

## APPRAISAL OF ANTIOXIDATIVE STRATEGIES IN THE ERYTHROCYTES OF MARWARI SHEEP DURING EXTREME AMBIENCES

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**Abstract:** The present investigation was carried out for appraisal of antioxidative strategies in the erythrocytes of *Marwari* sheep during moderate, hot and cold ambiences. Haemolysates were prepared to determine antioxidants. Antioxidants included vitamin E and Glutathione. Results revealed mean values of vitamin E and Glutathione in erythrocytes were significantly ( $p \leq 0.05$ ) lower during hot and cold ambiences as compared to respective moderate mean value. The mean values were significantly ( $p \leq 0.05$ ) higher in male animals in all the ambiences. Age effect showed a significant ( $p \leq 0.05$ ) increase in the mean values of both indicators being highest in the sheep of 18-24 months of age. On the basis of pattern of observations obtained in the present study, it was appraised that definitive strategies are present in the animals and during adverse conditions modulations occur to combat the stress.

**Keywords:** *Marwari* Sheep, antioxidative strategies, antioxidants, vitamin E.

### INTRODUCTION

Antioxidative strategies are present inside the cells in the form of various endogenous antioxidative enzymes, antioxidants and free radical scavengers. Erythrocytes are constantly subjected to oxidative stress, from their role as an oxygen transporter. Since oxidized erythrocyte components are antigenic in regards to the formation of auto antibodies, a long-term exposure to severe oxidative stress consequently causes an autoimmune response to oxidized erythrocytes that can be regarded as an oxidative modification (Iuchi *et al.*, 2007). An important consequence of an imbalance between the erythrocytes's components is the poor ability to cope with oxidative stress, which can result in degenerative changes in haemoglobin, cell membrane and enzymes required for normal erythrocytic function (Edwards and Fuller, 1996). Oxidative stress induces impairment of energy metabolism of erythrocytes (Tavazzi *et al.*, 2001). Heat stress modulates metabolic reactions through free radicals and produces oxidative stress (Kataria *et al.*, 2010). Indicators of oxidative stress allow the assessment of real status of physiological defenses and prevention of the appearance of correlated pathologies (Piccione *et al.*, 2007). *Marwari* breed of sheep

constitutes a major portion of the sheep population in Western part of Rajasthan. Changes in enzymes necessary for physiological adjustments are brought about by great fluctuations in ambient temperatures during extreme ambiences. Timely detection of oxidative stress due to extreme ambiences is an appropriate field of investigation to explore adaptive physiological measures of the animals and their use in health management and clinical diagnosis.

## **MATERIALS AND METHODS**

Three hundred and sixty blood samples of apparently healthy Marwari sheep of both sexes ageing 6 months to 24 months were collected from private slaughter houses in and around Bikaner district, Rajasthan during moderate, hot and cold ambiences. Blood samples were collected during slaughtering. In each ambience 120 blood samples were collected and the animals were grouped into male (60) and female (60). Moderate ambience was comprise of October-November; hot ambience of May and June and cold ambience of December-January. To assess the effect of hot and cold ambiences on the parameters of antioxidative strategies in the erythrocytes of Marwari sheep, the result of various parameters analysed was compared with those analysed during moderate months serving as control. Following indicators were analysed to appraise the antioxidative strategies in erythrocytes:

### **A. Antioxidants**

1. Vitamin E
2. Glutathione

Various computer programmes were used to determine means and standard error (<http://www.miniwebtool.com>) and analyses of variance ([www.danielsoper.com](http://www.danielsoper.com)) to test the significance of the effects of ambiences, sex and age groups and correlations (Kaps and Lamberson, 2004). The changes in the means were measured by using multiple mean comparison procedures. For this Duncan's new multiple range test was used (Duncan, 1955).

## **RESULT AND DISCUSSION**

### **Antioxidants**

#### **1. Vitamin E**

The mean overall value of vitamin E in erythrocytes of Marwari sheep during moderate ambience (control) was  $0.50 \pm 0.03$   $\mu\text{mol gHb}^{-1}$ . It was obtained from 120 Marwari sheep irrespective of sex and age. The mean values of vitamin E in erythrocytes were significantly ( $p \leq 0.05$ ) lower during hot and cold ambiences as compared to moderate overall mean value. A highly significant ( $p \leq 0.01$ ) effect of variation in ambience was also observed by analysis of variance. These results substantiated the earlier findings carried out by

Chaturvedi (2011) in goats and Abhimanu (2013) in buffalo calves for vitamin E status in erythrocytes. The values obtained in erythrocytes were lower than those reported for serum (Kataria *et al.*, 2010; Joshi, 2012 and Pandey, 2012). Decreased vitamin E levels have been well correlated with increased oxidative threats (Walwadkar *et al.*, 2006). This would remove the free radical intermediates and prevent the oxidation reaction from continuing. The sex and age effects were significant ( $p \leq 0.05$ ) in moderate, extreme hot and cold ambiances. The mean values were significantly ( $p \leq 0.05$ ) higher in male animals than female animals in all the ambiances. Age effect showed a significant ( $p \leq 0.05$ ) increase in the mean values being highest in the sheep of 18-24 months of age. Highly significant ( $p \leq 0.01$ ) sex and age effects were revealed by analysis of variance. Chaturvedi (2011) and Abhimanu (2013) also observed sex and age related changes in vitamin E status of erythrocytes. Sex and age related changes in serum vitamin E values have been also reported in several animal species by earlier researchers (Joshi, 2012 and Kataria *et al.*, 2012). In present study the vitamin E level was lower in females which showed lower requirement of antioxidants in female animals due to the presence of other strong antioxidant in the form of oestrogen (Sastre *et al.*, 2000). Nazifi *et al.* (2009) discussed about the influence of age on free radical generation and consequently, the enzyme antioxidant defense. De and Durad (1991) observed a decrease in vitamin E with the advancement of age. However, in our study vitamin E levels increased with the advancement of age.

## 2. Glutathione

The mean overall value of glutathione in erythrocytes of Marwari sheep during moderate ambience (control) was  $2.20 \pm 0.008 \mu\text{mol gHb}^{-1}$ . It was obtained from 120 Marwari sheep irrespective of sex and age. The mean values of glutathione in erythrocytes were significantly ( $p \leq 0.05$ ) lower during hot and cold ambiances as compared to moderate overall mean value. A highly significant ( $p \leq 0.01$ ) effect of variation in ambience was also observed by analysis of variance. It was observed that decrease in the values during hot ambience was greater than that of cold ambience. These observations of present study agreed with the earlier recordings by Chaturvedi (2011) in goats and Abhimanu (2013) in buffalo calves for glutathione status in erythrocytes. Depletion of glutathione was correlated to oxidative stress by various earlier workers (Bernabucci *et al.*, 2005 and Kataria *et al.*, 2010). Effect of environmental temperature on serum glutathione levels was recorded by many earlier researchers in animals (Dehghan *et al.*, 2010 in rams; Kataria *et al.*, 2010 in goats; Kataria *et al.*, 2010 in camels and Joshi, 2012 in buffaloes). This showed that antioxidant defense

system was changed to adapt and prevent oxidative stress effects because it protects cells from oxidative damages. The findings noticeably reflected the presence of oxidative stress during extreme ambiances. The sex and age effects were significant ( $p \leq 0.05$ ) in moderate, extreme hot and cold ambiances. The mean values were significantly ( $p \leq 0.05$ ) higher in male animals than female animals in all the ambiances. Age effect showed a significant ( $p \leq 0.05$ ) increase in the mean values being highest in the sheep of 18-24 months of age. Sex and age related changes in serum glutathione values have been also reported in several animal species by earlier researchers (Joshi, 2012 and Kataria *et al.*, 2012). Age related variation in antioxidant level could be hypothesized on the basis of relationship of free radicals with age (Sastre *et al.*, 2000 and Nazifi *et al.*, 2009).

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## FIGURES

Fig. 1: Mean changes in vitamin E ( $\mu\text{mol gHb-1}$ ) overall values in the erythrocytes of Marwari sheep during extreme ambiances.

Fig. 2: Mean changes in vitamin E ( $\mu\text{mol gHb-1}$ ) values according to sex and age groups in the erythrocytes of Marwari sheep during extreme ambiances.

Fig. 3: Mean changes in Glutathione ( $\mu\text{mol gHb-1}$ ) overall values in the erythrocytes of Marwari sheep during extreme ambiances.

Fig. 4: Mean changes in Glutathione ( $\mu\text{molgHb}^{-1}$ ) values according to sex and age groups in the erythrocytes of Marwari sheep during extreme ambiances.

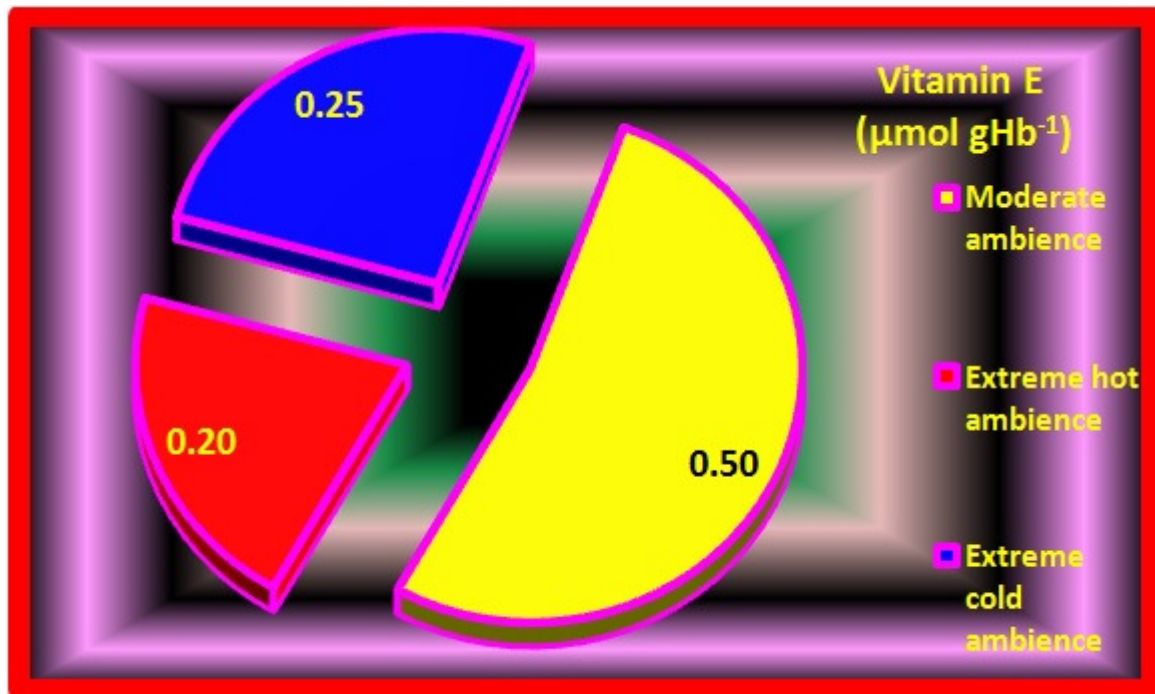


Fig. 1

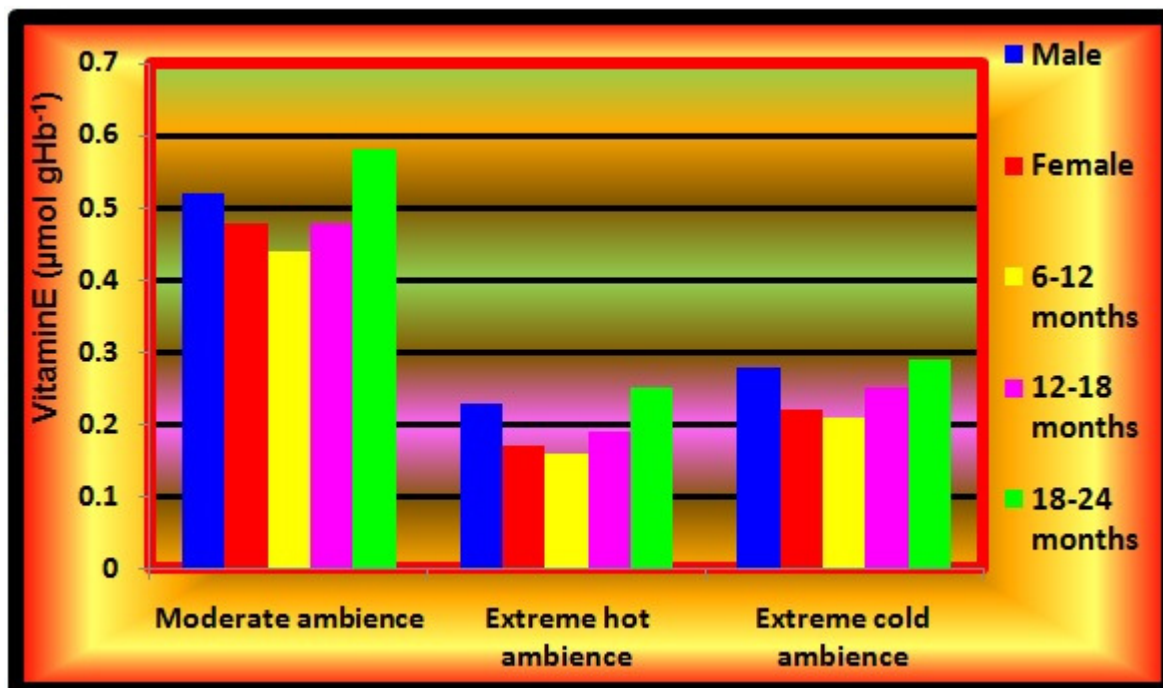


Fig. 2

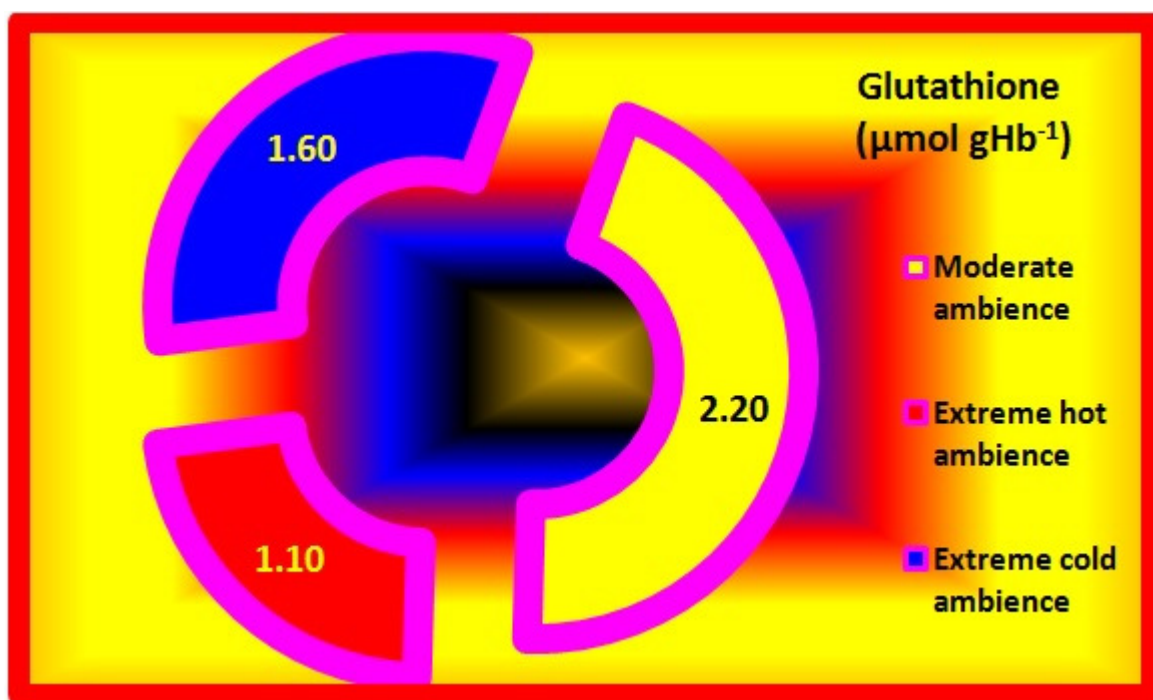


Fig. 3

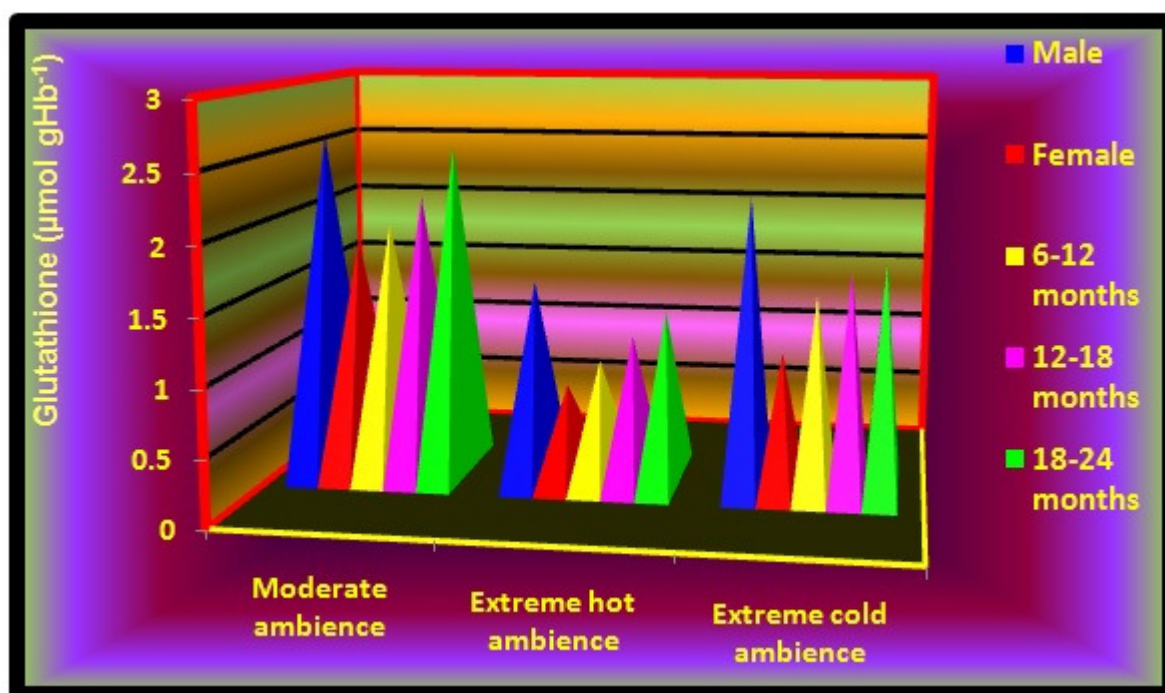


Fig. 4