

Adequacy of school menus and national school food program requirements: a systematic review

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Abstract

Objectives: this review aimed to evaluate the adequacy of school menus regarding the nutritional requirements of the Programa Nacional de Alimentação Escolar (PNAE) in Brazilian public schools regarding the presence of macronutrients and micronutrients and allocation of resources to purchase products from family farming.

Methods: a systematic literature review was carried out using the SciELO, Bireme and Lilacs databases to select the articles. The inclusion criteria were articles that presented data on the adequacy of energy, macronutrients, micronutrients, and purchases of products from family farming during the PNAE regimen, as well as quantitative, cross-sectional, and descriptive studies carried out in the Brazilian territory. Review, editorials, letters, case studies, duplicates and those that did not assess the requirements of the PNAE were excluded.

Results: at the end, 12 studies were included that showed overestimation and underestimation of nutritional adequacy in the school environment. In relation to purchases of inputs from family farming, it was observed that most of the Brazilian municipalities evaluated fulfilled the requirements for the allocation of resources.

Conclusion: school menus need more supervision so that they meet the adjustments proposed by the PNAE. In addition, it is essential to promote a healthy diet that contains all the nutrients necessary to provide nutritional support for child growth and development.

Key words School meals, Child, Nutrition



Introduction

Changes in the current lifestyle have promoted the adoption of eating practices that can contribute to the increase in overweight and obesity, especially in childhood.¹ In addition, social, economic and cultural changes also influenced the establishment of habits and behaviors, including the increase in consumption of ultra-processed foods (UPF) with a high concentration of energy, fat, sugar and sodium. Associated with this, there is a decrease in the intake of in natura foods such as cereals, legumes, fruits, vegetables and legumes.² This change in food intake has occurred more frequently in the early stages of life, such as childhood.³ A study that evaluated the food consumption of schoolchildren based on the National School Health Survey observed a daily consumption of 42.8% UPF among Brazilian adolescents.⁴

The school food environment should be a place to promote healthy eating habits, with a positive impact on the child's growth and development process.⁵ Inadequate nutrition in these stages of life can generate nutritional deficiencies and contribute to the appearance of Chronic Noncommunicable Diseases (NCDs), including obesity in adulthood.⁶ Evidence shows that severe changes in nutritional status and nutrient intake can impair school performance due to changes in brain development and memory capacity.⁷ In this way, school meals must be of appropriate quality and quantity, with the purpose of ensuring the essential nutritional needs, promoting adequate development and healthy eating habits.⁶

The National School Feeding Program (PNAE) aims to provide healthy meals, food and nutrition education actions to promote biopsychosocial growth, better school performance and healthy eating practices during the school period.⁸ In a study that evaluated the execution of the PNAE, it was observed that most problems were related to the reduction in acquisition of food from family farming and in the nutritional composition of the menus.⁹ The requirements of the PNAE are current strategies to reduce the prevalence of food and nutrition insecurity and hunger.¹⁰ These actions directly cause growth in the household income of residents under the age of eighteen and rural workers.¹¹

Thus, it is important to observe the implementation of nutritional and food requirements determined by the PNAE and to evaluate the adequacy of school menus regarding the purchase of products from family farming and the adequacy of nutrients. In addition, it is not clear how school menus are adapted and monitored in terms of PNAE requirements. Therefore, the aim of this systematic review was to evaluate the adequacy of school menus regarding the nutritional requirements of the PNAE in public schools in the national territory, considering the adequacy of macronutrients and micronutrients and

allocation of resources for purchases of products from family farming.

Methods

This is a systematic review of the literature, from which searches were carried out in original scientific articles that evaluated the recommendations required by the PNAE regarding nutritional adequacy in school menus. This review followed the recommendations of PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses).¹²

To carry out the searches, the following keywords were used based on Health Sciences Descriptors (DECS), forming the following equation: Alimentação AND escolas públicas. The articles were selected through the bases Scientific Electronic Library (SciELO), Latin American and Caribbean Literature on Health Sciences (*Lilacs*) and Regional Library of Medicine (*Bireme*). The searches were carried out in August/2022 by two independent researchers and discrepancies were resolved with the help of a third author. The agreement between the authors was evaluated using the Kappa coefficient ($k=0.089$, $p=0.542$).

For the inclusion criteria, studies that evaluated food according to the nutritional requirements of the PNAE in relation to the adequacy of calories, macronutrients (proteins, carbohydrates, and lipids), micronutrients (vitamin A and C, calcium, iron and sodium) and/or or purchase of products from family farming. In addition, quantitative, cross-sectional, and descriptive studies carried out in Brazil were included. Review articles, case studies, articles in duplicates and articles that did not assess the requirements of the PNAE were excluded. There was no distinction regarding language and year of publication.

All articles that met the eligibility criteria were evaluated in terms of title and abstract. Those for which it was not possible to identify their inclusion by title and abstract were evaluated for the full text.

After reading the included articles, data extraction was performed by two independent authors. Disagreements were discussed to reach a consensus. For the preparation of the qualitative synthesis, data were selected on: Author and year of publication, sample, type of study, method of evaluating the requirements of the PNAE, variables studied and results regarding the requirements of the PNAE.

Results

In total, 1020 studies (Bireme: 603/ SciELO: 94/ Lilacs: 323) were selected in the databases. After Reading the titles, abstracts and full text, 186 duplicates were excluded using

ENDNOTE® software. 834 articles were also excluded due to the reason that they were review articles, case studies, duplicates and articles that did not evaluate the subject. Finally, 12 studies that met eligibility criteria were included (Figure 1). Of the 12 selected studies, 4 evaluated the adequacy of menus¹³⁻¹⁶ and eight evaluated the purchase of family farming products.¹⁷⁻²⁴

Of the selected studies, most were published between 2018 and 2019 (n=7). The studies used a sample of PNAE students and managers. Most studies were carried out in the South (Paraná, Santa Catarina and Rio Grande do Sul) and Southeast (Minas Gerais, Rio de Janeiro, and São Paulo) regions (Table 1). Of the studies that evaluated the adequacy of menus, all were carried out in public, municipal or state schools, in different age groups, from nursery to Youth and Adult Education (EJA - Portuguese acronym). The menus were evaluated through quantitative analysis and direct weighing of the foods. The description of the studies and the adequacy results are shown in Table 2.

The adequacy of energy (kcal) and macronutrients was investigated in four studies. Studies that observed inadequacy of energy, carbohydrates and lipids observed that menus were above (>110%) or below (<110%) the recommendation. Only the study by carried out by Araújo *et al.*,¹³ observed adequacy of protein recommendations. About micronutrients, inadequacy of vitamin A C, calcium and iron was observed in most of the institutions that evaluated inadequacy. Regarding sodium levels, only one study evaluated its adequacy, observing high consumption in preschool (four to five years), Elementary I (6 to 10 years) and II (11 to 15 years) and high school (16 years). to 18 years). The percentage of inadequacy varied between 101.8% and 191.9%.¹⁵

The acquisition of products from family farming was investigated in eight studies as described in Table 3.¹⁷⁻²⁴ The investigation of the purchase of products from family farming was evaluated in different municipalities. Of the eight studies evaluated, five revealed that the investigated municipalities used at least 30% of the resources transferred by the FNDE to purchase products from family farming.^{17,18,20,23,25}

Figure 1

Study selection flowchart.

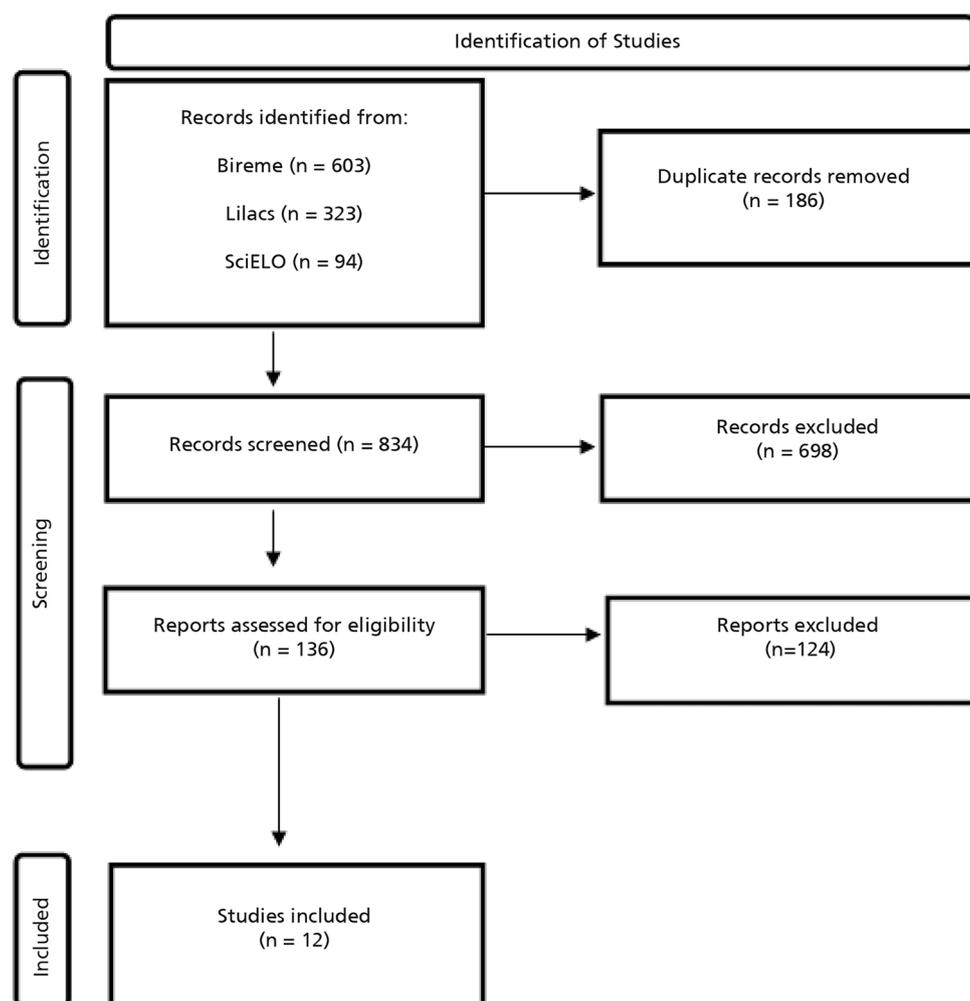


Table 1

Description of the studies selected regarding the sample, place of execution and executing institution of the PNAE.					
Author, year	Sample	Place of execution	Executing institution of the PNAE	Characteristics of the menus	Evaluation method
Araujo et al., ¹³ 2021	393 students	Piauí	2 state urban public schools: School A: Full-time primary and secondary education; School B: Full-time High School;	10 quantitative menus with 30 meals according to age group (11-15 years old/16-18 years old/19-30 years old).	Quantitative analysis of menus using the per capita of each meal to assess the nutritional composition.
Alencar et al., ¹⁴ 2016	114 students (2-5 years).	South zone of the Northeast city, Brazil	3 urban public schools: CMEI-A and CMEI-B: partial regime; CMEI-C: full regime.	15 daily menus according to age group (1-3 years / 4-5 years)	Quantitative analysis of menus by weighing food on a digital scale. Based on the weighing, the nutritional composition was evaluated.
Leão et al., ¹⁵ 2018	61,521 students (34,973 from municipal education and 26,548 from state education)	Pará	210 municipal and state public schools (152 rural schools; 58 urban schools). Type of regime was not informed.	The menus were defined according to age group (1 to 3 years old / 4 to 5 years old / 6 to 10 years old / 11 to 15 years old / 16 to 18 years old / 19 to 30 years old and 31 to 60 years old). Number of evaluated menus was not informed.	Quantitative analysis of menus using the per capita of each meal to assess the nutritional composition.
Rocha et al., ¹⁶ 2018	268 students (8 a 9 years).	Minas Gerais	17 urban schools in the municipal and state public network.	Information on the number and type of menus according to the assessed age group were not informed.	Quantitative analysis of menus by weighing food on a digital scale. Based on the weighing, the nutritional composition was evaluated.
Dias et al., ¹⁷ 2020	uninformed	All Brazilian capitals	uninformed	uninformed	The analysis of the menus was carried out based on secondary data referring to the years 2016 and 2017 available on the websites of the IBGE, FNDE and MDA.
Ferreira et al., ¹⁸ 2019	100 PNAE managers	Rio de Janeiro	Urban and rural municipal schools. Number of schools and type of regime was not informed.	uninformed	Analysis using a semi-structured questionnaire with information about the percentage of purchases of food from family farming.
Otoni et al., ¹⁹ 2019	93 372 students	All Brazilian capitals	238 rural and urban municipal schools. Type of regime was not informed.	uninformed	Analysis using data from the FNDE.
Souza e Villar, ²⁰ 2019	uninformed	São Paulo	105 rural and urban municipal schools. Type of regime was not informed.	uninformed	Analysis through a semi-structured questionnaire applied to the director of the institution.
Machado et al., ²⁵ 2018	uninformed	5184 Brazilian municipalities	Rural and urban municipal schools. Number of schools and type of regime was not informed.	uninformed	Analysis through an electronic questionnaire of the Google Docs® application applied to the nutritionist in charge of the PNAE.
Soares et al., ²² 2018	4031 students	Paraná	23 public elementary schools. Type of regime and area of location (urban or rural) were not informed.	uninformed	Analysis of public calls obtained from the technical manager of the PNAE.
Ferigollo et al., ²³ 2017	N uninformed	Rio Grande do Sul	Schools in 52 municipalities in urban and rural areas. Number of schools and type of regime was not informed.	uninformed	Analysis of public calls through telephone calls with qualified professionals from city halls.
Gabriel et al., ²⁴ 2012	97 700 students	Santa Catarina e Pará	26,522 municipal institutions in Florianópolis and 71,186 municipal institutions in Belém in the urban and rural areas of the public schools.	uninformed	Analysis through a questionnaire applied to the PNAE technical manager.

CMEI = Municipal Children's Education Center; PNAE = National School Feeding Program; N = number of participants; IBGE = Brazilian Institute of Geography and Statistics; FNDE = National Education Development Fund; MDA = Ministry of Agrarian Development.

Table 2

Author, year	Nutritional Adequacy								
	Energy (Kcal)	PTE (g)	CHO (g)	LIP (g)	Vit. A (µg)	Vit. C (mg)	Calcium (mg)	Iron (mg)	Sodium (mg)
Araújo <i>et al.</i> , ¹³ 2021	11-15 years: 86.2% ↓	11-15 years: 99%	11-15 years: 91%	11-15 years: 63.3% ↓	11-15 years: 35.72% ↓	11-15 years: 101%	11-15 years: 32.13% ↓	11-15 years: 227% ↑	-
	16-18 years: 76.1% ↓	16-18 years: 93.8%	16-18 years: 80.36 ↓	16-18 years: 55.8% ↓	16-18 years: 87.1% ↓	16-18 years: 87.1% ↓	16-18 years: 32.13% ↓	16-18 years: 187.1% ↑	
	19 - 30 years: 80.8% ↓	19 - 30 years: 90.26%	19 - 30 years: 85.4% ↓	19 - 30 years: 59.3% ↓	19 - 30 years: 70% ↓	19 - 30 years: 70% ↓	19 - 30 years: 41.77% ↓	19 - 30 years: 250.4 ↑	
Alencar <i>et al.</i> , ¹⁴ 2016	CMEI-A (1 - 3 years): 126.4% ↑	CMEI-A (1 - 3 years): 188.6% ↑	CMEI-A (1 - 3 years): 135.3% ↑	CMEI-A (1 - 3 years): 67.8% ↓	CMEI-A (1 - 3 years): 459.5% ↑	CMEI-A (1 - 3 years): 1157.6% ↑	CMEI-A (1 - 3 years): 62.3% ↓	CMEI-A (1 - 3 years): 191.4% ↑	-
	CMEI-B (1 - 3 years): 78.1% ↓	CMEI-B (1 - 3 years): 153.2% ↑	CMEI-B (1 - 3 years): 69.7% ↓	CMEI-B (1 - 3 years): 53.9% ↓	CMEI-B (1 - 3 years): 64.4% ↓	CMEI-B (1 - 3 years): 368% ↑	CMEI-B (1 - 3 years): 34.8% ↓	CMEI-B (1 - 3 years): 108.6%	
	CMEI-C (1 - 3 years): 135.9% ↑	CMEI-C (1 - 3 years): 126.3% ↑	CMEI-C (1 - 3 years): 128% ↑	CMEI-C (1 - 3 years): 136.6% ↑	CMEI-C (1 - 3 years): 72.8% ↓	CMEI-C (1 - 3 years): 335.8% ↑	CMEI-C (1 - 3 years): 106% ↓	CMEI-C (1 - 3 years): 75.1% ↓	
	CMEI-A (4 - 5 years): 93.6%	CMEI-A (4 - 5 years): 141.3% ↑	CMEI-A (4 - 5 years): 100.1%	CMEI-A (4 - 5 years): 49.8% ↓	CMEI-A (4 - 5 years): 344.6% ↑	CMEI-A (4 - 5 years): 694.6% ↑	CMEI-A (4 - 5 years): 38.9%	CMEI-A (4 - 5 years): 134% ↑	
	CMEI-B (4 - 5 years): 57.9% ↓	CMEI-B (4 - 5 years): 114.9% ↑	CMEI-B (4 - 5 years): 51.6% ↑	CMEI-B (4 - 5 years): 39.3% ↓	CMEI-B (4 - 5 years): 48.3% ↓	CMEI-B (4 - 5 years): 220.8% ↑	CMEI-B (4 - 5 years): 21.8% ↓	CMEI-B (4 - 5 years): 76% ↓	
	CMEI-C (4 - 5 years): 100.1%	CMEI-C (4 - 5 years): 93.1%	CMEI-C (4 - 5 years): 95.3%	CMEI-C (4 - 5 years): 100.4%	CMEI-C (4 - 5 years): 54.6% ↓	CMEI-C (4 - 5 years): 212.8% ↑	CMEI-C (4 - 5 years): 66.3% ↓	CMEI-C (4 - 5 years): 52.6% ↓	
	Nursery: 143.7% ↑	Nursery: 157.5% ↑	Nursery: 133.8% ↑	Nursery: 167.9% ↑	Nursery: 101.4%	Nursery: 274.2% ↑	Nursery: 149.8% ↑	Nursery: 165.3% ↑	Nursery: 83.4% ↓
	Preschool: 77.1% ↓	Preschool: 92%	Preschool: 67.2% ↓	Preschool: 95.4%	Preschool: 32.9% ↓	Preschool: 66% ↓	Preschool: 21% ↓	Preschool: 35% ↓	Preschool: 191.9% ↑
	Elementary 1: 62.9% ↓	Elementary 1: 69.2% ↓	Elementary 1: 55.8% ↓	Elementary 1: 73.2% ↓	Elementary 1: 21.7% ↓	Elementary 1: 42.7% ↓	Elementary 1: 15.1% ↓	Elementary 1: 38.9% ↓	Elementary 1: 162.5% ↑
	Elementary 2: 43.4% ↓	Elementary 2: 47.8% ↓	Elementary 2: 38.5% ↓	Elementary 2: 50.4% ↓	Elementary 2: 15.5% ↓	Elementary 2: 24.9% ↓	Elementary 2: 12.2% ↓	Elementary 2: 33.3% ↓	Elementary 2: 162.5% ↑
	High School: 30.2% ↓	High School: 30.9% ↓	High School: 26.5% ↓	High School: 40.5% ↓	High School: 15% ↓	High School: 14.3% ↓	High School: 12.3% ↓	High School: 19.2% ↓	High School: 101.8%
	EJA 1: 31.6% ↓	EJA 1: 31.6% ↓	EJA 1: 26% ↓	EJA 1: 42.2% ↓	EJA 1: 16.1% ↓	EJA 1: 14.7% ↓	EJA 1: 15.2% ↓	EJA 1: 23.1% ↓	EJA 1: 85.1% ↓
EJA 2: 32.7% ↓	EJA 2: 32.5% ↓	EJA 2: 26.9% ↓	EJA 2: 43.7% ↓	EJA 2: 16.1% ↓	EJA 2: 15.7% ↓	EJA 2: 13.8% ↓	EJA 2: 29% ↓	EJA 2: 85.1% ↓	
Rocha <i>et al.</i> , ¹⁶ 2018	Municipal school: 69.1% ↓	Municipal school: 76.1% ↓	Municipal school: 74.8% ↓	Municipal school: 62.8% ↓	Municipal school: 63.4% ↓	Municipal school: 35.1% ↓	Municipal school: 25.1% ↓	Municipal school: 94.4%	-
	State school: 67.4% ↓	State school: 84.0% ↓	State school: 65.5% ↓	State school: 58.6% ↓	State school: 118.8% ↑	State school: 22.8% ↓	Esc estaduais: 10,0% ↓	State school: 55.5% ↓	

CMEI = Municipal Children's Education Center; PNAE = National School Feeding Program; PTE = protein; CHO = carbohydrate; LIP = lipids, Vit. A = Vitamin A; Vit. C = vitamin C; EJA = youth and adult education; ↓ below adequacy; ↑ above adequacy; = adequate.

Table 3

Description of the results regarding the purchase of food from family farming for the composition of school menus regarding the requirements of the PNAE.

Author, year	Place of execution	Purchasing information source	Purchase of products from family farming
Dias <i>et al.</i> , ¹⁷ 2020	All Brazilian capitals	Website of the Ministry of Agrarian Development and transparency portal	↑ 30% of PNAE resources
Ferreira <i>et al.</i> , ¹⁸ 2019	38 municipalities from Rio de Janeiro	Semi-structured questionnaire built by the researchers	↑ 30% of PNAE resources
Otoni <i>et al.</i> , ¹⁹ 2019	749 Brazilian municipalities	Not informed	43,3% of the municipalities carry out purchases; Information on % resource allocation was not provided.
Souza e Villar, ²⁰ 2019	25 municipalities from São Paulo	Structured questionnaire	↑ 30% of PNAE resources
Machado <i>et al.</i> , ²⁵ 2018	5,565 Brazilian municipalities from all Brazilian regions	Structured questionnaire	Southeast region: ↓ 30% of PNAE resources Other regions: ↑ 30% of PNAE resources
Soares <i>et al.</i> , ²² 2018	23 elementary education units in Paraná	Public calls, bids and accountability of the PNAE.	29.5% of the funds transferred by the FNDE were used to purchase
Ferigollo <i>et al.</i> , ²³ 2017	52 municipalities from Rio Grande do Sul	Websites and municipal public transparency portals.	71.2% of municipalities: ↑ 30% of PNAE resources
Gabriel <i>et al.</i> , ²⁴ 2012	Florianópolis and Belém	Script with open questions about the functioning of the PNAE applied to program managers	0% of PNAE resources

↑ over 30% allocation of resources; ↓ below 30% allocation of resources; PNAE = National School Feeding Program; FNDE = National School Development Fund.

In Machado *et al.*²⁵ several Brazilian municipalities in all regions (North, Northeast, South and Midwest) purchased products from family farming and only those in the Southeast region did not reach the 30% required by the PNAE. In addition, in one of the studies it was observed that the allocation of resources occurred below the requirements (29.5%).²² However, the percentage of purchase from family farming met the recommendations of the PNAE. In another study, it was observed that no resources were allocated to purchases of food from family farming.²⁴

Discussion

This systematic review evaluated the adequacy of school menus in terms of PNAE requirements for the nutritional adequacy of macro and micronutrients, in addition to the allocation of resources from the purchase of food from family farming. It was possible to observe that the requirements of the PNAE for nutritional adequacy were not met for most of the evaluated nutrients, as well as the allocation of resources for the purchase of family farming inputs does not occur in all municipalities, in which the resource is transferred.

According to the PNAE, recommendations for nutritional adequacy for daycare centers should be 70% of total energy needs in full-time schools and 30% of needs for part-time students, considering variations of 10% above or below 100 % of recommendations.¹⁴ For basic education, recommendations should be 20% of nutritional requirements for one meal and 30% for two or more meals.²⁶ For students enrolled in full-time schools, nutritional needs must meet 70% of food intake spread over at least three meals. Nutritional adjustments must meet the closest values recommended by Article 18 of the Resolution of the Deliberative Council of the National Education Development Fund (CD/FNDE – Portuguese acronym) No. 06, of May 8, 2020.

The PNAE has norms to establish and ensure good nutrition for students and organization regarding financial resources. The adequacy of reference values is an important factor that will contribute to the supply of nutrients to students during their time at school.¹⁰ The supply of daily energy needs should seek to achieve nutritional goals that can avoid deficiencies or excess consumption of energy and nutrients, also preventing the emergence of nutritional disorders such as obesity or malnutrition.²⁷ Therefore, the PNAE acts as a guarantee mechanism for Food and Nutrition Security.

It is known that during childhood, adequate energy supply is necessary in sufficient quantity to provide nutrients for the processes of cellular hypertrophy and hyperplasia.²⁸ Food during childhood is an important

factor for development and growth, and may help prevent diseases that may develop in adulthood.²⁹ Thus, the school environment exerts great influence on the establishment of eating habits in childhood.³⁰

Well-nourished children reach their full potential for growth and development and some micronutrients are essential at this stage. Iron, for example, is essential for cognitive development. Prevention of iron deficiency in childhood is carried out through supplementation and increased intake of iron-rich foods in the diet.³¹ A cohort that investigated the long-term effects of iron deficiency observed that, at age 19, young people who were iron deficient as children performed less well on a recognition memory test when compared to those without iron deficiency in early life.³²

A cohort that investigated the long-term effects of iron deficiency observed that, at age 19, young people who were iron deficient as children performed less well on a recognition memory test when compared to those without iron deficiency in early life.³³ In the study of Leão *et al.*,¹⁵ sodium inadequacies ranging from 85.1% to 191.9% were observed. A study carried out with Brazilian preschool children observed that those with sodium intake greater than 1,200 mg/day have 3.32 (CI95%=0.98-11.22) times more likely to have high systolic blood pressure. The authors suggested that the main source of this micronutrient came from UPFs, since the salt added to the preparations was not evaluated.³⁴ In Resolution No. 06/2020, a maximum of 20% of PNAE resources can be used to purchase UPFs, such as refreshments, canned goods and sausages. It is possible that the inadequacies observed in the present review are due to the increase in the purchase and supply of ultra-processed foods, since they are negatively associated with the consumption of iron, zinc, phosphorus, magnesium, proteins, fibers, potassium and vitamins B12, C and E, and positively associated with the energy density of Brazilian diets.³⁵

When the purchase of food occurs primarily through the PNAE, there is a greater purchase of fresh and minimally processed foods. In a descriptive cross-sectional study that evaluated the degree of food processing obtained through the PNAE in three municipalities in southern Brazil, it was observed that there were greater purchases of in natura and minimally processed foods, which represented 49.8% of the total energy purchased. It should be noted that, among the acquisitions of family farming evaluated in the study, 51.3% of the total energy purchased came from in natura and minimally processed foods.³⁶ Thus, there is an importance of family farming to strengthen healthy eating habits in the school environment. In addition, it contributes to an adequate diet in qualitative and quantitative terms.

However, there are still regions that do not reach the purchase percentage required by the PNAE. As required by the PNAE, the purchase of food from family farming must be 30% of total purchases.¹³ Family farming is of great importance for school meals, as a way to strengthen local agriculture. The inclusion of products from family farming in school meals is an action that promotes food and nutritional security. Family farming respects biodiversity, food autonomy and environmental sustainability.³⁷ Thus, like the PNAE, the food acquisition program (PAA – Portuguese acronym) uses family farming as a way of encouraging the sale of local products and promoting access to adequate and healthy food.³⁸ In addition, it allows for a more sustainable food grouping, bringing together producers and consumers in order to improve the habits and food culture of each place.³⁹ Therefore, the FNDE, together with the PNAE, plays an important role in the mediation process between farmers and the public authorities, acting in the negotiation of menus, prices, among other items.

This review has limitations. Among them, only one study estimated the adequacy of sodium and only one study carried out direct weighing of foods, limiting the observation regarding the seasonality of foods. However, three large databases were consulted to identify the studies included in the review, making it possible to assess the adequacy of menus served for different age groups and regions of Brazil. In addition, this study draws attention to the need to evaluate the menus that are being served to schools, as well as purchases for their implementation, especially in scenarios of dismantling social public policies. Furthermore, it was possible to observe the interconnection between nutritional aspects and political, economic, and social aspects.

Final considerations

The nutritional requirements according to the PNAE were not followed, when the nutritional adequacy is an allocation of resources above 30% for the purchase of products from family farming. Thus, it is observed that there is a need in relation to the adequacy of menus for a better nutritional supply that provides adequate nutrients for school performance, growth, and human development. In addition, the need for regulatory bodies to supervise the execution of the PNAE in the municipalities is reinforced, given its importance in combating food and nutritional insecurity.

Authors' contribution

Santos GCJ: research design and design, data collection, analysis, and interpretation of results, writing and critical

review of the manuscript. Fernandes MSS: research design, data analysis, critical review of the manuscript. Ribeiro IC: data collection and analysis, interpretation of results, writing and critical review of the manuscript. Oliveira TLPSA: data collection, analysis, and interpretation of results, writing and critical review of the manuscript. Silva JA: research design and design, data collection, analysis, and interpretation of results, writing and critical review of the manuscript. The authors approved the final version of the article and declare that there is no conflict of interest.

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