The Physicochemical Properties and Mineral Composition of Yoghurt Produced From Fresh Camel and Cow Milk.

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ABSTRACT

This study was investigated physicochemical properties and mineral composition of yoghurt produced from fresh camel and cow milk. The fresh camel milk was collected from Azare, in Bauchi metropolis and cow milk was collected from Vom, Jos, and Plateau State, Nigeria. The milk samples were clarified to remove foreign materials, pasteurized at 65^{o}C for 30min to destroy pathogenic materials and later cool to temperature of 42^{o}C and inoculated with Freeze- dried yoghurt starter as inoculums and allowed to ferment for 8hrs. The semi- solid curds were homogenized; package and cool at 4^{o}C .The physicochemical properties and minerals composition of fresh camel and cow followed by yoghurt produced from their milks were determined by standard procedure. The result of protein, fat, lactose, moisture contents, ash, pH, TTA, TS, Fe, K^{2+} ,Mg and Zn were presented as followed: 3.04-3.28%, 3.42-3.56%, 0.74-0.88% , 86.93-87.33%, 6.67-6.78, 0.18-0.19% and 12.60-12.87% respectively. Meanwhile, camel milk and yoghurt reported to be high in all mineral composition especially Calcium which has higher nutritional quality in both milk and yoghurt production.

Keywords: Physicochemical Properties, Mineral Composition, Yoghurt, Fresh Camel and Cow Milk

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1. INTRODUCTION

Milk is a complex biological fluid secreted in the mammary glands of mammals. Its function is to meet the nutritional needs of neonates of the species from which the milk is derived. However, milk and dairy products form a significant part of the human diet. They are rich sources of nutrients such as proteins, fats, vitamins and minerals; ironically, it is because of this that these products are susceptible to rapid microbial growth. In some instances, this microbial growth may be beneficial, while in others it is undesirable. Dairy products are vulnerable to spoilage or contamination with pathogens or microbial toxins; therefore, the microbiology of milk products is of key interest to milk handlers and those in the dairy industry. Nigeria, with a population of more than 170 million is grossly underprovided with essential food components - particularly the milk protein. Reports indicate that cow provides essentially all the fluid milk consumed (Igwegbe et al., 2014); and that milk production has been nose diving or at best has remained constant since 1994 in the country. To ameliorate this problem of low-level protein intake, especially from cheap dairy sources, there is the need for concerted effort to bring about the massive production and utilization of protein based food items from milk of other animal species such as goat, and at competitive costs so that they would be affordable to the general masses.

Yoghurt is one of the oldest fermented milk product consumed all over the world and it is produced by fermenting milk with lactic acid bacteria which responsible for development of typical yoghurt flavor. Fermentation is one of the oldest methods practiced by human beings for the transformation of milk into products with an extended shelf life Tammie and Robinson (1999). The conversion of lactose to lactic acid in fermented products has preservative effect on as the pH of cultured milk inhibits the growth putrefactive bacteria and other determined organisms, thereby prolonging the shelf life of products Esharaga, *et al*., (2011). Yoghurt is nutritionally rich in protein, minerals and vitamins and the values differ due to a number of reasons such as sources of milk, processing methods and ingredients used. Worldwide, cow's milk is most commonly used to make yogurt but milk from water buffalo, goats, sheep, camels and yake is also use various different part of the Castro, (2007). Camel's milk is known to have better qualities such as digestibility and longer shelf life when processed the than cow milk.

Despite these qualities, camels are kept mainly for meat and farming in many countries. The promotion of the full use of camel's milk at household level to achieve cheap balance diet and food security is yet to be exploited. The awareness in this project work showcases an eye opener to the process, procedure and development of yoghurt from camel's milk. Many people who perceive they have issues with cows' milk can drink camel's milk without any problems. There is high level of proteins found camel which support the growth and development of bones and organ system. It stimulates circulation and reduces hyper-tension. The camel's milk has powerful effects on the neurological system and prevents certain autoimmune disorders Hosam, (2014).
The objective of this study was to produce yoghurt from camel's milk and cow's milk and to determine proximate composition of yoghurts.

2. MATERIAL AND METHOD

2.1 Source of milk

One liter (1000ml) of fresh camel's milk was collected from Azare local government, Bauchi, Bauchi State, Nigeria. The same quantity of fresh cow's milk was collected from Federal College of Animal Health and Production Technology, VOM. Milk samples were then kept in an ice box immediately after collection. A commercial starter culture *Lactobacillus bulgaricus* and *Streptococcus thermophilus* (Freeze- dried yoghurt starter) was purchased from food chemical store in Jos.

2.2 Proximate analysis of fresh milk samples

Fresh milk samples were analyzed in the laboratory for proximate composition , moisture, fat, protein, lactose, ash and total solids (TS), in addition to the measurement of the pH and titratable acidity (TA), in accordance with the procedures outlined in Atherton and Newlander (1981), AOAC (2000) and Suzanne Nielson (2010). Protein was determined through the quantification of the nitrogen content by the standard Micro-Kjeldahl method (AOAC, 2000; Nielson, 2010) and multiplying the total nitrogen obtained by a conversion factor of 6.38 to arrive at protein content. Fat content was determined by Gerber method (Atherton and Newlander, 1981; AOAC, 2000). The ash content was determined following the procedures described by Igwegbe *et al*. (2013); the lactose content was determined by subtracting the sum of protein, fat, ash and moisture from 100; the pH was measured with a pH meter (Model WTW410D8120, Welheim, German), while the titratable acidity was determined by titration of 9 ml of the fresh milk with 0.1NNaOH in the presence of phenolphthalein indicator (Atherton and Newlander, 1981). Proximate analysis was also conducted on the processed yoghurt using the above techniques.

2.3 Yoghurt Production

Yoghurt was manufactured using the method outlined by Tamime and Robinson (1999) with some modifications (Fig 1). The camel and cow milk were collected from Federal College of Animal Health and Production Technology, VOM. The milk was immediately stored and preserved in cooler containing ice crystals and conveyed down to Food processing Lab. At department of Food Science and Technology, Federal polytechnic, Bauchi. The milks were kept in the refrigerator at 4°C prior to subsequent used. The milks were filtered with a clean muslin cloth to remove dirt, debris, and udder tissues. The clarified milk samples were then pasteurized in 65 for 30 min. After which the pasteurized milk samples were cooled to inoculation temperature of 42 °C ± 1 °C and then cooled samples were inoculated with Freeze- dried yoghurt starter culture the samples were fermented for 8h.The plain yoghurt was then packaged in polyethylene terephthalate bottles, chilled in a refrigerator and presented for further analysis.

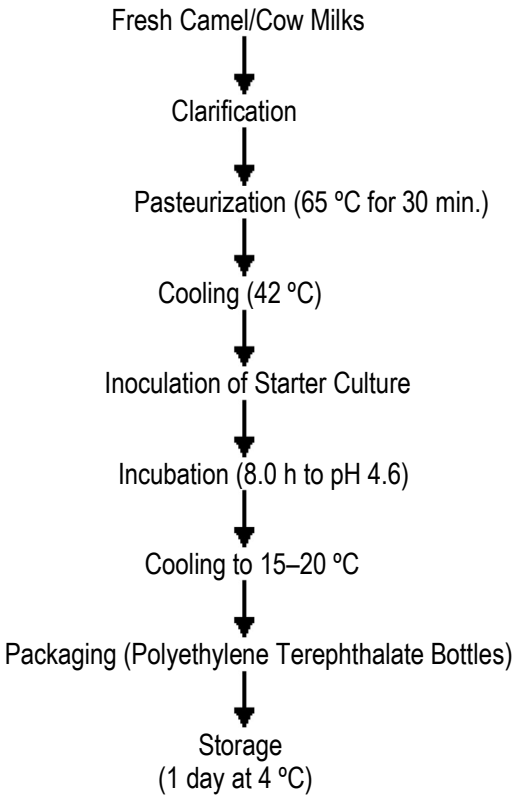

Figure1: Flow Chart for Modifying Method Yoghurts Production (Tamime and Robinson, 1999)

2.4 Mineral Determination

The analysis of minerals was done according to the AOAC (2005) procedures. The quantitative determinations of minerals (Zn, Fe, Mg and Ca) were done using beam atomic absorption spectrometer (Model S-929, Systonic, India). Working standards was used to establish calibration curve for each of the element to be determined. About 2.0 g of the sample was accurately weighed in a clean dry crucible. This was then transferred to hot plate in a fume cupboard and charred to burn off all the organic material until no more smoke was given off.

It was then transferred using a pair of tongs into the muffle furnace at a temperature of 500 ^{o}C until it was fully ashed for 8 h. The sample (ash) was leached with 5 ml of 6 M HCI into a 100 ml volumetric flask and the volume was made up to 20 cm3 with distilled water. Also, the blank determination was carried out in a similar procedures described above, except for the omission of sample. The solution was then filtered through a What man No.1 filter paper and transferred into the AAS auto sampler vial for analysis of Calcium (Ca) Magnesium (Mg), Iron (Fe), and Zinc (Zn).

2.5 Statistical Analysis

The physicochemical properties of the yoghurt samples were statistically evaluated using paired t-test

3. RESULT AND DISCUSSION

Table 1: Proximate composition of fresh camel and cow milks

Nutrient	Camel	Cow
Lactose (%)	4.10	4.65
Protein (%)	3.04	3.28
Total solid (mg/l)	12.60	12.89
Titratable acidity	0.19	0.18
pH	6.67	6.78
Fat (%)	3.56	3.42
Moisture content	87.33	86.93
Ash	0.88	0.74

The results of proximate composition of the fresh milk samples used in the preparation of yoghurt during this study are presented in Table 1. The quality of the raw milk is the single most important criterion that determines the quality of the end product. The quality of the raw fresh milk in turn is dependent on the sanitary procedures followed during the milk production and handling (Igwebge, *et al*., 2015). The proximate composition of the fresh camel and cow milks was significantly different ($P < 0.05$) except in lactose and total solid that are slightly different. Meanwhile, the protein, fat, ash and moisture content were recorded as follow: 3.04-3.28%, 3.42-3.56%, 0.74-0.88% and 86.93-87.33% respectively. Whereas, the mean composition for pH, tritatable acidity, total solid were presented as followed; 6.67-6.78, 0.18-0.19% and 12.60-12.87% respectively.

Table 2: Proximate analysis of yoghurt produced from camel and cow milks

Nutrient	Camel	Cow
Lactose (%)	2.68	3.68
Protein (%)	3.62	2.27
Total solid (mg/l)	12.40	12.89
pH	6.63	6.78
Fat (%)	5.87	5.56
Moisture content	87.54	86.59
Ash	0.71	0.74

The results in table 2: shown the proximate analysis of the yoghurts produced from camel and cow's milk. The mean composition of protein content of camel and cow yoghurt's were 3.62 and 2.27 is similar to research made by FAO, 2006 that camel milk is highly rich in protein than cow milk. Fat and lactose recorded in camel and cow milks were 5.76 and 5.56, 2.68 and 3.68 respectively compare (Eshraga, *et al*., 2011), camel's milk can often be enjoyed by people who are allergic or intolerant to cow milk. In acomparative study on the properties of camel's milk with that of cow, (Hashim *et al*., 2009) observed that camel milk could help in preventing diseases such as anemia and bone demineralization.

Table 3: Mineral composition of fresh and yoghurt produced from camel and cow milks

Nutrient	camel/cow (fresh milks)		Camel/cow (yoghurt)	
Iron (mg)	0.20	0.10	0.35	0.22
Calcium(mg)	118.00	116.00	135.00	127.00
Magnesium (mg)	12.11	10.36	13.89	11.66
Zinc (mg)	0.68	0.52	0.72	0. 58
Vitamin C (mg)	4.25	0.03	3.82	0.02
Vitamin B_6 (mg)	0.06	0.04	0.08	0.05

The mineral composition of fresh and yoghurt produced from camel and cow milk are presented in table 3. The nutritional composition of both camel milk and its yoghurt are significantly different (P>0.05) in compare with cow milk and yoghurt. Camel milk presents a high nutritional quality, it has 3 times more vitamin C, minerals (e.g., Calcium), and essential and polyunsaturated FAs than cow milk (Khalesi, *et al*., 2017).It also contains many antimicrobial agent (lysozyme, lacto-peroxidase, lactoferrin, immunoglobulin and bacteriocins) that participate to its high bacteriostatic properties (Farah,*et al*.,1992, Sawaya, *et al*., 1984).Camel milks can be considered sources of vitamin C, containing an average of 4.6, 4.3 and 3.8 mg/100 g, respectively. The availability of even a moderate amount of vitamin C in camel milk has significant nutritional relevance in areas where green vegetables and fruits are hard to find (Sawaya *et al*.,1984, cited in Zhang *et al*., 2005).

3. CONCLUSION

The result of the physicochemical properties and mineral composition of both camel fresh milk and its yoghurt was significant (p>0.05) different in compare cow milk and its yoghurt. Also, camel can be used in the treatment of certain diseases and having a higher digestibility rate and lower incidence of allergy than cow milk. Efforts should therefore be intensified toward commercial production of yoghurt and other dairy products using camel milk as the basic raw material.

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