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Evaluation of the Microbiological Quality of Pastries Marketed in the City of Man (Côte d'Ivoire)

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A B S T R A C T

Food safety is a major problem for all agro-food industries. Thus, with the COVID-19 pandemic, the problem becomes more crucial because it is essential to safeguard the health and safety of all those who work in food production. This product undergoes transformations and manipulations of which the consumer knows neither the nature nor the manipulators. Thus, pastry products are considered to be sensitive foods and therefore favorable to microbial growth causing food poisoning. The present study consisted in evaluating the microbiological quality of pastries in the city of Man (Côte d'Ivoire). The microbiological analysis was carried out by the decimal dilution technique and according to several standards on 24 samples in two large patisseries in the city. The analyzes revealed that the Total Aerobic Mesophilic Flora (FMAT) is present in 50% of the samples analyzed in the "ALI-BABA" pastry and 75% in the "BRIOCHE" pastry," *The Staphylococcus aureus*, *Escherichia coli* and *salmonella* germs are absent in all the samples analyzed for the two pastries. Thus, these pastry products are not completely clean; it is important to analyze the quality of other pastry products.

Introduction

The reference to quality in different meanings has become omnipresent (Kindji, 2008). In collective catering, compliance with hygiene principles is a vital issue because unsanitary conditions can manifest themselves in consumers through food poisoning. Perceived food quality refers to a complex set of expected qualities, made up of six aspects: nutritional, functional, organoleptic, social,

symbolic and health; however, the latter are not the least. The sanitary quality of food refers to chemical and bacteriological safety. Pastries, products widely consumed and considered as a major component in the international food market, are not on the sidelines of this observation (Mamoumi *et al.*, 2012). Pastry is a delicacy on happy occasions.

The pastry thus occupies a high rate of consumption during happy occasions, they are now an integral part of the diet of the populations. Pastries can be used as a source of high-density energy foods. The global market for these particular foods is currently growing at around 1.5% per year (Isiri, 2014). It is therefore good to have a healthy and nutritious food to preserve the health of the consumer because the non-respect of the rules of hygiene and the ineffective control of food products can cause diseases such as food poisoning which have as symptoms the nausea, vomiting, abdominal pain, cramps and diarrhea (Sharifzadeh, 2016). However, pastry products (especially cream) as nutritious foods rich in carbohydrates, fats, and proteins are susceptible to the growth of different microorganisms and the transmission of microbial agents, which are either bacteria, yeasts or molds (Smith, 2004). Thus, the prevention of these risks requires an analysis of pastry products intended for human consumption.

The general objective of this work is to evaluate the microbiological quality of some samples of pastries sold in the city of Man

The specific objectives are:

Count the Flore Aerobe Total (FMAT)

Count *Staphylococcus* sp., *Salmonella* sp. and *Escherichia coli* germs.

Materials and Methods

The study material is composed of several varieties of pastry products obtained in different pastries in the city of Man (Figure 1).

Technical equipment

The usual microbiology laboratory equipment was used for this work.

Preparation of decimal dilutions (French standard V08-010)

25 g of each pastry product was added to 225 mL of Buffered Peptone Water (EPT) constituting the stock solution; then mixed and left to stand for 30 min to 1 h at laboratory temperature to ensure the revivification of the germs. From the stock solution, decimal dilutions were made up to the 10-5 dilution.

Research and enumeration of germs

The search for and counting of all the FMAT colonies were carried out according to the ISO 4833: February 2003 standard on the PCA culture medium and incubated at 37° C. for 24 hours.

E. coli were searched for on VRBL agar according to ISO Standard 16649-2: April 2001. Counting was done after incubation at 44°C for 24 hours.

The search for *Staphylococcus* sp. was carried out according to Standard ISO 6888-1: July 2003. The colony count was carried out on Baird-Parker medium after incubation at 37° C. for 48 hours.

The search for *Salmonella* sp. was carried out according to the ISO 6579/A1 standard: July 2007.

After the incubation period mentioned in the standard specific to each germ, the count of the characteristic colonies for each dish containing less than 300 colonies and a minimum of 30 colonies was carried out.

Results interpretation

The results of the microbiological analyzes were interpreted from the microbiological criteria set by Algerian standards. These assessment criteria are defined by the ministerial decree of May 27, 1998

and published in the Official Journal of the Democratic and Popular Republic of Algeria No. 35 and presented in the following table:

If the results are less than or equal to m ($N \leq m$), the product is "satisfactory"

If the results are greater than m and less than or equal to M ($m < N \leq M$), the product is "acceptable"

If the results are greater than M ($N > M$), the product is "unsatisfactory".

Results and Discussion

The average load of FMAT, *Staphylococcus* sp., *E. coli* and *salmonella* sp., in all the samples taken (cakes, croissants, bread with grapes, chocolate bread) in the "ALI-BABA" and "BRIOCHE" pastries are presented respectively in Tables II and III.

Variation in the level of germ contamination of pastries

Total Aerobic Mesophilic Flora

The products of the pastry shop "ALI-BABA" presents a contamination rate of 50% and an absence rate of 50% with respect to the FMAT (Figure 2).

The products of the pastry shop "la BRIOCHE" have a contamination rate of 25% and an absence rate of 75%. (Figure 3)

Staphylococcus sp., *Escherichia coli, Salmonella sp*

In all the samples from the pastry shops "ALI-BABA" and "la BRIOCHE " that were analyzed, no presence of *E.coli*, *staphylococcus sp*. and *Salmonella sp* was detected. The products of the pastry shop "ALI-BABA" presents a level of FMAT contamination of 50%, the contaminated products are the cakes and croissants. The pastry shop "la BRIOCHE" presents a level of 25%, the contaminated products are the cakes. However, all the samples analyzed are of satisfactory quality.

These results differ from those obtained by Nour and Kabeb (2009) who during a study on pastries, found that all samples were unsatisfactory regarding Total Aerobic Mesophilic Flora. The presence of FMAT in the analyzed samples is probably due to the environment to which the products are exposed, a lack of hygiene in the manufacturing processes such as delay in preparation, prolonged stay of pastry products at room temperature as well as exposure to the open air. Thus, the FMAT in a food product reflects the general microbiological quality of the product.

This germ can give an indication of the state of decomposition of the product and is therefore an index of sanitary quality (Anihouvi, 2006).

The pastry shops "ALI-BABA" and "BRIOCHE" have a 100% satisfaction rate with *Staphylococcus* sp. These results are different from those of Nour and Kabeb (2009) who found a non-satisfaction rate of 20% during a study of pastries in the center of the wilaya of Biskra concerning this germ but it is largely superior to the result of Meldrum *et al.*, (2005) who found during their analyses, 0.1% of cream pastries that are unsatisfactory for *Staphylococcus* sp. Their presence is often due to the action of factors such as wind, dust and also contamination of human origin through handling and secretions.

The pastry samples analyzed for both pastries showed a 100% satisfaction rate towards Escherichia coli. These results are consistent with those found by Souti (2014), but different from the results of Kindji (2008), who found a non-satisfaction rate of 5.48% regarding this germ.

Table.1 Microbiological criteria for pastries and pastry creams

Germs	m	M
FMAT	$9\ 10^5$	**$3\ 10^6$**
Staphylococcus aureus	$3\ 10^2$	**10^3**
Coliforme fécaux	10^2	**$3\ 10^2$**
***Salmonella* sp.**	**Abs/25g**	

Table. 2 Average load of FMAT, *E. coli*, *Staphylococcus* sp. and *Salmonella* sp. of ‘‘ALI- BABA’’ pastry products

Pastries ALI-BABA								
Searched germs	FMAT (germes/g)		*E.coli* (germes/g)		*Staphylococcus* sp. (germes/g)		***Salmonella sp* (germes/g)**	
Products	N	Inter	N	Inter	N	Inter	N	**Inter**
Cake	$1{,}4.10^4$	**S**	00	**S**	00	**S**	00	**S**
Croissant	$6{,}9.10^3$	**S**	00	**S**	00	**S**	00	**S**
bread with grapes	00	**S**	00	**S**	00	**S**	00	**S**
chocolate bread	**00**	**S**	**00**	**S**	**00**	**S**	**00**	**S**

N: microbial load, Inter: interpretation
S: satisfactory quality compared to Algerian standards

Table. 3 Average load of FMAT, *E. coli*, sp., *Staphylococcus* sp. and *Salmonella* sp. of ‘‘BRIOCHE’’ pastry products

Pâtisserie BRIOCHE								
Searched germs	FMAT (germes/g)		*E.coli* (germes/g)		*Staphylococcus* sp. (germes/g)		***Salmonella* sp. (germes/g)**	
Produits	N	Inter	N	I	N	Inter	N	**Inter**
Cake	5.10^3	**S**	00	**S**	00	**S**	00	**S**
Croissant	00	**S**	00	**S**	00	**S**	00	**S**
bread with grapes	00	**S**	00	**S**	00	**S**	00	**S**
chocolate bread	**00**	**S**	**00**	**S**	**00**	**S**	**00**	**S**

N: microbial load, Inter: interpretation
S: satisfactory quality compared to Algerian standards

Fig.1 Photographs of pastry products
(A: Cake; B: bread with grapes; C: croissant; D: chocolate bread)

Fig.2 Distribution of contamination levels of "ALI-BABA" pastry by Total Aerobic Mesophilic Flora

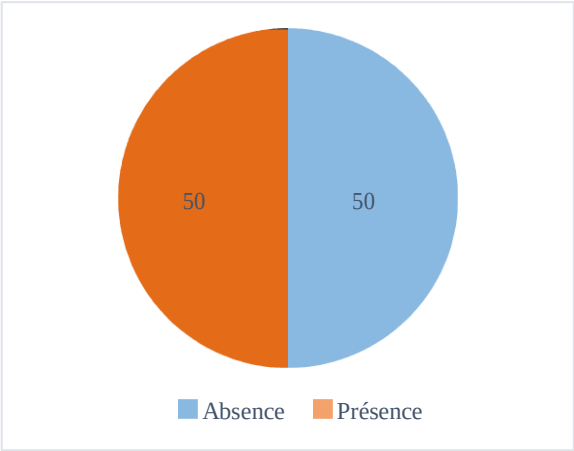
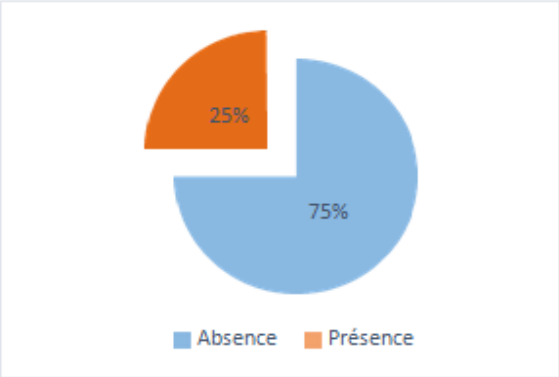


Fig.3 Distribution of the contamination levels of the pastry shop "la BRIOCHE" by the Total Aerobic Mesophilic Flora



The satisfaction level of the samples towards salmonella sp was 100%. These results are in agreement with the results obtained by Sultan *et al.*, (2010), and Nour and Kabeb (2009) who found contamination rates of 0% regarding this germ in pastry shops, cities of Isfahan, and the wilaya of Biskra. The total absence of *salmonella* in all samples analyzed, indicates the respect of hygiene rules during handling, and the absence of this germ in the raw materials (milk, eggs, cream...) which are the key to transmission. At the end of our analysis, it is important to retain that the results obtained for all the samples taken in the pastry shops 'ALI-BABA' and the Brioche in the city of Man present after enumeration a rate of satisfaction of 50% with respect to the total aerobic mesophilic flora, and 100% of satisfaction with respect to *Staphylococcus* sp., *Salmonella* sp. and *Escherichia coli*.

This result allows us to affirm that the pastry products from the two bakeries are not totally clean, therefore it is necessary to make an awareness on the different germs highlighted to limit these contaminations.

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