

Nutrient Contents and Sensory Quality Assessment of Home-Prepared Cheese and Yoghurt from Fresh Cow Milk

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ABSTRACT

Objective: This study was designed to assess the nutrient contents and acceptability of local cheese ('wara') and yoghurt.

Materials and Methods: Fresh cow milk was collected from Ijaye dairy farm, Oyo State, Nigeria. It was collected in three sterile containers of 2.5 litres each. Fresh cow milk and home-prepared cheese and yogurt were analyzed chemically using standard methods of AOAC, Atomic Absorption Spectrometry and Spectrophotometry. Data obtained were subjected to statistical analysis: means and standard deviation, analysis of variance (ANOVA) and means separated using Duncan's Multiple Range Test.

Results: Protein and fat contents of local cheese and yoghurt were higher than that of fresh milk. The values of the protein content of fresh milk were $4.25 \pm 0.01\text{g}/100\text{g}$ while that of local cheese and yoghurt were $4.70 \pm 0.06\text{g}/100\text{g}$ and $4.82 \pm 0.02\text{g}/100\text{g}$, respectively. The values of phosphorous and magnesium of local cheese and yoghurt were also found to be higher than that of fresh milk. Phosphorous in fresh milk, local cheese and yoghurt were $0.37 \pm 0.01\text{mg}/100\text{g}$, $1.04 \pm 0.03\text{mg}/100\text{g}$ and $1.06 \pm 0.04\text{mg}/100\text{g}$ while magnesium contents of fresh milk, cheese and yoghurt were $0.23 \pm 0.01\text{mg}/100\text{g}$, $1.04 \pm 0.02\text{mg}/100\text{g}$ and $1.06 \pm 0.03\text{mg}/100\text{g}$ respectively. The sensory analysis revealed that both cheese and yoghurt were well accepted.

Conclusion: Local cheese ('wara') and yoghurt produced locally should be introduced into Nigerian market to improve nutritional status of consumers and also could serve as complementary food. Local cheese and yoghurt have nutritional benefits beyond fresh cow milk.

Key words: Cheese, Yoghurt, Home-prepared, Cow milk, Dairy products

INTRODUCTION

Milk is the creamy whitish liquid produced from mammary glands of animals (1) and is often described as nature's nearly perfect single food for animals. It is natural food of the newborn mammal for which it provides the sole source of nourishment after birth (2). Its nutritive value includes proteins, carbohydrates, fats, minerals, vitamins and water. According to Richer (3) milk of all species is a complex biological fluid containing a wide variety of different constituents. The same nutrients are present in the milk of all species, but in different proportions. For example, the protein in human breast milk is considered the highest quality of protein in foods; Cow milk, Buffalo milk, Goat milk, Sheep milk, Camel milk follow in rank. However, the milk produced by the cow is the commonest and most commonly consumed by man.

Protein consumption in right proportion and adequate amount is inevitable for the effective body building and body metabolism. They are therefore considered to be of immense nutritional importance to man and animals. Nigeria like most other developing countries, is faced with acute protein shortage as protein intake falls short of the recommended minimum of Food and Agricultural Organization (FAO)

Food and Agricultural Organization (FAO), World Health Organization (WHO) recommended that the total daily protein intake should be 67g for the average Nigerian, of this 58% percent i.e. 39g should be of animal origin. But Food and Agricultural Organization survey in 1980

showed that only 20gms (i.e. 30%) of the protein recommendation was fulfilled(4)

Generally, the protein intake of an average Nigerian is grossly inadequate most especially, protein from animal sources such as from eggs, meat, milk and other dairy products.

Rather unfortunately, the dairy industry in Nigeria has suffered the greatest neglect because it has not been given its rightful place in the nation's livestock policies and programmes. There is need to preserve milk locally in form of dairy products (cheese and yoghurt) so that they can be available and affordable for the public. Surplus milk not immediately consumed needs to be preserved against period of scarcity.

Due to the rapidity of milk invasion with microorganisms, many attempts have been made in preserving milk and in the maintenance of its high nutritional value. Some of the methods employed include heat treatment and cooling (pasteurization), the use of preservatives and immediate processing of milk into products like cheese, butter, yoghurt, ice cream and chocolate.

Preservatives are not readily available in rural areas and cooling systems are not feasible due to lack of refrigerators and electricity. Stimulating efficient on-farm or village level processing therefore appears to be a better strategy in preventing milk spoilage.

Cheese and yoghurt for example provide a means of preserving milk. They are less perishable concentrated dairy products. They are excellent in their unique

flavour, less bulky, more palatable and easily digestible. Mocquot (5) stressed that one of the first aims of traditional cheese and yoghurt making was to find a way of keeping milk for period of several weeks, months or even years. Apart from improved qualities, there are other benefits derived from processing of milk into local cheese and yoghurt.

Milk is a splendid food for human beings. As a complete food, easily taken and easily digested and absorbed, milk is extremely valuable in the diet of children, invalids and convalescents on account of its value. No other single food is of so much value than milk (6).

Being a fluid, it is easily swallowed and the quantity given can be measured and regulated easily. It is more easily absorbed and requires less secretory effort than any other food and is therefore of great importance in gastric and intestinal diseases (7). The milk itself can be used in the production of home-made cheese and yoghurt.

Cheese and yoghurt are cheaper when produced locally and are more nutritious than refined ones because of the freshness. They also contribute to daily nutrient intake of the individuals. Cheese is a concentrated source of the nutrients which are naturally found in milk. Yoghurt is an excellent source of protein, calcium, riboflavin and vitamin B₁₂. When Yoghurt and cheese are compared to milk, they contain more calcium and protein because of the added cultures in these dairy products (8)

MATERIALS AND METHODS

Two and a half litres of milk was collected from Ijaye dairy farm, Oyo State, Nigeria. It was collected (2.5 litres each) in three sterile containers for analysis and for home-prepared cheese and yoghurt. Local cheese and yoghurt preparation were carried out the day the milk was collected. The fresh cow milk, local cheese and yoghurt were analyzed chemically in the laboratory. The samples of local cheese, yoghurt and cow milk were analyzed for moisture, crude protein, ash, lactose, fats using Standard Methods of Official Analytical Chemist (A.O.A.C) (9). The moisture content of the sample was determined by air oven method. Mineral analysis was determined (potassium and sodium) by digesting the ash of these samples with perchloric acid and nitric acid, and then taking the readings on Jenway digital flame photometer/Spectoronic 20. Phosphorous was determined by Vanado-molybdate colorimetric method. Calcium, iron, manganese, were determined spectrophotometrically by using Buch 200 Atomic Absorption Spectrophotometer (Buck Scientific Norwalk (10).

METHODS

The production processes of local cheese and yoghurt are as follows: Fresh cow milk was collected from Ijaye dairy farm, Oyo State, Nigeria and filtered with

muslin cloth. The filtered cow milk was then boiled initially under a low heat (65°C) for 20 minutes to prevent enzyme destruction and the heat was later increased to boil the milk for another 10 minutes. After boiling, 1.5ml of juice from Sodom apple - bombom leaf (Calotropis procera) was added to coagulate the milk, after which it was drained, and shaped. The sensory evaluation was made on the local cheese product and yoghurt.

For yoghurt, fresh milk was collected, filtered and mixed with warm water (ratio 1:4). The water was boiled initially to 100°C and cooled down to 50°C using thermometer to know the temperature of the water. Culture was dissolved in warm water before adding to the milk. The mixture was then incubated in a warmer for 6 - 8 hours. Stabilizer was prepared with boiled water to make gel which was also mixed with the milk mixture (sugar, flavour, colouring, etc). The mixture was allowed to cool and bottled. The yoghurt was refrigerated and sensory evaluation was made.

Sensory Evaluation

The dairy products (cheese and yoghurt) were evaluated using a 9-point hedonic scale, where a score of 1 is "dislike extremely" and a score of 9 is "like extremely." Twenty-five judges were randomly selected among the staff and students of Department of Transport and Tourism Studies, Redeemer's University to participate in the study. The Judges evaluated the products for taste, aroma, colour, flavour, texture and general acceptability.

Statistical Analysis

All the data obtained were analyzed using SPSS version 10.0 statistical packages. Means and standard deviation was calculated for all the samples. The method described by Larmond (10) was used to calculate Analysis of Variance (ANOVA). Means were separated using Duncan's Multiple Range Test of Steel and Torrie (11). Least significant difference (LSD) were used to separate the means and significance judged at $P < 0.05$.

RESULTS

In this study analysis of the proximate composition of fresh cow milk showed the moisture contents to be $42.25 \pm 0.06\%$, crude protein $4.15 \pm 0.01\text{g}/100\text{g}$, fat $16.45 \pm 0.07\text{g}/100\text{g}$, ash $2.90 \pm 0.04\text{g}/100\text{g}$, and lactose $3.6 \pm 0.04\text{g}/100\text{g}$, while the values for the composition of cheese were; moisture content $40.00 \pm 0.03\text{g}/100\text{g}$, crude protein $4.70 \pm 0.06/100\text{g}$, fat $17.20 \pm 0.04\text{g}/100\text{g}$, ash $2.95 \pm 0.07\text{g}/100\text{g}$, and lactose $3.7 \pm 0.03\text{g}/100\text{g}$. Likewise, the moisture content of yoghurt was found to be $43.0 \pm 0.03\%$, crude protein $4.82 \pm 0.02\text{g}/100\text{g}$, fat $19.50 \pm 0.07\text{g}/100\text{g}$, ash $3.45 \pm 0.06\text{g}/100\text{g}$ and lactose $4.2 \pm 0.04\text{g}/100\text{g}$ (Table 1).

Micronutrients composition of fresh cow milk, cheese and yoghurt are as shown in Table 2. Calcium content of fresh cow milk, cheese and yoghurt were $0.85 \pm 0.01\text{mg}/100\text{g}$, $1.00 \pm 0.02\text{mg}/100\text{g}$ and $1.05 \pm 0.02\text{mg}/100\text{g}$ respectively. Phosphorous values

were $0.37 \pm 0.01 \text{mg}/100\text{g}$ in fresh cow milk, $1.04 \pm 0.03 \text{mg}/100\text{g}$ in cheese and $1.06 \pm 0.04 \text{mg}/100\text{g}$ yoghurt. In addition the analysis of potassium and magnesium had the following values of $3.05 \pm 0.03 \text{mg}/100\text{g}$, $1.03 \pm 0.01 \text{mg}/100\text{g}$, $1.05 \pm 0.01 \text{mg}/100\text{g}$ and $0.23 \pm 0.01 \text{mg}/100\text{g}$, $1.04 \pm 0.02 \text{mg}/100\text{g}$, $1.06 \pm 0.03 \text{mg}/100\text{g}$ respectively. Sodium contents were as follows: for fresh cow milk, $1.06 \pm 0.04 \text{mg}/100\text{g}$; local cheese, $1.01 \pm 0.03 \text{mg}/100\text{g}$, and yoghurt, $1.06 \pm 0.03 \text{mg}/100\text{g}$. For iron, fresh cow milk contained $7.0 \pm 1.04 \text{mg}/100\text{g}$; local cheese had $6.00 \pm 1.02 \text{mg}/100\text{g}$, while yoghurt contained $7.2 \pm 0.03 \text{mg}/100\text{g}$ of iron.

Table 1: Proximate Chemical Composition of Fresh Cow Milk, Local Cheese and Yoghurt (g/100g)

Minerals	Fresh Cow Milk	Cheese	Yoghurt
Moisture%	42.25 ± 0.06	40.00 ± 0.03	43.0 ± 0.03
Crude Protein	4.25 ± 0.01	4.70 ± 0.06	4.82 ± 0.02
Fat	16.45 ± 0.07	17.20 ± 0.04	19.50 ± 0.07
Ash	2.90 ± 0.04	2.95 ± 0.07	3.45 ± 0.06
Lactose	3.6 ± 0.04	3.7 ± 0.03	4.2 ± 0.04

Table 2: Mineral Composition of Fresh Cow Milk, Local Cheese and Yoghurt (mg/100g)

Minerals	Fresh Cow Milk	Cheese	Yoghurt
Calcium	0.85 ± 0.01	1.00 ± 0.02	1.05 ± 0.02
Phosphorus	0.37 ± 0.01	1.04 ± 0.03	1.06 ± 0.04
Potassium	3.05 ± 0.03	1.03 ± 0.01	1.05 ± 0.01
Magnesium	0.23 ± 0.01	1.04 ± 0.02	1.06 ± 0.05
Sodium	1.06 ± 0.04	1.01 ± 0.03	1.06 ± 0.03
Iron	7.00 ± 1.04	6.00 ± 1.02	7.2 ± 1.03

The sensory evaluation of cheese and yoghurt revealed significant differences for taste, aroma, colour, consistency and overall acceptability of the products as shown in Table 3. The overall acceptability of the products showed that majority preferred cheese than yoghurt.

The local cheese had a mean score of 8.05, while yoghurt had a mean score of 7.70. There was significant difference between cheese and yoghurt samples ($p < 0.05$).

DISCUSSION

Milk is a splendid food for human beings. As a complete food, easily taken and easily digested and absorbed, milk is extremely valuable in the diet of children, invalids and convalescents on account of its value. In most developing countries poor families are under nourished on account of low income and inability to produce enough food for themselves. They survive on high starch, low protein foods like rice, maize, sweet potatoes, yams, cassava, etc and children are most badly affected (1). Milk is nutrient-rich food that provides a large number of

nutrients relative to the calories consumed (12). Milk is a delicious beverage and can be used as a base for other drinks such as hot chocolate or speciality coffees. Milk is a common ingredient in recipes such as cream soups, sauces and batters. It can also be used as a base to make delicious desserts, custards, sauces and mousses as complementary food for young children (13).

The micronutrients found in local cheese and yoghurt in this study will contribute to the daily nutrient intake of children and adult like. The local cheese analyzed had considerable amount to support the diet of an individual (14). Cheese had been shown to reduce plague and stimulate saliva which helps to keep the mouth clean therefore cheese is good for strong and healthy teeth (5). The results of the micronutrients contents of cheese and yoghurt found in this study corroborated that of previous studies (15). According to Bachmann (16) the micronutrients in cheese and yoghurt could improve the nutritional status of children and adult alike. The value of protein, fat and lactose contents of home prepared cheese and yoghurt had increased compare with fresh cow milk. It showed that the additional ingredients or additives to fresh cow milk in preparation of local cheese and yoghurt had improved the nutrients of the products.

The magnesium found in local cheese and yoghurt is important in a variety of metabolic functions particularly the transmission of nerve impulses because its lack in the body produces nervousness and irritability, and even cramps and spasms. Since local cheese and yoghurt are rich in magnesium they can be regarded as foods important for the nerves.

The sensory attributes (taste, aroma, colour, consistency and overall acceptability) of local cheese and yoghurt showed that the local cheese would be most preferred by the customers. Local yoghurt is the second in rank which were preferred by other consumers of the product. The two products are very good to improve the nutritional status of an individual and also could be consumed because of their health benefits; for example, cheese can boost the immune system. Eating certain types of cheese has been found to actually have a positive effect on the immune system. This prevents many forms of illness and diseases (17).

Cheese ('wara') also is a leading product for people who need to gain weight. However some people need to gain weight for example an athlete, an aged may become too thin which is dangerous for the health, cheese could be good as part of the balanced diet and lifestyle (18).

Local yoghurt is nutritionally rich in proteins fat and calcium. It has nutritional benefits beyond those of milk (6). People who are moderately lactose-intolerant can consume yoghurt without ill effects, because much of the lactose in the milk precursor is converted to lactic acid by the bacterial culture (6).

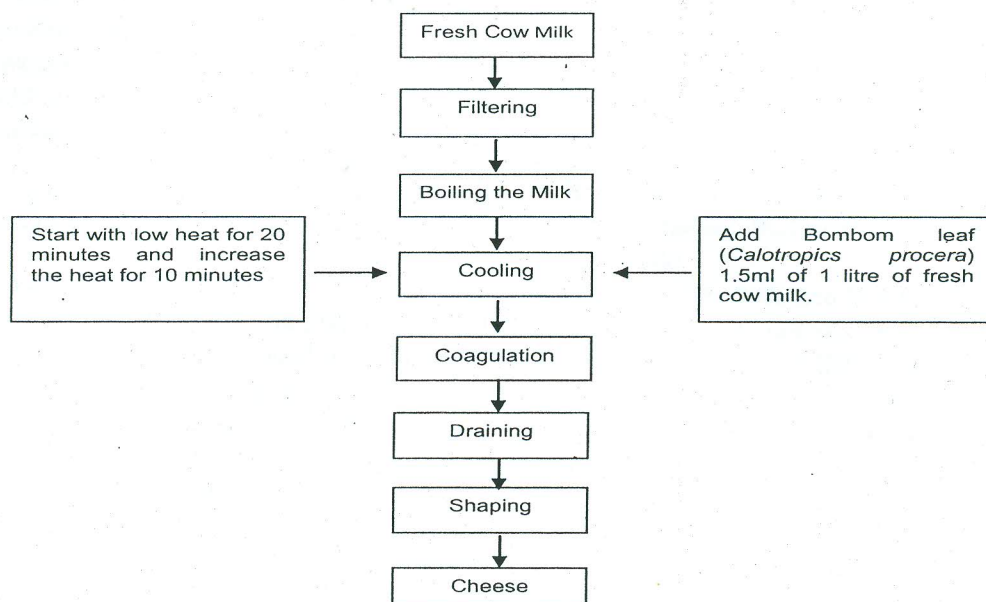


Fig 1: Flow chart in preparation of local "Cheese"

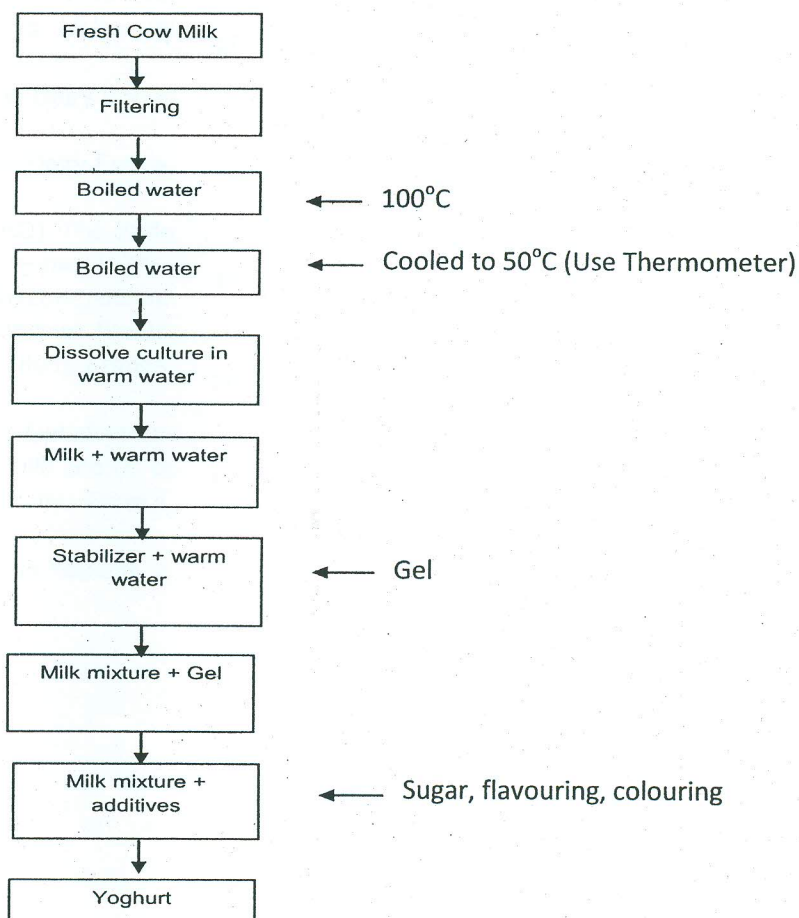


Fig. 2: Flow chart in preparation of "Yoghurt"

Table 3: Sensory Properties of Fresh Cow Milk, Local Cheese and Yoghurt

Simple	Taste	Aroma	Colour	Flavour	Texture	Overall Acceptability
Cheese	7.05a	7.06a	7.08a	8.02a	8.01a	8.05a
Yoghurt	6.05b	6.07b	7.02a	7.06b	7.04b	7.05b

Mean value of Twenty-Five (25) Judges Scores, mean for each attribute followed the same letters are not significantly different by Turkey's test. Higher values indicate greater preference.

Yoghurt may also be used in preventing antibiotic-associated diarrhoea, promote good gum because of the lactic acid present in the product (19). The consumption of low-fat yoghurt can promote weight loss, especially due to the calcium in the yoghurt (20).

Yoghurt could be introduced as a food drink at local festivals, marriage ceremonies, parties, family gatherings and so on (21). It is therefore worthwhile to produce cheese and yoghurt locally to contribute to the daily nutrient intake of the individual.

CONCLUSION

This study has shown that the home prepared traditional cheese and yoghurt can be produced following the flow chart provided. Cheese and yoghurt had an increased macronutrients and micronutrient contents over that of fresh milk and were also accepted by the public. The local cheese and yoghurt could be consumed by children and adult alike to improve their daily nutrient intake and should be available in Nigerian markets for their health benefits.

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