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Microbiological quality of locally fermented milk (nono) and fermented milk-cereal mixture (fura da nono) drink in Bauchi, a Nigerian city

¹A. A. Adebesein, ²N. A. Amusa*, and ³S. O. Fagade

¹Department of Science Laboratory Technology, Federal Polytechnic, Ede. Osun State.

² Institute of Agricultural Research and Training, Obafemi Awolowo University, Moor Plantation, PMB 5029 Ibadan, Nigeria.

³Department of Botany and Microbiology, University of Ibadan Nigeria.

*Corresponding author

Code Number: ft01023

Abstract

Fura da nono, fura and nono samples obtained from three areas in Bauchi metropolis were analysed to determine their microbial quality, the moisture content, pH and titratable acidity. The analysed samples were found contaminated with coliforms. The identified bacterial isolates from the products were *Staphylococcus aureus*, *Micrococcus luteus*, *Escherichia coli*, *Enterobacter sp*, *Streptococcus sp*, *Bacillus cereus* and *Lactobacillus sp*. The fungal isolate includes yeast *Sacharomyces cerevisiae* and mold species of *Aspergillus flavus* and *Rhizopus nigricans*. The average microbial load of bacteria isolates from the samples ranges between $3.0 - 4.7 \times 10^4$ cfu/ml.,

for fungal isolates it ranges between 1.0×10^4 to 2.9×10^4 cfu/ml and yeast counts from 0.0×10^4 cfu/ml in fura to 5.3×10^4 cfu/ml in fura da nono.

Key words: *Microbiological quality, nono, fura da nono, mold*

Introduction

"Fura da nono" (fermented milk-cereal mix) is a highly nutritious beverage which is a two-in-one product, consisting of a cereal, 'Fura', made from millet and 'nono' a fermented milk product similar to yoghurt. Fura da nono is sold from calabash converted with mat using scopes made from calabash. In the market, Fura is mixed with nono in a bowl for customers. Usually one bowl is used in mixing for all the customers, without cleaning. Depending on the consistency, the product is used as food, refreshing drink and a weaning food for infants. The product is in high demand, especially in the months of November to July (Umoh, *et al* 1988).

The poor handling of fura da nono during processing and marketing exposes it to microbial contamination. Fura is usually molded into balls by hand during its production, and the hands of the producers could be a source of contamination. Houseflies are always found in large numbers at the production sites and at sale outlets.

Shehu and Adesiyuh (1990) reported that in order to increase the volume and improve colour of nono, the female hawkers, prior to sale, engage in the fraudulent act of adding stream water and a milky white supernatant of water-soaked baobab tree seeds. This act could further lead to the contamination and spoilage of this product.

Umoh, *et al* (1988) isolated *Straphyococcus* sp from Fura da nono while Shehu and Adesiyun (1990) isolated *Escherichia coli* from Fura da nono. Their reports indicate the possibility of these products serving as source of microbial food poisoning. Fura da nono offered for sale is usually poorly handled and presented to consumers mostly in unhygienic manner. This research was therefore designed to isolate and identify microorganisms associated with fura da nono, fura and nono sold in Bauchi metropolis in 1998 and 1999 with a view of giving possible suggestions to improving the quality of the product.

Materials and Methods

Samples on nono, fura balls and fura da nono were purchased from three areas of Bauchi town, Viz Yelwa, Wunti and Gwallameji. Nono and fura da nono samples were collected in sterile large screw capped bottles while fura

balls were kept in new sterile polyethylene bags. Four samples each of the products were purchased from the local Fulani's bimonthly from each area between Nov. 1997 and Feb 1998 and repeated in 1999.

Isolation of Isolates

Ten-fold dilutions of each of the samples were made using peptone water. Appropriate dilutions were made and 0.1 ml of the diluted samples were pour plated in triplicate plates on Plate Count Agar (PCA) for viable count, Eosin Methylene Blue (EMB) for *Escherichia coli* count, Mannitol Slat Agar (MSA) for *Staphylococcal* count and Brilliant Green Bile Broth (BGBB) for coliform test. Sabourand Dextrose Agar with Chloramphenicol (250mg/100ml) was used for fungi, while for yeast count the medium was adjusted to pH 3.5 with tartaric acid. All plates were incubated for 48 hours at 30°C except for Sabourand Dextrose Agar that were incubated at 26°C for 6 days. Colonial counts were made using digital illuminated colony counter (Gallen kamp model).

Pure cultures of each isolate were obtained by streaking the specific colonies on suitable media and incubated appropriately, these were maintained in an agar slants in McCarthney bottles.

Identification of microbial isolates

The identification of the bacteria colonies was based on classification schemes proposed by Harrigan and McCance (1976), Buchanan and Gibbons (1974) and Collins and Lyne, (1984). The identification was based essentially on morphology and biochemical reactions.

The associated fungi were then identified with reference to Frazier and Westhoff (1978), while the yeast were identified using the methods of Beech *et al* (1968) and Lodder, (1970). The identity of the microbes were further confirmed by comparison with the existing cultures already identified by the International Mycological Institute, Kew, London, obtained from the Seed Health Laboratory, International Institute of Tropical Agriculture (IITA) Ibadan, Nigeria.

The pH of the samples were determined using a pH meter (Titrimeter U9N model). The moisture content and titratable acidity were determined as described by Egan *et. al.* (1981).

Results and Discussion

The bacterial found associated with fura, nono and fura da nono includes *Escherichia coli*, *M. luteus*, *Streptococcus sp*, *Staphylococcus aureus*, *B. cereus*, *Lactobacillus sp* and *Enterobacter sp* ([Table 1](#)) Results of this experiment indicate the presence of *S aureus*, *B cereus*, *Streptococcus sp* and *E. coli* which have previously been implicated in food poisoning outbreak of some products (Frasier and Westhoff, 1978). The presence of *E. coli* and *Enterobacter* species in the samples also indicates that they are likely to contain other enterobacteriaceae, as the presence of *E. coli* in foods is an indication of faecal contamination of products. However, *Lactobacillus sp.* is a lactic acid bacterium probably involved in fermentation of the product. Zaika *et al.*, (1983) reported *Lactobacillus plantarum* as an hetero-fermentative lactic acid bacterium, found to be important in initiating fermentation of vegetables and fruit juices.

The fungi isolate also includes *R. nigricans*, *A. flavus* a yeast *S. cerevisiae* ([Table 1](#)). The presence of *A flavus*, in the product might probably make its consumption harzadous to health. Some strains of *A. flavus* produces Aflatoxin, a potent toxin that has been implicated in Hepatoxin and Cancer in mammals including man (Bothast, 1978; Frazier and Westhoff, 1978).

The result also revealed that the average bacteria count from nono, fura and fura da nono ranges between $3.0 - 4.7 \times 10^4$ cfu/ml. The inoculum load of fungal isolates ranges from 1.0×10^4 to 2.9×10^4 cfu/ml and yeast count ranges from 0.0×10^4 cfu/ml in fura to 5.3×10^4 cfu/ml in fura da nono ([Table 2](#)). All the samples were found to harbour coliforms. Odunfa (1988) reported that Staphylococcal levels of 10^8 /ml is considered potentially hazardous, however, the microbial levels obtained in this report which is 10^4 could be considered hazardous to consumers because of the possibility of the presence of enterotoxigenic strains.

The mean pH and titratable acidity of nono and "fura da nono" ranges from 3.1 to 4.6 and 0.005 to 0.092 as show in [Table 3](#). The overall low pH range of 3.1-4.6 obtained for the samples could account for the low microbial counts obtained. This result is in agreement with the report of Umor *et al.* (1988). The pH of nono in this report was however lower than that reported for Yoghurt by Odunfa (1988).

The possible sources of contaminating organisms associated with these products could be traced to the use of the old portion of previously fermented nono as starter and the use of well and stream water for processing. The contaminating organisms could also be through air microflora which stick to the smoothening stick, calabash spoons and bowls used for the sale of the products. Moreover, normal human flora of the customers could also serve as contaminants especially when one bowl is used for mixing the product for all customers without cleaning between use.

In order to prevent contamination of fura da nono by *E. Coli*, *Staphylococcus* sp, *Streptococcus* sp and *B. cereus*, the local Fulanis who are the major producers should be educated on sanitary practices during milking of cows and further processing. The use of portable clean water where available should be encouraged. The calabash spoon and smoothening stick should always be kept clean and protected from houseflies, while the beverage could also be packed in polythene sachets. Also, more than one calabash cup should be used to serve the consumers and these must always be kept clean to avoid contamination.

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Table 1 Microorganisms associated with fura, nono and fura da nono in Bauchi metropolis

Location	Food type	Microorganisms									
		<i>S. aureus</i>	<i>M. luteus</i>	<i>E. coli</i>	<i>Lactobacillus</i> sp	<i>B. cereus</i>	<i>Enterobacter</i> sp	<i>Streptococcus</i> sp	Yeast	<i>A. flavus</i>	<i>R. nigrican</i>
Yelwa	Fura	-	+	-	+	+	-	-	-	+	+
	nono	+	+	+	+	+	+	+	+	-	-
	Fura da nono	+	+	+	+	+	+	+	+	+	+
Gwalla meji	Fura	-	-	-	+	+	+	-	-	+	+
	nono	+	+	+	+	+	+	+	+	-	-
	Fura da nono	+	+	+	+	+	-	+	+	+	+
Wunti	Fura	-	-	-	+	+	+	-	-	+	+
	nono	+	+	+	+	+	+	+	+	-	+
	Fura da nono	+	+	+	+	+	+	+	+	+	+

+ = Present; - = Absent

Table 2. Mean microbial counts of nono, fura and fura da nono (cfu/ml)

Food samples		Bacteria count		Yeast count		Fungal count	
Mean microbial load (cfu/ml) x 10 ⁴							
		1998	1999	1998	1999	1998	1999
Fura	A	3.4	3.2	0.0	0.0	2.6	2.2
	B	4.5	4.7	0.0	0.0	2.8	2.4
	C	3.2	3.9	0.0	0.0	2.9	2.4
Nono	A	3.6	3.4	4.8	4.7	1.3	1.0
	B	3.6	3.5	5.2	4.9	1.4	1.3
	C	3.4	3.2	3.7	4.0	1.5	1.4
Fura da nono	A	3.4	3.5	4.9	4.7	2.7	2.5
	B	3.8	4.0	5.3	4.8	2.6	2.5
	C	3.2	3.0	3.9	4.0	2.9	2.5

The values for the different areas are mean of 4 samples replicated three times.

Key: A - Yelwa; B - Gwallameji; C - Funti

Table 3 mean pH, titratable acidity and moisture content of fura and fura da nono

Location	Food type	PH	Titratable acidity (% lactic acid)	Moisture content (%)
Yelwa	Fura	3.6	0.079	48
	Fura da nono	3.8	0.005	87
Gwallameji	Fura	3.1	0.085	44
	Fura da nono	3.5	0.008	88
Wunti	Fura	3.4	0.092	46
	Fura da nono	3.6	0.006	84

Figures are means of the average of 4 replicates