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Environmental ambiences vis-à-vis antioxidants in *Tharparkar* cows from Bikaner district of Rajasthan

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Abstract
Present exploration was planned to know the antioxidants status in relation to various environmental ambiences and physiological states of *Tharparkar* cows from Bikaner district of Rajasthan. Apparently healthy 180 *Tharparkar* cows were screened 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). Maximum level of plasma malondialdehyde and plasma oxidase enzyme were observed during humid-hot ambience. During humid-hot, the per cent variation in the value of plasma malondialdehyde and oxidase enzyme were found to be maximum (+91.71) and (+11.01), respectively. It can be reiterated that extent of development of oxidative stress was higher during humid-hot. Higher plasma malondialdehyde and plasma oxidase in present study attempted to illustrate the apparition of oxidative stress in otherwise healthy cows.

Keywords: *Tharparkar* cows, oxidants, ambience, plasma malondialdehyde and plasma oxidase

Introduction
Antioxidants are molecules that stop the process of oxidation of other molecules. Oxidation is a well-known chemical reaction that can produce free radicals giving rise to chain reactions that may cause insult to cells. Antioxidants are considered as key factors of primary line of defense of the body which work by removing potentially damaging oxidizing agents. Since they counteract unsafe free radicals, therefore, little antioxidants profile is related with the development of oxidative stress. Encounter of dairy cattle to high ambient temperatures, high relative humidity and solar radiation for extended periods can decrease the ability of the lactating dairy cow to disband heat causing heat stress in the animals. When the body temperature is remarkably elevated, feed intake, metabolism, body weight and milk production reduce to help alleviate the heat imbalance.

Basic scientific need is to conduct research in the directions where the protection of native breeds can be enhanced by reducing the effect of stressors. Scientists have attempted to relate oxidative stress with abiotic stressor. A negative influence on skeletal muscle homeostasis can be caused by oxidative stress and plasma MDA is significantly associated with baseline or exercise-caused changes in muscle mass

Materials and Methods
To investigate the antioxidant status in *Tharparkar* cows from arid tracts of Rajasthan during moderate, dry-hot and humid-hot ambiences, 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 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. 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 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 ambiences. Distinctive computer programmes were used to various statistical analysis. (http://miniwebtool.com) and (www.danielsoper.com). The alteration in the means were assessed by Duncan's new multiple range test (Duncan, 1995).

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1. Plasma Malondialdehyde (MDA)

It was measured by the procedure as described by Rao *et al.* (2014) [15]. A pink colour complex was obtained ensuing the reaction, in an acidic medium, of malondialdehyde with thiobarbituric. The optical density was measured at 532 μm with a blank (Spectrophotometer, Systronics).

Hence, the plasma malondialdehyde (nmol dL-1) was computed as:

$$= \text{Optical Density} \quad X \quad \frac{100 \times 4}{0.15}$$

Value in n mol dL-1 was changed to μmol L-1.

2. Plasma Oxidase

Plasma oxidase was estimated by the colorimetric method (Snell and Snell, 1954) [18] with modest modification (Kataria *et al.* 2010b) [8]. The α- napthol and dimethyl p-phenylenediamine hydrochloride were made to oxidize to the blue indophenols in an alkaline medium of solution in the presence of oxidases.

Oxidase activity, UL-1 = Deviation per minute in OD X 1000
Here, 1000 = Conversion factor

Results and Discussion

1. Plasma Malondialdehyde and Plasma oxidase

The Mean± SEM values of plasma malondialdehyde and plasma oxidase enzyme 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 ambiences are presented in table 1 and table 2, respectively. Moderate ambience mean values corroborated the earlier research (Joshi, 2018 in cattle [4]; Promila, 2018 in sheep [14]; and Singh, 2018 in goat) [16]. Overall lipid peroxidation status can be marked by plasma malondialdehyde (MDA), which is one of several products of lipid peroxidation (Church and Pryor, 1985) [2]. The war of free radical with polyunsaturated membrane lipid produces hydroperoxide with resultant formation of malondialdehyde, which is now measured as the outcome of free radical damage (Joshi, 2018) [4].

1.1 Effect of varying ambiences on the values of plasma malondialdehyde and plasma oxidase enzyme

The overall mean values of plasma malondialdehyde and oxidase were significantly ($p \leq 0.05$) higher during dry-hot and humid-hot ambiences as compared to moderate ambience mean value. Maximum level of plasma malondialdehyde was observed during humid-hot ambience. During humid-hot, the per cent variation in the value of plasma malondialdehyde and oxidase enzyme were found to be maximum (+91.71) and (+11.01), respectively.

Pattern of changes in plasma MDA during dry-hot and humid-hot corroborated the findings of Joshi (2018) [4] in cattle. The outline of changes in the levels during both the adverse ambiences was similar to that observed by earlier researchers (Janagal, 2019; Promila, 2018; and Singh, 2018) [3, 14, 16]. Higher values during humid-hot substantiated the development of oxidative stress. Influence of raised atmospheric temperature on heifers associated with the oxidative stress was appraised in a study by Burke *et al.* (2007) [1] and it was stated that plasma level of malondialdehyde was a marker of lipid peroxidation. Researchers have used malondialdehyde to appraise antioxidant status in animals (Joshi, 2018 [4] and Song and Shen, 2019) [19]. It can be opined that higher malondialdehyde contents in the present study proposed the development of oxidative stress in cows.

Plasma oxidase indicated an increasing pattern during extreme ambiences which was found to corroborate earlier research work in cows (Joshi, 2018) [4]; camels (Kataria *et al.,* 2010c) [9]; goats (Kataria *et al.,* 2010b [8]; Pandey and Kataria, 2015 and Pareek *et al.*, 2016) [12, 13]; buffaloes (Joshi *et al.*, 2013a) [6]; donkeys (Kataria and Kataria, 2013b) [7]; horses (Singhal *et al.*, 2015 and Srivastava *et al.*, 2016) [17, 20] and sheep (Maan, 2010 and Promila, 2018) [10, 14]. Researchers rendered blood oxidase as a marker of oxidative stress (Kataria *et al.*, 2010b and Maan, 2010) [8, 10].

1.2 Effect of physiological states of on the values of plasma malondialdehyde and oxidase enzyme

In the present investigation, *Tharparkar* cows had two major groups according to physiological states (group A and group B) in all the three ambiences. Statistical analysis revealed significant ($p \leq 0.05$) variations among all the three overall mean values according to ambiences. 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 plasma malondialdehyde and oxidase enzyme of non- pregnant milch and pregnant milch cows. In each ambience, in group B, mean value of plasma malondialdehyde and oxidase enzyme multipara cows was significantly ($p \leq 0.05$) higher than the respective mean value of primipara cows. Findings of present study regarding effect of physiological states on plasma MDA and oxidase enzyme corroborated the observations of Joshi (2018) [4] in cattle. It can be reiterated that pregnant dry and multipara cows developed oxidative stress of highest magnitude.

Physiological states like parity, lactation and pregnancy can put immense pressure on blood constituents (Joshi, 2012 and Joshi, 2018) [5, 4]. Age marked changes in serum oxidase was appraised by Joshi (2012) [5] in buffaloes; Pandey (2012) [11] and Pandey and Kataria (2015) [12] in goats; Promila (2018) [14] in sheep and Joshi (2018) [4] in cows. Plasma oxidase can be used effectively as one of the indicators of oxidative stress (Kataria *et al.*, 2010b; Joshi, 2012; Pandey and Kataria, 2015; Joshi, 2018; Promila, 2018 and Srivastava *et al.,* 2018b) [8, 5, 12, 4, 14, 21].

Table 1: Mean ± SEM values of plasma malondialdehyde (MDA, µ mmol L^{-1}) in the *Tharparkar* cows during varying ambiences

S. No.	Effects	Mean ± SEM values during varying ambiences		
		Moderate	Dry hot	Humid hot
1.	Overall values (60)	7.60[b] ± 0.22	11.62[b] ± 0.21	14.57[b] ± 0.36
2.	Categorization according to physiological states (A & B groups)			
I.	Group A cows (60), Physiological states: Pregnancy and milch status			
a. a.	Non-pregnant milch (20)	5.59[bd] ± 0.11	9.63[bd] ± 0.12	11.58[bd] ± 0.11
b. b.	Pregnant milch (20)	7.61[bd] ± 0.11	11.63[bd] ± 0.11	14.08[bd] ± 0.22
c. c.	Pregnant dry (20)	9.62[bd] ± 0.12	13.59[bd] ± 0.11	18.07[bd] ± 0.23
II.	Group B cows (60), Physiological states: Parity			
a. a.	Primipara (30)	7.10[be] ± 0.30	11.13[be] ± 0.32	13.74[be] ± 0.46
b. b.	Multipara (30)	8.11[be] ± 0.30	12.10[be] ± 0.29	15.41[be] ± 0.53

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

Table 2: Mean ± SEM values of plasma oxidase (UL^{-1}) in the *Tharparkar* cows during varying ambiences

S. No.	Effects	Mean ± SEM values during varying ambiences		
		Moderate	Dry hot	Humid hot
1.	Overall values (60)	65.10[b] ± 0.61	68.77[b] ± 0.63	72.27[b] ± 0.62
2.	Categorization according to physiological states (A & B groups)			
I.	Group A cows (60), Physiological states: Pregnancy and milch status			
d. a.	Non-pregnant milch (20)	59.11[bd] ± 0.20	63.11[bd] ± 0.22	67.11[bd] ± 0.23
e. b.	Pregnant milch (20)	65.58[bd] ± 0.34	68.60[bd] ± 0.32	71.62[bd] ± 0.36
f. c.	Pregnant dry (20)	70.60[bd] ± 0.34	74.61[bd] ± 0.34	78.09[bd] ± 0.45
II.	Group B cows (60), Physiological states: Parity			
c. a.	Primipara (30)	63.76[be] ± 0.81	67.44[be] ± 0.83	70.78[be] ± 0.76
d. b.	Multipara (30)	66.43[be] ± 0.91	70.10[be] ± 0.90	73.77[be] ± 0.91

Conclusion
In present investigation the effects of ambiences and physiological states were studied. The findings of experiment revealed that the abiotic stress can mark an increase in plasma malondialdehyde and plasma oxidase. Upshot of present study lucidly revealed the presence of oxidative stress in cows during dry-hot and humid-hot ambiences. Impact was greater on pregnant dry and multipara.

Acknowledgement

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