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EFFECT OF DIFFERENT SOURCES OF SELENIUM ON SERUM MINERALS AND VITAMIN-E IN MALE GOATS (*Capra hircus*)

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ABSTRACT

An experiment was conducted on 18 male kids of similar age (2-3 months) and body weight (6.32 to 7.27 kg) to elucidate the effect of selenium yeast and sodium selenite supplementation on serum minerals and vitamin-E. Kids were randomly divided into three equal groups and fed a basal diet consisted of concentrate mixture and oat straw to meet their nutrient requirement. Group I served as control, without any supplementation and groups II and III were supplemented with 0.3 mg selenium/kg DM as Selenium yeast and sodium selenite respectively. Experimental feeding lasted for 180 days. Blood samples were collected on day 0, 60,120 and 180 days to study the serum minerals and vitamin-E. Results revealed significant ($P<0.05$) increased in serum selenium and vitamin E concentration in supplemented groups than control. Serum calcium, phosphorus, iron, copper, zinc, manganese were similar ($P>0.05$) among the three groups. It may be concluded that supplementation of 0.3 ppm selenium as selenium yeast and sodium selenite enhanced serum selenium and vitamin E concentration without affecting other serum minerals in goats.

Key words : Goats, Selenium yeast, Serum minerals, Vitamin E.

Selenium (Se) is required for anti-inflammatory, thyroid hormone function and reproduction in animals[8]. It acts in synergism with other anti-oxidative agents such as zinc and copper to inhibit the oxidation of membrane lipids and DNA by oxygen radicals produced during aerobic metabolism[2]. Inorganic forms (sodium selenite or selenate) have been commonly used as Se supplements. Organic Se from selenomethionine (Se-Met) or Se enriched yeast is an ideal additive for animals. Organic Se is needed not only for healthy and productive animals but also for the production of meat, milk and other products which are rich in Se[10]. Se supplement could disturb zinc (Zn), copper (Cu) and iron (Fe) metabolism leads to deficiency of these minerals in young animals[4]. However Se supplementation had no effect on plasma á-tocopherol concentration[6]. In view of facts; the present study was conducted on growing male goats to find out the effects of selenium yeast and sodium selenite supplementation on serum minerals and Vitamin-E profiles.

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MATERIALS AND METHODS

Selenium yeast was prepared by growing *Saccharomyces cervisiae* in broth media followed by addition of aqueous solution of sodium selenite. Animal experiment was approved by the "Committee for the Purpose of Control and Supervision of Experiments on Animals" (CPCSEA), India, and conducted on 18 local male kids (*Capra hircus*; 2-3 months of age, average live weight 6.32 to 7.27 kg) procured from Sheep and Goat Farm of Indian Veterinary Research Institute, Izatnagar, India. Animals were adapted on the experimental diet comprising of concentrate mixture and oat straw for a period of one month and treated against ecto and endo parasites. Kids were vaccinated against foot and mouth disease and *peste des petits of ruminants* (PPR). Experimental animals were distributed into three 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 all the three groups were fed on concentrate mixture and oat straw to meet their nutrient requirements for 50 g daily weight gain[7]. The concentrate mixture consisted of (%) crushed maize grain 30, soybean meal 37, wheat bran 30, mineral mixture 2 and common salt 1. Treatments were: group I (control), without any supplementation, group II supplemented with 0.3 ppm Se as selenium yeast, group III supplemented with 0.3 ppm Se as sodium selenite through the concentrate mixture. Oat straw was provided to the animals after total consumption of concentrate mixture. All the kids were offered about 100 g of the available green 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 180 days.

About 5 ml blood was collected from each kid through jugular venipuncture in the morning (before watering and feeding) at 0, 60,120 and 180 days of the experimental feeding. The blood was collected into a 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^{o}C and serum was separated. The serum was collected in plastic vials and kept at -40^{o}C until study the serum minerals concentration. Diagnostic kits manufactured by Span Diagnostic Limited, Surat (India), were used for the analysis of serum calcium (Ca) and Phosphorus (P). Serum concentration of trace minerals like Fe, Cu, manganese (Mn) and Zn was estimated by Atomic Absorbance Spectrophotometer (Model 4141, Electronic Corporation of India Limited, Hyderabad, India). Se in feed and serum samples was estimated by Atomic Absorbance Spectrophotometer, using a nitrous oxide-acetylene flame, nitrogen as inert gas and sodium borohydride (0.6% w/v in 0.5% NaOH) as a reducing agent. Serum samples were digested using double acid (HNO_3, $HClO_4$; 4:1) mixture and volume was made with double distilled water. The á-tocopherol concentration in serum was determined by the method of [7]using High Performance Liquid Chromatography (HPLC, Shimadju, Japan). Data were analysed by one way analysis of variance and significance difference between treatments was determined using Duncan's multiple range test[9].

RESULTS AND DISCUSSION

The chemical composition of the basal diet offered to the animals in different groups has been given in Table 1.The crude protein (CP) content of concentrate mixture and oat straw was 20.4% and 4.3%, respectively; whereas selenium concentration was 0.12 and 0.11 ppm; alpha tocopherol concentrations were 13.75 and 1.90 mg/kg respectively. The CP content of maize fodder offered to goats was 6.28%. The data concerning serum Ca, P, Fe, Cu, Mn, Zn and Se are presented in Table 2. The mean Ca and P values (mg/dl) did not differ among the different groups ($P>0.05$). Similar to the present finding, it was

reported that supplementation of 0.3 ppm Se in the diet of buffalo calves had no effect on plasma Ca and P levels[6]. Like Ca and P, serum Fe, Cu, Mn and Zn levels (mg/l) were also comparable (P>0.05) among two groups. Similarly supplementation of 25 mg of selenium yeast/day for 2wk in cows had no effect on plasma Zn and Cu concentration[3]. Overall mean Se levels (ppb) in serum of goats were 198.73, 256.35 and 229.54 respectively in three groups. Statistical analysis revealed that the Se levels were significantly (P<0.05) different in different groups, indicating that the supplementation of selenium caused an increased in serum Se concentration in goats. Selenium yeast supplemented group have higher Se concentration than inorganic Se and control group. Similar to our results, organic Se increased the blood levels of Se than inorganic Se supplemented group in sheep[1]. This is probably due to different absorption mechanisms for organic and inorganic forms of selenium. Inorganic selenium is passively absorbed from the intestine by a simple diffusion process, whereas organic selenium is actively absorbed through the amino acid transport mechanisms[11].

The values of alpha tocopherol estimated in the serum samples of the goat of different groups and at different period intervals have been presented in Table 2. The overall mean alpha tocopherol concentration in serum was 1.98, 2.58 and 2.32 µg/ml in three groups respectively, which differed significantly among control and supplemented groups. This may be due to synergistic action between these two micronutrients in the body. But it is been reported that supplementation of Se had no effect on the plasma tocopherol concentrations in male buffalo calves which is against the present findings[6].

Table1. Chemical composition of feeds offered to goats (% DM basis)

Particulars	Concentrate mixture	Oat straw
Organic matter	91.90	93.60
Crude protein	20.40	4.30
Ether extract	2.30	1.20
Neutral detergent fiber	34.50	78.30
Acid detergent fiber	11.80	57.10
Hemicellulose	22.90	21.20
Cellulose	9.50	43.90
Calcium	1.57	0.85
Phosphorus	0.86	0.14
Selenium(ppm)	0.12	0.11
alpha-tocopherol (ppm)	13.75	1.90

Table 2. Serum minerals and vitamin E profile in goats offered selenium yeast and sodium selenite

Attributes	Treatment	Period (days)				Mean(±SE)
		0	60	120	180	
Ca (mg/dl)	I	10.05±0.37	9.77±0.18	9.58±0.26	9.63±0.29	9.76±0.16
	II	9.69±0.22	10.12±0.20	9.81±0.19	9.18±0.17	9.68±0.18
	III	9.78±0.17	10.04±0.12	9.89±0.17	9.64±0.23	9.84±0.19
P (mg/dl)	I	5.38±0.11	5.37±0.16	5.48±0.22	5.17±0.09	5.33±0.15
	II	5.01±0.20	5.62±0.19	5.63±0.17	5.39±0.13	5.41±0.16
	III	5.60±0.09	5.75±0.13	5.97±0.14	5.42±0.19	5.62±0.12
Fe(mg/l)	I	6.05±0.22	6.04±0.18	6.78±0.10	6.71±0.24	6.73±0.18
	II	6.06±0.24	6.46±0.22	6.62±0.21	6.38±0.19	6.58±0.20
	III	6.09±0.27	6.60±0.18	6.76±0.16	6.29±0.15	6.66±0.17
Cu(mg/l)	I	3.62±0.08	4.45±0.14	3.89±0.07	3.63±0.09	3.75±0.12
	II	3.64±0.03	3.91±0.11	4.19±0.21	3.43±0.08	3.84±0.17
	III	3.13±0.05	3.91±0.17	4.06±0.11	4.19±0.19	3.82±0.13
Mn(mg/l)	I	1.34±0.02	1.19±0.08	2.11±0.10	1.87±0.09	1.77±0.07
	II	1.45±0.03	1.77±0.05	2.04±0.05	2.26±0.04	1.88±0.05
	III	1.33±0.03	1.69±0.04	2.19±0.06	2.05±0.07	1.79±0.05
Zn(mg/l)	I	4.08±0.11	3.86±0.08	3.80±0.09	3.48±0.12	3.81±0.10
	II	3.78±0.10	3.56±0.11	2.95±0.10	3.23±0.12	3.33±0.14
	III	3.84±0.10	3.61±0.08	2.98±0.12	3.73±0.08	3.56±0.10
Fe(ppb)	I	180.30±3.19	182.10±4.08	208.80±7.10	216.60±7.12	188.73±4.13
	II	182.30±3.09	246.70±6.10	270.10±9.13	308.30±7.19	256.39±50.09
	III	187.14±5.12	240.00±5.18	247.85±8.06	272.13±8.09	225.54[a] ±6.11
alpha tocopherol (µg/ml)	I	1.53±0.06	1.61±0.04	2.14±0.06	3.67±0.10	1.89±0.08
	II	1.98±0.08	2.21±0.09	2.86±0.08	3.98±0.09	2.58[a]±0.09
	III	1.94±0.04	1.90±0.04	2.52±0.10	3.33±0.08	2.32[a]±0.07

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

CONCLUSION

The result of the present study implied that supplementation of 0.3 ppm organic or inorganic Se in the basal diet of goats improved the blood selenium and vitamin E concentration. Selenium yeast is a better source for Se than the inorganic Se sources as they had higher blood Se concentration.

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