Nutritional Composition and Minerals value of Functional Yoghurts from Soursop Fruit, Cowmilk and Goatmilk

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Abstract

Yoghurt is one of the oldest fermented milk products known, its popularity is due to its characteristics; the pleasant aromatic flavour, thick creamy consistency and reputation as food associated with good health. Yoghurts were produced from soursop fruit, cowmilk and goatmilk. The yoghurts produced were subjected to chemical, nutritional and mineral analysis using AOAC methods. There is a slight increase in the moisture content of the soursop juice, cowmilk and goatmilk from (88.55%, 86.36% and 73.32%) to (91.87%, 86.38% and 73.43%) in the yoghurt samples. Also, a slight increase was observed in the fat content of fresh soursop juice, cow and goatmilk samples from (0.00%, 2.03% and 9.70%) to (0.02%, 2.06% and 9.90%) in yoghurt samples. The average vitamin C content of soursop juice was 61.8mg/100ml which later reduced to 16.4mg/100ml in soursop yoghurt. It is conclusive that the proximate analysis showed that soursop yoghurt had high ascorbic acid content of (16.4mg/100ml) which signifies the potential use of the fruit as a good antioxidant. This study also indicates that the levels of calcium, iron, magnesium, potassium and sodium were abundant in the yoghurts which reveal that the yoghurts were rich in mineral composition. Also, cowmilk yoghurt enhanced the overall acceptability in terms of colour, flavour, taste and thickness.

Keywords: Yoghurt, Cowmilk, Goatmilk and Soursop

Introduction

Fermented foods are of great significance since they provide and preserve vast quantities of nutritious foods in a wide diversity of flavours, aromas and textures, which enrich the human diet. Over 3500 traditional, fermented foods exist worldwide. Fermented foods have been with us since humans arrived on earth and fermented milks have long been an important component of nutrition and diet. Originally, fermented milks were developed as a means of preserving nutrients.

Yoghurt is one of the oldest fermented milk products known, its popularity is due to its characteristics; the pleasant aromatic flavour, thick creamy consistency and reputation as food associated with good health. Yoghurt is produced through fermentation of pasteurized milk by Streptococcus thermophilus and Lactobacillus delbrueckii subsp. bulgaricus. Its acidity varies from 0.7-1.1% lactic acid with pH approximately 4.0 to 4.2. The role of yoghurt and dairy products in human nutrition, health and development cannot be overemphasized.

Diversification of food processing using fruit juice is still limited. The diversity of products are needed to give alternative choice of products to consumers. The processing of soursop fruit to yoghurts could exploit potential market for the fruits and the processing of fresh goat milk into yoghurts is still at cottage level. Therefore, there is need...
for increased consumption of fruits (non-dairy) products especially that of underutilized fruits[7] as they are potential sources of health-beneficial (bioactive) compounds such as antioxidant vitamins, polyphenols and dietary fibre. These bioactive compounds are known to have inverse relationships with the risk of chronic diseases.[8-9] In the efforts to offer variety and competition in the market, new research is in progress on the use of carrot juice in yoghurt industry.[10-11][12] reported the use of ginger spice to maintain microbial stability of pasteurized mango juice,[13] showed that extracts of Aframomum danielli preserved quality attributes of cashew juice.

Present day consumers prefer foods that promote good health and prevent diseases. Such foods constitute current and future waves in the evolution of the food development cycle.[14] Also, food scientists have attempted to develop new technologies that improve the quality and quantity of products, while consumers have also become more critical on the use of synthetic additives to preserve food safety or enhance characteristics such as colour and flavour.[15] Study has shown that there are different varieties of wild fruits and lesser known vegetables in abundance in Nigeria that could be of health benefit.[16] The availability of fruits is short-lived due to seasonality and the perishable nature. It is therefore important to study one of those seasonal fruits and its usefulness in reducing some of the non-communicable diseases in Nigeria.

One such fruit is Annona muricata L. (soursop), this fruit is underutilized and this unexploited fruit may be of great potential in combating micronutrients deficiency and non-communicable diseases. Soursop (Annona muricata L.) fruits are important as they are good sources of vitamins, dietary fiber and minerals. They also provide flavour, aroma and texture to the pleasures of eating food as well as are presumed to have anticancer and antioxidant capabilities.[17-19][20-21] contend that compounds from soursop tested on breast cancer cells in culture were more effective than chemotherapy in destroying these cells.[21] worked on determining the best stabilizer for soursop juice yoghurt while[22] examined the dietary fibre, ascorbic acid and proximate composition of tropical underutilized fruits.

Cow milk is an exceptionally good source of protein because of its excellent assortment of amino acid; it is expensive due to its rising cost. Cow milk accounted for 83% of global milk production in 2010[23] and it contains more protein and minerals, especially calcium and phosphorus than human milk. Raw cow’s milk has all eight essential amino acids in varying amounts, depending on stage of lactation.

Goat milk has many benefits on human health, even more than cow milk. Goat milk and its products such as cheese and yoghurt have an important role in human nutrition because of higher digestibility (small fat globules) and less allergic reactions (low as1-casein content). The benefits are also attributed to biofunctional components such as medium-chain triglycerides, polysaturated fatty acids and some serum proteins.[24-25] Earlier studies show that goat milk has important and beneficial effects on bioavailability of copper, zinc, selenium and iron.[26-28, 24]

In this paper, the aim is to examine processing of yoghurts from soursop fruit, cow milk and goat milk in harnessing its nutritional advantages such as high protein, fats and minerals, which will also encourage its consumption because of its health benefits.

Thus, the objective of this study is to compare the nutritional, mineral and sensory properties of dairy (cow and goatmilk) and non-dairy (soursop juice) yoghurts.

**Materials and Methods**

**Sources of materials**

The soursop fruits (Annona muricata) used was procured from Oje market, Ibadan, Oyo State, Nigeria. The cow milk was obtained from the Teaching and Research Unit, Dairy Farm, University of Ibadan, while the goat milk was purchased from Fulani settlement in Odeda village, along Iseyin road, Ibadan.

**Soursop juice preparation**

The ripe and matured soursop fruits were washed with clean water, hand-peeled and de-seeded (removal of the seeds). 100g of the pulp was blended with 1000ml of distill water using electric blender (Oster, UL-564A, Mexico) several times. The pulp was filtered using (muslin cloth) to obtain soursop juice.[29]

**Soursop yoghurt preparation**

The soursop juice was pasteurized at 90°C for 30 minutes, cooled to 43°C. The yoghurt starter culture (Streptococcus thermophilus, Lactobacillus bulgaricus and Lactobacillus acidophilus) of 5g was added to a litre of the pasteurized juice, mixed thoroughly and incubated at 43°C for 8hours, cooled to 4°C and soursop yoghurt was produced.[21]

**Cowmilk yoghurt preparation**

The fresh cow milk was sieved, in order to remove any foreign matter like hair or stone during milking; it was pasteurized at 73°C for 20 minutes, cooled to 43°C. The yoghurt starter culture (Streptococcus thermophilus, Lactobacillus bulgaricus and Lactobacillus acidophilus) of 5g was added to a litre of pasteurised milk and incubated at 43°C for 11hrs. The yoghurt was allowed to cool to 4°C to form cow milk yoghurt.[30]

**Goatmilk yoghurt preparation**

The fresh goat milk was sieved to remove any foreign matter like hair or stone during milking, it was pasteurized at 73°C.
for 20 minutes; cooled to 43°C. The yoghurt starter culture (Streptococcus thermophilus, Lactobacillus bulgaricus and Lactobacillus acidophilus) of 5g was added to a litre of pasteurised goat milk and incubate at 43°C for 11hrs. The yoghurt was allowed to cool to 4°C to form goat milk yoghurt.[32]

Proximate analysis
The proximate composition of the yoghurt samples were analyzed for moisture, ash, fat, protein and crude fibre using the recommended methods of Association of Official Analytical Chemist AOAC 2012 while the total carbohydrate content (%) in the samples was calculated by difference method.

Chemical Analysis
Vitamin C (as ascorbic acid)

The method of titration using dye solution modified by[33] was used. The working standard solution of ascorbic acid was prepared (100mg Ascorbic acid in 100ml of 4% oxalic acid solution in a standard flask i.e.1mg/mL): 5mL working solution was pipetted into a 100ml conical flask, 10ml of 4% oxalic acid was added and titrated against dye solution (V1 mL), containing 2-6 dichlorophenol indophenol which oxidizes ascorbic acid and the appearance of pink colour marked the end point. The amount of dye consumed is equivalent to the amount of ascorbic acid. Thereafter, 5g of yoghurt sample was added to 100ml of oxalic acid and centrifuged at 100 rpm; 5mL of supernatant was taken and 10ml of 4% oxalic acid was added and titrated against the dye solution to obtain titre V2 mL.

Calculation

\[
\text{Ascorbic acid (mg/100g)} = \frac{0.5 \times V_2 \times 100\text{mL} \times 100}{V_1 \text{mL} \times 5 \times (\text{wt of sample})}
\]

Mineral Analysis
The mineral content of each sample was determined[34]: 5g of each sample was weighed into a 250ml Erlenmeyer flask; 25ml Hydrochloric acid (HCL) solution was added and was brought to heating. It was cooled and transferred to a 50ml volumetric flask and made to volume with deionized water and mixed thoroughly. The solution was filtered through No. 1 Whatman filter paper, while the filtrate was used for mineral determination using corresponding standards and blanks. The filtrate of each sample was used for Atomic Absorption Spectrophotometric analysis. The minerals (Ca, Mg, K, Na, Fe and Zn) content in the yoghurt samples were determined using BUCK Scientific; Atomic Absorption Spectrophotometer (Model 210/211VGP). The spectrophotometer was connected to the source of electric power and ignition was turned on. Buck cathode lamp was used for each element with the machine set at wavelength for the respective elements: Ca – 239.9nm, Cu – 327.4nm, Fe-372nm, Pb-283.3nm, Mg-285.2nm, K – 262.8nm, Na – 330.2nm and Zn-307.6nm respectively.

Sensory Analysis
Sensory evaluation of the yoghurts was carried out on the colour, flavour, taste and general acceptability using a nine-point hedonic scale, varying from “dislike extremely” (score 1) to “like extremely” (score 9) according to a method of[35] 10 untrained panel members carried out the sensory evaluation. The yoghurts were served in a coded and transparent white glass cups for proper assessment. The yoghurts were served in triplicate and coded separately.

Statistical Analysis
All analyses were carried out in triplicates and mean values were recorded as data which were analyzed using ANOVA at ps0.05 and means were separated using Tukey’s test in SARS statistical package.

Results and Discussion
Proximate composition and vitamin C contents of soursop juice, cow and goat milks
The average ascorbic acid content of soursop juice was 61.8mg/100ml Table 1. This result is in line with the findings of[37], while[38] reported value of 70mg/100g for ascorbic acid content of soursop fruit obtained from the southern parts of Nigeria.[37] also reported ascorbic acid content of 62.5mg/100 g for soursop pulp from Ghana. The high value of ascorbic acid in soursop fruit signifies the potential use of the fruit as a good antioxidant. The recommended daily intake (RDI) of ascorbic acid is about 30 mg/day for adults and 17 mg/day for children.[39] The African mango seeds had a low ascorbic acid content of (1.00mg/100 g). The differences in the ascorbic acid results may be attributed to varietal differences and pre-harvest environmental conditions. The underutilized fruits have high potential to significantly complement the daily Vitamin C requirements of consumers when incorporated into diets. Vitamin C has been associated with therapeutic benefits including maintenance and protection of skin and teeth as well as the prevention of scurvy, in addition to being an antioxidant. The moisture content of soursop juice (88.55%) was significantly higher than other samples Table 1. In addition, goat’s milk was often reported to provide higher proportion of total solids, protein and fat than cow milk[39] which is similar to the report of this study where goat milk had higher protein and fat values. Preparation of yoghurt slightly changed the level of protein, fat, ash, total solids and moisture for goat and cow milk products, suggesting the effect of the indigenous microflora on such constituents. Goat’s milk has some special nutritional properties that make it attractive to some consumers for example; it is easier to digest than cows’ milk and has certain therapeutic values;[40, 24] reported that the major differences between goats’ and cows’ milks are...
related to the proportions of the different kinds of casein and also their different structures and sizes of fat globules and protein micelles. All these differences could lead to the milk behaving differently during processing which can affect the final quality of goat’s milk dairy products. The special characteristics concerning the composition of goat milk mean that its nutritional utilization is markedly higher than cow milk. Thus, the protein of goat milk is more digestible and less allergenic.

Cow milk accounted for 83% of global milk production in 2010. The protein in cow milk is of high-quality (defined as protein that supports maximal growth), containing a good balance of all the essential amino acids, including lysine. Many human diets are deficient in certain essential amino acids, for example wheat and maize-based diets contain only 57 percent and 58 percent of required levels of lysine, and cassava-based diets are deficient in leucine, valine and isoleucine, containing only 79 percent of required levels. Reported that there has been a general increase in the volume of goat milk produced. Milk from goats (Capra hircus) accounted for 2.4% of global milk production in 2010. Urban consumers believe that goat dairy products have a good ecological image, are more digestible, healthy for many gastrointestinal illnesses, and are less allergenic than cow milk. Consequently, goat milk and goat dairy products have real future economic potentials.

### Proximate Analysis of Yoghurt Samples

The moisture content of the yoghurts samples varied from 73.43% to 91.89% and were significantly different from one another (p<0.05). The moisture content of sour sop yoghurt was significantly higher than that of cow milk and goat milk yoghurt samples Table 2. Higher percentage of moisture content in the sour sop yoghurt may be due to the high percentage in the moisture content of the sour sop juice, its ripening stage and the method used in extracting the pulp for juice. However, reported that the high moisture content observed in the pulp of the Annona species (soursop and sweetsop) and African mango reflects the limited shelf-life of these climacteric fruits and thus, the need for value addition of the fruits to extend their shelf-life. The fruits may therefore be tapped for commercial production of juices, jam and jellies. Moisture content is a measure of the water content in a product sample. According to, the moisture content accounts for the textural property of the product sample.

The crude protein content of the yoghurt samples varied from 0.92% to 8.75% and were significantly different from one another (p<0.05). Crude protein value of goat and cow milk yoghurts (8.75% and 5.55%) were higher because they are from animal source- containing a good balance of all the essential amino acids while sour sop yoghurt had the least protein content of 0.92% due to the fact that it was from non-dairy source. Fat content of yoghurt has negative impact on the shelf stability of yoghurts. Fats are used by cells of organs and glands to provide energy and in the synthesis of some of their secretions. Yoghurts are good sources of protein, fat and carbohydrates (The Dairy Council, 2010). The average protein content of probiotic yoghurt from cow milk was 5.5% (Table 2). These results were in line with the findings of who reported that the protein contents of low – fat stirred yoghurt ranged from 3.4 to 6.0%. Preparation of yoghurt slightly changed the level of protein, fat, ash, total solids and moisture for goat and cow milk products, suggesting the effects of indigenous microflora on such constituents. The high carbohydrate value for sour sop yoghurt is because of its plant origin.

### Mineral Compositions of Soursop Juice, Cowmilk and Goatmilk

Soursop juice contained a significant amount of important minerals like potassium (840.87mg/100g) being the highest, followed in descending order by magnesium (102.84mg/100g), calcium (67.03mg/100g), sodium (42.30mg/100g), iron (37.37mg/100g) and zinc (20.73mg/100g). The calcium content of the cow milk (3950.26mg/100g) was significantly different from that of goat milk (3844.98mg/100g). While goatmilk contained significantly higher amounts of magnesium, potassium, sodium, iron and zinc than cow milk and soursop. observed significant changes in the concentration of mineral elements in goat milk in the first 7 weeks of lactation. Also, found significant influence of season and breed on the concentration of most mineral elements in sheep milk. The content of major elements in milk differs significantly from the content in blood. Calcium and magnesium play significant roles in photosynthesis, carbohydrate metabolism, nucleic acids and binding agents of cell walls. Calcium assists in teeth development. Magnesium is essential mineral for enzyme activity and like calcium and chloride; magnesium also plays a role in regulating the acid-alkaline balance in the body. Phosphorus is needed for bone growth, kidney function and cell growth and also plays a role in maintaining the body's acid-alkaline balance. Minerals contribute to the structures of essential enzymes and the regulation of the activities of some enzymes. Potassium is an essential nutrient and has an important role in the synthesis of amino acids and proteins.

Sodium is the major cation in the extracellular fluids and is an important regulator of osmotic pressure, acid-base balance and cellular membrane potential and it is also important for the active transportation of substances through the cellular membrane and the contribution of cow milk to daily sodium intake in human nutrition is low, but cheese and some cream products which contain added quantities of salt, can provide significant sources of.
of sodium. Calcium is responsible for many regulatory functions, such as normal cardiac rhythm maintenance, blood clotting, hormone secretion, muscle contraction and enzyme activation. Milk and dairy products (cheese and yoghurt) are very rich sources of calcium. The majority of dietary calcium (70%) comes from dairy products because in milk, casein micelles constitute the natural carrier of calcium. The RDA for calcium is difficult to reach without consuming milk and dairy products. In the past, special attention was devoted to the bioavailability of calcium from milk. The average calcium absorption from cow milk varies between 21% and 45% and the bioavailability of calcium from cheese and yoghurt equals to those from milk.

Zinc is very important for growth, sexual development, the healing of wounds as well as normal functioning of the immune system and other physiological processes. Zinc is a component of the hormone insulin and it assists in the functioning of several other hormones that are important for reproduction and synthesis of DNA, RNA and proteins. Zinc is also a co-factor of many enzymes that are included in most of metabolic processes. Dairy products such as milk, cheese and yoghurt are very important in human nutrition, but an insufficient source of zinc. It is estimated that in western countries the contribution of dairy products to the total zinc intake ranges from 19 to 31%.

Mineral Compositions of Yoghurt Samples: Table 4 shows the mineral compositions of fresh yoghurt samples. Results showed that the mineral compositions of yoghurt samples were significantly different from one another (p<0.05). From this study, it can be deduced that fermentation was found to cause reduction in the mineral (Ca, Mg, K, Na, Fe and Zn) contents of all the yoghurt samples when comparing Table 3. This was in agreement with the observation of who reported that during ‘ugba’ processing, fermentation was found to cause reduction in its mineral (Ca, Mg, K and P) contents and fermentation however improved the protein quality and nutritive value of ‘ugba’. Essential minerals are present in milk products in varying levels depending on technological treatments of the products, the type of milk-base used and the accuracy of analysis. In this study, high concentrations of most minerals, especially macro-elements sodium, potassium and calcium were found whereas most micro-elements concentrations have very low as in yoghurt samples.

The levels of calcium, iron, magnesium, potassium and sodium were high in cow, goat and soursop yoghurts; which showed that cow milk, goat milk and soursop fruit are rich in mineral composition. Calcium is one of the abundant minerals in milk and milk products and it is essential in bone and tooth mineralization, blood clotting, hormone

### Table 1. Means Value of Proximate Composition and Vitamin C of Fresh Soursop Juice, Cow and Goat milk Samples

<table>
<thead>
<tr>
<th>Sample</th>
<th>Moisture content %</th>
<th>Protein %</th>
<th>Fat %</th>
<th>Ash %</th>
<th>CHO %</th>
<th>Vitamin C mg/100ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soursop Juice</td>
<td>88.55a</td>
<td>5.78b</td>
<td>0.00c</td>
<td>0.34c</td>
<td>5.35c</td>
<td>61.80a</td>
</tr>
<tr>
<td>Cowmilk</td>
<td>86.36b</td>
<td>5.11c</td>
<td>2.03b</td>
<td>0.72b</td>
<td>5.79b</td>
<td>0.03b</td>
</tr>
<tr>
<td>Goatmilk</td>
<td>73.32c</td>
<td>8.94a</td>
<td>9.70c</td>
<td>1.02a</td>
<td>7.02a</td>
<td>0.02b</td>
</tr>
</tbody>
</table>

Means on the same column with the different superscripts are significantly different from one another (p<0.05)

CHO: Carbohydrate

### Table 2. Means Values of Proximate Composition of Fresh Yoghurt Samples

<table>
<thead>
<tr>
<th>Samples</th>
<th>Moisture Content %</th>
<th>Crude Protein %</th>
<th>Fat %</th>
<th>Fibre %</th>
<th>Ash %</th>
<th>CHO %</th>
<th>Vit.C (mg/100ml)</th>
<th>Viscosity (dps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soursop Yoghurt</td>
<td>91.87a</td>
<td>0.92d</td>
<td>0.02d</td>
<td>0.19a</td>
<td>0.55d</td>
<td>6.61c</td>
<td>16.4a</td>
<td>0.18d</td>
</tr>
<tr>
<td>Cowmilk Yoghurt</td>
<td>86.38b</td>
<td>5.55c</td>
<td>2.06c</td>
<td>0.00b</td>
<td>0.82c</td>
<td>5.18c</td>
<td>0b</td>
<td>1.62a</td>
</tr>
<tr>
<td>Goatmilk Yoghurt</td>
<td>73.43c</td>
<td>8.75b</td>
<td>9.90b</td>
<td>0.00b</td>
<td>1.23b</td>
<td>6.69b</td>
<td>0b</td>
<td>1.56b</td>
</tr>
</tbody>
</table>

Means with the same superscripts on the same column are not significantly different from one another (p>0.05)

### Table 3. Mineral composition of fresh Soursop Juice, Cowmilk and Goatmilk

<table>
<thead>
<tr>
<th>Samples</th>
<th>Calcium (mg/100g)</th>
<th>Magnesium (mg/100g)</th>
<th>Potassium (mg/100g)</th>
<th>Sodium (mg/100g)</th>
<th>Iron (mg/100g)</th>
<th>Zinc (mg/100g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soursop Juice</td>
<td>67.03c</td>
<td>102.84c</td>
<td>840.87c</td>
<td>42.30c</td>
<td>37.37c</td>
<td>20.73c</td>
</tr>
<tr>
<td>Cowmilk</td>
<td>3950.26a</td>
<td>1822.30a</td>
<td>4582.66b</td>
<td>5415.88b</td>
<td>6.85b</td>
<td>26.84b</td>
</tr>
<tr>
<td>Goatmilk</td>
<td>3844.98b</td>
<td>584.23b</td>
<td>5103.82a</td>
<td>6269.98b</td>
<td>11.34a</td>
<td>66.75a</td>
</tr>
</tbody>
</table>

Means with the different superscripts on the same column are significantly different from one another (p<0.05).
secretion and nerve transmission. Goat milk yoghurt sample has the highest calcium with 640.75mg/100g and soursop yoghurt with the least with 40.05mg/100g (Table 4). Goat milk has many benefits on human health, even more than cow milk. Goat milk and its products such as cheese and yoghurt have an important role in human nutrition because of higher digestibility (small fat globules) and less allergic reactions (low αs1-casein content). The benefits of goat milk are attributed to bio-functional components such as medium-chain triglycerides, polyunsaturated fatty acids and some serum proteins.[40, 24, 25] Studies showed that goat milk has important and beneficial effects on bioavailability of copper, zinc, selenium and iron.[26-27]

The levels of magnesium (in soursop, cow milk and goat milk yoghurt) recorded in this study ranged from 25.75 to 31.95mg/100g and were much lower than the mean value of 406±20mg/kg as reported by.[65] The values were all lower than values obtained for all yoghurts analyzed by[66] which ranged from 101±1.14 to 144±7mg/g. Magnesium, a required cofactor for over 300 enzyme systems in the body, is related to calcium and phosphorus in function. Studies suggest a positive correlation between high magnesium intake in humans and increased bone density.[67] Sodium (Na) salt is necessary in the body for the control of extracellular fluid volume and blood pressure and for the transport of many nutrients into and out of cells. Sodium and potassium are essential minerals in human nutrition, but their deficiencies are rare since their intakes (especially that of sodium) usually exceed the recommend values.[68] In this study, soursop yoghurt had the highest sodium level of 85mg/100g and cheese sample the least with 17mg/100g.

The values of iron (Fe) and (Zn) contents of yoghurts from this study ranged from 7.85mg/100g to 15.35mg/100g and 0.48mg/100g to 0.61mg/100g respectively. Potassium and sodium were the most abundant minerals in soursop yoghurt followed by cow yoghurt and goat yoghurt. Soursop yoghurt (Table 4) contains more potassium content of 2457.75mg/100g than values reported by[69] with 278 mg of potassium and 3.3g of ash in every 100g fruit pulp. Potassium was also found as one of the abundant minerals in some selected vegetables,[70] in this study, potassium content (soursop, cow milk and goat milk yoghurt) was much higher than the mean amount of potassium in cow milk yoghurts reported by[71] 1711±41mg/kg. The minerals (potassium and sodium) in soursop yoghurt were higher than those of some commonly consumed plant foods such as cultivated and wild yams[72], cassava products[73], edible wild seeds[74], and green leafy vegetables.[73, 75] The amount of potassium shows great variability with the breed of the animal, with highest values in cow’s cheeses and lowest in ewe’s cheeses.

**Sensory Evaluation of Soursop, Cow Milk and Goat Milk Yoghurts**

The mean sensory scores of organoleptic evaluation and acceptability of the different yoghurt samples are shown in Table 5. The statistical analysis revealed that there were no significant difference (p>0.05) among the yoghurt samples in sensory attributes. The mean scores for flavour ranged from 5.30±1.56 to 7.00±1.38. A higher score for flavour of cow milk yoghurt was observed indicating a higher acceptability due to its familiarity among panelists. Goatmilk and cowmilk yoghurts have the highest mean scores for appearance of all the samples evaluated because of the high fat content in the samples. The mean scores for thickness of yoghurt samples ranged from 5.70±1.30 to 7.50±1.39 and the level of likeness was in increasing orders of cow milk yoghurt, goat milk yoghurt and soursop yoghurt.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Calcium (mg/100g)</th>
<th>Magnesium (mg/100g)</th>
<th>Potassium (mg/100g)</th>
<th>Sodium (mg/100g)</th>
<th>Iron (mg/100g)</th>
<th>Zinc (mg/100g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soursop Yoghurt</td>
<td>40.07d</td>
<td>31.95b</td>
<td>2454.75a</td>
<td>85.00a</td>
<td>12.78b</td>
<td>0.61b</td>
</tr>
<tr>
<td>Cowmilk Yoghurt</td>
<td>299.63b</td>
<td>25.75d</td>
<td>1344.25b</td>
<td>70.00b</td>
<td>15.35a</td>
<td>0.51c</td>
</tr>
<tr>
<td>Goatmilk Yoghurt</td>
<td>640.75a</td>
<td>26.40c</td>
<td>869.50c</td>
<td>60.00c</td>
<td>7.85c</td>
<td>0.48d</td>
</tr>
</tbody>
</table>

Means with the different superscripts on the same column are significantly different from one another (p<0.05).

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Soursop Yoghurt</th>
<th>Cow milk Yoghurt</th>
<th>Goatmilk Yoghurt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>4.80±1.44a</td>
<td>7.80±0.77a</td>
<td>7.30±0.98a</td>
</tr>
<tr>
<td>Colour</td>
<td>5.25±1.12a</td>
<td>7.75±1.07a</td>
<td>7.35±1.09a</td>
</tr>
<tr>
<td>Flavour</td>
<td>5.30±1.56a</td>
<td>7.00±1.38a</td>
<td>6.25±1.62a</td>
</tr>
<tr>
<td>Thickness</td>
<td>5.70±1.30a</td>
<td>7.50±1.39a</td>
<td>6.70±1.03a</td>
</tr>
<tr>
<td>Taste</td>
<td>5.15±1.53a</td>
<td>6.90±1.52a</td>
<td>6.55±1.39a</td>
</tr>
<tr>
<td>Overall Acceptance</td>
<td>4.85±1.53a</td>
<td>7.35±0.87a</td>
<td>6.65±1.42a</td>
</tr>
</tbody>
</table>

Means with different superscripts on the same column are significantly different from one another (p<0.05)
milk yoghurt and soursop yoghurt. Soursop yoghurt had the least value possibility because of extraction process from a fruit; which reduced its viscosity. Cowmilk yoghurt had the highest scores of 6.90 and 7.00 for both taste and flavour while soursop yoghurt had the lowest scores of 5.15 and 5.30 for taste and aroma respectively. Most of the panelists appreciated cowmilk flavour which was attributed to its fat content. [49] reported that fat content had a considerable influence on the sensory and instrumental characteristics of yoghurt, because the oil acts as an aroma solvent and has better rheology compared to low fat and skimmed yoghurts. Average overall acceptability scores ranged from 4.85±1.53 to 7.35±0.87 among the yoghurt samples. The results showed that the overall acceptability of cow milk yoghurt was not significantly different (p>0.05) from goat milk yoghurt but cow milk yoghurt had higher values for overall acceptability, colour, flavour, taste and thickness. Yoghurt from cow milk was most preferred among the samples presented for sensory evaluation and [76] reported that mouth feel, flavour, sweetness, soursness, and the balance between these factors have been shown to affect the overall preference for yoghurt.

Conclusion
Sensory results revealed that cowmilk yoghurt was most preferred among the samples. Proximate analysis showed that soursop yoghurt had high ascorbic acid content of (16.4mg/100ml) which signifies the potential use of the fruit as a good antioxidant. The level of (Ca, Fe, Mg, K and Na) were abundant in the yoghurts which reveals that soursop yoghurt had high ascorbic acid content of 12.4mg/100ml. This provides high nutritive value because of higher digestibility and less allergic reactions.

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References


