

Sanitary status of public school food services in Maceió (Alagoas, Brazil), 2013

Aspectos higiênico-sanitários dos serviços de alimentação das escolas públicas de Maceió, 2013

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RESUMO

The risk of foodborne illnesses is related to incorrect food handling practices and food service infrastructure and equipment. This study aimed to assess the sanitary status of the food services of public schools in Maceió. The services of 40 of 121 schools were chosen by simple random sampling. The assessment used a good-practices checklist containing all of the rules in Resolution 216/04 of the National Sanitary Surveillance Agency. The possible answers were “in compliance” and “not in compliance,” which were then considered to determine the compliance of the service with the above-mentioned Resolution. The services were classified as: critical ($\leq 30\%$), unsatisfactory (31 to 49%), regular (50 to 69%), satisfactory (70 to 89%), and excellent ($\geq 90\%$). Not one service achieved regular, satisfactory, or excellent compliance; 23 (57.5%) and 17 (42.5%) presented with unsatisfactory and critical compliance, respectively. The main problems were bad infrastructure and poor food-handling practices. The services do not comply with the norms for safe food production. This situation demands urgent action from the professionals and managers responsible for school meals, nutrition, and student health in the capital of Alagoas.

KEYWORDS: School Feeding; Food Services; Food Hygiene; Food Handling; School Health

ABSTRACT

Objetivou-se avaliar os aspectos higiênico-sanitários dos serviços de alimentação dos estabelecimentos públicos de ensino fundamental de Maceió, Estado de Alagoas, Brasil. De um total de 121 escolas, 40 foram selecionadas por sorteio simples e tiveram seus serviços avaliados. Para isso, utilizou-se um *checklist* de boas práticas baseado na Resolução 216/04 da Agência Nacional de Vigilância Sanitária, constando 83 questões referentes aos aspectos higiênico-sanitários, cujas respostas, “conforme” ou “não conforme”, determinam o percentual de adequação do serviço. De acordo com este percentual, os serviços foram classificados nas seguintes categorias: crítico ($\leq 30\%$), insatisfatório (31 a 49%), regular (50 a 69%), satisfatório (70 a 89%) e excelente ($\geq 90\%$). Nenhum serviço atingiu a condição de regular, satisfatório ou excelente, sendo que 23 (57,5%) serviços apresentaram nível insatisfatório e 17 (42,5%) nível crítico. As principais inconformidades relacionaram-se às condições de infraestrutura e à baixa qualificação dos funcionários no que se refere às boas práticas de manipulação de alimentos. Os serviços estudados não atendem às normas de produção de alimento seguro, situação que constitui uma violação ao direito humano à alimentação adequada e demanda providências urgentes por parte dos profissionais e gestores envolvidos com a alimentação, nutrição e com a saúde dos escolares da capital alagoana.

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INTRODUCTION

Cultural, social, and biological factors make food one of people's most important requirements¹. Food involves aspects that range from food production on the one hand to food intake in order to obtain the energy and nutrients for the body's cells (nutrition) on the other; and using foods to create nutritious meals is an important stage in this process. An appropriate diet is essential for full development, growth, and health², and so it is stipulated by the Brazilian Federal Constitution as a right of every citizen³. Inappropriate diets can lead to nutritional deficiencies when the nutritional requirements of the body are not met, and they are also associated with some microbiological and/or toxicological diseases known as foodborne illnesses⁴. The risk of foodborne illnesses is related to incorrect food-handling practices and food service infrastructure and equipment⁵.

The growing number of food services has increased the exposure of foods to contaminants, thus facilitating the transmission of foodborne illnesses. Food service managers strive to offer nutritionally appropriate foods and to guarantee their safety².

The concern with providing safe foods becomes even greater when the National School Food Program (PNAE) is involved, because its target population consists mainly of children. Children are considered especially vulnerable to foodborne illnesses, especially those from lower socioeconomic strata. According to Gomes et al.⁶, the food provided by PNAE to some of these low-income children is the most important meal of their day. Because of their greater likelihood of being debilitated by nutritional deficiencies, they tend to have less competent immune systems, making them more vulnerable to diseases in general^{4,6,7}.

Recent data suggest that 10.7% of foodborne illness outbreaks in Brazil occur in teaching institutions². Given the magnitude of the problem and the associated health hazards, foodborne illness outbreaks in teaching institutions are a public health problem in Brazil⁶. Some studies^{8,9,10,11} have shown that the food services of public schools usually have unkempt and poorly planned facilities and resources that promote food contamination. Figueiredo¹² mentioned the inadequate assessment of PNAE operations, including the safety of the distributed foods.

To date, no study has assessed the food preparation practices in the food services of the public schools of Maceió, the capital of the state of Alagoas. The present study therefore aimed to assess the sanitary status of the food services in the public schools of Maceió.

MATERIALS AND METHODS

This work is part of a larger project called "Assessment of the implementation of the human right to appropriate food for students of the public and private elementary schools of Alagoas," approved by the Research Ethics Committee of the Federal University of Alagoas under protocol number 017299/2011-43.

This cross-sectional study used a probabilistic sample of the public elementary schools of Maceió. The candidates included all

the public elementary schools of the municipality. The list of 121 schools was provided by the Municipal Department of Education (SEMED). For the results to be representative, a total of 40 schools were included in the study. Systematic sampling was used to select the schools. The principals of the selected schools were contacted by the researchers, who informed them about the objectives of the study, showed them SEMED's authorization for the study, and asked for their support. They were then asked to freely sign an informed consent form.

Data collection

Data were collected from July 2012 to June 2013 by a dietician trained in food safety. The dietician used a checklist developed by the authors, based on the Resolution of the Collegiate Board (RDC) no. 216 issued on September 15, 2004 by the National Sanitary Surveillance Agency¹³. Its applicability was previously tested in a pilot study.

The checklist was divided into two forms: the first identified and characterized the food service, and the second assessed sanitary practices. The latter was divided into nine categories, as shown in Table 1 below.

The assessment included measuring temperatures, interviewing food handlers, and making direct observations. A digital food thermometer with a -50°C to 300°C scale and accuracy of 1°C (Incoterm Ltda[®], Porto Alegre, RS, Brazil) was used.

The items in the checklist corresponding to establishment sanitation included subitems that could be classified as compliant (C) when they met the legislation requirements and noncompliant (NC) when they did not.

The percentage compliance was given by the following formula:

$$\% \text{ compliance} = \frac{\sum \text{of the items in compliance (C)} \times 100}{\text{total number of items}}$$

The schools were then classified into five compliance levels (Table 2), according to the percentage compliance of their food services as recommended by Cardoso et al.³.

Table 1. Categories of sanitary practices.

Nº	Category	Code
01	Facilities, equipment, furniture, and utensils	FEFU
02	Facility, equipment, furniture, and utensil sanitation	FEFUS
03	Integrated control of urban vectors and pests	ICUVP
04	Water supply	WSUP
05	Residue management	RM
06	Food handlers	FH
07	Raw materials, ingredients, and packaging	RMIP
08	Food preparation	PREP
09	Food distribution	DIST



Table 2. Classification of the food services according to the percentage of items in compliance with good food preparation practices.

% Compliance	Classification
≤ 30	Critical
31 to 49	Unsatisfactory
50 to 69	Regular
70 to 89	Satisfactory
≥ 90	Excellent

Source: Cardoso et al. (2010)

The data were entered and tabulated in an Excel spreadsheet (Microsoft, Redmond, WA, USA). The results were expressed as means, standard deviations, and proportions. Fisher's exact tests were used to determine whether the proportion of food services in a critical situation at the municipal level was different from those in a critical situation at the state level (for one of the cells in the 2 × 2 table, $n < 5$; therefore the Chi-square test was not recommended). The significance level was set at 5%.

RESULTS

A total of 40 schools participated in the study, including 31 municipal and nine state schools. The number of students enrolled per school varied from 165 to 1,428 (546.87 ± 354.67). All 40 schools (100%) had a food service. Sixteen schools (40.0%) served meals in the morning and afternoon, and 24 schools (60.0%) served meals in the morning, afternoon, and evening. The schools had from two to nine cooks, averaging one cook for every 109 students (minimum: 1:21, maximum: 1:219).

None of the schools had a copy of the Good Practices and Standardized Operational Procedures Manual, even though all of them had a dietician in charge of the school food at the municipal or state level, depending on the level at which the school was administered.

None of the food services presented regular, satisfactory, or excellent compliance with the norms. Most ($n = 23, 57.5\%$) presented as unsatisfactory, and the remainder ($n = 17, 42.5\%$) were critical.

A greater proportion of municipal schools had a food service classified as inadequate, compared to the state schools (48.4% versus 22.2%). However, this difference was not significant ($p = 0.26$).

Table 3 shows the percentage compliance per category according to school classification. The worst items were those associated with the facility ($n = 39, 97.5\%$), residue management ($n = 38, 95.0\%$), food handlers ($n = 38, 95.0\%$), food preparation ($n = 39, 97.5\%$), and food distribution ($n = 39, 97.5\%$). Table 4 shows the description of the main items classified as inappropriate.

In 37 (92.5%) schools, the bathrooms were not directly accessible from the food preparation and storage areas, which is in compliance with the legislation. However, 36 food services (90.0%) did not have separate bathrooms for men and women, and the bathrooms were not exclusive to food handlers. Furthermore, they did not allow personal hygiene ($n = 38, 95.0\%$), and the garbage cans were inappropriate ($n = 30, 75.0\%$) because they had no bottom, no lid, no pedal, and/or were broken. All establishments had janitors to clean the bathrooms, but in 12 food services (30.0%), these janitors were also involved with food preparation and/or distribution.

The water supplies in 14 (35.0%) and 13 (32.5%) schools were classified as regular and satisfactory, respectively. In most institutions ($n = 32, 80.0\%$), water was supplied by the city water supply system, and the water tanks were lined by materials that did not compromise water quality. The water tanks were also appropriately maintained in 30 (75.0%) schools. Only one school (2.5%) was not connected to the sewerage system and did not have a septic tank.

The cooks of 33 schools (82.5%) reported inspecting foods upon delivery. However, they only inspected the shelf life and packaging of nonperishable foods. For perishable foods, they inspected the former two parameters, plus some organoleptic characteristics, such as smell and texture. In 31 schools (77.5%), the rejected foods were appropriately isolated after this initial inspection, and in 35 schools (87.5%), the foods were stored as recommended by the 'first in, first out' rule.

Food preparation was also faulty. For example, food was allowed to thaw for too long, prepared foods waited too long to be distributed ($n = 17, 42.5\%$ for both criteria), foods prepared under refrigeration or freezing were not properly identified ($n = 39, 97.5\%$), and/or fruits and vegetables that were consumed raw were not properly washed ($n = 26, 86.7\%$). With respect to the latter, 10 food services (25.0%) did not include raw fruits and leafy vegetables in their preparations, so this item was not applicable to these establishments.

Table 3. Percentage compliance according to category in the food services ($n = 40$) of elementary public schools in Maceió, Alagoas, 2013.

Classification (%)	FEFU ¹ n (%)	FEFUS ² n (%)	ICUVP ³ n (%)	WSUP ⁴ n (%)	RM ⁵ n (%)	FH ⁶ n (%)	RMIP ⁷ n (%)	PREP ⁸ n (%)	DIST ⁹ n (%)
≤ 30	28 (70.0)	16 (40.0)	22 (55.0)	4 (10.0)	27 (67.5)	10 (25.0)	6 (15.0)	28 (70.0)	29 (72.5)
31 to 49	11 (27.5)	11 (27.5)	-	9 (22.5)	11 (27.5)	28 (70.0)	4 (10.0)	11 (27.5)	10 (25.0)
50 to 69	1 (2.5)	6 (15.0)	16 (40.0)	14 (35.0)	1 (2.5)	2 (5.0)	29 (72.5)	1 (2.5)	1 (2.5)
70 to 89	-	7 (17.5)	-	13 (32.5)	-	-	1 (2.5)	-	-
≥ 90	-	-	2 (5.0)	-	1 (2.5)	-	-	-	-
TOTAL	40 (100.0)	40 (100.0)	40 (100.0)	40 (100.0)	40 (100.0)	40 (100.0)	40 (100.0)	40 (100.0)	40 (100.0)

¹FEFU: Facilities, equipment, furniture, and utensils; ²FEFUS: Facility, equipment, furniture, and utensil cleaning; ³ICUVP: Integrated control of urban vectors and pests; ⁴WSUP: Water supply; ⁵RM: Residue management; ⁶FH: Food handlers; ⁷RMIP: Raw materials, ingredients, and packaging; ⁸PREP: Food preparation; ⁹DIST: Foods exposed for consumption.



Table 4. Description of the main problems found in the food services (n = 40) of elementary public schools in Maceió, Alagoas, 2013.

Indicator	Faults	n	%
Facilities	Presence of garbage, animals and/or unsanitary items outside	30	75.0
	Presence of garbage, animals and/or unsanitary items inside	20	50.0
	Internal areas allow all stages of food preparation to mix	40	100.0
	Free access to food preparation areas	32	80.0
	Unkempt facilities with infiltrations, molds, and peeling paint	31	77.5
	Hard-to-clean windows and doors, not fitting properly in their frames, unkempt	37	92.5
	Doors with no door closer	39	97.5
	Absence of screen in windows and other openings	36	90.0
	Open and unsiphoned drains	37	92.5
	Unprotected lights	39	97.5
	Air flowing toward foods	30	75.0
	Absence of hand-washing sinks	40	100.0
	Surface hygiene	Inappropriate sanitation of surfaces, equipment, and utensils	23
Food-handling area not cleaned between shifts		33	82.5
Use of scented or deodorizing substances in the food-handling area		32	80.0
Inappropriate use of cleaning agents (dilution and contact time)		32	80.0
Old and dirty cleaning utensils stored in inappropriate places		35	87.5
Pest control	Presence of vectors and urban pests	26	65.0
	Inappropriate use of insecticides	34	85.0
Potable water	Microbiological tests not done	40	100.0
	Water tanks not properly cleaned	20	50.0
Residue fate	Damaged or unidentified garbage cans	37	92.5
	Garbage cans without lids, pedals, and/or appropriate plastic bags	33	82.5
	Residues stored in open places and/or near the food storage and preparation areas	34	85.0
Handler hygiene	Food handlers not tested regularly	40	100.0
	Inappropriate uniforms	38	95.0
	Absence of posters promoting hand washing	40	100.0
	Incorrect hand washing	40	100.0
	Long nails and/or with nail polish	25	62.5
	Handling foods while wearing accessories	33	82.5
	Absence of training and supervision in Good Practices	30	75.0
	Absence of rules for visitors	36	90.0
Storage of raw materials	Inappropriate food storage areas	38	95.0
	Dirty and disorganized storage area without pallets and/or appropriate shelves	27	67.5
Food preparation	Cross-contamination not avoided	34	85.0
	Raw materials not properly stored or identified and ingredients not entirely used	38	95.0
	Unhygienic primary packaging of the raw materials	40	100.0
	Fruits and vegetables that are consumed raw not washed properly	26	86.7
Food distribution	Absence of food warmers	40	100.0
	Lack of procedures to minimize the risk of contaminating prepared foods	21	52.5
	Plates, cups, and silverware not washed properly	40	100.0
	No cafeteria	28	70.0

None of the handlers from the schools habitually washed their hands, or they washed them inadequately using only water or water and inappropriate soaps, such as scented detergents and soaps, even though these substances are not permitted in food-handling areas.

In 16 schools (40.0%), the behavior of food handlers in the food preparation areas was inappropriate: they talked too much and ate too often. They failed to use hair nets in 12

food services (30.0%), and in one of the food services (2.5%), a food handler had a mustache and beard.

DISCUSSION

This study aimed to assess the food services of public elementary schools in Maceió covered by the National School Food Program. The results show that, in general, food services do not comply



with the legislation with regard to their food-handling practices. Aspects related to infrastructure (facilities, equipment, furniture, and utensils) and poorly trained staff, as evidenced by their ignorance of good food-handling practices, stand out as the main problems.

The food services' inappropriate facilities and layout strongly promote food contamination. To ensure food safety, it is essential for all food handling and storage areas to be properly planned, and food preparation must involve the correct equipment, furniture, and utensils¹³.

Many studies^{6,8,10,11,14} state that the poor food preparation conditions found in Brazilian public schools stem from poorly planned and unkempt facilities. Furthermore, numerous other studies^{4,7,8,9,14,15} performed in many Brazilian states report that the foods served in public schools are not fit for human consumption because of their high microbiological contamination.

The present study found many problems in the facilities, including unkempt floors, walls, and ceilings. These structures were usually damaged and/or dirty. All schools presented nonlinear and disorganized preparation flow; they had wooden shelves and utensils that are inappropriate because of their porosity, making them hard to clean; they had unsanitary objects outside the facilities, such as unused objects, exposed garbage attracting urban vectors and pests, and unkempt fat containers; lighting not protected against accidents and explosions; dirty, broken, and/or rusty ventilation equipment; and airflow directed toward the food.

Results similar to the present findings were found by Cardoso et al.³ in public schools in Salvador (Bahia, Brazil), where roughly 60.0% of the 236 study schools presented unsatisfactory compliance with the legislation. According to the authors, the items that most contributed to this outcome were related to the facilities, water quality, food preparation, food distribution, and food handler behavior.

In order to characterize food safety in schools covered by the PNAE in Salvador (Bahia, Brazil), Figueiredo¹² systematically reviewed 53 studies published between 1990 and 2009. Of these, 19 articles (35.8%) mentioned the conditions in which the foods were prepared, and all schools had poor food-handling practices. Regarding the facilities, the author wrote, "Unkempt facilities seem to be the norm, persisting over the years."

Torres et al.¹¹ studied a food service from a municipal school of Viçosa (Minas Gerais, Brazil) whose compliance varied from 0% to 61.9%. Food preparation flow and dry storage had low and high compliance, respectively. The authors pointed out that inappropriate food preparation flow favors cross-contamination, among many other problems. The legislation dictates that the layout of the facilities should promote linear flow during all food preparation stages, so as to minimize the risks of cross-contamination and facilitate maintenance and hygienization operations^{13,16}.

The public schools of Maceió lack the necessary equipment to store and display ready-to-eat foods, so the foods are prepared and distributed right away. In some establishments (41.0%),

prepared foods are exposed to room temperature for less than 2 hours until they are distributed. Cardoso et al.³ found similar results in their study, where 232 of the 236 schools (99.1%) did not have food warmers, even though 84.3% of these schools distributed the food in less than 2 hours once ready. This period of time limits microbial growth and recontamination. The absence of time and temperature control was also mentioned in the study by Rosa et al.⁷.

Although food preparation should follow many safety procedures, maintaining appropriate times and temperatures are the strategies most commonly used to control, eliminate, or delay microbial growth during food preparation, conservation, and distribution⁵. Establishments need to have proper thermometers and train the employees to use them correctly. Furthermore, these instruments need to provide reliable data and be periodically calibrated by members of the Brazilian Calibration Network, as required by the legislation^{16,17}.

None of the food services of the public schools of Maceió had thermometers, so the employees could not monitor food or equipment temperature in any stages of food preparation. The only measuring instruments found in the food services were scales, and there were no calibration records in any of the schools in the survey.

Equipment also needs to be properly maintained to function well and ensure safe foods^{16,17}. The present study found that preventive maintenance was not done in any of the food services; rather, equipment was only repaired when it broke down.

Water provision is one of the most important of the factors in good food-handling practice, because water is used in food preparation and in all cleaning procedures. Hence, measures are needed to prevent water tank contamination and to keep them properly cleaned, lidded, and maintained to prevent cracks, leaks, infiltrations, and/or deterioration. Water quality must be tested every 6 months by certified companies. Water should only be tested after the water tanks are repaired and cleaned¹³.

Cardoso et al.¹⁸ assessed the water quality of 49 municipal and 34 state schools covered by PNAE in Salvador (Bahia, Brazil) and found problems in 32.0% and 22.0% of the state and municipal schools, respectively. The water samples were inappropriate for human consumption because of high thermotolerant coliform count, which apparently stemmed from unkempt water tanks – 21.0% were not properly lined, and 51.0% were not being cleaned regularly. Additionally, only 17.0% of the schools had water potability records.

Cleaning, food handler personal hygiene and behavior, food preparation, including the correct washing of fruits and vegetables, thawing periods, and anti-cross-contamination measures rely on handler training and knowledge about good hygiene and handling practices.

All elementary state schools of the state of São Paulo (Brazil) assessed by Silva et al.¹⁰ (n = 24) were somewhat deficient with respect to operational, environmental, and personal hygienization.



Only 37.5% of the institutions had properly sanitized equipment and utensils. Poorly sanitized equipment and utensils promote chemical and/or biological contamination. Chemical contamination occurs when the equipment and utensils are not properly rinsed or when the cleaning agents are not correctly diluted, allowing them to attach to equipment surfaces. Biological contamination occurs when hygienization is not properly performed and/or is not sufficient. Poor hygienization may allow the accumulation of food residues on surfaces, creating a breeding ground for bacteria, forming a biofilm⁵.

According to the legislation, the facilities, equipment, furniture, and utensils should be correctly cleaned by trained staff as often as necessary to minimize the risk of food contamination¹³.

Food handlers are the main vector of food contamination, and so personal hygiene, especially proper hand hygiene, is the main way to prevent food contamination^{16,17}. The absence of sinks exclusively for hand washing and of appropriate soaps explains the results of this study regarding the hygiene practices of food handlers/cooks. This item was faulty in most schools. Other faulty items included insufficient employee supervision and training, contributing to the poor compliance of the schools with respect to the sanitation of food-handling areas.

Piragine¹⁹ assessed the state schools of Curitiba (Paraná, Brazil) and found that the worst results were related to food handlers, especially because of their poor behavior (use of accessories, habits of talking or singing while preparing food, and frequent use of nail polish). The author attributed these results to the fact that the cooks were not fully aware of good personal hygiene practices.

Pistore and Gelinskib¹⁹ administered a questionnaire to 78.5% of the cooks working in all (n = 11) municipal schools of Videira (Santa Catarina, Brazil) to investigate their knowledge on food safety, hygiene, and contamination. The results showed that, in general, cooks had some knowledge about the subject, but few admitted to using the said knowledge in their daily routines, mostly because of a lack of habit. According to the authors, this lack of habit is responsible for the low adherence to good food-handling practices in the school environment. Most ignorance regarded safe food preparation and distribution practices,

foodborne illnesses, personal hygiene, and surface hygiene, with the latter being the most concerning factor.

Food handlers need to be constantly motivated and under continuous and efficient supervision to change their behavior. Motivation, training, and supervision can greatly improve the food handling practices of those involved with food preparation in schools¹⁴. Hence, training and supervision are essential for changing behavior in a food service¹⁹, so it is important for food handlers to be properly trained in good food handling practices as recommended by the sanitation legislation^{13,14}.

In addition to training, schools require the creation of a good food handling practices manual containing standardized operational procedures. This manual should contain all the technical information about the safety food preparation norms followed by the establishment, as well as step-by-step instructions for routine food-handling activities to ensure food safety¹⁹. The absence of such a manual has been noted in most studies, corroborating the present findings.

To modify the current public school reality, all those involved should have access to PNAE's norms and guidelines so that they may carry out their function, which is to provide safe foods for the students. The creation of a specific legislation for school food services, hiring more dietitians to supervise food preparation activities, regulation of the food handler function, and provision of systematic education to these individuals are all necessary to achieve this objective⁶.

The present study found that the health of the schoolchildren of the municipality of Maceió is at risk, and these children are very likely to experience foodborne illness. Since these children are often malnourished and have compromised immune systems, these results are even more concerning. Furthermore, these findings are a direct violation of the human right to appropriate nutrition.

Additionally, the present results show that the National School Food Program needs to implement better practices to ensure that its guidelines are followed. This is essential for the provision of safe foods. Specifically regarding Maceió, measures are needed to improve quality control during food preparation. To this end, investments in better facilities, training, and supervision of food preparation are essential.

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