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Effect of Micronutrients Supplement on Nutrient Utilization and Growth Performance in Pre-ruminant Calves

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ABSTRACT

The present study was undertaken to assess the effect of micronutrients supplement (MS) on the nutrient utilization and growth performance in pre-ruminant calves. The sixteen day old crossbred calves (body weight 24.50 ± 0.56 kg) were randomly allocated into two dietary treatments; control (C) and treatment (T) groups. Diets were same for both groups and in addition to diet micronutrients supplement was given to individual calf of treatment group. The supplementation of MS in the diet of crossbred calves did not affect the intake and digestibility coefficients of CP, EE, NDF and ADF. Over all body weight changes and feed conversion efficiency did not differ significantly between groups but average daily gain (g) was significantly ($P<0.05$) higher in T group as compare to control (C) group. Thus it was concluded that supplementation of micro-nutrients in pre-ruminant calves showed significant improvement in average daily gain while the intake, feed efficiency and digestibility of nutrients were comparable between the groups.

Keywords: growth, micronutrient supplement, nutrient utilization, pre-ruminant calves

The calf rearing in early life is one of the most critical and expensive feeding stage in the life of cattle. The feeding usually accounts for more than 70% of the total expenses involved in calves rearing due to non-functional rumino-reticulum in early life as the diets include milk and a high energy-high protein concentrate mixture known as calf starter. Although, calves start eating good quality green fodder in small amount from 2-3 week of age but nutritional contribution of fodder is much lower than that of milk and calf starter contribution. The most critical period is the first 2-3 weeks of calf life as its immature digestive system which is developing rapidly with regard to digestive secretions and enzymatic activity (Toullec and Guilloteau, 1989; Davis and Drackley 1998). The carbohydrate, fat, and protein in colostrum are essential as fuel for the new born. Most of the essential minerals and vitamins are substantially more concentrated in colostrum than in milk (Foley and Otterby 1978). Growth rates of young calves during the liquid feeding period are much lower than the maximal growth rates of calves required (Hodgson 1971), and feed efficiency is lower than that in the young of other farm animals that consume milk *ad libitum* (Davis and Drackley 1998). Since milk alone cannot fulfill the requirement of vitamins and trace minerals, it should be supplemented with liquid diet (NRC, 2001). Supplementation of milk with trace elements and some vitamins might be beneficial to the neonatal calf, via stimulating gastrointestinal tract (GIT) growth and development, and enhancing health and metabolic status of neonatal calves (Kamada *et al.* 2007). Therefore, the present study was undertaken with the following objective as to study the effect of micronutrients supplement on the nutrient utilization and growth performance in pre-ruminant calves.

MATERIALS AND METHODS

Day old sixteen crossbred calves (body weight 24.50 ± 0.56 kg) were randomly divided into two groups consisting 8 calves in each following random distribution based on their birth dates. The calves were randomly allocated into two dietary treatments; control (C) and treatment (T)

groups. Each calf was fed colostrum within few hours of birth to 3 days. Thereafter, the calves were fed as per the schedule given in Table 1. Supplement (MS) was given to individual calf of treatment group from 4th day onward 10 ml upto 30 days, 12.5 ml from 31-60 days and 15 ml from 61-90 days of experimental feeding. 10 ml MS contains 50 mg Fe, 20 mg Mn, 20 mg Zn, 5 mg Cu, 0.15 mg I, 0.05 mg Co, 0.2 mg Se, 4000 IU vitamin-A, 600 IU vitamin-D, 50 IU vitamin-E, 0.5 mg Ascorbic acid.

Table 1. Feeding schedule of calves

Age (days)	Whole milk	Calf starter	Green fodder
4 – 6	1/10th of b.wt.	Nil	Nil
7 - 56	1/10th of b.wt.	*Ad lib.*	Ad lib.
57 - 63	1/20th of b.wt.	*Ad lib.*	*Ad lib.*
64- 70	1/40th of b.wt.	*Ad lib.*	*Ad lib.*

The calves were individually offered measured quantities of respective supplements in the morning (8.0 AM). Offered and refusals of ration from all the calves were weighed daily and sampled at weekly intervals for subsequent analysis of dry matter to assess the average dry mater intake during the experimental period. All calves were weighed before feeding and watering at fortnightly intervals to find out the live weight changes during the study period of three months in order to assess the changes in body weight and average daily gain. A digestion trial of 6 days collection period was conducted post 90 days of experimental feeding and daily record of feed offered, refusal and faeces voided was maintained. Feed and faecal samples collected were pooled and analyzed for proximate principles (AOAC, 2005) and fibre fractions (Van Soest *et al.* 1991). Data were subjected to independent 't' test for analysis of variance (ANOVA) as described by Snedecor and Cochran (2004) using statistical package for the social sciences, version17 (SPSS 17) software. The data were expressed as mean ± SE considering $P<0.05$ as significant.

RESULTS AND DISCUSSION

The chemical composition of the feeds (Table 2) was similar throughout the experimental period. The intake of dry matter (DM) did not differ significantly ($P<0.05$) between the dietary treatments (Table 3). This is in accordance with the findings of Kalita *et al.* (2010) who observed that on similar dietary regime, addition of mineral mixture had no effect on DM intake in crossbred calves. Conversely Berhanu *et al.* (2003) observed significantly ($P<0.05$) higher DM intake in crossbred heifers by supplementing zinc and iodine together.

The supplementation of MS in the diet of crossbred calves did not affect the intake and digestibility coefficients of CP, EE, NDF and ADF. It is in accordance with the findings of Tiwari *et al.* (2000), they reported no change in digestibility of nutrients viz. DM, NDF, ADF on additional supplementation of minerals. Digestibility of DM and OM in the present study was statistically ($P>0.05$) similar between 2 groups. This is in agreement with the earlier reported observations of Saxena and Ranjhan (1978) who found no significant effect of supplementation of cobalt and copper (0.22 ppm Co, 12.64 ppm Cu) separately and in addition to other macro and microelements on digestibility of DM, OM and CP of a roughage-concentrate mixed diet in calves.

Table 2. Chemical composition (% on DM basis) of calf starter and berseem

Particulars	Calf Starter	Green Berseem
DM	89.41	22.81
CP	21.52	15.21
EE	4.03	2.89
NDF	24.44	43.80
ADF	11.63	23.98
ASH	3.50	11.59

Mean daily DMI increased progressively with increase in age up to 7th fortnights of the total experimental period of 90 days and then remains constant during digestion trial. DMI when expressed in % of body weight was similar between C and T groups (2.51 vrs 2.54). It is within the range reported by Das *et al.* (1997) who observed DMI/100 kg body weight in crossbred calves varies from 1.99-2.54, some other worker have observed almost similar findings (Borah *et al*. 1987; Santra,1995). DM, CP, DCP, TDN intake and Dry matter (% body weight) were identical in two groups in present study. This is in accordance with the finding reported by Tiwari *et al.* (2000) that DCP and TDN intake did not change on additional mineral supplementation in crossbred calves. Mudgal *et al.* (2008) also suggested that supplementation of 10 ppm Cu and/

Table 3. Intake, digested (g/d) and digestibility (%) of nutrients in two different groups

Attributes	Control	Treatment	SEM	P value
Dry matter				
Calf starter	1259.70 ± 79.07	1359.60 ± 70.47	122.8	0.44
Green Berseem	320.10 ± 15.67	291.90 ± 11.10	13.56	0.08
Total DM Intake	1579.80 ± 81.25	1651.50 ± 79.50	55.52	0.54
Digested	1156.30 ± 74.02	1203.50 ± 90.39	56.51	0.69
Digestibility	72.89 ± 1.86	72.30 ± 2.30	1.34	0.84
Organic matter				
Intake	1516.30 ± 78.57	1587.40 ± 76.67	53.64	0.53
Digested	1165.70 ± 66.32	1181.20 ± 86.67	52.47	0.89
Digestibility	76.88 ± 1.75	73.86 ± 2.20	1.42	0.30
Crude protein				
Intake	311.10 ± 17.21	329.08 ± 16.28	11.65	0.46
Digested	219.90 ± 5.05	236.36 ± 5.76	4.33	0.14
Digestibility	69.42 ± 0.63	72.34 ± 0.76	0.62	0.15
Ether extract				
Intake	59.72 ± 3.23	62.96 ± 3.09	2.19	0.48
Digested	43.59 ± 3.39	46.41 ± 3.00	2.21	0.54
Digestibility	72. 60 ± 2.90	73.41 ± 1.84	1.65	0.82
Neutral detergent fibre				
Intake	484.95 ± 21.50	493.78 ± 22.40	14.96	0.78
Digested	285.56 ± 28.52	311.14 ± 25.25	18.68	0.52
Digestibility	58.26 ± 4.26	62.50 ± 2.93	2.55	0.43
Acid detergent fibre				
Intake	184.34 ± 7.31	177.60 ± 7.21	5.02	0.52
Digested	73.59 ± 6.58	75.04 ± 9.98	5.75	0.87
Digestibility	40.19 ± 3.58	42.16 ± 4.89	2.92	0.75

or 0.3 ppm Se along with 40 ppm zinc had no beneficial effect on the growth rate and nutrient utilization in the buffalo calves.

Body weight changes during 2nd, 4th, and 6th fortnights were significantly (P<0.05) higher in treatment group as compared to control group. The total body weight gain was 37.04 ± 1.62, and 42.49 ± 2.53 kg in respective groups. The average daily gain (g) during 2nd and 4th fortnight was also significantly (P<0.05) higher in treatment group than control group (Table 4). In treatment group, average daily gain (ADG) and total weight gain during experimental period was 14.73 % and 17.66 % higher than that of control group, although, over all body weight changes did not differ significantly between groups due to large variations within a group, but ADG (g) was significantly (P<0.05) higher in T group as compare to C group. Overall feed conversion efficiency (FCE) was 2.84 ± 0.36 and 2.72 ± 0.35 in control and treatment groups, respectively which did not differ between two groups. This finding is also supported by Osorio *et al.* (2008) who reported that there was an interaction of trace mineral source and plane of nutrition, meaning that organic trace minerals improved growth of calves on the accelerated plane of nutrition but had no effect on conventionally fed calves. Sikka *et al.* (2002) reported that mineral supplementation in buffalo calves improved the humoral immunity in terms of circulating immune bodies with a subsequent enhancement in growth. Similarly, Golombeski *et al.* (2008) reported that in conventionally fed calves, organic trace mineral

supplementation did not affect average daily gain, feed efficiency, or health parameters. Vinu *et al.* (2012) as well concluded that dietary supplementation of 0.3 ppm organic selenium (Se) did not improve the growth performance and nutrient utilization in crossbred calves.

Table 4. Fortnightly average daily gain (g) in different groups

Fortnights	Control	Treatment	SEM	P Value
I	337.5 ± 14.68	362.50 ± 23.93	13.94	0.39
II	350.00^{a} ± 27.47	446.66^{b} ± 37.46	26.96	0.02*
III	416.66^{a} ± 32.73	558.33^{b} ± 40.70	25.80	0.04*
IV	441.67 ± 17.54	516.67 ± 43.19	24.51	0.13
V	483.33 ± 37.27	519.17 ± 44.74	28.74	0.44
VI	440.42 ± 52.88	499.58 ± 46.19	34.77	0.41
VII	349.58 ± 63.52	408.33 ± 59.81	42.82	0.51
ADG (g)	402^{a} ± 21.61	473^{b} ± 26.35	19.6	0.04*
Total gain (kg)	37.04 ± 1.62	42.49 ± 2.53	1.61	0.12

*^{ab}Means with different superscripts within a row differ significantly

The apparently higher body weight gain in treatment group of present study might be due to growth promoting action of minerals however, Herd (1997) hypothesized that the usage of organic forms of trace minerals may be of greater value when an animal is under nutritional, disease or production stress. Similarly, Ward *et al.* (1992) demonstrated that source of trace minerals may result in differences with result to ADG and feed intake. Their findings showed improvement in the performance of feedlot calves during the first two weeks compared to feeding the sulfate form of trace minerals. Likewise, Moser *et al.* (1977) found that whole milk supplemented with 0.15 ppm selenium significantly increased weight gain of calves.

The result indicated that the supplementation of micro-nutrients in pre-ruminant calves showed significant improvement in average daily gain while the intake, feed efficiency and digestibility of nutrients were comparable in both the groups.

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