OXIDATIVE STRESS AND ITS THERAPEUTIC RESPONSE IN MASTITIC COWS

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ABSTRACT:

In the present study Mastitic cows were assessed for oxidative stress and antioxidant profile and their response to an antibiotic with (Group III) and without antioxidants (Group II). Affected animals had an insignificantly increased TBARS (Thiobarbituric acid reacting substances), insignificantly decreased GSH and GSH-Px activity, but significantly decreased vitamin-E levels. GSH, GSH-Px and TBARS showed an insignificant change following therapy in both the groups. Vitamin E levels in Group III increased significantly with a better manner of recovery following therapy.

KEY WORDS: Mastitis, oxidative stress, antioxidants, vitamin E.

INTRODUCTION:

During inflammatory conditions of udder, it is damaged by the release of bacterial toxins and harmful free radicals associated with lower immune status of animals. The role of antioxidants becomes very important during the immune response when neutrophils produce large quantities of free radicals to destroy the invased foreign organisms (Sharma et al., 2007).

Several cell constituents including PUFA in cell membranes are damaged due to oxidative stress resulting in increased production of TBARS (Valko et al., 2006). GSH-Px is an antioxidant enzyme that plays an essential role in stabilizing cell redox. Vitamin E and Selenium have been known for their of antioxidant and immunomodulation in biological systems. They protect unsaturated fatty acid molecules from peroxidation and also directly scavenge oxygen free radicals. Thus they have been functioning as chain breaking antioxidants (Sharma et al., 2007). Hence the present study was aimed to determine certain oxidative enzyme profile and role of antioxidants in mastitic cows.

MATERIALS AND METHODS:

The study was carried out in mastitic cows presented to College Hospital, College of Veterinary Science, Tirupati during a period of six months. Eighteen mastitic cows were randomly divided into two uniform groups consisting of nine animals in each group i.e. Group II and III. A group of six healthy animals were selected which served as control Group I.

Affected animals were treated with Ceftriaxone-Tazobactum (7.5 mg/kg body weight, intramuscularly) alone (Group II) and Ceftriaxone-Tazobactum along with a single parenteral dose of vitamin E and Selenium (Group III) besides a similar supportive therapy of meloxicam. Therapeutic response was observed to analyse the role of antioxidants in mastitis treatment.

Whole blood samples were collected from affected animals before and after therapy and hemolysate was prepared by adding equal volume of distilled water to washed RBC and frozen at -20^{0}C overnight to cause hemolysis. The lysate was used for estimation of TBARS, GSH, GSH-Px, and vitamin E was estimated as per standard procedures mentioned by Subramanian et al. (1988), Moron et al. (1979), Rostruk et al. (1973) and Baker et al. (1951) respectively.

RESULTS AND DISCUSSION:

Analysis revealed insignificantly increased TBARS (38.14±2.58 mg/dl), insignificantly decreased GSH (1.17±0.08mg/dl) and GSH-Px (1.59 + mg/dl) activity in mastitic cows which is indicative of oxidative stress. Lykkesfeldt and Svendsen (2007) reported elevated levels of lipid hydroperoxide (as measured by TBARS) in erythrocytes isolated from dairy cows suffered with acute mastitis. Similarly, Celi et al. (2010) observed significantly elevated ROS levels and lowered GSH-Px activity in 2-4 weeks of postpartum goats, suggestive of some degree of oxidative stress and lipid peroxidation.

Table 1 Changes in the antioxidant status of clinical mastitis in Group II and Group III.

Parameter	Group II (n=9)			Group III (n=9)	
	Control	Before treatment (mastitic)	After treatment	After treatment	
GSH (mg/100ml of lysate)	1.28 ± 0.11	1.17 ± 0.08	1.28 ± 0.07	1.16 ± 0.08	
GSH-Px (mg of GSH utilized per 10 minutes /100ml of lysate)	2.06 ± 0.14	1.59 ± 0.21	1.66 ± 0.23	1.30 ± 0.22	
TBARS (nM of MDA/100ml of lysate)	32.52 ± 4.92	38.14 ± 2.58	35.68 ± 5.11	37.39 ± 4.02	
Vitamin E (mg/L of plasma)	3.54 ± 0.19	2.37 ± 0.25**	2.52 ± 0.23	3.10 ± 0.28*	

Values are mean ± S.E * Significant at 5% (P<0.05)

It is also evident that levels of vitamin E (2.37±0.25 mg/dl) in mastitic cows was significantly lowered (P<0.01). The suggested minimal plasma concentration of vitamin E/α-tocopherol in cattle was 3 to 3.5 mg/L. Low plasma concentrations of α-tocopherol were found to be a significant risk factor for clinical mastitis (Sharma et al., 2007). Similarly, Chatterjee and Kaur (2003), reported decrease of α-tocopherol concentration (0.46µg/ml) in plasma of mastitic cows on 7th day of parturition as compared to healthy cows without mastitis.

Following therapy, there was no significant change in mean values of the different parameters studied in both the groups except for a non significant decrease in the TBARS (Table 1), which may be indicative of relief from the oxidative stress. There was no change in vitamin E levels even after therapy in Group II as there was no supplementation with vitamin E. The significant increase noticed in vitamin E (from 2.25 ± 0.29 to 3.10 ± 0.28 mg/L) level in Group III could be due to

administration of vitamin E and Selenium on the initial day of therapy.

Though the recovery rate achieved in masitic cows with antibiotic alone or with vitamin E and Selenium was good in both the groups, the manner of recovery was comparatively quick in vitamin E and Selenium supplemented group as on day three of therapy, 6 / 12 quarters in Group III and 1 / 12 quarters in Group II exhibited clinical recovery.

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