



EFFECT OF DIETARY SUPPLEMENTATION OF ORGANIC SELENIUM ON GROWTH PERFORMANCE AND NUTRIENT UTILIZATION IN CROSS BRED CALVES*

M.N.Vinu¹, P.Gangadevi², A.D.Mercy³,
K. S. Anil⁴ and Shyama, K⁵

Department of Animal Nutrition
College of Veterinary and Animal Sciences
Mannuthy - 680 651, Thrissur, Kerala

Received - 28.06.2012
Accepted - 05.08.2012

Abstract

An experiment was conducted in 12 crossbred calves for 112 days to assess the effect of dietary supplementation of organic selenium for growth. Calves of one week of age were divided into two groups of six each as uniformly as possible with regard to age, sex and body weight and allotted randomly to one of the two dietary treatments T_1 and T_2 . Calves of T_1 and T_2 were offered standard calf starter as per BIS specifications and supplemented with organic selenium at 0 and 0.3 ppm respectively. Fresh green grass (Hybrid Napier) was supplied ad libitum throughout the experimental period. No significant difference could be observed in growth rate dry matter intake and feed efficiency of the calves between the groups. Average daily gain and total weight gain, respectively were 297.02 g and 33.27 kg for T_1 and 311.90 g and 34.93 kg for T_2 . Total dry matter intake was 103.81 and 105.89 kg and the feed conversion efficiencies were 3.33 and 3.15 respectively for T_1 and T_2 . The percentage digestibility of dry matter, crude protein, crude fibre, ether extract and nitrogen free extract also did not differ significantly between groups.

From a critical evaluation of the results obtained in the present study, it was inferred that dietary supplementation of 0.3ppm organic selenium did not improve the growth performance and nutrient utilization in cross bred calves. The feed cost per kilogram body weight gain for the calves in T_1 and T_2 was Rs.163.32 and 155.11 respectively. There was a saving of Rs.8.21 for T_2 over T_1 . The disease occurrence was low in selenium supplemented group when compared to the control group.

Keywords: Organic selenium, growth, nutrient utilization, calves

Success of dairy cattle production depends on the efficient management and production of healthy calves. Dairy calf losses are of major concern to dairyman. Calves without adequate circulating immunoglobulins are more likely to die or become ill than calves with adequate circulating immunoglobulins. Hence more emphasis should be given to improve the immune mechanism through proper nutrition.

Since selenium plays a significant role in immune mechanism and growth, organic selenium supplementation could be beneficial

*Part of MVSc thesis submitted by the first author to Kerala Veterinary and Animal Sciences University, Pookode, Wayanad.

1. P.G. scholar

2. Professor

3. Professor and Head

4. Associate Professor and Head, ULF & FRDS

5. Assistant Professor (SS)

to protect the pre ruminant calves against infection and to alleviate the weaning stress, thereby enhancing the production performance. Studies have shown that organic selenium is better absorbed and utilized in ruminants as compared to its inorganic sources (Gunter *et al.* 2003; Guyot *et al.*, 2007). Hence the present study was carried out to assess the effect of dietary supplementation of organic selenium in cross bred calves.

Materials and Methods

Twelve healthy crossbred calves of one week of age selected from the University Livestock Farm and Fodder Research and Development Scheme (ULF&FRDS), College of Veterinary and Animal Sciences, Mannuthy, formed the experimental subjects for the study. After the colostrum feeding, calves were housed individually in well ventilated, clean and dry shed with facilities for feeding and watering. The calves were divided into two groups of six each as uniformly as possible with regard to age, sex and body weight and allotted randomly to one of the two dietary treatments, T₁ and T₂. All the experimental calves were maintained under identical conditions of feeding and management throughout the experimental period. They were fed with whole milk up to twelve weeks of age. Calves of T₁ and T₂ were offered standard calf starter as per BIS(1983) specifications, supplemented with organic selenium at 0 and 0.3ppm respectively and fresh green grass (Hybrid Napier) *ad libitum* for a period of 112 days. The calf starter was prepared with yellow maize- 35.5parts, wheat bran-15parts, soya bean meal-45.5parts, calcite-2parts, dicalcium phosphate-1.5parts, common salt-0.5 parts and indomix AB₂D₃ K @10g/100kg feed. In T₂ ration Selplex (Altec Ltd.) was added at the rate of 15g per 100kg feed to obtain 0.3ppm of organic selenium.

All the experimental calves were fed required quantity of whole milk daily in two equal portions. The quantity of milk fed was at the level of 1/10th of their body weight for the first six weeks, 1/15th of body weight from seven to eight weeks and 1/20th of body weight from nine to twelve weeks of age. Calf starter and good quality green grass were offered to all the calves from first week of age. Clean

drinking water was made available to all calves throughout the experiment. Individual data on quantities of calf starter, milk and green grass offered daily were recorded. The left over portion of the calf starter and green grass were weighed daily and their moisture content was analyzed to calculate the dry matter intake. Daily dry matter intake from whole milk, calf starter and green grass with respect to each calf were calculated throughout the experimental period. Body weight of all the calves were recorded at fortnight intervals before feeding. Calves were fed as per ICAR standard (Ranjan, 1998). The concentrate allowance and green grass offered were revised weekly taking into consideration the increased nutrient requirement commensurate with the growth increment.

A digestion trial involving five days collection period was carried out at 13th week of experiment. Representative samples of calf starter and green grass offered were taken daily during the digestion trial for chemical analysis. The balance of feed and grass samples were collected from individual animals and their moisture content was determined daily. At the end of the collection period feed samples collected daily were pooled and subjected to chemical analysis. The dung was collected manually as and when it was voided. All precautions were taken to collect the dung quantitatively, uncontaminated with urine, feed residue or dirt. The dung collected each day was weighed accurately, mixed thoroughly and representative samples from each animal were kept in double lined air tight plastic bags and stored fresh in deep freezer during the entire collection period. At the end of collection period daily samples stored from each animal were pooled and used for chemical analysis.

Proximate analysis of the calf starter, green grass and dung were done as per the standard procedures (AOAC, 1990). The acid detergent fiber (ADF) was estimated by the method suggested by Van Soest (1963) and neutral detergent fiber (NDF) by the method suggested by Van Soest and Whine (1967). From the data obtained on the intake and outgo of dry matter and different nutrients during the digestion trial, digestibility coefficient of nutrients were calculated.

Data obtained on different parameters during the course of experiment were subjected to statistical analysis using Student's t test (Snedecor and Cochran, 1994).

Results and Discussion

Growth

Data on the average body weight of calves belonging to dietary treatments T_1 and T_2 maintained on calf starter supplemented with 0 and 0.3 ppm of organic selenium respectively and green grass for a period of 112 days recorded at fortnight intervals (Table 1) revealed that the calves of two groups recorded normal pattern of growth, without any significant difference ($P>0.05$) in any of the fortnights. Calves of T_1 and T_2 had an average daily body weight gain (ADG) of 297.02g and 311.90 g respectively, and the respective cumulative weight gain was 33.27 and 34.93 kg (Table 2). Statistical analysis of the data on ADG and total gain also did not reveal any significant difference ($P>0.05$) between the dietary treatments.

Table 1. Fortnightly average body weight of calves maintained on control and selenium supplemented rations, kg*

Weeks	$T_{1(\text{control})}$	$T_{2(\text{Se.supplemented})}$
0	24.00±1.93	22.00±2.52
2	25.75± 1.48	23.67±2.83
4	29.58±1.51	27.67±2.92
6	33.75±2.44	33.00±3.25
8	38.65±2.77	37.58±3.17
10	44.67±3.07	42.67±2.99
12	49.33±3.47	46.30±2.74
14	54.10±3.87	51.67±2.38
16	57.27±5.19	56.93±2.67

*Mean of six values

Present result on growth performance of experimental calves is in agreement with Kincaid *et al.* (1977), Weiss *et al.* (1983), Nicholson *et al.* (1991) and Guyot *et al.* (2007) who also noticed no improvement in the weight gain as a result of dietary supplementation of organic selenium. In contrary to the above Wichtel *et al.* (1996) reported higher mean daily body weight gain

for Friesian calves on supplementation of selenium as intra ruminal pellets than that of the non supplemented group.

Dry matter consumption

Cumulative average daily dry matter (DM) consumption of the experimental calves for the experimental period of 112 days was 0.92 kg for control group and 0.94 kg for selenium supplemented group and the respective total DM intake being 103.81 and 105.89 (Table 3). Statistical analysis revealed no significant increase in DM intake of calves of T_2 compared to that of T_1 .

Present results are in agreement with Juniper *et al.* (2008) who observed no treatment effect on the dry matter intake when ruminant animals were given varying levels of selenium (0.2 to 6.74 ppm) as selenium enriched yeast in feed. In contrary to the above result Ivancic and Weiss (2001) reported significant increase in dry matter intake of mid lactation Holstein cows fed diets supplemented with 0.1 or 0.3 ppm of selenium

Feed conversion efficiency

Cumulative feed conversion efficiency of experimental calves was 3.33 and 3.15 respectively for T_1 and T_2 (Table 2). Even though the selenium supplemented calves showed slightly better feed efficiency, statistical analysis did not reveal any significant difference ($P>0.05$) between the groups. In agreement with the present study, Juniper *et al.* (2008) observed no treatment effect on the feed efficiency in calves and lambs when supplemented with 5.86 and 6.63 ppm of selenium as selenium yeast. Richards *et al.* (2011) also reported no significant effect in the feed gain ratio on dietary supplementation of 0.34 ppm of selenium yeast in beef cattle.

Nutrient digestibility

Digestibility of dry matter, crude protein, ether extract, crude fibre and NFE observed in the present study were 74.63 and 71.42, 78.84 and 77.81, 84.08 and 83.63, 70.02 and 69.22, 79.37 and 74.52 per cent in the control and selenium supplemented calves respectively and statistical analysis did not reveal any significant difference between the groups (Table 3).

Table 2. Growth rate, feed conversion efficiency and economics of gain of calves maintained on control and selenium supplemented ration for a period of 112 days*

Parameters	T ₁ (control)	T ₂ (Se.supplemented)
Initial body weight (kg)	24.00±1.93	22.00±2.52
Final body weight (kg)	57.27±5.19	56.93±2.67
Total gain (kg)	33.27±5.27	34.93±2.89
Average daily gain (g)	297.02±47.07	311.90±25.79
Total dry matter consumed(kg/calf)	103.81±12.23	105.89±10.07
Average daily dry matter consumed(kg/calf)	0.92±0.11	0.94±0.09
Feed to gain ratio	3.33±0.39	3.15±0.41
Total cost of feed/ calf(Rs.)	5433.69	5417.91
Cost per kg gain (Rs.)	163.32	155.11

*Mean of six values

In agreement with the present result, non significant effect of selenium supplementation on dry matter, crude protein, ether extract, crude fibre and NDF digestibility were also reported by Nicholson *et al.* (1991) and Skrivanova *et al.* (2007) where as Wang *et al.* (2009) reported higher digestibility of dry matter, crude protein, ether extract and NDF in lactating dairy cows for diet supplemented with a higher level of selenium (150 and 300 ppm) than that of control.

Disease incidence

Incidence of diseases in calves during the experimental period of 112 days from first week to seventeenth week of age were recorded. While four calves of T₁ had calf scour due to coccidiosis and monieziosis, only two calves of treatment group had calf scour. Joint ill was noticed in one calf in the control group. During the course of experiment one animal from the control group had bloat. Decreased incidence of disease with a total of only two cases reported in selenium supplemented group compared to six cases in unsupplemented group within the experimental period of 112 days indicates better immune status of calves on selenium supplementation.

In accordance with the above result, Hidioglou *et al.* (1985) found that administration of intraruminal pellets to cows during the last three months of pregnancy reduced the case of nutritional muscular dystrophy in calves. In contrary to the present

study, Weiss *et al.* (1983) could not find any reduction in incidence of respiratory diseases in calves on selenium and vitamin E administration.

Economics of gain

The cost of feed per kilogram body weight gain of calves maintained on dietary treatments T₁ and T₂ were Rs. 163.32 and 155.11 .(Table 3) Though the feed cost for T₂ increased by 22 paise per kilogram feed due to selenium supplementation, the data indicates a reduction in feed cost per kilogram weight gain by Rs. 8.21 in T₂ (selenium supplemented group) compared to T₁ (non supplemented group).

Table 3. Percentage digestibility of nutrients of experimental rations*

Item	T ₁ (control)	T ₂ (Se.supplemented)
Dry matter	74.63±0.74	71.41±1.37
Crude protein	78.84±1.12	77.81±2.47
Crude fibre	70.02±1.54	69.22±2.29
Ether extract	84.08±0.96	83.63±1.78
NFE	79.37±0.99	74.52±1.43

*Mean of six values

References

- AOAC. 1990. *Official Methods of Analysis*, 15th ed. Association of official analytical chemists. Washington, D.C., 587p.

- BIS. 1983. Bureau of Indian Standards. Specification for compounded feeds for young stock: IS: 5560-1970. Manak Bhavan, 9, Bhahadur Shah Zafar Marg, New Delhi, 15p.
- Gunter, S.A., Beck, P.A. and Phillips, J.M. 2003. Effects of supplementary selenium source on the performance and blood measurements in beef cows and their calves. *J. Anim. Sci.*, **81**: 856-864
- Guyot, H., Spring, P., Andrieu, S. and Rollin, F. 2007. Comparative responses to sodium selenite and organic selenium supplements in Belgium blue cows and calves. *Livestock Sci.*, **111**: 259-263
- Hidiroglou, M., Proulx, J. and Jolette, J. 1985. Intraruminal selenium pellet for control of nutritional muscular dystrophy in cattle. *J. Dairy Sci.*, **68**: 57-66
- Ivancic, J. and Weiss, W.P. 2001. Effect of dietary sulfur and selenium concentrations on selenium balance of lactating Holstein cows. *J. Dairy Sci.*, **84**: 225-232
- Juniper, D.T., Phipps, R.H., Givens, D.I., Jones, A.K., Green, C. and Bertin, G. 2008. Tolerance of ruminant animals to high dose in feed administration of a selenium enriched yeast. *J. Anim. Sci.*, **86**: 197-204
- Kincaid, R.L., Miller, W.J., Neathery, M.W., Gentry, R.P. and Hampton, D.L. 1977. Effect of added dietary selenium on metabolism and tissue distribution of radioactive and stable selenium in calves. *J. Anim. Sci.*, **44**: 147-151
- 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
- Ranjhan, S.K. 1998. *Nutrient requirements of livestock and poultry*. Second edition. Indian Council of Agricultural Research, New Delhi. 5p.
- Richards, C.J., Blalock, H.M., Jacques, K.A. and Loveday, H.D. 2011. Efficiency of feeding selenium enriched yeast to finishing beef cattle. *Proff. Anim. Scient.*, **27**: 1-8
- Skrivanova, E., Marounek, M., De Smet, S. and Raes, K. 2007. Influence of dietary selenium and vitamin E on quality of veal. *Meat Sci.*, **76**: 495-500
- Snedecor, G.W. and Cochran, W.G. 1994. *Statistical Methods*. Eighth Edition. The Iowa State University press, Ames, IA. 314p.
- Van Soest, P.J. 1963. Use of detergents in analysis of fibrous feeds. II. A rapid method for the determination of fibre and lignin. *J. Assoc. Off. Analyt. Chem.*, **46**: 829p
- Van Soest, P.J. and Whine, R.H. 1967. Use of detergents in the analysis of fibrous feeds. IV. The determination of plant cell wall constituents. *J. Assoc. Off. Analyt. Chem.*, **50**: 50p.
- Wang, C., Liu, Q., Yang, X.M., He, D.C., Zhang, P., Dong, K.H. and Huang, Y.X. 2009. Effect of selenium yeast on rumen fermentation, lactation performance and feed digestibilities in lactating dairy cows. *J. Liv. Sci.*, **126**: 239-244
- Weiss, W.P., Colenbrander, V.F., Cunningham, M.D. and Callahan, C.J. 1983. Selenium/vitamin E : Role in disease prevention and weight gain of neonatal calves. *J. Dairy Sci.*, **66**: 1101-1107
- Wichtel, J.J., Craig, A.L., Freeman, D.A., Alvarez, V and Williamson, N.B. 1996. Effect of selenium and iodine supplementation on growth rate and on thyroid and somatotrophic function in dairy calves at pasture. *J. Dairy Sci.*, **79**: 1865-1872

