

Nutrition

School meals' centesimal and mineral composition and their nutritional value for Brazilian children



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ABSTRACT

The assessment of meals served under the Brazilian National School Meal Program (PNAE) is an important tool to verify its adequacy to the proposed parameters and the nutritional needs of school-aged children. The aim of this study was to evaluate the centesimal and mineral composition of the meals offered by the program and adequacy to the nutritional recommendations in three municipalities of the state of Bahia, Brazil. Centesimal composition of meals was determined according to the reference guidelines and mineral composition was analyzed by atomic absorption spectrometry. Non-parametric analysis of variance was used to test the differences of the medians among the municipalities and Student-t test to compare the means between the two sampling periods. There were inadequacies in the carbohydrate, lipid and protein contents, and none of the municipalities reached the recommendation of 20%. Mineral concentration, especially Fe, Se, Cu and K were much lower than expected. Sodium levels were three-folds higher than the recommended, being worrisome due to higher risk of elevated blood pressure. There were inadequacies with regard to the PNAE guidelines, and there is a need to reevaluate the meals that are being offered to better meet children's needs and to form healthy habits from childhood.

1. Introduction

Nutritional deficiencies in school-aged children have a strong impact on their intellectual and behavioral development, which is why infant feeding has been evident in several studies conducted in different countries [1–4].

At this age, quality and amount of food are determinant for the maintenance of the growth rate, which must be constant and adequate to enable satisfactory physical and psychosocial health [5]. Growth in this period is slow but steady, with increasing maturation of motor skills besides cognitive, social and emotional development [6], with the nutrients that make up the daily meals of extreme importance for child growth. It is important to emphasize that children's school performance is directly related to their nutritional status. Malnourished children with specific nutritional deficiencies, such as anemia and hypovitaminosis A, are more likely to have attention problems, compromising physical and intellectual development [7]. In this sense, it is important that well-prepared school meal programs exist in order to promote the

incorporation and maintenance of healthy eating habits, as well as contribute to the prevention of nutritional deficiencies and also of excessive weight gain.

The Brazilian National School Meal Program (PNAE) was created in order to guarantee to students of the basic education level, school meals, with the aim of attracting students to schools, reducing absenteeism rates and improving school progression rates [8,9]. According to this Program, school meals should supply, at least 20% of the nutritional needs of part-time students, 300 kcal and 9.4 g/day of protein, according to age and sex differences among children in the same school [6].

Thus, the purpose of this study was to evaluate the centesimal and mineral composition of the meals offered by the Brazilian National School Feeding Program and its adequacy to the nutritional recommendations established by the Program in three municipalities of the state of Bahia, Brazil.

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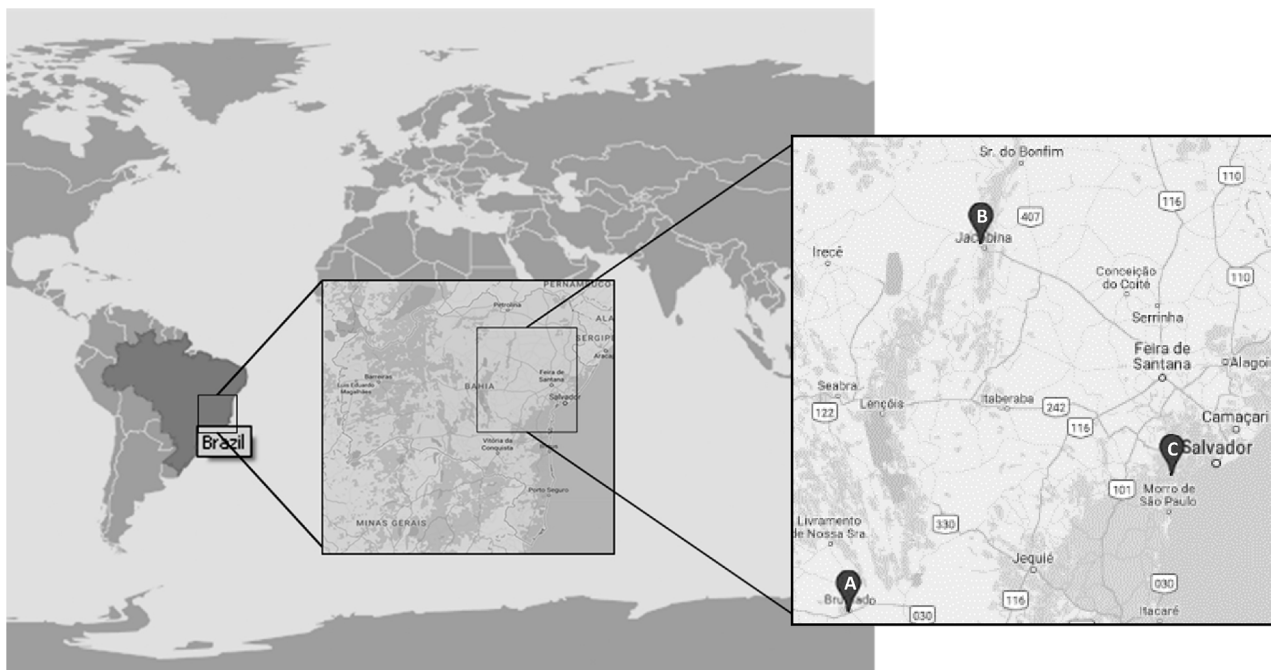


Fig. 1. Geographic location of the study areas. Municipalities: Brumado (A); Jacobina (B); Jaguaripe (C). Salvador, Bahia State capital (D) for simple reference.

2. Material and methods

A cross-sectional, exploratory study with quantitative approach was carried out, with data collection and sampling of school meals, in public institutions of basic education, in three municipalities of the State of Bahia, Brazil (Fig. 1).

2.1. Study area

In order to select the municipalities to be included in the study, a number of considerations were made, regarding several viabilities: population size, interest of the authorities in the study, distance from our base. However, the main selection criterion was based on the school performance ranking that was published by the Brazilian National Institute of Educational Studies and Research Anísio Teixeira (INEP) in the year 2013 [10]. In Brazil, school performance by municipality is determined by the IDEB score (Basic Education Development Index), an index calculated from data on school approval rate (obtained in the School Census) and average performance in the evaluations carried out by the INEP. This is ranked on a scale of 0–10. In the data presented in the year 2013, the national IDEB score average stood at 5.2; In relation to the state of Bahia, the mean IDEB was 3.9, with a range of 2.8–5.6. Due to these disparate values, three municipalities with different evaluations of the IDEB were selected: a) Brumado, a municipality in southwest Bahia located 550 km from Salvador, with an estimated population of 69,473 inhabitants [11] and per capita income of US\$ 120.9, HDI (Human Development Index) of 0.659 and IDEB score of 5.6 (the highest score in the state); B) Jacobina, located 330 km from Salvador, in the mid-west of the state, region of the Chapada Diamantina, has an estimated population of 83,435 inhabitants [11], per capita income of US\$ 122.1, HDI of 0.649 and with IDEB score of 3.9; C) Jaguaripe, located in the Recôncavo Baiano, with an estimated population of 18,849 inhabitants [11], per capita income of US\$ 74.0, HDI of 0.556 and whose IDEB score was 2.8 (one of the lowest in the state).

According to the school census [11], in 2015, the municipality of Brumado registered a total of 9296 enrollments in elementary education, of which 8324 were in municipal schools, which represents approximately 83% of all school-age children that are covered by the PNAE. In Jacobina, the total number of enrollments was 11,752, of

which 8324 were in elementary schools in the town, and therefore comprised 71% of the children. Jaguaripe, in turn, presented a total number of 2668 enrollments; however, 2548 of these were in the municipal schools, which indicates that the PNAE covered 95% of the children of this municipality, being quite representative of the importance of the assistance offered by the Program, which includes daily school meals.

We contacted the municipal authorities to get authorizations and then, appointments were made with the nutritionists in charge of each municipality to obtain additional information and set up meetings to arrange sample collections, which were planned for the two academic semesters of 2016.

2.2. Sample planning and collection technique

In order to perform a direct evaluation of the students' daily intake, the duplicate portion technique was used. This methodology consists of collecting and analyzing a portion identical to the one ingested by the study population during a given time, ranging from 1 to 7 days [12]. An adaptation was performed according to Weber & Morais [13], and a portion identical to the school meals offered to the children in the selected schools (including food and beverage) was collected during a three – alternating-day period. Since the purpose of this investigation was to analyze the nutritional contribution of the meal offered in the school environment and the compliance with the recommendations of the current Legislation, we did not attempt to include children's diet at their homes. In each municipality, four schools (representing between 10–25% of municipal schools) were randomly selected by drawing lots, and the collections were carried out in two semesters, totaling 72 meal samples for analysis (3 sampling days \times 4 schools \times 3 municipalities \times 2 semesters). The visits occurred without prior notice to the school principals, aiming to collect meal samples more representative of the daily reality.

At each school, the periodic menu prepared by the nutritionists was obtained and the distribution of the meals prepared for the students was observed. A similar sample to that the children were offered was obtained. Weighed in portable scale (Tramontina, N61101000, São Paulo, Brazil), homogenized in a blender (Mondial, DG-01, São Paulo, Brazil) and transported to the laboratory in iced-pack coolers. Meal samples

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