

Sales Environment and Hygienic Practices of Street Food in N'Djamena, Chad

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Abstract

The preparation and sale of street food is a sociocultural and economic fact in all countries of the world. For more than a decade, this activity has a remarkable growth given the rampant urbanization of African cities in general and N'Djamena, the capital of Chad in particular, the development of the middle class and the development of work both formally and informally. However, the hygienic failures observed around this activity constitute a source of contamination of these foods. The objective of this work is to evaluate sales environment and hygienic practices of Street Food in N'Djamena, Chad. The study was conducted from October 2013 to January 2018 in N'Djamena, Chad. Thus 809 sellers and 455 consumers were surveyed in the public squares of N'Djamena. The results showed a strong presence of women with a proportion of 63.04%. Our study showed that 66.63% of vendors sold in an unclean environment, 61.81% kept their food in pots placed on the floor and 100% of the same vendors did not wear gloves or bucco-nasal masks. The surveyed vendors (92.58%) received no training in hygiene and food technology. The majority (90.99%) of consumers ate their foods with bare hands and 93.33% said they found undesirable elements in foods. Only 23.08% of consumers said there is no risk of food transmitting disease. Improving the environmental conditions of the preparation areas and the sales site will prevent foodborne diseases. The competent authorities are called upon to train these sellers but also to implement clear texts with regular monitoring and follow-up plans to improve the hygienic conditions of the latter.

Keywords: Street Food; Sales Environment; Hygienic Practices; N'Djamena

Introduction

Street food refers to all food and beverages prepared and / or sold by vendors in streets and other public places for immediate consumption or consumption without further processing or preparation [1,2]. These street foods, because of their ease of access, their relatively low price, etc. provide food security for low-income urban population groups [3,4]. For example, many households save on their daily income through the use of street food [5,6]. Today, this sector has become a societal phenomenon due to its socio-economic and nutritional importance [7-9]. It provides a steady source of income for millions of people, men and women (many of them without training in food hygiene) in developing countries.

Studies in Africa, Asia, and South America suggest that some street food handlers lack protective equipment such as aprons, berets, or facial tissues [10-13]. The lack of training of these producers could be a compromising element for the safety of food offered on public roads [10,13]. The study conducted by Nieto-Montenegro and collaborator in 2008 revealed that the educational lessons alone produced a significant positive improvement in hygienic knowledge related to washing hands after using the toilet [14].

The preparation and sale of street foods takes place in an environment that can in some cases guarantee the quality of these foods and in other cases help to alter them. Several studies have clearly shown that these foods are sold close to open gutters, with the presence of stray animals and even insects that are true vectors of contamination [8,11,13,15]. The main causes of the unhealthy nature of these foods come from non-compliance with good hygiene practices in their processing, cooking, preservation or sale [16-18].

In Chad, a survey was conducted among street food vendors through the Research and Support Project for Food Safety in Street Food (PRASAR). The study shows that all food categories exist on the street. The majority of salespeople moved in the heap without specific training and these sellers were rather fixed than ambulant. Foods are often exposed to the outdoors. Many deficiencies in hygiene practices have been identified [18]. According to the World Health Organization (WHO), food-borne illnesses significantly degrade health and reduce economic growth in developed and developing countries [19].

The growth rate in N'Djamena is 2.9% [20]. As in other African cities, the expansion of the population of

N'Djamena and the many daily constraints that this population faces has led to an increase in the number of street vendors in recent years. The objective of this work is to study the sales environment and hygiene practices in the street food sector in N'Djamena, Chad, to prevent foodborne illness.

Material and Methods

This study was carried out in N'Djamena, capital of the Republic of Chad. N'Djamena subdivided in ten districts which comprise sixty-four quarters distributed unevenly. Among ten districts, eight were drawn at random for this study (Figure 1).

The sample size for the surveys was estimated by the simple random sampling method taking $\epsilon = 1.96$ for an accuracy $\alpha = 5\%$, the formula is as follows: $N = \frac{\epsilon^2 \times P \times Q}{i^2}$ $Q = 1 - p$ and being the precision. The prevalence of intoxication is estimated to be 5% for sellers and 10% for consumers (the phenomenon is more important for consumers who consume compared to sellers). So, for the size of sellers investigate, $N_v = \frac{(1,96)^2 \times (5 \times 95)}{5^2}$ and for the size of consumers to investigate, $N_c = \frac{(1,96)^2 \times (10 \times 90)}{5^2}$. This resulted in a number of sellers equal to 75 and a number of consumers equal to 140. However, given the availability, the interviews took place with 809 sellers and 455 consumers.

As far as the seller is concerned, the questionnaire dealt with Sex, Training in hygiene and food technology, Sales environment (dust, wind, garbage nearby, sewage around the sale), Food protection, Cutting tools for raw and cooked foods, Source of water used by sellers, State of dish water, Apron Wear, Gloves use, Buco-nasal mask use, Clean clothes, Hair cover, Food preservation materials, Utensils, Handling of food by customers, Manipulation of money by sellers, Medical follow-up of street food sellers, Taking money by the sellers, Handwashing device, Soap use. The questionnaire included Tools used by guests to eat, Unwanted elements found in foods by consumers, Spoiled/undercooked foods found by consumers, Consumer perception on Vendor Hygiene, Food transmitting disease.

Once in a neighborhood, the investigators placed themselves in the center of the neighborhood in relation to the directions of the warden and one of the four cardinal points is drawn to determine the direction in which the investigators will begin the interviews. The rest of the journey was clockwise until the neighbourhood was

swept away. Once at the point of investigation, the different sellers are codified and randomly drawn according to the predefined number. The same operation was carried out for consumers. Those selected to complete the questionnaires received a brief overview of the purpose of the work and the interview was not

completed until after the respondent's approval.

The data was processed using R 3.6.0 software (In the processing of statistical data, for a degree of significance $p < 0.05$, the results obtained were considered significant.

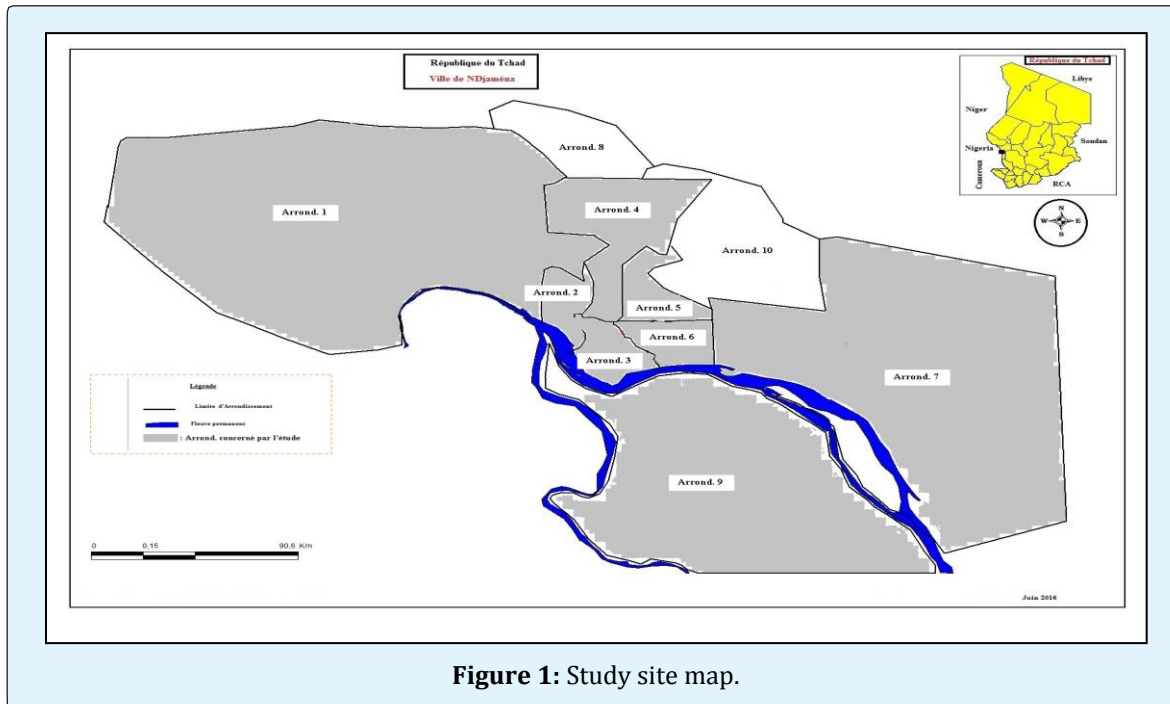


Figure 1: Study site map.

Results and Discussion

Result

Gender and Training in Hygiene and Food Technology for Vendors: The results of our surveys showed a strong presence of women in the sale of street food in the city of N'Djamena (Chad) with a proportion of 63.04%. Ninety two point fifty-eight percent (92.58%) of vendors surveyed received no training in hygiene and food technology (Table 1).

Sex	(n=809)
Female	510 (63.04 %)
Male	299 (36.96 %)
Training in hygiene and food technology	
Yes	60 (07.42 %)
No	749 (92.58 %)

Table 1: Gender and Training in Hygiene and Food Technology for Vendors.

Sales Environment: In the majority of cases (66.63%), food was sold in an environment consisting of dust, winds, nearby garbage and sewage around (dirty). The presence of insects (flies, mosquitoes, etc.) was observed in 67.61% of sellers in all categories (fixed, semi-fixed and mobile). Nine point fifteen percent (9.15%) vendors operated in conditions where animals wandered all around. The 50.19% of respondents did not provide any mechanism to protect the various dishes offered to consumers from possible bad weather (dust, rain, etc.) (Table 2).

Hygienic Practices : It also appears that in the 72.06% of cases, the utensils were not sufficiently washed, i.e. summarily cleaned in water that was not sufficiently soapy and loaded with organic matter and then rinse once in water still laden with organic matter. Work tools and water service, shown in Table 2, show that 84.05% of vendors handled food with their bare hands. It was also noted that 41.53% of the vendors surveyed used the same sharp tool to cut both raw and cooked foods. Most (63.29%) producers used water from the Chadian Water Company for preparation and other uses as part of their

activities. In 86.03% of cases, dishwashing water was very dirty (not soapy enough and loaded with organic). A high percentage (69.22%) of the outlets surveyed had half a barrel as a hand-washing device for consumers. Only 29.91% of sellers accompanied this hand-washing device with soap.

In terms of personal hygiene, clothing and behavioral standards for sellers (Table 2), 87.27% were not wearing an apron. All (100%) vendors had no masks or gloves. However, 31.64% of these vendors had clean clothing (no oil or dust stains making the garment dirty). We found that 60.57% of growers had a hair gear (scarf or beret).

The same table 2 shows that in the majority of cases (91.97%), customers did not handle the food exposed for sale. However, 95.43% of sellers handled money while serving food. Only 06.06% had regular medical follow-ups.

Sales environment (dust, wind, garbage nearby, sewage around the sale)	
Clean	270 (33.37 %)
Dirty	539 (66.63 %)
Presence of insects in sales outlets	
Yes	547 (67.61 %)
No	262 (32.39 %)
Presence of animals in sales outlets	
Yes	74 (09.15 %)
No	735 (90.85 %)

Table 2: Sales environment.

Majority (90.99%) consumers ate their food with their bare hands. Unwanted items were found in food by 93.33% of consumers. Those who found undercooked or spoiled food accounted for only 20.44 per cent of those surveyed. The large proportion (59.78%) found the sellers to be dirty (dirty clothes) (Table 3).

Food protection	
Yes	403 (49.81 %)
No	406 (50.19 %)
Cutting tools for raw and cooked foods	
Same tool for raw and cooked foods	336 (41.53 %)
Different tools for cooked and raw foods	473 (58.47 %)
Tools used by vendors to serve food	
Ladle	129 (15.95 %)
Hands	680 (84.05 %)
Source of water used by sellers	
Drilling water	186 (22.99 %)
Water from the Chadian Water Company	512 (63.29 %)
Purchase of Water from the Chadian Water Company from water peddlers	97 (11.99 %)
Others (wells, pond, river)	14 (01.73 %)
State of dishwater	
Dirty water	696 (86.03 %)
Less clean water	98 (12.11 %)
Clean water	15 (01.86 %)
Apron Wear	
Apron use	103 (12.73 %)
Apron non use	706 (87.27 %)
Gloves use	
Yes	0 (00.00 %)
No	809 (100.00 %)
Buco-nasal mask use	
Yes	0 (00.00 %)
No	809 (100.00 %)
Clean clothes	
Yes	256 (31.64 %)
No	553 (68.36 %)
Hair cover	

Yes	490 (60.57 %)
No	319 (39.43 %)
Food preservation materials	
Pots on fire	56 (06.92 %)
Pot on the floor	500 (61.81 %)
Plastic bucket	225 (27.81 %)
Cooler	28 (03.46 %)
Ustensils	
Clean	183 (22.62 %)
Not enough washed	583 (72.06 %)
Dirty	43 (05.32 %)
Handling of food by customers	
Yes	65 (08.03 %)
No	744 (91.97 %)
Manipulation of money by sellers	
Same hand used to serve foods	772 (95.43 %)
Other hand	37 (04.57 %)
Medical follow-up of street food sellers	
Yes	49 (06.06 %)
No	760 (93.94 %)
Taking money by the sellers	
Same hand used to serve	772 (95.43 %)
Other hand	37 (04.57 %)
Handwashing device	
Half drum	560 (69.22 %)
kettle	233 (28.80 %)
Other	16 (01.98 %)
Soap use	
Yes	242 (29.91 %)
No	567 (70.09 %)

Table 3: Street foods sellers' Hygiene Practices.

Table 4 shows that only 23.08% of consumers said there is no risk of food transmitting disease. However, the 50.55% and 26.37% said it was possible to have stomach

aches or get typhoid fever respectively when eating poor quality food (Table 5).

Tools used by guests to eat	
Spoon	41 (09.01 %)
Hand	414 (90.99 %)
Unwanted elements found in foods by consumers	
Yes	411 (90.33 %)
No	44 (09.67 %)
Spoiled/undercooked foods found by consumers	
Yes	93 (20.44 %)
No	362 (79.56 %)
Consumer perception on Vendor Hygiene	
Clean	79 (17.36 %)
Middle	42 (09.23 %)
Dirty	272 (59.78 %)
Indifferent	62 (13.63 %)

Table 4: Consumer Perception of Food Quality and Hygiene of Sellers.

Food transmitting disease	
Stomach aches	230 (50,55 %)
Typhoid fever	120 (26,37 %)
Diseases transmitted by food	105 (23,08 %)

Table 5: Knowledge of Foodborne Diseases and Reason for Consumption of Street Food by Consumers.

Discussion

It is important for street food sellers to be knowledgeable and aware of good hygiene practices in order to maintain the health of consumers. Even when food is safe from insidious levels of microorganisms, the risk of foodborne illness still exists. Maintaining hygiene standards in all aspects of food preparation sold in public places is fundamental. It has been observed that in 66.63% of cases, food is sold in an unclean environment. Nurudeen, et al. [15] also came to the same conclusion. Contrary to these data, other studies have shown that street foods are sold largely in a clean environment [21,15,11]. The presence of insects at the point of sale was noted in 67.61% of cases, confirming the work of Nurudeen, et al. [15], Hilario [13], Ntow, et al. [11], which revealed that there is always the presence of insects around the outlets. We observed the presence of evidence of relationship ($p < 0,05$) between unclean environment and the presence of insects at the point of sale. We found that in the majority of cases (50.19%) the food was not protected. Our results are contrasted by those of Criselda, et al. [21] who revealed in their work that food sold in public places is still protected. During the time of sale, most of the food is kept in pots placed on the floor (61.81%) and only 6.92% of the time that food is kept in the fire. In their study, Ntow, et al. [11] found that in 21.39% of cases food was kept on fire during the sale. Poor food preservation associated with the increased presence of insects and unsanitary environment could contribute to food contamination. The use of bare hands to serve food was observed in 84.05% of salespeople surveyed, in Nigeria, Chukuezi [12] found a rate much lower than ours (47.69%). Hand-washing can lead to cross-contamination, resulting in the introduction of microbes into healthy foods. Tap water produced by the Chadian Water Company (STE) is widely used in the food production chain sold in public squares (63.29%). Studies in Benin and Uganda have found that tap water is the main water used in the street food production chain [22,23]. We observed in our study that the main handwashing device was half-barrel (69.22%). However, the presence of soap beside these devices is only found in 29.91% of the cases studied. Unlike our work, Criselda, et al. [21] found that there is only occasionally a hand

washing device (sink) but each time we noted the presence of soap. Our study reported for wearing apron, covered hair and handling money with the same bare hand used to serve, rates of 12.73%, 60.57% and 95.43% respectively. In his study, Chukuezi found that 42.86% of the respondents wore aprons. Adjrah [23] also reported that 57.78% of the street food vendors surveyed covered their hair. In keeping with our findings, Chukuezi [12] found that 61.90% of the street food vendors surveyed handled money at the same time as food. We also observed the presence of evidence of relationship ($p < 0,05$) between vendors handled money at the same time as food and vendors who are no training in hygiene and food technology. Approximately 40 to 60% of cases of reported foodborne outbreaks were caused by inadequate handling practices that also include contamination between the cutting board and utensils [24].

Conclusion

The results presented in this study show a failure in good manufacturing practices and good hygiene practices among street food vendors in N'Djamena. The health risks associated with street foods could be minimized if good hygiene practices were followed during the preparation, storage and sale of these foods.

In view of the socio-economic and nutritional benefits of street foods, various measures and arrangements need to be taken to improve their qualities. It would be necessary to sensitize and train street food vendors on good hygiene practices and good food manufacturing practices. Food quality is related to the health of the environment. The production and sale of food must take place in a safe environment away from dust and other vectors such as flies and insects. It is important to sweep up and clean the food preparation media frequently. A clean environment too is one of the conditions necessary for the healthy production of food.

Conflict of Interests

The authors do not declare any conflict of interest.

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