

Sanitary quality of milk sold in Antananarivo, Madagascar on 2018, 2019

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ABSTRACT

The present study evaluated the microbiological and sanitary quality of fresh milk sold in Antananarivo, Madagascar. The research was performed between March 2018 to March 2019. One hundred twenty two samples of milk were collected to estimate the populations of mesophylls, psychrotrophic microorganisms, *Staphylococcus aureus*, *Salmonella*, mold and yeast, total coliforms, and *Escherichia coli*. An observational analysis was performed during the collection, using a checklist to verify the sellers sanitary conditions. A high non conformity index was registered regarding aspects in the checklist. In the microbiological analyses, the number of mesophylls ranged from 7,88 to 14,82 log CFU/g, and those of psychrotrophs ranged from 2,80 to 3,84 log CFU/g. Meanwhile, mold and yeast levels in the samples ranged from 8,06 to 5,54 log CFU/g. *S. Aureus* was detected at levels from 3,24 to 4,94 log CFU/mL, and the total coliform counts ranged from 4,48 to 7,18 log CFU/mL. The number of *E. coli* specimens ranged from 2,96 to 5,75 log CFU/mL. Microbial insecurity was noted for commercialized freshmilk, and the need for intervention was indicated.

Keywords:Milk, Antananarivo, Madagascar, Sanitary quality, Microorganisms

I. Introduction

In many cities and towns of developing countries, street food vending is a large source of employment and contributes significantly to households incomes. Street foods are defined by the FAO as ready to-eat food and beverages prepared and or sold by vendors and handlers especially in streets and other similar places for immediate consumption or consumption at a later stage without further processing or preparation. However, it is a major cause of food-transmitted diseases (FTDs) and various health issues [2]. Traditional street-vended food could represent a major risk to public health, due to the unsanitary and unhygienic conditions, including poor infrastructure, improper storage temperature, and poor hygiene among the handlers during commercialization [3]. Fresh milk is among commercialized and consumed foods even though the absence of microbiological contamination cannot be ensured; however, it has social and economic relevance [4]. Informal food vending is a common practice characterized by high microbiological risk, carrying serious health liabilities for consumers [5].

Considering the informal sale of milk and its derivatives, several studies previously identified the main pathogenic microorganisms, namely, *Staphylococcus aureus*, *Salmonella* spp., *Listeria monocytogenes*, and *Escherichia coli* [7–10]. Knowledge concerning the microbiological quality of commercialized fresh milk is valuable because the consumption of contaminated food may cause FTDs, thus, representing a public health problem. The present study evaluated the microbiological and sanitary quality of Fresh milk sold in Antananarivo, capital city of Madagascar, and verified whether a relationship exists between the commercialization conditions and the reported microbiological data.

II. Materials and Methods

The study was undertaken at 5 market places of Antananarivo. The following places were chosen randomly: 67Ha, Isotry, Andraovoahangyambony, Mahamasina, Besarety. One hundred twenty two samples of fresh milk were collected. Samples were collected in March 2014 to March 2017. Samples were collected aseptically, transported in an isothermal container with ice, and maintained under refrigeration until microbiological analyses were conducted at the Laboratory of Microbiology of the Indian Ocean Islands University Madagascar (IOI University Madagascar).

An observational analysis was performed at the time of sample harvesting using a checklist which included questions on the handlers' hygiene and sanitary habits and the commercialization and storage of milk. The temperature of milk was registered immediately after retrieving the samples to verify compliance with the legislation [11, 12]. The microbiological analyses comprised the total counts of psychrotrophic microorganisms, mesophylls, mold and yeast, *S.aureus*, total coliforms, and *E.coli*. The pour plate technique was employed for the microbiological analyses of psychrotrophic microorganisms and mesophylls, with plate count agar used as the culture medium. Samples (25ml in total) were obtained from several sites of each specimen and placed in 225 mL sterile flasks containing

0.1% peptonized water, and 1mL of each dilution was transferred to a Petri plate with 25mL of previously heated agar at 43–45°C. After homogenization and solidification, plates were incubated in a buffer at 7°C for 10 days or at 35°C for 48h for psychrotrophic microorganisms and mesophylls, respectively. Colonies were counted using a colony counter. The average colony number on each plate was multiplied by the corresponding dilution factor, and the result was presented as log UFC/mL. The spread plate method was employed to calculate the mold and yeast counts in Sabouraud dextrose agar medium. Plates containing 25mL of culture medium were prepared and inoculated with 0.1mL of each dilution on the medium surface, and the inoculum was spread carefully. Plates were then incubated and buffer at 24°C for 48–72h [13]. Coliforms were counted using Violet Red Bile Lactose Agar, following the manufacturer's instructions. Colonies were counted using a colony counter, in particular, dark blue to violet colonies were classified as *Escherichia coli*, and red colored colonies as other coliforms. *S.aureus* levels were analysed using international standard methods NF V 08 057 2 with BairdParker Medium. Statistical analysis was performed using SPSS 17, and descriptive analysis comprised means and standard deviations for quantitative variables and proportions for qualitative variables. Student's t-test was employed.

III. Results and Discussion

The Workers. This analysis revealed a low index for personal care, as 97, 21% of workers don't follow Good Practice Hygiene GPH. Microbiological Profile of Fresh milk. This analysis revealed high levels of contamination of fresh milk for mesophylls, mold, yeast, *S.aureus*, total coliforms, and *E.coli* (Table 1). This analysis revealed a low index for personal care, as 97, 21% of workers don't follow Good Practice Hygiene GPH. Moreover, in 2017, Tsirinirindravo et al reported that there a high contamination of some street vended foods in Madagascar, and relationship between quality of these street foods and workers.

Furlaneto-Maia et al. and Chukuezi also reported high non-compliance rates among the food handlers concerning their body care. Inadequacy concerning these factors contributes to increased transmission risks of pathogenic agents via commercialized food. All food

vendors were observed to handle money and food simultaneously, without washing their hands, jeopardizing proper food handling [21, 22]. Cortese et al. [16] also reported low efficiency for this factor, confirming global studies regarding the lack of hygiene among the food handlers. Microorganisms are present on the hands in substantial. When the food handlers were examined for their uniforms, all were found without gloves. The commercialized milk had a wide range of hole sizes which may be related to poor conditions during producing. Meanwhile, Franco and Landgraf found that these items are highly efficient concerning the aspects of hygiene and food safety. All commercialized milk was stored at room temperature even though the technical rules on the identity and quality of fresh milk stipulate that milk should be stored at a temperature not exceeding 4°C during conservation and commercialization [11]. Storage data revealed carelessness regarding the containers in which the food was preserved. In fact, 73.3% of containers did not meet the cleanliness standards.

The Table 1 has values which exceeded the values reported by Meneses et al. [20], who recorded levels of 8.1 and 6.4 log CFU/g for samples of fresh milk, respectively. High mesophyll levels (Table 1) were also reported by Delamare and al. in their analysis of homemade milk samples manufactured in Kenya. Specifically, the counts of mesophyll bacteria ranged from 7.91 to 9.47 log CFU/g. Although no normative standards exist at present, estimates of such populations are relevant because high levels of mesophyll microorganisms in food indicated efficient hygienic and sanitary conditions. Total coliform levels averaged 7.18 log CFU/g in milk samples, respectively. Salotti and al. reported that the levels of these microorganisms in food identify the product's sanitary and conservation state; thus, they are indicative of consumers' health risks. Tsirinirindravo et al noted that high levels of *E. coli* exceeding the standard limits define the product as inappropriate for commercialization and consequently for human consumption due to the faecal contamination [25, 26].

Microorganisms	1	2	3	4	5
	Av CFU/ml				
FMT	18,11	10,33	17,42	12,94	16,48
Mesophylls					
CT	11,21	5,84	6,89	7,01	11,42
<i>S.aureus</i>	2,36	3,42	2,17	3,95	1,51
Mold	8,03	13,17	12,84	7,97	9,31
Psychrotrophs	9,10	6,45	8,20	7,47	6,94
<i>E. coli</i>	5,78	1,94	1,24	1,92	1,11
<i>Listeria m.</i>	Abs	Abs	Abs	Abs	Abs
<i>Salmonella spp</i>	Abs	Abs	Abs	Abs	Abs

FMT : (mesophylls) Flores Mesophiles Totales, CT : Total Coliforms, *E. coli* : *Escherichia coli*, *Listeria m* : *Listeria monocytogenes*, *Salmonella spp* : *Salmonella typhi*, *S. aureus* : *Staphylococcus aureus*. 1 Av : Average 67 Ha. 2 Av : Average Isotry. 3 Av : Average Andravoahangyambony. 4 Av : Average Mahamasina. 5 Av : Average Besarety.

Microbial insecurity was noted for commercialized fresh milk in Antananarivo, capital city of Madagascar. The high levels of deteriorating and pathogenic microorganisms revealed poor hygienic and sanitary quality in the products analysed and the need for good practices in food manipulation and commercialization, coupled with efficient monitoring and surveillance by authorities.

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