



Microbiology of Sandwiches: “Street – Foods” and “Fast – Foods”

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aims: The aim of this study was to investigate the microbiological quality and the presence of pathogens in sandwiches from different snack bars.

Study Design: Foods ready for consumption present a composition which facilitates their deterioration and care from production to consumption ensures its quality. The sandwich is a product of high consumption for its easy acquisition and despite its immediate consumption the sandwich can be considered a food offering risk to the consumers because it is composed of different ingredients that require excessive manipulation.

Place and Duration of Study: Food Microbiology Laboratory - University of Uberaba.

Methodology: For this study, 30 samples of this product were collected from the popular snack bars, street-foods and reputable fast-foods chains in Uberaba trade. The samples were transported to the Laboratory of Food Microbiology of the University of Uberaba in isotherm boxes filled with ice where they were kept under refrigeration until the time of analysis. The microbiological analyses were done according to the methods proposed by Vanderzant and Splittstoesser (1999) and Silva et al. (2007).

Results: From the total of the samples analyzed, 36.6% presented fecal coliforms and *Salmonella*

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sp.; 46.6% presented coagulase-positive *Staphylococcus* and 30% *Bacillus cereus*. There was no presence of sulphite-reducing *clostridium*.

Conclusion: The presence of coagulase-positive *Staphylococcus aureus* indicates the lack of hygiene by food handlers because it is a living microorganism from the nasopharynx and the presence of *Salmonella* sp. and fecal coliforms indicate poor hygiene and sanitary handling. The improper handling and lack of care in relation to good practices favor the food poisoning.

Keywords: *Microbial contamination; sandwiches; microorganisms.*

1. INTRODUCTION

The growing migration of the rural population to urban areas encouraged industrial development, resulting in an increase in the concentration of people in these regions and an increase in food demand [1].

Flandrin and Montanari, 1998, said that urbanization and industrialization greatly changed the lifestyle in the 50s - 60s, in addition to the professionalization of women, the increase in the standard of living, education, use of the car, access to leisure, vacation and travel. Consequently, there was an increase in the number of meals taken away from home. [2] Fischler, 1995, also said that the breakdown of eating habits began in the 1960s in America [3].

An important factor that led the population to eat more often outside home was the increasing insertion of women in the labor market, resulting in less time to prepare food at home [1].

Exist a terminology to characterize foods that are prepared and sold on streets which is "street food", but some foods commons for Americans, such as hamburgers, pizzas and fries are called "fast food", which are foods that have gained more popularity [1].

The growing rate of unemployment and the need for qualified and dedicated labor have led many countries, including Brazil, to greater business competitiveness and, consequently, to increase the working hours of the economically active Brazilian population. With the need to work more hours outside the home and often in places far from home, the Brazilian worker changed his routine over the years and started to eat outside the home, using, among others, fast-foods or even street-foods [1].

The designation for street food is food and drinks ready for consumption, prepared and/or sold on the streets and other similar places, such as hospitals, schools, train stations, bus terminals, workplaces, among others, which can be

consumed immediately or later, with no preparation or processing steps [4,5].

In addition to the large chains, the informal snack trade by street vendors is also growing, giving the option of a job and offering a cheaper, faster and more accessible alternative for the general population, especially that people who works in large centers and often don't have time to make your meals at home [6]. Thus, the sale of food sold by street vendors poses risks to the health of the population, due to the sanitary condition of the products sold. [7].

According to Soto et al., 2008, this framework provides favorable conditions for increasing the risk of food poisoning [8].

Food poisoning and illnesses caused by ingestion of contaminated food or toxic substances are a major health problem that presents difficulties to be scaled in Brazil due to the non-mandatory reporting of outbreaks [9].

Food sold on the streets represents a public health problem because, with some exceptions, they are prepared and sold without the minimum conditions of hygiene and may contain contaminating and potentially pathogenic microorganisms, putting the health of those who consume them at risk [10,11].

The preparation of these foods requires excessive handling, thereby increasing the risk of contamination of these products, in addition to the poor hygiene conditions of the place, incorrect storage and unsatisfactory temperature of the raw materials, as well as during their preparation and sale due to the lack of training of handlers [10].

Food is contaminated by contact with insufficiently clean utensils, surfaces and equipment. It is known that pathogenic microorganisms can be present in food particles or in water over improperly washed utensils [12].

According to the World Health Organization, 1989, the manipulator can be a way of contaminating food produced on a large scale and plays an important role in the safety and preservation of food hygiene throughout the production chain, from receipt, storage, preparation until distribution. Incorrect handling and carelessness in relation to hygienic standards favor food poisoning. [5]

Contaminated food causes harm not only to the health of the consumer, but also to the company that supplies it [13].

Staphylococcus aureus and *Escherichia coli* are mainly responsible for outbreaks of food poisoning when associated with unsatisfactory sanitary conditions of handlers and utensils [14].

2. MATERIALS AND METHODS

This work was developed with 30 sandwich samples, acquired in seven popular snack bars, "street-foods", and in 3 renowned "fast-food" chains in the city of Uberaba_MG, having the concern with the standardization of snacks, all of them being made up of hamburger bread, beef hamburger, cheese, lettuce and tomatoes. The samples were transported to the Food Microbiology Laboratory at the University of Uberaba, in isothermal boxes with ice, kept under refrigeration until the moment of the analyzes, where microbiological analyzes were carried out according to methodologies proposed by Vanderzant and Splittstoesser, 1999, and Silva, 2007 [15,16].

3. RESULTS AND DISCUSSION

The results of the microbiological analyzes of the samples, are shown in Table 1, were classified as satisfactory or unsatisfactory based on the standards of Brazilian legislation that establishes that confectionery, snack bars, bakeries and similar products, sweet and salty, ready for consumption as cakes, pies and the like, sweet or salty, with or without filling and topping, stable at room temperature, such as pastries, pies, hot sandwiches and other salty foods must have an absence of *Salmonella* sp. in 25g; Coagulase positive *Staphylococcus*, *B. cereus* and sulphite-reducing *clostridium* should be <103UFC /g and faecal colliforms <102NMP/g [17].

It can be observed that the presence of coliforms at 45°C occurred in 36.6% (n = 11) of the

analyzed samples and all samples from establishment C, are above the current legal standards, that is, > 102NMP / g.

In analyzes performed by Kawano Junior, Vargas and Duarte, 2009 of the 25 samples analyzed, 3 (12%) presented coliform counts at 45°C [18]. Within the 6 samples analyzed by Giacomello et al, 2008, higher limits were found than those recommended by the Ministry of Health for thermotolerant coliforms in 2 samples [19]. In the analyzes carried out by Gandra et al, 2011, of the 16 samples, 6 presented results above the maximum amount allowed for thermotolerant coliforms [20].

The presence of this microorganism shows the lack of training of handlers on basic hygiene notions during the preparation of these foods, because when the analysis is carried out, the determination of coliforms of gastrointestinal origin is sought, however it is known that *Enterobacter* and *Klebsiella* strains included in this group may have non-fecal origin (water, soil and vegetables) [21].

According to Alves and Travain, 2011, the lack of running water in street vendors' carts does not allow the correct hygiene of hands and utensils, as well as the impossibility of controlling pests and other vehicles of microorganisms and diseases [7].

Regarding *Salmonella* sp., it is observed that of the 30 samples analyzed in 36.6% (n = 11) their presence occurred. These results differ from the analyzes carried out by Kawano Junior, Vargas and Duarte, 2009, since in 100% (n = 25) of the samples there was an absence of *Salmonella* sp. [18], results similar to those of Curi, Gallo and Dias, 2008, where none of the 50 samples analyzed presented contamination by *Salmonella* sp. [22].

Of the 6 samples analyzed by Giacomello et al, 2008, two presented great contamination by *Salmonella* sp., since the samples come from two vans and the conditions in these locations presented dust exposure, unavailability of drinking water, unprotected hands with gloves and, some times, manipulators came into contact with food and money [19], the latter also occurring in some of the 10 locations in this study. In analyzes carried out by Gandra et al., 2011, in 4 of the 16 samples, the presence of *Salmonella* sp. occurred [20].

Table 1. Microbiology of sandwiches “fast-foods” e “street-foods”

Locations	Microorganisms				
	Coliforms at 45°C (NMP/g)	<i>Salmonella</i> sp. (abs. in 25g)	<i>St.</i> coag.+(UFC/g)	<i>B. cereus</i> (UFC/g)	<i>Clostridium</i> sulfite-reducer (UFC/g)
A	29	Abs. in 25g	<10	<10	<10
	<3.0	Pres. in 25g	<10	<10	<10
	<3.0	Pres. in 25g	<10	<10	<10
B	3.6	Abs. in 25g	2.0x10 ³	<10	<10
	<3.0	Abs. in 25g	<10	<10	<10
	<3.0	Pres. in 25g	<10	<10	<10
C	>1,100	Pres. in 25g	1.3x10 ⁴	<10	<10
	>1,100	Abs. in 25g	6.3x10 ³	<10	<10
	460	Abs. in 25g	2.6x10 ³	<10	<10
D	<3.0	Abs. in 25g	<10	<10	<10
	<3.0	Abs. in 25g	5.2x10 ³	<10	<10
	3.6	Abs. in 25g	7.4x10 ³	<10	<10
E	<3.0	Abs. in 25g	<10	<10	<10
	<3.0	Abs. in 25g	<10	<10	<10
	<3.0	Abs. in 25g	2.5x10 ³	<10	<10
F	<3.0	Pres. in 25g	2.1x10 ⁴	<10	<10
	<3.0	Pres. in 25g	4.8x10 ³	<10	<10
	<3.0	Pres. in 25g	2.92x10 ⁵	2.0x10 ²	<10
G	9.2	Abs. in 25g	<10	<10	<10
	<3.0	Abs. in 25g	3.04x10 ⁵	<10	<10
	<3.0	Abs. in 25g	3.44x10 ⁴	1.4x10 ³	<10
H	3.6	Abs. in 25g	<10	<10	<10
	43	Abs. in 25g	<10	3.4x10 ⁴	<10
	<3.0	Pres. in 25g	<10	1.0x10 ²	<10
I	9.2	Abs. in 25g	<10	2.0x10 ²	<10
	3.6	Abs. in 25g	1.13x10 ⁴	3.7x10 ³	<10
	<3.0	Pres. in 25g	1.09x10 ⁶	1.0x10 ²	<10
J	<3.0	Abs. in 25g	<10	<10	<10
	<3.0	Pres. in 25g	<10	3.0x10 ²	<10
	<3.0	Pres. in 25g	<10	2.0x10 ²	<10

Source: Laboratory of food microbiology-UNIUBE

The legal standard for positive coagulase *Staphylococcus* is 1.0x10³ CFU / g, and in the results obtained, there is 46.6% (n = 14) of the samples analyzed were with the presence of this microorganism above the recommended standards.

Within the 6 samples analyzed by Giacomello et al., 2008, higher limits were found than those recommended by the Ministry of Health for coagulase positive *Staphylococcus* in 2 samples [19].

The results obtained acquire a relevant and concern role, because in addition to being a group of bacteria that indicates unhygienic manipulation of food, since it is resides in the nasopharynx, mouth, intestinal tract and several

areas of the skin, commonly characterized as asymptomatic carriers, it is responsible for several pathology, of clinical and epidemiological importance [23].

For *Bacillus cereus*, the required standard value is 1.0x10³ CFU / g and in the 30 samples analyzed, 10% (n = 3) were in disagreement with the current legislation, and these samples were acquired at locations G, H and I.

In the analyzes by Giacomello et al., 2008, two samples out of the six analyzed, exceeded the recommended standards for counting *Bacillus cereus* [19]. In the research by Curi, Gallo and Dias, 2008, none of the 50 samples analyzed showed contamination by *Bacillus cereus* [22].

There was no presence of sulphite-reducing *clostridium* in the analyzed samples and similar results were found by Curi, Gallo and Dias, 2008, where none of the 50 analyzed samples presented contamination by sulphite-reducing *clostridium* [22].

It is worth noting that the greatest number of contaminations occurred in street-food sandwiches, being that the presence of *Bacillus cereus* only occurring in some of them, whereas in fast-food sandwiches did not occur with this microorganism. Noting that at least one sample of each local was contaminated by any of the five microorganisms analyzed.

Gandra et al. [20], said that ready-to-eat foods sold by street vendors, in most cases, do not have standardized proceedings and manipulators with minimal basic knowledge of microbiology and hygiene.

Food poisoning can be prevented through training, education and better preparation of food handlers and they must be periodically supervised and trained in personal hygiene, in hygienic handling of food and in food-borne diseases, as stated in RDC n.216, of September 15, 2004, which provides for Technical Regulations on Good Practices for Food Services [24].

4. CONCLUSION

The results show the need for health surveillance to act with preventive and educational intervention actions for food handlers of this nature.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Bezerra. Still Couto Dinucci. The baguncinha sandwich on the streets of Cuiabá - MT: evaluation of educational intervention. 2007. 278 f. Dissertation (Doctorate in Public Health) - University of São Paulo, São Paulo; 2007.
2. Flandrin JL, Montanari M. History of food. São Paulo: Ed. Estação Liberdade. 1998;885.
3. Fischler C. El (h) omnivore- El gusto, la cocina y cuerpo. Barcelona: Anagram Editorial. 1995;421.

4. Latham MC. Human nutrition in the developing world. Rome: FAO. 1997;508.
5. WORLD HEALTH ORGANIZATION - WHO. Division of food and nutrition. Food Safety Unit. Essential safety requirements for street-sold foods (Revised Edition); 1996.
Available:<http://www.who.int/foodsafety/publications/fs_management/en/streetvend.pdf>
Accessed on September 28 2011.
6. Germano MIS, Germano PML. Street food: Pros and cons. Food Hygiene Magazine, São Paulo. 2000;11(77):27-32.
7. Alves, Gilberto, TRAVAIN, Glisyanne Domingues. Hygienic-sanitary conditions of a street vendor in the city of Umuarama, PR: a case study. Higiene Alimentar Magazine, São Paulo. 2011;25(194/195):24-29.
8. Soto FRM et al. Methodology for assessing the health conditions of street vendors of food in the municipality of Ibiúna - SP. Brazilian Journal of Epidemiology. 2008; 2(11):297-303.
9. Eiroa MNU. Investigation of outbreaks of bacterial toxoinfection caused by processed foods. Collection of the Food Technology Institute, Campinas. 1989;19(2):101-112.
10. Catanozi MPLM, Morelhão GG, Iurcic KM. Microbiological evaluation of snacks sold in street vending carts in the city of Araraquara, SP. Food Hygiene Magazine, São Paulo. 1999;13(66/67):116-120.
11. Dallari SG, et al. Health surveillance of food for immediate consumption in the city of São Paulo: The importance of information for planning. Food Hygiene Magazine, São Paulo. 2000;14(76):24-26.
12. Piragine KO. Hygienic and sanitary aspects of the preparation of school lunches in the State Education Network of Curitiba. 2005. 107f. Dissertation (Master in Food Technology) - Federal University of Paraná, Curitiba; 2005.
13. Silva Junior EA. da. Hygienic-sanitary food control manual. 5. ed. São Paulo: Varela. 2002;479.
14. Oliveira A. de. M.; et al. Food handlers: A risk factor. Food Hygiene Magazine. São Paulo. 2003;17(114/115):12-19.
15. Vanderzant C, Splittstoesser DF. Compendium of methods for the microbiological examination of foods. 3. ed. Washington: American Public Health Association. 1999;1219.

16. Silva N. Manual of methods of microbiological analysis of food. São Paulo: Varela. 2007;149-151.
17. Brazil. Ministry of health. national health surveillance agency. resolution - RDC n.12, of January 2, 2001. Technical regulation on microbiological standards for food. Official Gazette [of] the Federative Republic of Brazil, Brasília, DF; 2001. Available:<<http://www.anvisa.gov.br/legis/portarias/451-97.htm>> Accessed on: 22 sep. 2011.
18. Kawano Junior, Celso Nobuo,Vargas, Daniela Strauss Thuler,Duarte, Enios Carlos. Hygienic-sanitary quality of hot dogs sold by street vendors in the Santo Amaro neighborhood - São Paulo, SP. Food Hygiene Magazine, São Paulo. 2009;23(176 / 177):79-84.
19. Giacomello, Simone; et al. Microbiological quality of hot dogs produced and sold on public roads and cafeterias near the Integrated Regional University - Campus of Frederico Westphalen, RS. Higiene Alimentar Magazine, São Paulo.2008;22(163):50-55.
20. Gandra, Eliezer Ávila; et al. Hygienic-sanitary conditions of snacks from the mobile food trade in Umuarama, PR. Food Hygiene Magazine, São Paulo.2011; 25(2):148-152.
21. Silva, Maria Cecília da. Evaluation of microbiological quality of food using conventional methodologies and the SimPlate System. 87 f. Dissertation (Master in Food Science and Technology) - University of São Paulo, Piracicaba; 2002.
22. CURI, Jacqueline Duarte do Páteo; GALLO, Cláudio Rosa, DIAS, Carlos Tadeu dos Santos. Microbiological conditions of snacks (hot dogs) purchased from street vendors, located in the central part of the city of Limeira, SP. Higiene Alimentar Magazine, São Paulo.2008; 22(164):61-66.
23. Guerreiro MG, et al. Special bacteriology with interest in animal health and public health. Porto Alegre: Sublina. 1984;494.
24. Brazil. Ministry of health. national health surveillance agency. resolution– RDC, Technical Regulation on microbiological standards for food. Official Gazette [of] the Federative Republic of Brazil, Brasília, DF, 15 de sep. 2004;216. Available:<http://www.anvisa.gov.br/alimento/s/bps.htm> Accessed on: 21 October 2011

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