

Best practices in school food and nutrition units of public schools of Bayeux, PB, Brazil

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Abstract *The occurrence of foodborne illness outbreaks is increasing in schools, and due to the number of children who consume school meals as the only daily meal, this factor becomes even more worrisome. In this sense, the aim of this study was to evaluate the hygienic-health aspects of Food and Nutrition Units (SFNU) of public schools of Bayeux / PB in relation to the adoption of best practices in school food and nutrition. Data were collected through SFNU checklist during visits to units in 29 schools. The health risk of units evaluated was from regular to very high regarding structure and facilities, hygiene of food handlers, environment and food preparation. It was found that 10.3% of handlers used clean and adequate uniforms, and environment and equipment showed poor conservation status in 75.9% and 89.7% of Units, respectively; control of urban pests and vectors was not effective and cleaning of fresh produce was incorrectly conducted in 51.7% of SFNU of schools evaluated. It could be concluded that the production of meals in SFNU of schools evaluated does not meet the requirements established by the best practices in school food and nutrition.*

Key words *Food, School, Hygiene, Food handling*

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Introduction

The feeding of students has had positive effects on growth and biopsychosocial development, learning and student achievement, which is the main purpose of the National School Feeding Program (PNAE), currently managed by the National Fund for Educational Development (FNDE) of the Ministry of Education, and provides through subsidies, school feeding for all basic-education, kindergarten, elementary-school, high-school students and education of youth and adults¹.

Public schools attend a vulnerable population in relation to nutritional and socio-economic aspects, and due to the fact that most children consume school meals as the only daily meal, the production of safe food in this environment is a necessary practice². In Brazil, from the total number of foodborne illness outbreaks (FIO) reported from 1999 to 2008, 10.7% of cases occurred in educational institutions³. Children are more susceptible to FIO due to their immune system still in development, with less capacity to combat infections. For example, among other factors, the production of hydrochloric acid in the stomach is not sufficient to combat harmful bacteria⁴.

As with other School Food and Nutrition Units (SFNU), there is an intense food production and handling in public school units, which demonstrates the need for the implementation of the Best Practices for School Food and Nutrition (BPSFN), which can be evaluated by using the "Checklist of Best Practices for School Food and Nutrition" of BPSFN, which was developed by the Center of Workers in School Food and Nutrition Units (CECANE) in partnership with the National Fund of Education Development (FNDE), based on ordinances and resolutions of the states of São Paulo and Rio Grande do Sul and on DRC 216/2004^{5,6}. In this context, this study aimed to evaluate the hygienic-health aspects of School Food and Nutrition Units (SFNU) of the city of Bayeux (PB) in relation to personal hygiene of food handlers and the adoption of the Best Practices in School Feeding (BPSF).

Methods

Data were collected from visits to School Food and Nutrition Units (SFNU) of all public schools ($n = 29$) of Bayeux (PB), a municipality located in the metropolitan area of João Pessoa, in the period between January and June 2013, per-

formed at a single time, characterizing it as a cross-sectional study.

Data collection was conducted by a field evaluator that participated in previous training using a validated instrument, based on the Checklist of Best Practices for School Food and Nutrition (BPSFN)^{6,7}. The instrument consists of items related to the construction, maintenance and cleaning of facilities, equipment and utensils used; control and quality of prepared food; professional training; control of hygiene and health of handlers; handling of waste management and integrated control of vectors and urban pests, evaluated in relation to the final score as percentage according to the health risk classification into: very high health risk (score between 0 and 25%), high health risk (score between 26 and 50%), regular health risk (score between 51 and 75%), low health risk (score between 76 and 90%), very low health risk (score between 91 and 100%)^{6,7}.

Descriptive statistics of the results obtained by the percentage quantitative values was initially performed, and then considering the correlation strengths and their error probability ($p \leq 5\%$), the Pearson correlation test was performed (r), in which correlation strengths were classified into negligible (0.01 to 0.09), low (between 0.10 and 0.29), moderate (0.30 to 0.49), substantial (0.5 to 0.69) and very strong (≥ 0.70), as suggestions by Davis⁸. Later, Multivariate Analysis of Principal Components (APC) was held by chart in order to better elucidate the interdependence between variables and correlations among the 29 SFNU and the total percentage computed for each group of items of the BPAE Checklist⁶, which were encoded as A (group of items related to personal hygiene of food handlers), B (groups of items related to the hygiene of the environment and physical area), C (group of items related to hygiene, food handling and storage) and D (group of items related to the place and safety at work).

Results and discussion

After analyzing the items in the BPAE Checklist^{6,7}, it was observed that 4.4% of School Food and Nutrition Units (SFNU) present low or very low risk in relation to items evaluated (76-100%), demonstrating that most units presented high inadequacy index. Among schools, 48.3% were classified as regular health risk (score 51-75%), 24.3% as high health risk and 24.0% as very high health risk, i.e., score 0-25%.

In School Food and Nutrition Units visited, one of the first items observed was the personal hygiene of food handlers. In this item, the most significant inadequacies were the presence of ornaments, such as necklaces, bracelets, earrings and especially rings, which were used by 65.5 % of handlers (Table 1).

It was observed that 89.7 % of handlers in SFNU did not use standard uniform, but rather everyday garments like trunks and shirts with inappropriate colors, and in only some units, handlers wore caps and aprons. Results similar to those of the present study were observed in schools of Castanhal (PA), in which none of the handlers wore uniforms and wore adornments, which is not allowed during the production of meals⁹. Similarly, a study carried out in a municipal school in the city of Rialma (GO) observed that food handlers wore normal clothes, nail polish, ring and earrings, wearing only disposable cap and apron¹⁰. According to RDC No. 216/04⁵ and the Guide for Best Practices for School Food and Nutrition⁶, the personal hygiene of the manipulator is of utmost importance, and appropriate clothing is recommended, which should be kept clean, and adornments must be removed during the production of meals.

In 96.6% of schools, food handlers of Food and Nutrition Units used sandals or open shoes and not rubber soled shoes, which are required to work in a kitchen. Failure to use the proper footwear when handling the food as well as the lack of personal hygiene can also bring risks of accidents for food handlers.

Most of the items related to hygiene and environmental structure and physical area of Food and Nutrition Units (SFNU) were classified between high and very high risk (Table 2), being observed that tiles were cracked and with the

presence of dirt, roof had no ceiling, walls were with peeling paint and with mold, fixtures without any protection and rusty and broken lockers in insufficient quantities.

Structural problems similar to those detected in this study were also observed by Mezzari and Ribeiro¹¹ and by Oliveira et al.¹² in Food and Nutrition Units of municipal schools. In the SFNU of a municipal school of Campo Mourão (PR), the walls had cracks and holes, ceilings had water infiltration and there were no screens on doors and windows for protection against the entrance of vectors¹³. In SFNU of the city of Marília (SP), it was observed that workbenches had a dark and worn-out appearance and also had cracks; the ceiling showed cracks and leaks; the walls had old tiles, had porosity and grouting was dirty; the floor was worn and dirty¹². The National Health Surveillance Agency recommends through RDC 216/04⁵ and the Guide for Best Practices for School Food and Nutrition⁶ that the physical facilities such as floor, wall, ceiling, benches, doors and windows should have smooth, waterproof, washable coating, which should be kept intact, preserved free from cracks, leaks, spills, mold, peeling, among others in order not to transmit contaminants to food⁴.

The conservation status of facilities did not correspond to recommendations in 82.8% of units, since the structure in general was not suitable for food production. Walls, ceilings, floors were worn, and some storerooms had infiltrations. Some of the units had exposed wiring and piping, which in addition to causing dirt accumulation makes kitchen an unsafe place to work. Similar conditions were observed in over 25% of Food and Nutrition Units of schools in Salvador (BA), in which electrical installations were exposed, which contributes to dirt accumulation

Table 1. Health risk classification adapted and assigned to personal hygiene of the School Feeding Unit staff (SFNU) of 29 public schools of Bayeux - PB, 2013.

Item	Score(%)	Classification
Adequate hand washing and hygiene	58.60	Situation of regular health risk
Presence of garments	34.50	Situation of high health risk
Short and clean nails	55.20	Situation of regular health risk
Presence of strangers	6.90	Situation of very high health risk
Standard uniform	10.30	Situation of very high health risk
Use of rubber soled shoes	3.40	Situation of very high health risk
Poor posture while lifting weight	6.90	Situation of very high health risk
Organization for work performance	72.40	Situation of regular health risk
Overall assessment of UANE in this item	44.83	Situation of very high health risk

and makes the place unsafe to work¹³. In Food and Nutrition Units of schools of Marília (SP), the lack of protection of fixtures and switches and exposed wires were also observed¹².

Equipment such as blender, refrigerator, stove, freezers, and others were damaged and unfit for use and in 89.7% of the visited SFNU, these should be replaced by new ones. Stoves were among equipment showing more damage, which in most units were completely rusted, and freezers were out of order despite being new. Utensils (mugs, plates, cutlery, pans, etc.) were inadequate in 62.1% of visited units because they were not stored in appropriate cabinets to be protected from dirt. Some pans were in very bad condition (rusted, smashed and broken) and many were even stored on the floor. Accessories like sponge, soap support, dishcloth, among others, were non-compliant in 69% of units, because they were worn and needed to be replaced by new ones. Utensils and equipment present in evaluated SFNU were outside norms recommended by the Guide for Best Practices for School Food and Nutrition⁶, which states that equipment and utensils that come in contact with food must be of materials which do not transmit toxic substances, odors or flavors to food, must be resistant to corrosion and to repeated sanitization operations, and should be kept in proper condition.

In a study by Cardoso *et al.*¹³ in 235 public elementary schools of the city of Salvador (BA), 63.0% of furniture and 68.9% of equipment were in precarious conservation status, conditions also observed in this work. Similar results were observed in the study performed in six public schools in the municipality of Passos (MG),

where checklist applied to School Food and Nutrition Units showed that of 126 items of the group of utensils and equipment, 77% indicated that the amount of equipment was insufficient for the work demand, with older models and poor storage and hygiene conditions¹⁴.

Despite the general structure of the units are in poor condition, lighting and ventilation were adequate in 72.4% of SFNU. Lighting was sufficient to visualize dirt and the natural color of food and units had sufficient ventilation for the comfort of handlers, food preservation and air renewal. These results were also observed in SFNU of schools in Salvador (BA), in which it was observed that the lighting was adequate in 90.2% of 235 kitchens of public schools, although in most of them, no lamp protection was found (96.6%)¹³.

In 55.2% of the visited SFNU, the level of organization was out of compliance, which it was observed that disorganization occurs mainly by the inadequate size and structure of units. The shortage of cabinets and shelves prevents the storage of utensils, requiring storing them on the top of tables or at the bottom of sinks. In other units, it was observed that size and structure were no problems, but the lack of training of handlers, which did not organize shelves, cabinets, workbenches and tables properly.

The control of insects and urban pest was not done frequently, since the presence of flies, ants, spider webs, among others was observed in all Units. Some school principals reported that the units would be fumigated the following week; however, such a procedure would not be useful in the long term because inadequate sanitation,

Table 2. Classification of health risk adapted and assigned to hygiene and structure of the environment and physical area of School Food and Nutrition Units (SFNU) of 29 public schools of Bayeux - PB, 2013.

Item	Score (%)	Classification
Environment	24.10	Situation of very high health risk
Equipment	10.30	Situation of very high health risk
Utensils	37.90	Situation of high health risk
Accessories	31.00	Situation of high health risk
Conservation status of facilities	17.20	Situation of very high health risk
Ventilation and lighting	72.40	Situation of regular health risk
Organization	44.80	Situation of high health risk
Cleaning of workbenches, tops and sinks	44.80	Situation of high health risk
Removal of garbage	62.10	Situation of regular health risk
Control of rodents and insects	0	Situation of very high health risk
Overall assessment of UANE in this item	34.46	Situation of high health risk

lack of screens on the window and unprotected ceiling in some units make the presence of insects to be permanent. The same situation was observed in study by Silva et al.¹⁴ in units of six state schools in the municipality of Passos (MG), where it was observed that 83.3% of institutions do not adopt any preventive and corrective action to avoid the attraction of vectors and pests such as screens on windows and doors.

There is no doubt about the importance of adequate infrastructure to produce meals in Food and Nutrition Units, especially in SFNU that are inserted in actions recommended by PNAE such as: 1. Review of the specification of equipment and utensils used in SFNU, especially regarding the hygiene and ergonomics in the work process; 2. Review the uniform specification and use of Personal Protective Equipment (PPE) by food handlers, for the prevention of occupational accidents and improvement of the sanitary conditions of meals; 3. Definition of technical standards for construction and reforms in SFNU aiming at improving the ergonomic working conditions, workflow and consequently the health of workers and quality of food offered¹⁵. Vieira et al.¹⁶ observed that the adaptation of SFNU to existing spaces not only hinders workflow and processing but also contributes to food contamination by microorganisms.

The BPAE Checklist applied to units also evaluated hygiene, handling and storage of food (Table 3). In 51.7% of units, vegetables were cleaned only with running water, and no sanitizer was used. Similar results were found in a study conducted in thirteen Public and Philan-

thropic Kindergartens in São Paulo, where it was observed that in 80% of kitchens, handlers did not perform adequate disinfection of foods that would not be submitted to the cooking process¹⁷.

According to Silva et al.¹⁴, in 87.8% of SFNU of public schools in Passos (MG), products not indicated for the cleaning of perishable foods were applied; raw foods were in contact with cooked food; food products were placed together with cleaning products; refrigerators were not properly cleaned, and fresh produce was inadequately cleaned.

During visits to the units, in 82.8% of them, handlers talked while preparing meals and in 51.7%, open food not marked with date of opening and validity outside their original packaging were found or, when in other container, they did not have proper seal. According to RDC No. 216/04, foods that were not used in their entirety must be packaged and properly identified with at least the following information: product name, date of fractionation and shelf life after opening or removed from original packaging⁵.

The risk of cross-contamination in the evaluated units is high, considering that in 82.8% of units, handlers often do not wash their hands when changing activity; leave meats next to fruit pulps or hygiene products, and because some freezers are out of order, meats were stored together with vegetables that were not sanitized. To avoid cross-contamination, the RDC No. 216/04 states that it is imperative to avoid direct or indirect contact between raw, semi-prepared and prepared foods, and employees who handle raw foods should wash and sterilize their hands be-

Table 3. Classification of health risk adapted and assigned to hygiene, handling and storage of food in School Food and Nutrition Units (SFNU) of 29 public schools in Bayeux - PB, 2013.

Item	Score (%)	Classification
Produce properly washed	48.30	Situation of high health risk
Rice and beans properly washed and selected	96.60	Situação de risco sanitário baixo
Talking, coughing or sneezing on the food preparation	17.20	Situation of very high health risk
Thawing procedure	58.60	Situation of regular health risk
Separation of food by categories	79.30	Situation of low health risk
Food validity control	100.00	Situation of very low health risk
Open products being used and unidentified	34.50	Situation of high health risk
Refrigerator organization	48.30	Situation of high health risk
Reuse of foods	3.40	Situation of very high health risk
Meat storage	69.00	Situation of regular health risk
Risk of cross-contamination	6.90	Situation of very high health risk
Temperature and overall conditions of products	55.20	Situation of regular health risk
Overall assessment of UANE in this item	51.45	Situation of regular health risk

fore handling other foods⁵. Cardoso et al.¹⁸ detected a high rate of contamination in food after processing, especially in the post-cooking period, mainly due to the lack of equipment for warm temperature maintenance.

According to descriptive results, specific correlations between groups of items evaluated with the BPAE Checklist were determined (Table 4). There was a significant positive correlation between groups A and B, thereby indicating that the cleaning and the structure of the environment and the physical area are associated to personal hygiene of food handlers, being harmed when this is not appropriate.

It appears that groups A and C showed a moderate positive correlation, demonstrating that the personal hygiene of handlers is associated to cleaning and satisfactory food handling. In items A and D, the correlation strength was also moderately positive, and it was observed that inadequate hand hygiene of food handlers, uniforms inappropriate for work, presence of ornaments, lack of care for nails (items evaluated in group A) are directly related to the presence of strangers in the unit, lack of proper footwear and lack of organization for appropriate work of handlers (items evaluated in group D), which shows the lack of training.

The correlation strength between groups of items B and C was substantially positive due to the fact that both are related to hygiene, demonstrating that failures in one of the items consequently lead to other problems. Groups C and D showed a significant positive correlation, where it was observed that inappropriate care by food

handlers is interconnected with neglected safety in the workplace.

Figure 1 shows, by Multivariate Analysis of Principal Components (APC), the resulting correlation strengths between groups of the items evaluated by the BPAE Checklist with evaluated schools, so most schools were not correlated with the following list of items of the BPAE checklist: Personal hygiene (A), Hygiene and structure of the environment and physical area (B), hygiene, handling and storage of food (C) and safety at work (D).

Group A showed higher correlation with group B, showing that inadequate personal hygiene of each handler is interrelated with improper sanitation and structure of the environment and physical area of the unit. It could also be observed that Group B is close to group C, which makes it clear that hygiene, inadequate handling and storage of foods are correlated with inadequate cleaning of the environment and physical area. Group D kept a weaker correlation with the others because this group assessed through the BPAE checklist regarding safety at work, showing little relation to the other evaluated items.

It is observed in the APC graph that school 26, for being very close of group B, indicates strong inadequacy in this item. This school was in poor condition with regard to physical and equipment area, because it had cracked and broken tiles, presence of mold on ceiling and walls,

Table 4. Correlation between the items evaluated in the Best Practices for School Food (SFNU) and Nutrition Checklist of 29 public schools of Bayeux-PB, 2013.

Groups	A	B	C	D
A	1,00	0.57**	0.47**	0.38*
B		1.00	0.59**	0.39*
C			1,00	0.51**
D				1.00

A = Personal hygiene; B = Environmental Hygiene and physical area; C = Hygiene, handling and storage of food; D = Local and Safety at Work; E = Relationship. * The Correlation is significant at the 0.05 level (one end), according to Pearson Correlation (strengths1 to ÷ 1); ** The correlation is significant at the 0.01 level (one end), according to Pearson Correlation (strengths1 to ÷ 1).

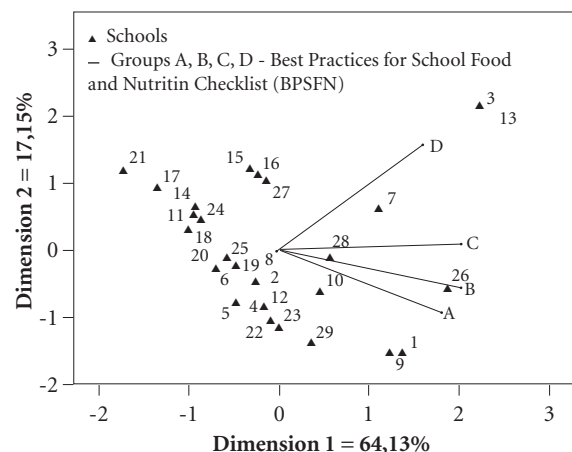


Figure 1. Multivariate Analysis of the Principal Component (APC) of the items evaluated by Best Practices for School Food and Nutrition Checklist (BPSFN) applied to the School Food and Nutrition Units of 29 public schools of Bayeux - PB, 2013.

cooking pans were in poor conditions and the stove was extremely rusty and defective in one of its supporters. Ventilation and lighting were also not enough, leaving the Unit in the dark and with high temperature. In addition, this unit is extremely small, which contributes to poor organization and high temperature.

Schools 1 and 9 were very close to group A, as in both SFNU, handlers do not wash their hands when changing from one activity to another and when they did, the procedure was not correct due to the lack of products suitable for such activity. The uniforms of the unit's employees were not suited to the environment, handlers did not use aprons or caps during visits and shoes were not appropriate.

It was observed that schools 3 and 13 were close to point D, demonstrating that both units did not have a work organization among cooks and many school officials were in the kitchen during the preparation of meals, and at times even helped in these activities, even though not trained to perform such functions. From the observed situations, it is noteworthy that the large number of meals prepared and served in improper operating conditions, the long time between preparation and distribution and insufficient training of food handlers greatly increase the exposure of food to contamination and microbial proliferation¹⁹, constituting an aggravating factor for students, given that many of them do not have access to adequate food in qualitative and quantitative terms, being considered vulnerable to present a more severe clinical condition of foodborne illnesses (DVAs)¹⁸.

SFNU of school 21 is far from points A, B, C and D because it was one of the few units that

showed that employees wash their hands properly, had no ornaments, nails were short and without polish and had clean and appropriate uniform, used caps and aprons during handling and distribution of food. Although some equipment is out of order, the Unit was organized and sanitized.

Conclusion

It was observed that a significant number of School Food and Nutrition units assessed were classified as high or very high health risk due to the low compliance with regulatory requirements regarding aspects of the Best Practices for School Food and Nutrition, requiring adjustments in services to ensure safety of food provided. In the evaluation by items, the aspects that contributed to non-compliance with current legislation comprised those concerning the structure and facilities of Units, food handlers and hygiene of the environment and food, all of which are correlated.

The production of meals in SFNU evaluated does not meet the food safety requirements, which leads to risks to the health of students. Financial investment aimed at improving the facilities of SFNU is necessary, but the food handlers' profile has not been defined, which was considered a study limitation. Higher qualification of these professionals is suggested through regular training sessions held by the nutritionist with the aim of promoting changes in the behavior of handlers targeting both their professional training as the safety of food supplied in schools in view of the significant lack of knowledge on the Best Practices for School Food and Nutrition.

Collaborations

ACC Lopes participated in data collection, design and writing of the manuscript; DCIO Costa participated in data collection and tabulation; RJ Mascarenhas participated in statistical analysis and interpretation of results; HRF Pinto and JS Aquino participated in orientation and writing of the manuscript and interpretation of data.

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