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IMPACT OF WATER RESTRICTION AND REHYDRATION ON BODY WEIGHT AND FEED AND NUTRIENT INTAKE OF SHEEP AND GOATS UNDER MIDDLE GUJARAT AGRO-CLIMATIC CONDITION

A.V. Khanvilkar, M.M. Islam, R.J. Modi, Y.G. Patel and K.N. Wadhwani*
Department of Livestock Production Management
College of Veterinary Science and Animal Husbandry
Anand Agriculture University, Anand, Gujarat, INDIA
*E-mail: knwadhwani@aau.in

Abstract: To study the impact of water restriction and rehydration on body weight, feed and nutrients intake of sheep and goats, twenty four sheep and goats (25-30 kg) were randomly divided into two treatment groups on the basis of body weight viz. T_1 (0% WR), T_2 (50% WR) during two different seasons viz. hot dry (S_1) and hot humid (S_2). The body weight (kg) of experimental animals reduced to the tune of 5.77% on 50% WR as compared to 0% WR which recovered significantly ($P < 0.05$) upon rehydration after 2nd (150%) and 4th (244%) day in hot dry season. The daily DMI (g/d, % B. Wt. and g/kg $w^{0.75}$) were significantly reduced due to 50% water restriction to the tune of 16.32, 13.69 and 16.96%, respectively as compared to T_1. The experimental animals consumed significantly ($P < 0.05$) higher DM (g/d, % B. Wt. and g/kg $w^{0.75}$) in hot humid season as compared to hot dry season to the tune of 16.32, 19.51 and 15.42%, respectively. Animals of T_2 group consumed significantly ($P < 0.05$) more DM (g/d and % B. Wt.) after 2nd (31.17 and 19.70%) and 4th (33.91 and 22.16%) day of rehydration in hot dry season and during hot humid season the corresponding values are 12.84% (2nddays) and 9.60% (4th days). The DCPI (g/d) reduced (5.37%) significantly ($P < 0.05$) in T_2 group of animals which increased significantly ($P < .05$) after 4th day of rehydration (6%), while DCPI (g/kg $w^{0.75}$) increased significantly ($P < 0.05$) on 2nd (9.31%) and 4th (22.58) day of rehydration under hot dry season. The TDNI (g/d, % B.Wt. and g/kg $w^{0.75}$) reduced to the tune of 18.65, 12.40 and 14.17%, respectively by the animals of T_2. TDNI (g/d, % B. Wt. and g/kg $w^{0.75}$) was significantly ($P < 0.05$) reduced in hot dry season as compared to hot humid season by 5.83, 12.40 and 10.86%, respectively. The experimental animals of T_2 group consumed significantly ($P < 0.05$) more TDN (g/d, % B. Wt. and g/kg $w^{0.75}$) after 2nd (7.12, 8.84 and 9.44%) and 4thday (21.44, 14.15 and 24.94%) of rehydration in hot dry season whereas TDNI (g/d and g/kg $w^{0.75}$) of T_2 group increased by 5.80 and 9.65 and 5.78 and 18.51% after 2nd and 4th day of rehydration in hot humid season, respectively.
Keywords: Dehydration, Rehydration, Sheep, Goats, Body Weight, Feed and Nutrient Intake

Introduction

Small ruminants are an integral part of farming systems in the marginal arid regions of the world which are characterized by water scarcity and fluctuating precipitation under the effect of global warming and unpredictable weather, rainfall is becoming even more irregular and water availability more limited. Along with water accessibility, feed and other resources will

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be markedly affected by climate change. The 75% indigenous sheep population of Gujarat exists in Saurastra and Kutch districts which received 38 and 44 percent less rainfall as compared to average rainfall of Gujarat state (800mm) and National average (887mm), respectively [5].

The response of animals to water restriction or water deprivation depends mainly on restriction rate, deprivation duration, animal species and breeds, physiological stage and diet composition. In the deserts of Rajasthan, animals do not get drinking water for 2-3 days at a time. Sheep deprived for water for 72 hours did not show any adverse effect on wool yield, in spite of the fact that water deprivation reduced feed intake [10], so it is of need to study the influence of water deprivation on animal body condition and loss in animal productivity. 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 [9].

Materials and Methods

Present study was conducted at ILFC, Department of LPM, College of Veterinary Science and Animal Husbandry, Anand Agricultural University, Anand. Total twenty four sheep and goats in both the seasons were randomly divided in to two treatment groups on the basis of body weight (25-30 kg) after accessing individual daily water requirement during adaptation period viz. T_1 (0% WR), T_2 (50% WR) during two different seasons viz. hot dry (S_1) and hot humid (S_2). The total experiment was of 32 days of which the water restriction phase was of 28 days followed by rehydration period of 4 days. The experimental animals were fed pelleted compound concentrate mixture (Amul Dan) and chaffed bajara straw as per ICAR feeding standard [8]. The water ingestion of all experimental animals were assessed by offering *ad lib* water after measuring in measuring cylinder during adaptation period of 15 days to decide the quantum of water required by the animals. The animals of control group were offered water in three installments i.e. 9.00 am, 2.00 pm 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 labeled bucket. During rehydration phase all experimental animals were offered *ad lib* measured water in three installments i.e. 9.00 am, 2.00 pm and 4.00 pm. Left over feed and water were measured next day and recorded if any. The data of body weight during dehydration phase was analyzed by four factorial completely randomized designs while the data of rehydration phase was analyzed by one way ANOVA by standard methods.

Results and Discussion

The effects of water restriction and rehydration on body weight (kg) in two different seasons are presented in Table 1. Significant ($P < 0.05$) reduction in body weight (5.8%) was observed in the experimental animals of T_2 (27.90) as compared to T_1 (29.61) group irrespective of season. The weight loss might be adduced to the reduction in DM intake. It may also be speculated that there might be reduced efficiency of digestion. Jaw movement was drastically reduced in goats that received highest level of water restriction [1]. The body weight of experimental animals of T_2 group reduced significantly ($P < 0.05$) during hot dry season and there is no significant effect of water restriction in hot humid season. This may be due to more dry matter and TDN intake by experimental animals during hot humid season than hot dry season. The body weight reduced to the tune of 6-7% [7] when Marwari sheep were deprived of water for 48 h, 6 and 8% [2] in Aardi goats when kept on 25 and 50% water restriction, respectively and 8.36 and 8.66% [12] significant ($P < 0.05$) reduction in body weight (kg) was observed when hoggets were kept on 40 and 20%water restriction as compared 0% water restriction which support the present findings. The body weight (kg) of experimental animals reduced significantly ($P < 0.05$) in hot humid season compared to winter and hot dry season which differed from present findings [12].

The experimental animals of T_2 group recovered body weight (kg) significantly ($P < 0.05$) upon rehydration after 2^{nd} (150%) and 4^{th} (244%) day in hot dry season, whereas the effect of rehydration on body weight (kg) in hot humid season was non-significant, this might be due non significant dehydration effect on body weight during hot humid season. The body weight (kg) of animals after 4^{th} day of rehydration also differed significantly ($P < 0.05$) from 2^{nd} day rehydration which indicated that experimental animals recovered their body weight (kg) within 96 hours of rehydration.

The effects of water restriction and rehydration on feed and nutrient intake in two different seasons are presented in Table 2 and 3. The daily DMI (g/d, % B.Wt. and g/kg $w^{0.75}$) were significantly influenced ($P < 0.05$) by treatments and seasons. The daily DMI in terms of g/d, % B.Wt. and g/kg $w^{0.75}$ reduced due to 50% WR to the tune of 16.32, 13.69 and 16.96%, respectively as compared to 0% WR. The need of water for the physical softening of feed, digestion, removal of undigested residues and excretion of metabolic waste might be the reasons for reduction in dry matter intake in water restricted group. During periods of reducedwater intake in goats, the ingested materialis retained in the rumen for longer periods than goats given water ad libitum [6].

Similarly, experimental animals consumed significantly ($P < 0.05$) higher DM (g/d, % B. Wt. and g/kg $w^{0.75}$) in hot humid season as compared to hot dry season to the tune of 16.32, 19.51 and 15.42%, respectively. Feed intake reduced due to 40% [7] and 25% [11] water restriction in Barmer goats and Marwari sheep, respectively. The daily DMI (g/d) reduced significantly ($P < 0.05$) due to water restriction [12] in animals of 40% WR (7.6%) and 20% (5.28%) group as compared to animals of 0% WR, respectively. Earlier author [13] also observed reduction in DMI as the level of water restriction increased. The feed intake was dramatically reduced [3] during the first day of water restriction and continued to decrease but at a slower rate towards the end of water restriction. This is very well in accordance with the present findings.

Animals of T_2 group consumed significantly ($P < 0.05$) more DM (g/d and % B.Wt.) after 2nd (31.17 and 19.70%) and 4th (33.91 and 22.16%) day of rehydration over the values of DMI during water restriction phase in hot dry season. The DMI (g/d) during hot humid season were 12.84 and 9.60% on 2nd and 4th day of rehydration, respectively. However, the impact of rehydration on DMI (% B. Wt.) in experimental animals of T_2 group in hot humid season was non-significant. Full recovery in feed intake did not occurred within 24 hours followed rehydration which is corroborated with earlier author [3].

The DCPI and TDNI (g/d, % B. Wt. and g/kg $w^{0.75}$) are presented in Table 2. The DCPI significantly ($P < 0.05$) influenced by treatments. The DCPI (g/d) reduced due to 50% water restriction by 5.37% but it did not influenced by the season. The animals of both the treatments consumed concentrate completely. Hence, difference in DCPI (g/d) is because of the animals of T_2 group consumed less bajra straw which leads to less dry matter intake on the account of water restriction. Whereas, DCPI (% B. Wt. and g/kg $w^{0.75}$) did not show any significant effect of water restriction but it significantly ($P < 0.05$) affected by season. Present finding was strongly supported by earlier author [12]. Significantly ($P < 0.05$) low DCPI in terms of g/d, % body weight, and g/kg $w^{0.75}$ during hot dry season reported earlier [4] which supports the present findings. The DCPI (g/d) increased significantly ($P < 0.05$) after 4th day of rehydration (6%) while DCPI (g/kg $w^{0.75}$) increased significantly ($P < 0.05$) on 2nd (9.31%) and 4th (22.58) day of rehydration under hot dry season. However, DCPI (% B.Wt.) did not influenced by rehydration.

The TDNI (g/d, B wt % and g/kg $w^{0.75}$) was significantly ($P < 0.05$) affected by treatments and seasons. The TDNI (g/d, % B. Wt. and g/kg $w^{0.75}$) reduced to the tune of 18.65, 12.40 and 14.17%, respectively by offering 50% less water to the sheep and goats. The TDNI (g/d,

% B. Wt. and g/kg $w^{0.75}$) was significantly ($P < 0.05$) reduced in hot dry season as compared to hot humid season by 5.83, 12.40 and 10.86%, respectively. Significantly ($P < 0.05$) low TDNI in terms of g/d, % body weight, and g/kg $w^{0.75}$ during hot dry season were reported earlier [4]. The TDNI (g/d) was significantly ($P < 0.05$) reduced in the experimental animals of 40% water restricted group as compared to animals of control and 20% water restriction group. Earlier author also supports present findings [12]. The TDNI in terms of g/d, and g/kg $w^{0.75}$ influenced significantly ($P <0.05$) by rehydration in both the seasons whereas TDNI (% B.Wt.) significantly ($P < 0.05$) influenced by rehydration in hot dry season only under water restricted group. The experimental animals of T_2 group consumed significantly ($P < 0.05$) more TDN (g/d, % B.Wt. and g/kg $w^{0.75}$) after 2nd (7.12, 8.84 and 9.44%) and 4th day (21.44, 14.15 and 24.94%) of rehydration in hot dry season compared to control group whereas TDNI (g/d and g/kg $w^{0.75}$) of T_2 group increased by 5.80 and 9.65 and 5.78 and 18.51% after 2nd and 4th day of rehydration in hot humid season, respectively. The rehydration significantly ($P < 0.05$) increased TDNI in terms of g/d, % b. wt and g / kg $w^{0.75}$ due to rehydration has been reported by earlier author [12] which supports the present findings.

Conclusion

The body weight, feed and nutrient intakes of experimental animals reduced due to water restriction which can be recovered within 48 hrs of rehydration to sustain productivity of animals.

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Table 1: Effect of dehydrating and rehydration on body weight of sheep and goats in different seasons

Particular	Phase	Season	Particular	B. Wt (kg)
Initial weight	Dehydration	S1	T1	30.76 ± 0.87
			T2	29.98^{x} ± 0.81
		S2	T1	28.37 ± 1.09
			T2	27.98^{y} ± 0.79
Final weight		S1	T1	31.32 ± 1.19
			T2	27.90^{a} ± 0.64
		S2	T1	28.18 ± 1.09
			T2	27.38 ± 0.73
2^{nd} day	Rehydration	S1	T1	31.43 ± 1.07
			T2	29.43^{b} ± 0.60
		S2	T1	28.21 ± 1.09
			T2	28.95 ± 0.87
4^{th} day		S1	T1	31.42 ± 1.09
			T2	31.37^{c} ± 0.67
		S2	T1	28.31 ± 1.09
			T2	28.74 ± 0.79

Dissimilar superscripts (a and b) in column (between season) during rehydration differ significantly ($P < 0.05$)
Dissimilar superscripts (x and y) in column (between Treatments) during dehydration differ significantly ($P < 0.05$)

Table 2 Effect of water restriction on feed and nutrient intake in sheep and goats

Particular	Feed intake			Nutrient intake					
	Dry matter			DCP			TDN		
	g/d	% B. Wt	g/kg $w^{0.75}$	g/d	% B. Wt	g/kg $w^{0.75}$	g/d	% B. Wt	g/kg $w^{0.75}$
T1	708.59^{b} ± 16.80	2.41^{b} ± 0.05	56.07^{b} ± 0.80	36.81^{b} ± 1.67	0.125 ± 0.0037	2.916 ± 0.059	404.30^{b} ± 8.76	1.37^{b} ± 0.03	31.96^{b} ± 0.61
T2	592.93^{a} ± 12.17	2.08^{a} ± 0.03	46.56^{a} ± 1.10	34.83^{a} ± 1.89	0.127 ± 0.0031	2.902 ± 0.260	328.88^{a} ± 5.44	1.20^{a} ± 0.04	27.43^{a} ± 0.56
S1	601.66^{x} ± 15.80	2.05^{x} ± 0.04	47.64^{x} ± 0.87	35.72 ± 1.69	0.122^{x} ± 0.0027	2.844^{x} ±0.036	356.19^{x} ± 8.76	1.21^{x} ± 0.02	28.19^{x} ± 0.41
S2	699.86^{y} ± 11.18	2.45^{y} ± 0.02	54.99^{y} ± 0.89	35.92 ± 1.56	0.129^{y} ± 0.0022	2.973^{y} ±0.044	376.99^{y} ± 8.89	1.36^{y} ± 0.03	31.20^{y} ± 0.46

Dissimilar superscripts (a and b & x and y) in column differed significantly ($P < 0.05$) showing treatment and season effect, respectively.

Table 3 Effect of rehydration on feed and nutrient intake of sheep and goats

Particular	season	Treatment	Feed intake			Nutrient Intake					
			Dry matter				DCP		TDN		
			g/d	% B. Wt	g/kg w $^{0.75}$	g/d	% B. Wt	g/kg w $^{0.75}$	g/d	% B. Wt	g/kg w $^{0.75}$
Final Intake (DH)	S1	T1	709.12 ±28.76	2.28 ±0.10	53.81 ±0.34	36.80 ±0.29	0.11 ±0.003	2.79 ±0.068	381.20 ±12.94	1.23 ±0.05	28.91 ±1.10
		T2	579.77^{a} ±7.44	2.03^{a} ±0.05	46.97 ±0.03	35.50^{a} ±0.08	0.12 ±0.002	2.79^{a} ±0.070	323.01^{a} ±3.34	1.13^{a} ±0.03	26.18^{a} ±0.68
	S2	T1	746.69 ±2.98	2.67 ±0.10	61.41 ±0.95	37.41 ±0.14	0.13 ±0.004	3.07 ±0.070	398.10 ±5.84	1.43 ±0.05	32.74 ±0.99
		T2	689.22^{A} ±12.95	2.54 ±0.10	48.83 ±0.46	33.58 ±0.43	0.12 ±0.003	2.82^{A} ±0.072	372.25^{A} ±5.82	1.37 ±0.05	28.58^{A} ±1.22
2nd day (RH)	S1	T1	774.91 ±34.52	2.48 ±0.11	53.98 ±0.29	39.55 ±0.38	0.12 ±0.002	2.89 ±0.064	352.59 ±15.70	1.37 ±0.04	26.69 ±1.20
		T2	760.50^{b} ±15.81	2.43^{b} ±0.071	47.34 ±0.06	36.82 ±0.6	0.12 ±0.003	3.05^{b} ±0.060	346.03^{b} ±7.19	1.23^{b} ±0.02	28.91^{b} ±1.10
	S2	T1	793.66 ±15.09	2.85 ±0.12	61.72 ±0.94	37.84 ±0.24	0.13 ±0.003	3.23 ±0.060	361.12 ±6.86	1.48 ±0.05	29.80 ±1.04
		T2	777.75^{B} ±23.64	2.71 ±0.13	49.34 ±0.45	33.92 ±0.49	0.11 ±0.001	3.05 ±0.090	393.87^{B} ±10.75	1.43 ±0.05	31.34^{B} ±0.97
4th day (RH)	S1	T1	788.25 ±35.44	2.53 ±0.12	54.29 ±0.33	40.39 ±0.24	0.11 ±0.001	2.96 ±0.060	358.65 ±16.12	1.46 ±0.06	27.17 ±1.24
		T2	776.41^{b} ±10.58	2.48^{b} ±0.067	47.53 ±0.07	37.64^{b} ±0.67	0.12 ±0.002	3.42^{b} ±0.050	392.27^{c} ±4.81	1.29^{c} ±0.03	32.71^{c} ±0.60
	S2	T1	767.16 ±18.22	2.75 ±0.12	61.71 ±0.96	38.33 ±0.34	0.13 ±0.002	3.32 ±0.070	349.06 ±8.29	1.52 ±0.05	28.71 ±1.06
		T2	755.40^{B} ±19.61	2.65 ±0.11	49.85 ±0.42	34.22 ±0.45	0.12 ±0.002	3.20^{B} ±0.010	393.79^{B} ±8.92	1.48 ±0.04	33.87^{B} ±1.00

Dissimilar superscripts (a and b) in a column differed significantly ($P < 0.05$) in hot dry season

Dissimilar superscripts (A and B) in a column differed significantly ($P < 0.05$) in hot humid season