

*Full Length Research Paper*

# Hygienic-sanitary conditions of school food service in Barretos/SP/Brazil

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It is important to ensure the hygienic-sanitary quality at all stages of food handling for human consumption. Therefore, the study was conducted to assess the school food service hygienic-sanitary conditions of public municipal schools of Barretos-SP. The survey was conducted in 2 schools in 4 phases: (1) Application of checklist contained in CHS Ordinance No.5 from Health Surveillance Center in São Paulo, April 09, 2013; (2) microbiological analyzes from hands of food handlers and sinks set in kitchens; (3) theoretical training on good hygiene practices in the kitchen; and (4) reapplication of the checklist to detect possible improvements. Through the checklist application, it was observed that the schools, labeled "1" and "2", had 52 and 44% of items in accordance respectively. The results of the microbiological analysis were not satisfactory, since the objects of study (hands and kitchen sinks) had presented a microbiological high count of mesophilic microorganism (ranging 2.8 to 5.7 log CFU), staphylococci (ranging 1.8 to 2.7 log CFU) and coliforms thermotolerant. To implement the theoretical training of food handlers, performed by means of a lecture, all cooks of the municipal health system of education were invited. There was positive feedback in the last step (checklist reapplication), since improvements had been observed in schools in four of the five groups assessed by checklist. It was concluded that it is really necessary to accomplish periodic monitoring of school food service, once the monitoring points out the need of improving the conditions of food handling, ensuring greater food safety.

**Key words:** Contamination, foodborne disease, gastroenteritis, good practices, handlers.

## INTRODUCTION

Food is essential both for the maintenance of life, as well as for the growth. School feeding is an important nutritional source for students, and should provide products with hygienic-sanitary quality. Food is important for the

development of a child, but if it is not well handled, it may be responsible for causing and/or transmitting food borne diseases to the consumers (Oliveira et al., 2023). Currently, one of the major concerns with food regards

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quality; it is essential to know the hygienic-sanitary conditions within which food is prepared. Food handlers are among the major components that can affect these conditions as highlighted by previous studies (Mello et al., 2014; Medeiros, 2017) which emphasizes the importance of training food handlers in the prevention of foodborne diseases (Medeiros et al., 2017). When food handlers do not practice good manufactures as the correct hygienization of hands they can become vehicles for food contamination by microorganisms.

Food handlers can transmit pathogenic microorganisms to food; therefore, principles of personal hygiene and food must be continuously reinforced and monitored (da Vitória et al., 2021). When school cooks and food handlers on the National School Feeding Program perform their roles as expected by the schools employing them, they certainly contribute to the well-being of students (Leite et al., 2011).

Controlling the risks of food contamination there are standards of good manufacturing practices and provision of services in the food area at all stages from production to consumption. These stages include the hygiene and health of the employees, technical responsibility and qualification of personnel, health quality of food production, installations and environment hygiene and sanitary until the documentation and information recording (Sao Jose et al., 2008).

When improperly performed, food handling, usage of inadequate temperature in food preparation, cross-contamination and the disabilities of sanitization of equipment are responsible for the main foodborne diseases (Campos, 2009). Carmo et al. (2003) reports a foodborne disease outbreak caused by production of enterotoxins of microorganisms gendered *Staphylococcus* in city of Passos, Minas Gerais. Although few cases of the disease had been reported, once some of them presented milder symptoms which has lead people not to seek appropriate assistance, it is possible to state that the statistics do not reflect the true incidence of the disease.

An outbreak of gastroenteritis has occurred by contamination of foods distributed to employees of the city of Guarujá, Sao Paulo, due to poor handling (sanitization) of vegetables by the company which was responsible for meals (Passos et al., 2010). Such cases allow us to state that handlers can contaminate the food when care actions with hygiene and food safety are not taken properly. A study conducted in a public daycare in the city of Natal, showed that from 65 food handlers 23 were carrying the *Staphylococcus aureus* bacterium (Xavier et al., 2007).

In another study from the research foodborne diseases outbreaks in the state of Rio Grande do Sul, it was identified the presence of *Salmonella* spp., coagulase positive staphylococci, *Escherichia coli*, *Bacillus cereus* and sulphite-reducing *Clostridia* at 46°C in food samples. (Welker et al., 2010). In the city of Joao Pessoa-PB 120 samples of industrialized mincemeat were analyzed. In 73.3% of the samples, it was positive results for the presence of coagulase-positive *Staphylococcus* (Lundgren et al., 2009).

Researches have shown that the production of staphylococcal enterotoxins in food is not restricted to the *S. aureus* species. Other species may produce coagulants, enzymes and enterotoxins. However, the Brazilian legislation considers the contamination of food with staphylococci as the most worrying ones (Brabes, 2005).

The presence of some pathogens can be lethal. An outbreak of Botulism due to the ingestion of a contaminated chicken pie had caused food poisoning that was accompanied by death in a family in the state of Ceara in 2011 (Barboza et al., 2011).

To prevent foodborne diseases caused by improper handling of food, some important measures should be taken, including training and awareness of manipulators, adequate personal hygiene, assessments of health conditions, deployment and compliance with good practices and constant supervision (Campos, 2009). Preparatory programs for food handlers should cover the themes "The hygienic handling of food"; and "Foodborne diseases" as required by the sanitary surveillance (Leite et al., 2011). This survey was developed to assess, train and educate the food handlers of school food service.

## MATERIALS AND METHODS

### Samples

The research was conducted to assess the hygienic-sanitary conditions of school food service in public municipal schools of Barretos - SP (School #1 and School #2).

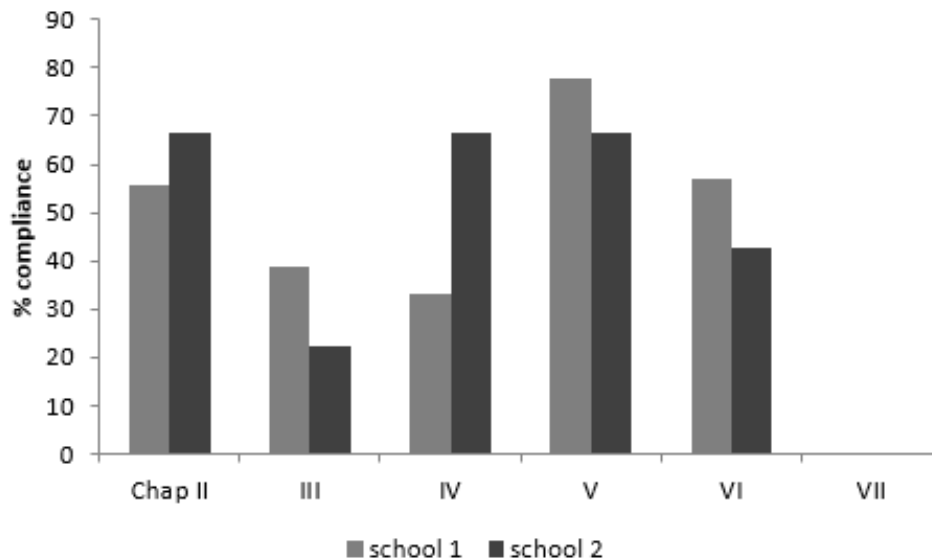
The focus of the study was the employees who were responsible for the preparation of food offered (school cooks) to children. These two schools chosen to be part of the research were appointed by the city (through the City Government) with the intention to seek the best representation of municipal schools per region. One in the central region and the other one in the periphery. The survey was conducted in 4 phases.

### Phase 1: Checklist application

In Phase 1 of the study a checklist contained in CHS (Center of Healter Surveillance) 5 it was applied (São Paulo, 2013), and divided in the following chapters (Ch): Hygiene and health of Employees (Chap. II); Sanitary quality of food production (Ch. III); Hygiene of facilities and the environment (Ch. IV); Operational support (Ch. V), Building and facilities (Ch. (VI) and Documentation (Ch. (VII), Chapters are divided into sections and all the items were evaluated according to compliance, that is, if the establishment met or not the evaluation item of questions.

### Phase 2: Collection of samples and microbiological analysis

In Phase 2 microbiological analysis were performed on the samples collected from sinks (50 cm<sup>2</sup>) and hands of food handlers, obtained by means of the wet swab technique (Swab Absorve-Jiangsu, China), as described by Jay (2005), on alternating days and weeks. Samples were inoculated in culture media for isolation and total counts of mesophilic microorganism - Plate Count Agar (PCA Oxoid-Basingstone, Hampshire, England) and incubated for 24 h at 37°C;



**Figure 1.** Checklist results: % compliance per chapter.

in the culture media Baird Parker (Difco). It also had added egg yolk enriched with potassium tellurite for staphylococci isolation and counting (Ruera, 2006), besides they were incubated for 48 h at 35°C; and application of the Most Probable Number (MPN) technique, for the detection of thermotolerant coliforms (Buzzanello et al., 2008). Samples were transported to the laboratory in coolers immediately after being collected and they were incubated subsequently. It was possible to have three collections, which were conducted at each school on different days to better represent the data.

### Phase 3: Training

For this survey, it was made an important partnership with the Municipal Secretary of Education of Barretos, who extended the invitation to all food handlers in public municipal schools to perform a third step, a theoretical training by means of a lecture about good hygiene practices and food safety.

### Phase 4: Reapplication of the checklist for detection of possible improvements

Aiming to establish possible improvements in Schools #1 and #2, it was reapplied the checklist of CVS 5.

The research was conducted in accordance with ethical principles and was approved by the Federal Institute of Sao Paulo Ethics Committee.

## RESULTS AND DISCUSSION

The checklist application in school #1 showed that 52% of the total of the items evaluated were in accordance and 32% were non-accordance. It is important to add that 16% of remaining items were not applicable to school food service.

In school #2, 45% of the items evaluated were in accordance, 39% were non-accordance and 16% of remaining items were not applicable. In Figure 1, compliance percentage per chapter was observed.

In chapter II on hygiene and health of employees, it was possible to notice that schools accomplish only a little more than 58 and 68% of the required assessment respectively. In both cases our research led us to observe the lack of health cares of employees through the presence of personal ornaments (earrings, ring). The use of adornments is a common non-compliance among Brazilian school food handlers (Gomes et al., 2012; Cardoso et al., 2010; Campos et al., 2009; Sao Jose et al., 2008; Nunes et al., 2017).

Another fact that has drawn attention was the lack of uniform, once the handlers of these establishments were wearing only a coat. Sao Jose et al. (2008) found that despite uniforms were available at the studied schools, the employees did not wear it, being limited only to the use of coats. It was also found similar results in the municipal schools of Natal, where 100% of the handlers were not wearing proper uniform (Campos et al., 2009; Nunes et al., 2017). Another action of the study was to provide posters of the correct procedure for hand hygiene, besides to observing the incorrect way of cleaning them, which can lead to the presence of microorganisms such as coliforms (Campos et al. 2009).

Despite the participants declare the existence of training offered by the city, there was the need of a constant work to increase awareness of good practices. One case of this lack of awareness could be observed when a manipulative coughed and did not wash his hands and had continued to manipulate food. Because of these examples, it was clear that the training of handlers is extremely important and it

must have a positive influence on food hygiene (Baluka et al., 2015).

The main items that do not meet the specifications can be seen in chapter III that deals with one of the most important aspects, that is, the sanitary quality of food production.

In this chapter we highlight the lack of equipment such as refrigerators in school 1, the absence of procedures to avoid cross contamination, exemplified by the presence of only one sink in school 2. The risk of this kind of contamination was also evident in schools in Goiás (Gomes et al., 2012).

Although the establishments were apparently cleaned, there are no standard operating procedures for sanitation of facilities and environments in these kitchens, causing low% compliance in Chapter IV. School 1 has lower compliance by not using personal protective equipment (PPE) when performing this cleaning. Similar results were found in Nunes et al., 2017

Schools have good operational support (Chapter V), once the water supply and garbage collection are adequate. However, at the school there is one trash can without cover in the food handling area and the managers claimed ignorance of the need of having trash cans with automatic or pedal drive.

Chapter VI (sanitary quality of the buildings and facilities) also has low% compliance, which might have happened due to the lack of planning in the buildings of school kitchens, generally seen as domestic ones (Oliveira et al., 2008).

We highlight in this chapter that there are no exclusive sinks for hand hygiene, which is a very concerned fact. The cooks used to wash their hands in the sinks aimed at hygienizing of food and the utensils which were used. This fact was also observed by Gomes et al. (2012) and Sao Jose et al. (2008).

The lack of thermal comfort for employees, protection screens on the windows and protection in the lamps were also observed in this chapter. What it really happens in School 1 which was recently rebuilt. The floor of the school was also not suitable as it was porous, making it difficult to be cleaned. The lack of screens was also observed in the school food service unit studied by Sao Jose et al. (2008). In chapter VII there is adequation because it deals with the documentation and records of the information which are held in the studied units. This non-compliance was also found in the study made by Sao Jose et al. (2008).

In the second application of the checklist, we could see that, only at school#1 the items in accordance had increased which led us to the possibility to name the adequacy of the floor and the acquisition of new cooler to store the food.

In the School #2, there were no changes comparing to the first application. When Gomes et al. (2012) applied the checklist, they only could observe improvements in operational hygiene items. The physical fitness of school kitchens required greater commitment to keep the

improvement in the quality of public management school feeding.

Similar results with high rates of non-compliance form have also been found in studies of Gomes et al. (2012) e Sao Jose et al. (2008). In general, it was observed that school food service facilities are treated as household kitchens, receiving adjustments in infrastructure that could compromise the hygienic-sanitary quality of food.

The study found a high number of the mesophilic microorganism counts on hands from food handlers (Table 1). Staphylococci count detected for hands did not respond to the recommendation of 2.17 log CFU/h and (Silva et al., 2003), in any of the schools, on average 2.45 log CFU/hand at School #1 and 3.0 log CFU/hand at School #2 (Table 2).

The high count of microorganisms in the manipulators' hands may have occurred due to the lack of sinks, soaps and disposable towels, besides the lack of correct procedure for hand hygiene. A similar fact was confirmed by Campos et al. (2009), and in addition to it, we have also detected the presence of thermotolerant coliforms in the hands of manipulators. High counts of staphylococci were also found on the hands of handlers at the restaurant at the Federal University of Rio de Janeiro, Brazil (Medeiros et al., 2017)

Regarding to the areas, it was also observed a standard average acceptable, (up to 50 CFU/cm<sup>2</sup> for the total count and absence of thermotolerant coliforms (at 45°C) (Silva Junior, 2005), as in two of the three samples has been detected the occurrence of thermotolerant coliforms (Table 3). This data is worrisome considering that some foods, especially vegetables, are sanitized and/or manipulated on those sinks, which can result in food contamination.

The presence of coliforms in sinks can lead to contamination of food handled and "sanitized" in these same places once it was observed the presence of vegetables directly in contact both with granite or the tank of the sinks.

## Conclusions

The discovery of microbiological counts that surpass acceptable parameters highlights the need for good hygienic-sanitary practice in school food service and its monitoring and constant supply of training for the improvement of professionals in the area of handling food.

The high percentage of nonconforming items might compromise the hygienic quality of food prepared in these environments and it also might endanger the health of schoolchildren.

It stresses the importance of having adequacy of school kitchens and training food handlers, especially in this environment, to ensure the supply of safe food for School children. The formulation of specific legislation for school kitchens and their enforcement must assist in ensuring safer food to school.

**Table 1.** Total mesophilic microorganism counts for sinks and hands of food handlers.

Total Mesophilic microorganism counts			1st Collection	2nd Collection	3rd Collection
School #1	Handler	Right hand	3 .82	3 .17	4 .77
		Left hand	3 .22	2 .40	3 .55
	Area	Sink (tank)	3 .57	1 .30	4 .43
		Sink (granite)	2 .84	4 .48	4 .93
School #2	Handler	Right hand	3 .02	3 .81	3 .78
		Left hand	4 .76	2 .86	0
	Area	Sink (tank)	3 .65	6 .38	3 .13
		Sink (granite)	2 .74	5 .83	6 .34

**Table 2.** Staphylococci Count for sinks and hands of food handlers

Staphylococci count			1st Collection	2nd Collection	3rd Collection
School #1	Handler	Right hand	2 .18	2 .71	1 .95
		Left hand	2 .04	1 .78	4 .01
School #2	Handler	Right hand	3 .19	2 .74	2 .74
		Left hand	3 .36	3 .75	Uncountable

**Table 3.** Counts of thermotolerant coliforms for sinks.

Thermotolerant coliforms (MPN)			1st Collection	2nd Collection	3rd Collection
School #1	Area	Sink (tank)	0	23	0
		Sink (granite)	0	>110	94
School #2	Area	Sink (tank)	0	>110	0 .62
		Sink (granite)	0	0	0 .09

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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## REFERENCES

- Baluka SA, Miller RA, Kaneene JB (2015). Hygiene practices and food contamination in managed food service facilities in Uganda. *African Journal of Food Science* 9(1):31-42.
- Barboza MMO, Santos NF, Sousa OV (2011). Familiar outbreak of botulism at Ceará State, Brazil: case report. *Journal of the Brazilian Society of Tropical Medicine* 44(3):400-402.
- Brabes KCS (2005) Identification and adhesion ability of *Staphylococcus* spp isolated handlers, air surfaces and of a dairyenvironments. (D.Sc. Dissertation. Department of Food Technology), Federal University of Viçosa. 101 p.
- Buzzanello EB, Martinhago MW, Almeida MM, Pinto FGS (2008). Determination of total and fecal coliforms at municipal lake water Cascavel, Parana. *Brazilian Journal of Biological Sciences* 6(S1):59-60.
- Campos AKC, Cardonha MAS, Pinheiro LBG, Ferreira NR, Azevedo PRM, Stamford TLM (2009). Assessment of personal hygiene and practices of food handlers in municipal public school of Natal, Brazil. *Food Control*. 20(9):807-810.
- Carmo LS, Dias RS, Linardi VR, Sena MJ, Santos DA (2003). An outbreak of staphylococcal food poisoning in the Municipality of Passos, MG, Brazil. *Brazilian Archives of Biology and Technology* 46(4):581-586.
- da Vitória AG, de Souza Couto Oliveira J, de Almeida Pereira LC, de Faria CP, de São José JF (2021). Food safety knowledge, attitudes

- and practices of food handlers: A cross-sectional study in school kitchens in Espírito Santo, Brazil. *BMC Public Health* 21:1-10.
- Gomes NAAA, Campos MRH, Monego ET (2012). Sanitary aspects of food preparation in public schools of Goiás, Brazil. *Brazilian Journal of Nutrition* 25(4):473-485.
- Jay JM (2005). *Food Microbiology*. Artmed, Porto Alegre 6 ed 711 p.
- Lundgren PU, Silva JA, Maciel JF, Fernandes TM (2009). Profile of hygiene and sanitary quality beef sold in free trade and public markets João Pessoa/PB. *Brazilian Journal of Food and Nutrition* 20(1):113-119.
- Leite CL, Cardoso RCV, Góes JAW, Figueiredo KVNA., Silva EO, Bezerril MM, Vidal Júnior PO, Santana AAC. (2011). Professional training for school lunch cooks: a methodological experiment done in state schools supported by the National School Feeding Program in Salvador, Bahia, Brazil. *Brazilian Journal of Nutrition* 24(2):275-285.
- Mello JF, Rocha LB, Lopes ES, Frazzon J, Costa M (2014). Sanitary quality, occurrence and identification of *Staphylococcus* spp. in food services. *Brazilian Journal of Microbiology* 45(3):1031-1037.
- Medeiros MGGA, Carvalho LR, Franco RM (2017). Perception of food handlers' hygiene and microbiological profile in a university restaurant. *Ciência and Saúde Coletiva* 22:383-392.
- Nunes GQ, Adami, Fernanda Scherer; Fassina, Patrícia (2017). Good practices in school food services. *Segurança Alimentar e Nutricional*. 24(1):26-32.
- Oliveira MN, Brasil ALD, Taddei JAAC (2008). Evaluation of hygienic and sanitary conditions of public and philanthropic daycare kitchens. *Ciência and Saúde Coletiva* (3):1051-1060.
- Oliveira LC, Fragoso L WS, Medeiros TC (2023). Knowledge about intestinal parasitoses and good handling practices in school lunch handlers in Caicó-RN. *Revista Multidisciplinar em Saúde* 4(3):24-29
- Passos EC, Mello ARP, Sousa CV, Silva CR, Alonso ACB, Gonzalez E, Tavares M (2010). Presumptive outbreak of foodborne disease among employees working for a company in the southeastern coastal region of Brazil. *Revista do Instituto Adolfo Lutz* 69(1):136-140.
- Ruera SC (2006). *Métodos de análisis microbiológico*. Normas ISO, UNE. Madrid. 36 p. *Analiza calidad – Departamento de Formación*.
- Sao jose JFB, Pinheiro-Santana HM (2008). Assessment of good handling practices in a school food service. *Nutrire the official journal of the Brazilian Society for Food and Nutrition* 33(3):123-138.
- São Paulo (2013). Ministry of Health. Health Surveillance Center Division of Health-Related Products. Ordinance CVS 5 What approves the technical regulation About Good Practice Paragraph Shops Food and Food Services. *Official Diary of the Union* 73(1):32-35.
- Silva CAS, Andrade NJ, Soares NFF, Ferreira SO (2003). Evaluation of ultraviolet radiation to control microorganisms adhering to low density polyethylene films. *Brazilian Journal of Microbiology* 34(2):175-178.
- Silva Júnior EA (2005). Control manual hygiene and health in food services. Varela, Sao Paulo.
- Welker CAD, Both JMC, Longaray SM, Hass S, Soerio MLT, Ramos RC (2010). Microbiological analysis of the foods involved in foodborne disease outbreaks occurred in the Rio Grande do Sul State. Brazil. *Brazilian Journal of Biological Sciences* 8(1):44-48.
- Xavier CAC, Oporto CFO, Silva MP, Silveira IA, Abrantes MR (2007). Prevalence of *Staphylococcus aureus* in the municipal creches food handlers in the city of Natal / RN. *Brazilian Journal of Clinical Analysis* 39:165-168.