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Research Article

NUTRIENT AVAILABILITY AND SUPPLEMENTATION OF AREA SPECIFIC MINERAL S AND VITAMINS ON THE PERFORMANCE OF CROSSBRED COWS IN BARGARH DISTRICT OF ODISHA

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ABSTRACT: To assess the availability of nutrients and the effect of area specific mineral mixture supplementation along with vitamins on growth and serum mineral profile, thirty crossbred cows were randomly divided into three equal groups. Group T0 served as control, the animals here were maintained as per the traditional practices of the farmer without any nutritional intervention, whereas in T1 group animals were supplemented with area specific mineral mixture @ 50 g per day per animal, and in T2 group along with area specific mineral mixture, 5 ml of fat soluble vitamins containing Vit. A, Vit. D_3, Vit. E was injected to each animal at 0 day and 7th day of the experiment. This experiment was continued for 60 days, during which initial and final bodyweight was recorded. Blood samples were collected at 0 day and 60 days to assess the serum mineral concentrations. There was significant ($P<0.05$) increase in the serum mineral concentration (calcium, phosphorous, zinc, manganese and copper) of the treatment groups than the control. However, the average daily gain (g) of the treatment groups did not differ significantly ($P>0.05$) from the control group. The results suggest that supplementation of area specific mineral mixture alone or along with vitamins may enhance the serum minerals concentration without affecting body weight gain of crossbred cows.

Key words: Area specific mineral mixture, Vitamins, Cow, Serum mineral concentration.

INTRODUCTION

High incidence of reproductive disorder is one of the contributing factors for low economic output from the livestock sector. In Odisha, the incidence of reproductive disorder was 33.40% in cross bred cows and 51.20% in heifers (Das *et al.* 2016). Among all the factors under nutrition in general and deficiency of trace mineral in particular is one of the key area to be addressed to overcome the high incidence of reproductive disorders in cross bred cattle. Trace elements are involved in multiple physiological processes including carbohydrate and lipid metabolism, antioxidant activities and collagen formation thereby playing major role in body growth and production (Andrieu 2008). Insufficient minerals are considered to be the most common form of nutritional infertility which is mostly observed in crossbred animals.

Minerals such as zinc, copper, manganese and selenium in dairy cattle rations are important for functioning of a number of enzymes and proteins which are essential for a large number of digestive, physiological and biosynthetic processes within the body (Close 1998). Sharma *et al.* (2012) reported significant increase in body weight gain (15-20% higher than the control), improvement in general health, better feed conversion ratio and body coat texture by supplementation of area specific mineral mixture in growing heifers for a period of 60days. But Mohri *et al*. (2005) observed non-significant difference in weight gain of calves injected with vitamin E and Se at a dose of 300 IU Vit. E and 6 mg Se (sodium selenite) per 45 kg body weight. Samanta *et al.* (2005) observed higher serum Zn and Mn levels in mineral mixture supplemented cows. Therefore, an experiment was conducted on crossbred cows to find out the effect of area specific mineral mixture (ASMM) along with vitamins on their growth and serum mineral profile.

MATERIALS AND METHODS

An on-farm trial was carried out in Atabira block in Bargarh district of Odisha in which 30 crossbred cows were allotted to three different groups with 10 animals

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each in a completely randomized design. Treatments were: group T0 (control), group T1: animals were supplemented with ASMM @ 50 g per day per animal, group T2: 5ml of fat soluble vitamin, (VETADE injection, Sarabhai Zydus Animal Health Limited, Ahemadabad, Gujarat, India) containing vitamin A (2.5 lac IU), vitamin D3 (25000 IU) and vitamin E (100 IU) per ml, was injected to each animal at 0 day and 7th day along with ASMM (Dicalcium phosphate; 800g, Cupric sulphate: 200mg, Potasium iodide:1.63g, Manganous sulphate: 400mg, Zinc sulphate:500mg and Wheat flour: 200g) @ 50 g per day per animal. The experimental cows were maintained in the normal husbandry practices of the farmers in the village. The sheds were made up of thatched roof with pucca floor. Animals were vaccinated as per the standard protocol. All the animals were dewormed with broad spectrum anthelmintic (Fenbendazole @ 10 mg/kg body weight) to rule out the possible effect of worms on the animals. The area specific mineral mixture was prepared as per the reported formulation of Mohapatra *et al.* (2012). The experiment was conducted for a period of 60 days. The animals were not allowed to graze outside. During the experimental period, daily feed and fodders offered to the animals and residue left were recorded to calculate the dry matter (DM) intake. Average DCP and TDN intake of the animals were calculated based on reported DCP and TDN values (Ranjhan 1997). Representative samples of pasture grass, paddy straw, maize fodder, wheat bran and mung chuni were collected from the farmer's house for analysis of proximate principles as per AOAC (1995). The body weights of the animals were recorded at 0 day and 60 days of the experiment. About 10 ml of blood was collected from each cow by puncturing jugular vein in the morning (before watering and feeding) at zero day and 60 days of the experiment. The serum samples were collected and stored in a deep freeze at –20°C for estimation of minerals. The serum calcium and phosphorus were analyzed by using the kit prepared by CREST BIOSYSTEMS (India). The serum micro minerals like copper, zinc and manganese were determined by Atomic Absorption Spectrophotometer (ELICO-SL 243 Double Beam AAS, Hyderabad, India). Data were analyzed using SPSS (1996) and for comparison of mean of different groups, one way analysis of variance (ANOVA) and Duncan's multiple range tests were used (Steel and Torrie 1980) with significance level of $P < 0.05$.

RESULTS AND DISCUSSION

In the present study, mixed grass contained 5% protein and the mixed grass normally includes locally available grasses i.e. doob grass. Naik and Sengar (1997) reported that Doob grass contains 30% dry matter (DM), 16.64% crude protein (CP), 1.85% ether extract (EE), 26.09% crude fibre (CF), 46.15% nitrogen free extract (NFE) and 9.27% total ash (TA) (Table 1). The variation in proximate composition as observed might be due to the types of grasses grown in the survey area. The wheat bran contained higher CP (14.1%) and lower EE (5.5%) as reported by Kumar *et al*. (2011). The CP content of maize fodder ranged from 8-10%, pulse chuni ranged from 15-12% as reported by NDDB (2012). The digestible crude protein (DCP) and total digestible nutrient (TDN) supply are lower than their requirement (Table 2). The low socio-economic status and low productivity of the animals are the two major factors responsible for the dismal situation of nutrient supply to the animals in the present study. Sahoo *et al.* (2016) reported higher percentages of deficit in DCP and TDN in crossbred cows. The percentage of crossbred cow deficit in DCP and TDN ranged from 50.0 to 56.25 and 23.95 to 25.46, respectively in Jatni block of Puri district in Odisha. For instance, in crossbred cows with higher productivity, the percentage of animals deficient in nutrients is normally less. The supply of nutrients is dependent on the type of animal, productivity of animals, land holding and socio-economic status of the farmer, season and availability of resources (Mudgal *et al*. 2003, Singh *et al*. 2003, Ganai *et al*. 2004).

No significant ($P>0.05$) difference was observed in the average daily gain (ADG) of treated groups in

Table 1. Composition and nutritive value of feeds and fodders offered to the animals on dry matter basis.

Ingredients	Proximate composition (% DM basis).					
	Dry Matter	Crude Protein	Ether Extract	Crude Fiber	Nitrogen Free Extract*	Total Ash
Wheat Bran	85.27	15.36	3.25	12.82	62.60	5.97
Maize fodder	26.33	6.12	1.98	34.75	49.09	8.06
Mixed Grass	20.45	5.00	3.09	32.37	45.82	13.72
Mung Chunni	88.50	8.12	2.53	27.38	48.02	13.95
Paddy Straw	90.00	2.89	2.78	36.33	49.79	8.21

*Calculated values.

comparison to control group (Table 3). Sahoo *et al.* (2016) reported no significant (P<0.05) difference in the body weight as observed in the present study among the groups but reported significantly (P<0.05) higher body weight gain in mineral supplemented group than that of non-supplemented group. In contradiction to this finding, Mohapatra *et al.* (2012) also observed the similar findings in crossbred cows of Dhenkanal district of Odisha. Similarly, Nagabhushana *et al*. (2008) reported no significant effect on either ADG or the FCR in Holstein Friesen cows upon supplementation of Co as cobalt chloride for a period of 2 months. Fagari-Nobijari *et al.* (2012) supplemented Zn as $ZnSO_4$ (150mg/ kg of DMI) to Holstein Friesen cows and found significant (P<0.01)

Table 2. Availability of nutrients to the cross bred cows during the experiment.

Attributes	Groups			
	T0	T1	T2	P value
DM intake (kg)	5.70 ±0.23	5.79 ±0.4	5.53 ±0.38	0.31
DCP supply (kg)	0.23 ±0.03	0.27 ±0.04	0.22 ±0.03	0.27
TDN Supply (kg)	2.71 ±0.18	2.88 ±0.21	2.66 ±0.18	0.74
DCP Requirement (kg)	0.27 ±0.02	0.29 ±0.03	0.26 ±0.03	0.75
TDN Requirement (kg)	3.66 ±0.21	3.83 ±0.31	3.31 ±0.27	0.12
DCP Balance (kg)	(-)0.04 ±0.01	(-)0.02 ±0.01	(-)0.04 ±0.01	0.17
TDN Balance (kg)	(-)0.95 ±0.11	(-)0.95 ±0.16	(-)0.65 ±0.12	0.08
Percentage (%) deficit of DCP	17.39	7.40	18.18	—
Percentage (%) deficit of TDN	25.95	24.80	19.63	—

Table 3. Growth performance of the cross bred animals during the experiment.

Attributes	Groups			
	T0	T1	T2	P value
Initial Body Weight (kg)	287.60±8.95	298.20±18.35	317.40±13.33	0.39
60Days Body Weight (kg)	297.80±9.33	310.20±18.66	331.20±12.97	0.32
Avg. Daily Gain (gm)	170.00±40.62	200.00±33.33	230.00±27.59	0.88

Table 4. Mineral profile of cross bred animals under different dietary treatments.

Parameters		Groups			
		T0	T1	T2	P value
Ca (mg/ml)	0^{th} day	7.68±0.52	8.18±0.44	7.41±0.12	0.55
	60^{th} day	7.28^{a}±0.19	8.48^{b}±0.17	7.93^{b}±0.06	0.044
P (mg/ml)	0^{th} day	4.01±0.13	3.89±0.13	4.13±0.11	0.39
	60^{th} day	3.84^{a}±0.15	4.69^{b}±0.09	4.40^{b}±0.08	0.031
Zn (ppm)	0^{th} day	0.65±0.04	0.63±0.03	0.67±0.06	0.97
	60^{th} day	0.65±0.04	1.15^{b}±0.02	1.07^{b}±0.01	0.001
Mn (ppm)	0^{th} day	0.31±0.03	0.29±0.05	0.28±0.02	0.80
	60^{th} day	0.31^{a}±0.01	0.64^{c}±0.01	0.51^{b}±0.01	0.002
Cu (ppm)	0^{th} day	0.73±0.03	0.73±0.02	0.71±0.02	0.97
	60^{th} day	0.71^{a}±0.02	1.07^{b}±0.03	1.03^{b}±0.02	0.001

Values bearing different superscripts in a row differ significantly (P<0.05).

decrease in the ADG and feed conversion ratio. Contradicting this, Sawant *et al*. (2013) observed increase in the total body weight gains and feed conversion efficiency in indigenous heifers supplemented with minerals blended with vitamins mixture. 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. Amrutkar *et al*. (2012) reported decreased weight gain by supplementing 5% and 10% lime stone powder.

The mean serum concentration of major minerals Ca and P (mg/dl) and trace minerals Zn, Cu, Mn (ppm) differed significantly ($P<0.05$) in the treated groups from the control group (Table 4). Similar to our findings, Samanta *et al.* (2005) found significantly higher serum phosphorus level in mineral supplemented group than non-supplemented cows. Tambe *et al*. (1998) also reported increase in serum Mn concentration due to mineral supplementation. Upadhyay (2004) also found that mineral supplemented animals had significantly higher serum Cu than the non-supplemented ones. Satpathy *et al*. (2016) reported significantly higher serum Ca, P Zn, Cu and Mn levels on mineral supplementation in crossbred cows. However, in contrast to this, lower serum Mn level was observed in mineral supplemented animals than non-supplemented animals by Upadhyay (2004). 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. Kojouri and Shirazi (2007) observed that supplementing Se and vitamin E could result in Zn deficiency in ewes.

CONCLUSION

Supplementation of area specific mineral mixture @ 50 g per day per animal alone or along with 5ml of fat soluble vitamins increased the serum levels of Ca, P, Cu, Zn and Mn without affecting the growth performance in crossbred cows.

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