

Original Research Article

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Impact of Water Deprivation and Rehydration on Blood Parameters of Sheep under Middle Gujarat Agro-Climatic Condition

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ABSTRACT

Present study was conducted on eighteen farm born adult hoggets (25-30 kg) of Patanwadi and Marwari breeds to study the effect of water restriction (WR) and rehydration on blood parameters. The experimental animals were randomly divided in to three treatment groups based on body weight comprising of six animals in each treatment viz. T₁: Control (*ad lib* water- three time), T₂: (WR₁- 12 hrs watering interval- two time), T₃: (WR₂-24 hrs watering interval- one time). The duration of experiment was 44 days. The experimental animals either offered water thrice or once, did not produce any significant effect on Hb (g/dL) and PCV (%). The Urea (mg/dL), uric acid (mg/dL) and creatinine (mg/dL) concentration significantly (P<0.05) increased when animals exposed to restricted watering in T₂ and T₃ as compared to T₁ group. Sodium level increased non-significantly when animals were kept on twice a day than once a day watering frequency but level increased significantly (P<0.05) when animal kept on thrice a day than once. Potassium level did not influence by any level of water frequency while chloride level significantly (P<0.05) influenced by treatment. The Triiodothyronine (ng/ml), Thyroxin (ng/ml) and cortisol (ng/ml) level remained at par either animals kept on once, twice or thrice a day watering frequencies. However, cortisol hormone level in 12 hrs WR and 24 hrs WR remained higher than *ad lib* water offered to animal groups. It may be concluded from the present study that hoggets should be watered at least twice daily and at less than twelve hours' interval.

Keywords

Water deprivation, rehydration, blood parameter, hoggets

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Introduction

Dehydration in warm weather conditions reduces plasma volume as water is taken up by the tissue (Schaefer *et al.*, 1990). Increased PCV (%) and Hb (g%) concentration are good indicators of dehydration. The water deprivation raised blood biochemical constituents. High values obtained in water-deprived ewes showed signs of haemo-

concentration caused by dehydration. The transfer function of the kidney is altered under water stress with slower glomerular filtration and higher urea re-absorption (Kataria and Kataria, 2007).

Increase in secretion of the hormone arginine vasopressin is observed which is released from hypothalamus in response to dehydration and it increases permeability of

collecting duct of kidneys and there by promote urea reabsorption in the kidneys and reduced the loss of urea concentration (Meintjes and Engelbrecht, 1999). 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 return to normal level even after 72 hours of rehydration (El- Nouty *et al.*, 1991).

Materials and Methods

Present study was conducted at Livestock Farm Complex, Department of Livestock Production Management, College of Veterinary Science and Animal Husbandry, Anand Agricultural University, Anand. The present experiment was conducted for 44 days' duration (42 days' water deprivation +2 days' rehydration) in hot dry season (1st May to 13th June). Farm born eighteen adult hoggets (25-30 kg) of Patanwadi and Marwari sheep were selected as experimental animals and randomly divided in to three treatment groups on the basis of body weight comprising of six animals in each treatment viz. T₁: Control (*ad lib* water- three time), T₂: (WR₁- 12 hrs watering interval- two time), T₃: (WR₂-24 hrs watering interval- one time). The experimental animals were maintained on ICAR feeding standard (1998) and wholesome clean drinking water were offered. In T₁ group, animals were offered water daily at 9.00 a.m., 3.00 p.m., and 9.00 p.m. where as in T₂ daily at 9.00 a.m. and 9.00 p.m. and in T₃ daily at 9.00 a.m. only. The tub containing measured quantity of water was placed in front of animals for 30 min. The blood samples were collected from the jugular vein in vacutainer with anticoagulant. The fresh whole blood was used to estimate hematological parameters like Hb, PCV using Automated blood cell counter (Mindray-BC-2800VET) and remaining blood was used to separate plasma which was used to estimate

various biochemical parameters like T3 (Triiodothyronine), T4 (Thyroxin) and Cortisol using Radio Immune Assay (RIA) kit with Gamma- counter. Plasma Creatinine and Uric acid was estimated using Chemistry analyzer (BS-120) while Sodium and Potassium was analyzed using Flame Photometer-128. Plasma Urea and Chloride were analyzed manually by readymade available KIT.

Statistical analysis

The experimental data of dehydration were analyzed by completely randomized design by individual analyses (Snedecore and Cochran, 1985). All the rehydration data were analyzed by one-way ANOVA.

Results and Discussion

Results of influence of water frequency and rehydration on blood parameters of hoggets are presented in Table 1 and 2, respectively. The experimental animals either offered water thrice or once, did not produce any significant effect on Hb (g/dL). The values observed under T₂ and T₃ was higher than T₁. The rehydration of experimental animals did not produce any significant change in Hb (g/dL) level. The PCV (%) did not alter by the level of water frequency indicated watering once in a day is sufficient to maintain PCV (%) and there is no development of haemo-concentration. However, PCV (%) in the animals of T₂ and T₃ showed higher values than the animals of control group. The PCV (%) recovered non significantly due to rehydration in T₂ (17.14 %) and T₃ (26.23 %) on 2nd day of rehydration. Jaber *et al.*, (2004) studied the effect of water restriction on certain physiological parameters in Awassi sheep and reported that PCV and hemoglobin showed no significant variation within and among treatments which supports the present findings.

Hb in Sheep and Goats neither influenced by dehydration nor by seasons as per the study of Khanvilkar (2014) which again supports the result of present study. The Urea level increased significantly ($P<0.05$) to the tune of 46.72 and 52.52 % when animals were exposed to twice (T_2) and once (T_3) daily watering frequency, respectively as compared to *ad lib.* watering. Blood urea (mg/dL) concentration of experimental animals dropped down non significantly due to rehydration and could not reach to normal value even after two days' *ad lib.* watering. The water deprivation was associated with significant ($P<0.05$) increase in serum urea (mg/dL) concentration as reported by Kheir and Ahmed (2008); Abdelatif *et al.*, (2010); Gupta (2013) and Patel (2015) which supports the present findings.

The uric acid concentration increased significantly ($P<0.05$) by 26.66 and 21.33 % when animals were offered water after 12 and 24 hrs, respectively as compared to animals of control group. Uric acid concentration drops

down significantly ($P<0.05$) by 37.50 and 48.40 % in T_3 after 24 and 48 hrs of rehydration, respectively. The creatinine concentration increased significantly ($P<0.05$) by 15.69 and 18.59 % when animals were offered water after 12 and 24 hrs, respectively as compared to animals of control group. The creatinine concentration did not normalise in spite of 48 hrs of rehydration. Basheir *et al.*, (2009) and Khanvilkar (2014) reported significant ($P<0.05$) rise in Uric acid (mg/dl) and creatinine (mg%) concentration due to water deprivation supported the present findings.

The sodium level increased non-significantly when animals were kept on twice (2.84%) a day and increased significantly ($P<0.05$) when kept on thrice (7.18%) a day watering frequency. Potassium level was not affected by any level of watering frequency in present study. The Chloride level significantly ($P<0.05$) increased by treatment in T_2 (9.57 %) and T_3 (19.02 %) animal groups as compared to control group.

Table.1 Influence of water frequency on blood parameters of hoggets

Blood Parameters	T1 (Control)	T2 (12 hr WR)	T3 (24 hr WR)
Haemoglobin (g/dL)	8.56±0.06	8.73±0.16	9.01±0.09
PCV (%)	28.41±0.21	28.75±0.42	29.55±0.23
Urea (mg/dL)	24.85 ^a ±0.51	36.46 ^b ±1.78	37.90 ^b ±2.01
Uric acid (mg/dL)	0.75 ^a ±0.06	0.95 ^{bc} ±0.07	0.91 ^b ±0.11
Creatinine (mg/dL)	1.53 ^a ±0.03	1.77 ^b ±0.06	1.82 ^b ±0.05
Sodium (mmol/L)	144.36 ^a ±0.39	148.47 ^{ac} ±1.68	154.73 ^{bc} ±3.09
Potassium (mmol/L)	3.98±0.12	4.04±0.10	4.07±0.04
Chloride (mmol/L)	101.03 ^a ±0.63	110.70 ^b ±03.72	120.24 ^c ±6.34
Triiodothyronine (T_3) (ng/ml)	1.33±0.14	1.30±0.18	1.39±0.16
Thyroxin (T_4) (ng/ml)	42.62±0.23	46.42±0.35	45.95±0.38
Cortisol (ng/ml)	47.36±00.46	59.07±04.99	56.61±04.41

Means with dissimilar superscripts (a,b,c) in a row differ significantly ($P<0.05$)

Table.2 Influence of water rehydration (RH) on blood parameters of hoggets

Blood Parameters	Days	T1 (Control)	T2 (12 hr WR)	T3 (24 hr WR)
Haemoglobin (g/dL)	Final Day (DH)	8.58±0.34	8.65±0.38	9.06±0.43
	1 st Day (RH)	8.53±0.33	8.43±0.22	9.15±0.49
	2 nd Day (RH)	8.30±0.16	8.23±0.18	8.45±0.28
PCV (%)	Final Day (DH)	28.81±1.12	28.76±1.05	30.05±1.18
	1 st Day (RH)	28.18±1.18	28.10±0.40	30.06±1.50
	2 nd Day (RH)	28.05±0.59	27.71±0.42	28.40±0.84
Urea (mg/dL)	Final Day (DH)	25.98±2.08	43.27±2.48	44.63±3.35
	1 st Day (RH)	25.30±2.00	41.35±2.09	43.50±3.19
	2 nd Day (RH)	24.52±1.81	40.34±2.31	40.22±2.70
Uric acid (mg/dL)	Final Day (DH)	0.85±0.11	1.13±0.23	1.28 ^b ±0.14
	1 st Day (RH)	0.55±0.12	0.85±0.12	0.80 ^a ±0.08
	2 nd Day (RH)	0.49±0.10	0.64±0.10	0.66 ^a ±0.09
Creatinine (mg/dL)	Final Day (DH)	1.61±0.06	1.98±0.08	1.96±0.07
	1 st Day (RH)	1.60±0.05	1.87±0.05	1.92±0.05
	2 nd Day (RH)	1.59±0.05	1.79±0.06	1.88±0.06
Sodium (mmol/L)	Final Day (DH)	144.30±6.85	156.90±2.78	162.90±4.23
	1 st Day (RH)	143.40±5.06	155.40±5.43	163.80±4.01
	2 nd Day (RH)	144.00±7.61	155.10±2.56	159.60±3.38
Potassium (mmol/L)	Final Day (DH)	4.27±0.13	4.60±0.16	4.21±0.18
	1 st Day (RH)	4.05±0.09	4.42±0.12	4.14±0.20
	2 nd Day (RH)	3.82±0.16	4.25±0.10	4.06±0.17
Chloride (mmol/L)	Final Day (DH)	101.59±1.45	123.43±7.35	141.37 ^a ±5.95
	1 st Day (RH)	100.59±3.08	121.91±5.89	130.87 ^a ±6.32
	2 nd Day (RH)	100.40±2.55	109.36±1.90	120.18 ^b ±6.93
Triiodothyronine (T₃) (ng/ml)	Final Day (DH)	0.71 ^a ±0.07	0.95 ^a ±0.07	0.62 ^a ±0.09
	1 st Day (RH)	1.36 ^b ±0.06	1.34 ^b ±0.09	1.77 ^b ±0.12
	2 nd Day (RH)	1.70 ^c ±0.07	1.55 ^b ±0.14	1.80 ^b ±0.08
Thyroxin (T₄) (ng/ml)	Final Day (DH)	42.21±6.14	47.39±5.58	46.36±5.99
	1 st Day (RH)	42.08±2.46	46.10±4.29	46.36±5.25
	2 nd Day (RH)	41.31±4.64	45.19±9.58	46.49±5.49
Cortisol (ng/ml)	Final Day (DH)	48.87±3.33	76.62±11.57	76.62±17.44
	1 st Day (RH)	46.45±3.15	68.78±6.54	75.41±22.63
	2 nd Day (RH)	44.04±5.40	64.55±18.13	65.76±14.93

Means with dissimilar superscripts (a,b,c) in a column within same parameter differ significantly (P<0.05)

After 48 hrs of rehydration, the chloride decrease significantly ($P < 0.05$) in T₃. The effect of rehydration was non-significant on sodium and potassium level. As per the study of Igbokwe (1993), Potassium level was not affected but Sodium and Chloride level increased by water deprivation which is in accordance of present findings.

Plasma minerals (Na⁺, K⁺ and Ca⁺⁺) levels were not affected by either water or feed restrictions or feed in the study of Kheir and Ahmed (2008) which again support the results of present study.

The Triiodothyronine (ng/ml) and Thyroxin (ng/ml) remained at par either animals kept on once, twice or thrice daily watering frequencies. These observations were in agreement with the findings of other workers (Gupta, 2013 and Patel, 2015). Similarly, the cortisol (ng/ml) level remained at par either animals kept on once, twice or thrice daily watering frequencies. However, the cortisol level of T₃ and T₂ group remained higher as compared to T₁ group.

Triiodothyronine level increased significantly ($P < 0.05$) under twice and once a day watering in hot dry season on 1st day (41.05 and 185%) but on 2nd day (15.67 and 1.7%) increased non-significantly of rehydration indicated 24hrs of rehydration is sufficient to bring out T₃ hormone level normal. There was no effect of rehydration on T₄ and cortisol hormone level.

It may be concluded from the present study that hoggets should be watered at least twice daily and at less than twelve hours' interval to maintain sodium and chloride level. Water should not be withheld for more than 12 hrs to maintain Urea, Uric acid and creatinine level in the blood of sheep. Watering Once daily is sufficient to maintain the Hb and PCV level in the blood.

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