EFFECT OF SUPPLEMENTATION OF ARSENIC AND PENTASULPHATE MIXTURE IN THE DIETS OF MURRAH BUFFALOES GIVEN HIGH LEVEL OF SELENIUM ON BLOOD SELENIUM AND ERYTHROCYTE GLUTATHIONE PEROXIDASE ACTIVITY

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ABSTRACT

In the present study, 16 Murrah buffalo male calves, selected from Livestock Research Centre of National Dairy Research Institute (NDRI), Karnal were divided in 4 groups of 4 animals in each group based on body weight and age. The average initial body weight of the groups T1, T2, T3 and T4 was 136.50, 134.50, 133.75 and 133.50 kg, respectively. The age in the corresponding groups was 11.14, 11.11, 11.08 and 10.96 months. All the animals were fed a basal diet (0.41 ppm Se) comprising of paddy straw, concentrate mixture and green maize (Control, T1). The animals in groups T2, T3 and T4 were also supplemented with 10 ppm of Se in the form of sodium selenite until blood Se level approached 1.5 ppm which happened at 60d of feeding. Thereafter, animals were given supplementary arsenic (40 ppm of diet) in form of sodium arsenite and pentasulphate mixture (9g/100 kg BW) in groups T3 and T4, respectively in addition to Se (10 ppm) being already given up to 105 days of experiment. Blood Se levels were monitored at fortnightly intervals since the beginning of the experiment while erythrocyte glutathione peroxidase (GPx) was monitored after 60d of beginning of the experiment at fortnightly intervals up to 105d. Blood Se level and erythrocyte GPx activity increased significantly (P<0.01) due to 10 ppm Se supplementation. Both arsenic @ 40 ppm of the diet and Degnala mixture/pentasulphate mixture @ 9 g/100kg BW given orally were able to reduce the concentration of blood Se and GPx activity bringing them to normal levels within 30-45 days of supplementation and hence they were effective in checking chronic selenosis.

Key words: Arsenic, buffalo, blood Se, erythrocyte GPx activity, hair Se, pentasulphate mixture, selenium.

INTRODUCTION

Selenium (Se) is an essential trace element for all the categories of livestock and its deficiency results in poor health and production. On the other hand, chronic selenosis in form of Degnala disease has been reported in buffaloes. Buffaloes contribute about 55% of the total milk production in India and also used as draught animal. Selenosis in the form of Degnala disease affects this species leading to deterioration in health and production status. Cases of Degnala disease have been reported in buffaloes fed mainly on paddy straw containing high levels of Se particularly in Punjab, Haryana, Uttar Pradesh (Arora et al., 1975, Bakshi et al., 1986). Se toxicity in animals due to feeding of green fodders and cereal straws containing 1.1 to 24 times the upper toxic limits of 5 ppm has been documented (Dhillon and Dhillon, 1990). Blood Se and erythrocyte glutathione peroxidase activity are good indicators of Se status of the animals. A 1.5 - 1.75ppm blood Se level is the signal of impending Se toxicity while adverse effects appeared when the whole blood Se concentration reached above 2 ppm and mortality occurred when they exceeded 3.4 ppm level (Deore et al, 2005). Cases of Degnala disease have been successfully treated using proprietary Degcure/pentasulphate mixture based on sulphur and Se antagonism (Arora et al, 1975). Antagonism between As and Se, whereby each reduces the toxicity of the other, has been reported in animal models (Pilsner et al., 2011). This study was conducted because the information on the effect of supplementation of pentasulphate mixture or arsenic in the diets of Murrah buffaloes given high level of Se on the status of blood Se and erythrocyte glutathione peroxidase activity is scanty.

MATERIALS AND METHODS

Sixteen buffalo male calves, selected from Livestock Research Centre of NDRI, Karnal were divided into 4 groups of 4 animals using Randomized Block Design (RBD). The average initial body weight of the groups T1, T2, T3 and T4 was 136.50, 134.50, 133.75 and 133.50 kg, respectively. The age in the corresponding groups was 11.14, 11.11, 11.08 and 10.96 months. All the animals were fed a basal diet (0.41ppm Se) comprising of paddy straw, concentrate mixture and green maize to meet 80% of energy and protein requirements as per NRC (2001). The animals in groups T2, T3 and T4 were also supplemented with 10 ppm of Se in the form of sodium selenite until blood Se level approached 1.5 ppm which happened at 60d of feeding. Thereafter, animals were given supplementary arsenic (40 ppm of diet) in form of sodium arsenite and pentasulphate mixture (9g/100 kg BW) in groups T3 and T4, respectively.
T₃ and T₄ were supplemented with 10 ppm of Se in the form of sodium selenite until blood Se level approached 1.5 ppm which happened at 60d of feeding. Thereafter, animals were given supplementary arsenic (40 ppm of diet) in form of sodium arsenite and pentasulphate mixture (9g/100 kg BW) in groups T₃ and T₄, respectively in addition to Se (10 ppm) already being given. Body weights and DM intake of the animals were recorded at fortnightly intervals. Blood Se levels were monitored at fortnightly intervals since the beginning of the experiment while erythrocyte GPx was monitored after 60d of feeding of the experiment at fortnightly intervals up to 105d of the experiment. Se in feeds and blood and As in feeds were analysed using atomic absorption spectrophotometer equipped with hydride generation facility (HGAAS). Sulphur in the feeds was estimated (Massoumi and Cornfield, 1963). GPx activity was estimated in RBC lysate by GPx assay kit (Cayman Chemical Company). The data were analysed statistically using Two way ANOVA (Snedecor and Cochran, 2007).

RESULTS AND DISCUSSION

The dietary concentration of Se in T₁, T₂, T₃ and T₄ was 0.40, 10.25, 10.32 and 10.43 ppm, respectively with corresponding values of 0.17, 0.16, 40.26 and 0.17 ppm for As and 0.16, 0.16, 0.16 and 0.23% for S.

Blood Se concentration and erythrocyte GPx activity were similar in all the groups at the beginning of the experiment (Fig. 1). The values for blood Se at the beginning were found to be 0.24, 0.21, 0.20 and 0.24 ppm in groups T₁, T₂, T₃ and T₄, respectively. The blood Se values remained almost constant throughout the experimental period. In group T₂, the values increased from 0.21 ppm at 0d to 2.35 ppm at 90d and then leveled off. In case of T₃ and T₄, blood Se values rose up to 60-75 days and showed a decreasing trend up to 105d and reached almost base line values. The highest values were observed in group T₂.

![Fig.1: Periodic blood Se concentration (ppm) under different dietary treatments](image)

Erythrocyte GPx activity was found to be 220.33, 206.43, 190.07 and 210.52 nmol/min/ml in groups T₁, T₂, T₃ and T₄ respectively at 0d (Fig.2). The differences among the treatments and periods were significant (P<0.01). GPx activity remained almost constant in control group (T₁) throughout the experimental period. In group T₂, the values increased from 206.43 at 0d to 736.46 nmol/min/ml at 75d and then plateaued. The activity in groups T₃ and T₄ rose significantly (P<0.01) from 0d to 60d and after that a decreasing trend was observed and the values at 105days were similar to those observed at 0d.
The levels of blood Se and GPx activity were higher in Se supplemented groups up to 60 days compared to the study (Chander Datt and Aruna Chhabra, 2004) wherein 2.7 ppm Se was supplemented to the basal diet containing 0.5 ppm Se. The reduction in blood Se and GPx activity in treatments T3 was due to antagonistic effects of arsenic on Se (Gailer et al., 2000, Pilsner et al, 2011, Zeng et al., 2005) while in treatment T4, sulphur effected the reduction of blood Se and GPx activity (Arora et al., 1975, Underwood and Shuttle, 1999).

**Conclusions:** Supplementation of 10 ppm Se to the control diet (Dietary Se= 0.41 ppm) did not affect feed intake, however, it elevated systemic blood Se load and erythrocyte GPx activity significantly (P<0.01). There was reduction in levels of blood Se and erythrocyte GPx when arsenic (sodium arsenite) or Degcure/pentasulphate mixture was supplemented to the control diets containing additional 10 ppm of Se. Both arsenic @ 40 ppm of the diet or Degcure mixture/pentasulphate mixture @ 9g/100kg BW of diet given orally seemed to be effective in checking chronic selenosis.

**REFERENCES**


