INFLUENCE OF INTERMITTENT WATERING ON SOME BLOOD COMPONENTS OF GRAZING YANKASA SHEEP

A.A. AGANGA, N.N. UMUNNA, E.O. OYEDIPE⁺ and P.N. OKOH*

+ Department of Animal Reproduction
National Animal Production and Research Institute (NAPRI),
Ahmadu Bello University,
Shika — Zaria,

* Department of Biochemistry, Bendel State University, Ekpoma.

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ABSTRACT

Blood picture, some serum biochemical and electrolyte measurements were determined in grazing Yankasa sheep that were subjected to various lengths of water deprivation. The study was carried out both in the dry and wet seasons to examine seasonal variations. Blood constituents namely packed cell volume (PCV), total proteins, and red blood count (RBC), haemoglobin (HB), were significantly ($P < 0.05$) higher during wet season than dry season. Watering intervals significantly affected ($P < 0.05$) the RBC and Hb components of blood. The blood components values were elevated with increases in watering intervals. Seasonal variations were observed in serum electrolyte values measured and water deprivation caused haemoconcentration especially in the dry season.

Key Words: Blood constituents, watering intervals, seasonal variations, haemoconcentration.

INTRODUCTION

Reports on the biochemical components and blood picture of Nigerian indigenous sheep breeds under various nutritional states especially water deprivation were scanty. Works by Oduye (1976) on Nigerian dwarf sheep, Saror and Schillhorn Van Veen (1977) and Esievo *et al.* (1984) on lambs considered only the blood picture and the animals were not subjected to any form of nutritional stress.

Over 99% by number of the molecules present in a ruminant are water (Macfarlane and Howard, 1972). The powerful effects of solar radiation on water demand in arid and semi-arid areas are integrated with

those of air temperature and food supply. Water requirement is influenced by age, environmental temperature, food supply, lactation and behaviour (Macfarlane and Howard, 1972). Tropical and sub-tropical climates are known for high ambient temperatures, irregular and scanty rainfall along with low quality and quantity of available forage. Such environments exact nutritional stress on the ruminants inhabiting the area.

This paper reports variations in some serum biochemical and mineral values of Yankasa sheep under short term water deprivation which is what occurs annually during the dry season in the Savanna Zone

of Northern Nigeria. The dry season is about 8 months in a year and the Yankasa sheep are grazed along with cattle herded by Fulani men which often goes for 3-4 days without water supply on the rough ranges.

MATERIALS AND METHODS

Blood samples were collected from forty grazing Yankasa sheep fortnightly during the wet season (June to August) and the dry season (February to April). The grazing sheep were divided into four groups of ten each. The groups were subjected to different watering regimes. Group 1 was watered daily (24 hourly), 2 was 48 hourly, 3 was 72 hourly while group 4 animals were watered once in 96 hours. All the sheep were taken out to graze for 6 hours daily but not watered on the field. Each animal was given 250g of concentrate mixture (tables 1, 2) daily after grazing before watering according to the treatment group of the sheep. Uncultivated pasture grazed by the animals was sampled once a week for laboratory analysis to determine composition (table 2). The study was done in the wet season and repeated in the dry season using another set of sheep. The climatic data in the dry season was: minimum temperature 20°C, maximum, 39°C, rainfall was nil, minimum relative humidity (RH) was 13, maximum RH 33, while the weather condition in the wet season was minimum temperature 17°C, maximum temperature 28°C, average daily rainfall was 6.28mm, minimum relative humidity (RH) was 71 while maximum RH 82.1 (Samaru I.A.R. Weather Station).

Blood analyses

The blood parameters are packed cell volume (PCV), haemoglobin (HB). RBC, Mean corpuscular haemoglobin concentration (MCHC), mean corpuscular volume (MCV) and mean corpuscular haemoglobin (MCH). The blood was analysed according

to Brown (1980). Estimation of total protein was performed by the Biuret method (Coles, 1974). The values were determined colorimetrically at 460nm⁺. Serum magnesium was determined with an atomic absorption spectrophotometer* by the method described by Willia (1960). Strontium chloride was used as the diluent in a ratio of 1:50. Serum sodium and potassium were determined by flame photometer as described by (King and Wooton, 1959). Chloride was determined by the method of Schales and Schales (1941). All data obtained were subjected to statistical analysis of variance (Steel and Torrie, 1980) and othogonal comparisons were used on means (Snedecor, 1959).

RESULTS

Blood biochemical constituents namely PCV, total proteins, RBC, Hb were significantly ($P < 0.05$) higher during wet than dry season. Watering intervals significantly affected ($P < 0.05$) the RBC, Hb components of blood (Table 3).

Results in Table 4 show that significant differences ($P < 0.05$) existed in sera sodium (Na), potassium (K), magnesium (Mg) and chloride (cl⁻) of sheep subjected to intermittent watering intervals when the two seasons wet and dry were compared. Water content of forage was 6.9% in the dry season while it was on the average 79.1% in the wet season. Sera K values for sheep on 24h, 48h, 72h and 96h watering intervals during dry season were 5.02, 5.16, 5.15 and 5.44meq/litre while the wet season values were 3.45, 3.38, 4.04 and 3.92meq/litre. The chloride, magnesium and sodium values in plasma were significantly higher ($P < 0.05$) in the dry season than the rainy season.

* Bausch and Lomb Spectronii 20

* Model 306 Perkin Elmer Corp., Norwalk, Connecticut, USA.

Table 1
Composition (%) of the concentrate mixture

Ingredient	Composition (%)
Maize	73.5
Cottonseed cake	24.5
Salt	0.2
Bonemeal	1.5
Vitamin-mineral Premix*	0.25

* Vitamin-mineral Premix used is ZOODRY VM 702 and it contains pr kg diet: Vit. A 25,000 I.U., Vit. D₃ 27,500 I.U., Vit. E 25mg, Magnesium (mg) 250mg, Manganese (Mn), 125mg, Iron (Fe) 200mg, Zinc (Zn) 112.5mg, Copper (Cu) 15mg, Iodine (I) 6.5mg, Cobalt (Co) 2mg.

Table 2
Proximate analysis (%) of concentrate meal and uncultivated pasture grazed (DM basis)

	Concentrate meal	Dry season pasture	Wet season pasture
Dry matter	97.0	93.1	20.9
Crude Protein (CP)	16.4	3.0	12.7
Ash	5.0	9.4	10.6
Ether extract	4.0	1.6	5.3
Crude fibre	5.5	38.5	23.6
Nitrogen free extract	61.3	47.4	47.8

Table 3
Blood parameters of grazing Yankasa sheep under intermittent watering during dry and wet seasons

Groups	T R E A T M E N T S							
	D R Y S E A S O N				W E T S E A S O N			
	1	2	3	4	5	6	7	8 SE ¹
Watering intervals (h)	24	48	72	96	24	48	72	96
Packed cell volume ^a (%)	27.40	28.68	32.12	33.83	30.92	30.64	32.72	31.40 0.58
Mean corpuscular haemoglobin (picograms)	9.66	9.65	9.71	9.47	11.88	14.33	12.75	11.23 0.21
Mean corpuscular haemoglobin concentration (g/dl)	33.14	33.19	32.10	30.85	39.31	39.18	39.47	37.77 0.35
Mean corpuscular volume (femtolitres)	29.00	28.99	30.22	30.70	30.34	36.60	32.35	29.80 0.59
Total protein ^a (g/dl)	6.78	6.89	7.08	7.01	6.48	6.80	6.70	6.74 0.13
Red blood cell ^a	9.45	9.88	10.62	11.01	11.01	8.40	10.17	10.64 0.19
Haemoglobin ^a (g/dl)	9.12	9.52	10.35	10.38	12.15	11.96	12.92	11.85 0.19

¹ Standard error.

^a 1, 2, 3, 4, Vs 5, 6, 7, 8 Sig. at P < 0.05.

Table 4
Sera minerals of grazing sheep under intermittent watering during dry and wet seasons.

Groups	T R E A T M E N T S							
	D R Y S E A S O N				W E T S E A S O N			
	1	2	3	4	5	6	7	8 SE ¹
Watering intervals (h)	24	48	72	96	24	48	72	96
Potassium ^a (meq/l)	5.02	5.16	5.15	5.44	3.45	3.38	4.04	3.93 0.08
Magnesium ^a (mg/100ml)	2.41	2.72	2.68	2.81	2.00	2.07	1.94	2.07 0.05
Sodium ^a (meq/l)	139.84	142.53	147.62	148.31	138.76	140.83	139.65	139.41 0.58
Chloride ^a (meq/l)	100.66	100.86	102.96	108.19	92.53	93.41	95.82	96.89 0.68

¹ Standard error.

^a 1, 2, 3, 4, Vs 5, 6, 7, 8 Sig. at P < 0.05.

DISCUSSION

Blood components of the grazing sheep were significantly ($P < 0.05$) affected by season. This is likely to be due to the differences in quality of grazed pasture in the two (wet and dry) seasons. Pasture is of high quality in the wet season with about 12.7% crude protein and 3.0% CP in the dry season. PCV values ranged between 26-30% which agrees closely with results of Anosa and Isoun (1976) in the healthy dwarf sheep. Total protein values of 6.9-7.1 g/dl were obtained which are slightly higher than 5.2- 5.9 g/100ml for dwarf sheep reported by Anosa and Isoun (1976). Haemoglobin values obtained in the present study were 7.5-8.0 g/dl which are lower than 10.78g reported by Hackett *et al.* (1957). Values for RBC obtained for the sheep under the various treatments varied and they were much higher in the wet season. Mean corpuscular haemoglobin concentration (MCH C) values and mean corpuscular values obtained agree with the results of Idris *et al.* (1976) who obtained 25 to 40 percent for sheep in Gezira province.

Sera sodium and potassium values obtained were in line with the findings of Idris *et al.* (1976) who reported 3 to 6 meq/l for potassium and 130 to 150 meq/l for sodium in Gezira sheep. Sera potassium and chloride levels were higher in the dry season compared to the wet season. This is in line with the findings of Akerejola *et al.* (1980) who reported seasonal variations in chloride and potassium levels of cattle in Northern Nigeria. Significantly higher sera concentrations of magnesium were obtained in the dry season than the wet season. This is also in line with the findings of Akerejola *et al.* (1980) in zebu cattle.

Water deprivation raised blood biochemical constituents significantly. Houpt (1977) stated that haemoconcentration can result

due to dehydration of animals.

This study suggests that sheep can withstand considerable reductions in plasma volume without failure of the circulatory system. Schmidt-Nielsen (1972) reported that a higher water re- absorbing ability of the mammalian kidney is an important factor in water conservation. The high water content of pasture in the wet season appeared to meet the requirements of the sheep as indicated by higher plasma volume (PCV) in wet season than dry season. Macfarlane and Howard (1972) reported that the turnover of water by ruminants is closely related to the succulence or dehydration of pasture plants. These workers explained that extracellular components of body fluid are regulated by absorption from the intestine, by volume sensors in the hepatic, portal system and the atrium of the heart. The extracellular components of body fluids are also regulated by concentration sensors in the juxtaglomerular cells of the kidney working through angiotensin of the glomerular layer of the adrenal cortex. They further explained that the complex is concerned with the volume of Na retained, which in turn retains water in extracellular fluid. They also noted that extracellular and gut fluids are labile and respond considerably to the environment. This explains the significant differences ($P < 0.05$) in blood components for wet and dry seasons in the study.

This study shows that adequate and regular water supply is essential for normal blood composition since blood becomes more viscous with increase in watering intervals; which distrupts blood circulation in the body. This eventually hampers the growth and survival of the animals which means lower productivity on the part of the animal or even death if water deprivation is too severe. Consequently; the farmer incurs economic losses from poor performance or death of the animals.

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