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Effect of Sodium Selenite Supplementation on Serum Mineral Profile of Male Kids (*Capra Hircus*)

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Abstract

An experiment was conducted on 12 male kids (about 2-3 months of age and 6.30 ± 0.39 kg average body weight) to elucidate the effect of supplementation of sodium selenite on their serum mineral profile. Kids were randomly divided into two equal groups and fed a basal diet consisted of concentrate mixture and paddy straw to meet their nutrient requirement. Group I served as control (without any supplementation), whereas animals in group II were supplemented with 0.3 mg selenium kg^{-1}DM as sodium selenite. Experimental feeding lasted for a period of 90 days, during which blood samples were collected on day 0 and 90 days of the experimental feeding to study the serum mineral profile of kids. Results revealed significant ($P<0.05$) increased in serum selenium concentration in sodium selenite supplemented group than control. Serum calcium, phosphorus, iron, copper, zinc, manganese were similar ($P>0.05$) among the two groups. It may be concluded that supplementation of 0.3 ppm Se as sodium selenite enhanced the serum Se concentration with out affecting other serum minerals of kids.

Keywords: Sodium selenite; Serum; Minerals; Kids

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Introduction

Selenium (Se) is an important trace mineral, required for antioxidant defence, anti-inflammatory, thyroid hormone function and reproduction in animals.[1] The nutritional essentiality of selenium arose from the work of Patterson *et al* in chickens.[2] It acts in synergism with vitamin E and other anti-oxidative agents such as Zn and Cu to inhibit the oxidation of membrane lipids and DNA by oxygen radicals produced during aerobic metabolism.[3] Selenium, copper and zinc are microelements that plays important role in intermediate metabolism of the animals. Several reproductive problems like retained placenta, abortion, premature birth, cystic ovaries, metritis, and delayed conception were reported due to deficiency of Se.[4] The level of absorption and retention of microelements is modulated by their actual levels in the tissue and their concentrations in the diet.[5] Some reports indicated that supplementation of Se inhibits absorption of zinc.[6] Cristaldi *et al* reported that administration of Se to sheep grazing on copper deficient pastures increased copper absorption.[7] However, a high Se supplement could disturb the Zn, Cu and Fe metabolism leads to deficiency of these minerals in young animals.[8] In view of these facts, the present study was conducted on growing male kids to find out the effects of Se supplementation on their serum mineral profiles.

Material and Methods

Animal's Management and Feeding

The experiment was conducted on 12 male kids (*Capra hircus*; about 2-3 months of age, average live weight 6.30±0.39 kg) in Instructional Livestock Farm, Orissa University of Agriculture and Technology, Bhubaneswar, Odisha (India). These animals were adapted on the experimental diet comprising of concentrate mixture and paddy straw for a period of one month during which they were treated against ecto and endo parasites and subsequently at regular intervals. All the kids were vaccinated against foot and mouth disease and *peste des petits of ruminants* (PPR). These animals were distributed in to two different groups of six kids in each on the basis of their body weights following randomized block design, and were kept in a well ventilated shed with individual feeding and watering arrangements. Kids in two groups were fed on concentrate mixture and paddy straw to meet their nutrient requirements for 50 g daily weight gain .[9] The concentrate mixture consisted of (%) crushed maize grain 30, soybean meal 35, wheat bran 32, mineral mixture 2 and common salt 1.Treatments were: group I (control), without any supplementation, group II supplemented with 0.3 ppm Se as sodium selenite through the concentrate mixture. Paddy straw was provided to the animals after total consumption of concentrate mixture. All the kids were offered about 100 g of maize (*Zea mays*) fodder once a week to meet their vitamin A requirements. Clean and fresh drinking water was provided twice a day to all the animals. This feeding practice lasted for 90 days.

Collection of Blood

About 5 ml blood was collected from each kid through jugular venipuncture in the morning (before watering and feeding) at zero and 90 day of the experimental feeding. The blood was collected into clean and dry test tube and kept in slanting position for 45 min. Then the blood samples were centrifuged at 3000 rpm for 10 min at 4°C and serum was separated. The serum was collected in plastic vials and kept at -40°C until study the serum minerals concentration.

Estimation of Serum Minerals

Diagnostic kits manufactured by crest bio-systems, Goa (India), were used for the analysis of serum Ca and Phosphorus. Serum Ca was estimated by the method of Trinder .[10] Phosphorus in blood serum samples was determined by method of Gomorri.[11] Selenium concentrations in the serum and colostrum were measured by hydride

generation atomic absorption spectrophotometer (AAS), according to the method described by Tiran *et al* .[12] One ml blood serum was taken in a 50 ml clean and dry micro Kjeldhal flask and to it 5 ml tripple acid (HNO_3,$H2SO_4$and $HClO_4$; 4: 2 : 1) mixture was added, followed by heating it on a hot plate till thick smoke of perchloric acid ceased to come out. The contents of flask were then cooled and volume was made up to 25ml with triple glass-distilled water.Serum concentration of trace minerals like Fe, Cu, Mn and Zn were estimated by Atomic Absorbance Spectrophotometer (Model SL243, ELICO, Hyderabad, India).

Table 1: Chemical Composition (% DM Basis) of Concentrate Mixture and Paddy Straw Fed to Kids

Nutrients	Concentrate mixture	Paddy Straw
Crude protein	19.70	3.10
Ether extract	2.50	1.30
Neutral detergent fiber	36.70	81. 50
Acid detergent fiber	12.10	56. 30
Hemicelluloses	24.60	25. 20
Cellulose	10.10	47. 60
Calcium	1.65	0.68
Phosphorus	0.94	0.14
Selenium, mg kg^{-1}	0.11	0.10

Table 2: Effect of Sodium Selenite on Serum Minerals Profile of Goat

Group	Days		Mean	SEM	P Value		
	0	90			G	P	GXP
Ca (mg/dl)							
I	9.29	10.18	9.73	0.26	0.18	0.15	0.37
II	9.65	9.97	9.75	0.22			
P (mg/dl)							
I	5.10	5.52	5.31	0.29	0.72	0.84	0.95
II	5.28	5.41	5.34	0.17			
Fe(mg/l)							
I	7.80	7.98	7.69	0.26	0.53	0.91	0.91
II	7.92	8.05	7.96	0.32			
Cu (mg/l)							
I	3.87	3.65	3.73	0.36	0.14	0.08	0.10
II	3.54	4.08	3.61	0.44			
Mn (mg/l)							
I	1.53	1.81	1.67	0.14	0.16	0.07	0.34
II	1.62	2.10	1.86	0.19			
Zn (mg/l)							
I	3.87	4.04	3.95	0.30	0.61	0.06	0.07
II	3.72	3.65	3.66	0.19			
Se (ppb)							
I	190.31	197.65	193.58[a]	8.98	0.01	0.02	0.01
II	188.78	265.17	226.97[b]	9.32			

[ab] Means bearing different superscripts in a column differ significantly (P<0.05)

Statistical Analysis

Data collected for different parameters were analysed as a randomized block design with kid as the experimental unit using the General Linear Model (GLM) procedure of SPSS[13] and treatments were compared using Tuckey's test. [14]

Results and Discussion

The chemical composition of concentrate mixture and paddy straw is presented in Table 1. The crude protein content of the concentrate mixture and paddy straw was 19.70 and 3.10 %, respectively, whereas the basal Se concentration in concentrate mixture and paddy straw were 0.11 and 0.10 mg kg^{-1}, respectively. The mean Ca values (mg/dl) did not differ among the different groups (P>0.05). Similar to our results, Mudgal *et al.*[15] reported that supplementation of 0.3 ppm Se in the diet of buffalo calves had no effect on their plasma Ca levels. Like Ca, the plasma phosphorus level was also comparable (P>0.05) among different groups. Mudgal *et al* (2012) reported that supplementation of graded levels of vitamin E and 0.3 ppm Se to cattle and buffalo calves respectively, did not have any effect on plasma phosphorus levels. Similarly, Arthur *et al* [16] also did not find any difference on plasma phosphorus concentration of steers fed on either a Se deficient (0.015 ppm) or sufficient (0.1 ppm) diet. Like Ca and P, blood serum Fe, Cu, Mn and Zn levels (mg/l) were also comparable (P>0.05) among two groups. Similarly Hoac *et al* reported that supplementation of 25 mg of selenium yeast/ day for 2wk had no effect on plasma Zn and Cu concentration.[17] Moeini *et al* did not observed significant changes in serum Cu and Fe concentration in heifer injected with different doses of Se.[18] Contrary to this, Atwal *et al* (2003) observed high plasma levels of Zn and Mn in anestrous buffaloes fed with selenium.[19] Cristaldi *et al* also observed increased copper concentration in serum of sheep supplemented with Se.[7]

The overall mean Se levels (ppb) in serum of

kids were 193.58 and 226.97 respectively in four groups. Statistical analysis revealed that the Se levels were significantly ($P<0.05$) different in two different groups, indicating that the plasma Se levels in the groups supplemented with Se was increased. Similar to our results, Pherson and Johnsson in young cattle bulls,[20] Weiss *et al* in Holstein cows [21] and Rowntree *et al* in Hereford cows reported that supplemental Se increased the blood levels of Se.[22]

Conclusion

It may be concluded that supplementation of sodium selenite in the diet improved the selenium status of the animals with out affecting other minerals in the serum of kids.

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