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Research Article

EFFECT OF CHELATED MINERALS SUPPLEMENTATION ON GROWTH PERFORMANCE OF MURRAH BUFFALO HEIFERS

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ABSTRACT

The objective of present study was to analyze the effect of feeding chelated minerals on growth performance of Murrah buffalo heifers. Fifteen apparently healthy heifers (22 to 28 months age) were selected and divided into three treatment groups each having five animals. In treatment T_1 (control), animals were fed seasonal green fodder, wheat straw and conventional concentrate mixture having 2% mineral mixture. In treatments T_2 and T_3, animals were fed similar to T_1 except inorganic minerals in concentrate mixture were replaced with 50% and 100% chelated minerals, respectively. Feeding trial was conducted for a period of 120 days. Body weight of experimental buffalo heifers at fortnightly intervals under different treatments showed no significant difference ($P>0.05$) throughout the experimental period. Metabolic body weight, average daily gain, body measurements (body length, height, heart girth and abdominal girth) too didn't differ significantly. Though each parameter was marginally higher for T_2 group, however, the difference remained non-significant. Thus, it can be concluded that replacement of inorganic mineral with chelated mineral has no beneficial effect on growth performance of Murrah buffalo heifers.

Key words: Chelated minerals, buffalo heifers, growth performance.

Buffalo plays a pivotal role in Indian dairy industry. But poor growth rate in calves and heifer results in higher age at first calving and in turn reduces the economic value. As heifers are future herd of a dairy farm, their optimum growth must be ascertained. Lower growth rate in the early life of the heifer may be due to lack of adequate nutrition associated with improper feeding management practices. In physical terms, minerals and vitamins constitute only a small proportion of the diet, but their importance is paramount. Minerals play many 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 health and production (Overton and Yasui, 2014). Deficiency of trace minerals in the diet alone can reduce animal production by 20-30%. Therefore, 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 (Underwood and Suttle, 1999). Trace mineral deficiencies can occur as a primary deficiency when mineral intake is inadequate or as a secondary deficiency when other factors in the diet interfere with the absorption and metabolism. To address the above problem, chelated minerals in recent years are being supplemented in the ration as the bio-availability of these minerals is more than their inorganic forms (Spears, 1989). The goal of forming chelates is to increase the bioavailability of minerals to the animals to support metabolic functions. Various literatures on chelated minerals and its effect on animal feeding trial specifically in non ruminants are well documented, but references available on the effect of supplementing chelated minerals on performance of dairy animals particularly buffalo heifers are very scanty. Therefore, the present investigation was undertaken to assess the effect of feeding chelated minerals on growth performance of buffalo heifers.

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MATERIALS AND METHODS

Fifteen buffalo heifers of 22-28 months of age were selected from the Buffalo Farm of this University. A preliminary adjustment period often days was given. Buffalo heifers were weighed individually and stratified into three groups of five heifers in each group based on CRD. Before start of the experiment all animals were de-wormed. The feeding trial continued for 120 days. Experimental buffalo heifers were kept in tie-stall and fed individually in well ventilated shed. The requirements

of buffalo heifers were met by feeding concentrate mixture, green fodder, wheat straw as per ICAR (Ranjhan, 1998) recommendations. The buffalo heifers in different groups were subjected to different dietary treatments. In treatment T_1 (control), animals were fed seasonal green fodder, wheat straw and conventional concentrate mixture having 2% mineral mixture while for treatments T_2 and T_3, animals were fed similar to T_1 except inorganic minerals in concentrate mixture was replaced with 50% and 100% chelated minerals, respectively. Before formulation of rations, the feed ingredients were analyzed (AOAC,1995) for proximate composition (Table 1). The feeding schedule was modified as per fortnightly body weight changes. Besides, animals were given *ad lib.* fresh water throughout the experimental period. The buffalo heifers were weighed at the start of the experiment and thereafter at fortnightly intervals. The body weight was recorded in the morning before offering any feed or water to the buffalo heifers. Similarly, various body measurements *viz.* body length (distance from point of shoulder to the point of pin bone), body height (the distance from the floor to the highest point of withers), heart girth (the circumference of the body over the chest of the animal just behind point of elbow) and abdominal girth (the circumference of the body over the flank of the animal just in front of udder) of buffalo heifers were recorded at the start and thereafter at monthly intervals during the experiment.

Data obtained were subjected to statistical analysis as per Snedecor and Cochran (1994) using Completely Randomized Design (CRD). All the data were subjected to ANOVA using the General Linear Models procedure of SAS software. The mean differences among different treatments were separated by Duncan's multiple range tests. Consequently, a level of significance ($P<0.05$) was used as the criterion for statistical differences (Duncan, 1955).

RESULTS AND DISCUSSION

Average body weight (BW) of all the experimental buffalo heifers at fortnightly interval showed increasing trend in all the three treatments throughout the experiment (Table 2). Initial average body weight of all the treatment groups i.e. T_1, T_2 and T_3 were 327.00, 331.40 and 325.80 kg and at the end of experiment they were 389.80, 398.00 and 387.60 kg, respectively. No significant difference ($P>0.05$) could be established between the various treatment groups in respect to body weight (BW) in 120 days of trial. Likewise, average metabolic body weights ($Kg\ W^{0.75}$) of experimental buffalo heifers were 76.83, 77.61 and 76.63 kg in T_1, T_2 and T_3 groups, respectively at the start of the experiment and final metabolic body weights at the end of the experiment for corresponding groups were 87.67, 89.07 and 87.31 kg, respectively. The data did not show any significant difference among the treatments during the 120 days of trial period. Our results corroborated with the findings of Muehlenbein *et al.* (2001) who found no differences ($P>0.10$) in BW, body condition scores and calf birth weights in cows after supplementing organic and inorganic minerals to cows prior to calving. Gengelbach *et al.* (1994) found no significant difference in the BW change for first-calf heifers exposed to mineral treatments. Ahola *et al.* (2004) also reported no difference in body weight change in calf after feeding organic and inorganic minerals to advanced pregnant females. Different trace minerals particularly manganese, copper and zinc function biochemically as a component of several metallo-enzymes and as cofactors for numerous other enzymes (Zapsalis and Beck, 1985). It is possible that different trace minerals enhance growth of heifers by stimulating activities of enzymes involved in nutrient utilization.

Average daily weight gain (g/day) of buffalo heifers under different treatments has been presented in Table 3. Overall, average daily body weight gain under three treatments during the whole experimental period was 523.33, 555.00 and 515.00 g/d, in T_1, T_2 and T_3 groups, respectively. The results of the study revealed that total weight gain and average daily gain per day did not differ significantly ($P>0.05$) in heifers fed ration supplemented with chelated minerals as compared to inorganic mineral mixture. The findings of present study are in agreement with previous studies (Olson *et al.,*1999; Muehlenbein *et al*., 2001; Ahola *et al*., 2004). Ahola *et al.* (2004) reported that neither ADG nor DMI were affected by either trace mineral supplementation (P=0.60 and P=0.75, respectively) or source (P=0.86 and P=0.25, respectively) throughout the growing phaseHowever,

Average values of body length, height, heart girth and abdominal girth of buffalo heifers under different treatments have been presented in Table 4. At the end of experiment the mean values of body length and height of heifers were 133.60, 137.20, 135.40 cm and 128.40,

Table 1

Proximate composition (% DM Basis) of feed ingredients fed to experimental buffalo heifers

Ingredients	DM	CP	CF	EE	Ash	OM	NFE
Wheat straw	94.56	2.31	34.43	1.06	7.83	88.12	54.37
Oat (Green)	30.54	8.99	26.26	5.68	10.36	87.25	48.71
Mustard Cake	94.37	32.21	7.98	6.65	7.81	91.26	45.35
Wheat	93.48	14.89	2.98	2.15	2.11	97.77	77.87
Wheat bran	89.21	16.03	10.99	4.21	6.27	86.36	62.50
Barley	88.23	13.41	5.53	2.12	2.40	87.12	76.54

Table 2

Mean body weight (kg) of buffalo heifers under different dietary treatments

Days	Treatments		
	T_1	T_2	T_3
0	327.00±16.10	331.40±14.83	325.80±13.70
15	334.80±15.72	337.60±15.13	332.20±13.94
30	341.80±16.12	346.80±14.77	340.20±14.06
45	349.20±16.27	354.80±14.88	348.20±13.53
60	359.20±16.38	365.60±14.88	357.00±14.36
75	369.00±16.72	375.00±12.93	367.00±14.56
90	378.40±16.76	386.00±15.07	376.00±14.11
105	380.40±19.99	391.20±14.31	381.00±13.86
120	389.80±16.74	398.00±13.97	387.60±14.30

Values have been presented as mean±standard error

Table 3

Changes in body weight of buffalo heifers under different dietary treatments

Attributes	Treatments		
	T_1	T_2	T_3
Initial body weight (kg)	327.00±16.10	331.40±14.83	325.80±13.70
Final body weight (kg)	389.80±16.74	398.00±13.97	387.60±14.30
Total body weight gain (kg)	62.80±1.36	66.60±1.57	61.80±2.35
Average daily gain (g/d)	523.33±11.30	555.00±13.07	515.00±19.62

Values have been presented as mean±standard error. There was no statistical difference for a parameter in a row

Table 4

Changes in body measurements of buffalo heifers under different dietary treatments

Attributes		Treatments		
		T_1	T_2	T_3
Body Length(cm)	Initial	124.40±1.97	127.20±1.88	126.20±1.72
	Final	133.60±1.86	137.20±1.93	135.40±1.50
	Total gain	9.20±0.49	10.00±0.70	9.20±1.36
Body Height (cm)	Initial	122.80±1.69	122.60±2.87	120.20±1.99
	Final	128.40±1.89	129.80±2.48	126.80±2.04
	Total gain	5.60±0.75	7.20±0.49	6.60±0.60
Heart Girth (cm)	Initial	174.40±2.41	173.80±2.54	174.40±1.99
	Final	185.40±2.77	185.00±2.61	185.00±2.55
	Total gain	11.00±1.05	11.20±0.86	10.60±0.75
Abdominal Girth (cm)	Initial	186.00±2.59	185.00±3.15	185.60±2.66
	Final	197.40±2.16	197.80±3.25	196.80±3.40
	Total gain	11.40±0.68	12.80±1.02	11.20±0.97

Values have been presented as mean±standard error

129.80, 126.80 cm in treatment groups T_1, T_2 and T_3, respectively. All the body measurements did not differ significantly (P>0.05) among the groups as body weight too did not differ significantly. Our results corroborated with the findings of Muehlenbein *et al*. (2001) who found no differences (P>0.10) among treatments in cow body condition scores at various times throughout the study when fed with chelated mineral. Based on the findings, it can be concluded that replacement of inorganic minerals in the ration with chelated minerals has no significant influence on growth performance of Murrah buffalo heifers.

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REFERENCES

Ahola, J.K., Baker, D.S., Burns, P.D., Mortimer, R.G., Enns, R.M., Whittier, J.C., Geary, T.W. and Engle, T.E. (2004). Effect of copper, zinc, and manganese supplementation and source on reproduction, mineral status, and performance in grazing beef cattle over a two year period. *J. Anim. Sci.* **82**:2375-2383.

AOAC. (1995). Official Methods of Analysis. (16th edn.), Association of Official Analytical Chemists, Washington, DC, USA.

Duncan, D.B. (1955). Multiple range and multiple F tests. *Biometrics.* **11(1):** 1-42.

Gengelbach, G.P., Ward, J.D., and Spears, J.W.. (1994). Effect of dietary copper, iron, and molybdenum on growth and copper status of beef cows and calves. *J. Anim. Sci.* **72**:2722-2727.

Mohanta, R.K and Garg, A.K. (2014). Organic Trace Minerals : Immunity, Health, Production and Reproduction in Farm Animals, *Indian J. Anim. Nutr.* **31 (3)**: 203-212.

Muehlenbein, E.L., Brink, D.R., Deutcher, G.H., Carlson, M.P. and Johnson, A.B. (2001). Effects of inorganic and organic copper supplemented to first-calf cows on cow reproduction and calf health and performance. *J. Anim. Sci.* **79**: 1650-1659.

National Research Council. (2001). Nutrient Requirements of Dairy Cattle. (7th revised edn.), National Academy Press, Washington, DC.

Olson, P.A., Brink, D.R., Hickok, D.T., Carlson, M.P., Schneider, N.R., Dentscher, G.H., Adams, D.C., Colburn, D.J. and Johnson, A.B. (1999). Effect of supplementation of organic and inorganic combination of copper, cobalt, manganese and zinc about nutrient requirement levels on postpartum two year old cows. *J. Anim. Sci.* **77**: 522-532.

Overton, T.R. and Yasui, T. (2014). Practical applications of trace minerals for dairy cattle. *J. Anim. Sci.* **92:** 416-426.

Ranjhan, S.K. (1998). Nutritional Requirement of Livestock & Poultry. (2nd Revised edn.), Indian Council of Agricultural Research. Krishi Anusandhan Bhavan, Pusa, New Delhi.

Snedecor, G.W. and Cochran, W.G. (1994). Statistical Methods. Iowa State University Press, Ames, Iowa, USA.

Spears, J.W. (1989). Zinc methionine for ruminants: Relative bioavailability of zinc in lambs and effects on growth and performance of growing heifers. *J. Anim. Sci.* **67**:835–843.

Underwood, E.J. and Suttle, N.F. (1999). The Mineral Nutrition of Livestock. (3rd edn.), CABI Publishing, New York.

Zapsalis, C. and Beck, R.A. (1985). Copper. *In*: Food Chemistry and Nutritional Biochemistry. Wiley and Sons, New York.