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## Evaluation of hydration status in Tharparkar cows during varying ambiances from arid tract of Rajasthan

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### Abstract

Present investigation assessed the hydration status through evaluation of osmolality and tonicity of plasma in Tharparkar cows from arid tracts of Rajasthan. Apparently healthy 180 Tharparkar cows were screened to collect blood samples from private dairies located in and around Bikaner district, Rajasthan. The blood samples were collected during moderate ambience (October-November), dry-hot ambience (May and June) and humid-hot ambience (July-August). The mean value obtained during moderate ambience was considered as control for the purpose of comparison from the mean values obtained during dry-hot and humid-hot ambiances.

Cows in each ambience were broadly divided into group A and group B according to physiological states. Animals of group A included non-pregnant milch; pregnant milch and pregnant dry cows. *Animals* of group B were classified according to parity and included primipara and multipara cows. Changes in osmolality and tonicity were higher during humid-hot as compared to dry-hot. This exhibited that hydration status was affected to a greater extent during humid-hot. Per cent variations were higher in plasma osmolality as compared to tonicity. Pregnant dry and multipara animals showed highest values of osmolality and tonicity comparatively. It was observed that different ambiances have varied effect on body hydration status. Along with that the physical states also influence the plasma tonicity and osmolality. It can be recommended that water intake of the animals should be strictly monitored during dry-hot and humid-hot.

**Keywords:** Tharparkar cows, Osmolality of plasma, Tonicity of plasma, Hydration status

### Introduction

Tharparkar is the native breed of cows from western Rajasthan. Though, this breed is resistant to variations in environmental ambiances but for survival in extreme ambiances physiological changes occur in animals. Environmental change is predictable to set forth an unbearable offhand impact on health status of animals, thereby influencing wellbeing. The effects of disturbance or changes in environmental conditions on the health of animal can vary from very high to very low degree. Arid tract experiences very soaring prevalence of strong heat waves. Appraisal of the per cent water in the individual compartment of the animal can be done by a number of the methods. Simple tools are based on determining concentration of analytes found in blood to evaluate the hydration status. In the present study hydration status was investigated by determining the values of plasma osmolality and tonicity. Increase in osmolality during dry-hot and humid-hot indicated towards water deficit and lowering of hydration status. The option of hydration status indicator can ultimately be measured by the sensitivity and correctness with which hydration status entails to be implicated. Seasonal variations have been reported to affect the physiology of animals (Arora *et al.* 2021 and Kour and Kataria, 2021)<sup>[1-9]</sup>.

### Materials and Methods

To investigate the osmolality of plasma and tonicity of plasma in Tharparkar cows from arid tracts of Rajasthan during moderate, dry-hot and humid-hot ambiances, blood samples were collected from 180 cows maintained under standard management conditions by private owners from unorganized sector. Collection of blood samples was carried out without causing stress to animals from jugular vein. Cows in each ambience were broadly divided into group A and group B according to physiological states. Animals of group an included non-pregnant milch; pregnant milch and pregnant dry cows. *Animals* of group B were classified according to parity and included primipara and multipara cows. This was irrespective of states like pregnancy and milch. All primipara were between 3.5 and 6 years whereas all multipara were between 6 and

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8.5 years of age. The mean value obtained during moderate ambience was considered as control for comparison from the mean values obtained during dry-hot and humid-hot ambiances. Distinctive computer programmes were used to various statistical analysis. (<http://miniwebtool.com>) and ([www.danielsooper.com](http://www.danielsooper.com)). The alteration in the means were assessed by Duncan's newmultiple range test (Duncan, 1995). Osmolality of plasma was determined as per the description of Gowenlock *et al.* (1988) [4]. It involved molar concentrations of potassium, sodium, glucose and urea as per an account given below:

Plasma osmolality (mOsmol kg<sup>-1</sup>) = 2 X 0.93 [(Na<sup>+</sup>) + (K<sup>+</sup>)] + [glucose] + [urea] Illustrations by Gowenlock *et al.* (1988) [4] was the basis of computation of tonicity of plasma

Plasma tonicity = Plasma Osmolality (mOsmol kg<sup>-1</sup>) - Plasma Urea concentration (mmol L<sup>-1</sup>).

## Results and Discussion

### 1. Osmolality of plasma (Posm)

The Mean ± SEM values of osmolality of plasma in Tharparkar cows of different physiological states i.e. group A (non-pregnant milch, pregnant milch and pregnant dry) and group B (primipara and multipara) during moderate, dry-hot and humid-hot ambiances are presented in table 1. The findings of Posm acquired in the present study during moderate environmental temperature periods (ETP) corroborated with the observations of the earlier researchers in calves (Kataria and Kataria, 2005c and Joshi, 2018) [6, 5]; sheep (Blair-West *et al.*, 1985 and Meena, 2002) [2, 11]; camel (Kataria, 2000) [8]; cows (Skrzypczak *et al.*, 2014) [16]; sheep (Promila, 2018) [12] and goat (Singh, 2018) [15].

#### 1.1 Effect of varying ambiances on the values of osmolality of plasma

The overall mean values of osmolality of plasma were

significantly ( $p \leq 0.05$ ) higher during dry-hot and humid-hot ambiances as compared to moderate ambience mean value. A highly significant ( $p \leq 0.01$ ) effect of extreme ambiances i.e. dry-hot and humid-hot was observed. Maximum level of osmolality of plasma was observed during humid-hot ambience, which was (+5.49). The authentication of the observations of present investigation was done on the basis of earlier findings (Kataria, 2000 [8] in camel; Meena, 2002 [11] in sheep; Joshi, 2018 [5] in calves and cows; Singh, 2018 [15] in goat). Changes in plasma osmolality due to hot ambience can be justified on the fact of evaporation of water to maintain body temperature. Saving of plasma osmolality largely depends upon osmoles in plasma including sodium, chloride, bicarbonate, urea and glucose.

#### 1.2 Effect of physiological states on the values of osmolality of plasma

In the present investigation, statistical analysis revealed significant ( $p \leq 0.05$ ) variations among all the three ambiances. In each ambience, in group A, mean value of pregnant dry cows was significantly ( $p \leq 0.05$ ) higher than the respective mean values of non-pregnant milch and pregnant milch cows. In each ambience, in group B, mean value of multipara cows was significantly ( $p \leq 0.05$ ) higher than the respective mean value of primipara cows.

The findings corroborated the earlier research (Joshi, 2018) [5]. Effect of age on osmolality was noted as reflected by previous research (Meena, 2002 [11] in sheep and Kataria and Kataria, 2005e in calves) [7]. Plasma osmolality is generally calculated to assess different solutes in plasma. Shalit *et al.* (1991) [14] in a study measured plasma osmolality two weeks before parturition in cows and confirmed the changes according to physiological states. Findings and changing pattern of the present exploration reflected that animals of all physiological states were influenced by extreme ambiances.

**Table 1:** Mean ± SEM values of osmolality of plasma (P<sub>osm</sub>, mOsmol Kg<sup>-1</sup>) in the Tharparkar cows during varying ambiances

S. No.	Effects	Mean ± SEM values during varying ambiances		
		Moderate	Dry hot	Humid hot
1.	Overall values (60)	288.13 <sup>b</sup> ± 1.20	297.39 <sup>b</sup> ± 1.55	303.97 <sup>b</sup> ± 1.77
2.	Categorization according to physiological states (A & B groups)			
I.	<b>Group A cows (60), Physiological states: Pregnancy and milch status</b>			
a.	Non-pregnant milch (20)	277.40 <sup>bd</sup> ± 0.53	283.12 <sup>bd</sup> ± 0.58	288.85 <sup>bd</sup> ± 0.57
b.	Pregnant milch (20)	288.39 <sup>bd</sup> ± 0.69	297.50 <sup>bd</sup> ± 0.86	303.01 <sup>bd</sup> ± 0.97
c.	Pregnant dry (20)	298.72 <sup>bd</sup> ± 0.85	311.47 <sup>bd</sup> ± 0.52	320.35 <sup>bd</sup> ± 1.31
II.	<b>Group B cows (60), Physiological states: Parity</b>			
a.	Primipara (30)	285.14 <sup>be</sup> ± 1.51	294.53 <sup>be</sup> ± 2.17	299.92 <sup>be</sup> ± 2.14
b.	Multipara (30)	291.19 <sup>be</sup> ± 1.72	300.20 <sup>be</sup> ± 2.13	308.23 <sup>be</sup> ± 2.63

1. Figures in the parenthesis = Number of Tharparkar cows
2. <sup>b</sup> = Significant ( $p \leq 0.05$ ) differences among mean values for a row.
3. <sup>d</sup> = Significant ( $p \leq 0.05$ ) differences among mean values for an ambience
4. <sup>e</sup> = Significant ( $p \leq 0.05$ ) differences between mean values for an ambience

### 2. Tonicity of plasma (P<sub>tonicity</sub>)

The Mean ± SEM values of tonicity of plasma in Tharparkar cows of different physiological states i.e. group a (non-pregnant milch, pregnant milch and pregnant dry) and group B (primipara and multipara) during moderate, dry-hot and humid-hot ambiances are presented in table 2. The findings of tonicity of plasma acquired in the present study during moderate environmental temperature periods (ETP) corroborated with the observations of the earlier researchers (Rasouli, 2016 [13]; Promila, 2018 [12] and Singh, 2018) [15]. There is dearth of research on this aspect. Hydration status can be appraised efficiently by employing plasma tonicity

(Joshi, 2018 [5]; Promila, 2018 [12] and Singh, 2018) [15]

#### 2.1 Effect of varying ambiances on the values of tonicity of plasma

The overall mean values of tonicity of plasma were significantly ( $p \leq 0.05$ ) higher during dry-hot and humid-hot ambiances as compared to moderate ambience mean value. A highly significant ( $p \leq 0.01$ ) effect of extreme ambiances i.e. dry-hot and humid-hot was observed. Maximum level of tonicity of plasma was observed during humid-hot ambience. During humid-hot, the per cent variation of tonicity of plasma was found to be maximum (+4.10). Prototype of changes in

the values during dry-hot and humid-hot ambiances corroborated previous researches (Joshi, 2018; Promila, 2018 and Singh, 2018) [5, 12 15]. Changes in plasma tonicity can be ascribed to heat stress as it is a positive potent indicator of water deficit (Lim *et al.*, 2015 [10]; Promila, 2018 [12] and Singh, 2018) [15]. There is dearth of research on this aspect in animals.

## 2.2 Effect of physiological states of on the values of tonicity of plasma

In the present investigation, statistical analysis revealed significant ( $p \leq 0.05$ ) variations among all the three overall mean values according to ambiances. The mean value

obtained during moderate ambience was considered as control for the purpose of comparison from the mean values obtained during dry-hot and humid-hot ambiances.

In each ambience, in group A, mean value of pregnant dry cows was significantly ( $p \leq 0.05$ ) higher than the respective mean values of non-pregnant milch and pregnant milch cows. In each ambience, in group B, mean value of multipara cows was significantly ( $p \leq 0.05$ ) higher than the respective mean value of primipara cows.

All the changes were significant ( $p \leq 0.05$ ). Multipara exhibited maximum per cent change in all ambiances (Joshi, 2018) [5]. Age effect on plasma tonicity values were noted by Promila (2018) [12] in sheep and Singh (2018) [15] in goat.

**Table 2:** Mean  $\pm$  SEM values of tonicity of plasma ( $P_{\text{tonicity}}$ , mOsmol Kg<sup>-1</sup>) in the Tharparkar cows during varying ambiances

S. No.	Effects	Mean $\pm$ SEM values during varying ambiances		
		Moderate	Dry hot	Humid hot
1.	Overall values (60)	279.54 <sup>b</sup> $\pm$ 0.97	285.51 <sup>b</sup> $\pm$ 1.30	291.02 <sup>b</sup> $\pm$ 1.48
2.	Categorization according to physiological states (A & B groups)			
<b>I.</b>	<b>Group A cows (60), Physiological states: Pregnancy and milch status</b>			
a.	Non-pregnant milch (20)	270.77 <sup>bd</sup> $\pm$ 0.42	273.48 <sup>bd</sup> $\pm$ 0.47	278.13 <sup>bd</sup> $\pm$ 0.46
b.	Pregnant milch (20)	279.75 <sup>bd</sup> $\pm$ 0.57	285.70 <sup>bd</sup> $\pm$ 0.73	290.28 <sup>bd</sup> $\pm$ 0.86
c.	Pregnant dry (20)	288.08 <sup>bd</sup> $\pm$ 0.73	297.34 <sup>bd</sup> $\pm$ 0.37	304.68 <sup>bd</sup> $\pm$ 1.01
<b>II.</b>	<b>Group B cows (60), Physiological states: Parity</b>			
a.	Primipara (30)	277.02 <sup>be</sup> $\pm$ 1.21	283.25 <sup>be</sup> $\pm$ 1.84	287.63 <sup>be</sup> $\pm$ 1.83
b.	Multipara (30)	282.05 <sup>be</sup> $\pm$ 1.41	287.76 <sup>be</sup> $\pm$ 1.78	294.42 <sup>be</sup> $\pm$ 2.19

## Conclusion

In present investigation the effects of ambiances and physiological states were studied. On the basis of results it could be concluded that the plasma tonicity and plasma osmolality were affected more during the humid hot condition than other environmental conditions. It could also be concluded that pregnant dry and multipara animals showed highest values of osmolality and tonicity comparatively. So the hydration status should be maintained in those affected animals during extreme ambiances and various physiological states.

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