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Short Communication

BLOOD BIOCHEMICAL, ELECTROLYTE AND ANTIOXIDATIVE STATUS IN BUFFALOES WITH DIAPHRAGMATIC HERNIA

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SUMMARY

Biochemical, electrolyte and antioxidative status were assessed in buffaloes suffering from diaphragmatic hernia (DH; n=18) and compared with healthy control (n=9). Lower to significantly lower values of glucose, triglycerides, sodium, potassium, total iron, total iron binding capacity, chloride, calcium and phosphorus values were observed in the DH-affected buffaloes as compared to healthy control. Compared to control, significantly higher aspartate aminotransferase activity in DH-affected animals suggested myocardial injury and inflammatory condition while lower superoxide dismutase ($P<0.05$) and glutathione peroxidase enzyme activities suggested oxidative stress. These parameters can provide a reasonable index of the general biochemical and oxidative stress status of the animal which can be helpful in deciding the line of supportive therapy.

Key words: Antioxidants, blood profile, buffalo, diaphragmatic hernia, electrolytes

Diaphragmatic hernia (DH) is a serious digestive disorder of buffaloes affecting their production. Indiscriminate feeding habit predisposes the animals to foreign body syndrome which is traditionally projected as the main cause of DH (Krishnamurthy *et al*., 1998). A number of physiological changes may occur in the affected animals that undergo several challenges of the antioxidant system. The antioxidative parameters allow the assessment of the status of physiological defenses and the disorder associated pathologies. The present investigation was carried out to study the blood biochemical, electrolyte and antioxidative parameters in the buffaloes suffering from DH.

The study was carried out on 18 buffaloes brought to the Teaching Veterinary Clinical Complex of this university for disease diagnosis and treatment. Based on clinical symptoms and X-rays, these cases were diagnosed as of DH. Blood samples were collected from all buffaloes in heparinized tubes. In addition, blood samples were also collected from nine healthy buffaloes maintained at the Buffalo Research Centre of this university, as control. Plasma was separated and stored at -20^{0}C till analysis. Glucose, triglycerides, total protein, albumin, aspartate aminotransferase (AST), calcium and phosphorus were estimated using reagent kits (Transasia) with a Chemistry Analyser. Plasma samples were also tested for sodium and potassium ions by Flame Photometry method. β-carotene and vitamin E were estimated by the method of Baker and Frank (1968) and Kayden *et al.* (1973), respectively. Glutathione peroxidase enzyme activity was measured by the kit supplied by Cayman Chemical Company, Ann Arbor, MI, USA and superoxide dismutase (SOD) enzyme activity by the method of Madesh and Balasubramanian (1998). Chloride ion, total iron concentration and total iron binding capacity (TIBC) were measured by reagent kit supplied by Crest Biosystem. Copper and zinc were estimated by an atomic absorption spectrophotometer. SPSS package was used for statistical analysis of the data.

The clinical signs in the animals suffering from DH included decrease in rumination, rumen motility, anorexia and recurrent tympany. The results of various blood parameters are presented in Table 1. The plasma glucose and triglycerides were significantly lower ($P<0.05$) in DH-affected buffaloes as compared to the controls which might be due to progressive loss of appetite and anorexia. Total plasma proteins were significantly higher in DH-affected animals that might be due to inflammation leading to increased synthesis of acute phase proteins in the liver (Kaneko *et al*., 1997). Evaluation of plasma proteins is useful for differentiating traumatic reticulo-peritonitis from other gastrointestinal disorders in cattle. The reduction in liver function in DH might explain lower level of plasma albumin recorded in the study as albumin is exclusively synthesized by the liver (Jafarzadeh *et al.*, 2004).

The AST activity was significantly higher in DH-affected cases. It could be attributed to the altered metabolic sequences at cellular level and change in the permeability of biological membranes (Rose *et al*., 2009). A rise in AST activity has been reported to be due to myocardial injuries (Murthy and Karmen, 1997) which is suggestive of inflammatory changes in the body. Sodium and potassium ion concentration was significantly

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Table 1

Blood biochemical, electrolyte and antioxidative parameters in buffaloes suffering from diaphragmatic hernia (mean±S.E.)

Parameters	Control group (n=9)	Diaphragmatic hernia (n=18)
Glucose (mg/dl)	56.42±0.67[a]	46.37±0.52[b]
Triglycerides (mg/dl)	36.55±1.07[a]	24.75±0.95[b]
Total protein (g/dl)	8.62±0.03[a]	9.04±0.072[b]
Albumin (g/dl)	3.72±0.12[a]	3.47±0.09[b]
Aspartate amino transferase (U/l)	173.36±2.34[a]	196.48±4.81[b]
Calcium (mg/dl)	10.11±0.43[a]	9.96±0.32[a]
Phosphorus (mg/dl)	5.15±0.24[a]	4.76±0.19[a]
Sodium (meq/l)	145.38±9.92[a]	115.44±1.90 [b]
Potassium (meq/l)	4.69±0.152[a]	4.19±0.127[b]
Chloride (mmole/l)	85.77±1.49[a]	81.5±1.25[a]
Total Iron (µg/dl)	89.73±12.29[a]	75.03±4.83[a]
TIBC (µg/dl)	181.53±16.82[a]	159.62±5.32[a]
UIBC (µg/dl)	91.79±16.26[a]	84.56±7.66[a]
â-carotene (µg/ml)	6.8±0.92[a]	5.35±0.72[a]
Vitamin E (µg/ml)	2.58±0.21[a]	1.57±0.31[b]
Superoxide dismutase (IU/ml)	27.68±3.01[a]	20.85±1.45[b]
Glutathione peroxidase (IU/ml)	4.35±0.55[a]	4.24±0.70[a]
Zinc (ppm)	2.47±0.05 [a]	1.95±0.09[a]
Copper(ppm)	1.98±0.07[a]	1.83±0.02[a]

Values in a row bearing different superscripts vary significantly (P<0.05)

lower in DH-affected cases as compared to controls. Plasma chloride ion concentration was also lower, though the decrease in diseased animals was not statistically significant. Tabarizi *et al*. (2007) also reported the changes in the electrolytes concentration associated with DH and traumatic reticulo-peritonitis and these included hypochloremia, hypokalemia and metabolic alkalosis occurring secondary to ruminal hypomotility and/or vagal indigestion. Slightly lower values of total iron, TIBC and unbound iron binding capacity in the DH-affected animals might be due to less availability of iron from pool that remains sequestered in macrophages and unavailable to erythropoeitic tissues resulting in anaemia in chronic inflammatory condition (Kaneko *et al*., 1997). No significant difference was observed in calcium and phosphorus concentration between two groups. Vitamin E and β-carotene contents were lower in the DH-affected animals as compared to control animals which implied occurrence of oxidative stress and poor antioxidant status in such animals. Kahlon and Singh (2003) reported that reduction in vitamin E may be due to either depletion of endogenous reserves to combat free radicals produced excessively in body or insufficient endogenous synthesis under stressful conditions. Significantly lower SOD activity was recorded in affected animals as compared to control. Glutathione peroxidase activity was slightly lower in diseased buffaloes. Plasma zinc and copper concentrations were also lower in the diseased animals though the decrease was non-significant as compared to controls. Zinc and copper are active components of antioxidant enzymes such as SOD and glutathione peroxidase. SOD is known to catalyze dismutation of superoxide radicals into H_2O_2 and it is considered the first line of defence against pro-oxidants. It scavanges intra and extracellular superoxide radicals by acting in conjugation with catalase and glutathione peroxidase (Agarwal and Prabhakaran, 2005). The fall in glutathione peroxidase activity in DH-affected animals is suggestive of oxidative stress and lipid peroxidation since the enzyme is directly targeted at removing hydrogen peroxide generated during the dismutation of free radicals (Droge, 2002). These parameters in DH-affected animals can provide a reasonable index of general biochemical and oxidative stress status that can be helpful in deciding the line of supportive therapy.

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