ARCHETYPE OF VARIATIONS IN ERYTHROCYTIC ANTIOXIDANTS OF NON-DESCRIPT GOAT FROM ARID TRACTS DURING HOT AND COLD AMBIENCES

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ABSTRACT

Study was planned to observe archetype of variations in erythrocytic antioxidants of non-descript goat from arid tracts during hot and cold ambiences. Erythrocytes were collected during moderate, hot and cold ambiences. Catalase and peroxidase were determined in the erythrocytic haemolysates and the mean values during moderate ambience (control) were 2.30±0.08 kU gHb^{-1} and 8.00±0.10 mU gHb^{-1}, respectively irrespective of sex and age. Hot and cold ambiences showed significantly ($p\leq0.05$) increased mean values as compared to moderate. Enormity of increase was higher during hot ambience than that in cold ambience for catalase and peroxidase. Significant ($p\leq0.05$) effects of sex and age were observed during moderate, extreme hot and cold ambiences. Male goats showed significantly ($p\leq0.05$) higher retorts than female animals in all the ambiences. An increase in the mean values was observed exhibiting a significant ($p\leq0.05$) age effect. The values were found to be highest in the goats of 13-18 months of age and lowest in the goats of 3-8 months of age for both the enzymes. Archetype of variations of erythrocytic antioxidant enzymes showed the variations during extreme hot and cold ambiences. This revealed the presence of oxidative stress. It can be concluded that female animals were found to be more affected during hot and cold ambiences than male goats. According to age, it can be opined that 3-8 months of the animals were more affected. On the basis of observations acquired in the endeavour, it was appraised that classical tactics exist in the goats and during hostile situations changes occur to oppose the stress.

***Key words*:** Ambience, antioxidants, enzymatic, erythrocyte, goat, non-descript

Introduction

Researchers have always tried to use appropriate markers of stress (Kataria and Kataria, 2010). Changes in environmental temperatures can bring about variations in enzyme activities (Kour and Kataria, 2011). A drop in performance can be due to stress. Stress of any kind can limit the body's antioxidant resources (Kataria *et al*., 2013). Outcome is oxidative stress posing increased burden and pressure on the animal at the levels of cells and tissue. The animals are bequeathed with resistance mechanisms in opposition to free-radicals. When the level of the free radicals becomes overly, they initiate to smash down cells, which can head to amplified disease force. So if the concentration of free radicals is higher than the concentration of antioxidants, then the body will experience oxidative stress. A drop in performance can indicate oxidative stress. Evaluation of antioxidant status is an effective device to find out the presence of oxidative stress in animals (Joshi *et al.,* 2016). Antioxidant competence of erythrocytes is important and considered to be the chief indicator to evaluate the state and potential of oxidative stress. The evaluation of magnitude of oxidative stress can be beneficial to define the role of oxidative stress in different pathologies and can be utilized to reach on a definite clinical diagnosis. Biomarkers of oxidative stress permit the appraisal of genuine status of physiological protection and avoidance of the manifestation of pathologies associated with it. Oxidative stress is known to be the mechanisms producing dysfunction in organs (Saini, 2017). Oxidative stress in animals needs to be addressed in order to maintain the health status.

Heat stress may produce insult to the vital organs in the body. Goat sector in arid tracts faces problems due to changes in environmental temperatures associated with quandary like drought (Gottam *et al*., 2013). In totality, country has an imperative genetic pool of breeds of goat. However, only a few of these breeds are discerned and majority of the population is of non-descript type (Saini, 2017). Looking towards the immense significance of goats in raising livelihood of marginal farmer and paucity of scientific research in the field of antioxidant status, the present endeavour was carried out to find out the archetype of variations in erythrocytic antioxidants of non-descript goat from arid tracts during hot and cold ambiences.

Materials and Methods

To determine the archetype of variations in erythrocytic antioxidants of non-descript goat from arid tracts during hot and cold ambiences, 360 non-descript male and female goats were screened to obtain blood samples for harvesting erythrocytes. Ages of animals were from 3 months to 18 months. Samples were collected in the morning hours during slaughtering from private slaughter houses maintained under standard management conditions. The samples were analyzed in the laboratory of Department of Veterinary Physiology, College of Veterinary and animal Science, Bikaner, Rajasthan to measure erythrocyte enzymatic antioxidants which included catalase (EC 1.11.1.6., CAT) and peroxidase (EC 1.11.1., PO).

Sampling period comprised of months of October and November (moderate/control), of May and June (extreme hot) and of December and January (extreme cold). In each ambience, 120 blood samples were collected (60 males

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and 60 females). Male and female goats were classified as 3-8 months (20 male and 20 female); 8-13 months (20 male and 20 female) and 13-18 months (20 male and 20 female) of age groups in each ambience. Blood was collected in di potassium EDTA as an anticoagulant. Erythrocytes were harvested by centrifugation (15 minutes at 2700 rpm) of blood. Aliquots of erythrocytes were processed (Russell *et al*., 1985) and haemolysates were treated with equal volumes of ethanol and chloroform blend and processed to determine enzyme activities in stroma free haemolysate along with estimation of haemoglobin required for calculation (Saini, 2017). Catalase was determined by the method as given by Goth (1991) with little modifications (Saini, 2017). Colorimetric method as illustrated by Snell and Snell (1954) was used for the determination of peroxidase (Saini, 2017). Ambiences, sex and age groups significances were tested (Kaps and Lamberson, 2004) and the changes in the means were obtained by Duncan's new multiple range test (Duncan, 1955).

Results and Discussion

The present endeavour was carried out to determine the archetype of variations in erythrocytic antioxidants of non-descript goat from arid tracts during hot and cold ambiences.

Catalase: The mean values of erythrocytic catalase were significantly ($p \leq 0.05$) higher during hot and cold ambiences as compared to moderate overall mean value (Table 1). It was found that per cent variation in the values during hot ambience was greater than that of cold ambience. Disparity in the values of catalase in different animals could be associated to free radical formation and decomposition of hydrogen peroxide. These reactions are vital for life (Kataria *et al*., 2010a). Catalase activity is an indicator of oxidative stress (Kataria and Kataria, 2012). Variations in the values due to environmental temperatures were reported in goat by Kataria *et al.* (2010b) and in camel by Kataria *et al.* (2010d). Increased catalase activity is associated with the development of oxidative stress (Kataria *et al.*, 2010a and Kataria *et al.*, 2010c). This is probably owing to increased rate of formation of hydrogen peroxide as catalase activity is an indicator of free radicals formation (Kataria *et al.*, 2010b). The raised activity of erythrocytic catalase during hot and cold ambience insinuated the skill of the physiological mechanism to supply resistance against free radicals. Observations about changes in erythrocytic catalase activity owing to cold ambience are scanty. Catalase is an enzyme of antioxidant defense system that reduces and regulates the toxic oxygen species. Changes in the values found in the present investigation almost certainly exhibited the body's retort to battle the oxidative stress (Kataria *et al*., 2010d). It can be assumed that hot and cold ambiences yielded stress, secondary to disproportionate production of free radicals, which culminated in oxidative stress and an inequity between oxidant and antioxidant system. Environmental stress incites oxidative stress (Kataria *et al*., 2010b). It can be deduced that higher catalase activities exhibited activation of defense system.

Significant ($p \leq 0.05$) effects of sex and age were observed during moderate, extreme hot and cold ambiences. The mean values were significantly ($p \leq 0.05$) higher in male goats than female goats in all the ambiences (Table 1). Age effect showed a significant ($p \leq 0.05$) increase in the mean values being highest in the non-descript goats of 13-18 months of age. The per cent variations were higher in male animals during hot ambience and in female animals during cold ambience. Among age groups changes due to extreme ambiences were maximum in 13-18 months of age of animals (Table 1).

Sex and age related changes in serum catalase values have also been reported in animals (Kataria *et al*., 2012 and Pandey *et al*., 2012). Comparatively lower levels of catalase in females can be attributed to oestrogen being a strong antioxidant (Saini, 2017). Age is known to influence the free radical generation largely and as a result the level of enzyme of antioxidant defense is also affected.

Peroxidase: Significantly ($p \leq 0.05$) higher mean values of erythrocytic peroxidase were observed during hot and cold ambiences as compared to moderate overall mean value (Table 2). It was found that rise in the values during hot ambience was larger than that of cold ambience. Peroxidase has been identified to play a shielding function in the body from peroxides (Saini, 2017). The values of erythrocytic peroxidase in present investigation were lower than the earlier recordings in serum (Kataria *et al*., 2010b), however, pattern of variation was similar. Peroxidase activity is a marker of oxidative stress (Kataria *et al*., 2010a). Its increased activity during hot and cold ambiences implied oxidative stress (Kataria *et al*., 2010b and Kataria *et al*., 2010d). Peroxidase activity is supposed to be the potential marker of the antioxidant activity. In a concised way, the extreme ambiences created oxidative stress in the non-descript goats. Moderate, extreme hot and cold ambiences exhibited significant ($p \leq 0.05$) sex and age effects (Table 2). Significantly ($p \leq 0.05$) higher values were observed in male goats than female goats. Age effect exhibited a significant ($p \leq 0.05$) rise in the mean values being highest in the goats of 13-18 months of age. The per cent variation was higher in female animals during hot ambience and higher in males during cold ambience. This feature was slightly different from other parameters. Among age groups, per cent variation due to hot ambience was highest in 3-8 months of age of animals.

This can be concluded that extreme hot and cold ambiences affected the erythrocytic antioxidant status. Each indicator differed significantly ($p \leq 0.05$) during hot and cold ambiences when compared from respective control or moderate ambience mean value. This archetype of variation in each indicator's mean value was similar in animals of both sexes and different age groups. This suggested that all types of the animals were affected due to drastic changes in ambient temperatures during hot and cold ambiences with development of oxidative stress.

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Table 1: Mean ± SEM values and per cent variations of catalase (kU gHb^{-1}) in the erythrocytes of non-descript goat during different ambiences

Effects	Moderate ambience Mean ±SEM (120)	Extreme hot ambience Mean ± SEM(120)	Per cent change In hot ambience	Extreme cold ambience Mean ± SEM(120)	Per cent change In cold ambience
Ambience Overall Value(120)	2.30^{b}± 0.08	4.00^{b}± 0.10	73.91	3.05^{b}± 0.09	32.60
Male (60)	2.58^{bc}± 0.009	4.52^{bc}± 0.009	75.19	3.40^{bc}± 0.009	31.78
Female (60)	2.02^{bc}± 0.009	3.48^{bc}± 0.009	72.27	2.70^{bc}± 0.009	33.66
3-8 Months age (40)	2.03^{bd}± 0.009	3.18^{bd}± 0.009	56.65	2.60^{bd}± 0.009	28.07
8-13Monthsage (40)	2.37^{bd}± 0.009	3.99^{bd}± 0.009	68.35	3.05^{bd}± 0.009	28.69
13-18 months age (40)	2.50^{bd}± 0.008	4.83^{bd}± 0.007	93.20	3.50^{bd}± 0.007	40.00

i. Figures in the parenthesis indicate number of goats.
ii. Overall value is the mean value obtained from goat in an ambience irrespective of age.
iii. ^{b}marks significant ($p \leq 0.05$) differences among moderate, hot and cold ambience mean values for a row.
iv. ^{d}marks significant ($p \leq 0.05$) differences among mean values of age group within an ambience.

Table 2: Mean ± SEM values and per cent variations of of peroxidase (mU gHb^{-1}) in the erythrocytes of non-descript goat during different ambiences

Effects	Moderate ambience Mean ± SEM(120)	Extreme Hot ambience Mean ± SEM(120)	Per cent Change In Hot ambience	Extreme Cold ambience Mean ± SEM (120)	Per cent Change In Cold Ambience
Ambience Overall Value(120)	8.00^{b}± 0.10	15.70^{b}± 0.17	96.25	9.75^{b}± 0.10	21.87
Male (60)	8.54^{bc}± 0.008	16.72^{bc}± 0.008	95.78	10.79^{bc}± 0.009	26.34
Female (60)	7.46^{bc}± 0.008	14.68^{bc}± 0.009	96.78	8.71^{bc}± 0.009	16.75
3-8 Months age (40)	6.42^{bd}± 0.009	13.69^{bd}± 0.009	113.20	7.70^{bd}± 0.009	19.93
8-13 Month sage (40)	7.98^{bd}± 0.009	15.68^{bd}± 0.009	96.49	9.75^{bd}± 0.009	22.18
13-18 month sage (40)	9.60^{bd}± 0.008	17.73^{bd}± 0.008	84.68	11.80^{bd}± 0.009	22.91

i. Figures in the parenthesis indicate number of goats.
ii. Overall value is the mean value obtained from goat in an ambience irrespective of age.
iii. ^{b} marks significant ($pd \leq .05$) differences among moderate, hot and cold ambience mean values for a row.
iv. ^{d} marks significant ($p \leq 0.05$) differences among mean values of age group within an ambience.

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