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Effect of Breed on the Composition of Cow Milk under Traditional Management Practices in Ado-Ekiti, Nigeria

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ABSTRACT: Studies on the effect of breed on the composition of cow milk kept under traditional management practices in Ado-Ekiti were carried out. Twelve lactating cows comprising four each of white Fulani (WF), Red Bororo (RB) and Muturu (MT) breeds were hand-milked 7 days post-partum before morning grazing. Representative samples of milk obtained from four cows of each breed were bulked separately and analysed for proximate, mineral and amino acids composition. The ash, protein and lactose contents of the milk did not differ significantly among the three cow breeds. However, breed of cow had significant effect on the water and fat compositions with milk fat varying extensively. The essential minerals like Ca, K, P, Na, Fe, Mg, Mn, Zn and Cu were detected in measurable concentrations ranging from 0.05 to 1.53mg/1, 0.06 to 151.5mg/1 and 0.09 to 1445mg/1 for WF, RB and MT breeds respectively. The result showed that breed of cow has no significant effect on the mineral and amino acids composition of the milk. Generally, the compositional variation of milk under study typified those of dairy herds earlier reported.

Keyword: Breeds, milk composition, Ado-Ekiti.

Surveys into the nature of milk refer to milk as a complex fluid secretion, excluding colostrums, with a complex biological molecule from the normal milking (manual or mechanical of the mammary glands of healthy, normally fed lactating animals (Jensen, 1995). Milking process and production are carried out in the topical, subtropical and temperate regions of the world from various animal species. The milk of each space of animal has been evaluated through the millennia to meet the growth and development requirements of its offspring. The state of milk production in Nigeria has been of less importance when compared with the current emphasis on meat production due probably to poor production incentive, negligible concentrate implement, poor calving percentage, poor genetic constitution and poor been management (Belewu, 2006). In Nigeria, cattle (cow) provide more than 90% of the total animal milk output while goats and sheep provides less than 10% and are kept for production of meat, hides and skin (Walshe et al., 1991). However, their production is mostly still based on the age-old (traditional) pastoral systems, which need to be gradually transformed in order to meet the needs of consumers (Nuru, 1988).

Regardless what milk is referred to, cow milk is the standard and commercially acceptable milk in which White Fulani cows are the principal producers (Adeneye, 1989). Milk is the best source of nutrients like carbohydrate (lactose), fat, protein (essential amino acids) vitamins, minerals and water both for their young and when compared to other sources of milk. Studies have shown that these nutrients are distributed in milk in appropriate dietary requirements (American Academy of Pediatrics, 1993). The current interest in the composition of milk is probably due to its nutritional importance in human diet and however, the composition is not absolute as many factors influence the end products. These variations can be related to animal breeds, season/weather condition during milking locality, stages of lactation, age and size of cow, environmental and dietary composition (Smith et al., 2000) herd management (Frank, 1988) and as a result of human handling, the mineral composition may vary (Zurera-Cusano et al., 1994).

Although, several authors have reported on the composition of cow milk for different animal species and localities of the world, yet, there is scanty literature on the milk composition characteristics of cows under the traditional (pastoral) management practices in the tropical climate of Nigeria especially on public-owned cattle production holdings in Ado-Ekiti. Therefore, this study was conducted to establish the effect of breeds on the composition of cow milk under extensive management of the owners with a view to providing up-to-date information and baseline scientific data to develop a foundation for dairy farming in the study area.

MATERIALS AND METHODS

*Study Site:*The study was carried out at the Fulani settlements at Erinffun and Ayoko villages located along Federal Polytechnic Road, Ado-Ekiti. Ado-Ekiti is located in Ekiti State of Nigeria on the Eastern part of Southwest of Nigeria, a typical rainforest belt. It is located within the tropics between latitude 7^{o} 45′ to 8^{o} 5′ North of the equator and longitude 4^{o} 45′ to 5^{o} 45′ East of the Greenwich meridian. The annual precipitation is about 1400mm. The mean annual temperature is 27^{o}C with two

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distinct seasons of rainy season (April – October) and dry season (November – March) (Diinat, 2005).

*Herd Management:*All the cows used for this study were owned by pastoralists and were raised under the extensive management systems. The animals were kept in open yard constructed mainly from local materials. The pens were made from wooden bars and the floor was covered with sand. Supplementary food was uncommon. Routine grazing was carried out twice daily (morning and evening). They were fed on natural pasture comprising mainly guinea grass *(Panicum maximum)* and other forages *(Eleusine Spp, pennisetum Spp, Asphilla Africana and Tridax procumbens)*. Milking of the cows is usually carried out manually by the owner before morning grazing into the collecting pail. The length of the lactation period ranged between 9 to 10 months.

*Sample Collection and Analysis:*Twelve lactating cows comprising four each of White Fulani (WF), Red Bororo (RB) and Muturu (MT) breeds were hand-milked 7 days post-partum before morning grazing. Representative samples of milk obtained from four cows of each breeds were bulked separately and collected into clean, white plastic container of 120mL capacity. The samples were taken in a cold box to the laboratory for analysis. The proximate composition were analysed according to the recommended methods of A.O.A.C., (2005). The mineral concentrations were determined using a Kemtech Analytical Alpha-4 Model atomic absorption spectrophotometer for Ca, Fe, Mg, Mn, Zn and Cu while flame emission spectrophotometer (Kemtech Analytical Alpha-4 model) was used to determine Na and K using appropriate instrumental conditions for each element. Phosphorus was determined using a UNICAM UV-1 Model UV-visible spectrophotometer. Amino acid profile of the defatted, hydrolysed and evaporated milk samples was determined using Technicon Sequential Multi-sample (TSM) Amino Analyzer Model DNA 0209. The mean values of the triplicate analyses were recorded.

*Statistical Analysis:*The data were analysed using the SPSS 10.0 software package (SPSS Inc., Chicago, Illinois, USA). The mean values obtained in the different groups were compared by one-way ANOVA, assuming that there were significant differences between mean values when statistical comparison gave $P<0.05$. The mean in a table in rows or column (as applicable) with different letters, (e.g., abc), are different significantly at the probability values of less than 0.05.

RESULTS AND DISCUSSION

Table 1.0 presents the mean results of proximate composition of milk obtained from three cow breeds. Water content was significantly higher in Muturu (MT) (87.42±0.26%) followed by White Fulani (WF) (87.17±0.30%) and lowest in Red Bororo (RB) (86.58±0.51%) breed at $P<0.05$. Water is the most important nutrient in animal feeding and health. It is a major component of the body that maintains blood volume, transport nutrients to the tissues and organs, maintains body temperature and determines the levels of milk production and composition in lactating dairy cattle (Barney and VanHorn, 2003). Milk fat varied extensively among the breeds. Fat content was significantly higher in RB (4.45±0.56%) compared to WF (3.60±0.11%) and MT (3.40±0.16%) at $P<0.05$. This finding is similar to that reported by Hurley, (1997a) and Belewu, (2006) on variation in fat content among cow breeds.

Table 1.0: Mean proximate composition of milk from different cow breeds

Proximate %	White Fulani WF)	Red Bororo (RB)	Muturu (MT)
Water	87.17±0.30ab	86.58±0.51b	87.42±0.26a
Fat	3.60±0.11b	4.45±0.56a	3.40±0.16b
Ash	0.65±0.06a	0.64±0.09a	0.67±0.09a
Protein	3.68±0.11a	3.54±0.72a	3.66±0.14a
Lactose	4.89±0.10a	4.79±0.23a	4.85±0.18a

[1]X±S.D. = mean ± standard deviation; [2]Mean with different letters (abc) on the same row are significantly different at $P<0.05$

The variation in the fat content may be attributed to different genetics and physiological status of the cow breeds (Frank, 1988). It may also be attributed to different herd management by the owners (pastoralists) (Zeleke, 2007). According to Belewu, (2006), variations in fat content among breeds of cow is an inherited character which implies that breeds with higher fat content produce less milk quantity than those with low fat content. There is no significant difference in the ash content among the three breeds at $P<0.05$ as they had close values of 0.65±0.06, 0.64±0.09 and 0.67±0.09% respectively for WF, RB and MT. Similarly, there are no significant differences in the values recorded for the

protein and lactose compositions at P<0.05 in the cow milk of the three breeds. The protein compositions were: WF (3.68±0.11%), RB (3.54±0.72%) and MT (3.66±0.14%) while lactose contents were in the respect of 4.89±0.10%, 4.79±0.23% and 4.85±0.18% for WF, RB and MT breeds respectively.

Table 2.0: Mean mineral composition of milk from different cow breeds

Minerals (mg/L)	White Fulani (WF)	Red Bororo (RB)	Muturu (MT)
Ca	1313±77a	1301±68a	1340±135a
K	1353±131a	1514±55a	1445±302a
P	859±78a	884±117a	867±95a
Na	441±25a	491±80a	490±83a
Fe	0.67±0.09a	0.38±0.15b	0.54±0.02ab
Mg	140±30a	137±24a	145±49a
Mn	0.05±0.02a	0.15±0.12a	0.09±0.04a
Zn	5.27±1.22a	5.15±1.10a	4.84±0.52a
Cu	0.13±0.04a	0.06±0.06a	0.12±0.03a

[1]X±S.D. = mean ± standard deviation; [2]Mean with different letters (abc) on the same row are significantly different at P<0.05.

The mineral content of the milk (Table 2.0) for the cow breeds were: Ca (1313±77, 1301±68 and 1340±135); K (1353±131, 1514±55 and1445±302); P (859±78, 884±117 and 867±95); Na (441±25, 491±80 and 490±83); Fe (0.67±0.9, 0.38±0.5 and 0.54±0.2); Mg (140±30, 137±24 and 145±49); Mn (0.05±0.02, 0.15±0.12 and 0.09±0.04); Zn (5.27±1.22, 5.15±1.10 and 4.84±0.52) and Cu (0.13±0.04, 0.06±0.06 and0.12±0.03) for WF, RB and MT respectively. There was no significant difference in the mineral composition of the milk among the breeds except iron content that was significantly higher (P<0.05) in WF (0.67±0.9) followed by MT (0.54±0.2) and lowest in RB (0.38±0.5). This observation is in consonance with the report of Hurley, (1997a) that mineral composition is one of the least variables in breed differences in cow. However, from the result, the milk samples of the three breeds are rich in micro minerals like calcium, potassium, phosphorous, sodium and magnesium. Calcium plays an important role in bones formation and metabolism, muscle contraction, nerve transmission and blood clotting.

Table 3.0: Mean amino acids composition of milk from different cow breeds

Amino acids (g/100g protein)	White Fulani (WF)	Red Bororo (RB)	Muturu (MT)
Lys*	6.28±0.27b	6.72±0.20a	6.86±0.16a
His*	3.21±0.13b	3.48±0.10a	3.51±0.10a
Arg*	4.37±0.95a	4.24±0.22a	4.07±0.15a
Asp	8.57±0.27a	8.55±0.88a	9.04±1.16a
Thr*	4.11±0.96a	3.85±0.05a	3.97±0.23a
Ser	3.80±0.23a	4.18±0.16a	4.13±0.20a
Glu	14.97±1.62a	15.94±0.12a	15.04±0.72a
Pro	3.45±0.41a	4.18±0.56a	4.16±0.29a
Gly	4.57±0.31b	5.49±0.36a	5.91±0.13a
Ala	3.36±0.28b	4.16±0.21a	4.51±0.02a
Cys	1.13±0.16a	1.03±0.07a	1.06±0.08a
Val*	4.49±0.15a	5.40±0.47a	4.98±0.61a
Met*	2.99±0.08b	3.67±0.15a	3.34±0.29ab
Ileu*	5.22±0.03b	6.53±0.46a	6.16±0.56a
Leu*	8.50±0.40b	10.29±0.31a	10.21±0.43a
Tyr	3.64±0.91a	4.27±0.60a	4.62±0.53a
Phe *	4.39±0.34b	5.11±0.32a	4.79±0.29ab
TAA	87.05	97.09	96.36
TEAA	39.45	49.29	47.89

***Essential amino acids; **TAA=** Total amino acids; TEAA= Total essential amino acids. ; Mean with different letters (abc) on the same row are significantly different at P<0.05.

Calcium and phosphorous are required in large quantities for rapid growth of neonate for bone growth and development of soft tissues. Phosphorous is involved in maintaining body pH, in storage and transfer of energy. Magnesium (Mg) is an enzyme cofactor and is important in bone metabolism. Sodium (Na) and Potassium (K) are electrolytes useful in maintaining water balance and blood volume. The macro minerals: Fe, Mn, Zn and Cu are needed by enzymes as co-factors (Hurley, 1997b).

Iron (Fe) is a component of blood and many enzymes. It is involved in blood metabolism and oxygen transport. Manganese (Mn) is involved in bone formation and in enzymes involved in amino acid and carbohydrate metabolism. Zinc (Zn) is a component of many enzymes and proteins. It is also involved in gene regulation.

The amino acid composition (g/100g protein) of milk from the three cow breeds is presented in Table 3.0 There is no much significant difference ($P<0.05$) in the amino acid profile of the breeds except for Lysine (Lys), Glycine (Gly), Alanine (Ala), Isoleucine (Ileu) and Leucine (Leu) contents of the milk from RB and MT that differed significantly compared to WF. Phenylalanine content in RB also showed a significant higher value than WF milk. The total amino acid (TAA) content is high for RB (97.09) followed by MT (96.36) and then WF (87.05) out of which the total essential amino acids (TEAA) were 49.29, 47.89 and 39.45g/100g protein respectively. Thus, the amino acid content in the three breeds are in the order RB> MT> WF. The amino acid values for the three breeds fall within the range of values reported for South African whole milk (Smith et al., 2000) and within the minimum and maximum values of amino acid content of infant formulas (Alegria et al., 1999). The values also meet the recommendations for dietary intake of school children and adults, and they would make a substantial contribution for infant (FAO, 1970). The values are approximately equivalent to at least 80% of the human milk protein used as standard. (EU, 1991; FAO/WHO, 1985).

*Conclusion***:** The cow milk composition of the herd under traditional management practices in the study area (Ado-Ekiti) typifies those of dairy herd earlier reported. It was observed that breed of cow had significant effect on the fat and water compositions with milk fat varying extensively. The ash, protein, lactose, mineral and amino acid compositions were not affected by breed differences.

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REFERENCES

Adeneye, J A (1989). Variations in yield and composition of milk from different quarters of lactating White Fulani cattle in a tropical environment. Nig. J. Animal Prod. 16 (1): 8 - 15.

Alegria, A; Baberά, R; Farre, R; Lάgarda, M J; Lapez, J C (1999). Amino acid content of Infant formulas. J. Food Comp. Anal. 12: 137 - 146.

American Academy of Pediatrics (1993). Pediatric Nutrition Handbook. American Acad. Pediatrics, ELK Grede Village, pp1 - 30.

AOAC (2005). Official Methods of Analysis. 18th edn. Association of Official Anal. Chemists, Washington D.C.

Barney, H J; VanHorn, H H (2003). Water and its Importance to Animals. Institute of Food and Agricultural Sciences, University of Florida, Gainesville. pp1 - 8.

Belewu, M A (2006). A Functional approach to Dairy Science and Technology. Adlek Printing Enterprises, Ilorin. pp117 - 136.

European Commission (1991). Off. J. Eur. Commmun. No. L175: 35.

FAO/WHO/UNU (1985). Energy and protein requirements. Report of a joint FAO/WHO/UNU expert consultation, WHO Tech. Rep. Ser. No. 724, Geneva, Switzerland, p205.

Food and Agricultural Organisation, FAO (1970). Amino acid content of foods and biological data on protein; (FAO Nutritional Studies No.24) Rome: FAO.

Frank, O (1988). Rural Dairy Technology Experience in Ethiopia. ILCA Manual No. 4: 1 - 10.

Hurley, W L (1997a) Lactation Biology. Factors affecting milk yield and composition. http://classes.aces.u. 1 - 5.

Hurley, W L (1997b). Lactation Biology. Milk Composition – Minerals, http://classes.ansci.edu/an438: 1 -3.

Jenson, R G (1995). Handbook of Milk Composition, Academic Press, San Diego, pp60 - 63.

Nuru, S (1988). Research and Development in pastoral production system in Nigeria: Past, present and future. In Proc: National Conference on pastoralism in Nigeria, Kaduna.

Smith, L E; Schonfeldt, H C; De beer, W H J; Smith, M F (2000). The effect of locality and season on the composition of South African whole milk. J. Food Comp. Anal. 13: 345 - 367.

Walshe, M.J; Grinddle, A; Neji C; Benchman, M (1991). Dairy Development in Sub-Sahara Africa. World Bank Tech. Paper 135, African Tech. Dept. Ser, pp1 - 20.

Zeleke, Z M (2007). Non-genetic factors affecting milk yield and composition of traditionally managed camel (*camelus dromedaries)* in Eastern Ethiopia. Livestock Res. Rur. Dev. 19(6):1- 6.

Zurera-Cusano, G; Moreno-Rojas, R; Amaro-lopez, M (1994). Effect of Processing on contents and relationship of mineral elements of milk. *Prod. Chem. 51: 75 - 78.*