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THE EFFECT OF CALCIUM AND PHOSPHORUS SUPPLEMENTATION ON THE COMPOSITION OF MILK AND BLOOD OF LACTATING DWARF GOATS

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*Target Audience: Dairy farmers, nutritionists, technologists

ABSTRACT

This experiment involved 12 West Africa goats aged 20 to 24 months and weighing 21 to 23kg. They were fed a basal diet of grass hay (Cynodon nlemfuensis) and randomly alloted to one of three isonitrogenous and isocaloric concentrate diets. Concentrate contained Ca 0.42% and P 0.28% (A), Ca 0.81% and 0.55% (B) and Ca 1.21% and P O.81(C). The experiment lasted 12)weeks of lactation. Results show that dry matter intake (DMI) was between 4.2 and 4.5% of body weight(BW). Treatment effect on blood glucose (BG) and plasma urea nitrogen (PUN)was not significant . Effects of week and time of blood collection were highly significant (P<0.01). Mean value (%of buttfat)of polyunsaturated fatty acid (PUFA) of colostrum and mature milk was 9.1 and 7.87 respectively .Ratio of PUFA to saturated fatty acid (SFA) was 0.16 for colostrum and 0.15 for mature milk. Treatment difference did not significantly affect fatty acid and milk composition. With the exception of lactose, all other milk analytes were higher in colostrum than mature milk, cholesterol and fatty acids contents were comparable to those reported in milk of temperate breed of goats.

Keywords: Fatty acids, blood glucose, plasma urea nitrogen, lactation, goats, milk composition.

DESCRIPTION OF PROBLEMS

Milk, a complete diet created by nature for feeding young ones before they can fend for themselves (1). However, feeding of goat milk to infants has been an age-old practice in India and it is increasingly becoming popular in United Kingdom (2) (Goat milk is also believed to score above cow milk mainly in its composition of fat, protein and other constituents like minerals and vitamins, which make it extremely nourshing for infants and old alike. This fact, coupled with special attributes of goat milk, such as high digestibility and its therapeutic use by abdominal ulcer patients, could be responsible for its marginal nutritional advantage over cow milk.

In spite of the attributes of goat milk, most published information on goat milk is still limited to protein, energy and mineral composition (3,4). In

this age when people all over the world are concerned with the composition of their diet, there is need to gather more information to enhance what is already in literature. This study was therefore designed to furnish some information on milk and blood analytes such as cholesterol, fatty acids and gross composition of WAD goat.

MATERIALS AND METHODS

Twelve adult female West African dwarf goats weighing between 21and 23 kg were involved in an experiment carried out to estimate milk composition, blood glucose, cholesterol, fatty acids and crude protein. The animals were fed a basal diet of Cynodon nlemfuensis and one of three concentrate diets containing increasing levels of Ca and P (Table 2).Goats were trasferred into metabolic cages at weeks 4, 8 and 12 of lactation for separate collection of urine. Blood samples were collected at 0, 2 and 4

Table 1. Analysed composition (g/mg DM) of Diets fed to WAD goats

Ingredients	A	B	C	*Grass
Maize	43.00	42.00	40.60	-
Dusa	18.00	17.60	17.00	-
Brewers dry grains	15.00	15.00	14.00	-
Rice bran	12.00	11.18	11.40	-
Palm kernel cake	10.10	10.10	9.80	-
Common Salt	0.60	0.50	0.50	-
Vit/Min Premix	0.50	0.50	0.50	-
NaH PO	-	1.10	2.65	-
$CaCO_3$	0.78	1.40	2.65	-
Total	100.00	100.00	100.00	-

** Dusa - By-product of a local gin made from fermented sorghum

- WAD - West African Dwarf
- Hay (*Cynodon nlemfluensis*)
- Vit/Mineral mix contains the following: Vit A 7500 I.U., Vit D3 1,500 I.U., Vit E 250mg, Vit B1 100mg, B2 2500mg, B12 5mg, Choline chloride 5000 mg, Manganese oxide 16100mg, Potassium iodide 350mg, K 1,500mg, Niacin 12,500mg, Copper oxide 1,300mg, Zinc oxide, 1,2500mg, Ferruous carbonate 20,323 mg.

Table 2. Proximate Analysis (%) of Experimental diets fed to goats

	A	B	C	*Grass
Ether extract	2.60	3.00	3.00	1.00
Crude protein	17.04	16.94	16.79	6.56
Crude fibre	12.50	12.65	13.00	33.00
Ash	8.60	9.00	8.50	8.00
Moisture	8.50	8.00	8.50	16.50
NFE	51.17	50.29	50.21	34.94
GE Kcal/g	4.20	4.16	4.10	
Ca	0.42	0.81	1.21	0.26
P	0.28	0.55	0.81	0.15

*Grass hay (*Cynodon nlemfuensis*)

hours after feeding on day 1 of weeks 4,8 and 12 of lactation. Blood was collected via jugular venipuncture into 7ml vacuum tubes (Becton Dickinson vacutainer Systems, Rutherford NJ). The tubes were then centrifuged at 1500 X g and 4°C for 20 minutes. Aliquots of plamsa were stored at -2°C untill required for analysis. Hand milked samples of milk were bulked weekly from 2 to 7 of lactation. Samples of colostrum were also bulked daily for 6 days after parturtion to give a sample per animal. Milk samples were frozen until required for analysis. Blood was analysed for plasma (PUN) (5) and plasma glucose (6). Milk samples were analysed for total solids, butterfat, protein (N X 6.38) lactose (7). After ether extraction, fatty acid profile was determined from ether supernatant liquots on a Hewlett Packard 5880A gas chromatography equipped with flame ionization detector. Fatty acids quantified were myristic acids (C 14:0), pentadecanoic acid (15:0), palmitic acid (C 18:0), oleric acid (C 18:1) and linoleic acid (C 18:2).

RESULT AND DISCUSSION

Blood glucose level and plasma urea nitrogen are indices of available energy and degree of protein metabolism respectively. Treatment effects on both parameters were not significant ($P<0.05$).This could be attributed to the isocaloric and isonitrogenous nature of the diets (Table 2). The effect of stage of lactation (weeks 4,8, and 12) and the hours (0,4,8) after feeding were however significant ($P > 0.05$).

Average cholesterol contents of mature goat milk reported in this study was 65mg per 100g DM, which is comparable to 83.0mg per 100g DM (8) and 58 to 125 mg 100-1 DM reported for adipose tissue and muscle of young goats raised entirely on all milk diet (10).

Values reported (Table 4) for palmitoleic and oleic acids were similar to values reported (11) for goat milk of temperate breeds.

The mean fat content of goat milk reported in this study was 6%, which is higher than 4.8% reported for cow milk (12) and 3.45% reported for British Alpine goats (13). It is however comparable to 7.6% obtained for pygmy goats (14). According to (15), milk fat tends to be higher with lower milk yield, therefore the value obtained in this study is meaningful as the milk yield of the WAD goat was low compared with temperate breeds. High temperature also depresses milk yield and increase fat content of milk. The high fat content and low milk yield reported in this study is therefore consistent with the climatic tropical environment where the WAD goat exists.

Mean crude protein of 8.3% is similar to 3.8 reported by (3) and Devendra for Saanen and Malabar goats . Mean values obtained for blood glucose

were comparable to published values for goats (18) and fall within the 66.6 to 70.0mg dl-1 reported by (19). The difference may however be due to apparent differences in experimental diets.

Table 3. Mean blood glucose and plasma urea nitrogen (mg dI-I) of WAD goats fed varying levels of Ca and P

		Weeks		
Treatments	**Hours**	4	8	12
Blood glucose	0	57.56[a]	57.57[a]	59.10[a]
A	4	64.53[b]	64.97[b]	64.97[b]
	8	66.57[c]	66.80[c]	66.90[c]
B	0	57.50[a]	57.47[a]	58.00[a]
	4	64.46[b]	64.87[b]	64.20[b]
	8	66.43[c]	66.17[c]	66.77[c]
C	0	57.70[a]	57.80[a]	58.97[a]
	4	64.60[b]	65.00[b]	64.23[b]
	8	66.63[c]	66.83[b]	65.50[c]
Plasma Urea Nitrogen (PUN)				
	0	14.00[a]	14.27[a]	14.13[a]
A	4	14.57[a]	15.10[a]	15.07[a]
	8	15.07[a]	15.53[a]	15.53[a]
	0	14.10[a]	14.03[a]	14.40[a]
	0	14.10[a]	14.03[a]	14.40[a]
B	4	14.43[a]	14.77[a]	15.30[a]
	8	15.00[b]	15.43[b]	15.77[b]
	0	14.23[a]	13.97[a]	14.03[a]
C	4	14.37[a]	14.70[a]	14.63[a]
	8	15.07[b]	15.07[b]	15.47[b]

a,b,c.....Values in a column with difference superscripts are significantly (P>0.05) different.

Colostrum has been reported to be higher in certain nutrients such as major minerals (20), cholesterol (21), total solids, crude protein and fat (4) than mature milk. The same trend has been observed in this study. Colostrum was higher in all fatty acids, cholesterol and protein. This buttress the nutritional importance of colostrum in the diet of newly born. Goat milk being of animal origin, contains more saturated than unsaturated fatty acids. This is demonstrated by the low PUFA:SFA ratio observed in this study. Goat milk is however lower in most saturated fatty acid than cow milk (11) and beef (22). Linoleic acid, a dietary essential for human accounted for about 7.22% of total butterfat of goat milk in this study. This is above the range of 1to 2% (23) needed to prevent a deficiency of this essential fatty acid. It indicates that goat milk contains sufficient amount of the fatty acid (2).

Table 4. Mean value of Polyunsaturated fatty acids (PUFA), Saturated fatty acids (SEA) and other analyt in milk of WAD goats.

Fatty acids and analytes	Colostrum	Mature milk	SE
Myristic acid	1.9	1.36	0.03
Pentadecanoic	1.0	0.57	0.03
Palmitic acid	22.2	18.03	0.13
Palmotoleic acid	4.4	2.75	0.08
Heptadeconoic acid	3.2	2.76	0.06
Stearic acid	26.0	18.97	0.32
Oleic acid	28.2	20.67	0.32
Linoleic acid	8.4	7.22	0.14
PUFA	9.1	7.87	0.18
SFA	58.1	50.85	0.27
UFA	45.2	40.33	0.35
PUFA/SFA	0.16	0.15	0.003
Cholesterol mg/100^{-1} DM%	72.4	65.33	0.22
% of Milk Total Solid	19.2	18.98	0.20
Crude Protein	5.0	3.85	0.13
Lactose	4.5	5.92	0.20
Total fat	8.1	6.93	0.13
Ether extract	33.1	28.3	0.34

CONCLUSION AND APPLICATION

The value obtained for the component of goat milk analysed in this study indicate that goat milk compares well with cow milk and could be of high dietary importance to humans.

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