

## **IMPACT OF WATER RESTRICTION AND REHYDRATION ON BLOOD HORMONE PROFILE OF SHEEP AND GOATS UNDER MIDDLE GUJARAT AGROCLIMATIC CONDITION**

**A.V. Khanvilkar, Neelam Gupta, R.J. Modi., M.M. Islam and K.N. Wadhvani**

Department of Livestock Production and Management, College of Veterinary Science and  
Animal Husbandry, Anand Agriculture University, Anand, Gujarat, India

E-mail: drajay.khanvilkar@gmail.com

**Abstract:** The effect of water restriction and rehydration on Blood Hormones like Cortisol (ng/ml) and Aldosterone (pg/ml) of Sheep and Goats were studied under Middle Gujarat Agro climatic Condition. The cortisol (ng/ml) level was observed significantly ( $P < 0.05$ ) higher (36.10%) in the experimental animals those who maintained on 50% of water supply. The experimental animals exhibited significantly ( $P < 0.05$ ) lower cortisol (ng/ml) level during hot humid season (28.00%) as compared to hot dry season. The values of cortisol level (ng/ml) were at par in Sheep and Goats. The cortisol (ng/ml) level of experimental animals dropped down significantly ( $P < 0.05$ ) by 44% and 55.90% after 2<sup>nd</sup> and 4<sup>th</sup> day of rehydration in hot dry season, respectively, whereas, in hot humid season rehydration did not produced any significant effect. The Aldosterone concentration (pg/ml) elevated significantly ( $P < 0.05$ ) by 17.90% when experimental animals were exposed to 50% water restriction which dropped down sharply and significantly ( $P < 0.05$ ) by 30.09 and 48.11% after 2<sup>nd</sup> and 4<sup>th</sup> day of rehydration, respectively, in hot dry season. Similarly, the Aldosterone concentration (pg/ml) was significantly ( $P < 0.05$ ) higher in hot humid season than hot dry season.

**Keywords:** Dehydration, Rehydration, Sheep, Goats, Cortisol, Aldosteron.

### **Introduction**

Cortisol and Aldosterone are the blood hormones secreted in order to deal with stress. It is released due to the activation of the hypothalamo-pituitary-adrenal axis by stress and plays a major role in maintaining the water balance and electrolytes. The cortisol could be a good indicator in accessing acute stress response in small ruminants, but, not chronic stress such as dehydration, also reported that, cortisol level did not returned to normal level even after 72 hrs of rehydration [3]. The regulation of  $\text{Na}^+$  blood level is the rennin-angiotensin-aldosterone system, Aldosterone hormone secreted by the adrenal cortex which is sensitive to low water content of the extracellular fluid [1]. The depression of plasma volume during water lack is known to stimulate the liberation of this hormone which lowers the  $\text{Na}^+$  elimination by acting in the renal tubules and preserve plasma sodium. The blood plasma or serum Cortisol and

Aldosterone concentration has been used as a physiological marker of stress in domestic animals, although some have questioned the correlation between stress and Cortisol concentration [2].

### **Materials and Methods**

Twenty four sheep and Goats were randomly divided in to two water restriction treatment groups on the basis of body weight (25-30 kg) after accessing individual water requirement during adaptation period viz. T<sub>1</sub> (0% WR), T<sub>2</sub> (50% WR) during two different seasons viz hot dry (S<sub>1</sub>) and hot humid (S<sub>2</sub>). The water restriction phase was of 28 days which divided in to four periods (P<sub>1</sub>, P<sub>2</sub>, P<sub>3</sub> and P<sub>4</sub>) followed by 4 days of rehydration. The experimental animals were fed on pelleted concentrate mixture (Amul Dan) and chaffed dry wheat straw as per ICAR (1998) feeding standard. The water ingestion of all experimental animals was assessed by offering *ad lib* water after measuring in measuring cylinder during period of 15 days adaptation to decide the quantum of water required by the animals. The animals of control group were offered the water in three instalments i.e. 9.00 am, 2.00 and 4.00 pm. after measuring every time while in water restriction groups, the whole day water requirement was measured once in morning and kept in respective labelled bucket. During rehydration phase all experimental animals offered *ad lib* measured water in three installments i.e. 9.00 am, 2.00 and 4.00 pm. The data of body weight during dehydration phase was analysed by four factorial completely randomized design while the data of rehydration phase was analysed by one way Anova by standard methods.

### **Results and Discussion**

The cortisol (ng/ml) level was observed significantly ( $P < 0.05$ ) higher in the experimental animals those who maintained on 50% of water supply ( $30.76 \pm 2.02$ ) than that of control group ( $22.68 \pm 2.06$ ). The values of cortisol (ng/ml) level reported by [4] are very high than the values observed under present investigation, this may be due to Marwari sheep exposed to constant 8 days of dehydration. The experimental animals exhibited significantly ( $P < 0.05$ ) lower cortisol level during hot humid season ( $21.56 \pm 1.89$ ) as compared to hot dry ( $31.89 \pm 1.99$ ) season. The significantly ( $P < 0.05$ ) lower value of cortisol (ng/ml) level observed in hot humid season as compared to hot dry season. The Sheep and Goats were at par as far as cortisol (ng/ml) level was concerned. The cortisol (ng/ml) level of experimental animals during hot dry season after rehydration of 2<sup>nd</sup> day ( $21.32 \pm 3.01$ ) dropped down significantly ( $P < 0.05$ ) by 44% and after 4<sup>th</sup> day ( $16.80 \pm 2.49$ ) by 55.90% of rehydration whereas, in hot humid season rehydration did not produced any significant effect on cortisol (ng/ml) level

when Sheep and Goats rehydrated [5] reported that, significant ( $P < 0.05$ ) reduction in cortisol (ng/ml) level after rehydration well supported the present findings.

The Aldosterone concentration (pg/ml) elevated ( $69.06 \pm 4.88$ ) significantly ( $P < 0.05$ ) when experimental animals were exposed to 50% water restriction than 0% water ( $58.52 \pm 2.88$ ) restriction. Similarly, the Aldosterone concentration (pg/ml) was significantly ( $P < 0.05$ ) higher in hot humid season ( $93.38 \pm 3.34$ ) than hot dry season ( $34.20 \pm 2.89$ ). The Aldosterone concentration dropped down sharply by 30.09% after 2<sup>nd</sup> day ( $54.00 \pm 13.08$ ) and 48.11% after 4<sup>th</sup> day ( $40.08 \pm 29.02$ ) of rehydration in hot dry season. [5] reported significant ( $P < 0.05$ ) decrease in Aldosterone concentration (pg/ml) upon rehydration.

### Conclusion

In Sheep and Goats blood hormone profiles like Cortisol (ng/ml) and Aldosterone (pg/ml) increased significantly ( $P < 0.05$ ) when received 50% water requirements at 7:30 a.m. and 2:30 p.m. Similarly, experimental animals exhibited significantly ( $P < 0.05$ ) lower blood hormone profiles in hot humid as compared to hot dry season and recovered significantly ( $P < 0.05$ ) after second day (48 hrs) of rehydration to sustain productivity of animals.

### References

- [1] Carlson, G.P. (1997). Fluid, electrolyte and acid-base balance. In: Kaneko, M.L., Harvey, H.W., Bruss, M.L. (eds), *Clinical Biochemistry of Domestic Animals*, 485-516. Academic press (Fifth edition), San Diego, California.
- [2] Cohen, S., Kessler, R.C and Gordon. L.U. (1997). *Measuring Stress: A Guide for Health and Social Scientists*. Oxford Univ. Press, New York, NY.
- [3] El-Nouty, F.D., El-Naggar, M.I., Hassan, G.A and Salem, M.H. (1991). Effect of lactation on water requirements and metabolism in Egyptian sheep and goats. *World Review of Animal Production*; XXVI: 40– 43.
- [4] Kataria, N and Kataria, A.K. (2007). Compartmental water management of Marwari sheep during dehydration and rehydration. *Veterinarski Arhiv.*, **77**(6): 551-559.
- [5] Neelam, (2013). "Performance of indigenous sheep under water restriction and rehydration in Middle Gujarat Agroclimatic condition". Thesis submitted to Anand Agriculture University, Anand, (Gujarat State). India.

**Table 1: Effect of water restriction on Blood Hormone profiles in Sheep and Goats**

articular	Cortisol (ng/ml)	Aldosterone (pg/ml)
<b>T1</b>	22.68 <sup>a</sup> ± 2.06	58.52 ± 2.88
<b>T2</b>	30.76 <sup>b</sup> ± 2.02	69.06 ± 4.88
<b>S1</b>	31.89 <sup>y</sup> ± 1.99	34.20 <sup>x</sup> ± 2.89
<b>S2</b>	21.56 <sup>x</sup> ± 1.89	93.38 <sup>y</sup> ± 3.34
<b>Po</b>	23.80 <sup>B</sup> ± 1.24	51.14 <sup>A</sup> ± 6.00
<b>P1</b>	32.90 <sup>C</sup> ± 1.52	57.93 <sup>A</sup> ± 4.89
<b>P2</b>	36.02 <sup>D</sup> ± 1.27	95.54 <sup>B</sup> ± 5.12
<b>P3</b>	31.07 <sup>C</sup> ± 3.56	52.50 <sup>A</sup> ± 6.87
<b>P4</b>	9.83 <sup>A</sup> ± 2.19	61.85 <sup>A</sup> ± 5.67

Superscripts (a and b) in column differed significantly ( $P < 0.05$ ) showing Treatment effect.  
 Superscripts (x and y) in column differed significantly ( $P < 0.05$ ) showing Season effect.  
 Superscripts (A, B, C and D) in rows differed significantly ( $P < 0.05$ ) showing Period effect.

**Table 2: Effect of water rehydration on Blood Hormone parameters in Sheep and Goats**

Particular	Season	Particular	Cortisol (ng/ml)	Aldosterone (pg/ml)
<b>Final weight (DH)</b>	<b>S1</b>	T1	17.56 ± 0.76	69.83 ± 6.33
		T2	38.10 <sup>b</sup> ± 6.37	77.25 <sup>b</sup> ± 10.43
	<b>S2</b>	T1	8.87 ± 0.77	44.66 ± 8.20
		T2	8.89 ± 1.10	55.66 <sup>B</sup> ± 12.01
<b>2<sup>nd</sup> day (RH)</b>	<b>S1</b>	T1	18.51 ± 0.75	70.04 ± 5.62
		T2	21.32 <sup>b</sup> ± 3.01	54.00 <sup>a</sup> ± 13.08
	<b>S2</b>	T1	9.38 ± 1.42	43.58 ± 8.18
		T2	9.68 ± 1.50	21.75 <sup>A</sup> ± 6.47
<b>4<sup>th</sup> day (RH)</b>	<b>S1</b>	T1	18.00 ± 0.45	69.63 ± 9.02
		T2	16.80 <sup>a</sup> ± 2.49	40.08 <sup>a</sup> ± 29.02
	<b>S2</b>	T1	8.89 ± 1.90	43.41 ± 8.10
		T2	10.32 ± 5.37	23.83 <sup>A</sup> ± 2.39

Superscripts (a and b) in rows differed significantly differ ( $P < 0.05$ ) in hot dry season  
 Superscripts (A and B) in rows differed significantly differ ( $P < 0.05$ ) in hot humid