THE EFFECT OF DIETARY ORGANIC SELENIUM AND IODINE SUPPLEMENTATIONS ON GLUTATHIONE PEROXIDASE ACTIVITY IN CROSSBRED FEMALE CALVES

A.S. Siddaramesh[1] and V. Beena[2]
Department of Veterinary Physiology
College of Veterinary and Animal Sciences,
Mannuthy, Thrissur-680 651

Received - 10.09.2014
Accepted - 16.02.2015

Abstract

The study was conducted to assess the blood glutathione peroxidase (GSH-Px) activity in 24 crossbred female calves of three to four months of age on dietary supplementation with selenium (Se) and iodine (I). The animals were randomly allocated to four groups (G_0, G_1, $G_2$and G_3) with six animals in each group and were subjected to four dietary treatments as G_0 - calf starter, G_1 - calf starter + 0.3 ppm Se, G_2- calf starter + 1ppm KI and G_3 - calf starter + 0.3ppm Se + 1ppm KI for a period of 90 days. Blood was collected on 0, 30, 60 and 90 days of the experiment. The results showed significant (P<0.01) increase in GSH-Px activity throughout the experiment in Se supplemented group and only on 90th day in combined (Se+I) supplemented group and remained unaltered with iodine supplementation when compared to control. Hence, it can be inferred that sole supplementation of organic Se increased antioxidant status of animals when compared to other two supplementations.

Keywords: *Glutathione peroxidase, selenium, iodine, calves*

Trace mineral iodine is very much necessary for thyroid hormone synthesis; on the other hand Qin *et al.* (2011) reported that iodine may lead to oxidative damage at higher doses in goats. Pavlata *et al. (*2005) also opined that increased I supplementation might have negative effect on Se metabolism in kids. The physiological well-being of the animal is always supported by the improved antioxidant status of that animal. Selenium is a constituent of glutathione peroxidase, an enzyme which plays a crucial role in preventing oxidative damage to the cells (Rotruck *et al.,* 1998). Manipulation of GSH-Px activity by changing Se levels in diet has more subtle functions (Arthur, 2000). Therefore the objective of the study was to detect the effects of dietary supplementation with Se and I and the interaction between these two minerals on GSH-Px activity of calves.

Materials and Methods

Twenty four crossbred female calves of three to four months of age were selected as the experimental animals. The calves were divided into four groups of six each and were allocated randomly to one of the four dietary treatments, $\mathbf{G_0}$ (calf starter), $\mathbf{G_1}$ (calf starter + 0.3 ppm of organic Se), $\mathbf{G_2}$ (calf starter + 1 ppm of potassium iodide) and $\mathbf{G_3}$ (calf starter + 0.3 ppm organic Se + 1 ppm potassium iodide). The calves were dewormed a week before the start of the feeding trial. Scientific management practices were carried out throughout the experimental period. All Calves were fed as per ICAR standard (Ranjhan, 1998) and maintained on their respective feeding regime for a period of three months. Ingredient composition of calf

1. M. V. Sc scholar
2. Assistant Professor

starter is presented in Table 1.

Table 1. Ingredient Composition of Calf Starter, %

Ingredients	% Composition			
	G_0	G_1	G_2	G_3
Maize	52.5	52.5	52.5	52.5
De-oiled rice bran	3.7	3.7	3.7	3.7
Soyabean meal	40	40	40	40
Calcite	1.2	1.2	1.2	1.2
Di-calcium phosphate	2.1	2.1	2.1	2.1
Salt	0.5	0.5	0.5	0.5
Total	100	100	100	100
Supplimin-TM[1]	0.125	0.125	0.125	0.125
Zagromix[2](g)	50	50	50	50
Tefroli[3](g)	30	30	30	30
UTPP-5[4](g)	100	100	100	100
Selplex[5](g)	0	15	0	15
Potassium Iodide (mg)	0	0	100	100

Blood was collected from all animals by jugular vein puncture on 0, 30, 60 and 90 days of the experiment. The blood with anticoagulant (heparin) was directly used for analysis of GSH-Px activity. Glutathione peroxidase activity was determined photometrically in semiautomatic bio chemical analyzer (Hospitex- Screen Master T) as per Paglia and Valentine (1967) by using Ransel kit supplied by RANDOX Laboratories Ltd, U.K.

The data obtained were statistically analyzed as per the method of Snedecor and Cochran (1994) using one way analysis of variance (ANOVA) for different supplemented groups of animals. Duncan's multiple range tests was used for comparing between groups.

Results and Discussion

The GSH-Px activity values on 0, 30, 60 and 90 days of experiment are presented in Table 2. On 30th day of the experiment, the calves of group G_1 (0.3 ppm Se) had significantly (P≤0.01) higher GSH-Px activity when compared to G_0 (Control), G_2 (1ppm KI) and G_3 (0.3 ppm Se + 1 ppm KI) with the mean values of 44.79 ± 1.61, 30.58 ± 1.44, 30.85 ± 1.83and32.17 ± 1.14 U/mL whole blood respectively. On 60th day of experiment, the GSH-Px activity followed the same trend as that of 30th day of experiment with significant (P≤0.01) increase in GSH-Px activity only in group G_1 (0.3 ppm Se) when compared to groups G_0 (Control), G_2 (1ppm KI) and G_3 (0.3 ppm Se + 1 ppm KI) the mean values of GSH-Px activity in these groups were 46.70 ± 1.43, 31.03 ± 1.73, 31.30± 1.72 and 33.98 ± 1.55 U/mL whole blood respectively. On 90th day of the experiment, significant (P≤0.01) increase in GSH-Px activity was observed in groups G_1

Table 2. Effect of supplementing organic selenium, iodine and combination of selenium and iodine on glutathione peroxidase activity of calves (Mean ± SE, n=6)

Days / Groups	0	30	60	90
G_0	29.10^a ± 1.35	30.58^a ± 1.44	31.03^a ± 1.73	31.45^a ± 1.31
G_1	30.68^a ± 1.87	44.79^b ± 1.61	46.70^b ± 1.43	48.12^b ± 1.16
G_2	30.32^a ± 1.86	30.85^a ± 1.83	31.30^a ± 1.72	30.93^a ± 2.10
G_3	29.64^a ± 0.76	32.17^a ± 1.14	33.98^a ± 1.55	39.60^c ± 1.77

a, b, c – means bearing different superscript within a column differ significantly at 1% level

(0.3 ppm Se) and G_3 (0.3 ppm Se + 1 ppm KI) when compared to groups G_0 (Control) and G_2 (1ppm KI) with mean values of 48.12 ± 1.16, 39.60 ± 1.77, 31.45 ± 1.31 and 30.93 ± 2.10 U/mL whole blood respectively.

In present study blood glutathione peroxidase activity increased significantly (P≤0.01) throughout the experiment in the Se supplemented group. This finding is in accordance with the findings of Arthington (2008), who observed a sharp increase in GSH-Px activity in growing yearling beef steers on supplementation of Se yeast. Nicholson *et al.* (1991) also reported that organic Se supplementation increased the GSH-Px activity at a linear rate with time up to four months from the start of supplementation in calves and heifers. Ebrahimi *et al.* (2011) reported that supplementation of organic Se in Holstein suckling calves with pneumonia, increased the GSH-Px activity when compared to the control group. Lum*et al.* (2009) observed a steadily increasing erythrocyte GSH-Px activity. However, Cortinhas *et al.* (2010) reported that supplementation of Se, Zn and Cu as inorganic source to dairy cows had no effect on GSH-Px activity. Nampoothiri (2012) also reported no variation in serum GSH-Px activity in response to Se supplementation. The increase in GSH-Px activity in present study could be due to increased antioxidant status of the animals on account of Se supplementation.

In the current study, supplementation of I @ 1ppm did not produce any effect on GSH-Px activity. This is contrary to the findings of Pavlata *et al.* (2005), who reported that supplementation of I (200 µg/day/animal upto 45 days of experiment and 300µg/day/animal up to 90 days of experiment) to kids decreased the whole blood GSH-Px activity. This could be attributed to the lesser dose of supplementation.

Combined supplementation of I and Se showed significant (P≤0.01) increase in GSH-Px activity on 90th day of the trial. Guyot *et al.* (2011) observed increased GSH-Px activity in both group of cows supplemented with higher and lower doses of a combination of I and Se. Contrary to the present results, Qin *et al.* (2011) reported that combined supplementation of I and Se in Liaoning Cashmere goats significantly decreased GSH-Px activity.

From a critical evaluation of the results, it could be inferred that supplementation of organic Se has an added advantage over the other two supplementations which was evident from the improved antioxidant status of the animals. However supplementation of iodine did not had any effect on glutathione peroxidase activity of calves but when supplemented in combination GSH-Px activity significantly (P<0.01) increased only on 90 day of experiment this apparently say iodine is suppressing the activity of Se, to know the exact reason further study is required.

References

Arthington, J. D. 2008. Effects of supplement type and selenium source on measures of growth and selenium status in yearling beef steers. *J. Anim. Sci.* **86**: 1472-1477.

Arthur, J.R. 2000. The glutathione peroxidases. *Cell Mol. Life Sci.* **57**: 1825-1835.

Cortinhas, C.S., Botaro, B.G., Sucupira, M.C.A., Renno, F.P. and Santos, M.V. 2010. Antioxidant enzymes and somatic cell count in dairy cows fed with organic source of zinc, copper and selenium. *Livestock Sci.* **127**: 84-87.

Ebrahimi, M., Towhidi, A., Ganjkhanlou, M. and Amini, M. 2011. The effects of organic selenium (Sel-Plex) on the viability of pneumonic Holstein suckling calves. *Int. J. Vet. Res.* **3**: 163-168.

Guyot, H., Oliveira, L.A.D., Ramery, E., Beckers, J.F. and Rollin, F. 2011. Effect of combined iodine and selenium supplementation on iodine and selenium status of cows and their calves. *J. Trace Ele. Med. Biol.* **25:** 118-124.

Lum, G.E., Rowntree, J.E., Bondioli, K.R., Southern, L.L. and Williams, C.C. 2009. The influence of dietary selenium on common indicators of selenium status and liver GSH-PX-1 messenger ribonucleic acid. *J. Anim. Sci.* **87**: 1739-1746.

Nampoothiri, V.M. 2012. Dietary supplementation of organic selenium in crossbred calves. *M.V.Sc* thesis, Kerala Veterinary and Animal Sciences University, Pookode, pp. 79-81.

Nicholson, J.W.G., McQueen, R.E. and Bush, R.S. 1991. Response of growing cattle to supplementation with organically bound or inorganic sources of selenium or yeast cultures. *Can. J. Anim. Sci.* **71**: 803-811.

Paglia, D.E. and Valentine, W.N. 1967. Studies on the quantitative and qualitative characterization of erythrocyte glutathione peroxidase. *J. Lab. Clin. Med.* **70**: 158-169.

Pavlata, L., Slosarkova, S., Fleischer, P. and Pechova, A. 2005. Effects of increased iodine supply on the selenium status of kids. *Vet. Med. Czech.* **50:** 186-194.

Qin, F., Zhu, X., Zhang, W., Zhou, J., Zhang, S. and Jia, Z. 2011. Effects of dietary iodine and selenium on nutrient digestiblity, serum thyroid hormones and antioxidant status of Liaoning cashmere goats. *Biol. Trace Ele. Res.***143:** 1480-1488.

Ranjhan, S.K. 1998. *Nutrient requirements of livestock and poultry*. (2nd Ed.). Indian Council of Agricultural Research, New Delhi, p.5.

Rotruck, W., Gregus, Z., Perjesi, P. and Gyurasics, A. 1998. Enhancement of selenium in bile by sulfobromophthalein: elucidation of the mechanism. *Biochem. Pharmacol.* **56**: 1391-1402.

Snedecor, G. W. and Cochran, W. G. 1994. *Statistical Methods.* (8th Ed.). Oxford and IBH publishing corporation, Calcutta. 564p. ■