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Factors Associated with Poor Food Hygiene Practice at the Koloboyi Small Market, in the Town of Mwene-Ditu in the DRC: Cross-Sectional Analytical Study

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Abstract

Introduction: Poor food hygiene is the basis of dirty hand diseases; especially in third-world countries. This problem also concerns DRC in general and the town of Mwene-Ditu in particular. Contributing to the implementation of good food hygiene practices on the market was our objective. **Method:** The cross-sectional analytical study within the small Koloboyi Market was carried out for a period of 9 months (January 25 - October 25, 2022), in the commune of Mwene-Ditu, province of Lomami in DR. Congo. Data collection was carried out using a semi-structured questionnaire. Statistical associations between the dependent variable and independent variables were established based on the Odds Ratio (95% CI) test. **Results:** During this study, 296 survey subjects were retained. After analysis, the observation is that the absence of hand washing (OR: 28.14 [8.28 - 95.58]; p = 0.00) and extreme ages including 10 to 17 years (OR 7.19 [2.24 - 23.08]; p = 0.001); 59 to 65 years old (OR 5.88 [1.44 - 23.96]; p = 0.02) as well as 65 years and over (OR 6.53 [1.38 - 30.97]; p = 0.03) are factors associated with non-practice of food hygiene. **Conclusion:** Building infrastructure and raising awareness about the implementation and compliance with hygiene measures among different vendors remains essential to improve the health of the population.

Subject Areas

Public Health

Keywords

Associated Factors, Food Hygiene, Market, Mwene-Ditu

1. Introduction

Contaminated food is the cause of many hand diseases. These often lead to the death of contaminated people and constitute one of the causes of major deaths worldwide [1].

In industrialized countries, food security is considered a priority by political and decision-making bodies. Significant resources are being deployed for the surveillance, prevention and control of these diseases throughout the food chain up to the consumer level [2].

According to a study conducted in Bangladesh, safe storage and fresh preparation or reheating of leftover food was frequently practiced, while hand washing and cleaning of utensils was practiced by fewer participants [3].

Poor hand hygiene and poor food handling and storage put consumers at risk of enteric disease, particularly in low-income countries [4].

A study carried out in Kabinda in the Lomami Province in DRC indicates that the management of foodstuffs requires good conservation from production, to sale/purchase to consumption. While food is sold without packaging to guarantee food hygiene [5]. Foodborne illnesses have a serious impact on people's health and are a concern for producers, sellers and consumers. In most developing countries where gastroenteritis is one of five causes of illness and death, unsafe food contributes enormously to this burden [6].

During a study carried out by the FAO in the DRC within the market of the National Pedagogical University of Kinshasa, it was shown that the number of rinses of food before cooking influenced food hygiene [7].

During a visit to one of the markets in the City of Mwene Ditu, a bitter observation was made regarding food hygiene. The merchants of this said market did not respect good food hygiene practices on the one hand and on the other hand, there was poor management of waste generated on site at the market.

In view of the above, poor food hygiene constitutes a public health problem in the market of the City of Mwene-Ditu exposing the population to a risk of diseases. On this, this study aimed to identify the factors associated with the non-practice of food hygiene in order to provide corrective measures, to spare the population of the town of Mwene-Ditu who buy their supplies from this market from hand diseases.

2. Method

This study was carried out at the Koloboyi market in the town of Mwene-Ditu, Lomami Province in DRC. This is a cross-sectional analytical study lasting 9 months, from January 25 to October 25, 2022.

Small market vendors were the source population from which we drew food vendors as the sample population. Statistical units were obtained by simple random sampling

We carried out a pre-survey to perfect the semi-structured questionnaire used for data collection before administering it to the sampled population. The questionnaire was designed in French and administered as such. However, for other targeted sellers who do not speak French, an interpreter was used to translate into Kanyok or Tshiluba, the two local languages used in this town (**Appendix** is the English version of the survey questionnaire).

Thus, we requested the agreement of the hierarchy of the small Koloboyi market, to access not only their institution, but also to reach our target population (food sellers) to be able to collect the data we needed; and these were delivered to us by the sellers without difficulty and with ease.

The dependent variable was food hygiene and the independent variables were: respondent's age, gender, marital status, education level, sales area, hand washing, time of food contamination, the method of preserving food, the existence of hygienic latrines, the existence of slaughterhouses and the preservation of food in the cold. During data collection, respondents were reassured that the information provided during this study could be used for scientific purposes only. On this point, free consent and confidentiality were guaranteed for ethical reasons.

The Epi-infoTM software version 7.2.2.6 (CDC, 2018) was used to estimate the sample size from the Statcalc subprogram, taking into account the prevalence of 22.6% observed in the town of Kabinda among sellers aware that food hygiene was good at Yakasongo market [5]. The confidence level retained was 95% and the acceptable margin of error was 5%. The sample should therefore have consisted of 269 boxes. Considering the proportion of missing data, the adjustment was made by adding 10% of the size to the value obtained. Thus, the final size of the adapted sample was 296 boxes.

Epi-infoTM software version 7 and Excel were used: data processing and figure design were carried out with Excel. Analyses were carried out with Epi-Info 7. Qualitative data were presented as frequency and quantitative data as a function of position and dispersion parameters. Odds ratio (OR 95% CI) test were used to study associations between variables. OR determined the association if it was greater than 1 and its lower bound also greater than 1, but otherwise there was none. Additionally, there was a significant association when p was less than 0.05.

3. Results

This study involved a total of 296 sellers from the small Koloboyi market who were our statistical units. Of all these units, the age group 31 to 38 was the most represented (**Table 1**). Women represented 66.5%, or 197 cases, and men 33.5%, or 99 cases (**Figure 1**). Married couples were the most represented with a total of 191 subjects or 64.5%; on the other hand, widows and widowers came in last

Table 1. Distribution of respondents according to their sociodemographic variables.

Variables	Frequency (296)	%
Age groups		
10 to 17	17	5.7
17 to 24	28	9.5
24 to 31	64	21.6
31 to 38	78	26.4
38 to 45	43	14.5
45 to 52	29	9.8
52 to 59	19	6.4
59 to 65	10	3.4
65 and over	8	2.7
Sales sector		
Manufactures	72	24.3
Vegetables	83	28.1
Spices	74	25
Others	67	22.6
Level of study		
Without level	63	21.3
Primary	55	18.6
Secondary	169	57.1
University	9	3

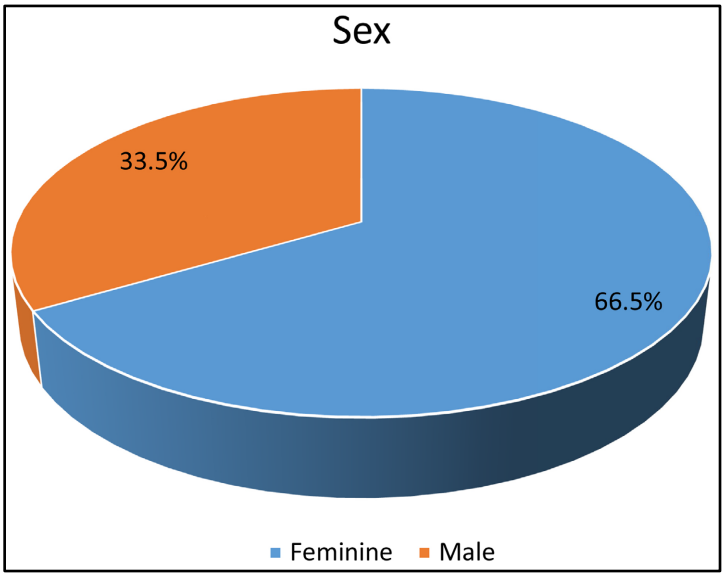

Figure 1. Distribution of respondents according to their gender.

position, 22 cases or 7.5% (Figure 2). In relation to the level of study, 167 cases or 56.5% had a secondary level, while those at the university level represented only 3.0%. The survey showed that vegetable sellers were the most represented, 83 cases or 28%, while those from other sectors were 66% or 22.6% (Table 1).

We noted in the data related to food hygiene that, 202 cases or 68.2% claimed to have knowledge of food hygiene, while the remainder did not know any. The practice of washing vegetables was widely observed by our respondents in a proportion of 90.2%. Hand washing was a widely observed practice because 264 of our respondents responded positively, *i.e.* 89.2%. 33.8% of respondents noted that food is often contaminated during production. 41.6% of respondents stored food in plastic buckets. 91.2% of subjects responded during this survey that they did not have access to hygienic latrines at the market. Slaughterhouses are almost non-existent because 241 cases or 81.4% responded negatively for the existence of the latter. Cold storage of food is almost not practiced because 248 of our respondents, or 83.8%, responded negatively (Table 2).

After carrying out the bivariate analyses between the dependent variable (Food Hygiene) as well as the independent ones on the basis of statistical associations, there was no significant association between food hygiene and sex, marital status, level of study, sales sector, and method of food preservation. On the other hand, a strong association was observed between not washing hands ($p = 0.00$) and age: the age group from 59 to 65 years ($p = 0.02$) as well as the age group 65 years and over ($p = 0.03$) (Table 3).

4. Discussion

This study was carried out on 296 statistical units (sellers) of the small Koloboyi market. At the end of the analyses, it was found that not washing hands before handling food and age are risk factors that can lead to non-practice of food hygiene. It should be noted that buyers, sellers of other items other than food,

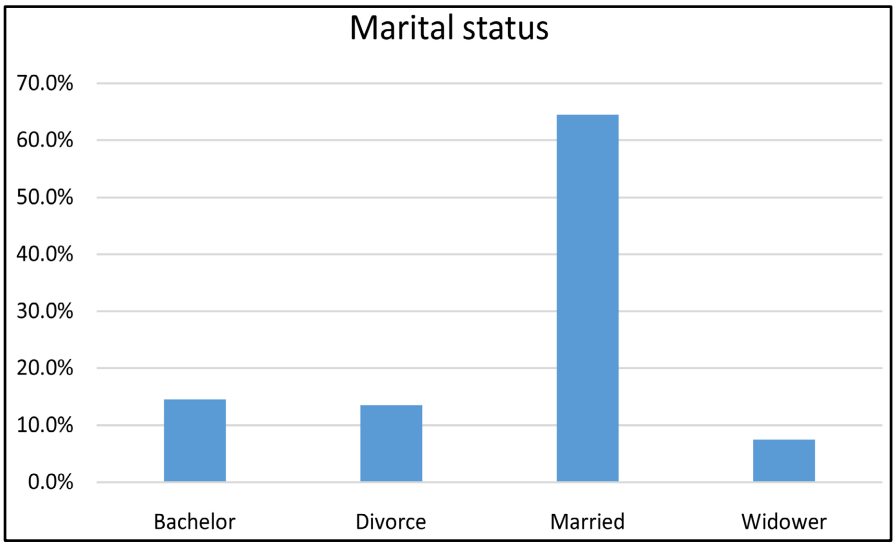

Figure 2. Distribution of respondents according to their marital status.

Table 2. Distribution of respondents according to variables linked to food hygiene.

Variables	Frequency (296)	%
Knowledge of food hygiene		
Yes	202	68.2
No	94	31.8
Hand washing		
Yes	264	89.2
No	32	10.8
Time of food contamination		
On consumption	42	14.2
On distribution	70	23.7
At production	100	33.8
At the transformation	61	20.6
When storing	23	7.8
Food storage method		
Plastic packaging	44	14.9
Freezer	13	4.4
Bag	47	15.9
Plastic bucket	123	41.6
Other	69	23.2
Access to hygienic latrines		
Yes	26	8.8
No	270	91.2
Existence of slaughterhouses		
Yes	55	18.6
No	241	81.4
Cold storage of food		
Yes	48	16.2
No	248	83.8
Cleaning vegetables		
Yes	267	90.2
No	29	9.8

street children, tourists and strollers were excluded from this study. It is certain that our data may be linked to biases or even to limitations such as the availability of hygienic latrines, displays and water points for hand washing.

The analyses show that of all the independent variables, not washing hands before handling food and age are risk factors. To do this, respondents who did not wash their hands had 8 times the risk of no longer practicing food hygiene

Table 3. Statistical associations.

Variables	No	Yes	Total	OR [95%]	p-value
Knowledge					
	94 (31.8%)	Yes (202)	296		
Age					
10 to 17	11 (64.7%)	6 (35.29%)	17	7.19 [2.24 - 23.08]	0.001
17 to 24	9 (32.1%)	19 (67.85%)	28	1.85 [0.68 - 5.05]	0.33
24 to 31	13 (20.3%)	51 (79.68%)	64	Reference	
31 to 38	19 (24.4%)	59 (75.64%)	78	1,26 [0.56 - 2.80]	0.70
38 to 45	15 (34.9%)	28 (65.11%)	43	2.10 [0.87 - 5.03]	0.14
45 to 52	9 (31%)	20 (68.96%)	29	1.76 [0.65 - 4.77]	0.38
52 to 59	8 (42.1%)	11 (57.89%)	19	2.85 [0.95 - 8.53]	0.10
59 to 65	6 (60%)	4 (40.00%)	10	5.88 [1.44 - 23.96]	0.02
65 and over	5 (62.50%)	3 (37.50%)	8	6.53 [1.38 - 30.97]	0.03
Sex					
Feminine	64 (32.49%)	113 (67.51%)	197	1.30 [0.76 - 0.20]	0.39
Male	30 (30.30%)	69 (69.70%)	99	Reference	
Marial status					
Bachelor	13 (30.23%)	30 (69.77%)	43	1.47 [0.44 - 4.84]	0.72
Divorce	13 (32.50%)	27 (67.50%)	40	1.63 [0.49 - 5.41]	0.60
Married	63 (32.98%)	128 (67.02%)	191	1.67 [0.59 - 4.74]	0.46
Widower	5 (22.73%)	17 (77.27%)	22	Reference	
Level of study					
Without level	25 (39.68%)	38 (60.32%)	63	2.30 [0.44 - 11.99]	0.51
Primary	16 (29.09%)	39 (70.91%)	55	1.43 [0.26 - 7.67]	0.98
Secondary	51 (30.18%)	118 (69.82%)	169	1.51 [0.30 - 7.53]	0.89
University	2 (22.22%)	7 (77.78%)	9	Reference	
Sales sector					
Spicy	26 (35.14%)	48 (64.86%)	74	1.27 [0.62 - 2.58]	0.62
Vegetable	25 (30.12%)	58 (69.88%)	83	1.01 [0.50 - 2.04]	1.00
Manufactures	23 (31.94%)	49 (68.06%)	72	1.10 [0.53 - 2.26]	0.93
Others	20 (29.85%)	47 (70.15%)	67	Reference	
Cleaning vegetables					
Yes	82 (30.71%)	185 (69.29%)	267	Reference	
No	12 (41.38%)	17 (58.62%)	29	1.59 [0.72 - 3.48]	0.33
Hand washing					
Yes	66 (24.91%)	199 (75.09%)	265	Reference	
No	28 (90.32%)	3 (9.68%)	31	28.14 [8.28 - 95.58]	0.00
Food preservation method					
Plastic packaging	16 (36.36%)	28 (63.64%)	44	1.66 [0.67 - 4.09]	0.37
Freezer	4 (30.77%)	9 (69.23%)	13	1.29 [0.33 - 4.99]	0.98
Bag	12 (25.53%)	35 (74.47%)	47	Reference	
Plastic bucket	44 (35.77%)	79 (64.23%)	123	1.62 [0.76 - 3.44]	0.27

95% CI 28.14 [8.28 - 95.58] and p-value 0.00, while those in the age group of 59 to 65 had 6 times this risk (p = 0.02), as well as those aged 65 and over with 7 times this risk (p = 0.03). This situation is justified by the fact that all sales activities are done quickly so that the seller gains a lot of customers per day. This is also explained by the fact that many people do not know the usefulness of hygiene measures. This situation is the same as those found in Bamako and Mali where the practice of hand washing was observed at a low rate [8] [9]. On the contrary, in restaurants near the National Pedagogical University (UPN) we see that there is an association between the number of times food is rinsed before cooking and food hygiene [7]. Thus, it was also noticed in the large Kisangani Market in the DRC that a large proportion of sellers did not wash their hands before serving their customers [10]. This same observation was made in the restaurants of the University of Basel as well as in the informal restaurants of Treichville Abidjan [11] [12]. Extreme ages were more represented in poor food hygiene. This is explained by the fact that in these age groups we found more people who do not have a high level of education and therefore with less information on hygiene. On the other hand, according to the study carried out in Chad, found that most of the sellers, *i.e.* 81.9%, were between 18 and 40 years old [4].

Furthermore, we noted that women or the female sex was the majority represented within the small Koloboyi market in the sale of food, *i.e.* 197 cases with 66.5%. The results on gender corroborate with those found by Nadège Ahou Kouadio Konan in 2021 in Côte d'Ivoire within the Grand Marche de Treichville and the Forum des Marches where women were the majority in the marketing of foodstuffs, *i.e.* a rate of 71, 84% [11]. This higher proportion is justified by the fact that women are the most concerned about food and especially in the vegetable sector and that of spices which come in first position. This observation is the same as that made in the city of D'jamena where the sample was composed of 86.7% women [4]. However, most of our respondents were literate because more than half knew how to write and read labels, unlike the results found in Ivory Coast where the majority, 77% of traders, were illiterate. This difference is linked to the socio-cultural and geographical context. The small Koloboyi Market is an urban market and the majority of traders have had the chance to study.

In this study we found that the majority of our respondents answered affirmatively for the practice of food hygiene. This statement would be the consequence of haste for fear that we would not lose customers by answering the questions according to our respondents. These results are in the same direction as those found in Bangladesh where participation in the food hygiene intervention was high with more than 75% attendance at each session [3]. On the other hand, in the studies carried out in Kabinda, in Kinshasa in the public markets and supermarkets of the Urban Commune of Antananarivo, the practice of food hygiene was marked by a low proportion [5] [7] [13]. Food management involves, among other things, good conservation from production, from purchase to

consumption. In this study, almost all of our respondents use plastic packaging. But sometimes food items are spread out on bags on the floor.

Around 90.2% of our respondents confirmed that they have the habit of washing vegetables at the market before selling them; which is the opposite of the results found in Ivory Coast [12]. This difference could be explained by the fact that each population has its habits and behaves according to its customs, therefore linked to socio-economic conditions.

The majority of our respondents (38.7%) affirmed that food is often contaminated during production. However, when cooking, germs can be killed. This observation is similar to that found in Burkina Faso where a clear improvement in the quality of dishes after cooking was noted [14].

Despite the level of education, certain flaws were observed in the practice of hygiene rules. This would be linked to the absence of training or awareness on good hygiene practices [15]. Unlike an Algerian study where regulations for the sale of food exist but are not respected by sellers [16].

Preserving food with cold was a practice least observed by sellers at the small Koloboyi Market, as there was a very small proportion of people owning refrigerators or freezers to preserve rotting food. This result is almost similar to those of an Ivorian study and another carried out in supermarkets in the Urban Commune of Antananarivo where sellers owning refrigerators represented only 15.38% [13] [17]. This is explained by the fact that the electricity supply is very low in the town of Mwene-Ditu, therefore sellers do not easily obtain freezers. This situation is favorable for the sale of products which are already in the process of rotting.

The animals are slaughtered on site and the meat sold directly. The rest is not kept cool; which increases the risk of spreading pathogenic germs. Limited access to hygienic latrines in a public environment like this further contributes to poor hygiene in this market and exposes foodstuffs and their consumers to.

5. Conclusion

Poor food hygiene in the public environment is a major health problem in developing countries which often leads to hand diseases. The DRC and more particularly the town of Mwene-Ditu is no exception to this problem. In order to protect the population, it is the responsibility of the authorities of this market to be able to consider building the minimum infrastructure such as stalls, latrines, slaughterhouses, hand washing points, etc. meeting the conditions hygienic in order to limit the spread of diseases. Furthermore, it would be desirable for those responsible for this market to organize awareness raising for sellers on the rules and concepts of hygiene.

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Author Contribution

Mbuyi designed the study, conducted the data analysis and drafted the manuscript; Sabwe, Tshibanda, Yanda contributed to the the data collection; Mukadi, Kasongo and Ilunga contributed to the analysis; Kazadi guided the study, analyzed the data, designed and edited the manuscript. All have read and approved the latest version of the manuscript.

Conflicts of Interest

The authors have declared no conflicts of interest.

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Appendix

Survey questionnaire

Sir, Madam, Miss Hello, we are researchers from the University of Mwene-Ditu, we are doing our research on food hygiene problems here in the Koloboyi market, with your agreement please answer these questions below.

I) SOCIODEMOGRAPHIC DATA

1) What is your age ☐

2) What is your gender
a. M
b. F

3) What is your marital status
a. Married
b. Single
c. Widow or widower
d. Divorce

4) What is your level of study
a. Without level
b. Primary
c. Secondary
d. University

5) What is your sales area?
a. Manufacturing
b. Vegetables
c. Spices
d. Others

II) DATA RELATED TO FOOD HYGIENE

1) Do you practice food hygiene?
a. Yes
b. No

2) Do you wash your hands with soap before eating or feeding another person?
a. Yes
b. No

3) Do you keep your fresh food cold?
a. Yes
b. No

4) Existence of hygienic latrines
a. Yes
b. No

5) When is food contaminated?
a. In production
b. At the transformation
c. At distribution
d. On consumption
e. during storage

6) Clean your raw vegetables before eating them
a. Yes
b. No

7) Food storage method
a. Plastic packaging
b. Freezer
c. Bag
d. Plastic bucket
e. Other

8) Existence of slaughterhouses
a. Yes
b. No