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MICROBIOLOGICAL AND NUTRITIONAL QUALITIES OF NONO PRODUCED FROM POWDERED MILK

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ABSTRACT

The research was carried out to produce a locally fermented dairy product "nono" from powdered milk. Microbiological and nutritional qualities of the product were assessed. The mean total plate count of nono was 1.0 $x10^3$ cfu/ml, the mean coliform count was 0.0 $x10^3$ cfu/ml while the mean fungal count was 10.0$x10^3$cfu/ml for the nono produced. The moisture content of the powdered milk nono was 80.0g/100g, total titratable acid was 1.8 and pH was 5.7. The values obtained for crude protein, total carbohydrate, and crude fat were 1.8g/100g, 17.7g/100g, and 0.5g/100g respectively. The absence of coliform organisms in the powdered milk nono and the physicochemical profile shows it is of good nutritional value and essentially a good source of defatted milk for children, adults and aged.

Keywords: Nono, Powdered Milk, Coliform, Physicochemical

INTRODUCTION

Powdered milk is a manufactured dairy product made by evaporating milk to dryness. One purpose of drying milk is to preserve it; milk powder has a far longer shelf life than

liquid milk and does not need to be refrigerated, due to its low moisture content. Another purpose is to reduce its bulk for economy of transportation. Powdered milk and dairy products include such items as dry whole milk, non-fat dry milk, dry buttermilk, dry whey products and dry dairy blends. Milk powders contain all twenty standard amino acids (the building blocks of proteins) and are high in soluble vitamins and minerals. According to USAID the typical average amounts of major nutrients in the un-reconstituted milk are (by weight) 36% protein, 52% carbohydrates (predominantly lactose), calcium 1.3%, and potassium 1.8%. Their milk powder is fortified with Vitamin A and D, 3000IU and 600IU respectively per 100g. Inappropriate storage conditions (high relative humidity and high ambient temperature) can significantly degrade the nutritive value of milk powder **[1, 2]**. Nono has been described as a locally fermented dairy product obtained from mixed culture fermentation of freshly drawn cow milk for 24 hours giving a sour milk, youghurt like in taste, delicious and refreshing beverage **[3, 4]**. Another description of nono together with its closest relative; wara reported them as local dairy products that are produced and widely consumed in many African countries, including Nigeria, **[5]** other authors also observed that mainly the Fulani's produce milk locally in Nigeria and the excess milk is processed into these products for preservation. Untreated milk is highly vulnerable to microbial spoilage; therefore measures for preservation have to be taken to ensure conservation **[6, 7, 8]**. Traditionally, nono is prepared by inoculating freshly drawn cow milk with a little of the leftover as a starter and then it is allowed to ferment for about 24 h at room temperature. During fermentation, some of the lactose is converted to lactic acid. At the end of fermentation period, the milk butter is removed by churning for further use, and the remaining sour milk, nono, is a delicious and refreshing beverage **[4]**. Fermentation is said to be essentially brought about by various species of bacteria especially members of the genus Lactobacillus and other Lactic Acid Bacteria (LAB), moulds and yeasts and variations in milk composition, bacterial flora and ambient temperatures has been noticed to be responsible for products of varying qualities according to **[9, 10]**.

The findings of earlier authors has however reveal poor hygiene being practiced by handlers of this product which may pose health risk to its consumers and hence the need to ensure its microbiological safety, **[11, 12, 13]**. The poor hygiene practiced by nono

handlers discourages many people from buying and taken it from the Fulani's who are the major producers and custodians of nono, **[14]** and **[11]**. The cost of and the poor accessibility of freshly drawn cow milk to the non- Fulani's coupled with the reduction in its production essentially during the dry season even among the Fulani's contributed it's lack of popularity. This research is therefore carried out with the aim of producing nono from powdered milk which is easily accessible to people and is relatively less expensive than freshly drawn cow milk, determining its physicochemical qualities and assessing its microbiological quality.

MATERIALS AND METHODS

Preparation of Nono From Powdered Milk

Powdered milk was obtained from Yankaba market in Kano in sterile container and transferred promptly to the Nigerian Stored Products Research Institute (NSPRI), Kano's laboratory where processing and analysis were carried out immediately. Nono was prepared from powdered milk as follows: one kilogram (1kg) of powdered milk was dissolved in two litres (2L) of clean sterile water in a sterile container; the mixture was thoroughly mixed by stirring gently with a sterile stirrer to aid dissolution, then 3L of boiled water (at 100°C) was poured into the mixture, covered and left to cool down to 45°C, the mixture was inoculated with 1% starter culture of a day old nono. The mixture was left to ferment for 24h. After fermentation the nono produced was analyzed variously as described below.

Isolation and Count of Microorganisms Associated With Nono

Samples were serially diluted using sterile distilled water as diluents. 1ml each from the appropriate dilutions was plated in duplicate using the pour plate method. Media used include nutrient agar for bacteria count, MacConkey agar for Colliform count and potato dextrose agar for fungi and mold count. The nutrient and MacConkey agar plates were incubated at 37°C for 24 h, while the potato dextrose agar plates were incubated at for 48 h. After incubation, developed colonies were counted **[15]**.

Physicochemical Analysis of Powdered Milk Nono

This was done following standard methods that have been described. The total soluble carbohydrate, titratable acidity, crude fibre, crude fat, moisture content, pH and protein were determined following the method of **[15]**. A pH meter (JENWAY Model, 3020) was used to determine the pH.

RESULT

Table 1 and **Figure 1** shows the nutritional status of the powdered milk nono after the

completion of fermentation. Carbohydrate was found to be the highest nutrient while fat was the lowest. Physicochemical parameters in terms of moisture content, titratable acid and p H were also shown.

Table 2 shows the result of the microbiological analysis of the powdered milk nono after fermentation process. Bacteria, yeast/mould and coliform status were as shown on the table.

The sensory evaluation result as seen on **Table 3** above was conducted on a nine point hedonic scale on smell, taste, color and general acceptability by a ten member semi trained panelist who are members of staff of the institute.

Table 1: Result of Physicochemical Analysis of Powdered Milk Nono

S. No.	PARAMETERS	VALUES
1	Titratable Acidity (%)	1.8
2	Total Carbohydrate (%)	17.7
3	Crude Fat (%)	0.5
4	Crude Protein (%)	1.8
5	pH	5.7
6	Moisture Content (%)	80.0

NOTE: *Values Recorded are Mean Values of the Result

Table 2: Result of Total Count of Powdered Milk Nono

S. No.	Microorganisms	CFU/ml
1	Bacteria	$1.00x\ 10^3$
2	Yeasts and Molds	$10.00\ x\ 10^3$
3	Coliform	$0.00\ x\ 10^3$

Table 3: Result of Mean Value of Scores of Sensory Evaluation

S. No.	Parameter	Scores
1.	Smell	6.63
2.	Colour	7.78
3.	Taste	6.75
4.	General Acceptance	7.02

Table 4: Showing the Nutritional Value (per 100 mg) of Dried Powdered Milk

Water	**3.16 g**
Energy	**362 Kcal**
Protein	**36.16 g**
Total Lipid	**0.77 g**
Carbohydrate	**51.98 g**
Fiber, Total Dietary	**0.0 g**
Ash	**7.93 g**

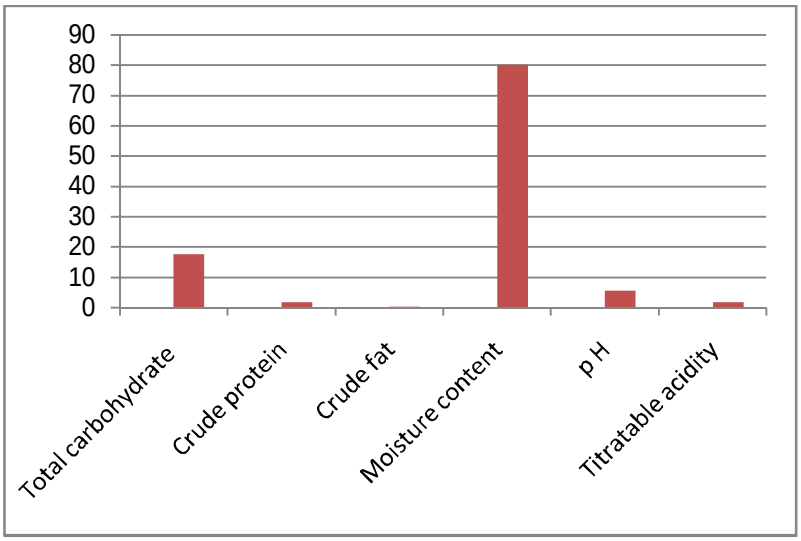

Figure 1: Physicochemical Analysis OF Powdered Milk Nono (%)

DISCUSSION

Powdered milk nono prepared as shown above was found to retain nutritional characteristics similar to nono produced or worked on by **[11]** shown in **Table 1**. The moisture content of the nono was high, 80%, **[11]** has reported that the moisture content of nono is higher than that of its close relative wara, carbohydrate, protein and fat were still retained although the fat level was low **[16-19]**. The titratable acid increased as a result of the acidic fermentation that has taken place in the milk with the introduction of starter culture, increase in acidity during fermentation has also been reported by earlier by **[19]** although the acid content of nono has been attributed to its lactic acid content which has been reported to give it its sensory and rheological properties as well as making it more digestible and energy yielding **[20]**. The result of the microbiological assessment of the nono produced is as shown in **Table 2**.

The total bacterial and fungal count of the product falls within the allowable limit of count in fermented or cultured dairy products, **[21, 22]**. The listed indicator organisms like the Colliform (*Escherichia coli), Staphylococcus aureus, Salmonella spp and Listeria monocytogenes* that have been recorded by early authors and whose presence in foods essentially fermented dairy products suggest faecal contamination and poor hygiene of food handlers during preparation were not found in this product **[11, 23, 24]**. This is contrary to earlier reports of previous authors who had encountered various forms of pathogenic bacteria in nono produced locally from raw freshly drawn cow milk **[11, 14, 18 & 25]**. Locally nono is prepared from raw unpasteurized milk which could be a rich medium for the growth of pathogenic and non pathogenic organisms **[18]**. Nono has however been shown as an excellent refreshing and nourishing drink that is used by nomadic cattle rearers, very much like yoghurt in taste, is being produced in limited daily consumable quantities due to its poor keeping quality. Knowledge of the biochemical and microbial changes that are associated with its spoilage and the various methods of preservation will obviously enhance the production and proper utilization on a larger scale **[3]**. The bacteria found in this product as shown in **Table 2** are most probably members of the genus lactobacillus (members of Lactic Acid Bacteria) which are common lactose fermenters found usually in fermented dairy products. These organisms have been recorded as probiotics while fermented dairy products are known prebiotic known to enhance normal functioning of the human gastrointestinal tract **[26]**. The sensory evaluation as shown in **Table 3** which was conducted by six semi-trained panelist who were members of staff of the institute, on a 9 point hedonic scale on smell, , color, taste and general acceptance showed that, the nono was of good quality and condition and was generally accepted for consumption. However powdered milk nono, if well prepared and preserved, can be a very refreshing and nourishing beverage that is affordable to many.

CONCLUSIONS

More work should be done on production of nono from powdered milk using known organisms as starter culture. The effects of fermentation on the antioxidant property of milk should be considered to enhance reduction of free radicals in the system thereby ensuring a healthy locally fermented dairy products for the masses. Also the microbial flora of the above product should be characterized and identified in order to avoid

consuming toxic microbes or their metabolite along with the product. To avoid self contamination of the product, critical hazard points should be guided jealously during production coupled with maintenance of environmental and personal hygiene. In conclusion people should be encouraged to produce and drink their own nono produced from fermented powdered milk as directed above as this could be refreshing, nourishing for consumption and aid in combating malnutrition in the under developed countries of Africa.

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