

Innocuousness of sandwiches sold on the streets of Cuiaba, Mato Grosso state, Brazil

Inocuidade de sanduíches vendidos nas ruas de Cuiabá - MT, Brasil

ABSTRACT

Objective: This article discusses the problem involving the street food commerce and its sanitary conditions, aiming at the food safety as part of food security and promotion of human right to healthy eating. It was analyzed the effectiveness of an educational intervention on Good Manufacture Practices carried out with food street vendors. The sandwich, known as the “baguncinha”, was sold in the city of Cuiaba/MT/Brazil, in 2005. **Methods:** It is a cross-sectional study with a test group case. Before the training intervention, 105 sandwiches were tested by standard methods regarding heat-stable coliform counts; identification of *Bacillus cereus*, *Clostridium perfringens*, *Staphylococcus aureus*; and incidence of *Salmonella spp.* One hundred eighty new samples were analyzed one and six months after the training program, totaling 285 sandwiches. **Results:** A total of 31.4% commercial premises were considered unsuitable for food consumption. The training program applied in this study does not seem to have altered the microbiological quality of sandwiches. **Conclusions:** This scenario can contribute to a high risk associated with foodborne illnesses. The results suggest the necessity of a review to identify approaches and methods that bring about effective changes in street food commerce. Interventions should be associated with actions for hygiene-awareness of the consumers. Furthermore, a debate on the importance of regulatory public policies is recommended.

Keywords: Capacitation. Ready-to-eat food. Bacterial contamination. Innocuousness.

RESUMO

Objetivo: O presente artigo contribui para a discussão sobre a questão da comercialização de comida de rua e a sua relação com a qualidade higiênico-sanitária, como parte da segurança alimentar e nutricional, na perspectiva da promoção do direito humano à alimentação adequada. Teve como objetivo analisar a eficácia de uma intervenção educativa sobre Boas Práticas de Manipulação, desenvolvida em 2005, com os comerciantes de sanduíches conhecidos como “baguncinha”, vendidos nas ruas do município de Cuiabá. **Método:** Foi delineado como um estudo transversal do tipo grupo controle. Antes da qualificação, foram testados 105 sanduíches, para contagem de coliformes termotolerantes; identificação de *Bacillus cereus*, *Clostridium perfringens* e *Staphylococcus aureus*, e incidência de *Salmonella spp.* Foram analisadas 180 novas amostras um e seis meses após o treinamento, totalizando 285 sanduíches. **Resultados:** Um total de 31,4% dos estabelecimentos estava inadequado para o consumo de alimentos e o programa de treinamento aplicado na pesquisa parece não ter alterado a qualidade microbiológica do sanduíche. **Conclusão:** Este cenário pode contribuir para um elevado risco associado a doenças transmitidas por alimentos. Os resultados assinalam a necessidade de uma revisão para identificar abordagens e métodos que permitam mudanças efetivas no comércio de comida de rua. É aconselhável que as intervenções sejam associadas a ações de conscientização dos consumidores sobre a questão higiênico-sanitária. Além disso, é fundamental que provoquem o debate sobre a importância da regulamentação de políticas públicas específicas para este segmento comercial.

Palavras-chave: Capacitação. Alimentos prontos para consumo. Contaminação bacteriana. Inocuidade.

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INTRODUCTION

The commercial segment of street food has provided a service at accessible prices in the urban area, particularly for the low-income population of Latin America, including Brazil.^{1,2} In 2002, it was possible to buy a hot dog and a beverage (soft drink or fruit juice) for US\$ 0.25 to 1.0. These become foods that often replace a main meal. The sensation of satiety provided by a hot dog has been considered equivalent to a meal.³ From the nutritional point of view, has contributed to the daily ingestion of some nutrients and energy.⁴

The Household Budget Survey collected information on food consumed away from home in 2008-2009. A subsample of 24.5% households also answered the National Dietary Survey (INA) and residents aged over 10 years (n°.34,003 people; 65% adults, 22% adolescents and 13% elderly), stratified by Brazilian region, recorded the food consumed for 24 hours throughout two nonconsecutive days, detailing the type of preparation, frequency, quantity, time and food source (inside or outside home).⁵ The food record in the first day allowed analyzing the features of consumption and 51% among adolescents in the Midwest region told to consume food away from home. Although the sandwiches are not food group with the highest average intake (g/day), in the Midwest region, they were the third highest percentage (47.4%) of consumption away from home, losing only to the group of pizzas (71, 7%) and alcoholic beverages (59.4%), in a total of thirty-three food groups.⁶

Some street foods have been also contributing with tourism, providing typical foods of the local culture and strengthening the gastronomic heritage.⁷⁻⁹ The “Baguncinha” is a typical sandwich of the metropolitan region of the city of Cuiabá - MT, Brazil. It is an adaptation of the traditional version of the “X-Tudo” (bread, mayonnaise, hamburger, cheese, ham, sausage, egg, lettuce, and tomato) with fewer ingredients. The low price makes the sandwich popular among poor people, particularly adolescents.

Located in the central region of the southern part of the state of Mato Grosso, Brazil, Cuiabá has an urban population of 551.350 and shows an annual growth rate of 2.72%.¹⁰ This capital

has reflected most of the elements present in the metropolises of developing nations, including a rapid growth in street food merchants, particularly those handling of sandwich.

Although the sale of street food provides a source of income to a significant number of workers, some international agencies have pointed out the potential hazard of these foods to public health, mainly microbiological, focusing on the hygienic and sanitary conditions of the products and correlating them with the food handlers' lack of qualifications in Good Manufacture Practices (GMP).¹¹ Among some reasons, due to the informal nature of street food commerce, little has been studied and published about this theme, making it relevant carrying out a detailed investigation from the standpoint of hygienic and sanitary quality.⁷

The Hazard Analysis and Critical Control Points (HACCP) can be an important tool for managing the food safety. This means establish a control point in each specific line of the production in order to adopt preventive measures to control by the end of the process. Thus, it is possible identify the potential hazard, mainly microbiological, associated with the specific food and the points at which this hazard could introduce or reach levels outside set by the law. Although not depend solely this variable, when is identified new hazards or there are changes in the food handling, it would be recommended to review the monitoring. A HACCP program must be training accomplished under GMP applied to food handlers.¹¹

From this perspective, the Brazilian Policy of Food and Nutrition has as one of its goals the guarantee of food innocuousness for consumption in the country.¹² The food security definition includes an articulated set of actions in the dimension of the human right to adequate food. It consists in the realization of right to regular and permanent access to good quality food in sufficient quantity, without compromising access to other essential needs, based on the promotion of healthy feeding practices, respecting cultural diversity and whether environmental, economically and socially sustainable.^{13,14} Having the care not to reduce its wide concept, this article is limited to the aspect of the street food handler's

qualification, but, emphasizes the importance of food safety as a component of food security.

Although their field not clearly defined because of the diversity of conceptual approaches and practices, the food and nutrition education can be an important strategy for promoting health, food safety and food security. Among many dimensions involved in dietary practices, are the meanings and the symbolic aspects. Once the food and nutrition education discusses these multiple dimensions, approaches the real life of individuals and allows the establishment of connections between the pedagogical process and the different local realities and needs.¹⁴

The food and nutrition education include the concept of qualification and capacitation. However, the definition of capacitation is considered differentiated of the term qualification. That because capacitation covers a wider view of feed, nutrition and health, going beyond training and allowing the empowerment. The capacitation is directed towards health promotion, knowledge sharing and focusing on knowing “why do” health practices; while the qualification has an operational connotation and focuses at the “knowhow”.^{14,15} To realize these objectives, the food and nutrition education could use as strategy, for example, the approach of popular education and the research-action method.^{15,16}

This paper aimed to analyze the effectiveness of an educational intervention carried out merchants of sandwiches known as “baguncinha” sold on the streets of Cuiaba city, comparing the innocuousness and a physical parameter of the food (internal temperature of cooking and storage) before, one and six months after the training program on GMP.

It is also important to emphasize that even though the study was undertaken in 2005 and 2006, the debate over this commercial sector is current. Although it is not only a Brazilian reality, recent studies show that the street food commerce scenario remains, getting worse in some cases.^{9,17-20} Furthermore, there are few studies exploring the methodologies used in the educational interventions.²¹⁻²⁵ and there are even fewer studies on educational interventions with street food handlers.^{8,18}

MATERIALS AND METHOD

SAMPLING AND ETHICAL ASPECTS

The study site was the urban sector of the district of Cuiaba, Mato Grosso, Brazil. This district was chosen due to their high population and concentration of street food merchants; however, the IBGE (Brazilian Institute of Geography and Statistics)¹⁰ and the Municipal Department of Urban Services and Environment did not have records about the informal food market. Therefore, it was defined a random sampling based on an estimated universe of 284 street food merchants. It was calculated the street food universe from a mapping of 75% of the four sub districts in the urban sector of Cuiaba, drawn up during the month of June 2004 in the mornings, afternoons and evenings.

Forty-three merchants were invited to participate in this research out of an estimated of 91 merchants of sandwiches. From 42 who agreed to participate, seven were recruited exclusively for the pilot test, e.g., about 20% from the universe. It was defined that percentage by the districts number (two – center and Coxipó) and sub-districts (four – north, south, east and west) of Cuiaba. The remaining sample (35 participants) was statistically representative of the universe, at a confidence level of 95% and precision of 5%.²⁶

Two independent groups of 16 to 19 participants per group: a test group (which participated in the educational campaign) and control group (which did not participate in the campaign) resulted of that sample. It was drawn manually a table with random numbers to represent each vendor formed these groups.²⁶

It was considered criterion of exclusion from the research if a vendor declared he uninterested in participating in a training program. Others criteria were if he was absence during some part of the educational campaign (e.g., he attended only one of the two sessions or he was present for both, but did not remain the full eight hours) or he changed of sales point after the training program.

Three sandwiches weighing on average 221 g were collected from each sales point in each sampling stage, making a total of 105, 90 and 90 samples analyzed, respectively, before, one and

six month after the educational campaign. Thus, it was analyzed 285 sandwiches between March 2005 and April 2006. It was collected sample immediately after cooking and under aseptic conditions. Then, it was wrapped it in sterile plastic bags, sealed it, labeled it and kept in cool boxes containing recycled ice.²⁷

Ethical aspects followed conformed to Helsinki Declaration and the Brazilian Code of Practice CNS n.196/1996 under research protocol number 1057/COEP/USP/2003.

MICROBIOLOGICAL ANALYSIS OF SANDWICH

The microorganisms researched included those that posed an indirect risk to the consumer's health, such as heat stable coliforms; a direct risk, such as *Salmonella* and *Staphylococcus* and other indicators of contamination such as clostridium sulphite reductase and *Bacillus cereus*.²⁷

The microbiological analyses carried out included isolation and identification of pathogens, following standard procedures to presumptive quantification of clostridium sulphite reductase, *Bacillus cereus*, differentiation of *Staphylococcus spp*, Most Probable Number (MPN) of coliforms at 45°C and the presence of *Salmonella sp*.²⁷

It was weighed twenty-five grams of a sandwich, put in 225 mL of saline peptone solution (SPS) 0.1% and homogenized for the following procedures:

COLIFORM COUNTS AT 45°C

The MPN of coliforms was determined using three series of dilutions (10^{-1} to 10^{-3}). Using a sterile pipette, an aliquot of 1 mL of each dilution was introduced into a series of three tubes containing lauryl sulphate tryptose (LST) with Durham tubes and incubated at 36°C for 48 hours for the presumptive test. All the tubes that had become turbid and in which gas produced, it was selected and transferred to tubes containing *E coli* culture. Then, the tubes were incubated in a bain-marie at 45°C for 48 hours. It was quantified the tubes of *E coli* medium that showed turbidity and gas production and the MPN of coliforms per gram was determined according to the MPN table for the three tubes.²⁷

DIFFERENTIATION OF *STAPHYLOCOCCUS SPP* USING THE COAGULASE TEST

An aliquot of 0,1 mL was drawn off from each of the series of dilutions (10^{-2} to 10^{-4}) and distributed on the surface of duplicate Petri dishes containing Baird Parker Agar (BPA), spread with a Drigalsky handle and incubated at 36°C for 48 hours. It was selected all the Petri dishes containing between 20 and 200 colonies and expressed as Colony-Forming Units per gram of sandwich (CFU/g). Typical and atypical colonies were tested using Gram staining, catalyse and coagulase tests.²⁷

COUNTS OF *CLOSTRIDIUM SULPHITE REDUCTASE*

For the Clostridium counts, an aliquot of 0.1 mL of the dilutions 10^{-2} to 10^{-4} were spread on duplicate Petri dishes containing tryptose sulphite cycloserine agar (TSC) using a Drigalsky handle. After drying completely, the Petri dishes were covered with a layer of TSC and incubated at 35°C for 24 hours in anaerobic conditions. After incubation, Petri dishes containing between 20 and 200 of the black colonies that typify Clostridium cultures were selected.²⁷

BACILLUS CEREUS COUNTS

An aliquot of 0.1mL was taken from the 10^{-2} to 10^{-4} dilutions and spread on duplicate Petri dishes containing mannitol egg yolk polymyxin agar (MYP) using a Drigalsky handle. After the surface of the agar had dried completely, the Petri dishes were incubated at 30°C for 24 hours. Following incubation, Petri dishes containing from 10 to 100 typical *Bacillus cereus* colonies were selected and at least five taken for confirmatory testing.²⁷

It was expressed the result of clostridium sulphite reductase and *Bacillus cereus* in Colony-Forming Units per gram of sandwich (CFU/g).

DETECTION OF *SALMONELLA SP*.

Prior to enrichment, it was homogenized 25g of the sandwich in 225 mL of lactose nutrient broth (LNB) and incubated at 36°C for 24 hours. Then, an aliquot of 1.0mL and 0.1mL of this suspension were added to test tubes containing 10mL of tetrathionate broth (TT) and Rappaport-Vassiliadis (RV) nutrient broth. They

were incubated at 35°C and 42°C for 24 hours, respectively, in bain-marie. Prior to that, it was spread a drop of each nutrient broth in Petri dishes of Hoekten Enteric (HE) and Rambach (RAM) agar, previously incubated at 36°C for 24 hours. The presumptive colonies of *Salmonella* were placed into tubes containing Nutrient Agar (ANI) and incubated at 35°C for 24 hours. The typical *Salmonella* sp. colonies were subjected to biochemical tests in Triple Sugar Iron (TSI), Lysine Iron (LIA) and Simmons' citrate agar. The TSI and LIA agars were incubated at 35°C for 24 hours and that one of Simmons' citrate at 35°C for 96 hours.²⁷ The colonies manifesting biochemical behavior conforming to that one of *Salmonella* were subjected to agglutination testing using polyvalent somatic anti-*Salmonella* serum da marca PROBAC do Brasil®, from São Paulo, Brazil.

MEASURING OF INTERNAL TEMPERATURE SANDWICH AND COMPONENTS

It was measured the temperature of some of the components (bread, hamburger and sausage) and of ready-to-eat sandwich, immediately after cooking, during each visit to the sales points. To measure the internal temperature, a digital bayonet-type penetration thermometer was used with a scale in Celsius and Fahrenheit, in an interval of -50°C to +150°C, which enabled us to check the minimum and maximum temperature of the food. To measure the cooking temperature, it was inserted the thermometer horizontally into the hamburger and the sausage, and vertically into the ready sandwich immediately after cooking. It was evaluated the temperature of the refrigerated items inserting the thermometer horizontally between hamburger, sausage and bread wrappers and wait for the temperature to stabilize.²⁸

EDUCATIONAL INTERVENTION

The intervention evaluated in this research was the only educational program proposal for street food merchants in Cuiaba city. Nutritionist instructors without the researcher's participation carried it out in October 2005. The duration of the training program was 8 hours of theoretical lessons divided into two classes. The program included basic notions of

personal and environmental hygiene, hygiene of cooking utensils and equipment, food purchasing, cross-contamination, time/temperature ratio, appropriate use of the thermometer and kitchen towels, use of leftovers and notions of microbiology. The technique adopted was lectures aided by audiovisual resources (slides and video) and the distribution of educational materials. There was not demonstration with food preparations equipment. There was a pre-test and post-test to ascertain the level of knowledge gained. However, it was not objective in this paper demonstrate these results here. There was not evaluation completed to ascertain the learner's perceived value. The street vendors' practices skills were assessed by the microbiological results and measuring temperatures (cooking and storage) at three moments: before (P0 = phase zero), one month (P2 = phase two) and six month (P3 = phase three) after the educational intervention, considering the moment when the training program was applied as phase one (P1). These moments (P0, P2 and P3) were measurements taken the test and control groups, without the seven subjects who only fit in the pilot test.

INTERPRETATION OF THE RESULTS

The microbiological results were interpreted according to the sanitary standards set forth in the RDC n.º.12, which approves the technical regulations for microbiological standards for food²⁹, as indicated in Table 1. In the thermal treatment, the minimum temperature considered suitable to ensure reduction of the microbial load was 74°C at the center of the food item. The temperature 5°C was the minimal safe cold storage for refrigeration.²⁸ The educational intervention was analyzed taking into account the benchmark of food and nutrition education to the public policy¹⁴ and the educational empowerment approach.^{15,16}

STATISTICAL TREATMENT OF THE DATA

The results were encoded with the help of the program *Statistical Package for the Social Sciences* (SPSS) version 10.0. The variables were initially described through averages and standard deviation. Subsequently, the results obtained from the control and test groups were crossed in phases

P0, P2 and P3 by means of inferential analysis. It was applied the normality test and close to normal distribution.²⁶

For the sociodemographic variables, it was used the chi-square (X^2) test to evaluate the differences of proportions, and Student's *t* test to compare intergroup averages. Student's *t* test was applied to the variables of microbiology and temperature to compare the average of two dependent samples, e.g., prior to and one month after the training program and for independent samples (control and test). Levene's test of equality of variance was requested for the statistical intergroup treatment in order to correct anomalous dispersion of sampled data. ANOVA one way and Scheffe pos-hoc test was applied to the variables of microbiology and temperature to compare the average of three independent samples, e.g., prior, one and six month after the training.²⁶

RESULTS

This study was a cross-sectional with test group case. Thirty five sales points were evaluated. Considering the criteria of exclusion adopted previously, nineteen merchants were invited to participate in the training program and five dropped out, so the educational program ended with an attendance rate of 73.7%. The control (N=16) and test (N=14) groups did not show statistically significant differences in their socio demographic data. Both were distributed as shown in Table 2. This educational intervention was ineffective to change food handling and the sandwiches innocuousness as shown by the following results:

FOOD MICROBIOLOGY

The sampled sandwiches were exhibiting heat stable coliforms and *Staphylococcus aureus* in higher numbers than allowed by Brazilian National

Table 1. Brazilian standard for microbiological analyses in hot sandwich, 2001*.

Food Group	Microorganisms group	Brazilian Standards
Hot Sandwich: Egg - Cheese - Hamburger - Tomato - Lettuce	<i>Salmonella spp</i> /25g	Absence
	Heat Stable Coliforms (MPN/g)	10 ²
	<i>Staphylococcus aureus</i> (CFU/g)	10 ³
	<i>Bacillus cereus</i> (CFU/g)	10 ³
	<i>Clostridium perfringens</i> (CFU/g)	10 ³

*Source: Brazil. Ministério da Saúde. Brazilian National Health Surveillance Agency. (Resolution nº12 of January 02, 2001).²⁹

Table 2. Profile of sandwiches vendors on the streets of Cuiaba city - MT, 2005.

Category	Control Group (n=16)	Test Group (n=14)
Age ^{a,b} (SD)	27 (SD ±11.0)	31(SD±11.4)
Gender ^c (%)		
Female	5 (31.3%)	3 (21.4%)
Male	11 (68.7%)	11 (78.6%)
Educational attainment ^c (%)		
No schooling	4 (25.0%)	4 (28.6%)
Primary school	7 (43.8%)	2 (14.3%)
Secondary school	5 (31.2%)	8 (57.1%)
Average productivity/daily	52 (SD±46.4)	50 (SD±30)

^a Mean±standard deviation (SD); ^b No significant statistical differences into groups (test t of student p<0.05); ^c No significant statistical differences between the groups (test X² p<0.05).

Health Surveillance Agency.²⁹ They did not show significant changes in relation to the average levels of contamination by heat stable coliforms after the educational intervention (Table 3).

Although the individual results are not demonstrated in tables of this paper, the highest contamination recorded prior to the educational intervention was 887NMP/g, in the second and third evaluation there were cases with counts up to >2.400 NMP/g.

The inadequate hygiene practices applied to the vegetables and the sales point was evident, since the sales point of the sandwich in 91.4% of the cases did not undergo any kind of sanitization during the period of observation. Only 20% of the establishments investigated had sufficient clean water to wash the food.

The reduction of coagulase-positive *Staphylococcus spp* average count in the food was not statistically significant $p < 0.05$ (Table 3). It is important to note that count found in the sandwiches of some sales points reached up to 1.7×10^6 UFC/g for that microorganism. The *Staphylococcus spp* counts in the sandwiches of the

test group one and six month after the educational intervention did not show a statistically significant difference (Table 3). *Bacillus cereus* and clostridium sulphite reductase remained at low levels of contamination in the sandwich before and after the educational intervention. *Salmonella* was not isolated in any sample (Table 3).

It was considered that the microbiological conditions of 21.4%, 50% and 35.7% of the sandwiches were unsatisfactory in phase P0, P2 and P3, respectively, in the test group.

COOKING AND STORAGE TEMPERATURES

The average temperatures storage of the ingredients (bread, sausage and hamburger) was above the recommended limit, both before and after the educational intervention. Although the average cooking temperature has increased after educational intervention, only the hamburgers minimum temperature reached the recommended level (Table 4).

The average internal temperature of the sausages and the ready-to-eat sandwich were below 74°C before the educational intervention.

Table 3. Microbiological food data in control and test group of 285 sandwiches sold on the streets of Cuiaba city – MT, according to each stage of evaluation, 2005-2006.

Control Group (n=16)			Test Group (n=14)		
1 st evaluation	2 nd evaluation	3 rd evaluation	1 st evaluation	2 nd evaluation	3 rd evaluation
P0	P2	P3	P0	P2	P3
Microorganisms					
<i>Coliform Counts at 45°C/g^a</i>					
27.04±31.58	263.13±636.99	447.56±705.28	77.41±233.58	727.21±983.21	455.93±872.29
<i>Clostridium sulphite reductase/g^b</i>					
<10 ² (c.est.)	<10 ² (c.est.)	<10 ² (c.est.)	<10 ² (c.est.)	<10 ² (c.est.)	<10 ² (c.est.)
<i>Bacillus cereus^b</i>					
<10 ² (c.est.)	<10 ² (c.est.)	<10 ² (c.est.)	<10 ² (c.est.)	<10 ² (c.est.)	<10 ² (c.est.)
<i>Staphylococcus spp/g^b</i>					
<10 ² (c.est.)	<10 ² (c.est.)	5.6×10 ³	1.3×10 ⁵	1.9×10 ³	1.6×10 ³
<i>Salmonella spp/25g</i>					
Absence	Absence	Absence	Absence	Absence	Absence

^a Mean±standard deviation (MPN); ^b CFU Mean = Colony-Forming Units per gram; ANOVA Significant statistical differences into groups (before and after) $p < 0.05$.

Table 4. Temperatures mean±standard deviation in control and test groups of 285 sandwiches sold on the streets of Cuiaba city – MT, according to each stage of evaluation, 2005-2006.

Control Group (n=16)			Test Group (n=14)		
Temp (°C)					
1 st evaluation	2 nd evaluation	3 rd evaluation	1 st evaluation	2 nd evaluation	3 rd evaluation
P0	P2	P3	P0	P2	P3
Minimum Temperature of Storage					
Hamburger					
9.68±10.98	8.53±9.60	5.02±8.50	16.92±10.12	15.31±16.30	13.22±21.84
Sausage					
16.20±7.91	17.87±9.76	16.23±12.39	17.30±8.87	18.12±7.66	16.91±9.50
Bread					
27.59±4.64 ^b	27.07±3.73	23.60±3.53	26.91±4.90	26.67±4.25	24.29±3.32
Maximum Temperature of Storage					
Hamburger					
16.09±12.14	12.14±12.55	6.05±8.74	16.92±10.12	15.26 ±16.24	13.28±21.77
Sausage					
20.24±9.19	21.82±7.94	8.03±12.86	23.29±5.73	21.51±7.24	18.79±10.79
Bread					
29.91±4.01 ^b	27.63±3.52	25.26±3.19	29.04±3.55 ^b	28.64±3.09	25.44±3.47
Minimum Temperature of Cooking					
Hamburger					
63.48±20.81	66.87± 17.10	74.00±6.49	51.35±19.50 ^b	65.37±16.97	75.84±7.25
Sausage					
59.24±19.26	57.15±12.23	68.14±8.15	52.17±16.51 ^b	54.59 ±11.79	70.73±6.26 ^c
Sandwiches					
55.60±16.37 ^b	51.05±12.04 ^a	71.27±9.70 ^c	50.39±18.09 ^b	52.10±9.93	69.54±8.23 ^c
Maximum Temperature of Cooking					
Hamburger					
74.99±7.97	78.57±7.13	78.66±7.31	75.58±8.10	75.46±8.76	79.79±7.07
Sausage					
67.37±14.98	65.88±13.51	71.34±8.20	67.21±10.39 ^b	66.76±6.08	75.22±7.31 ^c
Sandwiches					
68.62±8.82 ^b	62.68±12.12 ^a	75.54±9.37	62.39±13.77 ^b	59.08±10.07	74.21±8.35 ^c

ANOVA Significant statistical differences into groups (before and after) $p < 0.05$; ^a1st × 2nd evaluation; ^b1st × 3rd evaluation; ^c2nd × 3rd evaluation.

Only the maximum temperature of the hamburger cooking reached the recommended limit, but this was also the case in the control group. Furthermore, it was observed that the maximum temperature of hamburger cooking reached the food safety temperature in the test group before the educational intervention (Table 4).

DISCUSSION

For starting the discussion on the results obtained from this study, the widely scattered data found in temperature storage of sausages and hamburger by comparing the storage temperatures of bread could be attributed to the fact that some merchants stored their ingredients (sausages and hamburger) in the refrigerator. This would allow greater stability of food internal temperature; while others handlers stored at ambient temperature for different periods, providing opportunities for greater temperature variation. Additionally, although the hamburger has attained the ideal cooking temperature, it is important to point out that sometimes the sausages and the ready-to-eat sandwich did not reach 74°C. This fact could lead to cross-contamination post-cooking. Both the test group as the control group showed an increasing trend in cooking temperature average after educational campaign, even though sometime they did not reach recommended temperature (Table 4).

Some of these results might suggest a probable influence of the presence of the researcher in the field, during the data collection phases. The training program per se seems not to have sufficient to change the practices, since there were not reinforcement actions or follow-up after the intervention. Educational programs without supporting follow-ups tend to alter practices at the most for six months.²⁴ The presence of a researcher in the field can influence the outcome: this phenomenon was observed in analysis of a large psychometric study with 768 students in the USA in 1998, which was designed to test the impact of an educational intervention aimed at increasing the consumption of fruit and vegetables by children in three moments: baseline (grade 3), interim (grade 4) and post-test (grade 5) in sixteen schools.³⁰ The researcher presence

seems to influence both consumption and food handling.

The presence of coliforms in sandwiches in many establishments is high.¹⁸ Research of Rodrigues et al.³¹, in 2001, involved sixty street food establishments in Pelotas (Rio Grande do Sul) and corroborated the high rates of heat stable coliforms contamination. For these authors the raw vegetables, the use of homemade mayonnaise and the repeated use of mayonnaise dispensers (tubes) are among the possibilities for sources of contamination of street foods surveyed. The inadequate hygiene in the handling of the vegetables used in the composition of this type of sandwich might also explain the presence of heat stable coliforms, beyond the contamination of the water used for washing the equipment and hands. A literature review about street food safety, conducted between 1994 and 2007, seeking intervention strategies for handlers, consumers and human resources in public administration, analyzed the structure and hygiene of the food sales points and discussed about the precarious conditions of handling and conservation of water stored which could affect the final quality of the water.⁸ This quality has emerged as one of the most critical problems of street food. Improper hygiene practices for the water storage containers, inadequate frequency or technique for hand washing, and simultaneous handling of money and food might explain the microbiological results obtained from these sandwiches.^{8,17,18}

Between 2008 and 2009 a prospective study conducted microbiological analyses of typical foods sold in four bus terminal in Ghana (Africa)¹⁹; in 2010, researches study forty commercial foods of plant origin sold in Brazil¹⁷; between 2011 e 2012 seventy sandwiches of meat sold on the streets by Egyptians handlers were analyzed for microbiological quality²⁰ and in 2013 a telephone survey evaluated food safety knowledge, attitudes and self-reported hand washing practices in 499 trained and 199 untrained food handler groups in British Columbia, Canada.²⁵ All of them consider the training program most important way to prevent or mitigate food contamination risks by adjusting the practices of handlers and improving their skills. However, others studies have reported that educational interventions

have not been effective in changing unsuitable food handling practices. One example of study with this conclusion was based in depth, semi-structured interviews carried by telephone with forty handlers, their twenty managers and ten accredited training providers in the South-West London region.³² Another one it was the survey to evaluate the food safety knowledge, practices and attitudes of sixty food handlers within the campus of an university at Malaysia in 2009.³³ It is worth highlighting that the educational interventions meet the goals of social, cultural and economic development, political and, consequently, respond to certain interests. It is nourished for a philosophy of education in space and time, it adheres to specific epistemological concepts, takes into account the institutional interests. In part, this depends on the features, opportunities and interests of subjects. These factors and different social actors can exert an influence on educational interventions, although it is sometimes aware.^{14,15,22,23}

Whereas the total of 31,49% of the analyzed establishments were unsuitable for food consumption, the kind of educational intervention conducted with the merchants in this research was considered inefficient to change unsuitable street food handling practices. The training analyzed in this study was similar to the majority of studies reviewed from 2004 to 2009 by Medeiros et al.²¹ with food services handlers, as regards the subjects covered, duration and audiovisual resources employed to explain the topics. However, it was unlike them because it did not conduct recreational activities such as games, animations, hand washing and the use of gloves and thermometers.

The pedagogical approach adopted by food and nutrition education should focus on active processes that include popular knowledge and practices, contextualized in the reality of individuals, families and groups, enabling integration between theory and practice.^{12,18,21-23} Some pedagogical methods such as the action research and certain approaches such as the popular education allow going beyond the manifest content of an individual or group. By using resources such as thematic workshops which include spaces for troubleshooting dialogues between social agents it is possible to go beyond words, for emergency actions proposition

(education and political participation), identifying both points of resistance and support in work and in the personal reality from the attendees.^{16,22,23,34}

Studies show that six months post educational intervention the skills acquired in training is not maintained. The capacity program should be permanent and regular for guarantee that the acquired knowledge while training will be maintained in practice.^{32,33} From this perspective, such interventions should be accompanied by regular inspection of the handlers' activities at the workplace.^{21,25,32} However, the temporary nature of street food commerce, diversity of products and the mobility of street food merchants have obstructed an effective supervision by the sanitary vigilance. Due to these particularities, the street food commerce cannot be inspected based on the food service laws of private sector. It is worth remembering that, in general, it is not a license required for street food vending in Brazil^{7,8}, which allows anyone can set up an establishment to sell street food. In this context, the role of public policies would be to construct specific regulatory framework with the support from social control spaces, such as a consumer association or cooperatives which allow, amongst other things, formalize terms of conduct with ingredients suppliers who have guarantee of traceability and food security.

It is also important to note that in most municipal health department reports of claims from foodborne illnesses do not exist or the data is not statistically reliable, considering that there are few people who filed claim from the informal commerce. Both eating practice and handling practice are determined by two major dimensions which articulate in communities' social representation: individual and collective dimension. Aspects such as food and nutrition knowledge, healthy eating perceptions, tastes and food intolerances make up the individual dimension. The economic determinants (access and food supply), cultural factors, including the powerful impact from the contemporary lifestyle and media appeal form part of collective dimension. The educational actions for street food consumers are fundamental and must take into account such dimensions, seeking at effective and positive influence eating behavior as well as in

the social control to improve the sanitary quality of street foods.^{33,34}

In order to promote healthy eating practices with street food consumers, the food and nutrition education, as a strategy for public policy, should be integrated in wider development programs, from food production to consumption. This would broaden the odds for food and nutrition education have an impact on the choices that consumer can change those which the ambiance determines.¹⁴ Such actions could be carried out with or without the media partnership (private and community), government or non-governmental organizations by leveraging assists spaces. This would make possible to produce innovative solutions to the food quality. An example would be delivering booklets for guidance on choosing healthy foods and hygienic street food handling during the execution of food donation or milk distribution programs to underprivileged families, promoting the human right to adequate food and preserving the local food crop.

CONCLUSION

The training program applied in this research seems not to have changed the microbiological quality of the sandwich sold on the streets of Cuiaba city, MT, Brazil. This result suggests that such scenario can contribute to a high risk associated with foodborne illness. It is recommended a review to identify approaches and methods that bring about effective changes in street food commerce. One suggestion is that the interventions with street food handlers should be associated with action for hygiene-awareness of the consumer. Furthermore, it is recommended to provoke debate about the importance of the regulatory public policies with those social agents. Educational interventions can be performed by different sectors and professionals; but they should be planned, implemented, monitored and evaluated based on methodological references. There are few studies exploring their methodologies. This highlights the need to conduct detailed analysis of methodological strategies adopted by street food and nutrition education. Both additional qualitative researches and randomized, controlled, comparative studies are recommended. They can help us understand the safety perceptions of

street food handlers and the methods used in food handling practices as well as their impact on the learning for food safety. It would also be useful for the improvement of educational techniques and pedagogical indicators, monitoring and evaluating processes, outcomes and impact to validate specific instruments for the street food sector. An example would be extension projects aimed at strengthening the association between merchants.

It is important to develop strategies to raise consumers awareness with regard to routine inspection of commerce in which consume street foods in order to contribute to the maintenance of good practices learned from the food and nutrition education programs.

The educational interventions on good manufacturing practice should extrapolate the field of information and advancing in the understanding of complexity of education and health. The communication of food and nutrition education to street food handlers shall be built upon active listening, formation of horizontal relationships and appreciation of food crop, sharing and contextualizing the different knowledge and practices. A better understanding of the beliefs, values, customs, models, social symbols and reasons for non-compliance in food handling procedures on the street food could help in framing messages congruent with those perceptions. A greater theoretical and methodological consistency of pedagogical field should be required as part of nutritionists educators qualification to structure, develop and evaluate food and nutrition education programs with street food handlers, emphasizing their social participation and aiming at the political, economic and social empowerment of this community. It is also important to give visibility to successful experiences.

Some limitations for the development of this research, including that the merchants are not institutionalized, i.g., they are ambulant and the lack of vendors' registration for a government agency become more difficult to carry out this research. Also it was not possible to include assessment on the user satisfaction in relation to the improvement of food quality sold in the streets. Another limitation was the lack of one supervisor of the service to track and evaluate the

improvement of food handling practices in the workplace. Furthermore, the small sample size in this study can be considered one limiting factor for the extrapolation of the results.

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