

# THE INTRIGUING ALTERATIONS IN NON-ENZYMATIC SERUM OXIDATIVE STRESS BIOMARKERS OF NON-DESCRIPT SHEEP FROM ARID TRACTS DURING EXTREME HOT ENVIRONMENTAL TEMPERATURE PERIOD<sup>#</sup>

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## ABSTRACT

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The present investigation was planned to determine the intriguing alterations in non-enzymatic serum oxidative stress biomarkers of non-descript sheep from arid tracts during extreme hot environmental temperature period (ETP). Blood samples were collected to harvest the serum during moderate and extreme hot ETP. The mean overall values of non-enzymatic serum biomarkers viz. vitamin E and glutathione of non-descript sheep during moderate (control) and extreme hot temperature periods were  $3.70 \pm 0.10 \mu\text{molL}^{-1}$  and  $6.60 \pm 0.10 \mu\text{molL}^{-1}$ , respectively setting aside of sex and age. Significantly ( $p \leq 0.05$ ) decreased mean values were observed during extreme hot ETP as compared to moderate temperature for each parameter. Male animals exhibited significantly ( $p \leq 0.05$ ) higher responses than female animals in both the temperature periods. The values were observed to be highest in the sheep of 7-10 months of age and lowest in the sheep of 4-7 months of age for both the parameters. Results of the present investigation indicated the intriguing alterations in non-enzymatic oxidative stress biomarkers of non-descript sheep from arid tracts during extreme ETP. It can be submitted that females and younger animals were more affected; therefore ration of animals must be enriched with appropriate antioxidants to fortify the antioxidant status along with protecting the body from unsympathetic influences of extreme ETP.

**Key words:** Antioxidants, non-enzymatic, serum, sheep, non-descript

## Introduction

Abiotic stress is an abhorrent bash of non-living elements on the living animal in an explicit environment. Certain markers to appraise oxidative stress have been recognized as a part of antioxidant gambits out of which antioxidant non-enzymes can be used as sensitive indicators. Diminished status of antioxidants has been linked to development of oxidative stress. Since antioxidants can defend the animals form peril of oxidative stress, it is presumed that a superior blood antioxidant level might be associated to uphold energy levels (Kataria and Kataria, 2013a,b). Changeable environmental temperatures are unreliable factors producing threat to animal lives.

Oxidative stress causes budding cellular insults. This happens when a concise rise in oxidative stress quickly tempts several antioxidant protection, chiefly antioxidant non-enzymes such as vitamin E and glutathione that rapidly decrease the stress and restrict the skill of testing procedures to detect a variation. If expansion of oxidative stress can be checked beforehand, thrashing to health can be stopped. However, the glum is that existence of oxidative stress can only be instituted by laboratory observations only (Kataria *et al.*, 2012). Looking towards the dearth of research work on non-enzymatic biomarkers of oxidative stress in non-descript breed of sheep raised under natural ambience, the present investigation was launched to see intriguing alterations in non-enzymatic serum oxidative stress biomarkers in non-descript sheep from arid tracts during extreme hot ETP.

## Materials and Methods

To determine the intriguing alterations in non-enzymatic

serum oxidative stress biomarkers of non-descript sheep from arid tracts during extreme hot ETP, blood samples were taken to harvest the serum. For this purpose, two hundred and forty non-descript male and female sheep of 4 months to 13 months of age groups were selected belonging to owners of private slaughter houses. Blood samples were obtained with the permission of Institutional Animal Ethics Committee (IAEC), College of Veterinary and Animal Science, Bikaner, RAJUVAS, Bikaner, Rajasthan to measure biomarkers. ETPs during which the collection of blood samples were made, comprised of the months of October and November (moderate) as control and the months of May and June (extreme hot, ETP). Clear, non-haemolysed sera were used for the investigation.

In each ETP, 120 blood samples were obtained (60 males and 60 females). In each environmental temperature period (ETP), the male and female non-descript sheep were grouped as 4-7 months (20 male and 20 female); 7-10 months (20 male and 20 female) and 10-13 months (20 male and 20 female) of age groups. Serum vitamin E was quantified by the spectrophotometric method of Nair and Magar (1955) with modification (Kataria *et al.*, 2010b). Glutathione was measured by the rapid colorimetric micro method of Owens and Belcher (1965) with modifications (Wilson, 1968 and Kataria *et al.*, 2010b). Significance of the effects of ambiances, sex and age groups was tested (Kaps and Lamberson, 2004). The variations in the means were measured by Duncan's new multiple range test (Duncan, 1955).

## Results and Discussion

The present investigation was carried out to determine the intriguing alterations in non-enzymatic serum oxidative stress biomarkers of non-descript sheep from arid tracts during

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extreme hot ETP.

**Vitamin E**

Mean ± SEM values and per cent alterations of serum vitamin E in non-descript sheep from arid tracts during moderate and extreme hot ETPs are illustrated in (Table 1). A significant ( $p \leq 0.05$ ) decrease was found in the mean value  $3.70 \pm 0.10 \mu\text{molL}^{-1}$  at the time of extreme hot ETP. Moderate mean value observed in the present study was more or less in agreement with the earlier findings observed by Kataria *et al.* (2010c) in cows, Abhimanu *et al.* (2015) in buffaloes. Influence of extreme ETP was established to be highly significant ( $p < 0.01$ ) on serum vitamin E. Per cent change in the serum vitamin E mean value was evaluated to be -27.02 (Table 1). Hot ambience is known to be associated with depletion of antioxidant status (Kataria *et al.*, 2010b). Thus, hot environmental temperature period probably caused oxidative stress in non-descript sheep and resulted in depletion of vitamin E (Srivastava, 2018). There is paucity of this type of research in the non-descript sheep from arid tracts of Rajasthan.

Earlier workers (Pareek and Kataria, 2015) have reported that hot ambience affected the mean value of vitamin E and it was recorded to be reduced during hot ambience in both kids and lambs. Mean values of vitamin E were recorded to be significantly ( $p \leq 0.05$ ) higher in male sheep as compared to female sheep in both the ETPs. Magnitude of per cent lowering due to extreme hot ETP was more in female sheep than male sheep for vitamin E. Mean values of serum vitamin E were observed to be highest in sheep of 10-13 months age group and lowest in 4-7 months of age group in both the ETPs. Age group of 10-13 months in the investigation revealed lowest per cent alteration during extreme hot ETP and 7-10 months group exhibited maximum per cent alteration during extreme hot ETP. Depletion in the present study in the values of vitamin E was higher in female animals and 10-13 age groups. This showed that these animals were more sensitive to the development of oxidative stress as compared to male and other age groups,

Table 1: Mean ± SEM values and per cent alterations of serum vitamin E ( $\mu\text{molL}^{-1}$ ) in the non-descript sheep during moderate and extreme hot environmental temperature periods (ETPs)

Effects	Moderate ETP Mean ±SEM (120)	Extreme Hot ETP Mean ±SEM (120)	Per cent Alterations In Hot ETP
Environmental Temperature Periods ETP(120)	$3.70^b \pm 0.10$	$2.70^b \pm 0.10$	-27.02
Male (60)	$4.30^{bd} \pm 0.07$	$3.30^{bd} \pm 0.09$	-23.25
Female (60)	$3.10^{bd} \pm 0.07$	$2.10^{bd} \pm 0.08$	-32.25
4-7 Month(40)	$3.20^{df} \pm 0.03$	$2.30^{df} \pm 0.03$	-28.12
7-10 Months (40)	$3.80^{df} \pm 0.03$	$2.70^{df} \pm 0.02$	-28.94
10-13 Months (40)	$4.10^{df} \pm 0.03$	$3.10^{df} \pm 0.02$	-24.39

- i. Figures in the parenthesis indicate number of non-descript sheep.
- ii. <sup>b</sup> marks significant ( $p \leq 0.05$ ) differences between moderate and hot ETPs for a row.
- iii. <sup>d</sup> marks significant ( $p \leq 0.05$ ) differences between male and female mean values within an ETP.
- iv. <sup>f</sup> marks significant ( $p \leq 0.05$ ) differences among mean values of the age groups within an ETP.

respectively.

**Glutathione (GSH)**

Influence of extreme hot environmental temperature period was recorded to be significant ( $p \leq 0.05$ ) on serum glutathione value in non-descript sheep when matched up to control value  $6.60 \pm 0.10 \mu\text{molL}^{-1}$  gained during the period of moderate environmental temperature (Table 2). Per cent change in the serum glutathione mean value was evaluated when ETP was extreme hot as compared to the condition when ETP was moderate i.e. -30.30 (Table 2). Scientists have associated depletion of glutathione with the development of oxidative stress (Chaturvedi and Kataria, 2013). In the present investigation, ETP probably caused oxidative stress in non-descript sheep and resulted in depletion of glutathione. Glutathione is a well established antioxidant of the animals (Kataria *et al.*, 2010a). Influence of sex and age on serum glutathione shows the mean values of serum glutathione exhibited significant ( $p \leq 0.05$ ) alterations in both moderate and extreme hot ETPs due to sex and age. Mean values of glutathione were recorded to be significantly ( $p \leq 0.05$ ) higher in male sheep as compared to female sheep in both the ETPs. Magnitude of per cent lowering due to extreme hot ETP was more in female sheep than male sheep for glutathione. Mean values of serum glutathione were observed to be highest in sheep of 7-10 months age group and lowest in 4-7 months of age group in both the ETPs. Age group of 10-13 months in the investigation revealed lowest per cent alteration during extreme hot ETP and 7-10 months group exhibited maximum per cent alteration during extreme hot ETP.

Sex and age influence on glutathione values corroborated the earlier research (Joshi, 2012). It is opined that higher environmental temperature associated decline in glutathione indicated lowering of antioxidant status. It can be deduced that antioxidant status of older age group investigated in the endeavour was comparatively superior than youngest age group. It can be proposed that nutrition of non-descript sheeps required to be supplemented with appropriate antioxidants to make the antioxidant status stronger particularly during extreme ETP.

Table 2: Mean ± SEM values and per cent alterations of serum Glutathione ( $\mu\text{molL}^{-1}$ ) in the non-descript sheep during moderate and extreme hot environmental temperature periods (ETPs)

Effects	Moderate ETP Mean±SEM (120)	Extreme Hot ETP Mean±SEM (120)	Per cent Alterations In Hot ETP
Environmental Temperature Periods ETP (120)	$6.60^b \pm 0.10$	$4.60^b \pm 0.10$	-30.30
Male (60)	$7.20^{bd} \pm 0.07$	$5.20^{bd} \pm 0.09$	-27.77
Female (60)	$6.00^{bd} \pm 0.07$	$4.00^{bd} \pm 0.08$	-33.33
4-7 Month(40)	$6.10^{df} \pm 0.03$	$4.20^{df} \pm 0.03$	-31.14
7-10 Months (40)	$6.70^{df} \pm 0.03$	$4.60^{df} \pm 0.02$	-31.34
10-13 Month (40)	$7.00^{df} \pm 0.03$	$5.00^{df} \pm 0.02$	-28.57

- i. Figures in the parenthesis indicate number of non-descript sheep.
- ii. <sup>b</sup> marks significant ( $p \leq 0.05$ ) differences between moderate and hot ETPs for a row.
- iii. <sup>d</sup> marks significant ( $p \leq 0.05$ ) differences between male and female mean values within an ETP.
- iv. <sup>f</sup> marks significant ( $p \leq 0.05$ ) differences among mean values of the age groups within an ETP.

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