

# Hygienic and sanitary conditions of feeding and nutrition units at preschools of Palmeira das Missões - RS

## Condições higiênico-sanitárias de unidades de alimentação e nutrição de escolas de educação infantil de Palmeira das Missões - RS

### ABSTRACT

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**Introduction:** Food must be accessible in sufficient quantity, on a regular and permanent basis, totally free and with good food handling practices. **Objective:** Thus, the objective of this study was to diagnose hygienic and sanitary conditions of the feeding and nutrition units of preschools in Palmeira das Missões - Rio Grande do Sul state. **Method:** This work is a research with a cross-qualitative-quantitative approach. Data were collected through observation and application in situ of a selection list in good practices of the Collaborating Center of Food and School Nutrition in seven municipal schools of early childhood education. **Results:** The average of the general good practice percentage of the evaluated schools was  $31.5 \pm 4.3\%$ . The category 'Buildings' and facilities of the food preparation area obtained the highest percentage of adequacy,  $50.5 \pm 13.5\%$ . On the other hand, the 'Receiving' block had the lowest adequacy index. **Conclusions:** These results demonstrate the importance of accompanying the elaboration, preparation and manipulation of school feeding as well as the physical structure of the places, in order to improve the food supply and consumption of students.

**KEYWORDS:** School Feeding; Good Manipulation Practices; Legislation on Food; Food Quality; Sanitary Surveillance

### RESUMO

**Introdução:** A alimentação deve ser acessível em quantidade suficiente, de modo regular e permanente, baseada totalmente nas boas práticas de manipulação dos alimentos. **Objetivo:** Assim, o objetivo deste estudo foi diagnosticar as condições higiênico-sanitárias das unidades de alimentação e nutrição de escolas de educação infantil de Palmeira das Missões-RS. **Método:** Este trabalho trata-se de uma pesquisa com abordagem transversal quali-quantitativa. A coleta de dados ocorreu por meio da observação e aplicação *in loco* de uma lista de verificação em boas práticas do Centro Colaborador em Alimentação e Nutrição Escolar em sete escolas municipais de educação infantil. **Resultados:** A média do percentual de adequação geral em boas práticas das escolas avaliadas foi de  $31,5 \pm 4,3\%$ . A categoria Edifícios e instalações da área de preparo de alimentos obteve o maior percentual de adequação com  $50,5 \pm 13,5\%$ . Por outro lado, o bloco Recebimento obteve o menor índice de adequação. **Conclusões:** Esses resultados demonstram a importância do acompanhamento frente à elaboração, preparo e manipulação da alimentação escolar, bem como a estrutura física dos locais, no intuito de melhorar as condições higiênico-sanitárias da alimentação escolar ofertada aos alunos.

**PALAVRAS-CHAVE:** Alimentação Escolar; Boas Práticas de Manipulação; Legislação sobre Alimentos; Qualidade dos Alimentos; Vigilância Sanitária

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## INTRODUCTION

The Brazilian School Food Program (PNAE) was implemented in 1955 and is guaranteed by the Brazilian Constitution of 1988. It is considered one of the largest programs of this kind in the world. It is run by the Brazilian Educational Development Fund (FNDE), of the Ministry of Education, and includes all students enrolled in basic education, philanthropic and public schools and offers meals during breaks in school activities. The program aims to guarantee that nutritional needs are met during the school period and contributes to the development and improvement of learning abilities. The program also aims to provide safe food to students<sup>1,2</sup>.

Enough food must be accessible on a regular and permanent basis, based entirely on Good Food Handling Practices (BPMA). These conditions are indispensable for the promotion and maintenance of health, since the consumption of dubious quality food and its ingestion outside hygienic-sanitary standards are one of the factors responsible for food and waterborne disease outbreaks<sup>3</sup>.

According to the World Health Organization (WHO), one third of the population is affected every year by diseases associated with the consumption of contaminated food and water. This estimate is higher in developing countries, where there are more vulnerable groups. According to the Brazilian Ministry of Health, data on foodborne disease (FBD) outbreaks in Brazil indicate that approximately 7.9% of the cases occur in day care centers and schools<sup>4</sup>. When known, 9% of the causes of the outbreaks are mixed food and 6% are contaminated water. The main microorganism involved in FBD is *Salmonella* spp. It corresponds to 7.5%<sup>4</sup>, thus indicating the need for effective interventions in the School Food and Nutrition Units (UANE).

It is important to highlight that inadequate food preservation, lack of hygienic-sanitary conditions during preparation and carelessness with the elements involved in the production of meals, by both the handlers and the ingredients used, can lead to food contamination<sup>4</sup>.

In that sense, this study focuses on the UANE for they are a collective food service, therefore, they must follow the same requirements as other similar places in order to reduce the risk of FBD in schools<sup>5</sup>. For this reason, UANE must be continuously monitored because, in addition to offering healthy food, BPMA must be applied to products, services, buildings, as well as to the food production process in order to promote and expand the supply of safe food in schools<sup>6</sup>.

In order to evaluate and improve hygienic-sanitary control of school food, so that it is able to create healthy eating habits, the Collaborating Center in School Food and Nutrition (Cecane) of the Federal University of São Paulo (Unifesp), along with the support of the Cecane of the Federal University of Rio Grande do Sul (UFRGS), elaborated and validated a "checklist of good practices for school food and nutrition units"<sup>7</sup>. This list was created on the basis of sanitary legislation and checklists used by nutritionists of departments of education of Brazilian cities. This list aims to diagnose hygienic-sanitary conditions of childhood education schools, information required for decision-making by managers.

Considering that health is a right and that schools are also responsible for its provision, either through the food service available to the students or through the education of citizens who are aware of their choices<sup>7</sup>, this work is justified as it aims to diagnose hygienic-sanitary conditions of food and nutrition units of childhood education schools of the city of Palmeira das Missões, State of Rio Grande do Sul, Brazil, by implementing a checklist on BPMA.

## METHODS

We performed an evaluative observational descriptive study in BPMA in UANE, with a transverse quali-quantitative approach. The checklist of UFRGS Cecane<sup>5</sup>, which seeks to facilitate the evaluation of hygienic-sanitary conditions of schools, was applied onsite.

We performed our survey on childhood education school UANE of Palmeira das Missões from August to November 2016. All seven urban municipal childhood education schools (EMEI) were evaluated. The Municipal Department of Education and the nutritionist in charge signed an authorization term for the execution of this survey. The UANE were identified by letters (A-G) to keep them confidential. The checklist in BPMA adds up to 99 questions and is divided into six thematic blocks: Buildings and Facilities of the Food Preparation Area (Block 1); Equipment for Controlled Temperature (Block 2); Handlers (Block 3); Receipt (Block 4); Processes and Production (Block 5) and Environmental Hygiene (Block 6)<sup>1</sup>.

In order to verify the adequacy of UANE hygienic-sanitary conditions, we followed the execution of this survey onsite and observed the whole food production process of the EMEI. When applicable, we checked UANE equipment (freezers, refrigerators) temperatures with a digital thermometer Inconterm® with sensitivity of -50°C to +70°C.

For the evaluation, we assigned a score ranging from one to eight for each question of the checklist, depending on the degree of health risk and importance to the safety of food produced in the UANE. All the answers marked as "no" characterize non-conformity of the item with good practices, which means it received score zero. Regarding the alternatives identified as "yes", scores were assigned by the tool according to the characteristics of the question (Chart).

In addition, we assigned different weights for each block (k, equal to 10, 15, 25 or 30) according to the degree of risk and importance for food safety<sup>8</sup>.

After calculating the score obtained in each of the blocks, the results were summed. Accordingly, the final score is obtained, and based on this score, the UANE is classified by block or by total score in degree of health risk (Table 1).

Finally, data was collected by the researchers responsible for this project, previously trained by a professor of the area.



We tabulated the data with Microsoft Office Excel 2007 and made the graphs with GraphPad Prism 5.0. We made a simple descriptive statistical analysis with the data (average, percentage of conformity and standard deviation) with Statistica 7.0. We described the results obtained in the analysis through graphs and tables.

Finally, it is worth mentioning that this survey presented a report with general and specific data about good practices in each UANE to the Municipal Department of Education, as well as to each school.

## RESULTS AND DISCUSSION

According to the results obtained through the evaluation of the checklist of good practices, the overall average of conformity of the seven evaluated schools was  $31.5 \pm 4.3\%$ . This percentage, according to the conformity index of Cecane/UFRGS<sup>5</sup>, classifies these as high-health-risk food units (26-50%). This result is attributed mainly to the large number of nonconforming items

in the UANE, which poses risks of FBD in the EMEI. It is important to highlight that EMEI A (25.2%) and D (37.5%) showed the lowest and the highest percentage of conformity, respectively. Therefore, it is necessary to improve the risk control measures in school environments, ensuring health protection of its users through the provision of innocuous food. Furthermore, the effective compliance with the standards will only succeed if the people responsible for the units are trained to work in school meals together with actions of regulatory agencies<sup>9</sup>. The lack of supervision, proper training and updates of the food handlers take the EMEI to alarming ratings, like those of high health risk and very high health risk, as depicted in Figure 1. These results reveal a disturbing scenario from the perspective of food safety. It shows that the food units are not adequate to serve safe food from a hygienic-sanitary point of view. This situation compromises food quality and poses a high risk of FBD outbreaks.

When we evaluated the average percentage of conformity by degree of health risk, we verified that only the block of Buildings and Facilities of food preparation areas (Table 2) showed percentage of conformity higher than 50%.

Therefore, based on the data presented in Table 2, now we detail and compare the results of the UANE evaluated by blocks.

In the category of Buildings and Facilities of food preparation and distribution areas (Block 1), we obtained the overall average of  $50.5 \pm 13.5\%$ , which made this block the one with the highest percentage of conformity (Table 2). UANE D and E presented a higher percentage of conformity in this block. These two units were opened in the last five years, so their structure is more adequate to the sanitary legislation and they have buildings and facilities in better conditions.

It is important to highlight, as positive features, that, in general, the EMEIs presented good lighting in the preparation area, and did not have dark corners, thus facilitating the preparation of meals. Additionally, the hydraulic system was connected to the public network supply and all UANEs presented good water reservoirs. Another strength is that the EMEIs had bathrooms and locker-rooms with covered toilets bowls, efficient flushing systems, and running water exclusive to the school staff (teachers and

Chart. Degree of contamination risk and food safety.

Score	Degree of contamination risk and food safety.
8	For items that represent conditions or situations that prevent the multiplication of microorganisms
4	For those that prevent the survival of microorganisms
2	For those that prevent cross-contamination through direct contact with food
1	For those that prevent cross-contamination without direct contact with food

Source: Collaborating Center of School Food and Nutrition<sup>5</sup>.

Table 1. Degree of sanitary risk of the food and nutrition units.

Percentage	Degree of sanitary risk
0 - 25	Very high
26 - 50	High
51 - 75	Moderate
76 - 90	Low
91 - 100	Very Low

Source: Adapted from the Collaborating Center of School Food and Nutrition<sup>5</sup>.

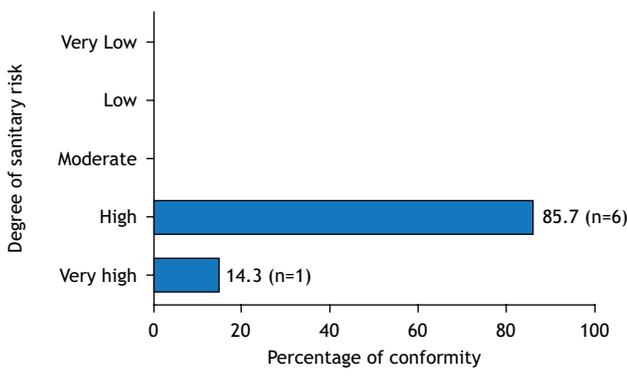


Figure 1. General classification of municipal schools of childhood education of Palmeira das Missões, 2016.

Table 2. Percentage of conformity of good handling practices per block of the School Food and Nutrition Units of Palmeira das Missões, 2016.

Blocks	School Food and Nutrition Units						
	A	B	C	D	E	F	G
1. Buildings and facilities of the food preparation areas	44.9	43.8	30.3	67.8	65.2	57.5	43.7
2. Equipment for Controlled Temperature	0	11.8	13.3	13.3	26.7	13.3	13.3
3. Handlers	33.3	50	50	58.3	33.3	50	41.7
4. Receipt	0	0	0	0	0	0	0
5. Processes and Production	44.2	50.3	36.8	38	36.8	44.2	39.3
6. Environmental Hygiene	28.9	34.2	47.4	47.8	36.8	47.4	28.9

Source: Author, 2016.



handlers). In contrast, no EMEI had adequate personal hygiene material, such as antiseptic soap and paper towel. However, in all EMEIs there were scented soap and cotton towels.

We also observed that 71.5% (n = 5) of the UANEs had a physical structure similar to domestic kitchens. The external area of the EMEIs had bad hygienic-sanitary conditions. We found unhealthy elements in the surrounding areas, like animals, construction material and debris. In the preparation area, we found obsolete objects, like bowls, buckets, bags, pots, cell phones, as well as poorly maintained buildings. This fact can lead to food contamination because these are adapted kitchens<sup>10</sup>. In food production and distribution areas, we did not observe lamps protected against falls and explosions in any UANE, as determines the RDC n. 216, of 15 September 2004<sup>11</sup>. This situation poses a physical risk because, if the lamps fall, in addition to losing food, users are exposed to accidents that could be avoided if proper protection existed<sup>12</sup>.

Also, the EMEIs' physical structure did not provide a sink exclusive to hand hygiene, thus not providing hygienic-sanitary conditions to food handlers. This indicates that it is necessary to adequate the physical structure of the UANEs<sup>10</sup>. The food production and distribution areas also did not have window protection nets, just like what was found in the studies of Santana et al.<sup>13</sup> and Lockis et al.<sup>14</sup>, who also verified the lack of window nets in 90% (n = 18) of the schools surveyed. The use of nets is mandatory by the legislation once it works toward food safety by preventing the entrance of vectors<sup>4</sup>.

Regarding the block of Equipment for Controlled Temperature (Block 2), the average conformity was  $13.1 \pm 7.7\%$  (Table 2). All UANEs had clean and functioning refrigerators and freezers. However, none of them had a thermometer to check food temperature, not even to ensure the temperature was suitable for the refrigerating equipment.

We observed that in 100% (n = 7) of the UANEs, the prepared and pre-prepared food items were much disorganized inside the cold equipment. Food in the refrigerator must be organized as follows: upper shelves for prepared and ready-to-eat food; middle shelves for semi-finished products and lower shelves for raw food<sup>4</sup>.

During the onsite observation, we measured the temperatures of the refrigerators and freezers of the UANEs, as presented in Table 3. The refrigerators were at an average temperature of  $6.3 \pm 2.2^\circ\text{C}$ , while the freezers were at  $-14.7 \pm 6.0^\circ\text{C}$ . Only the refrigerators and freezers of UANEs A and C showed adequate temperatures. This demonstrates how important it is to monitor the temperatures of the equipment for food refrigeration and freezing. These were apparently inadequate because, according to Ordinance n. 216/2004<sup>11</sup>, food must be stored at temperatures below  $5^\circ\text{C}$  or frozen at a temperature lower than or equal to  $-18^\circ\text{C}$ .

According to the data provided, the lack of thermometers makes food storage wrong at different stages of processing. Equipment with inadequate temperature decreases raw material quality, thus influencing the deterioration of perishable foods as well as bacterial multiplication, and may cause FBD in children who are

**Table 3.** Temperature of the food storage equipment of School Food and nutrition Units, Palmeira das Missões, 2016.

School Food and Nutrition Units	Equipment temperature ( $^\circ\text{C}$ )	
	Refrigerator	Freezer
A	4.7	-22.9
B	5.4	-14.7
C	3.1	-21.7
D	6.2	-7.2
E	8.1	-13.5
F	9.5	-8.2
G	7.6	-14.4

Source: Author, 2016.

more susceptible due to the immaturity of their immune system<sup>10</sup>. Legnani et al.<sup>15</sup> inspected 27 food units. The most frequent nonconformities were related to food storage equipment that did not have a temperature gauge or were in inadequate conditions, lack of records of preventive maintenance measures of equipment and lack of thermometers in refrigerators of some establishments. The lack of temperature control in food storage equipment poses a risk to the good quality of the final product.

In the block of Handlers (Block 3), schools, overall, presented  $45.2 \pm 9.5\%$  of conformity (Table 2). EMEI D presented the highest levels of conformity in this block, with a distinctive feature that no handlers were wearing personal adornments.

In all UANEs we observed that the handlers worked without apparent clinical diseases. They had caps to cover their hair and in 71% (n = 5) of the EMEIs the handlers took part in food safety training. However, the amount of nonconformities was high. These results were expected since there are no frequent supervision procedures in UANEs. We verified that the employees worked without a uniform compatible with their roles and in 85.7% (n = 6) of the EMEIs the handlers wore adornments (rings, bracelets and earrings). These results confirm the lack of information, training and ongoing supervision regarding the standards of personal hygiene, which can jeopardize the health of consumers.

Handlers are one of the main vehicles of contamination. And it must be considered that any food is already naturally contaminated by several types of microorganisms, so the greatest concerns are to prevent these microorganisms from surviving or multiplying and to prevent the food from being contaminated by more microorganisms as a result of inadequate handling<sup>16</sup>. Another concern is performing periodic examinations on food handlers since there were reports that it happened only once during the admission examination. These were performed after the public tender and laboratory tests were not made.

This information is troubling since through the examination one can prevent risks so that the handler is not a vehicle of pathogens, which decreases the risk of food contamination. Campos et al.<sup>12</sup> also reported that this nonconformity was observed in some schools. In 51.9% (n = 14) of urban and 58.3% (n = 15) of rural schools, the handlers did not receive periodical examination.



In Receipt (block 4), the UANE did not present an average percentage of conformity (Table 2). The UANE did not have employees responsible for the receipt of raw material and the handlers did not check the conditions of the raw material or the conditions of the packaging, expiration date, labeling and quality of the products during delivery, as demanded by sanitary legislation.

In food production chains, raw material reception is considered a control point. Because of this, the caution with the selection of suppliers and the checking of the products during receipt and storage are legal requirements that contribute to the quality and safety of the final product<sup>11</sup>.

During the receipt, in addition to checking the expiration date on the package, the receiver must also check the conditions of the delivery person, weight and the temperature measurements and recordings of the food that requires refrigeration<sup>9</sup>.

A study performed in elementary public schools of Salvador, in the state of Bahia, Brazil, highlighted the nonconformities of several units as to the place for receipt of ingredients and as to checking whether they were suitable or not, since they did not have a reserved area or trained handlers (98.3% n = 231)<sup>17</sup>.

In the block of Processes and Production (Block 5), the average percentage of conformity was 41.4% (Table 2). In all units, food was removed from cardboard or wooden boxes, which are replaced by suitable plastic bags when necessary, and we did not find those in refrigeration equipment. In 100% (n = 7) of the EMEIs, the handlers did not wash their hands properly, a critical situation that can lead to food contamination during cooking.

The fact that no institution had a specific washbasin for that purpose indicates that it is difficult to do that, but it does not justify failing to do so, since most of the staff received training on the importance of good practices and the correct procedure for hand hygiene. The lack of hand hygiene practices suggests the need to implement a specific Standard Operating Procedure (SOP) for this matter. It can be accomplished by a visible attached statement<sup>4</sup>. This inadequate behavior was similar in 99% (n = 119) of the 120 schools evaluated in Porto Alegre, state of Rio Grande do Sul, Brazil, in a study made by Oliveira et al.<sup>16</sup>, which showed that most food handlers performed hand hygiene improperly. Another very important fact was that 57.14% (n = 4) of the units presented a Manual of Good Practices (MGP) and none presented SOP. As the institutions (EMEIs) did not present hygiene standards to be followed and do not control the procedures that must be performed, it is difficult to establish and maintain quality standards during all procedures within the UANE.

Therefore, each unit must have a Manual of Good Practices and SOP accessible to all handlers and surveillance bodies under the precepts of the current sanitary regulation. These documents must justify all the procedures that take place in the preparation area because of a simple and relevant reason: food is essential for human subsistence and vital for the development of children. Therefore, some caution and procedures are indispensable for the best conservation and storage of raw materials and food.

Among them, it is important to highlight that food must be kept in dry, clean and safe places, thus maintaining their useful life<sup>2</sup>.

Food temperature records are not done in 100% (n = 7) of the EMEI, which can influence the deterioration of perishable foods and microbial growth associated with inadequate food handling and cross contamination of surfaces like counters and poorly cleaned cutting boards<sup>16</sup>. It is also important to highlight that nonconformities related to temperature control are a threat to the safety of children and lead to risks of FBD<sup>10</sup>.

The WHO attributed to insufficient cooking and preparation of food in great advance as factors that increase the proliferation of pathogenic microorganisms. According to the guidelines set by RDC n. 216/2004<sup>11</sup>, after being cooked, the food must be kept under conditions of time and temperature that do not increase microbial multiplication. For hot storage, food must be kept at temperatures higher than 60°C for a maximum of 6 hours.

In the UANE, meals were prepared in advance and remained for more than 1 hour outside the proper temperature. During the observation, the temperature was only measured when the food was delivered to the teachers because the researchers did not have access to the rooms where the food was distributed to the students (Table 4). We noticed that most of the temperatures would be in compliance with the current legislation<sup>11</sup> if the food was distributed immediately after preparation, since no EMEI had chaffing dishes to maintain the temperatures.

The average temperatures of distribution of hot food (rice, beans, meat and garnish) were  $80.8 \pm 6.1^\circ\text{C}$  and were in compliance with the guidelines required by the sanitary legislation<sup>11</sup> (Table 4). The cold food (salads) presented an average temperature of distribution of  $26.2 \pm 5.2^\circ\text{C}$ . We noted that they were not in compliance with the regulations, since the RDC n. 216/2004<sup>11</sup> states that these must be kept at  $5^\circ\text{C}$  or less (Table 4). Therefore, the maintenance of adequate temperatures, the possibility of times and good food handling and processing techniques can be used efficiently to fight FBD. It is therefore very important to monitor these factors, mainly in schools, since they are prone to having outbreaks as they provide food to a large number of children<sup>7</sup>.

**Table 4.** Food temperature of School Food and nutrition Units at the time of distribution, Palmeira das Missões.

Food	School Food and Nutrition Units						
	A	B	C	D	E	F	G
Temperature of hot food ( $^\circ\text{C}$ )							
Rice	89.7	.*	93.5	.*	.*	65.8	91.2
Beans	87.6	67.5	99.2	91.2	78	65.8	91.9
Meat	91.3	50.7	91.6	74.9	92.5	97.3	87.9
Garnish	81.5	39.3	.*	57.4	69.3	97.3	86.9
Temperature of cold food ( $^\circ\text{C}$ )							
Salad	20.25	.*	29.2	7.8	53	20.6	26.4

Source: Author. 2016. \*No food was prepared on the day of data collection.



However, one can notice that in UANEs B and D, the hot foods (meat and garnish) were at temperatures lower than the recommended value. It revealed that this food was in the hazardous zone, thus allowing the development of the microorganisms<sup>11</sup>.

Regarding the block of Environmental Sanitation (Block 6), the conformity index was  $38.7 \pm 8.6\%$  (Table 3). In 100% of the EMEIs, garbage was disposed properly in easy to clean containers with plastic bags. External waste areas were isolated from the food production and distribution area, thus avoiding contamination.

Among the EMEIs evaluated in the present study, 100% (n = 7) did not have a suitable place to store utensils. They were stored in open and exposed counters or shelves, without the minimum protection against insects or dust. No institution used disposable cloths for cleaning. This implies the use of non-disposable dish-washing cloths to clean places like counters, tables and shelves. We observed that they were not replaced every two hours and the correct process of cleaning was not done according to the State Ordinance SES/RS n. 78, of October 19, 2006<sup>19</sup>.

Regarding the integrated pest control, 85.7% (n = 6) of the EMEIs did not have a document proving the execution of the procedure by a specialized company. The principals reported that these documents are with the responsible nutritionist in the Municipal Department of Education. The lack of this documentation in the EMEIs goes against the sanitary legislation in force<sup>11</sup>, as it is responsibility of the food service to employ the measures

needed to avoid pests, as well as to have the proof of hiring a specialized company for the chemical pest control in the food unit. It is the responsibility of the company that performs pest control to follow the practical and operational guidelines regarding the type of product used and the application techniques to minimize environmental impact and guarantee children's health and quality of service<sup>9</sup>.

## CONCLUSIONS

According to the results, one can verify that the blocks that need more attention are: Equipment for Controlled Temperature and Receipt, since they were the categories that had the highest number of nonconformities. We verified that the hygienic conditions of the areas of handling, storage and distribution of the meals in the EMEIs are not good enough to guarantee food quality.

Because this is a matter of public interest, since it involves the health of children, greater monitoring is necessary, even if it is already performed by public authorities, in order to achieve conformity in food preparation areas, guaranteeing food with lower sanitary risk and better quality.

We concluded that it is necessary to implement good practices for food handlers, in compliance with the current requirements. It is also necessary to develop a MGP and to apply SOP to reduce the risks of foodborne disease outbreaks in the EMEIs.

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#### Conflict of Interest

Authors have no potential conflict of interest to declare, related to this study's political or financial peers and institutions.



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