

ASSESSMENT OF FLUID STATUS OF FEMALE *MURRAH* BUFFALOES FROM ARID TRACTS OF RAJASTHAN DURING EXTREME AMBIENCES**Ruchi Maan*¹ and Nalini Kataria²**¹Assistant Professor, Department of Veterinary Physiology, College of Veterinary and Animal Science, Bikaner Rajasthan, India.²Professor and Head, Department of Veterinary Physiology, College of Veterinary and Animal Science, Bikaner Rajasthan, India.***Corresponding Author: Dr. Ruchi Maan**

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ABSTRACT

An exploration was conducted to evaluate fluid status of female *Murrah* buffaloes incorporating animals in different physiological states from arid tracts of Rajasthan during extreme ambient temperature periods. Fluid status was appraised by determining blood and urine specific gravities. Apparently healthy animals were screened for blood and urine samples during moderate, extreme hot, rainy and extreme cold ambiances. The overall mean values of blood and urine specific gravities were significantly ($p \leq 0.05$) higher during rainy, extreme hot and extreme cold ambiances as compared to respective moderate mean value. During rainy ambience, the per cent change was found to be maximum for blood and urine specific gravities. Between heifers, pre-pubertals expounded greater impressions of extreme ambient temperature periods. Amongst groups of buffaloes as per physiological states, non-pregnant milch and primipara divulged higher brunt of extreme ambiances. The epitome of the present exploration was that rainy ambience produced slow water deficit of utmost degree in the buffaloes with adjustments in the physiological mechanisms to a degree which can establish disturbance of health status. All the buffaloes were observed to be distressed with mild water-deficit in all the three extreme ambiances with maximum consequences in rainy ambience. It can be advocated that exceptional consideration must be given regarding watering of the buffaloes during callous ambient temperature periods with ample antioxidant supplementations. Buffalo owners must be awakened to watch the health of animals regularly.

KEYWORDS: Ambience, cold, hot, rainy, specific gravity.**INTRODUCTION**

Ambient temperature periods in the arid tracts of Rajasthan incorporate moderate, hot, rainy and extreme cold periods including the months of October-November; April-May-June; July-August-September and December-January months, respectively with some intervening period incorporating February-March months. The thump of extreme ambient temperatures and humidities can influence physiological reactions.^[1,2,3] For the implemenation of all the physiological reactions, fluid medium is imperative. Fluid status provides an important element for diagnostic approach in animals regarding establishment of normal reference values of parameters in a specific breed. Homeostasis is sustained by ion transport, water movement and kidney function. Any abnormality can decline the water status of the body disturbing acid-base status. Fluid status determination is worthy to assess the incidence of water-deficit which can be the origin of any clinical condition.^[4,5,6,7] Sluggish water deficit arising owing to switching of environmental elements can disturb renal plasma flow affecting glomerular filtration rate. Filtered and excreted loads of

constituents can also be plunged and modulations in aldosterone and cortisol can be discerned.^[8,9,10,11,12,13]

Extreme ambieces can put impact on various metabolic reactions in the body along with hydration status.^[14,15,16,17] Though, increase in urine specific gravity can be associated with many pathological conditions, but in apparently healthy animals generally this increase is associated with dehydration. Specific gravities of blood and urine are essential parameters to assess fluid status indirectly. There determination play a principal role in veterinary clinical physiology.^[17] The animals native to arid tract of Rajasthan living under natural husbandry conditions are regularly victimized due to callous ambience resulting in huge economical deficit to marginal animal owners. Though buffaloes are valuable for the the economy of marginal owners, but they have received meagre scientific focus. Owing to scarcity of research concerning evaluation of fluid status in the buffaloes from arid tracts, the present exploration was conducted to assess fluid status of female *Murrah* buffaloes from arid tracts of Rajasthan during extreme

ambiences. The data collected in the exploration will assist as edifice for impending research in this course.

MATERIALS AND METHODS

Apparently healthy *Murrah* female buffaloes (800) incorporating buffalo heifers and buffaloes in different physiological states according to milch and parity status ageing one year old to 8 years of age were screened from private dairies located in and around Bikaner district, Rajasthan, India under the permission of Institutional Animal Ethics Committee, College of Veterinary and Animal Science, Rajasthan University of Veterinary and Animal Sciences, Bikaner, Rajasthan. Collection of blood samples was made to harvest serum during moderate (October-November), extreme hot (April-May-June), rainy (July-August-September) and extreme cold (December-January) ambiances. Category of buffalo heifers included pre-pubertal and post-pubertal, each encompassing 40 buffaloes. Buffaloes were also grouped as A and B. Sub-group A comprised of non-pregnant milch (40); pregnant milch (40) and pregnant dry (40) buffaloes. Sub-group B incorporated primipara (60) and multipara (60) buffaloes.

Determination of blood specific gravity was carried out as per standard falling drop technique utilizing copper sulphate solution.^[18] Urine specific gravity was assessed by the standard method.^[19] Data were expressed as mean \pm SE of mean and special computer programmes were employed to compute means and standard error (<http://www.miniwebtool.com>). The significance of the impacts was also calculated.^[20]

RESULTS AND DISCUSSION

Blood specific gravity

Mean \pm SEM values of blood specific gravity of *Murrah* female buffaloes i.e. heifers and buffaloes according to milch, pregnancy and parity status during moderate, extreme hot, rainy and extreme cold ambiances are presented in table 1. Validation of the moderate mean value obtained in the present exploration was carried out on the basis of the earlier observations recorded by researchers in animals from arid tract.^[17,21]

Description of changes in values during varying ambiances

The overall mean values of blood specific gravity were significantly ($p\leq 0.05$) higher during rainy, extreme hot and extreme cold ambiances as compared to moderate mean overall value. During rainy ambience, the per cent variation in the value of blood specific gravity was found to be maximum. As compared to moderate ambience, maximum mean overall value was obtained during extreme rainy ambience and minimum in extreme cold ambience. It is important to connect fluid retention, kidney functions and stress in animals.^[22,23,24,25]

The substantiation of the findings recorded in the present study was carried out on the basis of earlier research in animals.^[17,21,26] Upholding of thermoregulation needs

evaporation of water resulting into decrement in total body water. These mechanisms can affect the specific gravity. Animals of arid tracts face various kinds of stressors, influence of hormones on different physiological reactions must be assessed from time to time.^[25] Physiological intonations in animals from arid tracts needs assessment of fluid and electrolyte status with assessing hydration status along with electrolyte balance. Extreme hot environmental temperature can affect hydration profile greatly.^[27,28]

Effect of physiological states of animals on blood specific gravity

Significant ($p\leq 0.05$) variations were observed in the mean values according to physiological states due to extreme ambiances. Between buffalo heifers, post pubertal buffaloes had significantly ($p\leq 0.05$) higher mean values in each ambience comparatively. In both the types, maximum mean values were observed in rainy ambience as compared to moderate ambience. In comparative terms, both the groups exhibited higher per cent variations during rainy ambience. Pre-pubertal heifers marked maximum per cent variation in rainy ambience.

In group I buffaloes, non-pregnant milch had significantly ($p\leq 0.05$) higher values in each ambience. In all the three types, maximum mean values were observed in extreme rainy ambience followed by extreme hot and extreme cold ambiances. Per cent variations were maximum in pregnant dry in all ambiances. In group II buffaloes, multipara had significantly ($p\leq 0.05$) higher values in each ambience. In both the types, maximum mean values were observed in rainy ambience as compared to moderate. Multipara exhibited maximum per cent variations.

Influence of age on the values were also observed by previous researchers.^[17,21] Researchers have shown concern regarding the impact of heat stress owing to generation of free radicals.^[29,30] Observations of the present exploration indicated that animals of all physiological states were influenced by the alterations in temperatures of ambience.

Urine specific gravity

Mean \pm SEM values of urine specific gravity of *Murrah* female buffaloes i.e. heifers and buffaloes of different physiological states during moderate, extreme hot, rainy and extreme cold ambiances are presented in table 2. Specific gravity is of immense concern for the monitoring of several conditions. Moderate overall mean value collected in the present investigation validated the earlier recordings.^[17,21]

Solute concentration of the urine and density are represented by the specific gravity of urine. Specific gravity of the urine is relative to osmolality of the urine. It is an easy measure demonstrating indirectly the capability of the kidney to dilute or concentrate the urine.

Relation of renal plasma flow and glomerular filtration rate has been considered as a matter of importance in renal physiology. Urine specific gravity can be widely influenced by these two components.^[17,21,22]

Description of changes in values of urine specific gravity during varying ambiances

The mean values of specific gravity of urine were significantly ($p \leq 0.05$) higher during extreme cold, hot and rainy ambiances as compared to moderate mean overall value. During rainy ambience, the per cent variation in the value was found to be maximum. Comparison among extreme ambiances revealed maximum mean overall value during rainy ambience and comparatively minimum in extreme cold ambience.

On the basis of earlier research the corroboration of the findings observed in the present venture was made.^[17,21] Specific gravity is an important aspect of urinalysis. It can be ascertained that it is a simple test to be performed. Increased values during extreme ambiances effected to exemplify the presence of water deficit.^[28] Combination of heat stress and hypovolemia is common.^[17,28] Environmental stress in the present study raised blood specific gravity and consequently increased urine specific gravity.

Effect of physiological states on urine specific gravity

In the present study, significant ($p \leq 0.05$) variations among all the three ambiances were found. The moderate mean value in each case was considered as control. Between heifers, post pubertal animals had significantly ($p \leq 0.05$) higher mean values in each ambience comparatively. In both the types, maximum mean values were observed in rainy ambience as compared to moderate ambience. In comparative terms, both the groups exhibited higher per cent variations during rainy ambience. Pre-pubertal heifers marked maximum per cent variation in all ambiances. Among group I buffaloes,

non-pregnant milch had significantly ($p \leq 0.05$) higher values in each ambience. In all the three types, maximum mean values were observed in rainy ambience. Per cent variations were maximum in pregnant dry in all ambiances. In group II, multipara had significantly ($p \leq 0.05$) higher values in each ambience. In both the types, maximum mean values were observed in rainy ambience as compared to moderate ambience. Primipara buffaloes exhibited maximum per cent variations in all ambiances. Scientists have advocated the effect of age on urine specific gravity in the animals.^[17,21] There is scarcity of research on this facet in buffaloes.

Variations in the mean values as per physiological situations divulged adaptability of animals to water lack as all animals in the study were subjected to almost similar type of management conditions. It can be restated that compartmental water balance of the animals changes during extreme ambiances. This can influence renal transfer function.^[30,31] Urinary specific gravity is an important marker of kidney functions and is associated with the physiological dynamics of diuresis. Specific gravity is a measure of rate of excretion of water or conservation in apposite manner. Changes of rhythm of solute and water excreted can be the key of modulations in specific gravity.^[26] Glomerular filtration rate is also influenced by variations in ambient temperatures.^[32,33] Wide variations in urine specific gravity can be a normal phenomenon in healthy animal, however, problem occurs when some external factors are involved in its manipulation. Environmental temperature is one of them. Heat stress can influence endocrine status along with fluid status of animals of different physiological states.^[34,35] Variations in glomerular filtration rate can put influence on different clearances.^[36,37,38] All these factors may affect blood and urine volume. These changes were clearly displayed in the present exploration in terms of blood and urine specific gravities.

Table 1: Mean \pm SEM values of specific gravity of blood in the female *Murrah* buffaloes during varying ambiances.

S. No.	Effects	Mean \pm SEM values during ambiances			
		Moderate	Extreme hot	Rainy	Extreme cold
1.	Ambience Overall values (200)	1.0558 ^b ± 0.0002	1.0630 ^b ± 0.0001	1.0690 ^b ± 0.0002	1.0548 ^b ± 0.0001
2.	Age group categorization (I & II categories)				
I.	Murrah Heifers, 1-3.5 years (80), categorization as a & b				
	Overall values (80)	1.0559 ^{bg} ± 0.0001	1.0631 ^{bg} ± 0.0001	1.0690 ^{bg} ± 0.0001	1.0548 ^{bg} ± 0.0001
a.	Pre-pubertal (40)	1.0556 ^{bd} ± 0.00001	1.0628 ^{bd} ± 0.00001	1.0687 ^{bd} ± 0.00001	1.0546 ^{bd} ± 0.00001
b.	Post-pubertal (40)	1.0560 ^{bd} ± 0.00001	1.0632 ^{bd} ± 0.00001	1.0693 ^{bd} ± 0.00001	1.0550 ^{bd} ± 0.00001
II.	Female Murrah buffaloes, 3.5-8 years (120), categorization as group A & B				
	Overall values (120)	1.0566 ^{bg} ± 0.0001	1.0633 ^{bg} ± 0.0001	1.0694 ^{bg} ± 0.0001	1.0556 ^{bg} ± 0.0001
	Group A (120), Physiological states: Pregnancy and milch status				
a.	Non-pregnant milch (40)	1.0560 ^{be} ± 0.00001	1.0631 ^{be} ± 0.00001	1.0693 ^{be} ± 0.00001	1.0555 ^{be} ± 0.00001

b.	Pregnant milch (40)	1.0566 ^{be} ±0.00001	1.0634 ^{be} ±0.00001	1.0695 ^{be} ±0.00001	1.0557 ^{be} ±0.00001
c.	Pregnant dry (40)	1.0570 ^{be} ±0.00001	1.0637 ^{be} ±0.00001	1.0697 ^{be} ±0.00001	1.0559 ^{be} ±0.00002
Group B (120), Physiological states: Parity					
a.	Primipara (60)	1.0564 ^{bf} ±0.00001	1.0632 ^{bf} ±0.00001	1.0693 ^{bf} ±0.00001	1.0553 ^{bf} ±0.00001
b.	Multipara (60)	1.0568 ^{bf} ±0.00001	1.0636 ^{bf} ±0.00001	1.0697 ^b ±0.00001	1.0560 ^{bf} ±0.00001

- Figures in the parenthesis = Number of *Murrah* buffaloes
- 'b' = Significant ($p \leq 0.05$) differences among mean values for a row.
- 'd' = Significant ($p \leq 0.05$) differences between mean values of heifers for an ambience
- 'e' = Significant ($p \leq 0.05$) differences among mean values of Group A for an ambience
- 'f' = Significant ($p \leq 0.05$) differences between mean values of Group B for an ambience
- 'g' = Significant ($p \leq 0.05$) differences among overall values of heifers and buffaloes for an ambience

Table 2: Mean \pm SEM values of specific gravity of urine in the female *Murrah* buffaloes during varying ambiances.

S. No.	Effects	Mean \pm SEM values during ambiances			
		Moderate	Extreme hot	Rainy	Extreme cold
1.	Ambience Overall values (200)	1.0200 ^b ±0.0004	1.0398 ^b ±0.0003	1.0477 ^b ±0.0007	1.0192 ^b ±0.0005
2.	Age group categorization (I & II categories)				
I. <i>Murrah</i> Heifers, 1-3.5 years (80), categorization as a & b					
	Overall values (80)	1.0196 ^{bg} ±0.00015	1.0395 ^{bg} ±0.0005	1.0485 ^{bg} ±0.0005	1.0187 ^{bg} ±0.0002
a.	Pre-pubertal (40)	1.0195 ^{bd} ±0.00005	1.0390 ^{bd} ±0.00002	1.0480 ^{bd} ±0.00019	1.0185 ^{bd} ±0.00001
b.	Post-pubertal (40)	1.0198 ^{bd} ±0.00008	1.0400 ^{bd} ±0.00002	1.0490 ^{bd} ±0.00002	1.0189 ^{bd} ±0.00002
II. Female <i>Murrah</i> buffaloes, 3.5-8 years (120), categorization as group A & B					
	Overall values (120)	1.0206 ^{bg} ±0.0003	1.0404 ^{bg} ±0.0002	1.0496 ^{bg} ±0.002	1.0197 ^{bg} ±0.00018
Group A (120), Physiological states: Pregnancy and milch status					
a.	Non-pregnant milch (40)	1.0204 ^{be} ±0.00001	1.0402 ^{be} ±0.00001	1.0494 ^{be} ±0.00001	1.0195 ^{be} ±0.00001
b.	Pregnant milch (40)	1.0206 ^{be} ±0.00001	1.0404 ^{be} ±0.00001	1.0496 ^{be} ±0.00001	1.0197 ^{be} ±0.00001
c.	Pregnant dry (40)	1.0210 ^{be} ±0.00001	1.0408 ^{be} ±0.00001	1.0498 ^{be} ±0.00001	1.0199 ^{be} ±0.00001
Group B (120), Physiological states: Parity					
a.	Primipara (60)	1.0205 ^{bf} ±0.00011	1.0403 ^{bf} ±0.00011	1.0495 ^{bf} ±0.00001	1.0195 ^{bf} ±0.00001
b.	Multipara (60)	1.0209 ^{bf} ±0.00001	1.0407 ^{bf} ±0.00011	1.0498 ^{bf} ±0.00001	1.0200 ^{bf} ±0.00011

- Figures in the parenthesis = Number of *Murrah* buffaloes
- 'b' = Significant ($p \leq 0.05$) differences among mean values for a row.
- 'd' = Significant ($p \leq 0.05$) differences between mean values of heifers for an ambience
- 'e' = Significant ($p \leq 0.05$) differences among mean values of Group A for an ambience
- 'f' = Significant ($p \leq 0.05$) differences between mean values of Group B for an ambience
- 'g' = Significant ($p \leq 0.05$) differences among overall values of heifers and buffaloes for an ambience

CONCLUSION

It can be concluded that fluid status of female buffaloes divulged lalts during extreme ambiances. Blood and urine specific gravities depicted alterations during extreme rainy, extreme hot and extreme cold ambiances. Maximum changes were found during rainy ambience. Increased blood and urine specific gravities during rainy

and extreme hot ambiances lucidly revealed slow dehydration in buffaloes. It can be suggested that special attention must be paid regarding watering of the animals during callous ambient temperature periods with proper antioxidant supplementations.

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