

Characterization of the food environment in a peri-urban area of a municipality in the Recôncavo region of Bahia

Caracterização do ambiente alimentar em área periurbana de um município do recôncavo da Bahia

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ABSTRACT

Objective: the study aimed to characterize the food environment surrounding a Higher Education Institution (HEI) in Bahia, analyzing the types of commercial establishments and the predominance of foods offered.

Methods: this is an observational, cross-sectional, and descriptive study conducted within a 1,600-meter buffer zone from the HEI. To characterize the food environment, an audit was conducted and a validated instrument was applied. Subsequently, the establishments were classified as fresh, ultra-processed, or mixed based on the categorization proposed by the Interministerial Chamber of Food and Nutritional Security.

Results: A total of 126 establishments were identified, with a predominance of ready-to-eat or ultra-processed foods (48%), followed by mixed foods (40%) and low availability of fresh foods (12%).

Final considerations: the study observed the coexistence of characteristics typical of food deserts and food swamps in the same space, with difficulty in physical and economic access to healthy foods and greater availability for the consumption of products harmful to health.

Keywords: Food deserts; access to healthy food; Processed foods; urban population health; Geographic mapping.

RESUMO

Objetivo: o estudo objetivou caracterizar o ambiente alimentar no entorno de uma Instituição de Ensino Superior (IES) na Bahia, analisando os tipos de estabelecimentos comerciais e a predominância de alimentos ofertados.

Métodos: trata-se de um estudo observacional, transversal e descritivo, realizado na área de um buffer de 1.600 metros a partir da IES. Para a caracterização do ambiente alimentar, foi realizado auditoria e aplicação de instrumento validado, posteriormente, os estabelecimentos foram classificados em in natura, ultraprocessados ou mistos a partir da categorização proposta pela Câmara Interministerial de Segurança Alimentar e Nutricional.

Resultados: foram identificados 126 estabelecimentos, havendo predominância para a comercialização de alimentos prontos para o consumo imediato ou ultraprocessados (48%), seguida pelos mistos (40%) e baixa disponibilidade de alimentos in natura (12%).

Considerações finais: observou-se no estudo a coexistência de características típicas de desertos e pântanos alimentares no mesmo espaço, havendo dificuldade de acesso físico e econômico a alimentos saudáveis e maior disponibilidade para o consumo de produtos prejudiciais à saúde.

Descritores: Desertos alimentares; Acesso a alimentos saudáveis; Alimentos industrializados; Saúde da população urbana; Mapeamento geográfico.

INTRODUCTION

The conceptualization of the food environment draws upon an intersectoral analysis integrating physical, economic, political, and sociocultural dimensions that collectively influence the availability, cost, quality, and promotion of food, as well as individual dietary habits and nutritional status.¹ In the physical domain, accessibility to commercial establishments—including supermarkets, street markets, and restaurants—is particularly significant, as their geographic distribution and location are determinant factors in food access.

The distance between food suppliers, retail outlets, and residential areas, as well as the effort required to acquire foodstuffs, constitute key physical determinants of the food environment and directly influence food security outcomes.

Concurrently, the economic dimension—encompassing food costs, household income, and cost-benefit relationships—plays a fundamental role in food choices and constitutes a major barrier to healthy eating. The political dimension, in turn, is exercised through the formulation of public policies that establish guidelines and regulations governing access to quality food, including tax relief on staple foods via subsidies, programs promoting agricultural diversification and agroecology, and the regulation of misleading food advertising.

Additionally, the sociocultural environment—permeated by norms, behaviors, preferences, acceptability, and individual knowledge concerning food—shapes consumption practices and may either promote or hinder healthy eating. In urban contexts, particularly in rapidly expanding peripheral areas, the food environment tends to reflect structural inequalities that compromise access to healthy foods and favor the concentration of establishments offering ultra-processed products.^{2,3}

Two conceptual categories widely employed in the literature are food deserts and food swamps. The former refers to areas with a scarcity of establishments selling fresh or minimally processed foods, while the latter is characterized by the predominance of ultra-processed products with low nutritional value.^{4,5} Both concepts contribute to understanding

the multiple dimensions of food inequality in urban contexts. However, scientific evidence indicates that even peripheral areas often contain street markets, small grocery stores, and street vendors, challenging simplistic classifications as “food deserts.”^{2,4,5}

Thus, the use of these terms must consider, in addition to the availability of food, the economic, cultural and quality barriers of the products, which can influence food choice and consumption.

The study of the food environment thus contributes to understanding inequalities in changing urban contexts, such as Santo Antônio de Jesus, in Bahia, a municipality called “Capital of the Recôncavo” for its commercial, educational and health center role. Despite this regional relevance, little is known about how the urbanization process impacts the configuration of the local food environment⁶. Thus, the objective of this study was to characterize the food environment in this area of coverage, analyzing the types of commercial establishments

METHOD

This observational, cross-sectional, descriptive study was conducted between March and April 2025 in the municipality of Santo Antônio de Jesus, located in the Identity Territory of the Recôncavo da Bahia, Brazil.

To define the food environment investigation area, a 1,600-meter buffer (equivalent to 1 mile) was established around the Health Sciences Center of the Federal University of Recôncavo da Bahia. This radius was adopted because it constitutes a parameter frequently employed to delimit urban food environments, ensuring representative coverage of the area of influence.⁷ Buffer delimitation was performed using the Maps & Directions platform (Figure 1), using the geographic coordinates of the HEI facilities.

Within this coverage area, the commercial establishments that sold food for human consumption were quantified and classified, as well as the accessibility of these products by the population of the studied area was evaluated.

For the classification of establishments, the categorization proposed by the Interministerial

Figure 1

Delimitation of the study territory from the Health Sciences Center, Santo Antônio de Jesus, 2025. Source: Maps directions, 2025.



Source: authorship.

Chamber of Food and Nutrition Security (CAISAN) in the study on the “Mapping of Food Deserts in Brazil”² was adopted, which is divided into the following categories: Establishments with fresh food; Establishments with ultra-processed foods and mixed establishments, which sell both types of food.

The investigation of the food environment was conducted through an audit of commercial establishments, to investigate the factors associated with healthy eating (presence of natural or minimally processed foods) and unhealthy eating (ultra-processed foods), according to the classification of the Food Guide for the Brazilian Population⁸.

The analysis of foods considered healthy took into account the observation of the availability of these products, both permanently and temporarily, in the Recôncavo region of Bahia, based on data provided by the platform of the Brazilian Institute of Geography and Statistics – Cities. On the other hand, the investigation of ultra-processed foods focused on the most consumed items in Brazil, as described in previous studies^{2,5}, including hamburgers, sausages, sweetened beverages, stuffed cookies, sweets/sweets, instant noodles, packaged snacks, and soft drinks.

The audit was carried out by graduate students of the Specialization Course in Food Quality Management and Control at UFRB, using a validated instrument,

proposed in another study of the Food Environment⁷. The variables investigated included: Location of the food section, availability, variety and advertising of fruits and vegetables, as well as availability, variety and advertising of ultra-processed foods. These variables and their respective parameters are summarized in Chart 1.

The data were systematized in Microsoft® Excel® spreadsheets and later analyzed in a descriptive way. The statistical calculations to obtain the confidence intervals for 95% reliability were performed using Excel spreadsheets based on the normal Wald approximation for data of binomial proportions. According to Chart 1, the index of access to food has a classification parameter that varies from 1 to 16 points, with higher scores indicating greater availability of healthy foods, while lower scores indicate a predominance of unhealthy foods in the food environment investigated.

This study did not directly involve the participation of human beings, and is therefore exempt from approval by an ethics committee, in accordance with current national regulations for research of this nature. The data were obtained through direct observation of food establishments and information available to the public.

RESULTS

A total of 126 establishments were identified in the study

Chart 1

Variables of the consumer's food environment used to compose the index of access to food in establishments selling food for human consumption, Santo Antônio de Jesus, 2025.

CONSUMER FOOD ENVIRONMENT SHEET - FOOD ACCESS INDEX	
PROPERTY DETAILS	
Property Name:	
Opening hours:	
Type of establishment:	
Property rating:	
Variable	Score/Endpoint
Fruit and vegetable section near the main entrance	1. Not next () 2. Next ()
Different types of fruits (availability)	1. Not available () 2. 1 to 7 types of the top 10 are available () 3. 8-10 kinds of the top 10 are available ()
Variety of fruits (silver banana, dwarf, apple, earth...)	0- not available () 1- up to 14 varieties available () 2-15 or + varieties available ()
Different types of vegetables	1. Not available () 2. 1 to 7 types of the top 10 are available () 2- 8- 10 types of vegetables from the top 10 are available ()
Variety of vegetables	0- no variety available () 1-up to 14 varieties are available () 2-15 or + varieties available ()
Fruit and vegetable advertising (tasting counter, demonstrator or distribution of samples, pennants, posters/banners, display, folder, promotions/offers)	0- not available () 1- Available ()
Availability of soft drinks	0- not available () 1- Available ()
Availability of sweetened juices/powder	0- not available () 1- Available ()
Availability of cookies/chocolates	0- not available () 1- Available ()
Availability of snacks	0- not available () 1- Available ()
Advertising for ultra-processed foods	0- not available () 1- Available ()

area, which, according to the analysis of the National Classification of Economic Activities (CNAE), has a predominance of businesses focused on the supply of ready-to-eat or ultra-processed foods, configuring a characteristic scenario of food swamps^{7,9}.

From the data presented in Table 1, there is a greater presence of snack bars, tea houses, juices and the like, over bars and restaurants. This group concentrates 58% of the local food

supply, suggesting a predominance of the food environment of the “consumption away from home” type, strongly associated with the supply of foods with high salt, sugar and fat content³.

The retail trade of goods, represented by supermarkets and grocery stores/minimarkets, which are characterized by the predominance of food products, corresponded to 23%, evidencing an important role of these

Table 1

Characterization of establishments according to the National Classification of Economic Activities - CNAE, Santo Antônio de Jesus, 2025.

Type of establishment	n = 126	%	CI(95%)(-) Lower bound of confidence interval (%)	CI(95%)(+) Upper limit of confidence interval (%)
4711-3/02 Retail trade of general merchandise, with predominance of food products - supermarkets	16	13%	7	19
4712-1/00 Retail trade of general merchandise, predominantly of food products - minimarkets, grocery stores and warehouses	13	10%	5	15
4721-1/02 Bakery and confectionery predominantly resale	4	3%	0	6
4721-1/04 Retail trade of sweets, candies, bonbons and the like	3	2%	0	4
4722-9/01 Meat retail trade - butchers	1	1%	-1	3
4724-5/00 Fruit and vegetable retail trade	8	6%	2	10
4729-6/99 Retail trade of food products in general or specialized in food products not specified above	1	1%	-1	3
5611-2/01 Restaurants and similar products	18	14%	8	20
5611-2/02 Bars and other establishments specialized in serving beverages	25	20%	13	27
5611-2/03 Snack bars, tea houses, juice shops and the like	30	24%	17	31
5620-1/04 Supply of food prepared mainly for household consumption	7	6%	2	10
Property rating				
Establishments for the acquisition of fresh products	15	12%	6	18
Mixed establishments	50	40%	31	49
Ultra-processed food establishments	61	48%	39	57

establishments as sources of domestic supply. Commercial establishments of fresh or minimally processed foods, such as fruit and vegetables and butchers, had a minority presence, as shown in Table 1. This configuration may limit physical access to healthy foods, one of the central factors in the

characterization of possible urban food deserts^{4,9}.

Even more restricted was the presence of suppliers of prepared foods for home consumption, bakeries and businesses specializing in sweets and the like, reflecting a commercial segmentation

that favors convenience and practicality, often to the detriment of nutritional quality.

The analysis of the types of commercial establishments in the study area revealed a significant predominance of places that sell ultra-processed foods, followed by mixed establishments, which offer both fresh and processed or ultra-processed foods. On the other hand, a small number of commercial points specialized in the sale of fresh foods, such as fruits and vegetables, whether compact or leafy, were identified.

In the evaluation of the variables of the food environment (Table 2), it was observed that only a small portion of the establishments had a fruit and vegetable section located near the main entrance. Regarding the availability of fruits, the absolute majority, equivalent (76%), did not have this food group. As for vegetables, unavailability was found in most establishments (82.5%).

With regard to the advertising of fruits and vegetables, there was little expression in the establishments analyzed (7%), in contrast to the wide diffusion of promotional strategies aimed at ultra-processed foods (60%).

The analysis of the availability of ultra-processed foods revealed a wide presence of these products, with soft drinks identified in 85% of the places evaluated, powdered sweetened juices in 73%, cookies and chocolates in 68%, and industrialized snacks in 69% (Table 2).

DISCUSSION

According to the 2022 IBGE Census, the municipality of Santo Antônio de Jesus has a population of 103,055 inhabitants, representing a 13.18% growth relative to 2010. Current estimates indicate a population of approximately 109,260 people, with a demographic density of 393.7

Table 2

Evaluation of the variables of the food environment of the territory studied, Santo Antônio de Jesus, 2025.

Variable	n = 126	%	CI(95%)(-) Lower bound of confidence interval (%)	CI(95%)(+) Upper limit of confidence interval (%)
Fruit and vegetable section near the main entrance	24	19%	12	26
Fruit availability				
Not available	96	76%	69	83
1 - 7	23	18%	11	25
8 - 10	7	5,5%	2	9
Variety of fruits				
Not available	108	86%	80	92
up to 14	18	14%	8	20
15 or +	0	-	-	-
Availability of vegetables				
Not available	104	82,5%	76	89
1 - 7	8	6%	2	10
8 - 10	14	11%	6	16
Variety of vegetables				
No variety available	109	86,5%	81	92
up to 14	17	13,5%	8	19
15 or +	0	-	-	-
Advertisement				
Fruits and vegetables	9	7%	3	11
Ultra-processed foods	76	60%	51	69
Availability of ultra-processed foods				
Soft drinks	107	85%	79	91
Sweetened juices/powder	92	73%	65	81
Cookies/chocolates	86	68%	60	76
Industrialized snacks	87	69%	61	77

inhabitants/km² and an average household size of 2.69 residents. In terms of infrastructure, 73.6% of households have access to a sewage system or equivalent, 83.4% have piped water supply, and over 90% have solid waste collection services.

The age profile of the population is concentrated in the young adult to middle-aged ranges, and the local economy is driven by the sectors of services, commerce, health and education. The Firjan Municipal Development Index (IFDM) is 0.7223, considered moderate, positioning Santo Antônio de Jesus as the most developed municipality in the Recôncavo da Bahia, although still at an intermediate level when compared to larger urban centers.

In the intra-urban context, the Cajueiro neighborhood stands out, a peripheral and transitional area strongly impacted by urban expansion. The installation of relevant public facilities, such as the Health Sciences Center of the Federal University of Recôncavo da Bahia, the Federal Institute of Education, Science and Technology of Bahia (IFBA) and the Regional Polyclinic, has contributed to transforming the local dynamics, attracting real estate investments aimed mainly at the academic public, composed mostly of students from other locations.

In addition to the real estate sector in the area studied, the commercial activity is also expressive, with emphasis on the food sector, which brings together the largest number of establishments, diversifying between restaurants, bars, snack bars, snack stands, grocery stores and points of sale of produce.

Studies such as Costa's⁶ indicate that urban expansion in the Cajueiro neighborhood resulted in the concentration and diversity of activities close to homes, favoring immediate consumption. However, research indicates that, in peripheral urban contexts, these points tend to offer wide availability of processed and ultra-processed foods to the detriment of natural or minimally processed foods^{2,9,10}.

Corroborating Costa⁶, the data obtained in this study confirm this pattern, evidencing inequalities in the food environment, in which the population's food choices can be shaped by the predominance of foods of low nutritional quality. This pattern reflects the logic of contemporary urban procurement, in which convenience and quick access to

industrialized products overlap with the availability of fresh or minimally processed foods, ratifying previous studies that show the hegemony of ultra-processed foods in Brazilian urban contexts^{11,12}.

Ultra-processed foods, rich in sodium, saturated fats, added sugars and industrial additives, compete with healthy foods and negatively affect consumption habits, an influence that can be intensified by the strategic arrangement of these products at points of sale, as observed in this study. The absence of more incisive regulation on the advertising, labeling and availability of these products, as well as the negligence in promoting healthier food environments, highlights the hegemony of commercial interests to the detriment of the Human Right to Adequate Food (DHANA)^{13,14,15}.

The low proportion of establishments predominantly selling fresh food is consistent with the characterization of food deserts described in the literature.^{1,2,7} This scenario reinforces inequalities in access to healthy food and compromises the Food and Nutritional Security of the resident population.⁴

Establishments classified as "mixed" represent an opportunity as well as a challenge: Although they offer fresh foods, the presence and marketing strategies of ultra-processed foods in these spaces can influence less healthy food choices⁵. Thus, periodic assessments of the food environment and actions to promote the Food Guide for the Brazilian Population can be ways to improve the supply profile of these establishments⁸.

It is understood, therefore, that deserts and food swamps express the environment of dispute for urban areas, evidencing the need for a permanent struggle to guarantee Food Sovereignty. In this context, industrial conglomerates with great economic power overlap with other productive segments. This overlap occurs due to the imposition of commercial dynamics, which facilitates access to ultra-processed foods, exerting a strong influence on the population's eating habits and practices^{16,17,18}.

Given this scenario, it is essential to implement public policies that encourage the consumption and sale of fresh foods and inhibit the supply and advertising of ultra-processed foods, promoting equity in access to adequate and healthy food⁸. Such policies must be articulated with strategies that strengthen family farming, recognizing its

central role in the production of diversified, fresh and agroecological-based food, contributing to Food and Nutritional Security in peripheral regions.

Among the limitations of the study, the investigation restricted to the delimited area stands out, which may not fully reflect the food dynamics of the municipality. In addition, the collection was carried out in a specific period, not capturing seasonal variations in food availability. Despite this, the study has important strengths, such as the direct audit of all establishments in the defined perimeter, the use of a validated instrument to characterize the food environment and the systematic analysis of variables of availability, variety and promotion of food, ensuring robustness in the evaluation of the local scenario.

CONCLUSION

The analysis of the food environment in the study area revealed a scenario characterized by the predominance of ultra-processed food establishments, low availability and visibility of fresh foods, and a strong promotional emphasis on unhealthy products. These elements collectively configure an unhealthy

food environment that is unfavorable to the adoption of healthy dietary practices.

The concurrent presence of characteristics typical of both food deserts and food swamps within the same geographic space reflects the difficulty in achieving physical and economic access to healthy foods, while products harmful to health remain widely available.

Therefore, expanding research on the food environment as a social determinant of health is essential to inform evidence-based urban planning and the formulation of effective health promotion strategies.

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest.

AUTHOR CONTRIBUTIONS

Barreto JC, dos Santos GS, Almeida CS, Camilo VMA, de Oliveira FS contributed to conceptualization, methodology, formal analysis, investigation, and writing – original draft preparation.

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