



Assessment of the Hygiene Level of Street Food in the City of Beni in the Democratic Republic of Congo

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Authors' contributions

This work was carried out in collaboration among all authors. Author KML initiated the subject of research. Author DOF was responsible for the final reading and the author ARR contributed with the typing and formatting of the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: Street food is a cheap option for people in eastern DRC, but the unhygienic practices of street vendors and their customers create an environment that causes disease and other health problems, as well the introduction of food wastes into the environment is worrisome. The study objective is to assess the level of hygiene of the foodstuffs sold on Nyamwisi Boulevard in Beni City.
Methods: This is a descriptive cross-sectional study. It focused on food vendors and consumers in Nyamwisi Boulevard in 2021. The study population was infinite with a non-random sample whose number was fixed by the PEDUIZZI formula ($n=K*10$); K being the number of variables or 100 people.
Results: The study showed that 64% of the sellers are women while 58% of the consumers are men, the motivation for them being the creation of employment for 49% of the sellers, the home being far away for 40% of the consumers. The level of hygiene of the food sold on Nyamwisi Boulevard remains a concern with regard to elements such as 59% use well water, which could be the basis of food-borne diseases, 45% of the respondents are clean, only 8% used protective

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clothing, 12% wash their hands regularly before serving customers, 26% have dustbins, presence of rubbish at 38%; 36% protect against breath and flies, 55% of utensils are clean, 49% have workstations.

Conclusion: Generally speaking, the hygiene rules for food sold on the public highway on Nyamwisi Boulevard are not in place. Certain practices are said to be at the root of the lack of hygiene of food intended for consumption.

Keywords: Assessment; hygiene level; foodstuffs; public thoroughfare.

1. INTRODUCTION

Hygiene is a key issue at both local and national levels. The control of food safety has become a concern for international organisations, public services, consumers, etc. Food can transmit diseases from person to person, but also serve as a means of growth for certain bacteria (both on the surface and inside the food). Food can transmit diseases from person to person but also serve as a growth medium for certain bacteria that can cause diseases such as food poisoning [1].

Food safety is a public health priority. Unsafe food is a global health threat that puts everyone's life at risk. These foods create a vicious cycle of diarrhoea affecting the physical condition of the most vulnerable. According to WHO (2007), 220 million children contract diarrhoeal diseases every year. Children under five bear 40% of the disease burden from foodborne diseases and 125,000 die each year [2].

An estimated 2.5 billion people consume street foods, 65.3% of which are essential for urban and rural diets, and are responsible for hygiene-related diseases: 60% of diarrhoea cases, 45% of cholera cases and others including verminosis, typhoid fever and dysentery [3].

It is estimated that 600 million people, or nearly 1 in 10 worldwide, fall ill each year after eating contaminated food, and 420,000 die as a result. Diarrhoeal diseases are the most common illnesses resulting from eating contaminated food, affecting 550 million people a year and killing 230,000 a year. Foodborne diseases hamper socio-economic development by placing a heavy burden on health care systems, and by damaging national economies, tourism and trade [2].

Food hygiene includes all practices aimed at ensuring that food placed on the market is neither harmful (detrimental to health) nor unacceptable for consumption due to spoilage by

non-harmful micro-organisms. Hygiene is therefore said to have two components, safety and wholesomeness. Food safety is also called food security [4].

The fact that most of the world's population lives in urban areas today is due to the rapid growth of cities and peri-urban areas in recent decades, particularly in developing countries. In many urban areas, health problems are compounded by uncontrolled urbanisation, which in many cases is not adequately funded. As a result, municipal authorities often lack the means to provide the basic health and environmental infrastructure and services that are the minimum requirements for a healthy population [5].

In the developed world, certain foods have been repeatedly incriminated in food-borne outbreaks. In France, for example, the Centre de Contrôle des Maladies estimates that there are 250,000-750,000 cases of food poisoning per year, of which 70,000 are referred to emergency departments, 150,000 people are hospitalised and 400 people die [1].

In the developing world, the consumption of street foods is very high, 76.1% of which are also at risk of contamination by "*Salmonella*" bacteria due to the lack of hygiene in the stalls, refrigerators and cooking facilities required [3].

Following the example of other developing countries, the Democratic Republic of Congo, on the basis of surveys conducted from 1998 to 2010, reported a serious deterioration in the nutritional situation of food sold on the public highway. Thus, a law was promulgated in 2015 stipulating in its article 10 that "The sale of foodstuffs in the vicinity of public buildings, schools, pre-schools and universities must be carried out in conditions that ensure good preservation and effective protection of these foodstuffs against flies, dust and other disease vectors" [6].

In addition, it is a source of ready-to-eat food for most of the population working during the day or

away from home. Their ease of access and availability is of interest to the consumer, and because of their lower cost, i.e. low or no rent for the site occupied, low investment (equipment, and purchase of raw materials), they offer basic food at a better price than restaurants [7].

Furthermore, WHO advocates that a healthy market involves collaboration between all interested parties to provide healthy and nutritious food for the whole community. This implies that, markets can facilitate the spread of disease, as has been the case with cholera in Latin America and Severe Acute Respiratory Syndrome (SARS) in Asia. Therefore, local authorities, market managers, suppliers, vendors and all those who work in markets, as well as consumers themselves, must all agree on the critical role of markets in promoting community health and well-being [4].

Moreover, studies in many countries show the dominant role played by women in this type of trade [3]. According to Konan, foodborne diarrhoeal diseases are one of the most common diseases worldwide. In developing countries, they are responsible for 1.8 million deaths of children under five each year. As many as 70% of these cases are caused by foodborne pathogens. The incidence of foodborne disease is difficult to estimate accurately, even in developed countries, because many episodes go untreated and therefore unreported [8].

The US Centers for Disease Control and Prevention estimates that approximately one in three people in the United States contract a foodborne disease each year. Similar estimates have been made in the Australian population. Children, pregnant women, the immunocompromised and the elderly are particularly at risk of these diseases and of more serious complications. Other health problems associated with this type of disease are common. For example, 2-3% of all salmonellosis cases result in long-term health problems due to reactive arthritis [9].

In the Democratic Republic of Congo, street food is a social reality. However, the lack of hygienic conditions in the setting up of these foods constitutes a threat to the health of 65.8% of the population who suffer from hygienic diseases such as typhoid fever. In North Kivu, food poisoning and illnesses transmitted by street food represent 61.4% of consumers and vendors [10].

In Kisangani, as in all cities in the Democratic Republic of Congo, the trade and consumption of street food is a reality. To address these challenges, a study was conducted to monitor the hygienic quality of street foods. A survey was conducted to determine whether vendors in the central market restaurants were following Good Hygiene Practices. The quality of three samples was assessed by microbiological analysis and the results showed that 11% of vendors did not attend school, 44% of vendors were limited to primary school and 45% of vendors did not reheat their food before serving it. 100% of the samples were unsatisfactory for *Bacillus spore* and *Total Aerobic Mesophilic Flora* (TAFM). These results allow the different services concerned to better control these foods [11].

Sold in unhealthy conditions, the food constitutes a real danger for the health of the population, because, the environment being polluted, these food products are totally exposed to microbes of all kinds. The consumption of these foods is often a source of many diseases.

In Beni, infectious food diseases exist but seem to be ignored. They led to more than 70% of cases of diseases due to lack of hygiene in 2017 and 50.6% of deaths [12].

Through this study, we want to know the conditions in which street food is sold on Nyamwisi Boulevard in Beni city, which can serve as a starting point for scientists to look for strategies and control measures to improve this sector. This situation led us to ask a specific question, including:

- What is the level of hygiene of the foodstuffs sold on Nyamwisi Boulevard, in terms of cleanliness of the vendors, foodstuffs, environmental sanitation, the type of water used and the position of the foodstuffs?

In general, the objective of the study is to assess the level of hygiene of the foodstuffs sold on Nyamwisi Boulevard in Beni City.

This study has a double approach: social and scientific. From the social point of view, this study is a contribution to the fight against the lack of food hygiene in public area and a challenge to political and medical leaders and vendors to take appropriate measures to maintain and observe food hygiene in the market in order to prevent diseases linked to poor hygiene.

From a scientific point of view, the study paves the way for other researchers by providing a frame of reference for further research on the same topic.

2. METHODOLOGY

This is a descriptive study with a cross-sectional focus that was mainly interested in the sellers and consumers of foodstuffs on the public highway at Nyamwisi Boulevard in 2021, in the town of Beni in the Democratic Republic of Congo.

Our study population is infinite with a non-random sample whose number was fixed by the PEDUIZZI formula ($n = K*10$), K being the number of variables.

The sample consisted of 100 subjects, including sellers and consumers of foodstuffs sold and purchased on Boulevard Nyamwisi in Beni territory.

Those who would be included in our research are all regular and available foods, but also the sellers and consumers available during this survey period.

In order to obtain information relevant to our research, we used the following techniques:

- Participatory direct observation: which allowed us to personally come into contact with the state of food safety and observe the state of the vendors.
- Structured interview based on a questionnaire addressed to vendors and consumers, i.e. we formulated closed questions that we submitted to each respondent.
- Literature review: to reconstruct the statement of problem, the theory and the discussion of our work.

This study is an instrument to raise awareness and challenge street food vendors to maintain hygiene in their daily activities.

3. RESULTS

3.1 Demographic Characteristics

From the analysis of this Table 1, we see that 64% of sellers are women and 36% men, 58% of consumers are males and 42% females. In terms of age, 38 individuals, or 38% of the salespeople

surveyed, were between 11 and 20 years old. With regard to level of education, 48% of the subjects surveyed were primary school teachers, while 31% of the consumers are illiterate. With regard to marital status, 38% of the sellers surveyed were single and 46% of the consumers were single.

3.2 Type of Foodstuffs Sold on the Boulevard

In addition, 22% of respondents sell fruit, followed by a tie of 18% who sell tubers and beverages and 6% of respondents who sell dairy products.

3.3 Motivation for Selling and Consuming Street Food

In this table, 49% of sellers cited the possibility of employment, 23% the avoidance of taxes, 21% the accessibility of customers and 7% the lower cost of the site occupied, while 40% of consumers cited the distance from home, 29% the lack of time to prepare, 20% the better price and 11% the lack of food at home.

3.4 Sellers' and Consumers' Knowledge about Food

The analysis of this food knowledge table 4 shows that 21% of sellers have very good knowledge, 35% have good knowledge and 44% have poor knowledge, while 30% of consumers have very good knowledge, 37% have good knowledge and 33% have poor knowledge.

3.5 Degree of Food and Environmental Hygiene

According to this table 5, 45% of respondents are clean, only 8% have protective clothing, 12% wash their hands regularly before serving customers, 26% have bins, 38% have rubbish, 36% protect against breath and flies, 49% have work stations.

3.6 Water Quality for Dishwashing and Cooking

The table 6 shows that 59% of respondents use well water, followed by 20% who use Regideso water, 14% who use spring water and 7% who use river water for cleaning dishes.

Table 1. Distribution of subjects by demographic characteristic (n=100)

Variables	Effectives	%
Gender		
Male	36	58
Female	64	42
Age		
11 to 20 years	38	12
21 to 30 years	25	43
31 to 40 years	22	34
41 and more	15	11
Qualification		
Illiterate	16	31
Primary	48	18
Secondary	28	56
University	8	5
Marital Status		
Single	38	46
Married	25	28
Divorced	22	19
Widowed	15	7

Table 2. Distribution of subjects by type of food sold on the boulevard

Foodstuffs	Effective	%
Fruit	22	22
Beverages	18	18
Dairy products	6	6
Cereals	7	7
Tubers	18	18
Pulses	16	16
Animal products	13	13
Total	100	100

Table 3. Distribution of subjects according to motivation to sell and consume street food n = 100

Variables	Sellers				Consumers			
	More acces- sible custo- mers	Job opportuni- ties	Escaping from taxes	Lower cost for the occupied site	Bes t pric e	Home away from home	No time for cooking	Insufficie nt food at home
Gender								
Male	5	12	17	2	12	14	24	8
Female`	16	37	6	5	8	26	5	3
Age								
11 to 20 years	10	22	6	0	2	7	1	2
21 à 30 years	7	11	6	1	7	18	15	3
31 à 40 years	2	11	6	3	6	12	11	5
41 and more	2	5	5	3	5	3	2	1
Marital status								
Single	7	21	8	2	6	17	18	5
Married	2	10	10	3	9	15	2	2
Divorced	7	12	3	0	4	5	7	3
Widowed	5	6	2	2	1	3	2	1

Table 4. Distribution of subjects according to knowledge about food

Knowledge elements	Sellers			Consumers		
	TB	B	M	TB	B	M
Role of food	18	31	51	23	36	41
Method of preserving food	28	20	52	32	44	24
Measures to avoid contamination of food (food hygiene)	18	33	49	17	25	58
Consequences of poor food hygiene	19	46	35	37	39	24
Food-borne diseases	22	45	33	42	38	20

Table 5. Distribution of subjects according to the degree of food and environmental hygiene: n = 100

Observational elements	Effectives	%
Protection against bad smells, flies and dust	36	36
Clean utensils	55	55
Clean sellers	45	45
Vendors with protective clothing	8	8
Foodborne illness	12	12
Hand washing before serving customers	39	39
Clean environment	26	26
Presence of bins	38	38
Presence of rubbish	49	49
Existence of workstations	64	64
Proper handling of foodstuffs		

Table 6. Distribution of subjects according to the quality of water used for cleaning and cooking

Water quality	Effectives	%
Well water	59	59
Régideso water	20	20
Spring water	14	14
River water	7	7
Total	100	100

Table 7. Distribution of subjects according to the supervision of vendors on food hygiene at the market

Framing	Yes	No
Training	24	76
Structural	0	100

3.7 Supervision of vendors on food hygiene in the market

According to this table 7, only 24% of the respondents have received training in food hygiene; there is no organisation in this sector.

4. DISCUSSION

As a result, it was observed that the level of hygiene of the food sold on Nyamwisi Boulevard remains a concern with regard to elements such as 59% use well water, which could be the basis of food-borne diseases, 45% of the respondents are clean, only 8% with protective clothing, 12% wash their hands regularly before serving customers, 26% have dustbins, presence of

rubbish at 38%; 36% protect against breath and flies, 55% of utensils are clean, 49% have workstations.

This study reveals that among the 100 respondents, women were more involved in food selling activities along Nyamwisi Boulevard, 64% compared to 36% of male subjects, while of the consumers 58% were men and 42% were women. Similarly to Iyenda (2001), in her study of the 256 respondents interviewed, the majority were women (55.1% versus 44.9%). More than a quarter of the women were heads of household in the Democratic Republic of Congo. Similarly, Secke in 2007, in her thesis, also showed that on a global scale, street food trading is more common among women than men.

But also all ages practice this activity with a predilection between 11 and 20 years old with 38%. Those of primary level are more represented with 48%. Kanyere [13] estimated that the minimum age of street vendors in Beni was 24 years, while their maximum age was 40 years, she also states that most street food vendors have acquired a primary and secondary level of education. This is in line with Henriette's 2009 study which revealed that street food selling generates employment opportunities especially for the uneducated or less educated.

In terms of marital status, this study opines that 46% of consumers are single, followed by married (28%), most of whom are students and labourers. This is in line with Telamanu BE et al in 2020, report on street food selling, which states that the clients of street food selling were classified as civil servants, students, construction workers, parents with their children, less privileged residents of Kinshasa. People who are not so rich to afford standard restaurants and people who are socially unstable. It is widely accepted that street food is for people of medium and low socio-economic status [14].

In terms of the types of food involved and surveyed, it was found that the most common foods found and sold on Nyamwisi Boulevard were fruits 22%, beverages 18%, tubers 18%, pulses 16%, animal products 13%, cereals 7% and dairy products 6%. This result is in agreement with Secke's [15] study that street foods are traditional foods and are all variable, easily accessible, cheaper than in restaurants and available to consumers.

Regarding the motivation for selling street food among sellers, 49% of respondents considered this activity as an employment opportunity, 23% to avoid paying tax, 21% invoke an accessible clientele and 7% consider the lower cost for the occupied site, while 40% of consumers buy street food because their home is far away, 29% do not have time to prepare, 20% resort to it because of the better price and 11% because of the lack of food at home.

In Kisangani, as in all cities in the Democratic Republic of Congo, the trade and consumption of street food is a reality. A survey was carried out to determine whether the vendors in the restaurants of the central market respect hygiene practices. The quality of our three samples was assessed by microbiological analysis. The results

showed that 11% of the vendors had not attended school, 44% of the vendors had only attended primary school and 45% of the vendors did not reheat their food before serving it. 100% of the samples were unsatisfactory with regard to Bacillus spore and FMAT. These results allow the different services concerned to better control these foods [11].

This is in support with the ideas of Secke [15], who states in his study that this activity creates employment and brings in an income 3 to 5 times higher than the minimum wage in the country. This is like Kanyere [13] who found that the minimum earnings for most of them in a day is about 900 Congolese francs per day and the maximum is 20,000 Congolese francs, allowing them to meet their basic needs such as food, school fees, rent, hospital.

While Kristina Roesel and Delia Grace [16] note that most vendors have chosen to place their stalls at the intersection of major roads to access the combination of commercial, residential and business properties and the high volumes of pedestrian and vehicle traffic at all hours.

Regulations and policies developed by the government would allow for safe practices, monitoring and formality of the sector. This would have contributed significantly to the national economy if well organised and channelled.

For their part, Makelele and al [12] add that the income of street food vendors is so low that the tax from government and other agencies will be a burden on them. In terms of tax and levy negotiations, street vendors have to bear many costs - both legitimate costs such as paying for permits or licenses; regular daily, weekly, monthly or annual payments to national or local authorities for their sites; payment for certain services such as storage space, use of water or sometimes even toilets, etc.

In addition, it was shown that 21% of respondents have good knowledge about food, 35% have average knowledge and 44% have poor knowledge. However FAO [3], stresses the facts that food handlers should have the knowledge and skills to do so hygienically and that consumer education is necessary. They noted that the majority of street food operators engage in this activity without prior knowledge of food handling, preparation, storage and preservation, which is a potential risk to consumers and is of urgent public health

concern. It would therefore be desirable for the services concerned to train and inform these vendors in order to improve the quality of the service provided. However, Table 7 shows that 76% of vendors have not been trained in this area, and there is no structure in this sector.

With regard to the results recorded on the degree of hygiene of foodstuffs and the environment and on the quality of water used for cleaning dishes and cooking, 59% of respondents use well water, which could be the cause of food-borne diseases, 45% of respondents are clean, only 8% use protective clothing, 12% wash their hands regularly before serving customers, 26% have bins, 38% have rubbish disposal, 36% protect against bad smells and flies, 55% of utensils are clean, 49% have workstations.

This argument is shared by Ahou Kouadio Konan N. [17], who demonstrated in his survey that more than 65.7% of vendors display foodstuffs on the ground, which in some way produces health risks and poisoning for consumers. However, traders tend to seek financial resources without taking into account the healthiness of the foodstuffs and the environmental framework that could endanger the health of consumers.

Sellers and even consumers are not sufficiently educated in the basic rules of food hygiene and this poses a public health problem.

According to the WHO [18], fruits and vegetables need to be washed and rinsed thoroughly with clean water to remove sand and impurities adhering to their surface. In general, removing the first few layers of skin or rind is sufficient for clean vegetables. The use of disinfectants is rarely recommended, as the heat of cooking generally eliminates all pathogenic bacteria. Fruits and vegetables with dents or bad areas should be discarded, as these are usually breeding grounds for bacteria.

This quality keeps the poor in a vicious cycle of poverty. It is clear that food access patterns such as the use of small markets and street foods expose people to less healthy food. Poor hygiene practices encourage the spread of disease. These food-borne diseases, which are a favourite companion of dirty places, are caused by ingesting unsafe food or water contaminated with micro-organisms.

Monica [19] emphasises, in the same vein, that those responsible for food establishments must ensure that foodstuffs are not adversely affected by micro-organisms, residues, contamination or other causes, and that utensils are not damaged. According to Otsmane, this practice is illegal with adverse effects on consumers, deterioration of product quality because exposure to sunlight that transforms the chemicals to bins that carry the juice, dairy products are not regularly washed, which exposes consumers to foodborne illnesses.

This result is shared by Navereau and Espinasse [20], who critically analyse food safety in Africa in their study. According to them, foodborne diseases are public health problem. Every year people suffer from diseases caused by contaminated food. Lack of hygiene affects the exposure of street foods. The risk of food poisoning remains a major health problem for the population.

In the associations' practical guide, it is noted that the handling, storage and preparation of foodstuffs requires great vigilance. It is out of the question to leave them on the floor or on tables, and it adds that training of people working in this field is necessary. Each of them must be aware of the principles of hygiene.

These results corroborate those of Traoré [21], who states that the dysfunctions and inadequacies at the level of the administrations concerned are due to the behaviour and attitudes of the population in the management of public hygiene. Furthermore, awareness of the relationship between human activities, the environment and health remains an objective to be achieved. In reality, it is necessary to take into account the involvement of the population in hygiene management programmes.

According to Appiah [22], food can transmit diseases from person to person but also serve as a medium for the growth of certain bacteria (both on the surface and inside the food) that can cause food poisoning. Unattended food can spread disease. From the moment of production to the moment of consumption, food is constantly exposed to possible contamination, both by natural agents and by human intervention.

The consequences of poor hygiene management of foodstuffs and the market environment expose consumers to illnesses and food poisoning such as cholera, diarrhoea, coughing, vomiting and

many others. It was mentioned that poor personal hygiene can lead to the contamination of foodstuffs, and anything can be transferred to food through the handling of hands. The diseases raise both food safety and occupational hygiene issues, which can only be resolved by improving sanitary conditions in the markets.

5. LIMITATIONS OF THE STUDY

Not all aspects relevant to the study were addressed, including the microbiological analysis of food in the laboratory for microbes contained in food.

6. RECOMMENDATIONS

As poor hygiene at the market not only affects the food, but can also impact on consumer health safety, we suggest :

1) To the municipal authorities

- to scrupulously enforce the rules of food hygiene at the market;
- to build stalls to be made available to sellers;
- to create a permanent monitoring and control service for food hygiene measures at the market.

2) For sellers

- to carefully respect the hygiene rules laid down by the market authorities;
- to sell food on clean stalls
- to regularly ensure the sanitation and healthiness of the market.

3) To consumers

- not to buy and consume food sold in the open air, without clean stalls;
- to apply hygiene to food sold in the market before consumption.

7. CONCLUSION

The principal aim of this study was to assess the level of hygiene on food sold on Nyamwisi Boulevard in Beni, DR Congo.

As a result, it was observed that the level of hygiene of the food sold on Nyamwisi Boulevard remains a concern with regard to elements such as 59% use well water, which could be the basis of food-borne diseases, 45% of the respondents

are clean, only 8% with protective clothing, 12% wash their hands regularly before serving customers, 26% have dustbins, presence of rubbish at 38%; 36% protect against breath and flies, 55% of utensils are clean, 49% have workstations.

In conclusion, This study reveals that the hygiene of food sold on Nyamwisi Boulevard in Beni is not strictly observed and that consumers, characterised by proven ignorance, continue to buy and consume food sold in disregard of the rules of hygiene at the market, thus exposing themselves to diseases linked to the lack of hygiene. However, one of the specific issues that actors (state structures and traders) are concerned with is financial resources. Food hygiene measures are not taken into account by them.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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