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Nutrient composition of pastoralist's raw milk of different breeds of cattle in Adamawa and Taraba states, Northeastern Nigeria

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Abstract

This study was carried out to determine the proximate composition of raw milk produced in pastoral settlements. Six hundred pastoralists' raw milk samples were collected from 20 local governments in Adamawa and Taraba states, Nigeria. Milk samples were collected from White Fulani (WF), Red Bororo (RB) and Sokoto Gudali (SG) breeds of cattle and were analyzed for protein, fat, ash and moisture contents. The protein content ranged between 3.62±0.38% -3.95±0.11% in WF, 3.29±0.8% - 3.94±0.10% in RB and 3.31±0.27%-3.95±0.09% in SG in Adamawa and Taraba states. The fat content ranged between 3.55± 0.47% - 3.99±0.03% in WF, 3.98±0.04% - 3.98±0.06% in RB and 3.32±0.20% - 3.45±0.27% in SG. The ash content recorded was between 0.40±0.06% -0.41±0.04% in WF, 0.40±0.06% - 0.43±0.07% in RB and0.39±0.06% - 0.41±0.08% in SG, and the moisture content in Adamawa and Taraba states were between 83.52±2.07% - 84.00±0.57% in WF, 82.28±1.05% - 83.73±0.63% in RB and 82.90±1.48% - 83.56±1.35%in SG. The study from the two states revealed protein value between 3.29± 0.8% - 3.95±0.11%, fat content range of3.32±0.20% - 3.99±0.03%, ash content of between 0.39± 0.06% - 0.43±0.07% and moisture content that ranged between 82.28± 1.05% - 84.00±0.57%. Constituents of milk from Taraba state were higher in values than those from Adamawa sate. The statistical analysis of the results at95% confidence level showed significant difference among breeds and states. In comparison, the three breeds that resided in Adamawa state had least values, which could be attributed to herd management practices. This study showed that all the three pastoralists' breeds indicated desirable components in their milk Cross breeding with higher breeds and provision of quality feed and water may lead to better yield in all the breeds in this study.

Keywords: Adamawa state, Milk, Proximate composition, Taraba state

Introduction

Milk is a yellowish-white non-transparent liquid secreted by the mammary glands of all mammals. It is the primary source of nutrition and the only food for offspring of mammals before they are able to eat and digest other types of food. It contains in a balanced form of all the necessary and digestible elements for building and maintaining the human and animal body (Pandey and Voskuil, 2011). Dairy products in the Nigerian market are sourced locally and internationally. The major local dairy products in the market include Nono (sour milk), Kindirmo (sour yogurt), Cuku (Fulani cheese) and Wara (Yoruba cheese). The traditional dairy products in the Nigerian market is particularly prevalent in the urban and rural market outlets in Northern Nigeria where the tradition and culture of the people favour cattle rearing and where the consumption of fresh and locally-processed milk had long been part of the local diet. The milk of each mammalian species is unique in composition and nutritional value (Kataoka *et al.*, 1991). Cow's milk and milk products have played an important role in human nutrition growth, and development. Despite the nutritional hardships of pastoral diets, they are sufficient to allow pastoralists to survive in arid lands that are too marginal to

support agriculture (Little and Leslie, 1999). Physiochemical analysis is important tool to monitor the quality of milk and other dairy products. Adulteration in food is done either for financial gain or lack of proper hygienic conditions of processing, storing, transportation and marketing. Milk can harbor a variety of microorganisms and can be important sources of food-borne pathogens (Oliver *et al*., 2005). Compared to raw milk pasteurized fluid milk presents little health hazard. However, several food-borne disease outbreaks have been linked to pasteurized milk and this is traced to inefficient pasteurization temperature, poor packaging material and storage temperature abuse (ICMSF, 2005). Milk processing suitability is significantly affected by the proportions of milk components. It has been shown that the quality of milk intended for consumption and processing varies subject to cattle breed (Poulsen *et al.,* 2012). One of the primary goals of the dairy industry has always been to improve the technological properties of milk, including its chemical composition. Milk processing suitability is significantly affected by the proportions of milk components. It has been shown that the quality of milk intended for consumption and processing varies subject to cattle breed (Poulsen *et al.,* 2012). In subsistence-oriented pastoral systems, the most important output from livestock is milk for human sustenance (Sikana and Kerven, 1991). The demand for dairy products is principally based on the perceived health benefits to adults, pregnant mothers, babies and children (Adeneye *et al.,* 1984). Nigeria is a potential market for 1.3 million tons of milk valued at about N450 billion annually (Annette *et al*., 2012). The liberal policy approach by the government and the banking system also provide ample opportunity for milk powder business in Nigeria to be an exceptional if well planned and executed. (NZieas, 2014).

Materials and methods

Sample collection

The study animals were lactating cows at different stages of lactation of Red Bororo, White Fulani and Sokoto Gudali breeds of cattle domiciled in Adamawa and Taraba states during sample collection period. Raw milk samples from 20 Local Government Areas (LGAs) namely; Shelleng, Lamorde, Mayo-balwa, Numan, Toungo, Guyuk, Demsa, Gombi, Song, Jada and Ganye LGAs in Adamawa state and Jalingo, Sardauna, Bali, Yorro, Ardo-kola, Gashaka, Karim lamido, Zing and Lau LGAs in Taraba state. A total of 600 pastoralists' raw milk' samples were collected for proximate analysis. Early morning fresh milk samples were collected from the cows with separate containers using standard milking procedures. The collected samples were immediately packaged and transported on ice for analysis.

Proximate analysis

Crude protein, fat, ash and moisture content were determined using the AOAC method (AOAC, 2000).

Statistical analysis

The data were analyzed using one way Analysis of Variance (ANOVA) of Minitab 14 to examine the statistical significance of difference in the mean concentration of the proximate composition of the different milk samples.

Results and discussion

Table 1 shows the results of the proximate composition of White Fulani breed of cattle in Adamawa and Taraba states. Crude protein values were significantly different ($P<0.05$) in the seven LGAs from Adamawa and Taraba states. The values for crude protein, fat, Ash and moisture in White Fulani breed in Adamawa and Taraba states varies from 2.96±0.24% - 3.95±0.11%, 3.02±0.23% - 3.99±0.03%, 0.38±0.03% -

0.41±0.04% and 82.38±1.03% - 84.00±0.57% respectively. Values of ash was highest in Demsa local government, Ardo-kola LGAs had highest values for crude fat and moisture, while Yorro LGA had the highest value of crude protein. Table 2 shows the results of the proximate composition of Red Bororo cattle in Adamawa and Taraba states. Crude protein values were highest in Zing LGA; crude fat and ash were highest in Gashaka LGA, while Moisture contents were highest in Mayo balwa LGA. Crude protein values were not significant in (P<0.05) Jada and Gashaka LGAs, values between Toungo, Mayo Balwa and Ganye LGAs were not significant, as well as values between Sardauna and Zing LGAs. Crude fat was not significantly different (P<0.05) in Toungo and Sardauna LGAs, and values from Mayo Balwa, Ganye and Gashaka LGAs were not significant, but were values were significantly different in Jada and Zing LGAs. Ash values were not significantly different (P<0.05) in Jada and Mayo Balwa, Sardauna and Gashaka LGAs as well as values in Toungo, Ganye and Zing LGAs. Moisture contents were not significantly different in Jada and Mayo Balwa, Toungo and Zing as well as values from Ganye, Sardauna and Gashaka LGAs. Table 3 showed the results of the proximate composition of Sokoto Gudali cattle in Adamawa and Taraba states. Crude protein values were highest in Numan LGA; crude fat was highest in Bali LGA, while ash and Moisture contents were highest in Lau LGA. Crude protein values were not significant in (P<0.05) Lamorde, Bali, Karim Lamido and Lau LGAs but significant in Numan and Gombi LGAs. Crude fat were not significantly different in Bali and Lau LGAs, but were values were significantly different in Gombi, Numan, Lamorde and Karim lamido. Ash values were not significantly different in Lamorde and Karim lamido LGAs, while values were significantly different (P<0.05) in Gombi, Numan, Bali and Lau LGAs of Adamawa and Taraba states. Moisture contents were not significantly different in Gombi and Numan LGAs, also values in Bali and Lau LGAs were not significantly different, while the values were significantly different in Karim lamido and Lamorde LGAs.

Generally, milk protein percentage is positively correlated with the milk fat percentage. If one of them is high, the other is usually high (Ozrenk and Seleuk, 2008). The difference in protein and fat values could be a consequence of feeding regimen (Nickerson, 1999) or difference in herd management by pastoralists (Zeleke, 2007). The Unites States Standards for protein content is 3.3% and FAO standards are 3.5%. Reports showed no significant differences in the values recorded for the protein compositions at P<0.05 in raw milk of similar breeds of White Fulani and Red

Table 1: Proximate composition of white Fulani cattle milk from selected LGA in Adamawa and Taraba states

	Proximate composition			
Local Government	Crude protein	Fat	Ash	Moisture
Shelleng	2. 96±0.24^{ef}	3.18±0.24^{c}	0.39±0.06^{bc}	83.14±1.37^{bc}
Guyuk	3.03±0.27^{de}	3.22±0.23^{c}	0.39±0.04^{bc}	82.43±0.90^{d}
Song	3.62±0.38^{b}	3.02±0.23^{d}	0.40±0.05^{abc}	83.52±2.07^{ab}
Demsa	3.51±0.38^{c}	3.55±0.47^{b}	0.40±0.06^{abc}	83.02±1.15^{b}
Ardo kola	2.92±0.21^{f}	3.99±0.03^{a}	0.40±0.02^{ab}	84.00±0.57^{a}
Yorro	3.95±0.11^{a}	3.03±0.26^{d}	0.38±0.03^{c}	82.38±1.03^{d}
Jalingo	3.10+0.25^{d}	3.20±0.26^{c}	0.41±0.04^{a}	82.96±2.09^{c}

Table 2: Proximate composition of Red Bororo cattle milk from selected LGA in Adamawa and Taraba states

	Proximate composition			
Local Government	Crude protein	Crude fat	Ash	Moisture
Jada	3.29±0.28^{b}	3.35±0.34^{b}	0.40±0.06^{ab}	83.40±1.32^{a}
Toungo	2.95±0.24^{c}	3.17±0.26^{c}	0.39±0.05^{bc}	82.93±1.17^{b}
Mayo Balwa	2.90±0.21^{c}	3.97±0.04^{a}	0.40±0.03^{ab}	83.73±0.63^{a}
Ganye	2.99±0.09^{c}	3.98±0.04^{a}	0.36±0.02^{b}	81.78±0.63^{c}
Sardauna	3.83±0.25^{a}	3.12±0.16^{c}	0.42±0.04^{a}	81.73±1.47^{c}
Gashaka	3.01±0.20^{b}	3.98±0.06^{a}	0.43±0.07^{a}	81.58±0.47^{c}
Zing	3.94±0.10^{a}	3.02±0.26^{d}	0.38±0.04^{c}	82.28±1.05^{b}

Table 3: Proximate composition of Sokoto Gudali cattle Milk from selected LGA in Adamawa and Taraba states

	Proximate composition			
Local Government	Crude protein	Crude fat	Ash	Moisture
Gombi	2.99±0.09^{c}	3.15±0.25^{c}	0.35±0.02^{c}	81.54±0.50^{c}
Numan	3.95±0.09^{a}	3.32±0.20^{ab}	0.38±0.04^{b}	81.95±0.85^{c}
Lamorde	3.21±0.20^{b}	3.23±0.26^{bc}	0.39±0.06^{ab}	82.90±1.48^{ab}
Bali	3.14±0.31^{bc}	3.45±0.27^{a}	0.38±0.04^{bc}	83.50±2.15^{a}
Karim lamido	3.20±0.21^{b}	3.14±0.25^{c}	0.39±0.04^{ab}	82.71±1.24^{b}
Lau	3.31±0.27^{b}	3.430.38^{a}	0.41±0.08^{a}	83.56±1.35^{a}

Bororo by Adesina (2012), in Boran, Nguni, Tuli, Afrikaner, Bonsmara, Drakensberger breeds (Myburgh *et al.,* 2012), in Burkina Faso (Millogo *et al.,* 2008), in other studies (Mirzadeh *et al.*, 2010) and reports by Kebede (2018), Gemechu *et al.* (2015) and Tesfay *et al.*(2015) in Ethiopia. A study showed protein values of 3.96±0.16% and have significant effect on breed (Belal, 2013). However, Dandare *et al.* (2014) reported higher values in White Fulani breeds of cattle. Similar fat content was reported (Belewu, 2006, Farrington and Woll, 2010). Myburgh *et al.* (2012) reported lower values in Boran and Tuli breeds and (Dandare *et al.,* 2014) in same breeds in another region in Nigeria. Some scholars recorded higher fat contents (Adeneye *et al.*, 1970, Kebede, 2018). Many scholars reported extensively varied milk fat among the breeds (Adesina, 2012, Myburgh *et al.,* 2012) due to genetics and physiological status of breeds (Frank, 1988) or an inherited character (Belewu, 2006). However, Barłowska *et al.* (2006) reported fat values as high as 8.1% depending on cattle breed, nutritional regime and lactation stage. Adesina (2012) found non-significant difference in the ash composition of milk among White Fulani and Red Bororo cattle breeds contrary to other findings (Mariani *et al.,* 2002; Summer *et al.,* 2004). Studies by Kebede (2018) in Ethiopia, Dandare *et al.* (2014) in Nigeria and FAO standards (FAO, 2005) reported higher values. Ash contents are a reflection of the mineral composition of milk. Studies in Nigeria by Salau (2012) and Dandare *et al.* (2014) had similar results as this study. The type of breed can influence water composition in raw milk, but the average water content by FAO (2005) is (87%), similar to a report by Mirzadeh *et al.* (2010). In America, Farrington and Woll (2010) got values of up to 90%. High moisture content supports microbial growth which affects shelf life of the milk sample (Londhe *et al.,* 2012). The lower moisture content in this study might be due to the inadequate water supply to pastoralists' breeds in the study area, which may imply the better nutritive composition

in the study.

Conclusion

The study showed that all the three pastoralists' breeds indicated desirable components in their milk, but that Red Bororo breed was the least in terms of representative values, except for the Ash component. The ash component is the reflection of the mineral composition of the milk. In comparison, the three breeds that resided in Adamawa state had least values, which could be attributed to herd management practices. Resettlement programs and provision of quality feed and water can lead to better yield in all the breeds in this study. Hence, government policies that will permit permanent resettlement and provision of extension services hold great growth potentials for the dairy industry.

References

Adeneye, J. A., Akinwunmi, J. A. and Akinyosoye, V. O. 1984. National Dairy Products Study for South-Western Nigeria. *National Livestock Projects Division, Federal Ministry of Agriculture and Water Resources (FMAWR). Lagos, Nigeria*.

Adeneye, J. A., Oyenuga, V. A. and Olaloku, E. A. 1970. Preliminary findings in the milk composition of White Fulani cattle. *Nigerian Journal of Science*. 4(2).181-186.

Adesina, K. 2012. Effect of Breed on the Composition of Cow Milk under Tradition Management Practices in Ado-Ekiti, Nigeria. *Journal of Applied Science an Environmental Management.* 16.55 – 59. African Union (AU, 2010). *Policy Framework for pastoralism in Africa.* Addis Ababa, Ethiopia.

Annette, I., Fatima, B. A., Wambai, Y. S., Ruma, B. M., Gideon, M. M., Lawan, U. S., Lawrence, O. I., Aligana, M., Shofela, A. K., Mark, L.K. and Kasim, H. I. 2012. Major issues in Nigeria dairy value chain development. *Vom Journal of veterinary Medicine*. 9. 32-39.

AOAC 2000. Association of Analytical Chemists. Official Methods of Analysis. 1-24.

Barlowska, J., Litwinczuk, Z., Krol, J. and Kedziesrska-Matysek, M. 2006. Fatty acid profile and minerals content in milk from cows of various breeds over spring-summer feeding period. *Polish Journal of Food and Nutrition.* 5. 24-33.

Belal, H. M. 2013. Physicochemical characteristics of various raw milk samples in a selecte dairy plant in Bangladesh. *International Journal of Engineering and Applied Sciences.* 1(3*)*. 91-96.

Belewu, M. A. 2006. A Functional Approach to Dairy Science and Technology. *1st Edition. ISBN978-075- 394-x.AnAdlek production, Ilorin, Nigeria*.

Dandare, S. U., Ezeonwumelu, I. J. and Abubakar, M. G. 2014. Comparative analysis of nutrient composition of milk from different breeds of cows. *European Journal of Applied Engineering and Scientific Research*. 3(2). 33-36.

FAO 2005. *Global livestock production and Health atlas*. FAO, Rome. Italy.

Farrington, E. H. and Woll, F. W. 2010. *Testing milk and its products*. Published by Axibooks. 10-Vyas Ji KaNohraSardar para. India. 10-13.

Frank, O. 1988. Rural Dairy Technology Experience in Ethiopia. *ILCA Manual*.4. 1 - 10.

Gemechu, T., Beyene, F. and Eshetu, M. 2015. Physical and chemical quality

of raw cow's milk produced and marketed in Shashemene town, Southern Ethiopia. *Journal of Food and Agricultural Sciences.* 5(2). 7.13.

ICMSF(International Commission on Microbiological Specification for Foods) 2005."Microorganisms in foods". *Microbial ecology of food commodities*. Blackie Academic and professional. 6. London.

Kataoka, K., Nakae, T. and Imamura, T. 1991. *Comparative studies of the milk constituents of various mammals in Japan. Japan Journal of Dairy Science*. 20. 222-232.

Kebede, E. 2018. The effects of cattle breeds on milk composition in the same Management conditions. *Ethiopia Journal of Agricultural Science.* 28(2). 53-63.

Little, M. A. and. Leslie, P. W. 1999. *Turkana Herders of the Dry Savanna: Ecology and Biobehavioral Response of Nomads to an Uncertain Environment.* Oxford University Press. New York.

Londhe, G., Pal, D., and Narender Raju, P. 2012. Effect of packaging techniques on shelf life of brown peda, a milk-based confection. *LWT–Food Science and Technology.*47(1).117-125.

Mariani, P., Summer, A., Formaggioni, P. and Malacarne, M. 2002. La qualitàcasearia del latte di differentirazze bovine. *La RazzaBruna*. 1(7). 33.

Millogo, V., Ouedrago, G. A., Agnes, S. and Svernnenten-Sjaunja, K. 2008. Survey on Dairy cattle milk production and milk quality problems in peri-urban areas in Burkina Faso. *African Journal of Agricultural Research.* 3(3). 215-224.

Mirzadeh, K., Masoudi, A., Chaji, M. and Bojarpour, M. 2010. The subventricular zone en-face; wholemount staining and ependymal flow. *Journal of Animal and Veterinary Advances*.9(11). 1582-1583.

Myburgh, J., Osthoff, G., Hugo, A., de Wit, M., Nel, K. and Fourie, D. 2012. Comparison of the milk composition of free-ranging indigenous African cattle breeds. *South African Journal of Animal Science*. 42. 1-14.

New Zealand International Economic Advisory Service (NZieas) 2014. *Marketing dairy milk in Nigeria.* Auckland, New Zealand.

Nickerson, S. C. 1999. Milk production: factors affecting milk composition. In: *Milk quality*. Aspan, H . F . (Ed.). 1st Edition. Chapman and Hall, Glasgow, Scotland, UK. 3-23.

Oliver, S. P., Jayarao, B. M. and Almeida, R. A. 2005. "Foodborne pathogens in milk and the dairy farm environment": food safety and public health implications. *Journal of Dairy Science*. 2(2). 115- 129.

Ozrenk, E. and SelcukInci, S. 2008. The effect of seasonal variation on the composition of cow milk in Van province. *Pakistan Journal of Nutrition.*7 (1). 161-164.

Pandey, G. S. and Voskuil, G. C. S. 2011.*Manual on Milk safety, quality and hygiene*. Golden Valley agricultural Research Trust, Zambia. 52.

Poulsen, N. A., Gustavsson, F., Glantz, M., Paulsson, M., Larsen, L. B. and Larsen, M. K. J. 2012. The influence of feed and herd on fatty acid composition in 3 dairy breeds (Danish Holstein, Danish Jersey, and Swedish Red). *Journal of Dairy Science.* 95.6362- 6371.

Sikana, P. and Kerven, C. 1991. The

Impact of Commercialisation on the Role of Labour in: *African Pastoral Societies*. Pastoral Development Network Paper No.31c, Overseas Development Institute, London.

Summer, A., Franceschi, P., Malacarne, M., Formaggioni, P. Tosi, F., Tedeschi, G. and Mariani, P. 2004. Influence of somatic cell count on mineral content and salt equilibria of milk. *Italian Journal of Animal Science.* 8. 435-437.

Tesfay, T., Kebede, A. and Seifu, E. 2015. Physico-chemical properties of cow milk produced and marketed in Dire Dawa Town, Ethiopia. *Food Science Quality Management.* 42. 56-61.

Zeleke, Z. M. 2007. Non-genetic factors affecting milk yield and composition of traditionally managed camels (*Camelu sdromedarius*) in Eastern Ethiopia. *Livestock Research for Rural Development.* 19(6). 1-6.

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