

Public Procurement of Regional Food from Family Farming in Municipalities of the Eastern Amazon

Aquisição Pública de Alimentos Regionais da Agricultura Familiar Em Municípios Da Amazônia Oriental

Adquisición pública de alimentos regionales procedentes de la agricultura familiar en municipios de la Amazonía Oriental

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Research article

Editor: Edgar Bolívar-Urueta

Received: 21/12/2023. **Returned for revision:** 27/11/2024. **Accepted:** 27/12/2024

How to cite: da Conceição Cabral, B., Fernando da Silva Siqueira, F., das Graças Ferreira Frazao, A. y Tomchinsky, B. (2025). Public Procurement of Regional Food from Family Farming in Municipalities of the Eastern Amazon. *Mundo Amazónico*, 16(1), e112178. <https://doi.org/10.15446/ma.v16n1.112178>

Abstract

In addition to being strategic for Food and Nutritional Security, public procurement of regional food serves as a promoter and enhancer of Brazilian biodiversity through family farming. The study aims to identify the inclusion of local, regional, and socio-biodiversity foods in public purchases within the Intermediate Region of Marabá as a tool for valuing biodiversity. This retrospective, cross-sectional, qualitative-quantitative study used secondary documentary data regarding recent purchases from family farming in 23 municipalities. The items were classified into food groups, presented in frequencies, and statistically analyzed. In both programs, local foods were predominant across the municipalities. In the PNAE (National School Feeding Program), 27.6% of the items were socio-biodiversity foods and 10.2% were regional foods, while in the PAA (Food Acquisition Program), these figures were 25.9% and 12.4%, respectively. We didn't find any differences between the policies studied and between regions when classifying these foods. However, there was a moderate correlation between PNAE and the

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variables ‘demographic census’, ‘number of students’ and ‘poverty’. As well as between PAA and ‘local food group’ and ‘poverty’. The results identified the presence of local biodiversity foods in both policies’ purchases, with an emphasis on cassava as local and socio-biodiverse food. However, there is still a predominance of conventional foods in these purchases.

Keywords: Local foods, regional foods, Institutional markets, Socio-biodiversity

Resumo

Além de estratégica para Segurança Alimentar e Nutricional, a aquisição pública de alimentos regionais funciona como promotora e potencializadora da biodiversidade brasileira por meio da agricultura familiar. O estudo objetiva identificar a inclusão de alimentos locais, regionais e da sociobiodiversidade em compras públicas da Região Intermediária de Marabá como ferramenta de valorização da biodiversidade. Este estudo retrospectivo, transversal, qualitativo-quantitativo utilizou dados documentais secundários relativos a compras recentes da agricultura familiar em 23 municípios. Os itens foram classificados em grupos de alimentos, apresentados em frequências e analisados estatisticamente. Em ambos os programas, os alimentos locais foram predominantes nos municípios. No PNAE (Programa Nacional de Alimentação Escolar), 27,6% dos itens eram alimentos da sociobiodiversidade e 10,2% eram alimentos regionais, enquanto no PAA (Programa de Aquisição de Alimentos), esses valores foram de 25,9% e 12,4%, respectivamente. Não encontramos diferença entre as políticas estudadas e entre as regiões ao classificar esses alimentos. No entanto, houve correlação entre PNAE e as variáveis “censo demográfico”, “número de alunos” e “pobreza” e, assim como entre o PAA e “grupo de alimentos locais” e “pobreza”. Os resultados identificaram a presença de alimentos da biodiversidade local nas compras de ambas as políticas, com destaque para a mandioca como alimento local e sociobiodiverso. No entanto, ainda há uma predominância de alimentos convencionais nessas compras.

Palavras chaves: Alimentos regionais, Alimentos locais, Mercados institucionais, Sociobiodiversidade

Resumen

Además de ser estratégicas para la Seguridad Alimentaria y Nutricional, adquisición pública de alimentos regionales actúan como promotoras y valorizadoras de la biodiversidad brasileña a través de la agricultura familiar. El objetivo de este estudio es identificar la inclusión de alimentos locales, regionales y de sociobiodiversidad en las compras públicas en la Región Intermedia de Marabá como herramienta para la valoración de la biodiversidad. Este estudio retrospectivo, transversal, cualitativo-cuantitativo utilizó datos documentales secundarios sobre las compras recientes de la agricultura familiar en 23 municipios. Los artículos se clasificaron en grupos de alimentos, se presentaron en frecuencias y se analizaron estadísticamente. En ambos programas, los alimentos locales fueron predominantes en los municipios. En el PNAE (Programa Nacional de Alimentación Escolar), el 27,6 % de los ítems eran alimentos de la sociobiodiversidad y el 10,2 % alimentos regionales, mientras que en el PAA (Programa de Adquisición de Alimentos), estas cifras eran del 25,9 % y del 12,4 %, respectivamente. No encontramos diferencias entre las políticas estudiadas ni entre las regiones a la hora de clasificar estos alimentos. Sin embargo, se observó una correlación entre el PNAE y las variables “censo demográfico”, “número de estudiantes” y “pobreza”, así como entre el PAA y “grupo de alimentos locales” y “pobreza”. Los resultados identificaron la presencia de alimentos de la biodiversidad local en las compras de ambas políticas, destacándose la yuca como alimento local y sociobiodiverso. Sin embargo, sigue habiendo un predominio de alimentos convencionales en estas compras.

Palabras-clave: alimentos locales, alimentos regionales, mercados institucionales, sociobiodiversidad

Introduction

In addition to being able to improve Food and Nutritional Security (FNS), public food procurement can promote long-term changes in a food supply chain, for example, changes in agricultural practices or the creation of markets for small-scale producers, who are often marginalized by globalization (Sonnino, 2021). Food Acquisition Program (Programa de Aquisição de Alimentos - PAA) and National School Feeding Program (Programa Nacional

de Alimentação Escolar - PNAE) are successful examples of intersectoral public policies in Brazil. These initiatives contribute to expanding access to food, strengthening family farming, and promoting healthy eating habits (Bocchi et al., 2019; Brasil, 2003, 2009).

According to the Food and Agriculture Organization of the United Nations (FAO) Hunger Map, the average moderate or severe food insecurity in the last three years was 32.8% among the Brazilian population (FAO, 2023). Food insecurity was aggravated by the pandemic caused by COVID-19 and the dismantling of food purchase policies due to limited resources allocated to the PAA and poor management of the PNAE in recent years. General food insecurity (mild, moderate, and severe) is most prevalent in the Northern Region of the country (71.6%), in rural areas (63.8%), and among family farmers (70.6%) (Rede Penssan, 2022).

In this context, the importance of programs like the PAA and PNAE lies in their innovative contribution to Brazil's nutrition-sensitive agriculture strategy. These programs address key issues such as food assistance, income support to farmers, and the promotion of healthier, more nutritious, and diverse diets with local and fresh products, as well as encouraging short food supply chains, which can prevent food loss and waste, promoting sustainable practices, and lower transportation and logistics costs while saving energy (de Souza et al., 2023; Maluf et al., 2015).

One of the key differentiators of public procurement policies such as the PAA and PNAE is the direct acquisition of produce from family farmers without requiring a bidding process. In addition, these policies include criteria that prioritize local, regional, agroecological, and organic foods, as well as specific social groups such as Indigenous peoples and quilombola communities (Brasil, 2009, 2023a; Sambuichi et al., 2022). This expands the possibility of including dietary biodiversity into food policies, such as regional foods and socio-biodiversity resources unique to Brazil's flora. Notably, this includes products from the country's largest biome, the Amazon Rainforest (Beltrame et al., 2021; Brasil, 2015, 2023b).

Despite its remarkable biodiversity, Brazil has limited understanding and representation regarding how these resources contribute to the average Brazilian diet (Gomes et al., 2023). This situation reflects the global trend of food monotony, wherein more than 40% of the daily caloric intake is derived from just three staple crops: rice, wheat and maize (FAO, 2018). Within the context of public food procurement, the inclusion of regional and socio-biodiverse foods remains underexplored in academic research.

Although Brazilian legislation promotes the prioritization of local and regional foods and encourages the procurement of socio-biodiversity products in institutional markets, it does not mandate their exclusive purchase (Brasil,

2003, 2009, 2023a). Challenges persist in ensuring regionalized inclusion, such as the dilemma of mismatch over what is required by institutions and what is traditionally produced by local family farming. This is particularly evident regarding socio-biodiversity products, as institutional food procurement tends to align with conventional dietary patterns (Assis et al., 2019; Brito et al., 2020).

Given the scarcity of research on the regionalization of public food procurement, particularly in the Amazon, this study aims to identify the inclusion of regional foods, socio-biodiversity resources, and locally produced items by family farming in public food procurement in municipalities in the Marabá Intermediate Region in the Eastern Amazon.

Material and Methods

This retrospective, cross-sectional study employed qualitative and quantitative approaches, analyzing secondary data from 23 municipalities within the Marabá Intermediate Region (Figure 1), as classified by the Brazilian Institute of Geography and Statistics (IBGE), and encompass three immediate regions: Marabá, Parauapebas, and Tucuruí (IBGE, 2017a).

Data collection was conducted through documentary research between October 2022 and March 2023. This involved gathering demographic, economic, and social data from official sources, including the IBGE, the Atlas of Human Development in Brazil (2013), the National Fund for the Development of Education (FNDE, 2022) and the Ministry of Development and Social Assistance, Family and the Fight against Hunger - MDS (MDS, 2023).

To identify food demand within the scope of the PNAE in these municipalities, documents from transparency portals were analyzed, primarily obtained from official municipal websites. Additional information was gathered from the website of the Municipal Audit Court of the State of Pará - TCM-PA (Pará, 2022). This included all public calls issued in 2022 and/or active contracts executed by the municipalities as Executing Entities (EEx) during that year.

For the PAA, purchases were identified based on documents issued by entities responsible for publishing public notices related to family farming purchases, initially on the MDS website, considering the Purchase with Simultaneous Donation (CDS) modality on the transparency portal of the National Supply Company (CONAB), the Regional Superintendence of Pará of Conab (SUREG-PA) and the State Secretariat for Assistance and Social Development of Pará (SEASTER-PA), which provided information on purchases made under modality between 2017 and 2022 (CONAB, 2023).

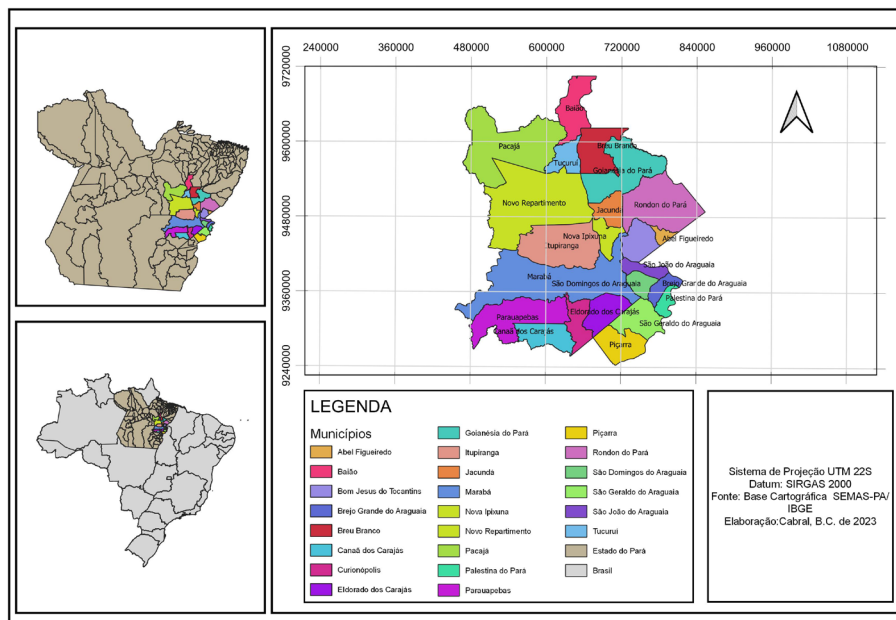


Figure 1. Intermediate Region of Marabá with a limited number of municipalities
Note. Source: IBGE adapted by the authors (2023).

Only public calls from the PNAE were chosen, as the bids and trading sessions do not prioritize family farming in their processes, which constituted an exclusion criterion in this study. The year 2022 was chosen as an inclusion criterion because every municipality receives federal resources annually from the FNDE and must purchase at least 30% of family farming by Law 11,947/2009 and FNDE Resolution No. 6/2020 (Brasil, 2009, 2020).

Unlike the PNAE, many municipalities did not make annual purchases through the PAA. To ensure a better understanding and inclusion of most municipalities in the analyzed region, the study focused on purchases made between the years 2017 and 2022, exclusively in the CDS modality, as it was the main one with the highest federal government investment (Sambuichi et al., 2022).

Data processing was performed using the Microsoft Excel® Program. Food demand was categorized into lists to assess the presence of locally produced foods from family farming, regional foods, and socio-biodiversity items.

Thus, lists comprising three groups were prepared for analysis: Group A - local foods, produced within the municipality by family farming, whose database was based on data from the 2017 Agricultural Census, accessed via the IBGE Automatic Recovery System (SIDRA), which identified a total of 1,006 plant species in the region (IBGE, 2017b); Group B - socio-biodiversity

foods, based on the list of native Brazilian socio-biodiversity species of dietary value, as outlined in the Interministerial Ordinance MAPA/MMA No. 10, dated July 21, 2021. This group included 58 species specific to the state of Pará (Brasil, 2021); Group C - regional foods, identified through the Ministry of Health's publication *Brazilian Regional Foods*. Only foods from the Northern Region were selected, totalling 46 vegetable items and regional preparations (Brasil, 2015).

It should be noted that the species *Eryngium foetidum*, commonly known as *chicoria-paraense/chicoria-do-pará/coentrão* is not listed in Interministerial Ordinance 10/2021 as native to Pará. However, due to its potential natural occurrence in the state and its widespread use in Pará's cuisine (Brasil, 2015; Lucas and Cardozo, 2023), it was included in the study's list as part of Pará's socio-biodiversity.

A quantitative analysis was conducted to determine the simple frequency of the items requested, classified by group. Given that many foods belong to the three groups, the distribution of food was also organized for a better understanding, based on the intersection of these groups by municipality. So, for the food list of regional and socio-biodiversity foods, 25 items were identified from the intersection of groups B and C. Specifically with Group A, the intersections of the three groups were analyzed, considering the specific food list of each municipality. The categorization of food items was then refined into Group $A \setminus (B \cup C)$ — exclusively local foods; Group $B \setminus (A \cup C)$ - exclusively socio-biodiversity foods; Group $C \setminus (A \cup B)$ - exclusively regional foods; Group $A \cap B$ - local and socio-biodiversity foods; Group $A \cap C$ — local and regional foods; Group $B \cap C$, — socio-biodiversity and regional foods; Group $A \cap B \cap C$ — foods classified as local, socio-biodiversity, and regional items, according to the methodology applied by Girardi et al. (2018).

Foods that did not fit into any of the predefined groups were classified as Uncategorized (UC). Local foods (Group A) that were not included in Group B or C, together with UC, were categorized as conventional food group.

Data were analyzed in RStudio® (version R 4.3.1). Results were presented as simple and/or relative frequencies of socioeconomic and demographic variables, classified according to food groups and their intersections.

Given the non-normality of the data, tests were used for non-parametric data. The *Mann-Whitney* test was used to compare the quantities of items required between PAA and PNAE, based on food group classification, disregarding intersections. *Spearman's* correlation was used to outline the relationship between socioeconomic and demographic variables and food group variables. The Chi-square test was also used to compare the categorical variables of regional foods and socio-biodiversity with conventional foods.

Results

The municipalities of Marabá, Parauapebas, and Tucuruí were identified as the most populous, with the largest PNAE clientele and the highest Gross Domestic Product - GDP *per capita*. On the other hand, the remaining immediate municipalities exhibited low to medium Municipal Human Development Index (HDI) values. Additionally, more than half of the populations in these municipalities were found to live in poverty or extreme poverty (Table 1).

Table 1. Socioeconomic and demographic characteristics of the municipalities surveyed

Townships	Demographic Census	GDP ¹ per capita (R\$)	IDHM Range ²	Population in poverty or extreme poverty (%) ³	PNAE – Students in 2022 ⁴
<i>Immediate Region of Marabá</i>					
Abel Figueiredo – M1	7,030	12,780.87	0.622 ^M	67.0	1,853
Bom Jesus do Tocantins – M2	18,005	12,141.30	0.589 ^L	42.5	3,448
Brejo Grande do Araguaia – M3	6,783	12,026.82	0.591 ^L	65.5	2,293
Itupiranga - M4	49,752	12,339.48	0.528 ^L	57.9	12,629
Jacundá – M5	37,707	8,846.22	0.622 ^M	59.4	10,477
Marabá – M6	26,6536	45,602.10	0.668 ^M	33.4	65,532
Nova Ipixuna – M7	13,955	10,036.28	0.581 ^L	45.7	3,553
Palestina do Pará – M8	6,885	10,942.25	0.589 ^L	67.5	1,949
Piçarra– M9	12,832	21,163.94	0.563 ^L	44.3	4,211
Rondon do Pará – M10	53,143	11,904.57	0.602 ^M	28.8	9,274
São Domingos do Araguaia – M11	21,092	11,764.62	0.594 ^L	59.6	6,488
São Geraldo do Araguaia – M12	24,255	24,266.56	0.595 ^L	52.6	7,036
São João do Araguaia – M13	13,465	11,629.44	0.550 ^L	69.4	4,230
<i>Immediate Region of Parauapebas</i>					
Canaã dos Carajás – M14	77,079	591,101.11	0.673 ^M	30.0	16.003
Curionópolis – M15	19,950	36,114.66	0.636 ^M	57.9	6,405
Eldorado do Carajás – M16	28,192	15,342.53	0.560 ^L	46.6	8,110
Parauapebas – M17	266.424	177,992.21	0.715 ^H	26.1	48.278
<i>Immediate Region of Tucuruí</i>					
Baião – M18 -	51,641	12,704.23	0.578 ^L	46.5	5,970
Breu Branco – M19	45,712	10,220.80	0.568 ^L	57.0	12,105

Goianésia do Pará – M20	26,280	9,054.66	0.560 ^L	52.8	8,390
Novo Repartimento – M21	60,732	12,171.19	0.537 ^L	53.9	15,132
Pacajá – M22	41,097	14,941.10	0.515 ^L	72.7	12,105
Tucuruí – M23	91,306	39,674.02	0.666 ^M	45.1	24,908

Note. Source: Own by the authors (2023). ¹Gross Domestic Product (GDP) data (IBGE, 2023); ²Human development data according to the Atlas of Human Development (2010); ³Percentage of individuals registered in CadÚnico within ranges 1 and 2 as of December 2022 (MDS, 2023), compared with the 2022 Demographic Census (IBGE, 2023); ⁴Students enrolled in the PNAE for the financial year 2022 (FNDE, 2022). Abbreviations: L - Low, M - Medium, H - High.

In the analysis of the PNAE documents, all municipalities issued public calls in 2022, except for three that relied on public calls from 2021, though their respective contracts were executed in 2022. Contracts from two municipalities were not identified, and two others had failed public calls, meaning no winners or contracts were finalized.

For the PAA analysis, purchases were identified in 19 municipalities during the investigated years. Of these, 18 were carried out by SEASTER, seven directly with the MDS, and six by CONAB in Pará.

Regarding the presence of local, regional, and socio-biodiverse foods in the public procurement across both programs, considering intersections (Table 2), the majority of foods were classified under Group A\ (B U C), representing exclusively local foods. No records of exclusively regional foods were found, and thus they were not included in the table. Socio-biodiverse foods were more frequent than regional foods, and municipalities that bought less variety of items were also those that allocated fewer resources to socio-biodiverse and regional foods.

In the analysis without considering intersections, a total of 550 items were identified in PNAE purchases, with 74.5% (n=410) classified as local foods, 27.6% (n=152) as socio-biodiverse foods, and 10.2% (n=56) as regional foods. For the PAA, out of 498 total items, the classification was 74.3% (n=370) local foods, 25.9% (n=129) socio-biodiverse foods, and 12.4% (n=62) regional foods. Figure 2 shows the quantitative variations in food categories according to this general classification. Despite these differences, food item purchases were similar in both purchasing policies. Table 3 presents descriptive statistical analysis and frequency distribution of local, socio-biodiverse, and regional food classifications. A proportionately moderate correlation was observed, according to the *Spearman's* coefficient, between most socioeconomic and demographic variables and food purchases in the PNAE. In contrast, for the PAA, only the population living in poverty and extreme poverty showed a significant relationship with the number of local items purchased.

When comparing PAA and PNAE regarding the procurement of regional and socio-biodiverse foods versus conventional foods using the Chi-square test, no statistically significant differences were observed between these groups (Table 4). Similarly, no statistical difference were found between the immediate regions (Table 5).

Considering the variability of food, 116 distinct foods were identified, of which 33 were classified as socio-biodiversity and regional in the PNAE. In the PAA program, there were 76 foods, including 26 socio-biodiversity and regional items. Cassava emerged as the most prominent socio-biodiverse food, being included in 89.5% of the municipalities participating in the PAA and 95.7% of those in the PNAE (Figure 3). Other notable socio-biodiverse items included passion fruit and cupuaçu in the PAA, as well as cassava flour and passion fruit pulp in the PNAE.

The main conventional foods in highest demand are shown in figure 4, with bananas, lemons and pumpkin were the most frequently purchased items in the PAA and cabbage, pumpkin and lettuce were the most sought after for school meal programs.

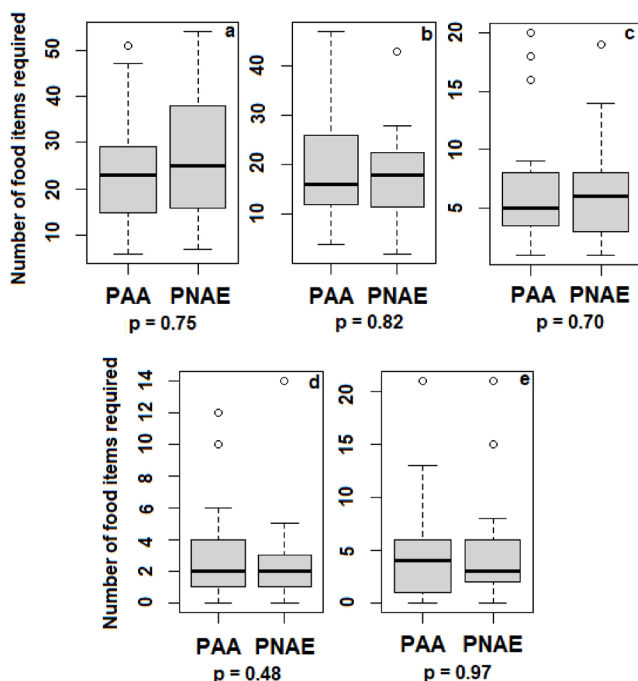


Figure 2. Variations in the number of items required in municipal public purchases by food classification group, presented as a boxplot

Note. Source: Own by the authors (2023). a: Total quantity of items, b: Local items, c: Socio-biodiverse items, d: Regional items, d: Uncategorized items. *Mann-Whitney test.

Table 2. Number of items required in public food procurement, according to food group, by the municipality

Variables	PNAE										PAA									
	A\BUC %	B\AUC %	A∩B %	A∪B %	B∩C %	A∩B∩C %	UC %	Total n (%)	A\BUC %	B\AUC %	A∩B %	A∪B %	B∩C %	A∩B∩C %	UC %	Total n (%)	A\BUC %	B\AUC %	A∩B %	A∪B %
Immediate Region of Marabá																				
Abel Figueiredo	33	17	0	0	0	0	50	6 (100)	-	-	-	-	-	-	-	-	-	-	-	-
Bom Jesus do Tocantins	57	0	18	4	0	4	18	28 (100)	-	-	-	-	-	-	-	-	-	-	-	-
Brejo Grande do Araguaia	39	13	9	0	0	4	35	23 (100)	40	4	4	0	0	4	48	25 (100)				
Itupiranga	59	0	17	3	3	7	10	29 (100)	61	2	17	0	2	9	9	54 (100)				
Jacundá	41	0	12	0	0	0	47	17 (100)	-	-	-	-	-	-	-	-				
Marabá	56	0	20	4	4	8	8	25 (100)	69	0	5	0	5	10	10	39 (100)				
Nova Ipixuna	75	0	17	0	0	8	0	12 (100)	50	0	11	0	6	6	28	18 (100)				
Palestina do Pará	53	0	5	0	0	0	42	19 (100)	59	4	4	0	4	7	22	27 (100)				
Piçarra	23	6	15	2	9	0	45	47 (100)	27	5	5	0	5	0	57	37 (100)				
Rondon do Pará	56	0	28	0	0	11	6	18 (100)	33	0	11	0	0	0	56	9 (100)				
São Domingos do Araguaia	71	0	14	0	0	14	0	7 (100)	34	4	13	0	9	13	28	47 (100)				
São Geraldo do Araguaia	50	7	14	4	4	4	18	28 (100)	54	4	7	0	4	4	29	28 (100)				
São João do Araguaia	45	0	18	0	0	0	36	11 (100)	44	0	19	0	0	25	13	16 (100)				

Immediate Region of Paraupébas																
Canaã dos Carajás	63	0	13	0	3	6	16	32 (100)	88	0	0	0	13	0	0	8 (100)
Curionópolis	75	0	17	0	0	8	0	12 (100)	-	-	-	-	-	-	-	-
Eldorado do Carajás	67	0	28	0	0	6	0	18 (100)	76	0	12	0	0	8	4	25 (100)
Paraupébas	55	0	10	2	10	18	6	51 (100)	58	0	17	0	17	4	4	24 (100)
Immediate Region of Tucuruí																
Baião	46	0	31	0	0	8	15	13 (100)	43	2	19	0	10	19	7	42 (100)
Breu Branco	57	3	14	3	0	6	17	35 (100)	67	0	20	0	0	7	7	15 (100)
Goianésia do Pará	67	5	10	0	0	5	14	21 (100)	71	0	14	0	0	0	14	7 (100)
Novo Repartimento	38	4	18	0	2	4	33	45 (100)	59	0	29	0	6	0	6	17 (100)
Pacajá	48	3	21	0	3	3	21	29 (100)	66	5	7	2	0	7	14	44 (100)
Tucuruí	58	0	21	0	4	8	8	24 (100)	88	0	13	0	0	0	0	16 (100)
TOTAL	51	3	16	1	3	6	20	550(100)	55	2	12	0.2	4	8	19	498(100)

Note. Source: Own by the authors (2023). Group A\ (B U C): Exclusively local foods; Group B\ (A U C): Exclusively socio-biodiversity foods; Group A ∩ B: Local and socio-biodiversity foods; Group A ∩ C: Local and regional foods; Group B ∩ C: Socio-biodiversity and regional foods; Group A ∩ B ∩ C: Local, socio-biodiversity and regional foods; UC: Uncategorized items.

Table 3. Spearman’s correlation coefficient between the socioeconomic and demographic variables and food group required in the PAA and PNAE

Variables	Census Demographic	IDHM	GDP	PNAE clientele	Poverty or extreme poverty
PNAE					
Total items	0.440*	-0,089	0.386	0.538**	0.475*
Group A items	0.635**	0.007	0.444*	0.690**	0,639 **
Group B items	0.593**	-0,076	0.515*	0.659**	0.632**
Group C items	0.610**	0.092	0.589**	0.652**	0.595**
PAA					
Total items	0.099	-0,362	0.181	0.117	0.117
Group A items	0.355	-0,310	0.244	0.355	0.467*
Group B items	0.258	-0,374	0.163	0.246	0.362
Group C items	0.128	0.230	0.164	0.103	0.206

Note. Source: Own by the authors (2023). *Significant correlation with $p < 0.05$; **Significant correlation with $p < 0.01$; Group A: Local foods; Group B: Socio-biodiversity foods; Group C: Regional foods.

Table 4. Distribution of demand for items by food group and procurement policy

Variables	PAA n (%)	PNAEn (%)	p*
Regional and socio-biodiverse	131 (23.3)	157 (28.5)	0.4581
Conventional	367 (73.7)	393 (71.5)	
Total	498 (100.0)	550.0	

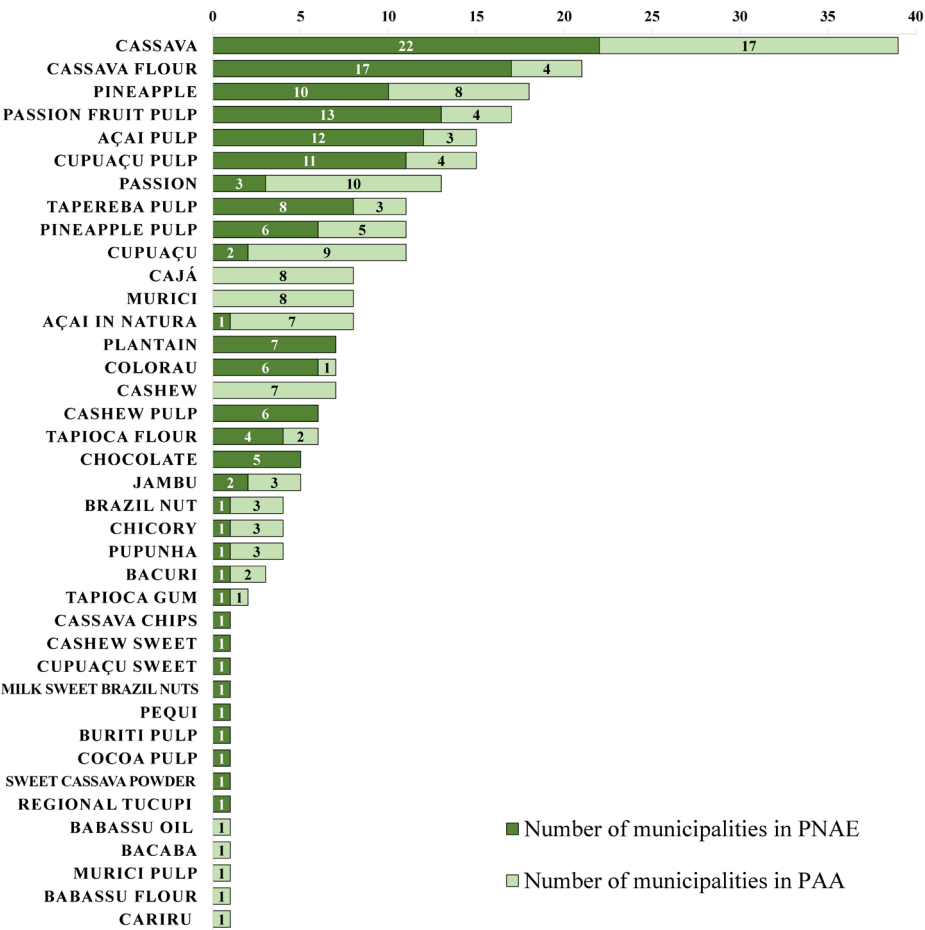
Note. Source: Own by the authors (2023). *Chi-square test

Table 5. Distribution of demand for items by food group, procurement policy, and immediate region

Variables	PAA		p	PNAE		p*
	Regional and Socio-biodiverse n (%)	Conventional n (%)		Regional and Socio-biodiverse n (%)	Conventional n (%)	
<i>Immediate region</i>						
Marabá	73 (24.3)	227 (75.7)	0.3907	73 (27.0)	197 (73.0)	0.6337
Parauapebas	15 (26.3)	42 (73.7)		36 (31.9)	77 (68.1)	
Tucuruí	43 (30.5)	98 (69.5)		48 (28.7)	119 (71.3)	

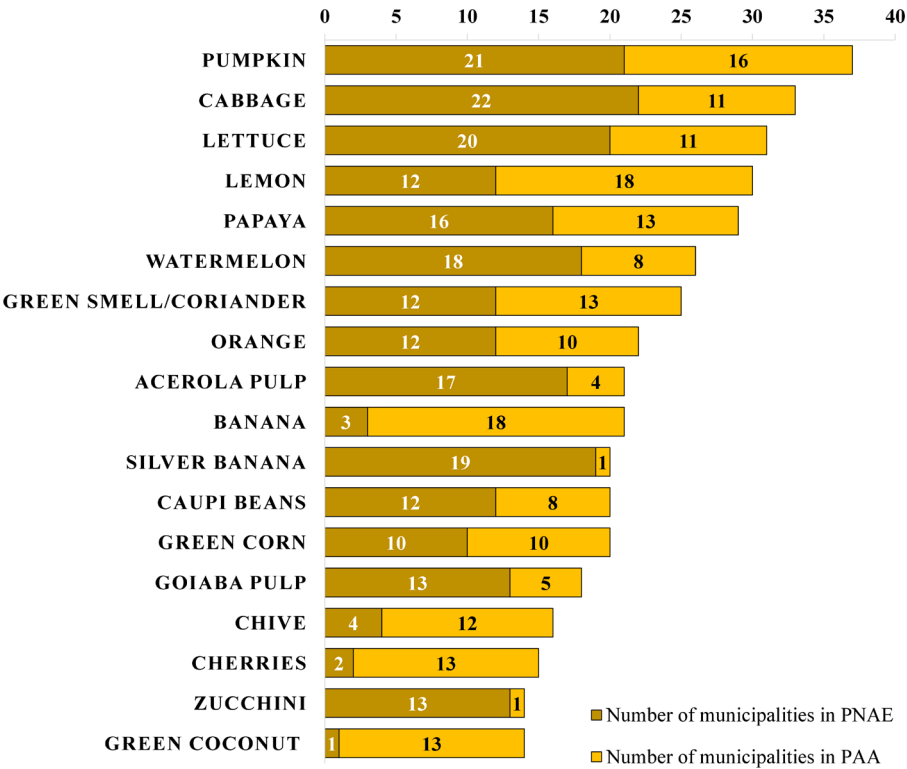
Note. Source: Own by the authors (2023). *Chi-square test

Figure 3. Distribution of regional and socio-biodiverse foods in public procurement based on the number of municipalities



Note. Source: Own by the authors (2023).

Figure 4. Distribution of the most demanded conventional foods in public procurement categorized by the number of participating municipalities



Note. Source: Own by the authors (2023).

Discussion

The economy of the Carajás region, encompassing most of the municipalities in the present study, primarily depends on the extractive industry (mining), followed by agriculture (cattle ranching). At times, the region’s economic growth surpasses the national economy due to the first activity. Although some cities have high GDP levels, the region is marked by extremely high inequality in the distribution of *per capita* income, reflecting negatively on high rates of poverty and extreme poverty, which decrease more slowly than national rates. These economic and social disparities are deeply rooted in the region’s historical concentration of land ownership, conditioning the existence of exclusionary development processes (Monteiro, 2023).

The social data from our study demonstrate the critical role of public procurement programs in advancing Food and Nutritional Security (FNS).

These programs are particularly significant in a region that serves more than 250,000 students and where the majority of the population fits a profile of poverty and extreme poverty that is, whose families survive on a monthly *per capita* income of up to R\$ 105 (extreme poverty - range 1) or from R\$ 105.01 to R\$ 210 (poverty - range 2), according to the analysis of the demographic census of 2022 and the number of people registered in CadÚnico - a federal government registry used to identify low-income families and provide access to social programs (MDS, 2023).

In a global study on school feeding, cultural aspects, food security, and the participation of agriculture were identified as areas requiring greater emphasis within school feeding programs to align with recommendations from the Food and Agriculture Organization (FAO) and the World Health Organization (WHO). In the same study, most of the countries incorporating cultural elements into their school menus predominantly had very high or high Human Development Index (HDI) scores, pointing out that this fact may increase disparities in public health, further distancing the most vulnerable populations from ideal situations (Cupertino et al., 2022).

Directly or indirectly, among the purposes of both policies discussed here, there is the legal recognition of biodiversity, respect for cultural and dietary habits, and prioritization of local and regional purchases by including family farming (Brasil, 2009, 2023a). However, there are local challenges that prevent these recommendations from being implemented.

Tregidgo et al. (2023) point out some challenges peculiar to the Amazon, in the inclusion of socio-biodiversity and regional foods in school feeding programs, such as lack of structure, material, and human resources, making it difficult to prepare food, poor living conditions, limited food supplies for the entire school term, low-quality food items on the menus, and the lack of prioritization of the specific regionalized calls for procurement.

The purchase of locally produced food, according to the Agricultural Census, was unanimous and predominant across all the municipalities in this study, suggesting that the programs act objectively to shorten food marketing chains. According to Maluf (2021), circuits or flows with smaller spatial ranges and operating scales —such as local, territorial, or regional circuits— are inclined to the circulation of foods that are less processed foods that align with socio-environmental and cultural diversity in countries and rural areas. These circuits, often referred to as decentralized food systems, describe how food is produced, marketed, and consumed locally, involving multiple social actors, conflicts, and decision-making processes.

In these systems, institutional markets are based on environmental and civic ethics, including family farming through short production circuits and good agricultural practices. This approach fosters local development, boosts

the local economy, and simultaneously promotes Food and Nutritional Security (FNS) for both beneficiaries and farmers (Marques and Ponzilacqua, 2022). Therefore, through public purchase, local food systems favors creating markets that bring consumers and farmers closer together, encouraging the circulation of food products distinct from those of markets dominated by large corporations (Borsatto et al., 2021).

In a study on the presence of regional foods in Brazilian households, researchers pointed out that there has been a downward trend in consumption by the Brazilian population in recent years (Silva et al., 2022a). In the present study, regional foods were included as part of intersections with local foods and socio-biodiversity but were not identified in isolation. The quantity of socio-biodiverse foods exceeded that of regional foods which was expected since socio-biodiverse items were more numerous and representative of the state rather than solely the Northern Region.

There was a similarity between the two purchasing policies in this study when classifying food items, even across regions. On diversity and variability, in a study conducted by Sambuichi et al. (2019) about the PAA, the authors highlighted that the Northern region of Brazil is a better representative in terms of the number of diverse products, with a wide variety of regional foods and socio-biodiversity. However, reductions in the program's financial resources have disproportionately affected this region with the greatest drop in diversity, indicating that products purchased in small quantities, especially regional and socio-biodiversity products, suffer the most from the reduction of resources.

Although this research did not characterize the farmers or identify the presence of Indigenous Peoples and Traditional Communities as suppliers, it is crucial to highlight the importance of this aspect in any study on socio-biodiversity in the Amazon. Sustainable economic development is intrinsically linked to the ancestral knowledge of forest peoples (Abramovay et al., 2021). In this region, biodiversity is largely preserved within Conservation Units (CUs) and Indigenous Territories (ITs), where multiple Indigenous Peoples and Traditional Communities coexist with a variety socio-biodiversity products. However, the informality of market access hinders an understanding of the true scale and potential. Strengthening initiatives like PAA and PNAE presents a strategic opportunity to consolidate biodiversity while integrating these communities into local markets (Tomchinsky et al., 2023).

Socio-biodiversity was present in almost a quarter of the purchases in this study. In Southern Brazil, Girardi et al. (2018) identified that only 8.5% of socio-biodiversity foods appeared in procurement processes or school menus. Meanwhile, in a six-year documentary study of school meal procurement in a city in Pará, socio-biodiversity products represented 36.6% of demand (Mota et al., 2021).

Purchasing socio-biodiversity foods strengthens small farming community, as they are an integral part of the regional economy. By purchasing these products, we contribute to the generation of local jobs and the sustainable development of the region. Furthermore, many of these farmers adopt agroforestry, composting and organic waste recycling systems, promoting biodiversity and the regeneration of the local ecosystem (Silva et al. 2022b; Silva et al. 2023).

A study conducted in Mato Grosso, Brazil, found that farmers participating in PAA and PNAE programs demonstrated greater agrobiodiversity than non-participants. The guaranteed market and advance contracts motivated farmers to invest in logistics and diversify their production beyond traditional cash crops. However, participants also faced challenges such as limited labour availability, high production costs, and difficulties in diversifying crops, were reported, particularly fresh fruits and vegetables cultivated using agroecological methods (Wittman and Blesh, 2017).

As a highlight of socio-biodiversity, the high demand for cassava presented in the results represents family farming since this segment is responsible for 80% of this food crop in Brazil (IBGE, 2017b). Cassava and passion fruit were the only native foods indicated as high-demand in a study on socio-biodiversity at the PNAE conducted by Brito et al. (2020), likely due to their widespread market presence across all regions of the country.

Chaves et al. (2009) identified that the North region had the lowest inclusion of “regional preparations” in school menus, with only 38%. In another study conducted in a southern Brazilian city considered local and regional foods in the analysis list, approximately 45% of regional preparations and 82.5% of regional foods were also offered on PNAE menus (Fabri et al., 2015).

A moderate positive correlation has been observed between the inclusion of local, regional, and socio-biodiversity foods in PNAE program and factors such as census data, student numbers, and poverty levels. This highlights the importance of dietary diversity for the population served, particularly where over 50% of purchases still focus on conventional foods, such as bananas, apples, tomatoes and others, with particularly low purchases of fruit and vegetables in northern Brazil (Oliveira et al., 2021). This pattern reflects global trends toward agricultural standardization and dietary monotony, which undermine biodiversity and contribute to health issues linked to the consumption of processed food (Abramovay et al., 2023).

Interestingly, about one-fifth of the items in this study were not classified as local, socio-biodiversity, or regional foods. This finding suggests that there may be products that are not from the region or were not identified in the Agricultural Census.

A survey conducted on women and children in seven countries found a positive association between dietary biodiversity and diet quality among vulnerable populations. The study, conducted in areas with high biodiversity supports conservation initiatives and sustainable food systems, pointing to evidence about the role of non-basic foods in enhancing energy and micronutrient intake, in rural areas. In the same study, the researchers highlighted that most species consumed were unique to each study site, highlighting the importance of local food biodiversity for diets (Lachat et al., 2018).

Many of these regional socio-biodiversity foods in this study fall under the concept of Non-Conventional Edible Plants (PANC, Brazilian acronym), a term widely recognized in Brazil. This category encompasses neglected and underutilized species, both native and naturalized, that were once integral to diets but have fallen into disuse, remaining on the margins of the dominant agri-food system. Currently, their use is limited to certain regions or traditional populations. Beyond their nutritional importance and role in food sovereignty, these plants contribute to biodiversity, preserve traditional knowledge, and promote more resilient food systems (Kinupp and Lorenzi, 2014).

This study's data reflect the food demands during the COVID-19 pandemic, highlighting the critical role of programs like PAA and PNAE in combating hunger, especially during crises. Food insecurity in Brazil had already been worsening since 2016, just two years after the country was removed from the FAO Hunger Map in 2014, following the dismantling of these programs (Rede Penssan, 2022). The situation is particularly alarming in the Amazon, a region characterized by persistent socioeconomic inequalities. However, some Amazonian municipalities demonstrated resilience by optimizing PNAE during the pandemic through collaborative efforts between public administrations and social actors. These initiatives underscore the program's potential to serve as a robust FNS tool when effectively implemented (da Silva et al., 2020).

With the ability to decide which foods to purchase (nutritious, healthy, and biodiverse), in addition to a powerful FNS instrument for those who receive and consume food, public procurement has the potential to address various components of the food system. It has the potential to reshape dietary patterns, promote more sustainable production patterns, and consequently, influencing healthier and more sustainable diets (Swensson and Tartanac, 2020).

Brazil is still moving slowly on studies on sustainable diets, unlike other countries where the debate, although recent, is on the rise, especially in Europe. While some Brazilian studies explore the connections between FNS, food sovereignty, sustainable development, agroecology, and family farming, among other topics, the role of diet and food consumption in the sustainability and direction of a sustainable food system remains largely

marginalized (Triches, 2021). Furthermore, it is known that one of the great challenges in acquiring a diverse range of foods from family farming is the action of governments to ensure that farmers have the infrastructure and capacity to supply the foods required by schools and other public services (de Souza et al., 2023).

It must be considered that there is limited research on the dimensions of the two policies related to the purchase of local, socio-biodiversity, and regional foods, especially for the PAA, bringing to our study an innovative reflection, even if locally. According to Cipriani, Barros, and Gabriel (2023), in addition to the scarcity in the scientific literature, there is a lack of standardization in terms used to describe regional foods, culinary preparations, and socio-biodiversity in the context of school feeding, which can generate different interpretations, especially among the social actors responsible for implementing the program, thus making the effective introduction of these foods even more difficult.

This research is limited by its focus on a single Brazilian region and the representation of local foods based on the IBGE Agricultural Census database, which means the actual number of local species may be greater than that reported here. Additionally, the study exclusively analysed procurement invitations and contracts from PNAE and PAA to identify institutional demand, without examining accountability documents such as invoices to verify the foods purchased and payments made to farmers. Future studies should go beyond procurement processes to gain a deeper understanding of the actual inclusion of these foods in public food procurement policies.

Conclusions

Based on the results of this study demonstrate that local, socio-biodiversity, and regional foods were included in the PAA and PNAE programs within the studied regions, with similar acquisition patterns across policies, immediate regions, or food groups. A moderate positive correlation was observed between some social indicators and food groups in the PNAE. Despite the predominance of demand for local foods, these foods are mostly conventional, such as bananas, lemons, pumpkin, cabbage, and lettuce. Cassava was the food for socio-biodiversity that stood out and was in high demand by most municipalities. However, the absence of parameters, minimum obligations, or standardized terminology in the legislation of the two programs regarding regional foods and socio-biodiversity, there is a certain comparative difficulty for the results of this study and highlights a gap in the literature.

Based on the understanding that public food procurement is one of the major strategies for valuing biodiversity, promoting healthy eating habits, and respect for peoples' culture, more sustainable trade practices, and local

income generation, specific actions are suggested. These include greater legislative clarification on the subject by the competent bodies; sensitization of managers responsible for executing the programs; food and nutrition education actions for beneficiaries, recipients and suppliers of these foods; encouraging the shortening of supply chains and their importance for sustainability; and encouraging more research in the area to understand and implement the promotion and increased consumption of regional foods and socio-biodiversity.

Acknowledgements

The authors wish to thank the Superintendência Regional do Pará da Companhia Nacional de Abastecimento - Conab (SUREG-PA), the Secretaria de Estado de Assistência Social e Desenvolvimento do Pará (SEASTER-PA) and the support of Arni/Propit/Unifesspa through Notice No. 04/2023 – PAPQ.

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