Status of antioxidant enzymes in different body organs of male buffaloes

R. Ranjan, S.V. Singh, R.C. Upadhyay

Dairy Cattle Physiology Division, National Dairy Research Institute, Karnal, 132001- India

Corresponding author: S.V.Singh, DCP Division,NDRI, Karnal,132001 India - Tel. 01842259072(o) - Fax: 0184-2250042 - Email: sohanvir2004@yahoo.com

ABSTRACT: Eighteen tissue samples each from five organs i.e. liver, lung, heart, kidney and skeletal muscle were collected immediately after slaughter of adult male buffaloes and taken to laboratory on the same day in cold normal saline solution. After homogenization of tissues, they were centrifuged at 3000 rpm for 30 minutes at 4°C. The supernatant collected from individual homogenized tissues were used for antioxidant enzymes viz. Superoxide dismutase (SOD), Catalase and Thiobarbituric acid reactive substance (TBARS). The levels of SOD and catalase were maximum in heart tissues and minimum in kidney tissues. The activity of TBARS was highest in liver tissues and lowest in skeletal muscles. The activity of SOD and catalase was significantly ($P<0.01$) different in the different tissues. The levels of catalase and TBARS varied significantly ($P<0.01$) at different intervals of sample collection. Catalase and SOD activities were positively correlated ($P<0.01$) in cardiac muscle. Similarly, TBARS and catalase also showed significant ($P<0.01$) positive correlation in different tissues. The data indicates, the varied levels of different antioxidant enzymes in various body tissues mainly due to different rate of metabolism and climate conditions therefore the information generated may be useful for assessing the stress levels in buffaloes.

Key words: Antioxidant, Body tissue, Buffalo.

INTRODUCTION - The productivity of buffalos is negatively affected by the adverse environmental conditions. Under stressful conditions observed during summer free radicals are likely to be produced in the body and to neutralize them antioxidant enzymes are produced in different tissues depending upon their metabolic activity. Mostly experiments have been limited to laboratory animals and scanty information is available in relation to antioxidant status in different body tissues of livestock species. Therefore, the present study was undertaken to find out the basal antioxidant status in different body tissues of buffaloes.

MATERIAL AND METHODS - Eighteen tissue samples from each body organ viz, Liver, lung, heart, kidney and skeletal muscle of healthy adult buffalo males were collected during mid February to mid May. Tissue samples were transferred to laboratory in cold saline on the same. Prior to use all tissues samples were washed 3-4 times with normal saline and were homogenized at 4°C at the speed of 10,000 cycles/min in a tissue homogenizer. The homogenates were centrifuged at 3000 rpm for 30 min at 4°C and supernatants were separated. The assays of antioxidant enzymes viz. Superoxide dismutase (EC 1:15:1.1), catalase (EC 1:11:1.6) and thiobarbituric acid reactive substance (TBARS) were carried out in su-

pernatants as per the method of Marklund and Marklund (1974), Aebi (1984) and Asakawa and Matsushita(1979) respectively. The data obtained were analyzed for means, standard errors, correlation coefficient and analysis of variance using suitable statistical method as described by Snedecor and Cochran (1967).

RESULTS AND CONCLUSIONS

Superoxide dismutase (SOD): The level of SOD in liver and lung of male Murrah buffaloes varied from 269.80 to 362.11 U/mg proteins and 250.50 to 373.49 U/mg proteins, respectively. The respective values in heart, kidney and skeletal muscle varied from 377.74 to 443.81, 189.99 to 219.16 and 279.51 to 341.74U/mg protein. The mean values of SOD in different tissues i.e. liver, lung, heart, kidney and skeletal muscles were 319.55±5.80, 268.89±6.30, 415.79±3.72, 207.81±2.20 and 314.97±3.60 U/mg protein respectively (Table 1).
The level of SOD was higher than catalase in different tissues of buffalo studied. These findings are in accordance to those reported by Iyawe and Onigbinde (2004) and Venukumar and Latha (2002). The higher SOD activity in heart and lower SOD activity in kidney observed in buffaloes can be due to differences in organ weights. Normally heart weighs

Table 1. Antioxidants status in different body organs of male buffalos.

Organs		Intervals						
		1	2	3	4	5	6	Mean± SE
Liver	SOD	296.31	330.58	303.8	339.38	315.05	332.33	319±5.8
	Catalase	52.12	52.76	53.36	50.88	53.48	53.90	52.75±0.42
	TBARS	3.38	3.59	4.40	3.78	4.53	4.70	4.06±0.14
Lung	SOD	255.29	266.92	301.28	264.06	257.88	267.93	268.89±6.3
	Catalase	42.21	44.03	43.49	45.36	45.89	45.82	44.46±0.6
	TBARS	2.89	3.39	3.40	3.40	4.42	4.25	3.62±0.15
Heart	SOD	403.29	451.21	403.17	403.60	420.77	421.72	415.79±3.72
	Catalase	66.54	69.65	64.50	70.83	71.69	73.75	69.49±0.9
	TBARS	2.78	3.08	3.56	3.33	4.06	4.23	3.47±0.14
Kidney	SOD	218.17	201.23	205.07	208.34	203.95	210.13	207.81±2.2
	Catalase	32.01	34.21	31.68	35.60	36.57	35.41	34.25±0.49
	TBARS	2.69	2.97	3.46	3.57	4.02	3.31	3.33±0.11
Skeletal muscle	SOD	332.11	312.83	304.55	325.58	313.12	301.66	314.97±3.6
	Catalase	51.87	47.90	47.90	55.09	55.92	55.24	52.91±0.25
	TBARS	2.84	2.89	3.21	3.12	3.55	3.83	3.23±0.09

Units: SOD (U/ mg protein), Catalase (μ mol of H_2O_2 used/ mg protein /min), TBARS (n mol/ml)
The values are the means of three observations based on three animals.

0.4 to 0.5% of the live body weight and kidney weighs only 0.16% of the gross body weight of animal (Ghosh, 1998). The redistribution of total cardiac output to heart is about 5% and kidney is 6%. Therefore the amount of blood flow to left ventricle of heart is about 10 times higher than the supply to skeletal muscles (Manohar, 1990), therefore, the total oxygen reaching the heart tissue is more compared to other tissue of body. Since heart beats continuously and produces free radicals moreThe extra oxygen present in tissues is converted to super oxide anion. To neutralize the activity of super oxide anions, the level of SOD increase as it dismutase the superoxide anion to H_20_2. In other words, the metabolism of heart is high as it continuously contract and relax. This may be the probable reason for higher SOD activity in heart than any other tissue. A positive correlation coefficient ($P<0.05$) was found among SOD and catalase. The analysis of variance indicated a significant ($P<0.01$) variation in the levels of enzyme in different tissues.

Catalase: The activity of catalase in liver 52.75±0.42 (47.84 to 55.13), lung 44.46±0.06 (39.52 to 48.09), heart 69.49±0.09 (62.37 to 75.45), kidney 34.25±0.49 (30.45 to 37.55) and in skeletal muscle was 52.91±0.25 (46.19 to 56.18) u mole of H_2O_2 used /mg protein/min respectively. The data indicates highest activity of catalase in heart and lowest in kidney (Table 1). The result of the present study corroborates with finding of Bernabucci *et al* (2002) who reported that the SOD, which catalyses the convention of super oxide anion to hydrogen peroxide. The concomitant increases in catalase serve as a protective mechanism against lipid peroxidation by scavenging the H_2O_2, which could be formed by the dismutation of superoxide anion in heat stressed animals. Analysis of variance of catalase among the various tissues showed a significant ($P<0.05$) variation, whereas the correlation coefficient showed a positive correlation ($P<0.05$) among the levels of catalase and TBARS in different body organs. In large domestic animals information on levels of antioxidant in different tissues are not available. Therefore, data can not be compared.

TBARS: The values of TBARS in different tissues of buffaloes viz. Liver, lung, heart, kidney and skeletal muscle ranged from 2.92 to 5.00, 2.76 to 4.74, 2.63 to 4.55, 2.63 to 4.23 and 2.69 to 3.91 n mol/ml respectively. The overall mean of TBARS of liver, lung, heart, kidney and skeletal muscle were 4.06±0.14, 3.62±0.15, 3.47±0.14, 3.33±0.11and 3.23±0.09 n mol/ml respectively (Table 1). Bernabucci *et al*. (2002) observed the blood TBARS level which was 1.7±0.14 n mol/ml in summer and 1.8 ±0.14 n mol/ml in spring in cows during the day of calving. Venukumar and Latha (2002) reported the level of TBARS in the liver of rats to be 0.81±0.05 n mol/ml protein. The level of TBARS was found to be significantly ($P<0.01$) different in various tissues.

The information generated during the present investigation can not be compared with large domestic animals (cattle and buffaloes) because information is lacking in these species. The study will be helpful in predicting the antioxidant status in various body organs during normal and stressful condition and for suggesting the optimum managemental practices for proper maintaining the internal *milieu* for optimum productivity.

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