e dados socioeconômicos. Consideraram-se significativos valores de $p \leq 0,005$.

Resultados

Foi possível identificar maior concentração de comércios de alimentos nos bairros com melhores níveis socioeconômicos. Lanchonetes (n=2051; 27,7%) e restaurantes (n=1945; 26,3%) apresentaram-se em maior quantidade e obtiveram correlação positiva com o Índice de Desenvolvimento Humano e a renda média. Supermercados e hipermercados (n = 288; 3,9%) e feiras livres (n=81; 1,1%) existiam em menor proporção e apresentaram a pior distribuição espacial.

Conclusão

Desigualdades socioeconômicas foram observadas na distribuição dos diferentes tipos de pontos de venda de alimentos. A pouca diversidade e a limitada quantidade de estabelecimentos em bairros periféricos, além da centralização da oferta de comércios que vendem alimentos prejudiciais à saúde, constituem-se obstáculos para que a população faça escolhas alimentares saudáveis.

Palavras-chave: Fast Foods. Abastecimento de alimentos. Alimentação Saudável. Ambiente social.

INTRODUCTION

The food environment can be defined as the consumer's interface with the food system that encompasses food availability, accessibility, convenience and desirability [1,2]. It can be conceptually divided into four main components: consumer food environment, organizational food environment, information food environment and community food environment. The latter refers to the number of establishments that sell food, their location, the kind of services offered and their accessibility in a community [3].

According to the characteristics of the environment, it can facilitate or hinder access to food in quantity and quality, interfering with the possibility of acquiring adequate food and determining the food nutritional status [4]. Neighborhoods with low socioeconomic status often have greater access to establishments that sell unhealthy foods and have the highest prevalence of obesity [5,6]. Other studies, carried out in developed countries, indicate that greater availability of supermarkets and healthy food outlets in a socioeconomically unequal region protects individuals against high body mass rates [7,8].

The disparities found in the characterization of the food environment allowed the elaboration of some terms to categorize that environment. One of the denominations used is “food deserts”, used to refer to areas with limited access to healthy foods, due to the reduced number of these products’ points of sale in a region [9]. The nomenclature “food swamps” refers to regions where there is a high density of establishments that offer foods that are harmful to health, such as fast-foods and ultra-processed food retailers, which have greater purchasing availability and attractiveness, compared to local healthy options [10,11]. Studies have shown that living in neighborhoods with these characteristics is associated with a greater chance of developing overweight [12], and that the occurrence of these environments is common in regions with worse socioeconomic levels and with insufficient education, health services and leisure spaces [11,13].

The current Food Guide for the Brazilian Population acknowledges the environment as a determining factor in food choices, pointing out that living close to open food markets and healthy food markets makes it feasible to have adequate food available. Some of its guidelines, such as shopping in places that offer varieties of fresh and minimally processed foods, and avoiding shopping in places that sell only ultra-processed foods, to be put into practice, depend on the characteristics of the local food environment and of the population’s social, economic and cultural conditions [14].

Based on the current Brazilian Food Guide, which proposes a classification of foods according to the level of processing, and specific characteristics of food stores, which include physical structure, nature of the main products sold and particular commercialization characteristics, which in national studies have used an analysis of the food environment from grouped establishments, including: supermarkets and hypermarkets; small markets and grocery stores; bakeries and coffee shops; restaurants; street markets and vegetable markets; butchers and slaughter houses; food supply centers [15-17]. This proposal for categorizing establishments is an important tool to identify which types of food a population has access to from their local food environment.

In Brazil, in a study carried out in the city of *Florianópolis*, it was observed that low-income areas have a lower concentration of food outlets [18]. In *Belo Horizonte*, researchers identified greater consumption of fruits and vegetables by residents of neighborhoods with a higher density of healthy food stores and with high buying power [19]. In the capital, *Brasília*, access to healthy foods was positively influenced by the type of food stores, indicating that an increase in the number of specialized fruit and vegetable markets, street markets and supermarkets could promote better access to healthy foods in high- and medium vulnerability areas [20]. In the city of *São Paulo*, the presence of fast-food restaurants close to adolescents’ homes was associated with overweight [15].

Analyzing the presence and distribution of different types of food outlets, correlating them with the socioeconomic conditions of a region, contributes to the understanding of how food is available to the population and allows identifying the dimensions of the food setting. Considering the absence of studies of this type carried out in the Northeast region of Brazil, the present study aims to characterize the community food environment through the different types of food stores in the city of *Fortaleza* and to associate their distribution according to sociodemographic indicators.

METHODS

This is an ecological study carried out in the Capital city of *Fortaleza, Ceará*. The city covers a total area of 312,353 km² and has an estimated population of 2.6 million inhabitants; it is the fifth most populous city in Brazil and the capital with the highest Gross Domestic Product in the Northeastern region [21,22].

The municipalities include 119 districts, all in their urban area, and are grouped into six administrative regions, managed by the *Secretarias Executivas Regionais* (SER, Regional Executive Secretariats), consisting of districts with geographic proximity and similar socioeconomic characteristics [23].

Fortaleza has a Municipal Human Development Index (MHDI) of 0.754 [24]. Each district in the city also has its specific MHDI index, which includes three indicators: average years of schooling of the head of the family, literacy rate and average income of the head of the family (in minimum wages). The closer to 1, the greater the human development; MHDI between 0.8 and 1 is considered high; medium between 0.5 and 0.799 and low between 0 and 0.499 (Figure 1) [24].

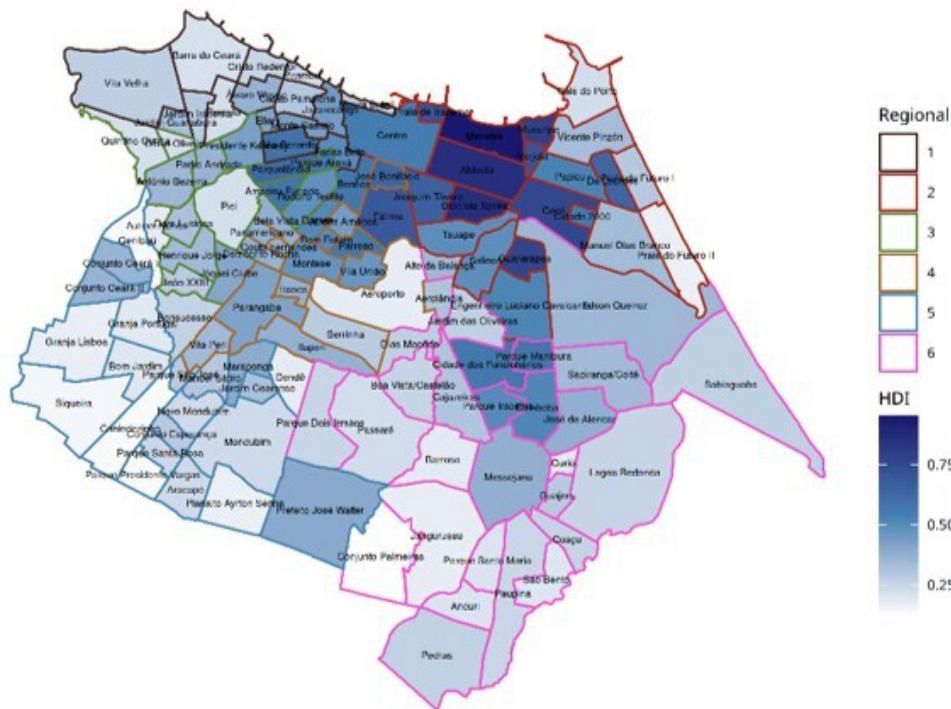


Figure 1 – Distribution of the Human Development Index and Regional districts in the city of *Fortaleza*. *Fortaleza* (CE), Brazil, 2020.

SER I is located at the extreme west of the city and encompasses 15 districts where 16.5% of the total population of the Capital dwells. It has the highest rate of inactivity in *Fortaleza*, with only 37.2% of residents included among the so-called economically active population. Ten districts of this Regional District Administration have an average MHDI rating and five districts have a low index [24].

SER II also covers downtown, which has its own executive secretariat. It is made up of 22 neighborhoods, where 14.64% of the population of *Fortaleza* dwells, with a large commercial and service density, responsible for an important share of municipal revenue. Seven districts have a high MHDI, ten districts have a medium MHDI and only three have a low MHDI [24].

SER III is made up of 16 neighborhoods that concentrate 16.5% of the Municipality's population. SER III has the third lowest illiteracy rate among the districts, and ranks fourth in terms of family income, with average earnings of 4.6 times the monthly minimum wage. Eleven districts of the Regional District Administration have an average MHDI and five have a low index [24].

SER IV covers 19 districts. Its population is the smallest among the six regions, corresponding to 12.13% of *Fortaleza* population. The average income of the heads of families is 5.62 minimum wages. Sixteen neighborhoods have a medium MHDH and three have an MHDH considered low [24].

SER V covers 18 districts that correspond to 21.1% of the population of *Fortaleza*. It is the most populous region, but also the poorest in the capital, with an average income of 3.07 minimum wages. Three districts have a medium IDHM and fifteen have a low index [24].

SER VI covers 29 districts that represent 20.37% of the population of the capital, occupying an area that corresponds to 42% of the territory of *Fortaleza*. It is the region with the highest illiteracy rate. Twelve districts have a medium MHDH and fifteen have a low MHDH [24].

The database of the establishments that sell food for the characterization of the community food environment was developed based on information from two government sources: the sector *Vigilância Sanitária* (VISA, Health Surveillance) of the Municipal Health Department of the city of *Fortaleza* and the SER of the Municipality of *Fortaleza*. The Municipal Health Department, through VISA, permanently supervises the food market through actions such as investigative inspections, maintaining documentation and control records, and is therefore considered a reliable source with regard to official data [25]. From these databases, the following information was extracted: type of establishment and full address (name of the street, number, neighborhood and postal address code) of all food stores licensed to operate in the years 2018 and 2019.

The VISA categorizes establishments according to their main activity, following the *Classificação Nacional de Atividades Econômicas* (CNAE, National Classification of Economic Activities): retail trade of goods in general, with a predominance of food products (hypermarkets; supermarkets; mini-markets, grocery stores and warehouses); retail trade (dairy products and cold cuts; sweets, candies, chocolates and the like; meat and butcher shops; fresh produce; merchandise in convenience stores); wholesale trade (milk and dairy products; processed cereals and legumes; fruits, vegetables, roots and tubers, fresh vegetables; beef, pork and derivatives; fish and seafood; meat and other animal products; bread, cakes, cookies and the like; pasta, that is, culinary products made with flour dough, generally wheat; ice cream; chocolate confectionery, candies and the like; food products in general); restaurants and the like; snack bars, tea houses, juice shops and the like; bakery and confectionery; pastry shop; ice cream shop; coffee shop and street food services.

On a supplementary basis, checkings were made to confirm the addresses of the snack shops (as they are present in greater numbers and suffer greater variation in opening and closing) through the Google Street View tool. The establishments that were incompatible with the database and which were not identified through the Google Street View were excluded from the study. Information on the IDHM, the average per capita income and the number of people living in the districts of the city of *Fortaleza* were extracted from the 2010 Demographic Census [26].

To facilitate data analysis, all identified food stores were grouped according to the classification proposed by Costa *et al.* [16], which takes into account the physical structure of the place, the nature of the main products sold and the specific characteristics of local marketing, resulting in eight large groups: 1) supermarkets and hypermarkets, 2) small markets (minimarkets, grocery stores and corner shops), 3) street markets, 4) restaurants, 5) snack bars (snack bars, tea houses, juice shops and the like; pastry and ice cream parlors), and 6) bakeries and coffee shops. To group retail and wholesale establishments that did not fit the previous categorization, the NOVA food classification was considered, which divides foods according to the extent and purpose of their processing [27], resulting in the following two groups: 7) establishments that

sell fresh and minimally processed foods (vegetables outlets; butchers; fishmongers; cereals and legumes outlets; fruits, vegetables, roots, tubers, vegetables and fresh legumes outlets; beef and pork outlets; slaughtered poultry and derivatives outlets; fish and seafood outlets; meat and derivatives of other animals outlets) and 8) establishments that sell processed and ultra-processed foods (dairy products and cold cuts outlets; confectionery outlets; breads, cakes, cookies and the like outlets; sweets, candies, bonbons and the like outlets; ice cream outlets; pasta and food products in general outlets).

To enable a better visual representation of the city's community food environment, a map was made of the addresses obtained, to identify the distribution and concentration of groups of food sales establishments in the city's neighborhoods.

For data analysis, R, version 4.0.3 was used. The packages for cleaning and organizing the data were *readxl*, *questionr*, *broom*, and the *tidyverse* packages [28-31]. To get the neighborhoods of each street market zip code *cepR* was used, since the approximate location of the street markets was received as a zip code [32]. To visualize the maps, *rgdal*, *corrplot*, *cowplot*, *ggplot2* were used [33-36]. Pearson's correlation test was used to evaluate the correlations between MHDi, average per capita income, number of people living in neighborhoods and density of establishments in the neighborhoods. To interpret the magnitude of the correlations, the following classification of correlation coefficients was adopted: from 0.1 to 0.3 (weak); from 0.4 to 0.6 (moderate) and from 0.7 to 1 (strong) [37]. For the significance level, the Bonferroni correction was used and $p < 0.005$ was considered.

RESULTS

A total of 7,391 food and/or meal establishments were found in the city of *Fortaleza*. Out of this number, the group of snack bars had the largest proportion, $n=2051$ (27.7%), followed by restaurants $n=1945$ (26.3%), small markets $n=928$ (12.6%), establishments that sell processed and ultra-processed foods $n=914$ (12.4%) and establishments that sell fresh and minimally processed foods $n=801$ (10.8%). The groups with the lowest frequency were bakeries and coffee shops $n=383$ (5.2%), supermarkets and hypermarkets $n=288$ (3.9%) and street markets $n=81$ (1.1%).

According to material obtained by VISA, no food outlets were identified in three districts of the city of *Fortaleza*: *Aracapé*, *Moura Brasil* and *Sabiaguaba*. This does not necessarily mean that these districts do not have food stores within their geographic boundaries, a limitation indeed of the database. Neighborhoods where data are missing were represented in gray on the maps.

The concentration of establishments in the group of supermarkets and hypermarkets and in the group of food establishments that sell processed and ultra-processed foods was higher in the central regions and in more populous peripheral neighborhoods. However, in some less populated neighborhoods, with lower average income and lower MHDi there were no supermarkets and hypermarkets (Figure 2).

The bakeries and coffee shops, restaurants and snack bars groups showed a similar distribution, with a low concentration in the peripheral areas of the municipality and a high concentration in the regions near downtown, in which MHDi and average income are higher (Figure 3).

There was a better distribution of establishments in the small market groups and of establishments that sell fresh and minimally processed foods, when compared to establishments in the other groups. The group of street markets exhibited the worst distribution when compared to the equipment of the other groups, since not all neighborhoods in the municipality have establishments of this category (Figure 4).

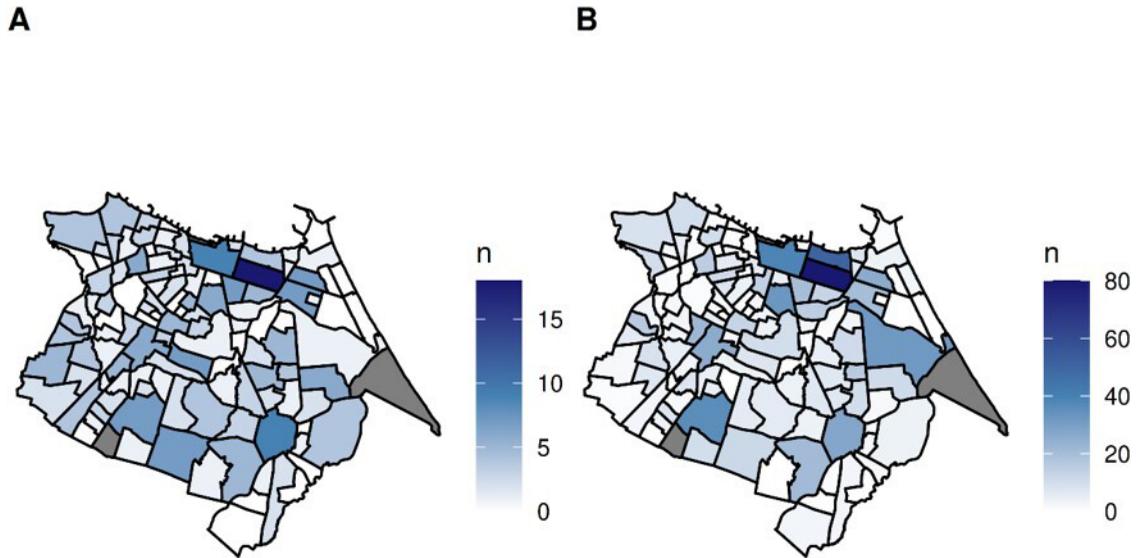


Figure 2 – Concentration of food selling establishments in the supermarkets and hypermarkets groups (A) and establishments that sell processed and ultra-processed foods (B), in the city of Fortaleza. Fortaleza (CE), Brazil, 2020.

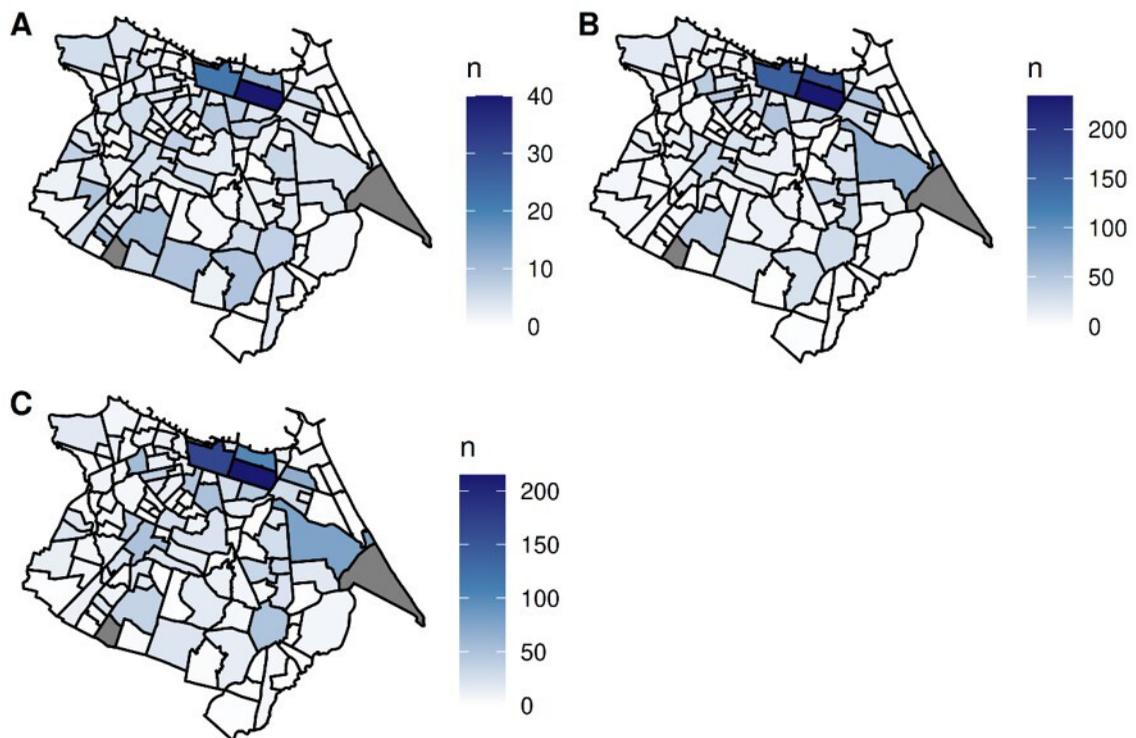


Figure 3 – Concentration of food selling establishments in the snack bars (A), restaurants (B) and bakeries and coffee shops (C) groups in the city of Fortaleza. Fortaleza (CE), Brazil, 2020.

All groups of food outlets that had statistical significance with socioeconomic data showed a positive correlation. Statistically significant results were the same in our outlets for MHDl and average income (Table 1).

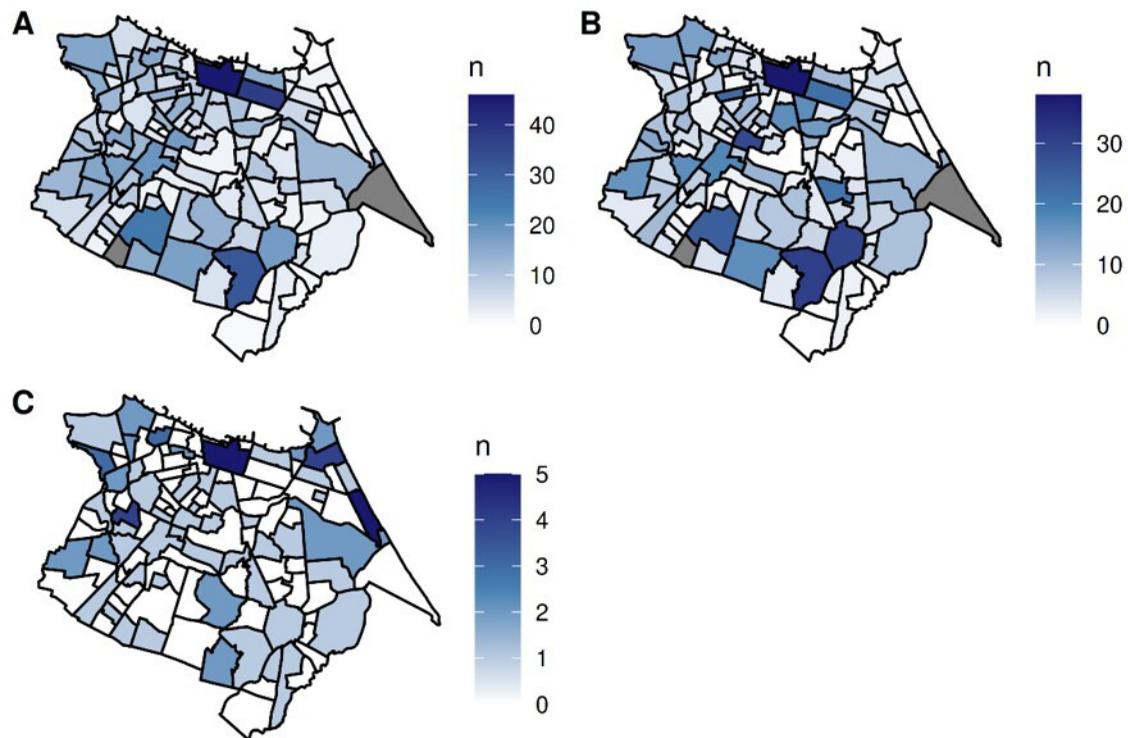


Figure 4 – Concentration of food selling establishments including small market groups (A), establishments that sell fresh and minimally processed foods (B) and street markets (C) in the city of Fortaleza. Fortaleza (CE), Brazil, 2020.

Table 1 – Correlation between the presence of food establishments and population, Municipal Human Development Index and average income in the different neighborhoods.

Establishment	Population		MHDl		Average income	
	r	p-value	r	p-value	r	p-value
Snack bars	0.170	1.000	0.499	<0.001	0.435	<0.001
Restaurants	0.188	1.000	0.532	<0.001	0.500	<0.001
Small markets	0.493	<0.001	0.096	1.000	-0.015	1.000
Establishments that sell processed and ultra-processed foods	0.324	0.062	0.451	<0.001	0.431	<0.001
Establishments that sell fresh and minimally processed foods	0.446	<0.001	0.138	1.000	0.018	1.000
Bakeries and coffee shops	0.327	0.049	0.331	0.046	0.282	0.256
Supermarkets and Hypermarkets	0.389	0.002	0.315	0.092	0.255	0.755
Street markets	0.282	0.210	-0.141	1.000	-0.147	1.000

Note: $p < 0.005$ was considered significant. MHDl: Municipal Human Development Index. Values in bold represent statistical significance.

Moderate significant correlation with the population was observed in: small markets ($p < 0.001$, $r = 0.493$), establishments that sell fresh and minimally processed foods ($p < 0.001$, $r = 0.446$). Weak significant correlation was found for supermarkets and hypermarkets ($p = 0.002$, $r = 0.389$).

There was a moderate significant correlation with the MHDl in the following groups: restaurants ($p < 0.001$, $r = 0.532$), snack bars ($p < 0.001$, $r = 0.499$) and establishments that sell processed and ultra-processed foods ($p < 0.001$, $r = 0.451$).

There was a moderate significant correlation with average income: restaurants ($p < 0.001$, $r = 0.500$), snack bars ($p < 0.001$, $r = 0.435$) and establishments that sell processed and ultra-processed foods ($p < 0.000$, $r = 0.431$).

DISCUSSION

We observed a predominance of establishments in the cafeteria and restaurants group in the municipality, both with a high concentration near downtown. We also identified socioeconomic inequalities in the spatial distribution of equipment in the municipality, with a greater concentration of food stores of all categories in areas with higher average income and higher MHDl. In peripheral areas, the predominance of points of sale occurred, mainly, in the most populous neighborhoods, with groups of small food stores and establishments that sell fresh and minimally processed foods.

The total number of food establishments identified in *Fortaleza* (7,391) is lower than that found in studies on the food environment in the largest capitals of the country, such as the city of *Rio de Janeiro*, in which 9,127 establishments were identified and the municipality of *São Paulo*, where 20,679 outlets were found [38,15]. In the northeastern region, in the capital city of *Aracaju*, only 725 food stores were identified [39]. This disparity can be explained by the population inequality and economic development of these capitals, as well as by the data source used, which was different between studies and this makes comparison difficult [22].

A greater concentration of establishments in areas of higher middle income and near downtown (SER II), and the little availability in peripheral areas (SER V and VI), was identified in studies on the food environment carried out in the southern and southeastern regions of Brazil [15,40]. The most socioeconomically disadvantaged neighborhoods in our study (SER V and VI), according to IDHM, are also those with the fewest food shopping options. In some neighborhoods with a more reduced population, the absence of establishments in the group of supermarkets and hypermarkets and the shortage of establishments that sell fresh and minimally processed foods characterize urban areas with reduced access to healthy foods due to the scarcity of these establishments. People living in areas with little adequate food supply are more exposed to food insecurity, which is associated with worse health outcomes such as malnutrition, obesity, diabetes and cancer, especially when the socioeconomic situation is unfavorable [41-43].

The recognition of areas with a higher concentration of establishments in the snack bar group and establishments that sell processed and ultra-processed foods, considered groups with a predominance of unhealthy food sales, was associated with regions with better conditions of average income and MHDl (SER II). This result differs from the findings of investigations carried out in developed countries, which related the presence of a higher density of establishments that offer unhealthy foods, such as fast-foods and ultra-processed food retailers, to low-income communities, with a predominance of ethnic minorities and people of low educational level [12,44,45]. This difference can be attributed to the fact that in Brazil, where the consumption of ultra-processed foods is also high, the worst food quality was associated with higher levels of income and education [46,47]. Furthermore, the cost of food has changed unfavorably in the country in the last two decades. The price of ultra-processed products has undergone successive reductions, becoming cheaper than processed foods and their price difference has been reduced between fresh and minimally processed foods, which is an important factor in reducing the quality of food for the Brazilian population in general [48].

Snack bars, restaurants and bakeries and coffee shops were also more concentrated in higher average income and IDHM neighborhoods, the first two establishments standing out for being present in greater quantity among all the groups of food stores reviewed. These establishments have in common the characteristic of selling ready meals or food for immediate out-of-home consumption. In Brazil, despite a slight reduction in prevalence, identified by the Household Budget Survey (2017-2018), compared to the previous survey (2008-2009), the consumption of out-of-home food remains significant, showing a growth

trend with income increase [49]. Generally, these out-of-home meals have low nutritional quality and their frequent consumption is associated with higher prevalence of obesity [50,51].

In a positive way, establishments that sell fresh and minimally processed foods were the ones that showed better spatial distribution compared to the other groups, being a favorable factor for the population to have access to healthy foods. In a review of studies carried out with populations from different socioeconomic situations in North American countries, the presence of establishments selling healthy foods was predominantly associated with areas with a low prevalence of obesity; however, in low- and middle-income countries, evidence on the association between dietary environment and positive nutrition and health outcomes is inconclusive [52,53]. In Brazil, in a study carried out in *Belo Horizonte* with the objective of investigating the consumer's food environment, low access to fruits and vegetables was the main contributor to overweight in the studied population, revealing that the low supply of healthy food choices can increase the risk of becoming overweight [54]. Despite a better distribution of establishments that sell fresh and minimally processed foods, data from the *Sistema de Vigilância Alimentar e Nutricional* (Food and Nutrition Surveillance System) indicate an increasing prevalence of obesity in adults in the city of *Fortaleza*, at a rate that exceeded 30% in 2020 [55].

Another point considered important for the acquisition of fresh food is the street markets [56]. In this study, this group of establishments exhibited the lowest concentration and the worst distribution, and was identified in less than half of the city's neighborhoods; it was absent, even, in neighborhoods that have a reduced presence of establishments that sell fresh and minimally processed foods. It is worth noting that the street markets in the city of *Fortaleza* operate weekly, and are not available as sources of daily food purchases for the residents of a neighborhood. Even so, they are considered relevant shopping sites because they reveal the traditional eating habits of a region and promote the sale of healthy foods at affordable prices; however, they have lost relevance in the place selection for buying food, being replaced by the supermarkets [57,58].

Supermarkets and hypermarkets were present in the most populous neighborhoods; however, they were not identified in some neighborhoods with lower population and lower average income. The presence of establishments belonging to this group can facilitate access to food, when the limiting factor is the economic condition, as they usually offer sales promotions and sell products at lower prices throughout the year, in addition to carrying out weekly sales of fresh food [59]. In Brazil, supermarkets and hypermarkets, because they are characterized as mixed establishments, are important sources of purchase of fresh foods and also ultra-processed foods, and selling ultra-processed food is considered as an obstacle to have access to healthy food due to a greater advertising appeal and lower prices of ultra-processed food, which favor the selection of this type of food over healthy foods [60,61].

The distribution of the group of small food stores is a characteristic of both peripheral neighborhoods and central regions. These places are usually more geographically close to consumers and offer a variety of food options, promoting frequent purchases [16]. However, they have little supply of fresh foods, with a predominance of less nutritious foods, with a high content of sugar, sodium and high caloric density, which consumption is associated with worse health outcomes [62].

This study proposed an analysis of the food environment based on the grouping of food sales establishments with common characteristics, such as the physical structure of the place, the nature of the main products sold and the marketing specifics. We recognize the importance of the categorization of food establishments proposed by the *Câmara Interministerial de Segurança Alimentar e Nutricional* (Interministerial Chamber for Food and Nutrition Security) which suggests a division as follows: "fresh food purchase establishments", where there is a predominance of healthy products purchasing; "Ultra-processed food establishments", where there is a predominance of unhealthy products purchases and "mixed

establishments”, where there is a predominance of culinary preparations or processed foods purchases or where there is no predominance of fresh and minimally processed foods or of ultra-processed foods purchases [63]. However, this actual categorization has gaps in its proposal that make it difficult to establish comparisons at national level, since some establishments such as supermarkets, grocery stores, mini-food stores, bars, canteens and street services have different classifications depending on the macro-region or state of the country, actually making comparisons difficult.

One of the factors that limited the results of this study was the lack of data on food stores in three districts of the city. We are aware that these locations are not devoid of food outlets, but the lack of VISA information on the location of these establishments suggests that many of them operate irregularly. It is important to recognize the existence of informal food vendors, which can mask the true distribution of the city’s food businesses. The lack of such data may be supported by the fact that the Government is absent from the more vulnerable spaces and does not reach out to this population. The use of VISA information to form the database may have, therefore, underestimated the actual number of establishments in the city, since the non-inclusion of establishments that exist but are not registered in any of the secondary databases (true negative) and the non-inclusion of street vendors are issues that should preferably be corrected through on-site observations [64].

The lack of information on the consumer’s food environment, such as quality, variety, price and advertising of the food available within the identified establishments, restricts a more in-depth characterization of the local food environment. The use of secondary data is also a limitation, as the information originates from different sources and, consequently, has an inconsistency in credibility, resulting from errors in collection, typing, sub-recording, among others; however, the junction of two databases and the virtual checking allowed a more reliable database for the assessment of the city’s food environment. Another important limitation to be mentioned is the fact that the registration data of the establishments are dated from 2018 to 2019 and the sociodemographic data are from the 2010 census, interfering with the reliability of the comparisons.

The present study contributes to the literature by characterizing the food environment of one of the largest Brazilian capitals, identifying the availability of food from the categorization of establishments and the processing extent of the food marketed. This analysis points out the inequality in the supply of food in the same territory and provides evidence that can be used to plan settings that promote access to healthy food, as recommended by the documents that guide public nutrition policies in Brazil [14,65].

CONCLUSION

We observed socioeconomic inequalities in the distribution of different types of food outlets in the city. Populations living near downtown, in neighborhoods with higher MHD and income, have more options for food outlets when compared to people who live in the peripheral areas. However, a greater concentration of food stores in a region did not translate into greater purchasing options for healthy foods.

The lack of diversity and the limited number of food outlets in the peripheral neighborhoods, in addition to the centralization of the supply of establishments that sell unhealthy foods, are obstacles for the population to make healthy food choices. Thus, public policy strategies for food supply should be developed in order to favor access to food in regions of greater social vulnerability and limit the availability of establishments that predominantly sell ultra-processed foods, minimizing food and nutritional insecurity.

CONTRIBUTORS

BB BARBOSA participated in the data analysis, methodology and writing of the article. EDS PENHA participated in the data analysis and final review. AAF CARIOCA participated in the design, data analysis, methodology and final review of the manuscript.

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