

## **Hygienic conditions and quality of the dishes cooked by the women traders in the town of Korhogo.**

### **ABSTRACT**

The aim of this study is to evaluate the hygienic quality of the dishes sold by the women traders in the town of Korhogo. The study was carried out with 45 restaurants in the town of Korhogo. It consisted on the one hand of a survey based on the Ishikawa diagram in order to assess the hygiene conditions and on the other hand of microbiological analyses of the ready-to-serve meals. 90 samples were taken, including 2 dishes per restaurant respectively consisting of one hot and one cold dish. From the results obtained, it appears that the hygiene on the whole is unsatisfactory. From a microbiological point of view, the meal samples were 75.2% satisfactory, 7.6% acceptable and 17.2% unsatisfactory. In view of these results, it appears essential to improve hygiene conditions by greater involvement of the official services involved in training these traders and monitoring compliance with good hygiene practices and the establishment of a program of cleaning and disinfection of premises and equipment.

*Keywords: hygiene, marketed dishes, women traders, microbiological analyses*

### **INTRODUCTION**

The informal food sector has been defined as "the sector producing food and beverages ready for consumption, prepared and/or sold by vendors, especially in the streets and other similar public places"[1]. It accounts for a significant share of the daily urban food consumption of millions of low- and middle-income consumers in urban areas [2]. This is because due to the lack or inadequacy of efficient collective catering systems, such as canteens in workplaces and schools, the latter buy food in the street at low cost. Street feeding is very dynamic and growing, while the products on offer are not always of good quality [3] [4]. Indeed, despite its importance, street food poses several health problems due to Foodborne Toxins (FTIs). Especially since microbiological analyses carried out on street foods in several countries have shown insufficient microbiological quality, increasing the risk of foodborne infections [5] [6]. These toxi-infections, which are ignored, often lead to large-scale cases of

death as sometimes reported in the press in many countries<sup>3</sup>. According to the [7], in developed countries the annual percentage of people suffering from foodborne infectious diseases is as high as 30%, while the problem is likely to be much more widespread in developing countries. And in Côte d'Ivoire, as elsewhere in the world, bacterial toxi-infections remain a real public health problem [8]. It is therefore recognized that foodborne pathogens represent a serious health hazard, the risk depending mainly on the type of food, the method of preparation and conservation [9], and it is therefore necessary to improve the nutritional, hygienic and organoleptic quality of these foods in order to provide the population with good quality products. For this reason, food safety is everyone's business, from farm to fork [3]. In **Korhogo**, there is a great diversity of street foods, however, they cause enormous problems of safety or nutritional quality that are related to the environment, the safety of the vendors and the way in which these foods are distributed. In addition, these traders have not received any training in hygiene by the Ministry of Health and Public Hygiene of the city. This fact, added to the various cases of intoxication that have occurred around the city, proves that this is a real public health problem. Especially since the Korhogo Anti-Tuberculosis Center counted 211 patients in 2018 and 48 cases in the first quarter of 2018, including 17 women street sellers. As the majority of these patients frequent these street selling places almost every day, it is very important to note the risk of infection of these patients. It is in this logic that our topic entitled: "Hygienic conditions and quality of the dishes cooked and sold by small traders in the town of Korhogo" is part of. The aim of this study is to evaluate the hygienic quality of the dishes sold by the women traders in the town of Korhogo in order to limit the risks linked to the consumption of foodstuffs by the population.

**Comment [F1]:** Country and province?

## **2. MATERIALS AND METHODS**

### **2.1. Materials and sampling**

This study consisted in conducting a survey in the town of **Korhogo** from January to February 2019 with survey forms developed on the basis of the Ishikawa diagram. After the survey phase, a sample collection was carried out by purchasing the dishes with the women traders in order to determine the different microbiological risks. These samples were collected in the morning for breakfast foods, at noon for lunch and in the evening for dinner. 90 samples were taken and divided into twenty-one (45) hot and twenty-one (45) cold dishes, with two (2) dishes per restaurant, including one (1) hot and one (1) cold dish.

**Comment [F2]:** in the method, it should be to display the observed parameters for hygienic condition

**Comment [F3]:** Country and district?

### **2.2. Enumeration of Microorganisms**

In this study, 25 g of samples were aseptically collected and introduced into a STOMACHER bag, and then the volume is made up to 250 mL with pre-sterilized Buffered Peptone Water (EPT). The tenfold serial dilutions were prepared and spread-plated for determination of microorganism counts. After dilutions, enumeration of **total aerobic mesophile** was carried out using plates of Plate Count Agar (PCA, Difco 0479-17-3; Difco Laboratories, Detroit, MI, USA) which were incubated at 30°C for 2 days. Lactic acid bacteria (Gram positive catalase negative, rods, cocci and coccoids) were enumerated by pour plate on DeMan, Rogosa and Sharpe Agar (MRS, Merck 10660; Merck KGaA, Darmstadt, Germany) containing 10 mg/mL cycloheximide (ICN 100183 Biomedical Inc., Aurora, OH, USA) to

**Comment [F4]:** Pour or spread plate, which used?

suppress yeast growth after incubation at 30°C for 3 days in an anaerobic jar with anaerocult A (Merck). Yeasts and moulds were enumerated on plates of Sabouraud Chloramphenicol agar (BIO-RAD, France) which were incubated at 30°C for 3 - 5 days. Enumeration of total faecal coliforms was carried out using plates of Violet Red Bile Lactose agar (VRBL, Merck 10660, Merck, Darmstadt, Germany) which were incubated for 24 h at 30°C for total coliforms and 44°C for faecal coliforms.

**Comment [F5]:** Method enumeration? Pour or spread?

**Comment [F6]:** Method enumeration? Pour or spread?

**Comment [F7]:** Data in Table 15, specific to *E.coli*, not fecal coliforms

**Comment [F8]:** This criteria, according to??

#### Microbiological criteria for ready-made meals

Mesophilic Aerobic Germs (MAG):  $3 \cdot 10^5$  germs/g of food

Faecal coliforms:  $10^3$  germs/g of food

Lactic acid bacteria:  $10^6$  germs/g of food

Fungal flora:  $5 \cdot 10^2$  germs/g of food

### 2.4 statistical analysis

The data obtained were subjected to analysis of variance (Statistica, 99 Edition, Alabama, USA) and mean differences determined by Duncan's multiple range tests. Significance of variations in the analyzed data was tested at 95% confidence limit.

**Comment [F9]:** where the data is the result of statistical analysis

## 3. RESULTS AND DISCUSSION

Tables 1, 2 and 3 show the local of the different restaurants visited. The restaurant premises of Korhogo's women traders are most often located along the main roads, in or in front of schools, in neighbourhoods or in courtyards. According to the results of the survey, 68.89% of the restaurants have no fences, and there are no compartments or cloakrooms in the 45 restaurants. Only a few restaurants have a poor handwashing system (26.66%) with handwashing products (liquid soap). Also, the survey reveals that 68.89% of the restaurants have a floor covered with soil, 8.89% have a floor covered with tiles and 22.22% have a floor covered with cement. Garbage is stored in front of the restaurant at 68.89%, within the restaurant at 24.44% and at 6.67% at the back of the restaurant to be burned or thrown away. Most of the installations are done without the opinion of the technical services in charge of the establishment of these women traders and even, the establishment of the premises of the women traders does not carry out any control in relation to the potential risks that the situation of a premises in an unhealthy area could generate. The construction of the sheds in no way respects the master plan for the construction of premises. Indeed, most of them do not benefit from fencing, sanitary facilities, cloakrooms and storage rooms for raw materials, cooking equipment and cleaning services. Hence the non-respect of the 5S, i.e. the separation of healthy and unclean areas. In addition, the soil is mostly earth, which causes dust to be raised during the entire service. This leads contaminations, especially since the bushes in the back of the restaurant or the back of the restaurant provide relief to the sales women who do not wash their hands effectively when handling the food. As regards the equipment used by women traders, all the results are recorded in Tables 4 and 5. This equipment is essentially made up of aluminium-based kitchen utensils (pots, deep fryers, ladles), cooking equipment (stoves, coal, bundles, gas, etc.), stainless steel tableware (spoons, forks, cups,

**Comment [F10]:** It mean the environment condition?

plates, tureens), and cleaning equipment (detergent, broom, mop). Most of the equipment is renewed only after they have completely deteriorated (91.11). Also, the surface of the cooking equipment becomes black due to lack of effective maintenance. In addition, the equipment is often stored with cleaning products (80%). The results show that 93.33% of the women traders use equipment that is degraded. The materials are poorly identified according to their use, resulting in the use of the same equipment for several purposes. This situation causes the dilapidation of the infrastructure, especially since this equipment is used without any concrete maintenance and with little renovation. Indeed, the use of cooking and serving equipment is not made according to their use. Thus, the same equipment can be used for cooking several foodstuffs. This leads to an accelerated degradation of the equipment. Also, the use of unsuitable equipment for the cutting of animal and vegetable food leads to the presence of wood debris in the cooked dishes causing physical hazards. The raw materials received are tuna fish, attiéké, pork meat, eggs and bread for some women traders. The other commodities are bought on the market especially on market days. The quantities to be received are evaluated according to needs and cover a period of 3 to 4 days for perishable foodstuffs such as attiéké, fish, tuna and pork meat. Food from Abidjan is transported in bags by the luggage trunk of the buses of the various transport companies in Korhogo. 35.55% of the food purchased or received is controlled by the vendors, while 64.45% is not controlled by the women traders. 57.78% of the raw materials (vegetables) in a state of decomposition (chilli, fresh tomatoes, onions, etc.) are used. The storage of perishable foodstuffs is done in freezers in poor condition with 11.11% ice, 13.33% with coolers containing ice, 60% in basins and 15.56% on the ground. Raw materials of long duration such as rice, and of medium duration such as eggs are stored 71.11% on the ground and 28.89% in basins (Tables 6 and 7). Tables 8, 9, 10 and 11 provide information on the labour used in the various restaurants. The qualification of staff remains the major problem in the commercial sector in Korhogo. Street commerce in Korhogo employs the majority of illiterate people with no culinary training, with 91.11% of the actresses unaware of good hygiene practices and 8.89% who have an overview of hygiene rules in collective catering. Also, only 6.67% of staff have suitable work clothes and 93.33% have household clothes. Of these uniforms used for service, 4.44% are washed after each service, 84.45% are washed 2/3 times a week and 11.11% are changed into clean uniforms every day. 62.22% of the actresses in these street restorations are ill and 35.56% are injured. As regards the wearing of objects during services, 13.33% of women traders do not wear them, 35.55% wear rings, 48.9 wear bracelets and 2.22% wear watches. Moreover, 48.90% of women traders do not protect their heads when serving, 42.22% wear scarves. None of the 45 restaurants respect their work area, but the majority of the shopkeepers have uncut and unpolished nails (84.45%). Tables 12, 13 and 14 provide information on the cooking methods of the women traders in Korhogo. This cooking method is mostly done in the traditional way with 35.55% for charcoal and 46.68% for wood fire. Gas is rarely used (17.77%) and the water used to wash the raw materials consists of well water (44.45%), tap water (20%), and spring water (35.55%). As regards the frequency of changing dish water, 28.89% is changed at any time during the service, 33.33% is changed at the end of each service and 37.78% is changed when it is dirty. Also, in these restorations, one observes movements in all directions. In addition, the clients are in direct contact with the service area (100%) and that the most used method

for conservation of cooked food is trays with plastic bags (66.67%). In these restaurants, the glasses used for the drinks are mostly replaced without being washed (68.89%), while 66.67% of the premises are cleaned at any time during the service. The raw materials used are still not of good quality and they do not serve as packaging. Indeed, the foodstuffs are received by people who have no concept of hygiene. Hence the lack of control of these incoming foodstuffs. This leads to the sale of moldy foodstuffs such as attiéké often leading to gastroenteritis. As for the foodstuffs purchased such as vegetables, only those with a considerable volume at a derisory price are the most sought after. Also, all raw materials are stored mostly in the same container or are exposed on the floor with cleaning and disinfecting products due to the lack of compartments for their storage. In addition, the "first in first out" plan is not being followed, thus constituting another source of cross-contamination. The workforce is provided by people who have no qualifications in terms of compliance with hygiene. They are recruited solely for their culinary talent or for their dedication to sales. Indeed, most of the shopkeepers who make up the workforce are either from the close or distant family or an acquaintance of the restaurant owner. The latter having dropped out of school either through negligence or lack of means. They thus become actors in the street trade only because they have mastered a few notions about cooking. As they do not have any training in good hygiene practices to make up for their lack of knowledge in this area, these actresses therefore represent a serious danger to the health of the consumer. Indeed, due to their ignorance of good hygiene practices, employees of street restaurants work without respecting the rules of hygiene. Also the lack of training and information for street vendors and those installed at the roadside and in the neighbourhoods is evidence of their installation in these areas not adapted for their trade. This lack of knowledge of several anomalies in this sector remains dangerous for the health of the consumer. Failure to respect the work area and the preservation of their nails leads to cross-contamination. Another consequence of the non-application of hygiene rules in these restaurants is the lack of support from the Ministry of Commerce towards these women traders. Thus, not having the necessary means to carry out their activities, these women traders use the means to set up shop. This is why they use rudimentary methods for their activities such as the use of traditional means of preparation like charcoal and wood fire. Also in addition to using raw materials of dubious quality, they do not wash these raw materials properly or wash them with unsuitable water such as undisinfected well water. Dishes are washed with the same unsuitable water and are not replaced on a regular basis. This causes dirt to accumulate on the service equipment, resulting in contamination. Also, after washing, systematic hand washing is not carried out or is done with the dishwater containing the dirt beforehand. Hence the high risk of contamination. This risk of contamination remains because most of the drinking water comes from these infected wells and is served mostly in glasses that have not been washed after a client. Moreover, when cleaning the premises, cooked food is not always protected despite the fact that the floor is not covered and the premises are located in an unhealthy area. The clients are in permanent contact with the waitress since there is almost no counter. The Kitchen is located under trees for the most part and is mostly made of earth and therefore not washable. The results are similar to those of [10]. According to him, the personal hygiene of the food handlers is not satisfactory. This is largely due to the lack of control services. For waitresses wearing jewellery and bracelets should be reprimanded. The clothing is

Comment [F11]: Who?

mostly messy. This is due to contact with the premises and equipment, which are also dirty. The responsibility for the employees lies with the managers of establishments that do not provide sufficient spare clothing. Table 15 shows the results of the mesophilic aerobic germs loading. After enumeration, 80 ready-made meals, including 44 hot and 36 cold dishes, are satisfactory with a microbial load less than or equal to  $9.10^5$  CFU/g, i.e. 88%. Two cold dish are acceptable with a load between  $9.10^5$  and  $3.10^6$  CFU/g ( $9.10^5 \leq F \leq 3.10^6$  CFU/g), i.e. 2.22%. 8 cold dishes are unsatisfactory with an average load greater than  $3.10^6$  CFU/g, i.e. 8.89%. Concerning faecal coliforms 58 ready-made meals, including 46 hot and 12 cold dishes, are satisfactory with a microbial load less than or equal to 30 CFU/g, i.e. a percentage of 62%. 14 cold dishes are acceptable with a load between 30 and  $10^2$  CFU/g ( $30 \leq F \leq 10^2$  CFU/g), (15.56%). 18 cold dishes are unsatisfactory with an average load greater than  $10^2$  CFU/g (20%) (Table 16). Table 17 shows the load of lactic acid bacteria counted in the different dishes. For the 46 dishes analysed, 60 ready-made meals, including 34 hot and 26 cold dishes are satisfactory with a microbial load less than or equal to  $3.10^5$  CFU/g, i.e. 64%. Thirty ready-made meals, including 10 hot and 20 cold meals, are unsatisfactory with a microbial load of less than or equal to  $10^6$  CFU/g, i.e. 33.33%. For yeasts and moulds, 58 ready-made meals including 40 hot and 18 cold dishes are satisfactory with a microbial load less than or equal to  $1.5.10^3$  CFU/g, (62%). Eight ready-made meals, including 2 hot meal and 14 cold meals are satisfactory with a microbial load of between  $1.5.10^3$  and  $5.10^3$  CFU/g ( $1.5.10^3 \leq F \leq 5.10^3$  CFU/g), (17.78%). Eight cooked dishes, including 2 hot dish and 14 cold dishes are unsatisfactory with a microbial load of more than  $5.10^5$  CFU/g, (17.78%) (Table 18). For the dishes analysed, an unsatisfactory level of contamination (17.2%) was observed, while the dishes with a satisfactory level of contamination were (75.2%). The heat used to cook the dishes could explain this low rate of non-compliance. This rate of non-compliance is mainly attributable to cold ready meals that are poorly preserved. The samples concerned are cold dishes (14.28%), generally cooked with raw vegetables, fish, meat, seafood, mayonnaise and spices. Also, after cooking, these dishes are poorly packaged, especially since they are either poorly sealed or not sealed at all. These results are inferior to those obtained in Tunisia by [11] who had conducted a study in the same sense as ours, where appetizers accounted for 72.5% of non-compliance in restaurants without an HACCP system. Moreover, similar studies conducted between 1990 and 1995 showed that 67.7% of the foods analyzed were satisfactory versus 33.3% unsatisfactory. The total flora provides information on the cleanliness of handling, storage conditions, the effectiveness of heat treatments and the freshness of products. It remains the best indicator of the application of good hygienic practices. Here, mesophilic aerobic germs are responsible for 10% of unsatisfactory samples and are attributable to cold ready meals. This can be explained by the preponderance of non-compliance with hygiene rules and the poor preservation of these foodstuffs in these premises. Indeed, it is not uncommon to see women in dirty clothes tasting different sauces or pasta which are most often cooked over a low heat with dirty hands. Also the material used for tasting does not act as an effective wash and at the same time is used for serving. In addition, there is undercooking when re-cooking dishes and pasta. Similarly, these foods are stored under non-regulatory conditions, i.e. in trays, jars, boxes or uncovered bowls. The results obtained are similar to those of [12] in Dakar with a sample size of 100. In addition, [10] and [13] having respectively worked in the same area with the 100 and

**Comment [F12]:** Need to be explained, hygiene conditions are the cause this data

440 samples found the percentages of 4% and 35%. According to them, the different rates of microorganisms could be explained by a significant contamination of foodstuffs in poorly maintained storage premises, but also by the geographical location of the restaurant. Enterobacteriaceae do not present an unsatisfactory result, but are present in 57% of the samples. However, our study shows that 21% of the non-compliant dishes due to *E. coli* are from cold dishes only. Indeed, *Escherichia Coli* is part of total coliforms, however it is often sought separately, because it is considered to be the best indicator of faecal contamination of food. This rate would indicate a faecal contamination of food by these traders at the time of cooking but especially during the service of cooled food. This contamination would be related to a lack of hygiene by kitchen staff handling cold food ready to be served. In fact, systematic hand washing is not observed in these restaurants after their toilets, which are most often carried out in the bush not far from the restaurant premises or in public toilets. In addition, most of them have uncut nails that act as a germ deposit, including *E. Coli*. For similar work [14] and [9] obtained results of 35% and 20.73% with samples of 143 for [14] and 240 for [9]. According to them, this contamination is linked to several causes, the main ones being the lack of personal hygiene of the staff, considered as the main source of faecal contamination, the absence of sanitary facilities at the sales points and also the presence of kitchens under trees, which leads to contamination by bird and fly faeces. Lactic acid bacteria are naturally present in plants (leaves, fruits and vegetables), dairy products and the digestive tracts of humans and animals. Their presence on a food is therefore a sign of poor environmental hygiene, raw materials and handling. Indeed, in this study, the results show that they are concerned in 36% of the unsatisfactory samples, including 23.81% in cold dishes. This high rate is due in particular to the presence of trees in kitchens, services and restaurants. Indeed, our prospecting shows the poor geographical location of the restaurants' premises, all the more so as they are always located in unhealthy areas. Moreover, their design does not respect the mass plan of a restaurant building. All this encourages the proliferation of lactic acid bacteria. Also, this rate could be explained by the use of poor quality raw materials as well as the poor handling of these restorers. Indeed, the vegetables used to accompany certain meals that do not require cooking are sometimes in a state of decomposition and insufficiently washed or washed with unhealthy water. Yeasts and moulds are brought in by the environment and carried by the air. The results of the analyses show that the fungal flora is observed in both hot and cold meals giving 19% of unsatisfactory meals. This is due to the fact that the fungal flora is thermoresistant and not very sensitive to antiseptics. Nevertheless, this percentage reflects the unhealthy environment of the points of sale, which are mainly located in depressed areas. Also the environment of the city favours the growth of these germs especially as it does not benefit from enough bitumen. This generates a cloud of dust when the slightest wind blows. Moreover, in our work we have noticed that the restaurant owners conserve the raw materials with food additives and even those already cooked that have to be kept for re-use the next day. The results observed in our microbiological analyses are superior to those of [12] (0% unsatisfactory) and <sup>10</sup>?? (6% unsatisfactory) who both conducted studies following the same idea with samples of 100. According to them, yeasts and moulds can be brought into meals that have received food additives that have been left open too long and also foods exposed to humidity.

Comment [F13]: italic

Comment [F14]: Inconsistent faecal or fecal

## CONCLUSION

The street food trade is one of the most important economic activities in the city of Korhogo. However, the growth of this activity reflects many consequences such as the relaxation of basic hygiene measures in the preparation of food leading to the exposure of consumers to the risk of toxi-infections. It is therefore important that particularly strict hygiene rules are observed in the kitchens where meals are prepared for consumers. Of the 90 meal samples analysed, 75.2% of the samples were satisfactory, 7.6% were acceptable and 17.2% were unsatisfactory. It is therefore clear that the level of bacterial contamination of the meals is quite high for lactic acid bacteria. In order to improve the quality of these meals, there is an urgent need for corrective measures to be taken to remedy this both from the point of view of the design of the premises and the organisation of work. The prevention of food-borne diseases will therefore require improved product safety, while ensuring the increased involvement of health services at all stages. But there is also a need for continuous monitoring of contaminants in these foods and the promotion of food quality control, education and information of personnel in food hygiene and product safety.

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**Table 1: The environment in which women traders work**

	Locked restaurant		Inspection of traders' facilities		Presence of compartment		Presence of cloakroom	
	Yes	No	Yes	No	Yes	No	Yes	No
<b>Total</b>	14	31	0	45	0	45	0	45
<b>Proportion (%)</b>	31.11	68.89	0	100	0	100	0	100

**Comment [F15]:** Why titles of Table 1,2 and 3 are same? The title should specifically describe contents of the table

**Table 2: The environment in which women traders work**

	The floor in restaurants			Toilet facilities in restaurants			Restaurant sewage disposal system	
	Earth	Tiles	Cement	No	In the restaurant	Far from the restaurant	Gutter	On the floor
<b>Total</b>	31	4	10	28	6	1	6	39
<b>Proportion (%)</b>	68.89	8.89	22.22	84.45	13.33	2.22	13.33	86.67

**Table 3: The environment in which women traders work**

	Hand washing system		System location		Location of garbage		
	Tap barre l	Water containin g basin	In front of the restaurant	Inside the restaurant	In front of the restaurant	Inside the restaurant	Far from the restaurant

			t	t	t	t	t
<b>Total</b>	16	29	12	33	31	11	3
<b>Proportion (%)</b>	35.55	64.45	26.66	73.34	68.89	24.44	6.67

**Table 4: Work equipment in restaurants**

**Comment [F16]:** Table title 4 & 5 should be distinguished

	Identification of equipment according to use		Identification mode		
	Yes	No	Color	Shape and size	Permanent marker
<b>Total</b>	19	26	4	36	5
<b>Proportion (%)</b>	42.22	57.78	8.89	80	11.11

**Table 5: Work equipment in restaurants**

	Renewal of front equipment complete breakdown		Storage of equipment with cleaning products		Use of degraded material for cooking and serving	
	Yes	No	Yes	No	Yes	No
<b>Total</b>	4	41	26	19	42	3
<b>Proportion (%)</b>	8.89	91.11	60	40	93.33	6.67

**Table 6: Raw materials used in restaurants**

**Comment [F17]:** Table title 6 & 7 should be distinguished

	Control of the raw material on purchase or reception		Storage place for perishable raw material				
	Yes	No	Freezer in good condition	Freezer in poor condition	Cooler with ice	Bowl	Floor
<b>Total</b>	16	29	0	5	6	26	7
<b>Proportion (%)</b>	35.55	64.45	0	11.11	13.33	60	15.56

**Table 7: Raw materials used in restaurants**

Use of raw material in a state of	Long-term raw material storage location
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degradation					
	Yes	No	Floor	Pallet	Bowl
<b>Total</b>	26	19	32	0	13
<b>Proportion (%)</b>	57.78	42.22	71.11	0	28.89

**Table 8 : Labour Used in Restaurants**

Dressing used in restaurants		Maintenance of the clothing			
	Service uniform	Housekeeping	Dress washed after the service	Washed 2 to 3 times a week	Clean change of clothes per day
<b>Total</b>	3	42	2	38	5
<b>Proportion (%)</b>	6.67	93.33	4.44	84.45	11.11

**Comment [F18]:** Table title 9-11 should be distinguished

**Table 9 : Labour Used in Restaurants**

Knowledge of hygienic rules by women traders		Dress used for service		Maintenance of the uniform		
	Yes	No	Yes	No	Yes	No
<b>Total</b>	4	42	28	17	16	29
<b>Proportion (%)</b>	8.89	91.11	62.22	37.78	35.55	64.45

**Table 10 : Labour Used in Restaurants**

Carrying an object during service				Head protection during operation				
	No	Ring	Bracelet	watch	No	With a scarf	With a cap	With a hat
<b>Total</b>	6	16	22	1	22	19	2	2

<b>Proportion(%)</b>	13.33	35.55	48.90	2.22	48.90	42.22	4.44	4.44
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**Table 11 : Labour Used in Restaurants**

Respect for work areas			Cleanliness of the nails			
	Yes	No	Cutting without varnish	Cutting with varnish	Uncut without varnish	Uncut with varnish
<b>Total</b>	0	45	2	0	38	5
<b>Proportion(%)</b>	0	100	4.44	0	84.44	11.11

**Table 12: Method of working in restaurants**

Means of preparation				Water for washing raw materials before preparation		
	Charcoal	Gas	Wood fire	Well water	Tap water	Spring water
<b>Total</b>	16	8	21	20	9	16
<b>Proportion(%)</b>	35.55	17.77	46.68	44.45	20	35.55

**Comment [F19]:** Table title 12-14 should be distinguished

**Table 13: Method of working in restaurants**

Client contact with the service area			Method of conserving foodstuffs			Frequency of water replacement for washing kitchen utensils		
	Yes	No	Glass box	Tray with plastic bag	Jar with lid	At any time during service	At the end of each service	When water is dirty
<b>Total</b>	45	0	3	30	12	13	15	17
<b>Proportion(%)</b>	100	0	6.67	66.67	26.66	28.89	33.33	37.78

**Table 14: Method of working in restaurants**

Frequency of replacing drinking glasses			Frequency of room cleaning			
	After washing	Without washing	Unused glass	At any time during service	At the end of each service	The next day
<b>Total</b>	14	31	0	30	12	3
<b>Proportion(%)</b>	31.11	68.89	0	66.67	26.66	6.67

**Table 15: Level of contamination by mesophilic aerobic germs**

Microbial load (CFU/g)	Number of samples		Accumulated results	Proportion(%)
	Hot dishes	Cold dishes		
Absence	16	0	16	17.78
$F \leq 9.10^5$	28	36	64	71.11
$9.10^5 \leq F \leq 3.10^6$	0	2	2	2.22
$F > 3.10^6$	0	8	8	8.89

**Table 16: Level of contamination by *E. Coli***

Microbial load (CFU/g)	Number of samples		Accumulated results	Proportion(%)
	Hot dishes	Cold dishes		
Absence	26	0	26	28.89
$F \leq 30$	20	12	32	35.56
$30 \leq F \leq 10^2$	0	14	14	15.56
$F > 10^2$	0	18	18	20

**Comment [F20]:** Specific *E.coli*? or Faecal coliform? and what about total coliform? (in method, faecal and total coliform were observed)

**Table 17: Level of contamination by Lactic acid bacteria**

Microbial load (CFU/g)	Number of samples		Accumulated results	Proportion(%)
	Hot dishes	Cold dishes		
Absence	12	0	12	13.33
$F \leq 3.10^5$	22	26	48	53.33
$3.10^5 \leq F \leq 10^6$	0	0	0	0
$F > 10^6$	10	20	30	33.33

**Table 18: Level of contamination by yeasts and moulds**

Microbial load (CFU/g)	Number of samples		Accumulated results	Proportion(%)
	Hot dishes	Cold dishes		
Absence	4	0	8	8.89
$F \leq 1.5 \cdot 10^3$	36	18	50	55.56
$1.5 \cdot 10^3 \leq F \leq 5 \cdot 10^3$	2	14	16	17.78
$F > 5 \cdot 10^3$	2	14	16	17.78

UNDER PEER REVIEW