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Stress enzyme Level during different seasons in Pandharpuri Buffalo

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Abstract

The aim of the present study was to determine the stress enzyme level during different seasons in Pandharpuri Buffalo. The study was conducted on 10 healthy Pandharpuri buffaloes more than 2 years of age. All the animals were maintained under standard feeding and management practices. Temperature Humidity Index (THI) was calculated from meteorological data for the different seasons. Five ml blood was collected from each buffalo aseptically from jugular vein once in the Month of May, August and December. Serum was separated by centrifugation from each blood sample and was used for estimation of activity of stress enzymes. Mean ± S.E. THI was 76.97 ± 0.38, 73.32 ± 0.38 and 68.81 ± 0.49 for summer, rainy and winter season, respectively. Mean ± S.E. activity of SOD (U/ mg of protein), CAT and GPx was 52.41± 1.49, 39.55± 1.92 and 32.54± 0.70; 61.84 ± 2.23, 43.98 ± 3.57 and 29.304 ± 1.51 and 0.374 ± 0. 05, 0.232 ± 0.01 and 0.128 ± 0.20 during summer, rainy and winter seasons, respectively. All the serum antioxidant enzymes were found to be significantly ($P < 0.05$) higher in the summer season compared to the rainy and winter seasons.

Introduction

Livestock plays an important role in rural economy through its contribution to food, employment generation and drought power. Buffalo has been the mainstay of rural economy in the Indian subcontinent and South East Asian countries. Most of the domestic animals are able to maintain equilibrium between the heat production and heat loss under thermoneutral zones. Heat stress has many detrimental effects on livestock (Marai and Habeeb, 2010). High ambient temperature, relative humidity and radiant energy compromise this ability of animals to dissipate heat. As a part of defence against the menace of reactive oxygen species, the body employs antioxidants to quench these free radicals. The antioxidant enzymes superoxide dismutase (SOD), catalase and glutathione peroxidase (GPx) act by scavenging both intracellular and extracellular superoxide radical and preventing lipid peroxidation of plasma membrane. The activities of antioxidant enzymes and lipid peroxidation alter signiûcantly during oxidative stress. So, they can be used as markers of oxidative stress. Glutathione peroxidase functions in cellular redox reactions to protect the cell membrane from oxidative damage caused

by free radicals. Hence the present study was undertaken to assess the influence of seasons on antioxidant enzymes in Pandharpuri Buffaloes at their habitat tract.

Materials and Methods:

The present study was conducted at Department of Veterinary Biochemistry, K.N.P. College of Veterinary Science, Shirwal and Bombay Veterinary College, Parel, Mumbai-400012. The experiment was conducted on 10 apparently healthy Pandharpuri buffaloes above two years of age maintained under loose housing condition at LIRD Farm, K.N.P. College of Veterinary Science, Shirwal. The meteorological variables like temperature (dry bulb and wet bulb) and relative humidity were recorded for the Month of May, August and December and were used for calculation of temperature humidity index by formula of Mader *et al*., (2006). Five ml of blood samples were collected from 10 apparently healthy Pandharpuri buffaloes from jugular vein at morning hours once in the Month of May, once in Month of August and once in Month of December. Clear serum samples were separated by centrifugation and were immediately transported in ice box by road within five hours to Bombay Veterinary College Mumbai for further investigations.

The activities of stress enzymes viz, Superoxide dismutase (SOD), Catalase (CAT) and Glutathione peroxidise (GPx) was measured by the method of Marklund and Marklund, (1974); Sinha (1972) and by Assay Kit (Sigma-Aldrich-Catalog Number CGP1), respectively. The data were analysed using Completely Randomized Design as per standard statistical method (Snedecor and Cochran, 1994).

Results and Discussion:

Mean ± S.E. of THI, SOD, CAT and GPx during different seasons presented in Table 1 reveals that there was a gradual increase in all the parameters from winter to rainy and summer season. There was significant difference among the three seasons in all the parameters studied.

Table 1: Mean ± S.E. of THI, SOD, CAT and GPx during different seasons.

Season	THI	SOD (U/ mg of protein)	CAT(U/ mg of protein)	GPx (U/ mg of protein)
Summer	$76.97^{a} \pm 0.38$	$52.41^{a} \pm 1.49$	$61.84^{a} \pm 2.23$	$0.374^{a} \pm 0.051$
Rainy	$73.32^{b} \pm 0.38$	$39.55^{b} \pm 1.92$	$43.98^{b} \pm 3.57$	$0.232^{b} \pm 0.012$
Winter	$68.81^{c} \pm 0.49$	$32.54^{c} \pm 0.70$	$29.30^{c} \pm 1.51$	$0.128^{c} \pm 0.20$

Means with different superscripts differ significantly (P<0.5)

Temperature humidity index (THI)

Mean values of temperature humidity index (THI) during different seasons of the study period was recorded significantly (P<0.5) higher in summer as compared to winter and rainy season and differ significantly from each other. Our observations closely resembles with reports of Dikmen and Hansen, (2008) and Al-Samawi *et al.* (2014). Heat stress has adverse effects on reproductive performances of cattle and buffaloes. The Higher ambient temperature during the summer has been associated with reduced fertility in dairy cattle through its deleterious impact on oocyte maturation and early embryo development (Das *et al.,* 2013 and Chandrabhan, *et al.,* 2012)

Superoxide dismutase (SOD)

In the present study, serum SOD activities recorded in summer season was significantly (P<0.05) higher compared to winter and rainy season. SOD catalyses the dismutation of O_2- into oxygen and hydrogen peroxide (H_2O_2). The dismutation of O_2- results into increased level of H_2O_2. Our results corroborate with the findings of Megahed *et al*, (2008) who reported significantly increasing trends in the serum SOD activities in she Egyptian buffaloes during summer as compared to winter season and with the findings of Ganaie *et al.,* (2013) who revealed increased plasma SOD activities in Murrah buffaloes due to oxidative stress during advanced pregnancy and Bernabucci *et al.,* (2002) in dairy cows.

Catalase (CAT)

In the present study, serum catalase activities recorded in summer season was significantly ($P<0.05$) higher as compared to the winter and rainy season. The increased activity of catalase during summer may be due to enhanced production of H_2O_2 as a result of increased activity of superoxide dismutase observed in the present study during summer season. Similar findings were also reported by Kumar *et al.* (2007) in cattle and buffaloes, Ganaie *et al*. (2013) and Lallawmkimi *et al.,* (2009) in Murrah buffaloes. The thermal stress stimulates excessive production of reactive oxygen species (ROS), such as superoxide anion (O_2^-), hydroxyl ion (OH) and hydrogen peroxide (H_2O_2), which are continuously produced in the course of normal aerobic metabolism and these free radicals can damage healthy cells.

Glutathione peroxidise (U/ mg of protein):

In the present study, the serum GPx activities recorded in summer season was significantly ($P<0.05$) higher compared to the winter season. A significant increase in GPx concentration in summer was observed which indicates increased production of the free radical in hot dry as well as in hot humid season. Our studies are in close resemblance with the reports of Lallawmkimi (2009) in summer season in Murrah buffalo calves, heifers and lactating buffaloes.

Conclusion

During summer season, there is an increase in the production of different antioxidants enzymes (SOD, CAT and GPx) in Pandharpuru buffalo. All the serum antioxidant enzymes were found to be significantly ($P < 0.05$) higher in the summer season compared to the rainy and winter seasons. This increased concentration of theses enzymes might help the Pandharpuri buffalo to adapt and acclimatize themselves to the changing environmental condition of western region of Maharashtra.

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Conflict of Interest

All authors declare no conflict of interest.

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Sigma-Aldrich (Catalog Number CGP1): Glutathione Peroxidase Cellular Activity Assay Kit, *www.sigma-aldrich.com*

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