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# Microbiological and comparative analysis of indigenous and semi-industrial fermented milk drinks (Fura da Nono and Fura da Yoghurt) sold in Nigeria's capital

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## Abstract:

**Purpose:** Fura da nono is the Fulani name for a Nigerian locally made food drink which translates to millet and milk. Dairy products have frequently been implicated in transmission of food-borne pathogens. This research was aimed at ascertaining the overall safeness of locally prepared Fura da nono and packaged Fura and yoghurt sold in Abuja, Nigeria, by analyzing their microbial and nutritional contents.

**Methodology:** Five locations vending the food drinks of interest in Nigeria's capital city, Abuja were sampled; and five samples each of the two drinks obtained from the locations. Microbiological analysis was done using pour plate technique after six-fold serial dilution. Microbes were isolated *via* culturing and biochemical tests and confirmed using Microgen™ kits. Seven bacteria and two fungi were isolated. Proximate, comparative and sensory evaluation analysis was done on both food drinks and results obtained were analysed using SPSS version 20.

**Results:** Instant Fura da nono drinks obtained from Maitama district had the highest mean microbial count ($p<0.05$) while the highest for instant Fura da yoghurt was seen in Wuse. The percentage proximate analysis from the present study revealed Fura da nono to be more nutritious than its Fura da yoghurt counterpart while sensory evaluation showed the latter to be more acceptable and preferable to the former.

**Conclusion:** This study revealed the two drinks to be unsafe for consumption, most likely due to environmental factors, post-production handling and/or hygiene. However, instant Fura da nono prepared and sold in hygienic and/or non-open air environment serves as a more nutritious food drink than Fura da yoghurt. The urgent implementation of Hazard Analysis and Critical Control Points (HACCP) for these dairy products is therefore imperative.

**Keywords:** Fura da nono, Yoghurt, Microbial count, Proximate analysis, Sensory evaluation, HACCP

## Introduction

In many cultures of the world, especially the western world, human continue to consume milk beyond infancy, using the milk of animals especially like cattle, goats and sheep as food products. For millennia, cow milk has been processed into dairy products such as condensed milk, skimmed milk, ice cream, butter, yoghurt and the more durable and easily transportable product, cheese [1].

Locally made foods drinks provide an excellent alternative to the conventional food drinks. These locally made food drinks have gradually gained public acceptance and their consumption has increased over the years across developing countries like Nigeria. Fura da Nono is a two in one highly nutritious milk beverage consisting of a cereal – "Fura" – made from millet, and "nono", a locally fermented milk product similar to yoghurt, but with a consistency less thick than yoghurt. Nono is the Fulani word for cow's milk produced (Figure 1) and sold by the Fulani women (of the Fulani tribe) in Nigeria, while Fura is the Fulani word for the spiced ground millet processed (Figure 1) and moulded into balls for sale and consumption with the dairy product. Hence, Fura da nono translates to millet and milk. Depending on the consistency, the product serves as either food (desert), refreshing drink or a weaning food for infants. The mixture of fermented milk and cooked spiced millet is almost a complete food, with nono serving as a source of protein while the Fura provides energy. The Fura balls are marshed and mixed with the yoghurt before consumption. Fura da Nono was very popular in the northern states of Nigeria until about a decade ago, when yoghurt took the place of nono for many consumers.

Yoghurt is a fermented milk product of creamy texture that can be prepared from milk of many

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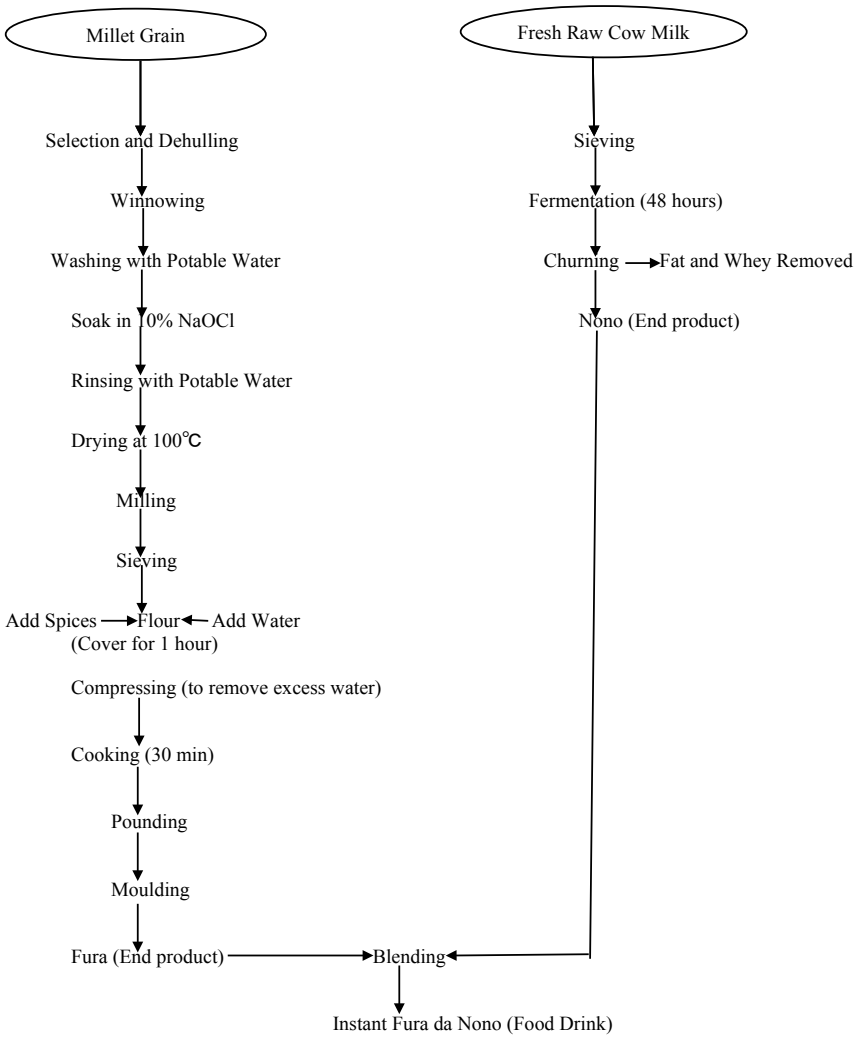


**Figure 1:** Processes involved in Instant Fura da Nono food drink production from raw materials.

species of diary animals, but most often made from cow milk. It is rich in protein, calcium and vitamins, and tremendously popular all over the world. Yoghurt is made by the controlled thermoduric fermentation of pasteurized non-fat or low-fat milk, carried out around 45°C [2]. Yoghurt is produced by the fermentation of milk by *Lactobacillus bulgaricus* and *Streptococcus thermophillus* which ferment the milk's lactose to produce lactic acid. These organisms produce organic acids and other flavour components; and can grow in such numbers that a gram of yoghurt regularly contains 100 million bacteria. Yoghurt has a characteristic acidic taste and pH ranging from 3.7-4.2 with viable and abundant fermenting microorganisms.

Dairy products have frequently been implicated in transmission of food-borne pathogens. The contamination of dairy product by coliforms is attributed to milk products being ideal growth medium for microbial proliferation [3], and to the wide distribution of coliforms in nature, making them useful indicators for enumerating the extent of re-contamination after pasteurization as well as the sanitary quality of pasteurized product. Coliforms also cause the rapid spoilage of food held under conductions favourable to microbial growth. Some strains of bacteria and other enteric pathogens may also be disseminated by dairy products. Many consumers prefer to mix plain yoghurt with Fura, rather than the locally made nono, majorly due to fear of food poisoning and/or infection which may result from the consumption of ill prepared Fura da nono. Fura da nono may harbor harmful microorganisms which may be of health risk to consumers, especially when unhygienically prepared. While it is possible to get foodborne illnesses from many different foods, raw milk is one of the trickiest of all. The poor handling of Fura da nono during processing and marketing exposes it to microbial contamination. Yeasts are major cause of spoilage of yoghurts and fermented milks as the low pH provides a selective environment for their growth [4]. Since the Fulani merchants of this food drink are nomads who engage in open grazing, there is

general skepticism about the preparation processes of the nono as well as the proper observation of personal/environmental hygiene and Hazard Analysis and Critical Control Points (HACCP). It has been reported that in order to increase the volume and improve colour of nono, the Fulani women, prior to sale, use stream water and milky white supernatant of water-soaked baobab tree seeds [5]. This act could escalate the exposure of the end product to contamination. Another risk practice is the use of a single bowl in mixing Fura da nono for all customers without cleaning. With the increased patronage of Fura and yoghurt food drink, Fura da nono is more often than not made with yoghurt, although the original name has been maintained.

The increased patronage given to Fura and yoghurt drink does not however, entirely overrule the risk of food-borne infection or poisoning, as the locally made Fura can still be an inanimate vector of infectious microbes and/or toxins. 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 also found in large numbers at the production sites and sales outlet.

Nono and yoghurt are fortified with vitamin A and D which help to promote eyesight and enhance calcium, potassium absorption, as well as lactose. However, the compromising attitudes of the sellers of those dairy products are aimed towards profit maximization, with little regards to the nutritional health of the consumers. But for the exposure risk of nono consumption, it is more advantageous to consume, compared to processed yoghurt which has lower nutritional quality. Nono contains high amount of carbohydrates compared to yoghurt which contain about 6% of lactose, as fermentation process has proven to digest about 20%–30% of the lactose into its absorbable components–glucose and galactose [6].

Giving the risk of contamination of dairy products and subsequent infection or intoxication of consumers, this research was aimed at ascertaining the overall safeness of locally prepared Fura da nono and packaged Fura and yoghurt sold in Abuja, Nigeria, by analyzing their microbial and nutritional contents.

## Materials and Methods

### Study location

Five locations in Nigeria's capital city, Abuja, vending fresh Fura da nono and Fura da yoghurt were selected as follows: Jabi, Wuse, Karu, Utako and Maitama markets (for Fura da nono) and Jabi (Maple yoghurt), Wuse (Farm fresh yoghurt), Karu (Yogurberry frozen yoghurt), Wuse Zone 4 (Habib yoghurt), and Garki Area 11 (Shagalinku yoghurt) markets (for Fura and yoghurt), all in Abuja.

### Sample collection and processing

Five (5) instant Fura and yoghurt each, were obtained from different markets (total of 25 samples), as well as from 5 different instant Fura da nono vendors (25 samples) making an overall total of 50 samples. All Fura da nono and Fura and yoghurt samples (100 mL each) were collected in sterile bottles, transported immediately to the laboratory and stored in a refrigerator at 40°C for processing the same day. Six (6) fold serial dilution was done for each obtained mixed food drink sample by homogenizing 1 mL of each sample in 9 mL of 0.85% (w/v) sterile sodium chloride solution to make the initial dilution (10-1), then 1 in 9 mL each from subsequent dilutions up to 10-6.

### Microbiological analysis

Using the pour plate method, 1 mL each of corresponding dilutions (10-5 and 10-6) were inoculated into the different media selected for the study: Nutrient agar for Total Aerobic Plate Count (TAPC), (CM003, Oxoid, UK), McConkey agar for Total Coliform Count (TCC), (CM0050, Oxoid, UK), MRS agar for Lactic Acid Bacteria Count (LABC), (CM0361, Oxoid, UK) at 35-37°C for 48 hrs and Sabouraud Dextrose agar (CM0041, Oxoid, UK) with chloramphenicol for Fungi Count (FC) at room temperature for 6 days. All culture media were prepared according to manufacturer's instruction. After incubation, plates showing 30-300 colonies were enumerated using digital illuminated colony counter (GallenKamp, Loughborough, Leicestershire, UK) and the calculated results were expressed as colony forming unit (cfu) per mL by multiplying the average number of colonies from the observed triplicates with the reciprocal of dilution factor. Presumptive bacterial isolates with distinct morphologies such as elevation, surface, form, margin, consistency, colour were randomly selected and sub-cultured using streak plate technique. Incubated isolates were then identified by observing their morphology on the agar plates and characterizing them according to the methods and criteria of Bergeys Manual of Determinative Bacteriology, 8th Edition. Presumptive bacterial isolates were further subjected to conventional biochemical tests such as Indole, Catalase, Oxidase, slide and tube Coagulase, Voges-Proskauer (VP), gelatin liquefaction, Methyl Red (MR), and Carbohydrate fermentation–glucose, sucrose, maltose, fructose, lactose, galactose, arabinose, dextrose, mannitol and starch–tests using

fermentation broth medium which contains 1% (w/v) carbohydrate, bromothymol blue 0.1% as pH indicator in inverted Durham's tube.

Presumptive fungal isolates were further subjected to microscopy using acetone and lactophenol on cotton blue stain placed on a clean grease slide. The cultural and morphological characteristics of the isolates such as hyphae (septation), reproductive structure (sporangia/conidia) in chain or single; the type of spore, etc were observed and served as criteria used for identification [7]. All isolates were confirmed using Microgen™ Identification test kits according to manufacturer's instruction.

### Proximate and comparative analysis

The quantitative proximate analysis, as well as comparative analysis of the two food drinks was carried out in the Department of Chemistry, Ahmadu Bello University, Zaria, Nigeria by NCJA and AO. Moisture content was determined drying samples to constant weight as described by [8]. Ash content was determined then by dry-washing in a Muffle Furnace at 500°C [8]. Crude protein, crude fat, crude fibre and carbohydrate were analyzed following the AOAC methods [9].

### Sensory evaluation

A 5-point hedonic scale ranging from 1 ("Dislike very Much") to 5 ("Like very Much") was used to evaluate samples organoleptically using parameters such as aroma, colour, taste, acceptability, thickness and flavour. The panel lists were 25 in number and consisted of students and staff members of Bingham University, Karu, Nigeria.

### Statistical analysis

Data obtained were analysed using IBM SPSS Version 20. Mean occurences were used to determine the microbial load of various samples. Chi Square was used to investigate the significant difference in the microbial load in the different locations sampled as well as the proximate, comparative and sensory evaluation. Each test was conducted at 95% confidence interval ($p<0.05$).

## Result

Except for the Total Coliform Count (TCC), Instant Fura da nono drinks obtained from Maitama district of Abuja significantly had the highest mean microbial count (Table 1). The least TCC, FC, LABC and TAPC were found in samples obtained from Utako, Jabi, Utako and Wuse respectively ($X2=34.41$; $p<0.05$). For the Fura da yoghurt drinks, samples obtained from Wuse had the highest mean microbial count, except for samples from Garki, which had the highest report of TCC ($X2=21.643$; $p>0.05$). The least TCC, FC, LABC and TAPC for fuara da yoghurt food drink were found in samples obtained from Jabi, Gwarinpa Karu and Gwarinpa respectively (Table 1). Seven (7) genera of bacteria (*Staphylococcus, Escherichia, Lactobacillus, Streptococcus, Leuconostoc, Pseudomonas* and *Bacillus*) were isolated from the present study (Table 2); while two species of fungi (*Rhizopus stolonifer* and *Aspergillus niger*) were isolated (Table 3). On comparing the major compositions, no statistical difference ($p>0.05$) was observed in most of the constituents such as crude fat, crude fibre, ash and Carbohydrate. Statistical differences ($p< 0.05$), were however observed in the moisture and crude protein content (Figure 2). Fura da yoghurt was found to have a lower protein content ($2.12 \pm 0.68\%$) than Fura da Nono ($3.91 \pm 0.36\%$). The proximate composition between between Fura da Nono and Fura da Yoghurt is presented on

**Table 1:** Mean Microbial count of the two food drink sold in Abuja
Key: A–Jabi (Maple yoghurt); B-Karu (Yogurberry frozen yoghurt); Ca–Utako; Cb-Gwarinpa (Farm fresh yoghurt); Da–Maitama; Db–Garki Area 11 (Shagalinku yoghurt); E–Wuse (Habib yoghurt); CC–Coliform Count; FC–Fungi Count; LABC–Lactic Acid Bacteria Count; TAPC–Total Aerobic Plate Count.

| Drink | Location | Mean Microbial Count ($Log^{10}$ cfu/mL) | | | |
|---|---|---|---|---|---|
| **Fura da Nono** | | **TCC** | **FC** | **LABC** | **TAPC** |
| | A | $3.7x10^5$ | $2.27x10^5$ | $3.5\ x10^6$ | $7.9\ x10^5$ |
| | B | $2.27x10^5$ | $3.34x10^5$ | $5.8\ x10^6$ | $8.3\ x10^5$ |
| | Ca | $1.93x10^5$ | $4.54x10^5$ | $1.5\ x10^6$ | $7.5\ x10^5$ |
| | Da | $2.8x10^5$ | $5.34x10^5$ | $5.5\ x10^6$ | $8.8\ x10^5$ |
| | E | $3.74x10^5$ | $3.54x10^5$ | $4.1\ x10^6$ | $7.4\ x10^5$ |
| **Fura da Yoghurt** | **Location (Yoghurt brand)** | | | | |
| | A | $0.2x10^5$ | $1.6x10^5$ | $5.1\ x10^7$ | $4.2\ x10^5$ |
| | B | $0.14x10^5$ | $1.1x10^5$ | $5.0\ x10^7$ | $3.8\ x10^5$ |
| | Cb | $0.8x10^5$ | $0.8x10^5$ | $5.5\ x10^7$ | $3.4\ x10^5$ |
| | Db | $1.2x10^5$ | $1.4x10^5$ | $5.9\ x10^7$ | $4.8\ x10^5$ |
| | E | $0.67x10^5$ | $2.14x10^5$ | $6.7\ x10^7$ | $5.3\ x10^5$ |

**Table 2:** Cultural, Morphological and Biochemical Characteristics of Bacteria Isolated from the 2 types of Food drinks

| Colony Morphology | | | | | | Biochemical tests | | | | | | | | | Sugar Fermentation | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Colour | Form | Elevation | Surface | Margin | Microscopy | Gram Staining | Catalase | Coagulase | Indole | MR | VP | motility | Gelatin | Oxidase | Spore | Growth @ 4% NaCl | Glucose (A/G) | Lactose (A) | Maltose (A) | Arabinose (A) | Galactose (A) | Sucrose (A/G) | Fructose (A) | Xylose (A) | Mannitol (A/G) | Starch (A) | Presumptive Isolate |
| **Light yellow** | Circular | Flat | Dull and Rough | Undulate | Single cocci in clusters | + | + | + | - | + | + | - | + | - | - | + | +/+ | + | + | - | + | +/+ | + | - | +/+ | - | *S. aureus* |
| **Greyish white** | Circular | Raised | Smooth | Entire | Short rods, | - | + | - | + | + | - | + | - | - | - | + | -/+ | + | - | + | + | +/+ | - | - | +/+ | - | *E. coli* |
| **White** | Circular | Flat | Rough | Undulate | Thick short rods, single or in short chains | + | - | - | - | - | - | - | - | - | - | + | +/- | - | + | - | + | +/- | + | + | -/- | + | *Lactobacillus* sp. |
| **white** | Circular | Convex | Smooth | Entire | Single cocci in pairs or short chains | + | - | - | - | - | - | - | - | - | - | + | +/- | + | - | + | + | +/- | + | + | -/- | - | *Streptococcus* sp. |
| **Cream** | Spherical | Flat | Dull and dry | Entire | Cocci, in pairs or clusters | + | - | - | - | - | + | - | - | - | - | + | +/+ | + | + | + | + | +/- | - | - | -/- | - | *Leuconostoc* |
| **Green** | Spherical | Plateaux | Mucold | Entire | Rod | - | + | - | - | - | - | + | + | + | - | + | +/- | - | - | + | + | - | + | + | +/+ | - | *P. aeruginosa* |
| **Cream** | Circular | Low convex | Rough | Irregular | Rod | + | + | - | - | - | + | + | - | - | + | + | +/- | - | + | - | - | +/- | + | - | -/- | + | *B. cereus* |

**Key:** A – Acid; G – Gas; + - Positive; - - Negative

**Table 3**: Cultural and Morphological Characteristics of Fungi in the 2 Food Drinks

| Culture | Morphology | Fungal Isolate |
|---|---|---|
| Dark-Brown Mycelium | Dark brown conidia with long conidiophores, map-like Conidiospores and globose vesicles completely covered with biseriate phialides, borne on brown metulae | *Aspergillus niger* |
| Powdery white appearance with white cotton-like fluffy mycelia | Umbrella-like shape; Non-septate hyphae with rhizoid and coenocytic twin sporangiophore | *Rhizopus stolonifer* |

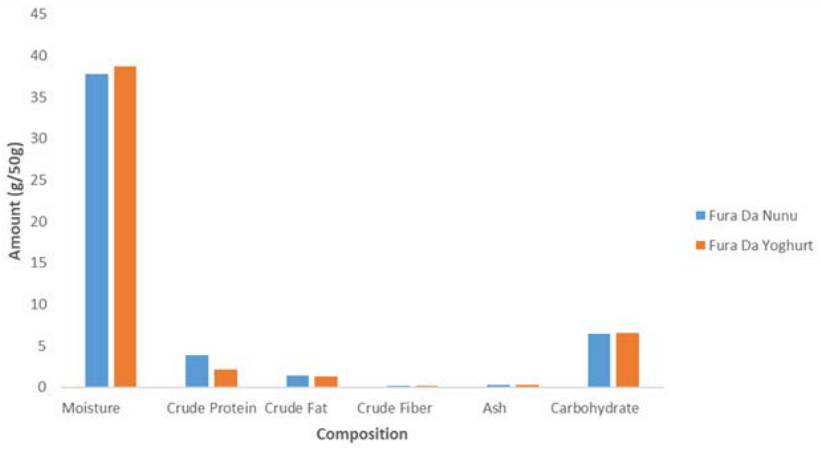


**Figure 2:** Quantitative comparative analysis of the two food drinks. Experiments were done in triplicates expressed as Mean ± SD.

Composition per constituent (g/50 g):

Fura da Nono: Moisture - 37.83 ± 0.27, Crude Protein - 3.91 ± 0.36, Crude Fat - 1.35 ± 0.25, Crude Fibre - 0.16 ± 0.05, Ash - 0.29 ± 0.03, Carbohydrate - 6.44 ± 0.23.

Fura da Yoghurt: Moisture - 38.76 ± 0.68, Crude Protein - 2.12 ± 0.25, Crude Fat - 1.30 ± 0.16, Crude Fibre - 0.19 ± 0.07, Ash - 0.31 ± 0.01, Carbohydrate - 6.49 ± 0.35.

Figure 3. The composition in percentage for both food drinks are similar, except for the crude protein and moisture content. From the sensory evaluation feedback, the aroma and flavor were significantly higher in Fura de yoghurt (4.6 ± 0.2 and 4.8 ± 0.35 respectively) than in Fura de Nono (3.8 ± 0. 3 and 3.3 ± 0.4 respectively). No significant difference was observed between both food drinks in terms of color, taste, acceptability and thickness (Figure 4).

## Discussion

Diet that includes milk products such as the food drinks captured in this study, is a good source of energy, and its consumption helps in elimination of heart problem associated with high cholesterol level in the blood. Calcium and potassium obtained from these food play an important role in regulating and possibly lowering blood. However, yoghurt, as other dairy products, are frequently contaminated by pathogens, which sometimes lead to food intoxication. Health complications associated with consumption of inadequately pasteurized milk products include serious infections that are difficult to treat with antibiotics.

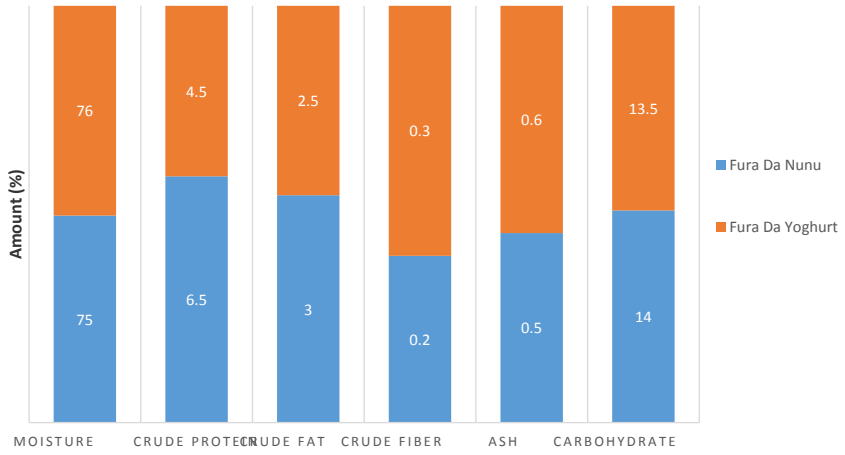


**Figure 3:** Percentage proximate composition of Fura da Nono and Fura da Yoghurt.

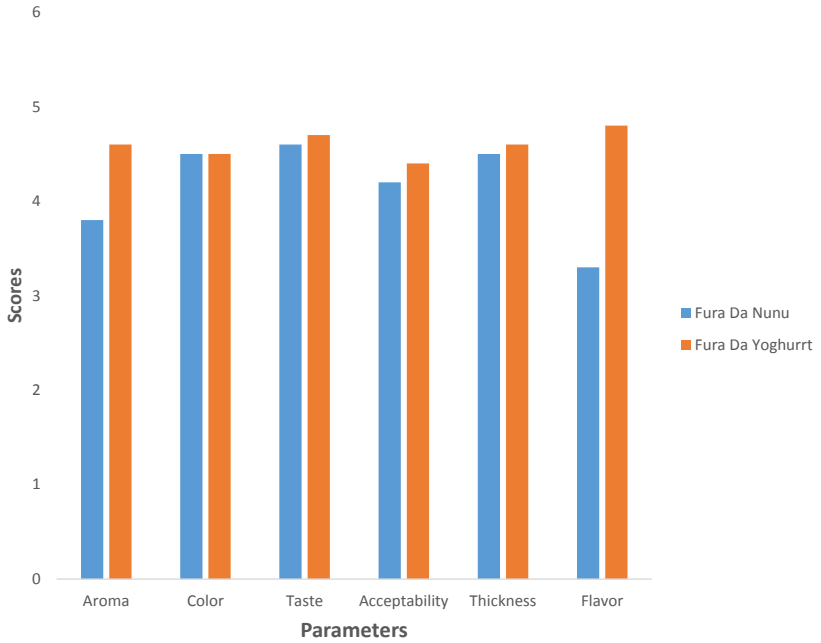


**Figure 4:** Sample mean of sensory evaluation attributes of the two food drinks.
Experiments were done in triplicates expressed as Mean ± SD. Values Containing different alphabet on the same row are significantly different ($p < 0.05$)
**Score per parameter:**
**Fura da Nono**: Aroma - 3.8 ± 0. 3, Colour - 4.5 ± 0.2, Taste - 4.6 ± 0.3, Acceptability - 4.2 ± 0.2, Thickness - 4.5 ± 0.1, Flavor - 3.3± 0.4;
**Fura da Yoghurt**: Aroma - 4.6 ± 0.2, colour - 4.5 ± 0.3, Taste - 4.7 ± 0.1, Acceptability - 4.4 ± 0.3, Thickness - 4.6± 0.1, Flavor - 4.8 ± 0.35.

Microbiological analysis carried out in the present study revealed the presence of microbes, some of which pose danger to potential consumers. Seven (7) genera of bacteria (*Staphylococcus, Escherichia, Lactobacillus, Streptococcus, Leuconostoc, Pseudomonas and Bacillus*) and two species of fungi (*Rhizopus stolonifer* and *Aspergillus niger*) were isolated. While the presence of *Lactobacillus* and *Streptococcus* in this study was expected as they play key role in the fermentation process of milk to yoghurt; the presence of *Bacillus cereus* is a cause for great concern. *B. cereus* wasn't isolated from any of the instant food drink made from processed yoghurt (Fura da yoghurt), but was observed in Fura da nono–the food drinks made from the locally fermented yoghurt. While *B. subtilis* is a proven fermentation agent [10], *B. cereus* is a pathogen whose spores, when ingested, may lead to food poisoning. It also produces toxins–diarrheal (characterized by diarrhea) and emetic toxin (characterized by nausea and vomiting). The absence of the organism from the food drinks made from industrially processed yoghurt may be due to pasteurization process involved at some point, during the processing. In recent times, microbial contamination is further check mated in high quality yoghurts by either pasteurizing at low temperature, or producing from already pasteurized milk.

*Staphylococcus, Escherichia, Leuconostoc*, and *Pseudomonas* were reported in all food drinks sampled in the current study. While *Leuconostoc* is an epiphytic organism which plays key role in several industrial and food fermentation as well as impart characteristic flavor; the other microbes are capable of causing food borne infection. Environmental hygiene and handling process may have played a role in the contamination of the food drinks with these organisms. The possibility of transmission/contamination of Fura da nono from the respective animal sources is also not ruled out in this study as the Fulani nomads move about with their cattle, and so, the production process and general observation of HACCP is highly unlikely.

The presence of the two (2) isolated fungi species from this study is in concordance with Oyeleke et al. [11] who reported that moulds to be the major contaminants of yoghurt in Nigeria. Their presence may also have been introduced by the Fura (mashed millet) used to make the food drink mixture. Fungi are known to contaminate plant produce, especially during harvest or post-harvest. *Aspergillus* is known to produce mycotoxin, which exposes consumers to food intoxication [12] while *Rhizopus* is an opportunistic pathogen and one of the most common causative agents of invasive mucormycosis. It also causes zygomycosis, in which fungal infection are seen in face and oropharyngeal cavity. Organisms like *Corynebacterium* and *Listeria* were not isolated in the present study. This could be attributed to the culture media used.

The mean microbial count revealed colony forming units higher than the 1x104 cfu/mL standard that is set for dairy food drinks/beverages under regulations. Higher microbial count was seen for the instant Fura da nono drinks obtained, compared its Fura the yoghurt counterpart. Only the Lactic Acid Bacteria Count (LABC) of all obtained Fura da yoghurt were higher. This is understandable, as *Lactobacillus* and *Streptococcus* are used as starter culture for the industrially processed yoghurt contained in the Fura da yoghurt, and hence, the regulation of inoculum standards by manufacturers, to attain the required standard of 107 cfu/mL [13]. There is no such regulation in the locally processed yoghurt, hence, the lower count observed. The Fura da yoghurt were expected to have little or no contamination, giving the presence of processed yoghurt which is generally believed to be safer. The titre levels observed could however be attributed to post-production contamination, almost open air marketing and other environmental factors, as well as handling procedures by vendors. This invariably means that Fura da yoghurt is not absolutely safe, as generally believed by the patronizing Nigerian customers, unless purchased in hygienic and closed environments like restaurants and malls.

Generally speaking, the highest mean microbial count in Instant Fura da nono obtained from Maitama market. This is surprising, as Maitama district of Abuja is an exclusive area for the top brass and crème de la crème of the society, hence, expected to be less exposed to food contamination and/or food borne infections. It should be noted however, that some of the vendors of instant Fura da nono drink move from one location to another to hawk their products and so, may have carried the samples used for the present study from other more exposed locations. The instant Fura da yoghurt drinks obtained from Wuse market had the highest mean microbial count. This is expected, since the market is the main market in Abuja, and probably the largest, hence, is more exposed to food-borne pathogens which may more easily be introduced into the samples via the unhygienic environment, air, water used to wash the blender and mixing containers; as well as handling processes.

The percentage proximate analysis from the present study revealed Fura da nono to be more nutritious than its Fura da yoghurt counterpart. The industrially processed yoghurt used in the making of the instant Fura and yoghurt drink undergoes

pasteurization and other production processes which may lead to the reduction of some of the nutritional components. The result obtained from both drinks is however, in agreement with that obtained by Eruteya and Eze [14]. The carbohydrate and protein content of the two food drinks studied were lower than expected. It could be that the Fura (millet balls) used for the drinks were not freshly prepared at the time of purchase, or some crude carbohydrate might have been lost to production processes. Also, the modern method of raising cow involves some potentially harmful inputs that pass on to the milk, and eventually into the yoghurt; such substances may be the antibiotic medicines and hormones in the feeds which may affect the nutritional content of the end product.

The sensory evaluation showed the Fura da yoghurt samples to be more acceptable and preferable to its Fura da nono counterpart. This could further explain the reason for its higher patronage.

## Conclusion and Recommendation

This study revealed that Fura da nono and/or Fura da yoghurt drinks sold in common Abuja markets are unsafe for consumption as they contain microbes which pose the threat of food-borne illnesses, food intoxication and gastroenteritis. However, instant Fura da nono prepared and sold in hygienic and/or non-open air environment serves as a more nutritious food drink than Fura da yoghurt. Since both food drinks are instant, ready-to-eat food that require no further heating or processing, great attention should therefore be given to their microbiological safety to eliminate the health hazard posed to consumers. There is urgent need to implement the HACCP on these almost open-air, local food production centres with the main objective of preventing food contamination and safeguarding public health.

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