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Evaluation of Physicochemical, Sensory Properties and Microbial Load of Yoghurt Produced from Fresh Camel and Cow Milk.

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ABSTRACT

Background: 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 is responsible for the development of typical yoghurt flavor.

Objective: To evaluate the chemical composition of fresh camel and cow's milk and to determine the chemical composition, microbial and sensory quality of yoghurt made with camel and cow milk.

Methods: Proximate analyses of the fresh milk's samples were determined prior to yoghurt production. The fresh milk samples were filtered separately with muslin cloth to remove sediment. Each filtrate was pasteurized at temperature of 65℃ for 30 minutes, and cooled to 40℃. Twenty milliliters (20ml) of starter culture was inoculated into the filtrate and stirred thoroughly. Incubation was done for 8-hours to allow proper fermentation to take place. The curd was homogenized and sugar was added to taste. The yoghurt was packaged in container and cooled to temperature of 4℃ .The proximate composition, sensory evaluation and microbial analyses were carried out on both samples using standard procedures.

Result: Chemical and physical analyses were carried out on both the fresh milk and the prepared product. The mean composition of Total solid, pH, specific gravity, protein, moisture content, ash, fat and lactose recorded in camel and cow milks were: (0.18 & 0.19), (0.028 &0.038), (6.58 & 6.25), (86.59, & 87.54), (0.72 & 0.84), (2.92 & 3.46), (12.18 & 13.89), (3.86 & 4.94) respectively. The average total plate counts (TPC) from yoghurt samples were 6.5 x10^4 and 7.3 x 10^6 cfu/ml as well as sensory properties of both samples were recorded as follows: flavor ranged from (1.80 & 5.00), Texture ranged from (4.00 & 4.80), Color (2.00 & 5.00), Taste (2.10 & 4.80) and overall acceptability (3.00 & 5.00) respectively.

Conclusion: It was concluded that camel milk has a very good potential for future utilization on commercial level, including yoghurt production in Nigeria.

Keywords: Sensory Properties, Microbial load, Yoghurt, Camel and Cow's Milk

Aims Research Journal Reference Format:
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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 FAO, (2006). Fermentation is one of the oldest methods practiced by human beings for the transformation of milk into products with an extended shelf life Tamime and Robinson, (2006). The conversion of lactose to lactic acid in fermented product has preservative effect on the pH of cultured milk inhibits the growth of putrefying bacteria and other organisms, thereby prolonging the shelf life of products Eshraga 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 used Castro, (2007).

Camel milk is known to have better qualities such as digestibility and longer shelf life when processed than cow milk. Despite these qualities, camels are kept mainly for meat production and farming activities 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. Camel milk has greater contents of vitamin C Mehaia, (1994), ash, and sodium, potassium, phosphorus, zinc, iron and manganese Gorban and Izzeldin, (1997) than cow's milk .Agrawal et al.(2005) also reported that Camel milk improved long-term glycemic control and reduced insulin dose in patients with type-1 diabetes .In Sudan, *garris*, a traditionally fermented camel milk product, is used to cure leishmaniasis and the protozoal disease of the belly Dirar,(1993). More than half the quantity of milk produced in Sudan is processed into some fermented dairy products, such as *Roub*, *Mish*, *Gariss, Jibna-Beida* and Yogurt (Abdelgadir et al. 2008; El Zubeir et al. 2005) and Meanwhile camel milk is considered has one of the main components of the human diet in many parts of the world. It contains all essential nutrients as cow milk Elagamy et al. (1998). Also, it has a high biological value due to the higher contents of antimicrobial factors such as lysozyme, lactoferrin and immunoglobulin's Elagamy et al. (1992). Most camel milk is consumed in the fresh or sour state Elagamy, (1992). Besides its use as a food, camel's milk has been used in many regions as a cure for certain diseases. The major differences in composition between camel's and cow's milk Gran et al (1991) could lead to the milk behaving differently during processing and thus, could affect the final quality of camel's milk dairy products. Traditional yogurt is mainly a fermented cow's milk product. Typically, preparation of yogurt from camel milk is almost absent in Nigeria.

2. MATERIALS AND METHODS

Materials

Camel and cow milk were obtained from Azare Local Government area Bauchi State, Nigeria. Milk was collected from lactating mothers, and stored in a refrigerator for subsequent processing. All chemicals and media used in this study were of reagent grade. Samples were stored at less than 7°C. Analyses on fresh pooled milk samples were carried out within 12 to 24 h after collection of the samples while those for the yoghurt, including sensory evaluation, were conducted twenty-four (24) hours after processing.

Physical and chemical properties 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 AOAC, (2010) and Nielson,(2010) . Protein was determined through the quantification of the nitrogen content by the standard Micro-Kjeldahl method (AOAC, 2010; 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 AOAC, (2010).

The ash content was determined following the procedures described by Igwegbe et al; (2014), 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 (AOAC, 2010). The moisture content was determined by drying the samples overnight at 105°C AOCA, (2005). The same procedures were also conducted on the processed yoghurt and analyses were performed in triplicate.

Yoghurt preparation

The fresh milk samples were filtered separately with muslin cloth to remove sediment. Each filtrate was pasteurized at temperature of 65℃ for 30 minutes, to destroy pathogenic microorganism. The samples were allowed to cool to temperature of 40℃ and twenty milliliters (20ml) of starter culture was inoculated into each filtrate and stirred thoroughly. Incubation was done for 8-hours to allow proper fermentation to take place. The curd was homogenized and sugar was added to taste. The yoghurts were packaged in container and cooled.

Sensory analysis

Sensory profiling of the yogurt samples was conducted, using conventional profiling, by a trained panel. Ten judges were selected among the staff, and students of the Department of Food Sciences and Technology Federal Polytechnic Bauchi, who had successfully passed standardized tests for Olfactory and taste sensitivities as well as verbal abilities and creativity. The panelists were given a hedonic questionnaire to test taste, texture, color, flavor and overall preference of Coded samples of cow milk yogurt and camel milk yogurt. They were scored on a scale of 1–5 (1 = poor, 2 = fair, 3 = good, 4 = very good and 5 =Excellent). Each attribute was evaluated in triplicate and the values were then averaged.

Microbiological tests

Prepared yogurt samples were analyzed for total bacterial count, total coliform count, and yeast and mold count after fermentation. One gram of yogurt sample was diluted with 9mL of distilled water. Peptone water was used for the serial dilution. Total plate count was determined using plate count agar, incubated at 37^{o}C for 48h. Colony counter was used for the enumeration of total plate count. Culture tubes with MacConkey broth was used as the medium for the determination of coliform, and incubated at 37^{o}C for 48h. Presence of air bubbles in the Durham tubes or any color change indicated the positive results of coliform. Yeast and mold count was determined by inoculating the samples on potato dextrose agar incubated at 25^{o}C for 5 days.

Statistical analysis

The data obtained were subjected to T-test and one-way ANOVA for sensory evaluation of both samples.

Results

Table 1: Physical composition of fresh camel and cow milk.

Nutrients	Camel	Cow
pH	6.58 ± 0.02	6.25 ± 0.01
Titratable Acidity (%)	0.18± 0.01	0.19 ± 0.03
Specific gravity	0.028 ± 0.001	0.038 ± 0.002

Table 2: Proximate composition of fresh camel and cow milk.

Nutrients	Camel	Cow
Lactose	3.86±1.20	4.94±0.23
Protein (%)	2.27±0.02	3.62 ±0.10
Total solid (mg/L)	12.18±0.04	13.89 ±0.07
Fat (%)	5.76±0.04	4.56±0.35
Moisture content (%)	87.54±1.22	86.59±0.06
Ash (%)	0.72±0.02	0.84 ±0.05

Table 3: Chemical properties of Yoghurt produced from camel and Cow's milk

Nutrient	Camel	Cow
Lactose (%)	2.86 ±0.04	3.68 ±0.01
Protein (%)	2.62 ±0.13	3.27 ±0.22
Total solid (mg/L)	12.40 ±0.16	12.89 ±0.28
Zinc (%)	3.67 ±0.12	1.77 ±0.06
pH	5.87 ±0.30	5.65 ±0.20
Titratable acidity (%)	0.16 ±0.18	0.78 ±0.04
Fat (%)	4.76 ±0.02	3.56 ±0.33
Moisture content (%)	87.24 ±0.24	86.30 ±0.14
Ash (%)	0.74 ±0.022	0.86 ±0.16

Table 4: Organoleptic attributes of camel and cow milk yogurt

Attribute	Camel	Cow
Flavour	1.80 ±0.48	5.00 ±0.62
Texture	4.00 ±0.34	4.80 ±0.24
Colour	2.02 ±0.17	5.00 ±0.85
Taste	2.10 ±0.42	4.80 ±0.22
Overall Preference	3.00 ±0.65	5.00 ±0.08

Table 5: Microbial quality of the yoghurt prepared from the camel and cow milk (cfuml$^{-1)1}$

Microorganisms	Camel	Cow
Total plate count	6.5 x 10^4	7.3 x 10^6
Coliform	Nil	1.5 x 10^3
Salmonella	<0.01x10^3	< 0.02 x 10^3
Yeast	2.5 x 10^4	1.4 x 10^3
Mould	Nil	Nil

3. DISSCUSSION

The physical and chemical properties of fresh camel and cow milk analyzed and presented in Table 1&2. pH of milk samples from the two species (Camel milk and cow milk) were determined at the time of sampling. The mean value for pH of camel milk was 6.58 and cow milk had a mean value of 6.05, while Zaharaddeen *et al* (2007) reported a similar value for the pH of West African Dwarf goat (WAD) milk and cow milk to be 6.21. Also, the mean value of for the pH of camel milk (6.58) in this study was similar to those reported by Zubeir and Jabreel, (2008). The quality of the raw milk is the single most important criterion that determines the quality of its end product. The quality of the raw fresh milk in turn is dependent on the sanitary procedures followed during the milk production and handling Igwegbe et al; (2014). The proximate composition of the fresh camel and cow milks was significantly different ($P < 0.05$) in Table 2: Mehaia , (1997) reported the levels of total solid, fat, protein, ash and lactose in whole camel milk to be 12, 3.6, 3.2 and 0.81 presents respectively.

Also, Zubeir and Jabreel, (2008) found similar results for chemical composition of whole camel milk in which the levels of total solid, fat, protein ash and lactose were 8.5, 2.5, 4.5 and 0.20 respectively. Nutrients composition of camel and cow milk was affected by processing into yogurt in Table 3. The pH of both milks decreased significantly ($P \leq 0.05$) after processing to (5.87 & 5.65) in camel yogurt and cow yogurt respectively. Güler, (2007) found that nutrients composition in yogurt is influenced by the fermentation process, draining of yogurt, cooking, and manufacturing utensils. Similarly, the chemical composition of the fresh milks and the yoghurt drink prepared from them are also in line with the standard recommended for good quality yoghurt. It has been observed that insufficient heat treatment of milk, low total solids, over acidification, insufficient denaturation of Whey proteins; too high incubation temperature and too low acidification ($pH > 4.60$) are the most important factors that may affect the quality of yoghurt such as whey separation and viscosity Igwegbe et al; (2015).

The protein content of camel and cow milk yoghurt were 3.62 ± 0.13 and 2.27 ± 0.22, and is in agreement with the finding by FAO, 2006 that camel milk is richer in protein than cow milk. Fat and lactose recorded in camel and cow milks were 4.76 ± 0.02 and 3.56 ± 0.33 for camel milk and 2.86 ± 0.04 and 3.68 ± 0.01 for cow milk respectively. Titrable acidity is a measure of the number of acid molecules present. Acidity of yoghurt is as a result lactic acid bacteria fermentation which converts lactose to lactic acid (Lee and Lucey, 2010). The scores for flavor, texture, color, taste, and overall preference of camel milk yogurt were significantly ($P \leq 0.05$) lower than those of cow milk yogurt (Tab. 4). Camel milk yogurt was evaluated as less consistent and less acid, with a non-typical yogurt colour and taste. The low organoleptic properties of camel milk yogurt was attributed to many factors including the presence of microbial growth inhibitors Gran et al; (1990), higher level of polyunsaturated fatty acids and difficulty of fat hydrolysis during fermentation Gran et al; (1990), high concentration and poor protein composition. Meanwhile, cow milk yogurt gained higher acceptance for all attributes tested. The average total bacteria counts (TBC) of camel and cow milk yoghurt were 6.5×10^4 and 7.3×10^6 cfu/ml respectively. The coliforms were not detected in camel milk yoghurt whereas about 1.5×10^3 cfu/ml was present in cow milk yoghurt. This could be as a result of poor hygiene level of milk handlers. Meanwhile, mould was not detected in both samples. According to the Codex (1999) guideline and the specification given by the ICMSF (1986), the milk should contain less than 5.0×10^4 cfu/ml and 3.0×10^4cfu/ml respectively.

4. CONCLUSION

The outcome of this study showed that the physical and chemical quality of the camel milk yoghurt and cow milk yoghurt show that camel milk yoghurt was significantly difference from cow milk yoghurt and has lower value in terms of its titrable acidity, total solid, fat, and protein content. Camel milk is non allergic as compared to cow milk and it can be used in the treatment of certain diseases. 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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REFERENCES

1. Abdelgadir, W.; Nielsen, D. S.; Hamad, S. and Jakobsen, M.; (2008). International Journal of Food Microbiology, 127, 215–219.
2. Agrawal, R. P.; Beniwal, R.; Kochar, D. K.; Tuteja, F. C.; Ghorui, S. K.; Sahani, M. S. and Sharma, S. ;(2005). Diabetes Research and Clinical Practice, 68, 176–177.
3. AOAC, (2010).Official Methods of Analysis. Association of Official Analytical Chemists 17th Edition. Gaithersburg, Maryland, USA
4. AOAC, (2005). Official methods of analysis, 12th ed., Association of Official Analytical Chemists, Washington, D.C, USA.
5. Atherton V.H and Newlander JA (1981). Chemistry and Testing of Dairy Products. AVI Publishing Company Inc., West Post, Connecticut.
6. Castro DJ (2007). Goats' milk is more beneficial to health than cows' milk: study suggests. Science Daily.
7. Dirar, A. H. ;(1993). The Indigenous Fermented Foods of the Sudan. In: A Study in African Food and Nutrition, Wallingford, UK: CAB International, 576 pp.
8. Eissa, E.A, Mohamed-Ahmed I.A, Yagoub A.EA, Babiker ,E.E (2010). Physicochemical, microbiological and sensory characteristics of yoghurt produced from goat milk. Lives. Res. Rural Dev. 22(8):22-28.
9. Elagamy, E.I.; (2000) Food Chemistry, Vol 68, Pp 227-232
10. Elagamy, E.I.; Zeinab, I.; Abdel-Kader, Y.I. ;(1998). Alexandria Journal of Agricultural Research, 43, 57–70.
11. Elagamy, E.I.; Ruppanner, R.; Ismail, A.; Champagne, C.P.; (1992). Assaf, R.; Journal of Dairy Research, 59, 169-17.
12. Elamin, F. M.; Wilcox, C. J.; (1992). Journal of Dairy Science, 75, 3155–3157, pp.
13. Eshraga A.E., Abu E.A. Yagoub, Efadil E, Babiker, Isam A, Mohamed Ahmed (2011). Physicochemical, Microbiological and Sensory Characteristics Of Yoghur Produced From Camel Milk During Storage.
14. FAO, (2006). Food and Agriculture Organization of the United Nations.
15. Gran, S.O.; Mohammed, M.O; Shareha, A.M. and Lgwegba, A.O.L.; (1991). Proceeding of the International Conference On Camel Production and Improvement. 183-188,pp.
16. Gorban, A. M. S. and Izzeldin, O. M.; (1999). International Journal of Food Science and Technology, 34, 229–234.
17. Gorban, A. M. S.; Izzeldin, O. M.; (1997). Journal of Dairy Research, 64, 471–474.
18. Gũler, Z; (2007). Small Ruminant Research, 71, 130–137 pp.
19. Igwegbe AO, Negbenebor CA, Chibuzo EC; (2014). A comparative study on the fermen-tability of camel and cow"s milk by a symbiotic blend of lactic acid cultures. Scot. J. Arts Social Sci. Sci. Stud. 18(2):68-76.
20. Igwegbe, A.O; Florence, J.M; Afodia, L.K; Gervase, I.A; Elizabeth, C.C and Mamudu, H.B. (2015).Evaluation and acceptability of yoghurt drink processed from goat milk and a combination of goat and cow milk. International Journal of Biotechnology and food science. Vol. 3(4), pp.41-48.
21. Marshall, T.R. (1992). Chemical and physical methods. In: Standard methods for the Gran microbiological Examination of Dairy products.(Ed), 16th edition. Washington D.C.,USA, 570pp.
22. Mehaia, M.A. (1997). Studies on rennet coagulation of skimmed camel milk concentration by ultrafiltration. Journal of king saud. University 9(1):111-123
23. Mehia, A.M. (2006). Manufacture of fresh soft white cheese (Domaiti-type) from Dromedary camels'milk using ultrafiltration process. Journal of food technology 4(3):206-212.
24. Mehaia, M. A.; (1995). Food Chemistry, 50, 153–155.

25. Nielson, S.S. (Ed) (2010). Introduction to Chemical Analysis of Foods. Jones and Bartlett Publishers, Boston / London.
26. Tamime A.Y, Robinson Rk (1999). Yoghurt Science and Technology. Cambridge, UK: Woodhead Publishing Ltd.
27. Zahraddeen, D., Butswat, I.S.R. and Mbap, S.T. (2007). Evaluation of some factors affecting milk composition of indigenous goat in Nigeria. Livestock Research for Rural Development 19 (11).
28. Zubeir, I.E.M and Jabreel, (2008).Fresh cheese from camel milk coagulated with Camifloc. Intenational Journal of Dairy Technology 61: 90-95.