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Food and Nutrition Security indicators in Brazil's most populous state: potentialities and weaknesses in municipal management

Indicadores de Segurança Alimentar e Nutricional no estado mais populoso do Brasil: potencialidades e fragilidades na gestão municipal

Abstract

Introduction: There is a pressing need to advance mechanisms for monitoring and evaluating the Food and Nutrition Security situation in subnational governments, especially in times of crisis and the increased hunger in Brazilian homes. *Objective:* The study evaluates the Food and Nutrition Security situation in the municipalities of the state of São Paulo, through the application of a multidimensional assessment matrix based on the Brazilian concept of Food and Nutrition Security. *Method:* The development of the instrument was previously described, containing seven dimensions, 11 subdimensions, 27 indicators, and 59 measures, collected on public domain secondary databases. The databases were revisited and updated, accounting for six sources of information. The municipalities were classified based on the attribution of grades and situation classification (poor, regular, good, and excellent). *Results:* The results showed 2% of the municipalities in the state of São Paulo in poor situation, 26% in regular, 59% in good, and 13% in excellent. Most municipalities presented good and excellent results for the Food and Nutrition Security situation. *Conclusion:* Despite the difficulty in obtaining data due to the great variability of available tools, the study highlights important weaknesses in the "Universal access to adequate food," "Universal access to water," and "Permanent processes of education, research, and training in Security Food and Nutrition" dimensions in the state, which confirms the urgency of creating mechanisms for evaluating and improving government actions and strategies in this area.

Keywords: Food Security. Assessment of Health Programs and Projects. Public Policy.

Resumo

Introdução: É premente a necessidade de se avançar em mecanismos de monitoramento e avaliação da situação da Segurança Alimentar e Nutricional nos governos subnacionais, sobretudo em momentos de crise e amplificação da fome nos lares brasileiros. *Objetivo*: O estudo avalia a situação de Segurança Alimentar e Nutricional nos municípios do estado de São Paulo,

por meio da aplicação de matriz avaliativa multidimensional alicerçada no conceito brasileiro de Segurança Alimentar e Nutricional. *Método*: A construção da ferramenta foi previamente descrita contendo sete dimensões, 11 subdimensões, 27 indicadores, 59 medidas, coletadas em bases de dados secundários de domínio público. As bases de acesso aos dados foram revisitadas e atualizadas, contabilizando seis fontes de informação. Os municípios foram classificados a partir da atribuição de notas e juízos de valor (ruim, regular, bom e ótimo). *Resultados*: Os resultados apontaram 2% dos municípios do estado de São Paulo como ruins, 26% regulares, 59% bons e 13% ótimos. A maioria dos municípios apresentou bons e ótimos resultados para a situação de Segurança Alimentar e Nutricional. *Conclusão*: A despeito da dificuldade na obtenção dos dados em função da grande variabilidade das ferramentas disponíveis, o estudo aponta fragilidades importantes nas dimensões "Acesso universal à alimentação adequada", "Acesso universal à água" e "Processos permanentes de educação, pesquisa e formação em Segurança Alimentar e Nutricional" no estado, corroborando a urgência de se criar mecanismos de avaliação e aprimoramento das ações e estratégias governamentais nessa área.

Palavras-chave: Segurança Alimentar. Avaliação de Programas e Projetos de Saúde. Política Pública.

INTRODUCTION

Over the last five decades, civil society organizations, researchers, and public administrators from different countries have dedicated themselves to developing approaches and strategies that qualify governance and decision-making related to Food and Nutrition Security (FNS) and its integration with public policies from different sectors.[1-5] However, the multiple FNS dimensions make its governance, and especially its assessment, a complex and challenging technical-operational action.[3-7]

In Brazil, although FNS has permeated academic debates, guided public policies, and engaged social movements since the mid-20th century, its institution as a specific public policy only occurred in 2006, with the creation of the *Sistema Nacional de Segurança Alimentar e Nutricional National* (SISAN, Food and Nutritional Security System),[8] strengthened in 2010 with the institution of the *Política Nacional de Segurança Alimentar e Nutricional* (PNSAN, National Food and Nutrition Security Policy).[9] The regulations that govern the SISAN and its public policy bring the need to develop instruments and methodologies capable of monitoring and evaluating the public policy itself and the FNS situation, through the use of public data and indicators related to different sectors and spheres of government. Furthermore, these monitoring and assessment instruments must encompass different analysis dimensions that include different data on food production and availability, income and living conditions, access to adequate and healthy food, including water, health, nutrition, and access to related services, education, programs and actions concerning FNS.[9,10]

Currently, weaknesses are still identified in the tools used to monitor and assess FNS, mainly due to limitations in their analysis dimensions and insufficient systemic and comprehensive evaluative research.[10-13] Among the studies found, one of them presents an instrument to monitor and assess the multiple FNS situation dimensions at the municipal level. This tool was successfully applied in the universe of municipalities in the state of Santa Catarina, Southern Brazil.[14]

In order to qualify the assessment processes within the scope of FNS and contribute to the process of resuming and strengthening the SISAN, this study adapted and applied the aforementioned model,[14] aiming to assess the FNS situation in the municipalities of the state of São Paulo, Southeast Brazil.

MATERIAL AND METHODS

Exploratory descriptive study carried out with the universe of municipalities in the state of São Paulo (n = 645) which, according to population estimates, has 46.6 million inhabitants, which corresponds to around 22% of the Brazilian population.[15]

The tool used in the study was built from an assessment matrix designed to evaluate FNS at the municipal level through public data, collected on available information systems. To define the FNS situation, the base tool proposes the use of seven different dimensions, 11 subdimensions, 27 indicators, 59 measures and 94 pieces of information (Table 1), related in a hierarchical manner.[14]

Chart 1. Dimensions, subdimensions and number of indicators of the multidimensional assessment matrix regarding the municipal FNS situation. Brazil, 2023

Dimensions	Subdimensions	Indicators
Access to adequate food	Vulnerable population	2
	Income	3
	Distribution of food and meals	4
Agroecological production systems and sustainable food supply	Access to land	1
	Food production and distribution	3
Permanent processes of education, research, and training in FNS	Food and nutrition education	2
	Public education network	2
Food and nutrition at all levels of health care	Primary health care	5
Universal access to water	Basic sanitation	3
Traditional peoples and communities	Traditional peoples and communities	1
Assessment and monitoring	SISAN assessment and monitoring	1
Total		27

The detailed methodology for the development process of the aforementioned model was previously described.[14] To use the matrix in this study, the dimensions, subdimensions, indicators, and measures were maintained, and the data were adjusted according to information updates and availability. The reference values for poverty and extreme poverty were updated, as per the update provided in a federal decree.[16] To collect the illiteracy rate, "age over 10 years" was considered. To determine the level of economic activity of the population, the information "economically active people" at all ages was used.

Data collection took place from July to November 2021 on public secondary databases available online, and was carried out in two stages: manual and automated. The data present on the *Consulta, Seleção e Extração de Informações do CadÚnico* (CECAD, Consultation, Selection and Extraction of Information from CadÚnico) system were obtained in an automated manner by means of a web scraping technique using Python®, programming software with free access and open source.[17,18] The repository with the code used is available on GitHub® hosting platform.[19] The remaining data were collected manually from available websites. It was possible to collect 59% of the measures described. The remaining were not collected due to unavailability on public databases.

Data were collected from the following information source: CECAD; *Sistema IBGE de Recuperação Automática* (SIDRA, IBGE System of Automatic Recovery); IBGE cities; *Departamento de Informática do Sistema Único de Saúde* (DATASUS, Department of Information Technology of SUS); public access reports from the *Sistema de Vigilância Alimentar e Nutricional* (SISVAN, Food and Nutrition Surveillance System), and *e-Gestor Atenção Básica* (e-Primary Care Manager).

Data analysis was carried out in three stages, namely: data pre-treatment, application of metrics, and information visualization. Pre-treatment consisted of making data compatible per municipality, using Microsoft Excel®. Data analysis was carried out using Pandas library, written in the Python® programming language.[18] Graphical visualizations of the data were generated using Matplotlib® and Seaborn® libraries.[20,21] For the geographic data treatment, one used GeoPandas® library.[22] Pandas, Geopandas, Matplotlib, and Seaborn libraries are modules written in the Python® programming language, and all are free access and open code.[18] Relative and absolute parameters were used, as described by Guedes et al.[14]

RESULTS

Among the municipalities in the state of São Paulo, 2% were characterized as presenting a poor FNS situation, while 26% were classified as regular, 59% as good, and 13% as excellent according to data in Table 1, also represented geographically on the map in Figure 1.

Table 1. Distribution of the municipalities of São Paulo according to the classification by the multidimensional assessment matrix regarding the FNS situation, Dimension and Subdimension. Brazil, 2023.

Classification	Poor		Regular		Good		Excellent	
	n	%	n	%	n	%	n	%
Food and nutrition security situation	10	2	169	26	379	59	87	13
Dimension 1: Access to adequate food	39	6	220	34	355	55	31	5
Subdimension 1: Vulnerable population	83	13	80	12	376	58	106	16
Subdimension 2: Income	46	7	222	34	273	42	104	16
Subdimension 3: Distribution of food and meals	218	34	300	47	127	20	0	0
Dimension 2: Agroecological production systems and sustainable food supply	80	12	139	22	315	49	104	16
Subdimension 1: Access to land	121	19	156	24	217	34	141	22
Subdimension 2: Food production and distribution	142	22	145	22	258	40	90	14
Dimension 3: Permanent processes of education, research, and training in FNS	161	25	165	26	162	25	156	24

Table 1. Distribution of the municipalities of São Paulo according to the classification by the multidimensional assessment matrix regarding the FNS situation, Dimension and Subdimension. Brazil, 2023 (Continues).

Classification	Poor		Regular		Good		Excellent	
	n	%	n	%	n	%	n	%
Subdimension 1: Food and nutrition education	*	*	*	*	*	*	*	*
Subdimension 2: Public education network	161	25	165	26	162	25	156	24
Dimension 4: Food and nutrition at all levels of health care	32	5	197	31	371	58	45	7
Subdimension 1: Primary health care	31	5	197	31	371	58	45	7
Dimension 5: Universal access to water	137	21	165	26	194	30	149	23
Subdimension 1: Basic sanitation	137	21	165	26	194	30	149	23
Dimension 6: Traditional peoples and communities	*	*	*	*	*	*	*	*
Subdimension 1: Traditional peoples and communities	*	*	*	*	*	*	*	*
Dimension 7: Assessment and monitoring	*	*	*	*	*	*	*	*
Subdimension 1: SISAN assessment and monitoring	*	*	*	*	*	*	*	*

SISAN: Food and Nutrition Security System
* Available data.
Source: Elaborated by the authors

Figure 1. Map of the municipalities of the state of São Paulo according to the classification by the multidimensional evaluation matrix regarding the Food and Nutritional Security situation. Brazil, 2023.

FNS: Food and Nutritional Security

Dimension 3 – "Permanent processes of education, research, and training in FNS" – presented the worst results, grouping approximately half of the municipalities into poor and regular, followed by Dimension 5 – "Universal access to water." Dimension 1 – "Universal access to adequate food" –, despite having the majority of good and excellent municipalities, also requires a careful look, as it grouped 40% of the municipalities into poor and regular (Table 1).

Dimension 2 – "Agroecological production systems and sustainable food supply" and Dimension 4 – "Food and nutrition at all levels of health care" – presented positive results, with more than 60% of the municipalities assessed as good and excellent. Dimensions 6 – "Traditional peoples and communities" and 7 – "Assessment and monitoring" – could not be evaluated due to the public data unavailability (Table 1).

Regarding the subdimensions, the most notable in Dimension 1 is Subdimension 3 – "Distribution of food and meals" –, which totaled 80% of the municipalities classified as poor and regular, concentrated in the Southern region of the state, as seen in Figure 2. In contrast, Subdimension 1 – "Vulnerable population" – brought together 75% of the municipalities classified as good and excellent, and Subdimension 2 – "Income" – presented 58% of the municipalities in these classifications.

DISCUSSION

São Paulo is considered the most developed Brazilian state, with a high Human Development Index (HDI). It has the highest GDP in Brazil, totaling 32% of the country's total value. Nevertheless, it maintains significant inter-regional inequalities. For example, the total income of the richest state's region is 19 times that of the poorest one.[23] The results of the assessment of the "Vulnerable population" subdimension reflect this disparity, making it possible to observe the concentration of municipalities classified as poor in Itapetininga and São Paulo South Coast mesoregions.

The "Universal access to adequate food" dimension highlights the need for advances in strategies linked to the "Food and meals distribution" subdimension. Studies have reinforced that access to food is directly associated with income and, in this sense, it is important to expand the network of public facilities, policies, and programs capable of distributing food, especially to low-income and socially vulnerable populations.[24-26] The Covid-19 pandemic intensifies the ongoing political and economic crisis in the country and amplifies, above all, the social crisis, directly related to the rise in food inflation, the increase in unemployment, the level of family debt, and the reduction of the population's purchasing power.[27-29]

The *II Inquérito Nacional sobre Insegurança Alimentar no Contexto da Pandemia da Covid-19 no Brasil* (VIGISAN, II National Survey on Food Insecurity in the Context of the Covid-19 Pandemic in Brazil), published in 2022, revealed 33 million Brazilians in a situation of hunger, expressed in severe food insecurity.[30] Of these, more than 11 million are in the Southeast region. According to the research, in the region, mild food insecurity affects 27.2% of the municipalities, and moderate and severe food insecurity were found in 14.3% and 13.1% of the households, respectively, which further reinforces the importance of actions to guarantee the Human Right to Adequate Food (HRAF).[30]

In the "Permanent processes of education, research, and training in FNS" dimension, it was possible to assess only the population literacy level, since other data were unavailable. Lack of data regarding the "Food and nutrition education" (FNE) subdimension highlights the fragility of the performance of FNS actions within the scope of education. It is described that FNE actions are present at the municipal level, but in an unstructured way and at a low frequency, not reaching the proposed objectives.[31] FNE actions have to be

qualified and promoted by municipal and state managers in order to guarantee FNS and assure HRAF to the population.

The "Universal access to water" dimension represents access to basic sanitation by the population: garbage collection, water supply, and sanitary sewage. It is necessary to look carefully at this dimension, since approximately half of the municipalities were classified as poor and regular. Access to water and adequate sanitation are considered basic human rights, necessary to guarantee a full state of health, in addition to preventing pathologies such as diarrhea and gastroenteritis.[32]

Still regarding water, the II VIGISAN observed that 42% of the households with water insecurity were also in a situation of hunger. It was found that 12% of the Brazilian population lived with restricted access to water. The first highest combination between Food Insecurity (FI) and water insecurity was observed in the North region (48%), followed by the Southeast region (43%).[30]

The state of São Paulo presented better results when compared to the results obtained in the state of Santa Catarina, where the former appeared with 59% of the municipalities classified as good and 13% as excellent, and the latter presented 35% of the municipalities classified as good and none as excellent.[14] In the South, the "Universal access to adequate food" and "Food and nutrition at all levels of health care" subdimensions stood out negatively, which did not occur in the state of São Paulo. In the state of Santa Catarina, the "Assessment and monitoring" dimension presented 98% of the municipalities classified as being in poor situation,[14] but such dimension was not assessed in the state of São Paulo due to lack of information at the time of collection.

The "Assessment and monitoring" dimension reflects the SISAN instances and its implementation, so the data unavailability demonstrates the historical incipience of the policy in the state of São Paulo. The "Traditional peoples and communities" dimension also did not present available data, and the same occurred in the state of Santa Catarina. This fact highlights the weakness in the prioritization of traditional communities present in both states,[14] a characteristic that still persists in other country's regions. *Quilombola* communities have high FI rates, as evidenced in a study performed in 2015 in the state of Maranhão and published in 2020, where 79.9% of the communities were in a FI situation,[33] surpassing previous national surveys.[34]

Compared to the research undertaken in the state of Santa Catarina, there was greater difficulty in collecting data in the state of São Paulo because of more unavailable data at the time of collection. One believes that this difference was reflected in better results obtained in the latter.[10] Nonetheless, the study reflects the most up-to-date data available during the Covid-19 pandemic period, demonstrating potentialities and weaknesses in the state's FNS policy.

CONCLUSION

The municipalities in the state of São Paulo presented, for the most part, good and excellent results regarding the FNS situation. However, the study highlighted important weaknesses in different dimensions assessed, with emphasis on that relating to universal access to adequate food. This result is particularly worrying at a time of crisis and increased food insecurity among Brazilians.

Data unavailability and the extensive variability in the information decentralization stand out as the main study limitations. Despite that, the scope of the study and the data originality for the state of São Paulo are highlighted, as well as the importance of assessing and monitoring FNS in its complexity as a tool to drive the execution and consolidation of the FNS policy. In this vein, the recommendation is the continuous review and application of the assessment matrix in different Brazilian municipalities and states.

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Contributors

Guedes AAF, Gabriel CG, Machado ML and Ribeiro LC participated in the conception, design, data analysis and interpretation. Motta RR participated in the data analysis and interpretation. All authors participated in writing, reviewing and approving the final version of the article.

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