Original Article

Journal of Animal Feed Science and Technology
Volume 10 Number 2, July - December 2022
DOI: http://dx.doi.org/10.21088/jafst.2321.1628.10222.1

Effect of Supplementation of Chelated Minerals on Growth Performance of Buffalo Calves in Surat District

H C Parmar[1], J K Movaliya[2], J K Raval[3]

How to cite this article:

H C Parmar, J K Movaliya, J K Raval/Effect of Supplementation of Chelated Minerals on Growth Performance of Buffalo Calves in Surat District/ J of Ani Feed Sci and Tech/ 2022;10(2):45–52.

Abstract

The present study was undertaken to evaluate the influence of supplementation of chelated mineral mixture on growing buffalo calves in the field through front line demonstration. Sixteen buffalo calves were divided into two equal groups viz., Group T1 (Control) and T2 (treatment). Group T1 received roughages and concentrate mixture prepared as per the practice of farm and group T2 received same ration as per group T1 and supplemented with chelated mineral mixture @ 25g/day. The results of the study revealed that on or after 120 days of supplementation in T2 group there was significantly higher ($P<0.05$) bodyweight gain, DMI, FCE, Body measurements, as compared to control T1 group, while average mean of feeding cost did not differ significantly ($P<0.05$) in calves of both the groups so the present study was finally concluded that feeding of chelated minerals has beneficial effect on growing calves.

Keywords: Chelated mineral mixture; Buffalo calves; Body weight; Feed conversion efficiency.

INTRODUCTION

Buffaloes are known to be more efficient in utilizing fiber component of the coarse feed than cattle and they thrive well on crop residues and agricultural byproducts.[1] There are 0.3 million buffalo heads in Surat district as per the 18th livestock Census of India. Farmers prefer to use buffaloes for utilization of low quality roughages, docile temperament, more disease resistance and long working life. Buffalo plays a pivotal role in Indian dairy industry. But poor growth rate in calves results in higher age at first calving and in turn reduces the economic value. As calves are future herd of a dairy farm, their optimum growth must be ascertained. Lower growth rate in the early life of the calves may be due to lack of adequate nutrition associated with improper feeding management practices.[2] In physical term, minerals and vitamins constitute only a small proportion of the diet, but their values are more importance in the feed. A mineral pays vital roles in animal's life. They are required in very small amounts in comparison to other nutrients; however, their deficiency results in poor animal growth. Supplementation of trace elements in animal diets has long been practiced in order to ensure their rapid growth, boost reproductive performance and improve immune response.[3] Trace mineral deficiency becomes as primary deficiency when minerals

Author Affiliation: [1]Assistant Professor, Department of VCC, [2]Assistant Professor, Department of Livestock Farm Complex, College of Veterinary Science & AH Kamdhenu University, Navsari 396450, Gujarat, India, [3]Assistant Research Scientist, Department of Livestock Research Station, Navsari Agricultural University, Navsari 396450, Gujarat, India.

Corresponding Author: J K Movaliya, Assistant Professor, Department of Livestock Farm Complex, College of Veterinary Science & AH Kamdhenu University, Navsari 396450, Gujarat, India.

E-mail: jkmovaliya@kamdhenuuni.edu.in

Received on: 05.01.2022 **Accepted on**: 12.02.2022

intake is inadequate and becomes secondary deficiency when other factors in the diet interfere with the absorption and metabolism. Overdose supplementation of trace minerals than its requirement is common practice at field level. In that concern, over supplementation of one mineral may interfere with the absorption and availability of other minerals.[4] To resolve this problem, supplementation of organic minerals was developed, in that minerals are chelated with organic source and relatively high bio-available compared to inorganic minerals.[4] 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.[5] Due to the shortage of the literature on the effect of chelated mineral on the mineral concentration of buffalo calves, the present study has been planned to evaluate the efficacy of chelated mineral mixture on growth performance of buffalo calves.

METHODOLOGY

Sixteen buffalo calves of 4-8 months of age were selected at farmer's field level from two different buffalo farms of Surat district. Before the commencement of experiment, all the buffalo calves were dewormed against parasites. After the preliminary adaptation period of seven days, buffalo calves were divided into two groups of eight calves in each group on the basis of body weight and age (Table 1). Both the groups at both the farms rearing condition and feeding pattern were similar. In group T1 (control) animals were fed with seasonal green fodder, paddy straw and concentrate mixture throughout the experiment period while group T2 animals were fed similar to group T1 but supplemented with chelated minerals @ 25g per day. The trial continued for 150 days. Experimental buffalo calves were tied in well ventilated common shed and feeding and watering separately in both the farms. All the experimental animals were weighed before start of experiment and thereafter at fortnight interval using standard platform weighing balance. The body weight was recorded in the morning before providing water or feed to the buffalo calves which were used for determining the growth rate. For feeding intake parameters, all the groups of calf inputs feeding of 24 hrs at fortnight interval measured. Body measurements viz. height of withers, body length, chest girth and abdominal girth of experimental animals were recorded in centimetres (cm) at the beginning and 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 analysed statistically using standard methods. The data were expressed as Mean ± SE and were analysed by one-wayANOVA using general linear model of SPSS version 14 and Duncan's multiple range tests was applied to test the significance at $P< 0.05$.

RESULTS AND DISCUSSIONS

Daily Weight Gain (g/Day)

Average daily weight gains up to 105 days revealed insignificant between experiment group T2 and T1. On the 150 days, average daily weight gains of treated group T2 and control group T1 were 141.60 and 159.89 g/d, respectively (Table 1). The results of the study revealed that on or after 120 days of experiment, there was significantly higher ($P<0.05$) bodyweight gain in T2 group as compared to control T1 group. Improvement in body weight due to feeding of chelated minerals in T2 treatments 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.

Above finding are in agreement with findings of ***Mowat*** et al.[6] and ***Hong*** et al.[7]observed that there was increase in daily weight gain of beef steer when basal diet was supplemented with chelated chromium. ***Bhanderi*** et al.[8] concluded that supplementation of MBOTMs at NRC requirement in male calves can improve the body weight gain than that of inorganic trace minerals. Similarly, ***Mondal*** et al.[9], ***Kadu*** et al.[10] and Chang et al[11] also observed similar pattern of significant ($P<0.05$) improvement in daily weight gain in

Table 1: Body weight of experiment and control calves

Days	Control	Treatment	P values
0	86.06 ± 4.36	86.86 ± 5.05	0.9
15	92.13 + 4.31	93.77 ± 5.00	0.795
30	98.02 ± 4.29	100.75 ± 5.06	0.67
45	103.73 ± 4.21	108.09 ± 5.11	0.499
60	109.46 ± 4.22	115.52 ± 5.08	0.346
75	114.72 + 4.21	122.74 ± 5.03	0.221
90	120.10 ± 4.17	130.36 ± 4.93	0.126
105	125.57 ± 4.18	138.03 ± 4.93	0.073
120	130.88^{a} ± 4.16	145.53^{b} ± 4.81	0.039
135	136.23^{a} ± 4.13	152.53^{b} ± 4.92	0.027
150	141.60^{a} ± 4.20	159.49^{b} ± 4.87	0.019

Values are Means ± SE, Means bearing different superscript in a column differ significantly (P < 0.05)

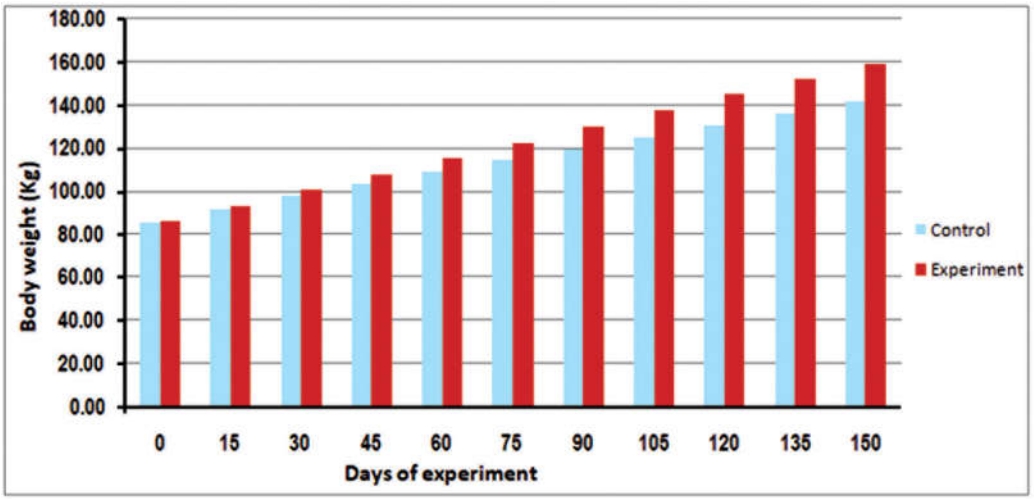

Chart. 1. Body weight of experiment and control calves.

Table 2: Body weight gain of buffalo calves during experimental period

Parameters	Control	Treatment
Initial body weight (kg)	86.06^{a} ± 4.36	86.86^{a} ± 5.05
Final body weight (kg)	141.60^{a} ± 4.20	159.49^{b} ± 4.87
Total body weight gain (Kg)	55.46^{a} ± 3.81	72.79^{b} ± 3.98
Body weight Gain/day (gm)	0.369^{a} ± 0.18	0.485^{b} ± 0.21

Values are Means ± SE, Means bearing different superscript in a column differ significantly (P < 0.05)

crossbred calves, when supplemented with mineral mixture and different types of Zinc.

Dry Matter Intake (kg/day)

There was increased in DMI during progressive growth period of calves under treatments of supplementary dietary chelated minerals. The dry matter intake values did not differ significantly up to 90 days of experiment between treatments and control group, however, on or after 105 days'dry matter intake increased significantly ($P<0.05$) in calves of treatment group T2 which were fed diet supplemented with chelated minerals as compared to control T1 group (Table 3).

Table 3: Dry Matter Intake (DMI) of buffalo calves during experimental period

Days	Control	Treatment	P values
0	1.869 ± 0.034	2.244 ± 0.059	0.056
15	2.134 ± 0.041	2.267 ± 0.073	0.537
30	2.388 ± 0.055	2.298 ± 0.028	0.569
45	2.340 ± 0.032	2.556 ± 0.024	0.209
60	2.662 ± 0.032	2.635 ± 0.038	0.81
75	2.829 ± 0.062	2.891 ± 0.083	0.801
90	2.868 ± 0.021	3.151 ± 0.026	0.066
105	2.832^{a} ± 0.031	3.248^{b} ± 0.035	0.035
120	2.839^{a} ± 0.040	3.705^{b} ± 0.063	0.005
135	3.115^{a} ± 0.025	3.818^{b} ± 0.057	0.007
150	3.515^{a} ± 0.028	4.140^{b} ± 0.033	0.003

Values are Means ± SE, Means bearing different superscript in a column differ significantly ($P < 0.05$)

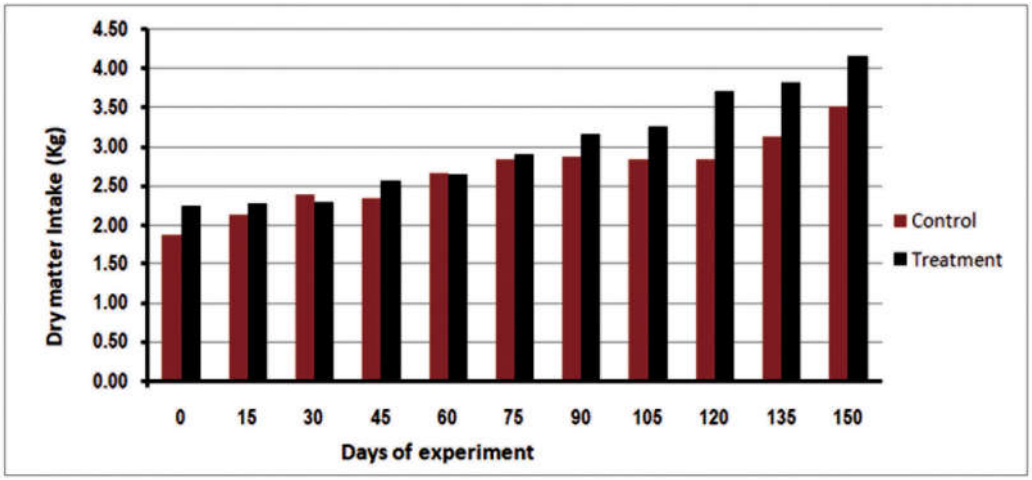

Chart. 2. Dry Matter Intake (DMI) of experiment and control calves.

The present finding of the study are in comparable with earlier reports of ***Kumar*** et al.[12, 13] and ***Mallaki*** et al.[14] who observed that dry matter intake was significantly more in buffalo calves and in lambs in study of supplemented chelated minerals and organic zinc respectively.

Feed Conversion Efficiency (FCE)

The average feed conversion efficiency was not significantly differing up to 45 days of experiment but at 60 days and after it was significantly increased in treatment (T2) group as

Table 4: Average feed conversion efficiency of buffalo calves during experimental period

Days	Control	Treatment	P values
15	18.75 ± 1.59	21.19 ± 1.89	0.327
30	17.74 ± 0.98	20.47 ± 0.99	0.076
45	15.99 ± 1.42	19.38 ± 1.00	0.107
60	13.92 ± 0.93	19.05 ± 1.01	0.006
75	13.04^{a} ± 0.73	17.37^{b} ± 1.13	0.03
90	13.34^{a} ± 0.51	17.18^{b} ± 0.81	0.017
105	13.32^{a} ± 0.48	16.78^{b} ± 0.43	0.004
120	11.96^{a} ± 0.53	15.49^{b} ± 0.57	0.001
135	11.30^{a} ± 0.21	13.67^{b} ± 0.45	0.002
150	11.53^{a} ± 0.24	12.76^{b} ± 0.22	0.001

Values are Means ± SE, Means bearing different superscript in a column differ significantly (P < 0.05)

compare to control group (T1). It follows similar trend up to end of experiment at 150 days. The mean FCE values at the end of experiment, for control T1and T2 treatment was 11.53 and 12.76 respectively (Table 4).

The results are in agreement with ***Kumar*** et al.[12,13] and ***Mudgal*** et al.[15] were studied effect of chelated minerals on buffalo calves. Similarly, Mallaki et al[14] also reported improved FCE in lambs fed chelated minerals. Dey and Garg[16] observed significantly improved feed efficiency in weaned albino rats given organic zinc supplemented compared to untreated groups.

Body Measurements (cm)

Average mean of height of withers, body length, chest girth and abdomen girth in treatment and control group were presented in table no. 3. At the end of the treatment, the mean values of height of withers, body length, chest girth and abdomen girth were 111.35, 137.53, 150.08 and 131.10 cm in treatment (T2) group respectively. It showed higher significant difference (P<0.05) at 150 days in calves fed chelated minerals in treatment group (T2) as compared to control (T1) however,

Table 5: Body measurement of buffalo calves during experimental period

	Parameters	Control	Treatment
Height of wither	Initial height of wither (cm)	87.43^{a} ± 5.58	88.55^{a} ± 12.00
	Final height of wither (cm)	106.12^{a} ± 2.57	111.35^{b} ± 5.12
	Total height of wither gain (cm)	18.70^{a} ± 0.92	22.80^{b} ± 3.62
Body length	Initial body length (cm)	109.93^{a} ± 4.16	111.25^{a} ± 8.91
	Final body length (cm)	132.75^{a} ± 2.25	137.53^{b} ± 10.19
	Total body length gain (cm)	22.83^{a} ± 0.52	26.27^{b} ± 1.63
Chest girth	Initial Chest girth (cm)	109.35^{a} ± 4.37	109.90^{a} ± 15.29
	Final Chest girth (cm)	142.23^{a} ± 9.44	150.08^{b} ± 21.00
	Total Chest girth gain (cm)	32.88^{a} ± 1.50	40.18^{b} ± 1.89

Abdomen girth	Initial Abdomen girth (cm)	105.59[a] ± 6.81	105.073[a] ± 7.64
	Final Abdomen girth (cm)	122.84[a] ± 7.37	131.10[b] ± 19.29
	Total Abdomen girth gain (cm)	17.25[a] ± 1.08	26.03[b] ± 0.60

Values are Means ± SE, Means bearing different superscript in a column differ significantly (P < 0.05)

these parameters did not differ significantly between groups T1 and T2 up to 120 days of experiment. Similarly, the total gain in height of withers, body length, chest girth and abdomen girth were significantly higher (P<0.05) in calves supplemented with chelated minerals (T2) as compare to control calves (Table 3).

The results of the study revealed that body measurement parameters were significantly (P<0.05) higher in calves fed ration supplemented with chelated minerals as compared to control calves, however, supplementation of chelated mineral up to 120 days had no significant effect over control. According to James[17], about 50% of the total gain in chest girth occurs during the first 6 months, 25% from 7-12 months and the remaining 25% during the last 12 months and the age of the experimental animal (group A Cow calf and group B Buffalo calf) were 1 year 8 months and 1 year 8.5 months, respectively. Our study result is contradictory with the findings of ***Muehlenbein*** et al[19] who found no significant difference (P>0.10) among treatments in cow body condition scores at various times through the study when fed with chelated minerals.

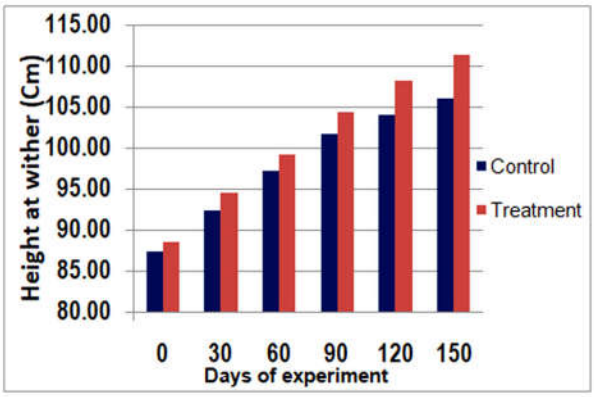

Chart 3: Height of wither of buffalo calves

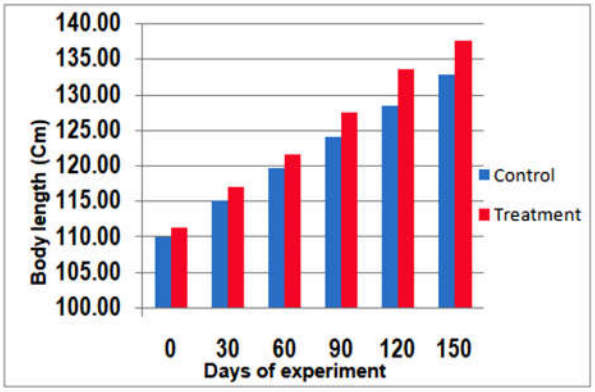

Chart 4: Body length of buffalo calves

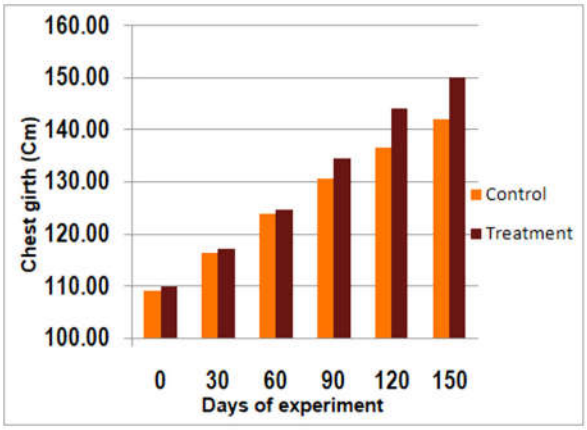

Chart 5: Chest girth of buffalo calves

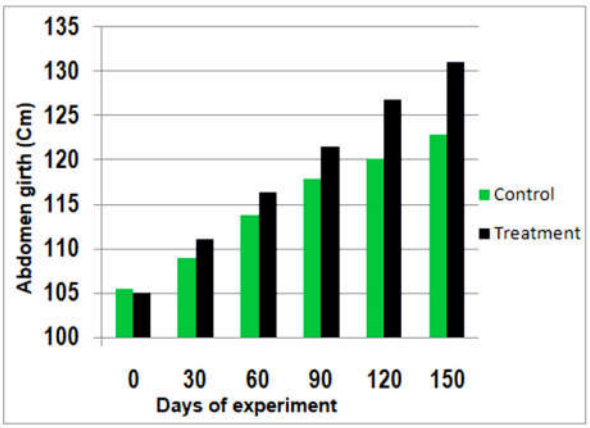

Chart 6: Abdomen girth of buffalo calves

Feeding Cost (Rs.)

At the end experiment, the mean values of feeding cost were 48.291 and 40.255 rupees per unit weight gain in treatment (T2) and control (T1) groups respectively. Average mean of feeding cost did not differ significantly (P<0.05) in calves supplemented with chelated minerals (T2) as compare to control calves (Table 6) throughout the experiments. The results of present study

Table 6: Feeding cost of buffalo calves during experimental period

Days	Control	Treatment	P values
0	25.021 ± 6.62	23.576 ± 3.63	0.834
15	27.092 ± 10.85	36.462 ± 32.17	0.537
30	26.815 ± 11.46	23.023 ± 9.42	0.569
45	24.779 ± 6.70	31.227 ± 13.72	0.642
60	40.565 ± 19.89	36.676 ± 9.00	0.81
75	36.260 ± 11.86	38.727 ± 17.48	0.801
90	42.119 ± 8.51	41.977 ± 16.10	0.909
105	36.539 ± 13.10	32.779 ± 18.39	0.1
120	47.239 ± 15.39	50.173 ± 15.99	0.786
135	41.461 ± 5.26	40.664 ± 25.38	0.165
150	40.255 ± 5.81	48.291 ± 26.38	0.959

are supported by ***Butani*** et al.[19] who recorded that the feed cost per unit weight gain reducedin supplementation of chelated minerals as compared to inorganic mineral mixtures in growing calves.

CONCLUSION

The present study was finally concluded that feeding of chelated minerals has beneficial effect on the feed conversion efficiency, body weight gains and growth performance of buffalo calves.

ACKNOWLEDGEMENT

Author is thankful to Navsari Agricultural University that organization has given the opportunity to do the trial during his tenure at Krishi Vigyan Kendra, NAU, Surat.

REFERENCES

1. Devendra C. The potential value of grass and crop by-products for feeding buffaloes in Asia. Buffalo Production for small farms. Food Fertil Technol. 1980;15:141-160.
2. Overton TR, Yasui T. Practical applications of trace minerals for dairy cattle. J. Anim. Sci. 2014; 92:416-426.
3. Underwood EJ, Suttle NF. The Mineral Nutrition of Livestock. 3rd Edition, CABI Publishing, Wallingford, Oxon, 1999;283-292.
4. Spears JW. Organic trace minerals in ruminant nutrition. Anim. Feed Sci. Technol.1996;58:151-163.
5. Pal DT, Gowda NKS. Organic trace minerals for improving livestock production. Feedipedia, Ani. Feed Resources 2015; Inf. Sytm.
6. Mowat DN, Chang X, Yang WZ. Chelated chromium for stressed feeder calves. Can. J. Anim. Sci. 1993;73: 49–55.
7. Hong SM, Sung KI, Ohh SJ, Shin JS, Kim CH, Kim HS. Effect of chromium methionine supplementation to castrated fattening steers on carcass quality and blood metabolites. Proc Ann Congress Kor Soc Anim Sci Tech.2002;2:136.
8. Bhanderi BM, Pande AM, Parnerkar S. Influence of organic and inorganic forms of trace minerals supplementation at different doses on daily weight gain and serum mineral levels in male calves. Livest Res Rural Dev. 2010; 22: 143.
9. Mondal S, Paul SK, Bairagi B, Pakhira MC, Biswas P. Comparative studies of reducing level of organic with inorganic trace minerals

supplementation on the performance, nutrient digestibility and mineral balance in cross-bred male calves. Livest. Res. Rural. Dev.2008;.20:112.

10. Kadu MH, Todkar SR, Durgawale MB, Sawant DN. Effect of Chelated Minerals Supplementation on Growth Performance of Crossbred Calves. Life Sci Adv 2016;5(5): 1694-1699.
11. Chang MN, Wei JY, Hao LY, Ma FT, Li HY, Zhao SG, Sun P. Effects of different types of zinc supplement on the growth, incidence of diarrhea, immune function and rectal microbiota of newborn dairy calves. J Dairy Sci. 2020;103:6100-6113.
12. Kumar D, Grewal SS, KumarR, Singh V. Effect of supplementation of chelated minerals on feed conversion efficiency of buffalo calves. Int J Adv Biotechnol Res. 2017;7(4):787-791.
13. Kumar D, Grewal SS, Kumar R, Ramkaran SS, Rohila H, Singh N. Effect of Supplementation of Chelated Minerals on Growth Performance of Buffalo Calves, Int J Pure App Biosci. 2017;5(5): 1378-1383.
14. Mallaki M, Norouzian MA, Khadem AA. Effect of organic zinc supplementation on growth, nutrient utilization, and plasma zinc status in lambs. Turk J Vet Anim. Sci. 2015;39:75-80.
15. Mudgal V, Saxena N, Kumar K, Dahiya SS, Punia BS, Sharma ML. Effect of supplementing chelated zinc, copper and manganese on performance of Murrah buffalo calves. IX ABC-2018 at ICAR-Central Institute for Research on Buffaloes, Hisar, Haryana, India.
16. Dey A, Garg AK. Effect of supplementation of zinc methionine complex on growth rate and feed efficiency in weaned rats. Indian Vet Med J. 2004;28:117-120.
17. James RE. Growth standards and nutrient requirements. An Imprint of Elsevier Sci California, USA. Ency. of Dairy Sci. 2002;4:2405-2411.
18. Muehlenbein EL, Brink DR, Deutscher GH, Carlson MP, Johnson AB. Effects of inorganic and organic copper supplemented to first-calf cows on cow reproduction and calf health and performance. J. Anim. Sci. 2001;79 (7): 1650–1659.
19. Butani JB, Parnerkar S, Patel DC. Augmenting buffalo reproduction in tribal areas of Panchmahal district (Gujarat) through appropriate mineral mixture supplementation. Indian J Anim Res. 2016;50(5):782-787.