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Hygienic quality of melting salads sold in Antananarivo, capital of Madagascar, in 2018

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ABSTRACT

Street foods are foods and beverages sold on the streets or other similar public places (FAO, 1990). They are one of the main income-generating activities for women, promote local products, and express the culinary art of the country.However, they are very often linked and involved in cases of food poisoning. Among the best-selling and most beloved street foods in Madagascar are compounds. Thus, the hygienic quality of the compounds sold in the markets of Antananarivo, capital of Madagascar, was studied, from January to December 2018.

The germs of alterations, the germs indicative of faecal contamination, and indicators of human contamination have been counted. Pathogenic germs were sought, according to international standards ISO and AFNOR.The samples analysed were of bad hygienic quality. The TABs, the contamination indicator germs were all at levels above the reference criterion.

A high level of Total Aerobic Bacteria TAB (>10^6ufc/g), Enterobacteriaceae (>10^2/g) and *Escherichia coli* β glucuronidase+ is noted. The values of the Total Aerobic Bacteria count was 0.1x10^6-4.8x10^6cfu/g. Enterobacteriaceae count range from 0.4x10^2 to 1.9x10^2cfu/g and *Escherichia coli* count range from 0.04x10^2cfu/g. to 0.19 x10^2cfu/g. Pathogen bacteria as *Salmonella* was present in melting saladssamples. *Bacillus cereus* count range from 0,1x10^2 to 1,5x10^2cfu/g. *Campylobacter jejuni were* absent on all samples.

Keywords : salads samples, aliments de rue, qualité hygiénique, Antananarivo, Madagascar

I. INTRODUCTION

According to FAO, street foods are foods and beverages sold on the streets or other similar public places (FAO, 1990). Its expansion is mainly linked to urbanization and the multiple constraints associated with it such as poverty, unemployment, distance from workplaces from home, etc. Street foods allow more than 80% of urban populations to satisfy their needs. They are one of the main income-generating activities for women, promote local products, express the culinary art of the country. In addition, they generate income allowing many households to meet their needs (Delisle, 1991).

These street foods can be characteristic of a country or a region: kobandravina, mofogasy, ramanonaka in Madagascar, Chipsi Mayai (a kind of potato omelet) in Tanzania, Baozi (breads baked in steam) in China or Pempek (Fish cakes) in Malaysia or Indonesia.

The "processor-seller" ensures both the production (at home or at the point of sale) and the marketing of food. Unfortunately, many cases of food poisoning or foodborne illness are directly related to these street foods.

In Morocco, in 2016, 5,991 cases of poisoning related to street food were recorded, including 78 deaths (WHO, 2001).

In Antohombe Rural Commune, Betafo District, Madagascar, 70 people suffered from food poisoning on December 23, 2016. Characteristic symptoms were diarrhoea, severe abdominal pain, requiring evacuation to Antsirabe hospital. The food in question was a mixed dish in the same tavern (Express de Madagascar, December 2016).

Foods sold on the outskirts of city streets therefore constitute a major public health problem due to the multiplicity and diversity of the microbial flora they carry.Among these street foods, figure the "mixed salad", which is a variant of pasta salad, appreciated and eaten by many populations in the big cities of Madagascar, especially Antananarivo. Thus, a study was carried out to determine the sanitary quality of foods and street foods in Madagascar. This study was undertaken in 2018 in Antananarivo (urban and suburban area), capital of Madagascar.

II. MATERIALS AND METHODS

Materials

137 samples constituted our study material. They were collected from January to December 2018 in Antananarivo, capital of Madagascar. Table 1 show the number of samplestaken and analysed.

Table 1: Characteristics of the samples analyzed.

	Samples from Urban community	Samples from suburban commune	**Total samples**	period
Mixed salad	87	50	137	2018

Methods

The methods used during this study follow international standards: ISO and AFNOR.Given the size of the population studied, several types of sampling were undertaken, depending on the type of foodstuff analysed, the target populations (type of consumer, density per population).Thus, during sampling, we make sure that by studying a small group (sample) chosen at random, we obtain data on the desired variables of a group of larger dimensions (population), following which one can reason by inference about the behaviour of these variables in the population. Several parameters must first be defined: the population, the sampling frame, the sampling unit and the type of sampling (WHO, 2004).

Sample preparations and analysis

Serial dilution

Twenty-five grams (25 g) of each sample was mixed carefully with 225 ml of buffered peptone water. This mixture was homogenized and shacked to obtain a uniform mixture. One ml of the homogenized food sample was aseptically transferred into a test tube containing 9 ml sterile distilled water. Five dilutions of the homogenates were prepared in conformity with the recommendation of the norm ISO 6887.

Enumeration of Total Aerobic Bacteria

Plate Count Agar (PCA) (Oxoid Ltd, United Kingdom) was used for Total Aerobic Bacteria and was done in conformity with the recommendation of the norm ISO 4833.

Enumeration of *Bacillus cereus*

The recommendation of the norm ISO 7932 was used. 1 ml of the dilution of each food sample was plated onto polymyxin-pyruvate-egg yolk mannitol-bromothymol blue agar plates (Oxoid), which were air dried and incubated at 37°C for 24 to 48 h. Blue colonies with blue zones were subjected to appropriate biochemical tests.

Detection of *Salmonella* spp.

*Salmonella spp*was detected with the recommendation of the norm ISO 6579. Twenty-five grams (25 g) of each sample was mixed with 225 ml of buffered peptone water and incubated at 37^{o}C for 16 h. One ml of this culture was pipetted into 10 ml of Rappaport-Vasilliadis Soya broth (RVS). These were incubated at 41^{o}C for 24 h. The culture was streaked into Hektoen Agar. The agar plate were incubated at 37^{o}C for 24 h. The plate were examined for typical green blue colonies of *Salmonella*.

Detection of *Escherichia coli β* glucuronidase +

1 ml of the dilution of each food sample was plated onto Eosin Methylen Blue Agar Medium and incubated at 44°C for 24h to 48 h. Black green metallic colonies were subjected to appropriate biochemical tests according to the norm ISO 16649.

Detection of *Campylobacter jejuni*

25 g of the food sample was mixed with 100 ml Preston broth (Oxoid) and homogenized for 2 min. The enrichment broth was incubated at 42°C for 24 to 48 h. The broth culture was streaked onto Skirrow's agar plates (Oxoid), which were then incubated at 42°C. Colonies were Gram stained and tested for oxidase reaction. Suspect colonies were subjected to appropriate biochemical tests, done in conformity with the recommendation of the norm ISO 10272: 2006.

III. RESULTS

As shown in Table 2, melting salads was found to be contaminated. A high level of Total Aerobic Bacteria TAB (>10^{6}ufc/g), Enterobacteriaceae (>10^{2}/g) and *Escherichia coli* β glucuronidase + is noted.

The values of the Total Aerobic Bacteria count was 0.1x10^{6}- 4.8x10^{6}cfu/g. Enterobacteriaceae count range from 0.4x10^{2} to 1.9x10^{2}cfu/g and *Escherichia coli* count range from 0.04x10^{2}cfu/g. to 0.19 x10^{2}cfu/g.

Pathogen bacteria as *Salmonella* was present in melting saladssamples. *Bacillus cereus* count range from 0,1x10^{2} to 1,5x10^{2}cfu/g. *Campylobacter jejuni,* was absent on all samples.

Table 2: Microbiological assessment of melting salads samples collected in Antananarivo market on 2018.

Microorganismsɳ	TAB.10^{6}/g	Ent. 10^{2}/g	E.C.BG+ 10^{2}/g	SLM/g	CAMP/g	BC10^{2}/g
Melting salads	4,854	1,927	1,259	12,49	A	1,445

TAB : Total AerobicBacteria, Ent : Enterobacteriaceae, E.C.BG + : *Eschercichia coli βglucuronidase* +, SLM : *Salmonella spp,* CAMP : *Campylobacterjejuni,* BC : *Bacillus cereus,* A: Absent

IV. DISCUSSION

The result of these different analysis carried out on street foods: melting salads samples revealed that all samples collected were contaminated by microorganisms.

This is due to the inadequate personnel hygiene of vendors, the bad condition at which it produced, and using raw materials of poor quality or the fact that they were exposed in an open air because there are several microorganisms (beneficial or pathogen) that we can find in environment.

Salmonella species belongs to the family of Enterobacteriaceae. It is present in melting salads. It confirms study led on 2016, which showed especially the implication of melting salads and skewers for several cases of Typhoid fever in Madagascar.

Escherichia coli is a bacteria that normally lives in the intestines of people and animals. There are many different types of *E. coli*. Most E. coli are found naturally in intestines and play an important role in helping our bodies digest food. However, a few types of *E. coli* can cause diarrhoea and other illnesses when swallowed.

A previous study led in the Urban Commune of Antananarivo, Health Ministry and WHO shows that this species is the first responsible for foodborne disease in Antananarivo on 2016.

In 2015, Tsirinirindravo and al found that melting salads was the first food associated with foodborne illness in Antananarivo. However, it is very appreciated by consumers.

The presence of *E. coli* and other *Enterobacteria* is an indication of possible faecal contamination of food, water or food workers and poor hygienic processing practices (Little et al., 1998; Tambekar et al., 2007). The presence of *S. aureus* is largely as a result of human contact and this suggests poor hygiene practices of the operators since this organism is a normal flora of the skin and nasal passage (Garret, 1988; Nichols et al., 1999).

Bacillus cereus is present in highly concentration in melting salads. Their microbial load are superior to the bacteriological criteria. It could be due to the characteristic of this bacteria to metabolize starch while these foods are made of starch.The occurrence of *Bacillus cereus* in the foods could be due to the fact that they are spore formers. These heat-resistant spores may have survived processing while vegetative cells were eliminated.

Contamination of foods could have resulted from inappropriate processing, incomplete heating, or secondary contamination via contact with contaminated equipment and utensils.

Education of the food handlers/food vendors on food safety practices and a close and stringent supervision of ready-to-eat foods sold in the schools should be carried out by relevant authorities to prevent foodborne illness.

These diseases are seen as a pervasive, permanent problem that can lead to morbidity and, occasionally, to mortality. Foodborne diseases are increasing worldwide, particularly in the developing countries, due to neglect of personal hygiene and food hygiene.

Foodborne illnesses pose a threat to international public health safety and economic development. With the increasing amount of trade, travel and immigration, the rate at which dangerous contaminants and pathogens pass through the borders has also risen.While experts on food safety and health have determined that millions of foodborne disease cases are reported every year, the actual numbers are clouded by uncertainty, as most cases go unreported. Furthermore, foodborne diseases are difficult to diagnose, since they have various symptoms, including fatigue, chills, mild fever, vertigo, upset stomach, dehydration caused by diarrhoea, severe cramps and, in some cases, even death.

In many of the reported cases, foods prepared outside of the home are the primary cause of foodborne diseases, though it is not uncommon for home-made foods to also cause diseases. In fact, most foodborne diseases can be prevented if the regulations governing food safety were complied with, from production stages to consumption.Improper heating of the food, such as undercooking, re-heating and waiting in the heat, or improper cooling of the food account for 44% of the foodborne illnesses. Inadequate preparation and improper cooking practices, such as those involving cross-contamination, insufficient processing, poor hygiene and the re-use of leftovers, are responsible for causing 14% of these diseases.

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