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Research Article

EFFECT OF SODIUM SELENITE AND VITAMIN E SUPPLEMENTATION ON GROWTH AND SERUM MINERALS PROFILE OF PIGS (*SUS DOMESTICUS*)

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ABSTRACT: To assess the effect of sodium selenite and vitamin E supplementation on growth and serum minerals, twenty male large white Yorkshire pigs of similar age (2-3 months) and body weight (14.96 ± 0.68 kg average) were randomly divided into four equal groups. Group I served as control (without any supplementation), whereas animals in groups II and III were supplemented with 0.3 mg selenium kg^{-1} DM as sodium selenite, 100 mg of vitamin E as DL-α-tocopheryl acetate, respectively. Piglets in group IV were supplemented with both 0.3 ppm Se as sodium selenite and 100 mg of vitamin E as DL-α-tocopheryl acetate. This experimental feeding lasted for 120 days, during which fortnightly bodyweight changes were recorded. Blood samples were collected at day 0 and day 120. There was significant ($P<0.05$) increase in serum Se concentration in supplemented groups than control. Average daily gain and serum calcium, phosphorus, iron, copper, zinc, manganese were similar ($P>0.05$) among the four groups. The results suggest that supplementation of 0.3 ppm Se as sodium selenite and 100 mg of vitamin E may enhance the serum Se concentration without affecting body weight gain and other serum minerals of pigs.

Key words: Growth, Pigs, Serum minerals, Sodium selenite, Vitamin E.

INTRODUCTION

Minerals and vitamins are essential components in swine diet as they are required for the metabolism and utilization of other nutrients. Feeding of ration deficient in minerals and vitamin to swine may lead to diverse clinical symptoms and poor performances. Selenium (Se) and vitamin E are the micronutrients acting in synergism to inhibit the oxidation of membrane lipids and DNA by oxygen radicals produced during aerobic metabolism (Surai 2000). 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 (Surai 2002). Cristaldi *et al*. (2005) reported that administration of Se to sheep grazing on Cu deficient pastures increased Cu absorption. However, a high Se

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supplement could disturb the Zn, Cu and Fe metabolism leading to deficiency of these minerals in young animals (Kojouri and Shirazi 2007). Jalilian *et al.* (2012) observed increased plasma Se and Cu concentrations in Se treated ewes compared with those in controls. Ghazi *et al*. (2012) observed that dietary supplementation of 1 ppm Se caused a significant reduction in the serum Cu concentrations of heat-stressed broilers. Therefore, an experiment was conducted on growing male pigs to find out the combined effects of selenium and vitamin E supplementation on their growth and serum minerals profile.

MATERIALS AND METHODS

An experiment was conducted on 20 male large white Yorkshire piglets of similar age (2-3 months) and body weight (14.96 ± 0.68 kg average) at Instructional Livestock Farm, Orissa University of Agriculture and Technology, Bhubaneswar, Odisha. These piglets were divided into four different groups of five animals each on the basis of their body weights following randomized block design and were kept in a well-ventilated shed. Pigs in all the four groups were fed on concentrate mixture to meet their nutrient requirements (NRC 1998). The concentrate mixture consisted of (% as such basis) crushed maize 62, deoiled soyabean meal 15, wheat bran 15, fish meal 06, mineral mixture 1.5 and common salt 0.5. Treatments were: group I (control), group II supplemented with 0.3 ppm Se as sodium selenite, group III supplemented with 100 mg vitamin E as DL-α-tocopheryl acetate/pig/day (Impextraco, Belgium, 50% purity) and group IV supplemented with both 0.3 ppm inorganic Se and 100 mg vitamin E through the concentrate mixture. Clean and fresh drinking water was provided twice a day to all the animals. This feeding experiment lasted for 120 days. All the animals were weighed at 15 days intervals to assess their growth rate.

About 3 ml blood samples were collected from each pig through ear venipuncture in the morning (before watering and feeding) at 0 and 120 days of the experimental feeding. The serum was collected in vials and kept at -40^{o}C until further analysis. Serum calcium (Ca) and phosphorus (P) were estimated by the method of Trinder (1960) and Gomorri (1942) respectively by using Crest Biosystems® (Goa, India) kit. Se concentrations in the serum were measured by hydride generation atomic absorption spectrophotometer (AAS), according to the method described by Tiran *et al*. (1992). One ml blood serum sample was taken in a 50 ml clean and dry micro Kjeldhal flask and 5 ml triple acid (HNO_3, H_2SO_4 and $HClO_4$, 4: 2 : 1) mixture was added to it, 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 25 ml with triple glass-distilled water. Serum concentrations of Fe, Cu, Mn and Zn were estimated by Atomic Absorbance Spectrophotometer (Model SL243, ELICO®, Hyderabad, India). Data were analyzed using SPSS (1996) and significance difference between treatments was determined using Duncan's multiple range test.

RESULTS AND DISCUSSION

The chemical composition of the basal diet offered to the animals in different groups has been given in Table 1. The CP content of concentrate mixture was 18.30%, whereas Se concentration was 0.02 mg/kg.

Table 1. Chemical composition of feeds offered to pigs (% DM basis).

Proximate Composition	Percentage on DM basis
Organic matter	89.28
Crude protein	18.30
Ether Extract	2.18
Crude fibre	5.63
Total Ash	10.72
Nitrogen free extract	63.17
Calcium	1.47
Available Phosphorus	0.80
Selenium (ppm)	0.02

Average daily gain (ADG) was similar in four groups (Table 2). Similarly, Mudgal *et al.* (2012) in male buffalo calves and Dominguez-Vara *et al.* (2009) in finishing lambs did not find any effect of supplementation of 0.3 mg Se-yeast kg^{-1} DM on their growth rate. Shinde *et al.* (2008) observed that supplementation of vitamin E (300 IU) and Se (0.3 ppm) or both (300 IU vitamin E and 0.3 ppm Se) in the diet of buffalo calves had no effect on total body weight gain and ADG.

The mean Ca and P values (mg/dl) did not differ among the different groups (P>0.05; Table 2). Mudgal *et al*. (2012) also reported that supplementation of 0.3 ppm Se in the diet of buffalo calves had no effect on their plasma Ca and P levels. Similar to our results, Cipriano *et al*. (1982) and Reddy *et al*. (1987) did not observe any effect of vitamin E supplementation in the diet of calves on their serum Ca and P levels.

Like Ca and P, serum Fe, Cu, Mn and Zn levels (mg/l) were also comparable (P>0.05) among two groups (Table 3). Hoac *et al.* (2008) reported that supplementation of 25 mg of selenium yeast/day for 2 weeks in cows had no effect on plasma Zn and Cu concentration. Moeini *et al*. (2011) did not observe significant changes in serum Cu and Fe concentration in heifer injected with different doses of Se. Contrary to this, Atwal *et al*. (2003) observed high plasma levels of Zn and Mn in anestrous buffaloes fed with selenium. Similarly Cristaldi *et al*. (2005) observed increased Cu concentration in serum of sheep supplemented with Se. Increased in the concentration of these minerals may be due to synergistic effect of these minerals with Se. Similarly, Kojouri and Shirazi (2007) observed that supplementing Se and vitamin E could result in Zn deficiency in ewes. Similarly, Ghazi *et al.* (2012) observed that dietary supplementation of Se at 1 mg/kg Se caused a significant reduction in the serum Cu concentrations of heat-stressed broilers. The decreased concentration may be due to higher concentration of Se in their basal diet.

The mean Se levels (ppb) in serum of pigs at 120 days significantly increased in pigs supplemented with Se and vitamin E. Similar to our results, Rowntree *et al*. (2004) in Hereford cows, Mudgal *et al*. (2007) in buffalo calves reported that supplemental Se increased the blood levels of Se. Similarly, Zhan *et al*. (2007) and Arthington (2008) observed increased Se concentration in serum of Se supplemented pigs and beef steer, respectively. Similarly Svedaite *et al*. (2009) observed that blood selenium concentration was increased by 266.7% in pigs supplemented with 0.1 ppm Se and 20 IU of vitamin E for 4 months.

CONCLUSION

Supplementation of 0.3 ppm Se and 100 mg

Table 2: Fortnightly body weight changes (kg) in large white Yorkshire.

	Group				
Attributes/ Fortnight BW	**I**	**II**	**III**	**IV**	**P Value**
Initial	15.02±0.37	14.94±0.75	14.89±0.60	14.98±0.62	0.999
8 (Final BW)	61.12±0.84	61.68±0.23	61.85±0.46	61.75±0.33	0.219
ADG (kg)	0.384±0.06	0.389±0.05	0.391±0.08	0.389±0.07	0.551
Average Dry matter intake (kg)	1.52±0.18	1.65±0.16	1.60±0.16	1.55±0.15	0.963

Table 3: Serum mineral profile of pigs given sodium selenite and vitamin E.

Parameters	**Days**	**I**	**II**	**III**	**IV**	**P value**
Ca (mg/dl)	0	8.18±0.72	9.12±0.67	9.55±0.64	8.64±0.42	0.292
	120	9.74±0.77	10.31±0.60	11.38±0.58	9.69±0.49	0.226
P (mg/dl)	0	5.18±0.62	5.84±0.13	5.69±0.21	5.92±0.27	0.724
	120	5.07±0.56	5.11±0.08	5.18±0.12	5.24±0.19	0.981
Zn (mg/l)	0	195.94±11.42	188.23±8.74	196.08±11.27	197.91±11.63	0.153
	120	197.19±10.43	187.15±9.05	197.47±10.28	198.86±10.23	0.170
Cu (mg/l)	0	19.42±0.74	18.54±0.11	16.97±0.82	19.65±0.47	0.172
	120	18.71±0.98	17.73±0.69	18.65±0.98	19.00±0.33	0.143
Mn (mg/l)	0	140.02±9.11	142.91±10.17	143.22±11.07	141.23±9.42	0.221
	120	142.52±9.23	141.85±10.39	141.12±10.28	142.54±10.54	0.119
Se (ppb)	0	159.42±9.66	159.10± 9.75	158.43±10.58	161.22±8.54	0.135
	120	160.01±9.71^{a}	240.35±10.36^{c}	211.13±8.68^{b}	280.73±11.13^{d}	0.000

^{abcd} Means bearing different superscripts in a row differ significantly (P<0.05).

of vitamin E increased the blood Se concentration without affecting the serum levels of Ca, P, Fe, Cu, Zn and Mn in pigs.

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REFERENCES

Arthington JD (2008) Effects of supplement type and selenium source on measures of growth and selenium status in yearling beef steers. J Anim Sci 86(6): 1472 -1477.

Atwal K, Prabhakar S, Dhillon KS, Nayyar VK, Ghuman SPS (2003) Epidemiological studies and mineral profiles in selenotic anoestrus buffaloes. J Res 40 (1): 87-91.

Cipriano JE, Morrill JL, Anderson NV (1982) Effects of dietary vitamin E on immune responses of calves. J Dairy Sci 65: 2357-2365.

Cristaldi LA, Mc Dowel LR, Buergelt CD, Davis PA, Wilkinson NS, Martin FG (2005) Tolerance of inorganic selenium in wether sheep. Small Rumin Res 56: 205-213.

Dominguez-Vara IA, Gonzalez-Munoz SS, Pinos-Rodriguez JM, Borquez-Gastelum JL, Barcena-Gama R, Mendoza- Martinez G, Zapata LE, Landois-Palencia LL (2009) Effects of feeding selenium-yeast and chromium-yeast to finishing lambs on growth, carcass characteristics, and blood hormones and metabolites. Anim Feed Sci Technol 152: 42-49.

Ghazi SH, Habibiyan M, Moeini MM, Abdolmohammadi AR (2012) Effects of dietary selenium, Vitamin E, and their combination on growth, serum metabolites and antioxidant defense system in skeletal muscle of broilers under heat stress. Biol Trace Elem Res 148(3): 322-330.

Gomorri GA (1942) Modification of the colorimetric phosphorus determination for use with the photoelectric colorimeter. J Lab Clin Med 27: 960-977.

Hoac T, Stagsted J, Lundh T, Nielsen JH, Akesson B (2008) Short term effects of selenium supplementation of cows feed on the content and distribution of selenium, copper and zinc in bovine milk, whey and blood plasma. J Dairy Res 75: 326-334.

Jalilian MT, Moeini MM, Karkodi K (2012) Effect of selenium and vitamin E supplementation during late pregnancy on colostrum and plasma Se, Cu, Zn and Fe concentrations of fat tail Sanjabi ewes and their lambs. Acta Argi Slovenica 100(2): 123-129.

Kojouri GA, Shirazi A (2007) Serum concentrations of Cu, Zn, Fe, Mo and Co in newborn lambs following systemic administration of vitamin E and selenium to the pregnant ewes. Small Rumin Res 70: 136-139.

Moeini MM, Kiani A, Karami IH, Mikaeili E (2011) The effect of selenium administration on the selenium, copper, iron and zinc status of pregnant heifers and their new born calves. J Agr Sci Tech 13: 53-59.

Mudgal V, Garg AK, Dass RS (2007) Effect of dietary selenium and copper supplementation on growth and nutrient utilization in buffalo calves. Anim Nutr Feed Technol 7: 79-88.

Mudgal V, Garg AK, Dass RS, Varshney VP (2012) Effect of selenium, zinc and copper supplementation on blood metabolic profile in male buffalo (*Bubalus bubalis*) calves. Biol Trace Elem Res 145: 304-311.

NRC (1998) Nutrient Requirement of Swine. National Research Council, 10th revised Edn, National Academy of Sciences, Washington, D.C.

Reddy PG, Morril HK, Minocha HK, Strvenson JS (1987) Vitamin E is immunostimulatory in calves. J Dairy Sci 70: 993-999.

Rowntree JE, Hill GM, Hawkins DR, Link JE, Rincker MJ, Bedner GW, Kreft MJ Jr (2004) Effect of Se on selenoprotein activity and thyroid hormone metabolism in beef and dairy cows and calves. J Anim Sci 82: 2995-3005.

Shinde PL, Dass RS, Garg AK, Bhadane KP (2008) Effect of vitamin E and selenium supplementation on growth, nutrient utilization and their balance in male buffalo calves. Anim Nutr Feed Technol 8(2): 135- 143.

SPSS (1996) Statistical Packages for Social Sciences Ver. 7.5, SPSS Inc. Illinois (USA).

Surai PF (2002) Selenium in poultry nutrition: A new look at an old element. Reproduction, egg, meat quality and practical applications. World Poult Sci J 58: 431-450.

Svedaite V, Lipinski K, Falkowska A, Baranauskiene D, Kulpys J, Stankevicius R (2009) Effect of selenium and vitamin E supplementation on the quantity and quality of the pork production and selenium accumulation in organs of fattening pigs. Poland J Nat Sci 24 (1): 35-42.

Tiran B, Tiran A, Petek W, Rossipal E, Wawschinek O (1992) Selenium status of health children and adults in Styria (Austria). Trace Elem Med 9(2): 75-79.

Trinder P (1960) Colorimetric micro determination of calcium in serum. Analyst 85: 889-894.

Zhan XA, Wang M, Zhao RQ, Li WF, Xu ZR (2007) Effects of different selenium source on selenium distribution, loin quality and antioxidant status in finishing pigs. Anim Feed Sci Technol 132: 202–211.

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