Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.5941

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **5 (5):** 1378-1383 (2017)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Effect of Supplementation of Chelated Minerals on Growth Performance of Buffalo Calves

Deepak Kumar[1], Surinder Singh Grewal[1], Ravi Kumar[1*], Ramkaran[3], Sajjan Sihag[2], Harish Rohila[1] and Narender Singh[1]

[1]Department of Livestock Production Management, Collage of Veterinary Sciences,

[2]Department of Animal Nutrition, Collage of Veterinary Sciences,

[3]Department of Veterinary Physiology and Biochemistry, Collage of Veterinary Sciences,

LLR University of Veterinary and Animal Sciences, Hisar-125004, Haryana, India

*Corresponding Author E-mail: ravighotar@gmail.com

Received: 18.09.2017 | Revised: 22.10.2017 | Accepted: 26.10.2017

ABSTRACT

Fifteen buffalo calves of average six to ten months old were used to determine the effects of supplementation of chelated minerals on their growth performance. Calves were divided into three groups each having five animals in such a way that mean body weight was similar (P>0.05) among the groups. Each group was assigned to one of the following diets as: control diet with conventional mineral mixture (T_1), diet with 50% conventional mineral mixture replace with chelated minerals (T_2) and diet with 100% conventional mineral mixture replace with chelated minerals (T_3). Body weight of experimental buffalo calves at fortnightly intervals under different treatment showed no significant difference (P>0.05) except at the end of experiment at 120 days where significantly higher body weight was observed in T_3 than T_1. Average daily gain (ADG) was found significantly higher (P<0.05) in the chelated mineral supplemented group compared to T_1 after 45 days of supplementation. Average increase in body length and height were higher (P<0.05) in T_3 as compared to T_1 while total gain in heart girth and abdominal girth was significantly higher (P<0.05) in T_3 as compare to T_2 and T_1. The present study concluded that feeding of chelated minerals has beneficial effect on body weight, body weight gain and body measurements in buffalo calves.

Key words: *Calves, Chelated minerals, Growth performance, Body measurements*

INTRODUCTION

Minerals are essential for growth and reproduction and are involved in a large number of digestive, physiological and biosynthetic processes in the body. Animal obtain minerals through the consumption of natural feeds, fodders and supplementation of inorganic salts as mineral mixture in the ration. Minerals are supplied to the livestock through mineral mixture in the inorganic form. One of the major disadvantages of using such supplements is that the minerals from such sources are not fully absorbed due to antagonism and anti-nutritional factors present in the diet.

Cite this article: Kumar, D., Grewal, S.S., Kumar, R., Ramkaran, Sihag, S., Rohila, H. and Singh, N., Effect of Supplementation of Chelated Minerals on Growth Performance of Buffalo Calves, *Int. J. Pure App. Biosci.* **5(5):** 1378-1383 (2017). doi: http://dx.doi.org/10.18782/2320-7051.5941

In addition, higher levels of inorganic salt based mineral mixture resulted in increased excretion, which may cause environmental pollution. Therefore, in order to meet the increasing demand of bio-available elements and to reduce the contamination of surface water and soil, the concept of chelated mineral / mineral proteinate came up[13]. A chelated mineral is a mineral such as copper, zinc, manganese, cobalt or iron (there are others) that is bonded to "small proteins", peptides or amino acids. The level of chelated minerals in livestock feeding is typically added at 25-30% of the total mineral in a feed[6]. There are several studies in different animal species with different sources of different mineral elements, which have revealed notable differences in the bioavailability of organic and inorganic minerals. Studies suggest that binding of Cu, Zn, Fe and Mn with amino acids and peptides can enhance the bioavailability of these trace minerals, thereby leading to improved milk production, growth, reproduction and general health status in livestock[12].

Due to the paucity of the literature on the effect of chelated mineral on the growth performance of buffalo calves, the present study has been planned to evaluate the efficacy of chelated mineral mixture on the growth performance of buffalo calves.

MATERIALS AND METHODS

The experiment was conducted for the period of four months at Buffalo farm, Department of Livestock Production Management, LUVAS, Hisar to study the effect of supplementation of chelated minerals on the growth performance of buffalo calves. The fifteen buffalo calves were randomly distributed into three treatment groups each having five buffalo calves in such a manner that average body weight and age of each experimental group was statistically similar. In treatment T_1 (control) animals were fed with seasonal green fodder, wheat straw and conventional concentrate mixture throughout the experiment period while treatment T_2 animals were fed similar to T_1 but 50% conventional minerals mixture were replaced by chelated minerals. Likewise in treatment T_3 conventional concentrate mixture was supplemented with 100% chelated minerals per animal per day. The amount of concentrate mixture was given to each group in such a way that the experimental ration remains iso-nitrogenous and iso-caloric. The quantity of different feeds given to each group was adjusted at fortnightly intervals so that the overall DCP requirements of buffalo calves were met according to the change in body weight. All the animals were maintained under isomanagerial condition and similar husbandry practices except the different feed treatment during the experimental period. The animals were given the diet as per ICAR[11] feeding standard. Animal were given *ad lib* fresh water throughout the experimental period. All the animal were de-wormed and disinfected for ectoparasites as per the standard protocol followed in the farm.

Observation recorded

1. Body weight gain

The buffalo calves were weighted at the beginning of the experiment and thereafter at fortnightly intervals using standard platform weighing balance (Avery, capacity 1000kg) installed at animal farm, LUVAS, Hisar. The body weight was recorded in the morning before providing any water or feed to the buffalo calves. These body weights were used for determining the growth rate and also for the purpose of the computing the ration for the buffalo calves.

2. Body parts measurements

Body measurements viz. body length, height, heart girth and abdominal girth of experimental animals were recorded in centimeters (cm) at the beginning and then at the monthly interval during the experiment. Body measurements were recorded in the morning before providing feed and water to the animals.

Statistical analysis

The data were analyzed statistically using standard methods[12]. The data were expressed as Mean ± SE and were analyzed by one-way

ANOVA using general linear model of SPSS version 16 and Duncan's multiple range tests was applied to test the significance. Significance was declared when P value is less than 0.05[3].

Chemical composition of the concentrate mixtures[1]

Chemical composition of the concentrate mixtures of various proximate nutrients and mineral contents has been presented in table **1, 2, 3** and **4**.

Table 1: Ingredient composition of experimental concentrate mixture (kg)

Ingredient	T_1	T_2	T_3
Maize	15	15	15
Wheat	15	15	15
GNC	25	25	25
Mustard Cake	15	15	15
Wheat Bran	27	27	27
Common salt	1	1	1
Mineral mixture	2	2*	2**
Total	100	100	100

*supplemented @conventional mineral mixture replaced with 50 % chelated minerals

**supplemented @conventional mineral mixture replaced with 100 % chelated minerals

Table 2: Proximate composition (per cent) of concentrate mixture

Treatments	Attribute								
	DM	OM	CP	CF	EE	NFE	TA	NDF	ADF
T_1	89.77	89.3	19.93	6.97	4.12	52.36	10.70	37.44	18.60
T_2	90.01	89.31	19.90	6.92	4.05	52.12	10.69	37.40	18.25
T_3	89.04	89.35	19.80	6.88	4.09	52.26	10.65	37.47	18.44

Table 3: Inorganic and chelated elements composition of different mineral supplement in ration of buffalo calves

Minerals (%)	Inorganic Minerals	Chelated Minerals
Zinc	0.9%	0.9%
Copper	0.4%	0.4%
Manganese	0.35%	0.30%
Cobalt	0.15%	0.15%
Iron	3%	2.8%

Table 4: Chemical composition (%) of whole diet fed to the experimental animals

Ingredients	DM	OM	CP	CF	EE	ASH	NDF	ADF	NFE
Maize	92.20	97.50	9.03	2.65	3.39	2.50	67.70	44.36	82.43
Wheat	91.61	97.77	10.89	2.77	3.15	2.23	23.07	10.12	80.96
Wheat Bran	92.86	93.88	12.00	11.83	1.01	27.07	49.23	16.13	48.09
GNC	92.70	90.00	39.60	8.00	8.30	7.50	19.20	10.12	37.04
Mustard cake	93.46	93.17	34.62	8.33	6.25	6.83	23.50	13.27	43.97
Maize Green	25.00	14.30	7.45	27.00	3.40	10.70	64.87	37.84	51.45
Wheat Straw	90.00	78.00	2.81	35.00	1.05	12.00	74.83	51.90	49.14

RESULT AND DISCUSSION

Body weight:

Initial average body weight of all the treatment groups i.e. T_1, T_2 and T_3 were 94.00, 93.60 & 94.80 kg and at the end of experiment they were 158.0, 164.60 and 172.80 kg, respectively. No significant difference could be established between the various treatment groups in respect to body weight (BW) in first 105 days of trial, however, at 120 days of

experimental period body weight (BW) was significantly (P>0.05) higher in experimental calves of treatment group T_3 which were fed diet supplemented with100% chelated minerals as compare to control T_1 with inorganic mineral mixture.

Table 5: Average body weight (BW) of all the experimental buffalo calves at fortnightly interval

Days	T_1	T_2	T_3
0	94.00±5.64	93.60 ± 4.26	94.80 ± 4.07
15	101.20±5.30	101.60 ±4.02	103.20±3.44
30	108.80±4.28	110.40 ±3.18	112.00±2.68
45	116.80±5.28	119.20 ± 2.41	122.00 ±2.68
60	124.40±5.44	127.60 ±2.31	131.20±2.41
75	132.40±5.13	136.40 ±2.04	141.20 ± 2.41
90	140.80±4.39	145.60 ±1.72	151.60 ± 2.40
105	149.60±4.22	155.20 ± 1.74	162.40 ± 2.63
120	158.00^{a}±4.29	164.60^{ab} ± 2.19	172.80^{b} ± 2.41

Mean values with different superscripts in a row differ significantly (P<0.05). The mean values in a row with different superscripts differ significantly between the treatments (P<0.05)

Table 6: Body weight gain of buffalo calves during experimental period

Attribute	Treatments		
	T_1	T_2	T_3
Initial body weight (kg)	94.00±8.64	93.60±4.26	94.80±4.07
Final body weight	158.00^{a}±7.29	164.60^{ab} ± 2.19	172.80^{b} ± 2.41
Total body weight gain (Kg)	64.00^{a}±2.19	70.80^{ab} ± 3.44	78.00^{b} ± 1.67
Body weight Gain/day (gm)	0.533^{a}±0.18	0.590^{ab} ± 0.28	0.650^{b}± 0.15

Values are means ±standard errors

Means values in a row with different superscripts differ significantly between the treatments (P<0.05)

Average increase in body length (table 7) and height (table 8) were significantly higher (P<0.05) in calves fed chelated mineral (T_3) replacing 100 % inorganic mineral mixture as compared to control (T_1), however, did not differ significantly between groups T_1& T_2 and T_2 & T_3. Similarly the total gain in heart girth (table 9) and abdominal girth (table 10) was significantly higher(P<0.05) in calves supplemented with chelated minerals (T3) as compare to calves fed inorganic mineral mixture or 50% replacement of inorganic mineral mixture with chelated minerals.

Table 7: Body length of buffalo calves during experimental period

Attributes	Treatments		
	T_1	T_2	T_3
Initial body length (cm)	80.20±2.90	78.80±1.59	80.20±1.35
Final body length (cm)	96.40±2.31	97.60±1.16	101.00±2.19
Total body length gain (cm)	16.20^{a}±0.80	18.80^{ab} ±0.73	20.80^{b}±1.11

Values are means ±standard errors

The Means values in a row with different superscripts differ significantly between the treatments (P<0.05)

Table 8: Body height of buffalo calves during experimental period

Attributes	Treatments		
	T_1	T_2	T_3
Initial body height (cm)	86.20±1.98	87.40±2.08	86.60±3.12
Final body height (cm)	101.00±2.86	102.80±2.15	104.40±1.72
Total body height gain (cm)	14.80^{a}±1.24	15.40^{ab}±0.74	17.80^{b}±0.49

Values are means ±standard errors

The Means values in a row with different superscripts differ significantly between the treatments (P<0.05)

Table 9: Heart girth of buffalo calves during experimental period

Attributes	Treatments		
	T_1	T_2	T_3
Initial heart girth (cm)	107.60±3.41	108.00±1.94	108.00±1.28
Final heart girth (cm)	125.20±3.24	127.20±1.01	131.80±2.05
Total heath girth gain (cm)	17.60^{a}±0.81	19.20^{ab} ±1.20	20.00^{b} ±0.93

Values are means ±standard errors

The Mean means values in a row with different superscripts differ significantly between the treatments (P<0.05)

Table 10: Abdominal girth of buffalo calves during experimental period

Attributes	Treatments		
	T_1	T_2	T_3
Initial Abdominal girth (cm)	126.80±3.72	130.20±2.43	128.80±1.62
Final abdominal girth (cm)	145.60±4.01	151.20±1.74	152.40±2.03
Total Abdominal girth gain (cm)	18.80^{a}±1.49	20.40^{ab}±1.32	24.20^{b}±1.98

Values are means ±standard errors

The Means values in a row with different superscripts differ significantly between the treatments (P<0.05)

The results of the study revealed that total weight gain and gain per day were significantly (P<0.05) higher in calves fed ration supplemented with chelated minerals as compared to inorganic mineral mixture, however, supplementation of 50% chelated mineral replacing inorganic mineral mixture had no significant effect over control. Improvement in body weight due to feeding of chelated minerals in T_2 and T_3 treatments respectively might be due to the better availability of minerals at absorption site in small intestine as chelated minerals escape the rumen and being available for the absorption in the small intestine and helps in better growth of Buffalo calves. Mowat *et al*.[9] also observed that 12.9% increase in average daily gain of steer calves when fed chelated chromium. Hong *et al*.[5] observed that 5.5 – 11.4% increase in daily weight gain of beef steer when basal diet was supplemented with chelated chromium. Mallaki *et al*[7],also found similar pattern of significant (P<0.05) improvement in average daily weight gain in lambs by supplementing zinc peptide in treated group over control. Gerg *et al.*[4] also reported supplementation of Zn-methionine in the basal diet (containing 34 mg Zn/kg DM) of the lambs significantly improved their growth rate. Similarly Bhanderi *et al.*[2] concluded that supplementation of MBOTMs at NRC requirement in male calves can improve the body weight gain than that of inorganic trace minerals. Our results are in agreement with previous finding of Mondal *et al*.[8] who reported the similar pattern of significant (P<0.05) improvement in average daily weight gain in male calves by supplementing chelated minerals in treated group over control.

CONCLUSION

From the result obtained in the present study it can be concluded that feeding of chelated minerals has beneficial effect on body weight and body weight gain.

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