

## Research Article

### Sanitary Hygiene Diagnosis for Street Food Sales in Cereté (Córdoba), Colombia

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**Abstract:** The objective of this study was to hygienically improve community-based street sales of Ready-To-Eat (RTE) foods through the implementation of GMP (Good Manufacturing Practices) and food preservation techniques in the municipality of Cereté. Street food sales are an economic and social phenomenon, which has become a serious regional governance issue. Microbiological analyses were carried out in RTE's and on street vendors that sell them, which resulted in the absence of *Staphylococcus aureus*, total coliforms and fecal coliforms in the manipulators; as well as on the equipment and surfaces, there was an uncountable number of molds in the environment, which is consistent with the high exposure to climatic factors to which these street sales are exposed; the evaluated RTE's were, chorizo, cheese, Suizo (Swizz sausage meal), arepa de queso (cheese corn cakes) and empanada, finding that all complied with the permissible limits of microbial growth; except the empanada that evidenced the presence of total Coliforms and Fecal Coliforms. Fifty-two food handlers were trained by representatives of the Municipal Ministry of Health in the implementation of GMP and food preservation; in addition, compliance with the training was verified through the initial hygienic diagnosis of sanitary hygiene. The market area was found to be the one with the highest percentage of compliance (57%), while the central area was the one with the lowest percentage (33%) regarding regulations that establish at least a 60% compliance rate.

**Keywords:** Conservation, diagnosis, good practices, ready to eat, street vendors

## INTRODUCTION

According to the United Nations Food and Agriculture Organization (FAO)/World Health Organization (WHO) of the Codex Alimentarius, "street foods" are defined as ready-to-eat foods, prepared and/or marketed by street vendors or mobile sellers, especially on the streets and other similar public places (INFOSAN, 2010). People who work in food handling on street sales tend to have a low education level, are unaware and much less apply the minimum health and quality standards for handling food, putting themselves and consumers' health at risk. Foodborne Diseases (FBDs) are a major consequence of eating contaminated products, which in many cases are linked to the street vendor of Ready to Eat (RTE) foods (De La Hoz *et al.*, 2014). Street vendors generally do not know how to manage GMP, putting the health of consumers at risk, given that the necessary conditions are in place for FBDs to appear, becoming one of the most common health problems and having the greatest impact on people's health, affecting mainly population with scarce resources and greater vulnerability such as children, pregnant women and elderly people. Outbreaks of these diseases can have a negative impact

on trade and consumer confidence, leading to losses of income, unemployment and lawsuits (Serna *et al.*, 2012). In Latin American regions, according to the Pan American Health Organization (PAHO) the information system for surveillance of FBDs informed that during the past 9 years, 6,511 outbreaks were reported from 22 countries (including Cuba, which reported more than 54%), nearly 250,000 people became ill and 317 died. In Colombia in 2014, 11425 cases were registered (Guerrero, 2016). In outbreaks of FBDs with confirmed etiology, 57% were attributed to bacteria, 12% of viruses and 21% of marine toxins; the remaining 10% of cases caused by parasites. The most common food products associated with the outbreaks were fish, water and beef. Studies of the causes of diseases originated by the ingestion of popular food consumption and its incidence in the population have not received sufficient attention within Colombia's social and economic context and as a consequence of the inadequate management of the entire food production chain, the true origin of multiple enteric pathologies and food poisonings is overlooked (Kopper *et al.*, 2009).

España (2014) carried out the research "Risk in the sale of food on the street" and among the results obtained, it is worth highlighting the low level of

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education of the workers, the absence of ambulatory sales, the existence of sanitary controls by qualified personnel, frequent supply of risk foods poorly preserved and exposed to prolonged time between processing and consumption, as well as increasing health education in relation to this form of food supply. Teja and López (2013), carried out a study on informal trade in the municipality of Texcoco in Mexico, the study revealed that 44% of those interviewed entered into this activity due to lack of employment, 26% is attributed to the low level of education and 13% because they do not have occupational and professional skills. Likewise, Castellanos (2014) conducted a study to monitor the informal economy of street vendors in the metropolitan area of Lima (Peru), where he found that 80% of the participating merchants in the study have their main source of income in ambulatory commerce and are almost entirely self-employed, which reveals the great vulnerability due to the lack of social protection, which characterizes informal workers. In Buenos Aires (Argentina) the Government sought to order the itinerant sale of food to regulate an illegal activity and improve quality by creating a vendor registration in which interested parties had to approve a food handling course and request an annual permit to work and pay a monthly fee (Herrera, 2006).

With all the above, it is possible to question the hygienic-sanitary conditions in which street vendors handle food in the municipality of Cereté; and if it is possible to improve the hygienic sanitary conditions of RTE foods sold by street vendors in the municipality of Cereté.

## MATERIALS AND METHODS

A descriptive-ethnographic study was conducted. The study population were street vendors located in the

following areas: Market, Hospital and downtown and the RTE foods sold by them in the municipality of Cereté (Cordoba). Fifty-five street vendors were diagnosed. The work was carried out in the municipality of Cereté, located in the Sinú River basin, in the area known as Medio Sinú, with an average temperature of 29.7°C. Microbiological analyses were carried out in the Microbiology and Food Biotechnology Laboratory located at the University of Córdoba, Berástegui headquarters with an average temperature of 29°C and relative humidity of 80% (IGAC, 2015).

**Initial sanitary hygiene diagnosis:** An evaluation of the conditions under which street vendors produce and sell RTEs was carried out using Resolution 2674 (2013) of the Health Ministry as a guide.

**Microbiological analysis:** Five stands were chosen, in which the following were analyzed: Surfaces, environment, food handlers and the best-selling product; special features were taken into account when selecting the stands, such as: those with the highest commercialization (empanada and suizo), those with the best physical appearance (cheese and arepa de queso) and those with the worst physical appearance (chorizo). The selected products were analyzed as shown in Table 1 and handlers, surfaces and environments as shown in Table 2, based on the Vanderzant and Splittstoesser (1992) methods.

**Street vendors training:** With Cereté's Secretary of Municipal Health collaboration, 3 meetings were held for 3 groups at different times, during which they were given a theoretical-practical course on food handling and conservation. Training was evaluated and closed at the last meeting.

Table 1: RTE food analysis based on INVIMA's parameters

Food	Chorizo	Empanada	Cheese	Suizo (Swiss sausage meal)	Arepa de queso (cheese corncake)
Count A. and F. Mesophilic (*)	X			X	
MPN total Coliform (**)	X			X	X
MPN fecal Coliform (**)	X	X	X	X	X
Count <i>Staphylococcus aureus</i> coagulase + (*)	X	X	X	X	X
Count Espores <i>Clostridium</i> s. r (*)	X			X	
<i>Salmonella</i> sp. 25 g	X	X	X	X	X
<i>Bacillus cereus</i> (*)					X
Yeast and molds (*)			X		X

Instituto Nacional de Vigilancia de Medicamentos y Alimentos (INVIMA, 2008); \*: Counting plate; \*\*: Counting in tubes

Table 2: Analyses carried out to the retailer based on INVIMA

Retailer	Handlers	Surfaces	Environment
Count A. and F. mesophilic (*)			
MPN total Coliform (**)	X	X	
MPN fecal Coliform (**)	X	X	
Count <i>Staphylococcus aureus</i> coagulase + (*)	X		
Bacterial contamination (*)			X
Fungal contamination (*)			X

Instituto Nacional de Vigilancia de Medicamentos y Alimentos (INVIMA, 2008); \*: Counting plate; \*\*: Counting in tubes

Table 3: Results of microbiological tracing to street vendors

Handlers	<i>Staphylococcus aureus</i> coagulase	Total and fecal coliform	Hand washing	
	+ CFU/g	CFU/g	Before	After
1	Absence	Absence	Uncountable	10 <sup>8</sup>
2	Absence	Absence	Uncountable	Uncountable
3	Absence	Absence	Uncountable	Uncountable
4	Absence	Absence	Uncountable	Uncountable
5	Absence	Absence	Uncountable	Uncountable

Table 4: Results of microbiological tracing to surfaces and environment

Handler	Total and fecal coliform	Environment (CFU)	
	CFU/g on surfaces	Bacterial	Fungal
1	Absence	84	Uncountable
2	Absence	28	Uncountable
3	Absence	120	Uncountable
4	Absence	67	Uncountable
5	Absence	136	Uncountable

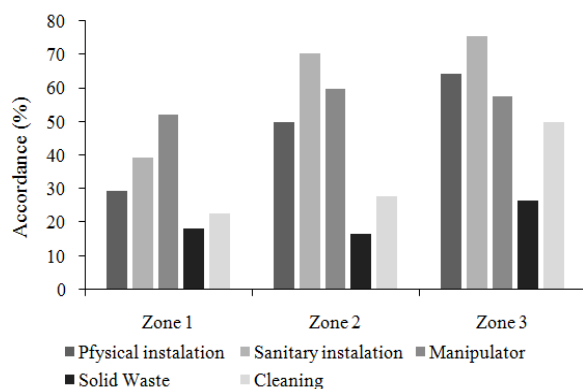


Fig. 1: Hygienic health diagnosis of street sales

## RESULTS AND DISCUSSION

In the hygienic-sanitary diagnosis, a census of the RTEs was carried out, registering 35 sale stands concentrated in three areas. Among the reasons given by street vendors of RTEs for engaging in this activity were: unemployment, family tradition, lack of job skills and educational opportunities, which obliges them to have their own sustainable business such as street foods and finally the age of some street vendors, who are older than the economically active population and therefore unable to access formal job opportunities.

Teja and López (2013) indicate that one reason that motivates some people to dedicate themselves to the ambulant sale of food, is the fact that they do not have to pay taxes, nor to declare income and fiscal obligations, which generates informality in the activity and a greater income margin of the business, in comparison to businesses in equal conditions that operate legally. On the other hand, Osorio (2012) found that the main reason for choosing this job was unemployment (37%), followed by family traditions (25%), displacement (19%) between other reasons.

Figure 1 shows the results of the hygienic sanitary diagnosis of street sales, where it is observed that the aspect with the best evaluation in all areas was the sanitary facilities, whose ratings do not exceed 70% compliance; on the other hand, zone three recorded the highest overall score of all aspects evaluated, although the global average reaches only 55% compliance.

Table 3 presents the results of microbiological tracing of manipulators, where it can be seen that *Staphylococcus aureus* coagulase is absent, indicating good oral hygiene, good personal hygiene habits and compliance with the sanitary requirements established in Resolution 2674 (2013).

Regarding fecal contamination of the vendor's hands, the results revealed the absence of total and fecal coliforms; on the other hand, the high microbial counts in manipulators' hands show a deficiency in washing and disinfection; a reason for these results is the method used and the lack of sinks, where water that does not comply with microbiological criteria is reused; likewise, for hand drying, they also use cloth towels, which are not replaced during the day and become a source of recontamination.

According to Toscano and Gonzalez (2014) citing Galindo (2008), most people involved in food handling do not perform adequate handwashing, which is why there are about 80 million cases of FBDs and an estimated 10,000 deaths/year in known cases worldwide, handlers do not frequently wash hands before they start working in food production.

Table 4 shows the results of microbiological tracing of surfaces and environment, where it can be seen that there are no total and fecal coliforms for all surfaces, utensils and equipment of all the itinerant sales analyzed. The results obtained are due to the fact that the working surfaces of the street sales were made of stainless steel and the vendors assured that every day they carried out cleaning and disinfection procedures at the beginning and end of their work.

In relation to the results of environmental pollution, high counts of bacteria and fungi (>10 CFU in 10 min) were recorded, which is due to the fact that these stands are exposed to contamination vectors, as they are located near roads with high vehicular traffic that facilitates exposure to environmental pollution factors. The results indicate that the disinfection process of the environment should be improved.

Table 5 presents the results of the microbiological analysis performed on the selected foods, in which it can be established that the chorizo sample met all the parameters stipulated by NTC 1325 (2008), due to the fact that the product is subjected to high temperatures in the frying process (150 to 180°C) and subsequently immediately consumed.

Table 5: Microbiological analysis of food samples

Variable	Food				
	Chorizo	Empanada	Cheese	Cheese corncake	Suizo
Count A. and F. mesophilic (*)		<1000			
MPN total Coliform (**)		7		<93	
MPN fecal Coliform (**)	<100	3	<3	<3	<100
<i>Staphylococcus aureus</i> coagulase + CFU/g	<100	<100	1000-3000	<100	<100
<i>Salmonella</i> sp. 25 g	Absence	Absence	Absence	Absence	Absence
Count spores <i>Clostridium</i> s. r (*)	<100				<100
Yeast and molds (*)			<100	<1000	
<i>Bacillus cereus</i> (*)				<300	

\*: Counting plate; \*\*: Counting in tubes

Empanada samples complied with *Salmonella* and *Staphylococcus* parameters, but showed coliform counts above the parameter; the possible causes of this contamination were deficiencies in food handling and hygiene, handling simultaneously with food preparation, as well as the use of jewelry (rings, watches, earrings) and the use of nail polish for women.

The microbiological quality of the cheese sample was within the parameters established by Resolution 0184 of 1989, which indicates that it is a product fit for human consumption and does not represent a risk to consumers. Suizo (Swiss sausage meal) sample also met the required criteria of Resolution 0184 of 1989; and the microbiological results of the arepa (corncake) sample did not exceed the stable recommendations of the Institute of Medicines and Foods (INVIMA, 2008).

After verifying the microbiological quality of all food products, surfaces, environments and manipulators, we proceeded to train them on the topics of hygienic food handling, application of Good Manufacturing Practices, Cleaning and Disinfection.

## CONCLUSION

Street food vendors are engaged in these activities due to unemployment and lack of work alternatives.

Microbiological tracing of manipulators and surfaces resulted in compliance with all parameters, while analysis in the environment showed higher-than-permitted counts.

Microbiological analysis of foods showed compliance with the established criteria in the samples of chorizo, cheese and Suizo (Swiss sausage meal), while the empanada and arepa (cheese corncakes) samples exceeded the parameters to verify microbiological quality.

## REFERENCES

Castellanos, T., 2014. Informal Economy Monitoring Study: Vendors and Street Vendors from Metropolitan Lima, WIEGO: Peru, ISBN 978-92-95095-77-9, (online).

De La Hoz, F., M. Martínez, O. Pacheco and H. Quijada, 2014. Foodborne Diseases (ETAS). Retrieved form: <http://www.ins.gov.co/lineas-deaccion/SubdireccionVigilancia/sivigila/Protocolos%20SIVIGILA/PRO%20Enfermedades%20Trans.%20por%20alimentos.pdf>, (Accessed on: March 21, 2015).

España, S., 2014. Evaluation of Good Manufacturing Practices (GMP) in Street Vending of Food and Proposal of Quality Control Manual for Food Handling Offered by Street Food Vendors in the Departmental Head of Totonicapán, Guatemala. Nutritionist Thesis in Licentiate Degree, Rafael Landívar University, Guatemala, Quetzaltenango, Quetzaltenango Campus.

Guerrero, J., 2016. Protocol on Public Health Surveillance Foodborne Diseases. National Institute of Health, PRO-R02.001, Version 2, 1: 69. Retrieved form: <http://www.ins.gov.co/lineas-deaccion/Subdireccion-Vigilancia/sivigila/Protocolos%20SIVIGILA/PRO%20Enfermedades%20Trans.%20por%20alimento s.pdf>.

Herrera, E., 2006. There is Little Compliance with the Law Regulating Street Food Sales. The Bugle. Buenos Aires, Argentina.

IGAC (Instituto Geográfico Agustín Codazzi), 2015. Geographic Dictionary of Colombia. Retrieved form: <http://www.igac.gov.co/digeo/app/index.html> (Accessed on: November 21, 2016).

INFOSAN, 2010. International Network of Food Safety Authorities. Basic Measures to Improve the Safety of Street Foods. Retrieved form: [http://www.who.int/foodsafety/fs\\_management/No\\_03\\_StreetFood\\_Jun10\\_sp.pdf](http://www.who.int/foodsafety/fs_management/No_03_StreetFood_Jun10_sp.pdf), (Accessed on: August 13, 2015).

INVIMA, 2008. National Institute for the Surveillance of Medicines and Foodstuffs. Related to Food Products. Retrieved form: [https://www.invima.gov.co/index.php?option=com\\_content&view=article&id=606&Itemid=139](https://www.invima.gov.co/index.php?option=com_content&view=article&id=606&Itemid=139) (Accessed on: August 10, 2015).

Kopper, G., G. Calderón, S. Schneider and W. Domínguez, 2009. Foodborne Illness and its Socioeconomic Impact. Mejía Danilo, ISBN 978-92-5-306153-2.

- Osorio, N., 2012. Supply and consumption of street food in the national park in Bogotá D.C. Dietitian Nutritionist Thesis, Pontificia Universidad Javeriana. Bogotá.
- Resolution 2674, 2013. Ministry of Health and Social Protection. Retrieved form: <https://www.invima.gov.co/images/pdf/normatividad/alimentos/resoluciones/resoluciones/2013/2674.pdf> (Accessed on: August 14, 2015).
- Serna, L., A. Guarnizo and J. Valencia, 2012. Risk factors of ethics, in a university community in Colombia. *Biotechnology Journal in the Agricultural and Agroindustrial Sector*, National University of Colombia, ISSN 1692-3561.
- Teja, R. and N. López, 2013. Informal trade a study in the municipality of Texcoco Edo de México. *Int. Rev. Administ. Finance*, 6(4): 51-72.
- Toscano, H. and A. González, 2014. Hygienic-sanitary diagnosis in the cheese houses of San Anterito-Montería and evaluation of the production process of the coastal cheese. Thesis Food Engineer; University of Cordoba. Food Engineering Program. Berástegui-Córdoba.
- Vanderzant, C. and D.F. Splittstoesser, 1992. *Compendium of methods for the microbiological examination of foods*. American Public Health Association, Washington, DC.