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PHYSIOLOGICAL RESPONSES OF INDIGENOUS HOGGETS UNDER WATER DEPRIVATION IN 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 breed to study the effect of water restriction (WR) on physiological responses. The experimental animals were randomly divided in to three treatment groups based on body weight comprising of six animals in each treatment viz. T_1: Control (ad lib water- three time), T_2: (WR_1- 12 hrs watering interval- two time), T_3: (WR_2-24 hrs watering interval- one time). The duration of experiment was 44 days. Pulse rate and rectal temperature recorded at 7.30 am and 2.30 pm did not differ significantly among the treatment groups. Respiration rate recorded at 7.30 am was significantly ($P < 0.05$) higher in T_2 and T_3 as compared to T_1, while water frequency did not show any significant effect on respiration rate recorded at 2.30 p.m. The skin temperature recorded at 7.30 am and 2.30 pm significantly ($P < 0.05$) differed among the treatment groups. The study indicated that water frequency had no effect on pulse rate and rectal temperature, while skin temperature and respiration rate increased as water frequency decreased.
Keywords: Water deprivation, physiological responses, hoggets, middle Gujarat

INTRODUCTION

The water intake of sheep depends on the available feed stuff, environmental temperature, individual animal and its physiological stages and water quality. Water deprivation affects the body weight, feed intake and physiological responses of sheep. In the changing scenario of climate change, thermal stress along with feed and water scarcity are the major predisposing factors for the low productivity of small ruminants under hot semiarid environment. In water deprivation condition, the deprivation duration, animal species and breeds, physiological stage and diet composition mainly affect the normal physiological response of animal [3]. To assess the real problem faced by the animals in the field conditions and to understand water crisis management, the best experimental model is dehydration and rehydration [6]. Sheep and goat showed the ability to tolerate a moderate water shortage by activating several physiological mechanisms and behavioural strategies. The Marwari sheep has been found to

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have considerable ability to withstand body water deficit and no particular derangement of physiological functioning was seen even when their plasma volume was decreased due to water deprivation [11]. Water restriction caused a rise in rectal temperature but had no effect on either respiration or pulse [15]. Sweating rate was reduced in water-deprived sheep during summer [2]. Sheep tend to reduce their thermoregulatory evaporative cooling mechanisms (panting and sweating) in order to maintain their body water and prevent further dehydration during water restriction. Dhydration was a stress to the animals, but the changes brought about by five days of dehydration were reversible [13]. The effect of microclimatic variables on performance of ewes can be analysed using daily Temperature Humidity Index (THI).

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 based on body weight comprising of six animals in each treatment viz. T_1: Control (ad lib water- three time), T_2: (WR_1- 12 hrs watering interval- two time), T_3: (WR_2- 24 hrs watering interval- one time). The experimental animals were maintained on ICAR feeding standard [5] and wholesome *ad lib* clean drinking water (TDS less than 800 ppm) were offered. In T_1, animals were offered water at. 9.00 a.m., 3.00 p.m., and 9.00 p.m. where as in T_2 at 9.00 a.m. and 9.00 p.m. and in T_3 at 9.00 a.m. only. The tub containing measured quantity of water was placed in front of animals for 30 min. The physiological responses viz., rectal temperature, pulse rate, respiration rate and skin temperature of all the experimental animals were recorded by using doctor's thermometer, femoral artery, flank movements and infrared thermometer, respectively per minute once in a week at 07.30 a.m. and 02.30 p.m. during whole period of experimentation. Meteorological parameters especially like dry bulb and wet bulb temperatures were recorded daily regularly in morning (07.30 a.m.) and afternoon (02.30 p.m.) by using sling Psychrometer. The THI was calculated by using formula given by US weather bureau which is $THI=0.72(C_{db}+C_{wb})+40.6$,where, C_{db}= dry bulb temperature (C°) and C_{wb}=wet bulb temperature (C°). The experimental data of dehydration were analyzed by complete randomized design by individual analyses [14]. All the rehydration data were analyzed by one – way ANOVA.

RESULTS AND DISCUSSION

The Temperature Humidity Index (THI) value was higher at 2.30 pm than at 7.30 am (Table 1) which indicated that the afternoon time was more stressful than morning for the experimental animals. The pulse rate recorded at 7.30 am and 2.30 pm did not differ significantly among the treatment groups. However, pulse rate was highest in T_3 (24 hrs WR) followed by T_2 (12 hr WR) and T_1 (control) throughout the experiment (Table 2). It was in agreement with the findings of earlier workers [7, 10, 12]. Respiration rate was significantly higher in T_2 and T_3 as compared to T_1 at 7.30 am (Table 2). However, there was no significant difference in respiration rate among treatments at 2.30 pm. As per the findings other author [10], the experimental animals under 40% WR showed significantly ($P<0.05$) higher respiratory rate as compared to 0% and 20 % WR at 7.30 am, whereas at 2.30 pm the respiratory rate was at par among the treatment groups. And hence the results of present study are in accordance with other author [10]. The rectal temperature ($^{\circ}$F) recorded at 7.30 a.m. and 2.30 p.m. did not differ significantly due to water deprivation, which was in similar with the findings of other worker [1, 7, 8, 10] (Table 2). The skin temperature (ºC) of the experimental animals recorded at 7.30 am and 2.30 pm differed significantly ($P < 0.05$) among the treatment groups. The skin temperature of animals under T_2 and T_3 remained significantly higher ($P < 0.05$) higher than the animals of control group (Table 2) at both 7.30 a.m. and 2.30 p.m. The arid-adapted sheep tend to reduce their thermoregulatory evaporative cooling mechanisms (panting and sweating) which increase the skin temperature in order to maintain their body water and prevent further dehydration [9]. Brain cooling may also be responsible for the observed temporary hyperthermia that is often reported in dehydrated sheep, activated by the hyper osmolality observed in dehydrated animals [4].

Table 1: Temperature humidity index during the experiment

Periods	Hot Humid season	
	7.30 am	**2.30 pm**
P1	75.82	85.15
P2	79.63	86.26
P3	79.12	85.90
P4	80.09	87.34
P5	82.51	87.65
P6	81.07	86.52
Average	**79.71**	**86.47**

Table 2: Influence of water frequency on physiological responses of hoggets

Physiological responses	T1 (Control)		T2 (12 hr WR)		T3 (24hrWR)	
	7.30 am	2.30 pm	7.30 am	2.30 pm	7.30 am	2.30 pm
Pulse rate (No/min)	62.55 ± 1.22	73.38 ± 1.31	65.11 ± 1.95	76.44 ± 2.98	67.05 ± 1.67	78.66 ± 2.19
Respiration rate (No/min)	34.28^{a} ± 1.20	65.55 ± 1.12	37.30^{b} ± 1.61	73.33 ± 2.99	37.50^{b} ± 2.09	66.66 ± 2.78
Rectal temperature (°F)	101.19 ± 0.10	102.18 ± 0.05	101.26 ± 0.07	102.12 ± 0.09	101.21 ± 0.12	102.01 ± 0.07
Skin temperature (°C)	30.71^{a} ± 0.44	36.85^{A} ± 0.19	30.99^{b} ± 0.38	37.64^{B} ± 0.58	30.95^{b} ± 0.34	37.75^{B} ± 0.19

Means bearing uncommon lower case superscripts (a and b) within the row differ significantly ($P < 0.05$) at 7.30 am, and those bearing upper case superscripts (A and B) within the row differ significantly ($P < 0.05$) at 2.30 pm.

CONCLUSION

It may be concluded from the present study that water deprivation significantly affects the respiration rate and skin temperature, whereas pulse rate and rectal temperature had no effect. It indicated that water deprivation increase the skin temperature of sheep during summer season.

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