Distribution of protein fraction in the milk of West African dwarf goat

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Abstract

Milks from lactating West African dwarf goat and white Fulani cow were analysed for total protein, casein, whey protein, non protein nitrogen, Globulin and albumin and proteose peptone contents. Milk samples were from healthy goats and cows (n=24) in mid-lactation. The data were grouped and analysed as treatment 1 (Goat milk) and treatment 2 (cow milk). The average casein nitrogen, globulin and albumin, non-protein in nitrogen, whey nitrogen and proteose peptone were 0.4034, 0.0574, 0.0563, 0.0225 and 0.0225g/ 100ml for goat milk respectively and 0.414, 0.0572, 0.030, 0.0212 and 0.0219 g/ 100ml for cow milk respectively. In total nitrogen (g/100ml) goat milk ranked 0.56 to 0.54 cow milk. Goat milk also ranked higher in casein nitrogen, protein nitrogen and non-casein nitrogen. Milk differed also in the casein number with higher casein number reported for cow milk. This study revealed the protein fraction of West African dwarf goat milk with special attention on the whey nitrogen since milk supplied to the market in Nigeria is intended for fluid consumption due to little or no cheese industry.

Key words: Protein fraction, goat milk, cow milk.

Introduction

Goat which was known as "Wet nurse of infant" in United Kingdom and "Poor man's cow" in India was the first animal to be domesticated (Zeuner, 1903). The animal has been neglected all over the world, mostly in tropical countries like Nigeria. The scantiness of information on the protein fraction is even more striking in the tropical environment where goats are the most numerous ruminant (Mba *et. al.*; 1975). Goat milk which is rarely utilized for human consumption in Nigeria due to social belief was found to have small fat globules (Jenness, 1980; Chandan *et. al.*; 1992). The protein of goat milk differ from cow milk in amino acid, casein structure and composition. Goat milk is useful in the treatment of dyspepsia, peptic ulcer, pyloric stenosis, liver dysfunction, jaundice and biliary disorder. Based on the above facts, the dietary value of goat milk is still not well known enough, the effort to popularise and encourage the consumption of goat milk among the populace should be intensified since goat is owned by nearly all the household unit unlike cow which is more expensive.

The distribution of milk between the casein and whey fraction is very vital for cheese production however, the whey protein and lactose content should be very low because the whey protein is an under-utilised by-product of the cheese industry. With these trends, information on the composition of milk of other breeds of ruminant animals (goats) in Nigeria is desired so as to complement that which is produced from cow. Much of the information available provides only on the characteristics and quality of goat milk. In addition, adequate date on the distribution of the milk protein between the whey and casein fractions are not available in literature. In this contribution report on the distribution of protein fraction milk of West African dwarf goat and Bunaji cow are discussed.

Experimental Methods

Milk Sample

Samples of milk were taken from twelve lactating West African dwarf goats and cows at the morning and evening milking times. All goat and cow were in good health and in mid-lactation. Feeding regimes were same for all animals (Extremely grazing).

Analytical Methods

Nitrogen was determined by the standard micro-kjeldahl method of A.O.A.C. (1975) while a nitrogen factor of 6.38 was used for the calculation of protein content of milk and its various fractions using the methods described by Shahani and Somer

Table 1. Mean Nitrogen Fractions in Goat and cow.

Nitorgen Fractions (g/100ml)	Goat Milk (T1)	Cow Milk (T2)	Significance
Total Nitrogen	0.5615	0.5453	T1 vs T2
Casein Nitrogen	0.4034	0.414	T1 vs T2
Non casein nitrogen	0.1518	0.130	T1 vs T2
Non Protein nitrogen	0.563	0.030	T1 vs T2 NS
Protein Nitrogen	0.5052	0.5158	T1 vs T2*
Proteose Peptone	0.0225	0.022	T1 vs T2 NS
Globulin and Albumin	0.0574	0.057	T1 vs T2 NS
Whey nitrogen	0.0225	0.021	T1 vs T2 NS
Casein Number %	72	76	T1 vs T2 *

(1951). True protein nitrogen was calculated as follows: True protein N = total nitrogen - non-protein nitrogen. Whey protein was determined by the method of A.O.A.C. (1975). Protein Nitrogen = Whey Nitrogen - Non Protein nitrogen; casein Nitrogen = Total Nitrogen - Whey Nitrogen. Albumin and Globulin = Non casein Nitrogen - proteose peptone.

Statistical analysis: All data collected were subjected to a parametric student 'T' test.

Results and Discussion

All the animals were in good health and in their mid-lactation period. **Table 1** presents the N-fraction analyses of milk samples. The nitrogen fractions include casein nitrogen, non-casein nitrogen, non-protein nitrogen, protein nitrogen, proteose peptone, globulin and albumin's and whey nitrogen. There were significant differences between the total nitrogen content of goat milk and cow milk with higher value reported for goat milk due probably to higher protein content of its milk. The mean total nitrogen content reported for cow milk in this study was lower than that reported by Adeneye (1988) and Belewu (1992). The variation in the results might be due to the type of concentrate diets given while in this study, the animals were raised extensively. However, the value reported in this study was higher than the reported value for temperate breeds (Shahani and Sommer, 1951). The mean total nitrogen content of goat milk was higher than the value reported by Tripaldi *et. al.* (1998).

The mean casein nitrogen content of cow milk was significantly higher than that of goat milk. This agreed with results reported elsewhere that casein represent a small proportion of total nitrogen in goat milk than in cow milk. However, it was found that differences in the casein nitrogen did not reflect any significant biological value (BV) differences between the two milk (Aiyegbusi, 2000).

The mean value of non- casein nitrogen in goat milk was higher than cow milk due probably to the higher casein content in cow milk. The mean value of non-protein nitrogen for goat milk was higher than the value (0.044) reported by Singth (1972) and Tripaldi *et. al.* (1998). The protein nitrogen of cow milk was significant higher ($P < 0.05$) than that of goat milk and this could be attributed to the higher NPN in goat milk.

Table 2 revealed the expression of the values as a percentage of total nitrogen. An average 0f 10% of total nitrogen in milk of goat is in NPN (Non Protein Nitrogen) fraction while that of cow milk has 6% This means that NPN in milk of goat and cow milk is equivalent to 36g protein/100g of milk and 19.14g protein / 100g milk respectively. Results of NPN reported here was lower than the values reported for Bunaji cow milk by Adeneye (1998) and Belewu (1992) but higher than values reported for goat milk by Grappin *et.al.* (1979) and Tripaldi *et.al.* (1998). The value agreed with the report of Hoyberg (1992) but lower than values reported by Adeneye (1988) and Belewu (1992). Variation in results could be due to differences in type of feed given. The casein number characterised the suitability of milk for cheese production. For cheese industry, milk from cow would be suitable for the manufacturing of cheese. However, the milk from goat could equally be used to complement that of cow milk. The larger true protein nitrogen was in cow milk and lower in goat milk due probably to the higher-non-protein nitrogen of goat milk since this was obtained by calculation. The protein nitrogen as percentage of total nitrogen in this study was 94.5% (cow) and it was similar to the value reported by Szijarto et al. (1973) and Grappin et al (1979), Adeneye (1988) and Belewu (1992). The whey nitrogen was superior (P 0.05) in goat milk compared to that of cow milk. The whey nitrogen accounts for 4.5% of the true milk protein. The results were different from the values of Davies (1974), Adeneye (1988) and Belewu (1992). The biological value of the whey protein is highest among the milk proteins and from the nutritional point of view it is desirable to increase the whey content in milk intended for fluid consumption.

The value of globulin and albumin nitrogen found in this study averaged 0.023 (goat) and 0.021 (cow) was lower than the value reported by Shahani and Sommer (1951) (cow). Variation in the results might be due to nutritional status of the animal. In conclusion, the results obtained in this study revealed the proportion of various nitrogen fractions in goat and cow milk with goat milk having higher whey nitrogen content which is a welcome opportunity in a situation like Nigeria where milk is intended for fluid consumption due to little or no cheese industry. Also, the problem of poor calorie protein intake will be solved. However, for cheese industry the utilization of cow milk (Bunaji) should be encouraged while goat milk should be made to complement cow milk.

References

Adeneye, J. A. (1988). Evaluation of the Nitrogen fraction in Milk of Bunaji (White Fulani) cattle in hot humid environment. Nig. *J. Animal Production* vol. Pg. 28-36.

Aiyegbusi, O. F. (2000). Mineral composition and Biological value of cow and goat milk using

Table 2. Nitrogen Fractions as Percentage of Total Nitrogen

Nitrogen Fractions	Goat Milk	Cow Milk
Casein Nitrogen	71.84	76.01
Non casein nitrogen	27.03	23.92
Non protein nitrogen	10.02	5.50
Protein nitrogen	89.97	94.46
Proteose Peptone	4.01	4.02
Globulin and Albumin	10.22	10.33
Whey Nitrogen	4.01	3.89

rat bioassay. B. Sc. Project submitted to the Dept. of Animal Production, University of Ilorin.

A.O.A.C (1975) Association of Official Analytical Chemist. Official Methods of Analysis.

Belewu, M. A. (1992). Evaluation of broiler litter and cassava waste as feed for the while Fulani Cattle. Ph. D. Thesis. University of Ibadan, Nigeria.

Chandan, R. C., Marin, H., Nakrani, K. R. and Zehner, M.D (1992). Production and consumer acceptance of Latin American White cheese. *J. Dairy Sci.* 62 (5).

Davies, D. T. (1974). The quantitative partition of the albumin fraction of milk serum proteins by gel chromatography. *J. Dairy Research* 41:217.

Jenness, R. (1980). Composition and characteristics of goat milk. A Review. 1968-1979. *Journal of Dairy Sci.* 63: 1605-1630.

Mba, A. U., Bayo, B. S. and Oyenuga, V. A. (1975). Studies on the milk composition of west African dwarf, Red Sokoto and Sannen goats at different stages of lactation. *J. Dairy Research* 42: 217-226.

Shahanim K. M. and Sommer, H.H (1951). The protein and non-protein nitrogen fractions in milk 1. Methods of analysis. *J. Dairy Sci.* 34: 1003-1009.

Singth, N. P. (1972). A study on the nitrogen distribution in goat milk. Milch Wissencheft 27: 165.

Szijarto, L., Biggs, D. A. and Irvine, D. M. (1973). Variability of casein, serum, protein and non-protein nitrogen in plant milk supplies in Ontario. *J. Dairy Sci.* 45-56.

Tripaldi, C., Martilloti, F. and Terramocilia, F. (1988). Content of taurine and other free amino acid in milk of goat bred in Italy. *Small Ruminant Research* 30: 127-137.

Zeuner, F. E. (1963). A History of Domesticated Animals. London: Hutchinson.