

Chemical and bacteriological assessment of *Kindirmo* (local yoghurt) put on sale in Niger State.

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Abstract

Chemical and bacterial analysis of 120 *Kindirmo* samples collected from the three senatorial zones of Niger state were carried out with the aim of assessing their chemical and bacterial qualities. Bacteria species identified were *Staphylococcus aureus*, *Streptococcus* sp., *Lactobacillus* sp., *Pseudomonas aeruginosa*, *Bacillus* sp., *Micrococcus* sp. and *Escherichia coli*. *Streptococcus* sp. accounted for 31.7% of the total isolates followed by *Lactobacillus* sp. 29.2%; *Staphylococcus aureus* 20.8%, *Bacillus* sp. 5.8% and *Staphylococcus epidermidis* 3.3%; while *Micrococcus* sp., *Pseudomonas aeruginosa* and *Escherichia coli* each had 2.5% and *Klebsiella* sp. 1.7%. *Streptococcus* sp. and *Lactobacillus* sp. were the beneficial bacteria while *Staphylococcus* sp. and the coliform, *Escherichia coli*, were pathogenic. Proximate analysis of sampled *Kindirmo* revealed that *Kindirmo* contained between 2.99-8.00% crude protein; 5.96 – 15.38% total solids, 1 – 3% lipid and 88 – 92.5% moisture, with pH values ranging between 4.73 and 5.3. The Niger State government is therefore urged to educate and enlighten the public on the routes of contamination of this widely-consumed product in order to make the product safe for consumption.

KEY WORD: -*Kindirmo*, Bacteriological assessment, Pathogenic.

Introduction

The need for adequate consumption of animal protein in Nigeria cannot be over emphasized. Milk and milk products, being an important source of animal protein, contribute greatly to the growth and development of man. FAO (1982) Milk Report shows that production of milk and milk products in most developing countries (Nigeria inclusive) has been increasing at the rate of 2.8% per year while demand is increasing at the rate of 3.6% per year. Low production of milk and milk products in developing countries, particularly Nigeria, is attributed to production and storage problems, contamination by microorganisms during collection and during processing of the milk.

In the traditional society, fresh milk is not always taken raw. It is processed into products that are more stable and can last longer. Nowadays, milk is converted to *Kindirmo* (local yoghurt in Hausa), cheese (*wara* in Hausa), and *Nono* (skimmed milk in Hausa). *Kindirmo* is a thick, semi-solid, cheese like fluid. It is obtained when a fresh whole milk is partly evaporated and allowed to cool. Unlike the industrially-prepared yoghurt, flavours, sweeteners and bacteria are not added. *Kindirmo* can be taken with “*fura*”, a fermented cereal food. Sugar may be added during consumption. The consumption of *Kindirmo* is very popular among the people of Northern Nigeria. *Kindirmo* stored at a chilling temperature not higher than 5°C has a longer shelf life but if not properly refrigerated, it is prone to spoilage by microorganisms. This study was carried out to evaluate the chemical and bacteria qualities of *Kindirmo* put on sale in Niger State.

Materials and Methods

The research was conducted in the three senatorial zones of Niger state namely zones A (Bida area), B (Minna area) and C (Kontagora area), representing treatments T₁, T₂ and T₃ between June and September 2008. Four locations (towns) were selected per zone as sites for random

sample collection (to get different from the field). A multistage random sampling technique was used. Niger state was divided into three zones. Each zone was divided into four towns. Each town contributes ten samples, giving a total of 40 samples per zone and a total of 120 sample for the 3 zones. Each collection was made once a month. At each collection, *Kindirmo* were purchased from Fulani women hawking the product between the hours of 11 a.m. and 12 noon each day. The collected *Kindirmo* samples were immediately packed in sterile ice and transported to the Microbiology Research Laboratory of the Federal University of Technology, Minna, for analysis.

Microbial assessment of *Kindirmo* samples collected was in accordance with ALPHA (1985) guidelines. Treatment procedures for bacteria counts, frequency of occurrence of bacteria isolates and characterization and identification of bacteria were carried out using standard plate counts. Biochemical tests which included Gram Stain Reaction, Indole test, Oxidase Test, Urease Production Test, Carbohydrate Fermentation Test, Coagulase Test, Methyl Red Test, Catalase and Voges – Proskaver Tests were used for characterization of bacteria isolates. Isolates were identified by comparing their characteristics with those of known taxa using the scheme of Cowan (1974) and Cruickshank *et. al.* (1975). Proximate analysis was carried out in accordance with AOAC (1990).

Results and Discussion

The proximate composition of analyzed *Kindirmo* samples is presented in Table 1. There was a significant difference ($p < 0.05$) in parameters tested (crude protein, total solids, lipid, pH and moisture), showing that the biochemical characteristics of *Kindirmo* vary. The product is slightly acidic (4.5) due to lactic acid development in the medium.

The result of bacteria and coliform count is presented in Table 2. Generally, viable plate count was high in all the treatments (zones) revealing that all the sampled *Kindirmo* were contaminated with several species of bacteria. The data for coliform was low especially in treatments 1 and 3 (zone A and C).

The result of frequency of occurrence of bacteria isolates in sampled *Kindirmo* is presented in Table 3. The result revealed that *Streptococcus* sp had the highest number of isolates 38(31.7%) followed by *Lactobacillus* sp. 35(29.2%). *Staphylococcus aureus* had 25(20.8%), *Bacillus* sp. 7(5.8%) and *Staphylococcus epidermidis* 4(3.3%); *Micrococcus* sp., *Pseudomonas aeruginosa* and *Escherichia coli* each had 3(2.5%) and *Klebsiella* sp 2(1.7%). This result is in agreement with Frazier and Westhof (1992), who stated that *Streptococcus* sp., *Lactobacillus* sp. and *Staphylococcus* sp. grew well in milk and hence endanger its keeping quality. *Streptococcus* and *Lactobacillus* were predominant contaminants in the samples of *Kindirmo* analysed. This was expected because according to Trema and Musa (1998), these were the organisms involved in the fermentation of milk for *Kindirmo* production. The organisms also give *Kindirmo* its usual flavour and aroma.

The presence of *Pseudomonas* sp is undesirable because it produces pigments that cause coloration in *Kindirmo* (Salle, 1967). The presence of *Escherichia coli* was also observed in the samples of *Kindirmo*. Its presence could be as a result of the raw milk used in the production of *Kindirmo* which must have been contaminated with faecal matter because *Escherichia coli* are abundantly found in the toilet (Prescott *et. al.*, 1993; Talaro and Talaro, 1998). The presence of *Bacillus* sp may be due to improper heating, packaging and handling of the product. *Bacilli* sp. is agent of food poisoning (Antai, 1985).

Staphylococcus aureus and *Escherichia coli* seen in *Kindirmo* samples are pathogenic.

Staphylococcus aureus is associated with mastitis, which is a deadly disease of dairy animals. Dageish (1995) stressed that in every four cows, there is about one suffering from mastitis.

As stipulated by the Standard Organisation of Nigeria (SON) under the Nigeria Industrial Standard of 1984, raw milk containing up to a minimum of 500,000 colonies of microbes are

unfit for human consumption. Also the presence of *Escherichia coli* is an indication of poor level of hygiene of milkers, utensils, water and the milking environment. This assertion is in agreement with Najib (2003) who observed that the source of *E. coli* found in raw milk include soil, manure, unsanitary equipment and humans.

Table 1: Proximate composition of tested *Kindirmo* samples

| Parameters | Treatments | | | SEM | Significance |
|---------------|------------------------|-------------------------|-------------------------|--------|--------------|
| | T ₁ | T ₂ | T ₃ | | |
| Crude Protein | 3.18±0.13 ^c | 4.14±0.24 ^b | 7.61±0.40 ^a | 0.5783 | * |
| Total solids | 8.92±1.98 ^c | 15.08±0.23 ^a | 11.28±0.20 ^b | 0.8220 | * |
| Lipid | 1.63±0.25 ^b | 2.75±0.050 ^a | 1.50±0.58 ^b | 0.2083 | * |
| PH | 4.91±0.13 ^b | 5.22±9.42 ^a | 4.77±2.65 ^b | 6.245 | * |
| Moisture | 91.25±0.87 | 88.63±2.69 | 91.13±1.3 | 0.5850 | NS |
| NFE | 8.29±12 ^c | 8.56±0.26 ^b | 13.58 ±35 ^a | 0.4507 | * |

*Means in the same row bearing different superscripts are significantly different (P<0.05).

Table 2: Bacterial count of sampled *Kindirmo* put on sale in Niger State (cfu/ml)

| MONTHS | Count of total viable bacteria (cfu/ml) | | | Coliform Count | | |
|--------|---|---------------------|---------------------|---------------------|---------------------|----------------|
| | T ₁ | T ₂ | T ₃ | T ₁ | T ₂ | T ₃ |
| JUNE | 1.4×10 ⁷ | 1.2×10 ⁷ | 9.6×10 ⁶ | ND | ND | ND |
| JULY | 0.4×10 ⁵ | 1.2×10 ⁵ | 3.7×10 ⁵ | ND | 1.3×10 ² | ND |
| AUGUST | 2.5×10 ⁵ | 4.4×10 ⁵ | 2.3×10 ⁵ | 1.3×10 ³ | 1.2×10 ³ | ND |
| SEPT. | 2.2×10 ⁵ | 2.0×10 ⁵ | 9.3×10 ⁴ | 1.3×10 ⁴ | 5.6×10 ³ | ND |

*ND - Not Detected.

Table 3: Frequency of occurrence of bacteria in sampled *Kindirmo* put on sale in Niger State

| Bacteria | T1 | T2 | T3 | TOTAL |
|-----------------------------------|----------|----------|----------|----------|
| <i>Streptococcus</i> sp | 14(11.7) | 12(10) | 12(10) | 38(31.7) |
| <i>Lactobacillus</i> sp | 12(10) | 12(10) | 11(9.2) | 35(29.2) |
| <i>Staphylococcus aureus</i> | 9(7.5) | 8(6.7) | 8(6.7) | 25(20.8) |
| <i>Bacillus</i> sp | 3(2.5) | 2(1.7) | 2(1.7) | 7(5.8) |
| <i>Staphylococcus epidermidis</i> | 1(0.8) | 1(0.8) | 2(1.7) | 4(3.3) |
| <i>Micrococcus</i> sp | 1(0.8) | 0(0) | 2(1.7) | 3(2.5) |
| <i>Pseudomonas aeruginosa</i> | 0(0) | 2(1.7) | 1(0.8) | 3(2.5) |
| <i>Escherichia coli</i> | 1(0.8) | 2(1.7) | 0(0) | 3(2.5) |
| <i>Klebsiella</i> sp | 1(0.8) | 1(0.8) | 0(0) | 2(1.7) |
| TOTAL | 42(35) | 40(33.3) | 38(31.7) | 120(100) |

*Number in parenthesis represent percentage occurrence of bacteria isolates

Conclusion and Recommendations

This Study has shown that *Kindirmo* put on sale in Niger state is highly contaminated though, the beneficial bacteria are more: these include *Streptococcus* sp and *Lactobacillus* sp with 31.7% and 29.2% occurrence respectively. The pathogenic ones are *Staphylococcus* sp and *Escherichia coli* with 20.8% and 2.5% occurrence respectively. Poor level of hygiene is indicated by the presence of these organisms and this implies that the local yoghurt (*Kindirmo*) put on sale in Niger state can be a source of disease infection to humans that consume this product. After all, almost all *Kindirmo* sellers and producers are Fulanis who are largely illiterates, and are not so mindful of the type of water and utensils used. Besides, the product is mostly transported to town daily by trekking long distances along dusty paths. Hence, regular enlightenment and education by Niger State Government is recommended for its populace. This should be on the need to handle milk and *Kindirmo* with absolute hygiene. Storage facilities and processing points should also be established.

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