EFFECT OF WATER DEPRIVATION ON NUTRIENT DIGESTIBILITY, NITROGEN RETENTION, AND WATER EXCRETION IN YANKASA SHEEP AND MARADI GOATS

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(Received 28 June 1988; accepted for publication 1 July 1988)

ABSTRACT

The effects of various lengths of water deprivation on nutrient digestibility were studied with Yankasa sheep and Maradi goats fed on a diet consisting 60% grass hay (*Andropogon gayanus*) and 40% concentrate.

The water-restricted animals consumed less dry matter than normally-watered animals. The digestibility coefficients of the different nutrients were apparently though not significantly higher in water-restricted animals.

Mean faecal and urinal nitrogen excretion reduced with water deprivation. Faecal moisture content and urine output reduced with water deprivaton. Maradi goats conserved water better than Yankasa sheep by producing drier faeces, and less urine volume.

Key Words: Water, deprivation, nutrient digestibility, sheep, goats.

INTRODUCTION

Water deprivation reduced feed intake in Yankasa sheep (Aganga *et. al.*, 1988). Thornton and Yates (1968) and Umunna *et. al.* (1981) reported that nutrient digestibility is generally increased when water is restricted. Increase nitrogen metabolism has been reported in ruminants under restricted water intake (Payne, 1966). Water sscarcity is a problem of grazing ruminant during the long dry season in the Sudano-Sahelian Savanna Zone of Nigeria. The protracted dry season lasts for about 8 months in a year. This study was designed to investigate the influence of water deprivation on nutrient utilization and nitrogen metabolism being a part of extensive studies carried out on water metabolism and requirements of Nigerian indigenous sheep and goats.

MATERIALS AND METHODS

Twelve Yankassa rams with an average weight of 21.8kg and twleve Maradi bucks weighing on the average 19kg were used in the study. The animals were dandomly distributed to 3 watering treatments that is: once in 24 hours, once in 48 hours and once in 72 hours. Under each watering regime there were 4 rams and 4 bucks. All the experimental animals were maintained for a

preliminary period of 10 days in metal metabolism cages on cowpea pod shells. After the preliminary period the animals were given the experimental diet of 95% dry matter (table 1 and table 2) for 4 days during which no urine or faeces were collected for the animals to adjust to the feed. This preliminary and adjustment period was followed by the collection period of 21 days during which animals were watered according to their treatment and all urine and faeces voided were collected for proximate analyses according to the procedure of A.O.A.C. (1975).

Five (5) litres of drinking water was provided in metal pails and the animals were allowed to drink to appetite after which the remaining water was measured to determine intake by difference. Feed intake was measured daily.

Faeces was collected in harness bags fitted to the animals while urine was collected in plastic pails placed below the metabolism cages. Toluene (25ml) and 50% sulphuric acid (25ml) were placed in the plastic pails to prevent evaporation of urine and escape of nitrogen as ammonia.

The study was conducted during the hot, dry season (in March- April) with maximum temperature 39°C, *minimum temperature* 21°C, maximum relative humidity, (RH) 68% miniumu RH 14% and rainfall nil (I.A.R. Samru weather report).

Table 1
Percentage composition of the concentrate mixture

Ingredient	*Composition (%)*
Maize	73.20
Cotton seed cake	24.50
Salt (Nacl)	0.50
Bone meal	1.55
vitamin-mineral Premix*	0.25

*Vitamin-mineral premix used is ZOODRY VM 702

Table 2
Analyzed composition (%) of the concentrate and Hay

(DM basis)

	Cowpea pod shells	Hay	Concentrate
Cruce protein	12.4	4.5	16.7
Ash	8.9	8.9	5.0
Ether extract	1.94	1.9	4.9
Crude fibre	29.96	35.9	6.5
Nitrogen free extract	46.8	48.8	66.9

RESULTS

Daily feed consumption and water intake of the animals on the three watering regimes are shown in table 3. As the watering interval increased from 24h to 72h, the feed intake of the sheep and goats declined significantly ($P<0.05$).

Table 4 shows nitrogen balance of sheep and goats. Nitrogen intake of sheep and goats gave a similar trend to the feed intake. Nitrogen losses through faeces and urine declined from 24h to 72h watering intervals. Faecal nitrogen loss in the three treatments was lowest in animals on 48h watering intervals. Nitrogen-retained as percentage nitrogen intake was significantly ($P<0.05$) higher in sheep on 48h watering intervals while goats on 72h watering interval had highest nitrogen retention. Nitrogen excretion as percentage nitrogen intake was highest in sheep and goats on daily watering. Table 5 shows urine output and faecal water excretion in the experimental animals. Sheep and goats on daily watering produced significantly ($P<0.05$) higher urine output than those on 48h and 72h watering intervals.

Table 3
Mean daily water and feed intake of sheep and goats.

	SHEEP				GOATS			
Watering intervals (h)	24	48	72	SE	24	48	72	SE[1]
Mean free water intake, ml/day	1818.57[a]	1657.72[b]	1406.5[c]	120.80	1394.35[d]	1190.87[e]	10.35.5[f]	103.90
Mean feed water intake, ml/day	38.58	34.24	32.27	1.80	29.46	27.43	25.02	1.28
Mean total water intake, ml/day	1856.95[a]	1709.96[b]	1437.77[c]	122.8	1423.81[d]	1218.3e	1060.52[f]	105.2
Mean total water intake ml/kg$^{0.73}$	195.67	180.18	151.50	12.94	165.94	141.99	123.60	12.26
Mean feed intake, g	767.57[a]	684.8[b]	645.35[c]	36.0	589.29[d]	548.6[e]	500.38[f]	25.7
Mean feed intake/kg$^{0.73}$	80.88	72.16	68.00	3.79	68.68	63.94	58.32	2.99
Water intake/dry matter intake ml/g	2.55	2.63	2.34	0.09	2.54	2.34	2.23	0.09

[1] Standard error

a,b,c,d,e,f Means being different superscript within the same row are significantly different ($P<0.05$).

Table 4
Effect of water deprivation on nitrogen balance of sheep and goats

	SHEEP				GOATS			
Watering intervals (h)	24	48	72	SE[1]	24	48	72	SE[1]
Nitrogen intake, g/day	11.52	10.28	9.69	0.54	8.84	8.23	7.51	0.38
Faecal nitrogen, g/day	3.57	2.58	2.65	0.32	2.82	2.02	2.10	0.25
Urinary nitrogen, g/day	2.65	1.84	1.62	0,31	1.85	1.67	1.15	0.21
Nitrogen retained, g/day	5.3	5.86	5.42	0.17	4.17	4.54	4.26	0.11
Nitrogen digestibility (%)	69.0	74.9	72.6	1.72	68.10	75.4	72.0	2.11
Nitrogen excretion as percentage nitrogen intake	53.9	42.9	44.1	3.48	52.8	44.8	43.3	2.95
Nitrogen-retained as percentage nitrogen intake	46.0	57.0	55.93	3.50	47.2	55.2	56.7	2.94

[1] Standard error

Table 5
Effect of water deprivation on urine output and faecal water excretion in sheep and goats

	SHEEP				GOATS			
Watering intervals (h)	24	48	72	SE[1]	24	48	72	SE[1]
Free water intake, ml/day	1818.57	1675.72	1406.5	120.80	1394.35	1190.87	1035.5	103.90
Urinary volume, ml/day	3323.57[a]	226.65[b]	165.05[c]	41.36	133.22[d]	121.79[e]	84.29[f]	14.78
Faecal water, g/day	168.2[a]	150.7[b]	116.3[c]	15.24	75.0[d]	63.33[e]	48.4[f]	7.70
Total water loss through faeces and urine, ml/day	491.8	377.3	281.3	60.85	208.2	185.1	132.7	22.34
Faecal water, g/100g of fresh faecal matter	59.2	54.0	49.5	2.80	46.4	41.2	40.0	1.96

[1] Standard error

a,b,c,d,e,f Means being different superscript within the same row are significantly different ($P < 0.05$).

DISCUSSION

The decline in the average intake of free water with the increase in watering intervals is similar to the observation of Umunna *et. al.* (1981). Also, feed intake was depressed with progressive period of water deprivation. Nitrogen intake decreased with increased watering interval because of the voluntary refusal of feed caused by water deprivation. Consequently, there was a decrease in faecel and urinary nitrogen excretion in water deprived sheep and goats. This is similar to reports of Payne (1966) and Ikhatua *et. al.* (1985). Also, there is a proportionate increase in nitrogen retention in the water

with the findings of Umunna *et. al.* (1981) which meant that more nitrogen was recycled.

Goats have a better ability to effect a reduction in the amount of faecal moisture than sheep. This is an effective mechanism of water conservation. Also the water deprived goats and sheep produced less urine volume than those on daily watering.

The ability of the indigenous sheep and goats to survive the long period of water scarcity of the Sudano-Sahelian zone of Northern Nigeria could be attributed to water conservation ability in the form of reduced faecal and urinary losses and recycling of water during this period.

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