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Effect of Extremely Higher Environmental Temperature Linked Changes in Glutathion (Endogenous Antioxidant) Responses of Liver in *Marwari* Goat

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ABSTRACT: Evaluation of the pattern of extremely higher environmental temperature linked variations in endogenous antioxidant responses of liver in *Marwari* goat was carried out in the present exploration. Liver samples were collected from *Marwari* breed of goat ageing from 3 to 12 months during extremely higher or hot environmental temperature periods (ETPs) from private slaughter houses. To achieve the objectives of the investigation, analytes were measured in the liver during extremely hot ETPs. The endogenous antioxidant responses of liver included different analytes i.e. glutathione. A significant ($p \leq 0.05$) decline in the mean value of glutathione was observed during extremely hot ETP as compared to respective comfortable ETP mean value. The results of the investigation pointed out that *Marwari* goat had superior antioxidant potential of liver as compared to female goat. The capability of the goats to bring about the reactions during the extremely hot ETP was exhibited by per cent changes in the value. Suggestion can be put forwarded that goats of arid tracts must be kept safe from enlarged exposure to intense hot environmental temperature. Pattern of alterations in the values of parameters of endogenous antioxidant responses of the liver during extremely hot ETP exhibited the development of oxidative stress of a comparatively greater magnitude in female goats. Resolution of research have tried to focus on the relative worth of the changes in the levels of antioxidants associated with the extremely hot environmental temperature.

Keywords: *Marwari* Goat, Endogenous Antioxidant, Analytes, Glutathione, Liver.

INTRODUCTION

Physiology of stress and performance of animal are estimable kits of environment to erect cover and housing methods for animals. It is essential to check the retorts of productivity when stress is present so that strategies related to management can be tailored for the sake of animal welfare (Kataria and Kataria 2016). Imbalance of antioxidant and oxidants furnishes oxidative stress with a cellular damage. Free radicals mediate these reactions. Free radicals can bring out serious changes in the cells (Saini *et al*., 2018; Singhal *et al*., 2018). The oxidative stress produces liver insult. The mechanism involves changes in contents of DNA, lipids and proteins. Changes in pathways regulating biological tasks may occur. Stress from any source is able to reduce the endogenous antioxidants (Kataria *et al*., 2010a). Recording of the contents can assist in the explanation of stress level of the animals. Heat stress changes metabolic parameters through free radicals and causes oxidative stress (Kataria *et al*. 2010b, c and Kataria *et al*., 2013 a). It is important to monitor these endogenous antioxidant responses of the liver. Non-enzymatic antioxidant is glutathione. Antioxidants also considered to have a wide scope to confiscate metal ions involved in mechanism of oxidative stress. Oxidative stress is an important issue in the expansion of several disorders (Kataria *et al*., 2012; Joshi 2018). Effect of extreme environmental temperature on various serum physiological parameters has been studied. However, paucity of work is there on liver analytes. These animals are transported frequently and grouping and regrouping are common stressors experienced by them. These activities are known to induce emotional stress to the animals. Simultaneously, all the above-mentioned stressors are coupled with the most potent stressor, the higher environmental temperature. Looking towards the worth of *Marwari* breed of goats with the aim to set the reference values of native breeds, an endeavour associated with antioxidant responses can facilitate researchers and clinicians to put in a nutshell the contemporary implications.

MATERIALS AND METHODS

Liver tissue was collected from the goat after slaughter with the help of sterile B.P. blade for the measurement of parameters of antioxidant responses. After completion of cleaning, each sample was washed with sterile normal saline solution. Then precise weighing of 1g piece of each tissue sample was done. Into a clean dried test tube, 5 ml of normal saline solution was introduced and 1g of liver tissue sample was taken into

it. A tissue homogenizer was used for proper homogenization of liver tissue with liquid. The final volume was made to 10 ml by adding normal saline solution with mixing. Due care was taken to maintain the temperature from 4 to 8°C by the use of chilled distilled water. Then this was shifted to small beaker and vibrated at 1000 rpm for 10 minutes in an electronic digital vibrator (Century). Then again it was shifted to a test tube and centrifuged at 4°C (10,000rpm) for 20 minutes. Then the tube was put in an incubator at 37°C for 1hour.This tissue supernatant was used to measure the different liver antioxidant responses as the procedure mentioned for the serum using spectrophotometer (Shimadzu UV-1800). The levels of antioxidant was determined per mg of protein. Protein in liver supernatant was determined by biuret method (Oser, 1976) with little modification.

Calculation was carried by taking one ml of tissue supernatant signified 0.1g of liver tissue sample. In a particular sample, when the optical densities were found beyond the range, dilutions were made while measuring optical densities and then needed corrections were made while doing the calculations (Anonymous, 2010 a).

A. Estimate the glutathione level Glutathione

A clean dried cuvette was employed in the procedure. Toting up of 0.2 ml supernatant, 2.5ml of 0.05 M phosphate buffer (pH7.1), 0.8ml of EDTA solution and 0.03 ml of DTNB was done. Quivering of 2 minutes was made. After keeping the cuvette for 10 minutes in a water bath at 37°C, mixing of 0.1 ml solution of enzyme and 0.1 ml solution of $NADPH_2$ was carried out. Following modest shaking, the optical densities were measured with a spectrophotometer (Shimadzu UV-1800) at 412 mμ using a blank (phosphate buffer) at every 1st and 5thminute. Then difference was observed from the first to the fifth minute for obtaining corrected optical density. This was utilized to get the concentration of glutathione directly from the standard curve. The standards were handled in the accurate way similar to that of samples.

B. Statistical analysis

Present investigation was executed to evaluate the pattern of extremely higher environmental temperature linked variations in endogenous antioxidant responses of liver in *Marwari* goat from arid tracts. The changes in the means were assessed by Duncan's new multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Sizeable changes in liver glutathione values was recorded during extremely hot ETP in the form of a significant ($p \leq 0.05$) decrease in liver glutathione value in *Marwari* goats as compared to comfortable ETP value. This change was quantified to be highly significant ($p \leq 0.01$) when analysis of variance was executed. Per cent change in extremely hot ETP as compared to the value during comfortable ETP was computed to be -46.15.

Evaluation of the pattern of extremely higher environmental temperature linked variations in endogenous antioxidant responses of liver in *Marwari* goat divulged the presence of oxidative stress in the animals during extremely higher environmental temperature period. This was evaluated by measuring the levels of analytes of the endogenous antioxidant responses of liver i. e. glutathione. In the present study, several parameters of endogenous antioxidant responses of liver i.e. glutathione exhibited significant ($p \leq 0.05$) changes in the mean values during extremely hot ETP as compared to respective comfortable ETP mean values. Liver glutathione revealed significant ($p \leq 0.05$) decline in the mean values during extremely hot ETP as compared to respective comfortable ETP mean values. A bigger crash of oxidative stress can be handled by enhancing the levels of antioxidants principally enzymes as the part and parcel of the natural ploy of the body (Upreti *et al.,* 2002). It can be surmised that body tends to employ endogenous antioxidants like glutathione to offset the oxidative stress and to bump the flooded free radicals. Extremely hot ETP in the present investigation affected the contents of glutathione responses with a higher propensity. Antioxidant responses were found to be influenced during extremely hot ETP. It was surmised that depletion of antioxidants like glutathione presented a biological crusade between free radicals and antioxidants. In order to fight free radicals glutathione was utilized and the concentrations reflected a decrease. The authentication of the outline of observations obtained in the present study for liver glutathione was made out on the basis of previous work conducted in blood samples for goats (Kataria *et al.,* 2010b; Pandey *et al.,* 2012; Chaturvedi and Kataria 2013; Bhartendu, 2017); dromedaries (Kataria *et al.,* 2010c); buffaloes (Kataria *et al.,* 2013b and Abhimanu *et al.,* 2015); lambs (Pareek and Kataria 2015); pigs (Singhal *et al.,* 2018); cattle (Joshi, 2018) and sheep (Promila, 2018). Since glutathione level in the blood is taken as a decent indicator of oxidative stress (Kataria *et al.,* 2010b) along with an immunomodulator (Pareek and Kataria 2015), the decline in the concentration in liver revealed the presence of oxidative stress in the present investigation during extremely hot ETP. Scientists have tried to correlate the progression of oxidative stress with the extremely hot ETP by appraising glutathione levels (Kataria *et al.,* 2010b and Joshi, 2018) in the animals belonging to arid tracts. Declined liver glutathione value in goats during extremely hot ETP attempted to clarify the presence of oxidative stress in apparently healthy *Marwari* goats. Glutathione is ubiquitous and consists of glutamate, cysteine, and glycine. It is contemplated to be the most bounteous cellular thiol antioxidant. Its association with many supple functions of the body contributing towards homeostasis is well known. Owing to this verity, research workers are giving a straitlaced significance to this analyte as one of the tools to assess antioxidant responses (Abhimanu *et al.,* 2015; Pareek and Kataria 2015). Scarcity of research on this outlook in *Marwari* goats from arid tracts has made the scientific significance of the present investigation with the opinion that the data collected will help in interpretation

of clinical data. Lowered liver glutathione value in goats during extremely hot ETP efforted to explain the existence of oxidative stress in apparently healthy *Marwari* animals. Glutathione protects against free radicals and safeguards the animals from the harmfull effects of oxidative stress.

Table 1: Mean ± SEM values of liver glutathione (nmol mg Protein^{-1}) in the *Marwari* goat during comfortable and extremely hot environmental temperature periods (ETPs) along with per cent change during extremely hot ETP.

S. No.	Effects	Mean ± SEM values during different environmental temperature Periods (ETPs)		Per cent change during extremely hot ETP
		Comfortable ETP	Extremely hot ETP	
1.	Overall ETP(150)	26.00^{b} ± 0.14	14.00^{b} ± 0.11	- 46.15
2.	Categorization according to gender (I and II categories)			
I.	Males (75), categorization of age groups as a, b & c			
	Males (75)	28.00^{bc} ± 0.06	16.00^{bd} ± 0.06	- 42.85
a.	3-6 months (25)	26.00^{bd} ± 0.01	14.00^{bd} ± 0.01	- 46.15
b.	6-9 months (25)	28.00^{bd} ± 0.01	16.00^{bd} ± 0.01	- 42.85
c.	9-12 months (25)	30.00^{bd} ± 0.01	18.00^{bd} ± 0.01	- 40.00
II.	Females (75), categorization of age groups as a, b & c			
	Females (75)	24.00^{bc} ± 0.07	12.00^{bc} ± 0.07	- 50.00
a.	3-6 months (25)	22.00^{bd} ± 0.01	10.00^{bd} ± 0.01	- 54.54
b.	6-9 months (25)	24.00^{bd} ± 0.01	12.00^{bd} ± 0.01	- 50.00
c.	9-12 months (25)	26.00^{bd} ± 0.01	14.00^{bd} ± 0.01	- 46.15
3.	Categorization of age groups irrespective of gender			
a.	3-6 months (50)	24.00^{be} ± 0.07	12.00^{be} ± 0.07	- 50.00
b.	6-9 months (50)	26.00^{be} ± 0.07	14.00^{be} ± 0.07	- 46.15
c.	9-12 months (50)	28.00^{be} ± 0.07	16.00^{be} ± 0.07	- 42.85

Figures in the parenthesis = Number of *Marwari* goat
ETP = Environmental temperature period
'b' = Significant ($p \leq 0.05$) differences between mean values for a row.
'c' = Significant ($p \leq 0.05$) differences between overall mean values of males and females for an ETP
'd' = Significant ($p \leq 0.05$) differences among mean values of different age groups of a gender for an ETP
'e' = Significant ($p \leq 0.05$) differences among mean values of different age groups irrespective of a gender for an ETP
- = Per cent decrease in the mean value

CONCLUSIONS

The conclusion of the exploration will confer aid in supervising the stratagem for placate of the native breeds of goat. Eloquent stipulations of the present study have attempted to divulge that liver cells are fraught with a blend of glutathione. Resolution of research have tried to focus on the relative worth of the changes in the levels of glutathione associated with the extremely hot environmental temperature. Research contribution of the present study can be employed in strengthening the clinical aspect of Physiology in Veterinary sciences in the field of antioxidant status and in systematizing the scientific supervision of the animals during adverse ambiences. The vibrancy of alterations regarding glutathione responses of liver revealed the existence of oxidative stress. Findings acquired in the investigation will assist in increasing the endorsement of contrivances to have gist about the damaging effects of harsh ambiences in the goat. Results will be temptingly valuable in crafting scientific tactics for *Marwari* goat to assist the marginal farmers and goat raisers from arid tracts and for researchers associated in the scientific execution of practices in goat sector. It can be concluded that present study evaluated efficiently the pattern of extremely higher environmental temperature linked variations in glutathione responses of liver in *Marwari* goat.

FUTURE SCOPE

Research has attempted to concentrate on the relative importance of changes in antioxidant levels related to extremely hot ambient temperatures. The outcomes will be attractively useful in developing scientific strategies for Marwari goat to assist marginal farmers and goat raisers from arid tracts as well as for researchers involved in the scientific implementation of practices in the goat sector. It can be said that the present study effectively assessed the pattern of alterations in the endogenous antioxidant responses of the liver in Marwari goats from arid tracts associated to exceptionally high ambient temperatures.

Conflict of interest. None.

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