MINERAL ELEMENTS IN MILK OF THE WEST AFRICAN DWARF EWES AS AFFECTED BY STAGE OF LACTATION

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ABSTRACT

Analysis of ewe's milk from twenty West African dwarf ewes collected from day one after parturition showed that the colostrum contained (mg/100ml) Ca 115.0 ± 1.82, P 65.8 ± 4.08 Na 108.3 ± 2.0, K 163.2 ± 1.74, Mg 17.9 ± 0.78, Cl 217.7 ± 27.42, and (in mg/litre) Fe 4.3±0.20, Cu 3.2 ± 0.17 Mn 0.21 ± 0.03, Zn 13.6 ± 0.62, and Ug/litre of I 311.2 ± 6.63. The corresponding values with standard deviation for the mature ewe's milk were Ca 129.5 ± 7.17 P 99.5 ± 6.20, Na 106.2 ± 1.46, K 149.7 ± 3.18, Mg 17.5 ± 1.51, Cl 202.4 ± 15.52 Fe 0.67 ± 0.38, Cu 0.41 ± 0.39, Mn 0.07 ± 0.04, Zn 3.8 ± 0.22 and I 113.1 ± 28.78. The concentration of these elements in the colostrum approached that of the normal ewe s milk on the seventh day after parturition The results showed a rise in Ca P, Na Mg and Cl levels with stage of lactation and a fall in K, Fe Cu Mn, Zn and I contents of the milk with advancing lactation.

Key Words: Major, trace Minerals, Ewes Milk, Stage, lactation.

INTRODUCTION

The West African dwarf sheep (WAD) described as ***Fouta Djallon,*** Djallonke (Mason, 1951) is a small compact, hardy breed. Aside from producing milk, hides and other products, mutton is the most important. The current and future needs of animal protein in the diets of people in many tropical countries call for an appraisal of every available information in livestock production Reproductive performance, growth (Dettmers, Igoche and Akinkuolie, 1976), proximate composition and total milk yield of the WAD sheep under intensive management had been reported (Adu and Ngere, 1979). However there is a dearth of knowledge on the minerals in WAD ewe's milk. The importance of minerals in human and animal nutrition has been reviewed (Underwood, 1977, Scott, 1972). The present experiment is therefore designed to contribute to the existing knowledge on ewe's milk in general and in particular that of the WAD sheep.

MATERIALS AND METHODS

Animals and their management

Twenty ewe's about 2 years old and weighing 24 to 26kg were used for lactation studies lasting 16 weeks.

The animals were kept in individual pens with concrete floors, where they had free access to salt licks and fresh

water daily. Ewes were supplied individually per day, freshly cut grass ***(cynodon nlemfuensis) ad-libitum*** plus 0.6kg contentrate mixture of ground yellow maize 65%, groundnut cake 20%, palm kernel cake 15% and a proprietary vitamin and mieral mixture added at 5kg/tonne. Dicalcium phosphate was added to the concentrate mixture to supply 22g Ca and 3.2g P per kg DM of feed. Details of the proximate composition and mineral contents of the grass and concentrate are presented in Table 1.

Collection of milk

Each ewe was handmilked for 16 weeks from the first day after parturition. The milk was well mixed and portions (30%) from each ewe in the morning and after noon were bulked together mixed and stored in a deep freeze cabinet - 5°C in two 3 –day and 4 - day bulked samples per week except during the first 7 days after parturition, when the bulked daily samples of colostrum were collected and stored as separate samples in a deep freeze cabinet Each pooled sample was

Table 1

CHEMICAL COMPOSITION OF CONCENTRATE SUPPLEMENT AND GRASS FED TO SHEEP.

Nutrients	*Concentrate Supplement*	*Grass*
Dry matter (DM) %	89.6	31.1
Ash g/100g DM	8.6	9.1
Crude protein g/100g DM	18.8	10.1
Crude fibre g/100g DM	5.8	28.0
Ether Extract g/100g DM	5.4	1.1
Ca g/100g DM	2.2	0.62
P g/100g DM	0.32	0.16
Na g/100g DM	0.04	0.06
K g/100g DM	14.5	2.5
Mg g/100g DM	0.09	0.23
Mn ppm	204 2	127.1
Fe ppm	540.1	1570.6
Zn ppm	61.6	50.5
Cu ppm	20.0	14.1
I ppm	28.0	5.1
Mo ppm	1.3	1.2
Se ppm	0.05	0.03

warmed to 40°C to melt the butterfat and then cooled at 20°C for chemical analysis which was done in duplicate within one week. No preservatives were added.

Analytical procedure

Samples of milk, grass and concentrate supplements were analysed for iodine (AOAC, 1980) and chloride (Davies, 1932). Other elements concentrations were determined after wet digestion of samples with a mixture of perchloric, nitric and sulphuric acids with perkin-Elmer atomic absorption spectrophotometer. The phosphorus (P) in the digest was determined as phosphovandomoly bdate (AOAC, 1980) and the yellow colour so developed was measured spectro photometrically at 425nm. Statistical evaluation of data were according to Steel and Torrie (1980).

RESULTS AND DISCUSSION

Results obtained for the major and trace minerals contents of the WAD ewe's milk are shown in Tables 2 and 3 respectively. Each figure which corresponds to week 2 to 16 is an average from the 3-day and 4-day bulk samples per week and so represent a mean of 40 determinations for 20 ewes.

Tables 2 and 3 show that the colostrum was richer in its content of Na, K, Cl, Fe, Cu, Mn Zn and I. than the mature milk. The values (mg/100ml) obtained for Ca (115.0 ± 1 82) and P (65 8±0.08) in the colostrum were lower than the corresponding estimates of 129 5±87.17 and 99.5±6.20 recorded for Ca and P respectively in mature ewe's milk.

The mineral composition however approached normal values on day 7 after parturition. Similar observations in the colostrum and mature milk have been reported for rabbits (Lebas, Besancon and Abouyoub, 1971), ewe's (Ashton and Yousef, 1966) and goat's (Akinsoyinu & Akinyele 1979) milk. The Ca and P are however higher in cow's (Miriani & Russo, 1976, Akinsoyinu, 1980) and human's (Kisza & Zbikowoski, 1975) colostrum than in mature milk. The apparent differences between the concentration of Mg or K in the colostrum and normal ewe's milk were not significant.

The larger amount of trace minerals in colostrum are consistent with publis hed data on cow's, sheep and goat's milk (Underwood 1977). The reason could be due to the importance of colostrum in the early but delicate part of life. The mean Fe in the colostrum was about six times the average in mature ewe's milk. This ratio is similar to that obtained for the WAD goat (Akinsoyinu Tewe & Mba, 1979) but larger than the range 3 to 5 reported for Fe in the colostrum of cow, human and goat in the temperate, when compared with their mature milk (Underwood, 1977).

The contents of Ca, P, Na, Mg and Cl increased with advancing lactation but that of K and the trace cations decreased. Statistical analysis revealed that the increasing or decreasing trends were highly significant ($P<0.01$). In addition there was no indication that the trends were different for the 20 ewes. Reports in literature seem to justify the results obtained in the present study. it was observed for cow's (Dawes, 1965: Akinsoyinu, 1981), ewe's (Ashton & Yousef 1960) and buffalo's (Jenness & sloan, 1971) milk, that Ca, P, Na, Mg & Cl increased and K decreased with stages of lactation and differences such

Table 2

MAJOR MINERALS(mg/100ml) IN EWE'S MILK WITH ADVANCING LACTATION

Times after Parturition						
Day	*Ca*	*P*	*Na*	*K*	*Mg*	*Cl*
1	118 1	70.1	110.1	165.6	19.1	250.1
2	116.2	70.0	110.2	165.2	18.3	245.0
3.	114.5	67.5	108.2	163.2	18.0	230.1
4.	114.5	64.3	106.1	162.1	17.9	200.0
5.	113.8	62.1	109.6	161.6	16.8	190.6
6.	113.1	60.5	105.7	161.8	17.4	190.1
*Mean	115.0	65.8	108.3	163.2	17.9	217.7
Week						
2.	128 1	100.1	104.0	160.3	16.0	180.0
3.	120 0	89.1	104.3	151.1	15.5	180.4
4.	121.2	91.0	104.8	150.8	15.5	185.1
5.	121.6	91.4	104.9	150.1	16.0	190.2
6.	122.5	95.3	105.1	150.0	16.6	192.3
7.	122.9	97.0	105.4	149.4	16.0	197.1
8.	123.0	97.6	105.9	149.1	17.1	198.4
9.	130.1	98.0	106 3	148.8	17.8	199.0
10.	131.6	100.1	106.7	148.8	18.4	202.0
11.	134 1	101.6	106.9	148.3	18.4	210.6
12.	135.3	102 9	107 3	148.0	19.0	211.4
13.	135.8	103.6	107.6	148.0	18.0	219.0
14.	137.2	105 4	107.6	147.5	19.4	221.1
15.	139 1	108 1	108.1	147.5	19.4	224.1
16.	140.0	110.5	108.7	147.1	19.6	225.6
Mean+	129.5	99.5	106.2	149.7	17.5	202.4

* Colostrum

\+ Colostrum excluded

Table 3

TRACE MINERALS PER L!TRE IN EWE'S MILK WITH ADVANCING LACTATION.

Times after parturition	*Fe*	*Cu*	*Mn*	*Zn*	*I*
Day		*Mg*			*Ug*
1	4.51	3.44	0.27	12.70	300.11
2	4.40	3.31	0.20	13.11	320.11
3	4 35	3.20	0.23	13.52	310.05
4	4.20	3.08	0.20	23.90	312.01
5	4.04	3.02	0 18	14.20	315.00
6	4.03	3.00	0.18	14.25	310.10
7					
Mean*	4.26	3 18	0.21	13.61	311 23
Week					
2.	1.60	1.42	0.18	4.20	144.10
3	1.42	1.00	0.10	4.19	143.82
4	0.81	0.82	0.10	3.85	143.10
5	0.80	0.51	0.08	4.10	142.04
6	0.75	0.44	0.06	4.00	140.11
7	0.73	0 40	0.05	4.02	139.24
8	0 56	0.35	0.05	4.02	137.05
9	0.52	0.30	0.06	3.71	112.32
10	0.48	0.24	0.06	3.70	100.00
11	0 42	0.20	0.05	3.68	90,44
12	0.40	0.15	0.04	3.66	87.35
13	0.41	0.10	0.04	3.64	80.15
14	0.39	0.07	0.03	3.60	79.24
15	0.40	0.06	0.04	3.60	78.86
16	0.38	0.06	0.04	3.65	78.24
Mean+	0 67	0.41	0.07	3.84	113.07

* Colostrum; + Colostrum excluded.

as those between animals were of no effect.

The mean values (mg/100ml) for Ca (129.5) and P (99.5) are higher than corresponding estimates of Ca (85.5) and P (74.7) recorded for Anglo-Nubian and Ca (89.9), P (82.1) for British Alpine goats imported into Trinidad (Devendra, 1972) but are comparable with Ca (126.4) (Miculec *et al.* 1925 and P, 91.6 (Miriani & russo 1976) reported for cows milk. There is a highly positive relationship between Ca & P in milk (Akinsoyinu, 1981 Miriani & Russo, 1976) and Ca & P originate from the blood contents (Kamal & Cragle, 1962) The mean milk yield of ewes in the present study was 408±47.5 g/head/day, which is much lower than the mean daily yields of cow's, Anglo Nubian or British Alpine goats (Miriani & Russo, 1976, Devendra, 1972. It therefore seems likely that more Ca and P would be secreted into the milk of lactating animal with lower milk yield. The study also indicates a gradual increase in milk Ca and P concentration throughout lactation as the milk yield reported elsewhere (Adu *et al.* 1974) decreased.

The average contents of Na K Mg and Cl over the lactation period in this report were higher than the values repor ted for milks of temperate breeds of goats (Devendra, 1972), ewes (Ashton & Yousef 1966) and mixed breeds of cows (Armstrong 1959 Alichanides & Vafopoulou, 1976). Since supplementa tion of a diet adequate in Na, K, & Mg with these elements has no effect on thir contents in milk, it seems conclusive that the WAD ewe's milk is richer in Na, K Mg and Cl than cow s milk.

The concentration of Fe in mature milk was slightly higher than the range 0.4 to 0.5 mg/litre quoted for cow's human's and goat's milk (Underwood, 1977) but less than 0.92 mg/litre of Fe for the Bulgarian cow's milk. (Naplatarova, 1977). The mg/litre of Cu in this study is higher than the range 0.04 to 0.16 for ewe's (Beck, 1941), 0.05 to 0.15 for cow's (Underwood, 1977) and 0.28 for goat's (Akinsoyinu *et al* 1979) milks. Since addition of Cu to a diet already adequately supplied with this element has no effect on the Cu content of milk (Elvehjam, Steenbock & Hart, 1929), this high value could be peculiar to the WAD ewe's milk. The mean concentrations of Mn and Zn in mature milk were however comparable to values reported for mare's (Naplatarova, 1977) goats (Akinsoyinu *et al* 1979) and cow's (Archibald, 1944) milk. The average content of I was higher than the range 30 –70 ug/litre of I (Underwood · 1977) but fell within the range 72 to 23 136 Ug/litre for cow's milk (Lewis & Ralston, 1953).

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