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AVAILABILITY OF MICRONUTRIENT ELEMENTS IN FATTENING MALE BUFFALO CALVES

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A balance trial was conducted on fattening male buffalo calves to study the availability of essential trace elements from rations containing 0, 0.5 and 1.0 per cent urea. Balance of micronutrient elements was determined by total collection of dung and urine after allowing a period of 12 weeks.

Comparatively more iron was excreted through faeces than urine. About 1/3 of the dietary iron was retained. The excretion of copper was also higher in faeces than in urine. All the animals were in marginal copper balance. This element showed negative balance in control ration while other two groups were in positive balance. Faecal losses of manganese were higher but urinary losses were in traces. Zinc balance was marginal but positive. The retention was low due to more faecal losses. The study indicated the need for supplementation of copper manganese and zinc in the practical rations of fattening calves.

INTRODUCTION

Significant improvement occurs in the growth rate of fattening calves by adding trace elements to low quality hay (Klosterman *et al*, 1956). A much progress in this regard can be achieved if the rations of these animals are completely balanced, which needs supplementation of deficient essential trace elements. Some trace elements are probably essential while some others have been shown to be dietary essential, like iron, copper, zinc, manganese, cobalt, molybdenum and selenium which must be added to the animals ration (Underwood, 1962). Addition of cobalt, copper, iron, iodine, manganese and zinc to a ration containing corn grain produced a highly significant increase in the rate of gain and feed efficiency was improved (Oltjen *et al*, 1959). Since information on the availability of minerals from natural sources in common practice is lacking the present study was conducted to assess the balance of essential trace elements e.g, Fe, Cu, Mn and Zn in the rations of the fattening calves.

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MATERIALS AND METHODS

In order to study the availability of essential trace elements of routine rations of fattening calves, a balance trial on nine male buffalo calves was conducted at the premises of PL-480 Project "Beef Production in Pakistan", University of Agriculture, Faisalabad in 1975. The calves were fed three experimental rations for a period of 10 weeks. Three rations were offered to three groups of three animals each adlibitum. Composition of rations is given in Table 1.

Table 1. *Percentage composition of experimental rations.*

Ingredients	Ration 1	Ration 2	Ration 3
Cotton-seed cake (Undecorticated)	30	24	18
Wheat bran	20	20	20
Molasses (Cane)	15	20.5	26
Wheat straw (Finely threshed)	35	35	35
Urea (46% N2)	—	0.5	1
Total:	100	100	100

A balance trial of 10 days was conducted in which total collection of dung and urine was done on 24 hours basis. Care was taken to avoid all possible contaminations of trace elements. During this period complete record of feed consumed was kept. Samples of faeces and urine voided daily by each calf were directly collected in dung containers and plastic buckets, respectively. Urine collection was done by the urine collection bags specially designed for the purpose. Representative samples of dung and rations were drawn, weighed and placed in hot air oven at 105°C till constant weight for the estimation of moisture content. Separate samples of ingredients of the rations were also preserved after oven drying for analysis. The dried samples were ground seived and preserved in air tight plastic bottles. Urine samples were drawn at the rate of one milliliter per 100 ml. of the urine voided. The samples of venous blood from the jugular vein were taken at the end of the trial from each calf using sodium oxalate as anticoagulant. Urine samples and blood plasma were preserved under deep freezed conditions for further analysis.

The samples of dung, urine, separate feed ingredients and blood were digested with nitric acid-perchloric acid and the volume was made with demineralized water. The samples so prepared were analysed for iron, copper, manganese

and zinc by atomic absorption spectrophotometer. Total intake, out go in faeces and excretion in urine of all the minerals were calculated and the balance of these minerals was worked out.

RESULTS AND DISCUSSION

The availability and balance of various trace elements obtained from the experiment are discussed as under and the data has been summarized in Table 2.

Table 2. *Average balance of micronutrient elements in fattening male buffalo calves fed routine rations with and without urea.*

Elements	Rations	Intake (mg)	Undigested (mg)	Digested (mg)	Excreted in urine (mg)	Net balance (mg)
Iron	Control	296.585	216.679	79.906	14.925	64.981
,,	0.5% Urea	274.633	186.637	87.996	17.229	70.767
,,	1% Urea	271.587	156.913	114.674	20.632	94.042
Copper	Control	6.508	5.778	0.730	1.192	0.462
,,	0.5% Urea	5.843	3.728	2.115	1.553	0.562
,,	1% Urea	5.688	3.121	2.567	1.570	0.997
Manganese	Control	26.246	20.950	5.296	1.702	3.594
,,	0.5% Urea	24.329	19.396	4.933	0.776	4.157
,,	1% Urea	24.438	17.476	6.962	0.926	6.036
Zinc	Control	17.454	15.596	1.858	1.165	0.693
,,	0.5% Urea	15.080	12.290	2.790	1.683	1.107
,,	1% Urea	14.039	10.882	2.157	1.419	1.738

Iron. Small variations were noticed in iron intake in fattening calves fed routine rations with and without urea. The excretion of dietary iron in faeces was much higher (156.913 to 216.679 mg per calf per day) than its losses through urine (about 17 mg per head per day). About 27 per cent iron was digested in control group while the digestibility of 0.5 and 1.0 per cent urea containing rations was 32 and 42 per cent, respectively. Traces of dietary iron were excreted in the urine. In control ration iron retention was found to be 64.981 mg while in 0.5 and 1.0 per cent urea ration it was 70.767 and 94.042 mg

per head per day, respectively. Results showed that 22 to 35 per cent of the dietary iron in a practical fattening ration was retained.

No considerable change in the blood level of iron was noticed as influenced by rations. Plasma iron level ranged from 6.25 to 9.38 ppm. The results showed that the practical rations contained 56 to 63 ppm of iron, which is sufficient for the fattening calves because this value is higher than the minimum requirement of iron (Miltimore *et al* 1970). It may therefore be assumed that there is no need of iron supplementation in the practical fattening rations.

Copper. Slight variations were present in the consumption of copper. The average intake ranged from 6.508 to 5.688 mg per head per day. Digestion of copper was very poor in control ration as compared to urea containing rations. Only 0.730 mg copper was digested in the control ration, while it was 2.115 and 2.567 mg per head per day in 0.5 and 1.0 per cent urea rations, respectively. It means that 11 to 45 per cent copper was digested by the fattening animals. Underwood (1962) reported that 90 per cent of dietary copper was excreted in the faeces. The excretion of copper in urine was less than its losses through faeces. Urinary losses of copper in animals on urea containing rations were somewhat higher than the control ration. Control ration had negative copper balance but urea containing rations showed possitive balance. Plasma copper level in fattening calves ranged between 2 to 3 ppm.

The results indicated that fattening calves practical ration contained, 1.24 ppm of copper which is much less than the recommended minimum level (10 ppm) while the maximum level is 100 ppm (Hillman, 1973). Therefore, it is suggested that practical ration must be supplemented with copper.

Manganese. Intake of manganese was higher in the control ration than the urea containing rations. Average daily consumption ranged from 24.329 to 26.246 mg per calf per day. Much of the dietary manganese remained undigested in the fattening calves. The faecal losses ranged from 71.5 to 79.9 per cent. Manganese excretion through urine ranged between 3.2 to 6.5 per cent. Miltimore *et al* (1970) reported that about 1 per cent manganese was excreted in urine. It means that about 14 to 25 per cent dietary Mn was retained from a practical ration. The plasma level of manganese was probably so small that it escaped even the atomic absorption spectro photometric determination. Differences due to rations were found to be non-significant when the balance data were subjected to analysis of variance.

Fattening practical rations contained 5.0 to 5.6 ppm manganese. This

is less than the required concentration for growing calves i.e. 20 ppm (Hillman, 1973). It is suggested that practical fattening rations should be supplemented with manganese.

Zinc. The average daily intake of zinc was little higher in the control ration than the urea containing rations. High faecal losses of zinc were observed in this study. About 77.5 to 89.4 per cent of the dietary zinc was excreted through faeces. Only 10.6 per cent dietary zinc was digested in the control ration and 18.5 per cent in the calves on ration containing 0.5 per cent urea. When the level of urea was increased to one per cent, the dietary zinc digestibility further increased to 22.5 per cent. Underwood (1962) reported that zinc was digested only 3 to 10 per cent. Feaster *et al* (1954) also observed similar results in steers. The excretion of zinc in urine was lower than its excretion in faeces. In control ration 6.7 per cent of the dietary zinc was excreted through urine. Whereas, in rations having 0.5 and 1.0 per cent urea, 10.11 and 11.14 per cent of the dietary zinc was excreted in urine, respectively. Zinc retention increased with increasing urea level and ranged from 3.9 to 12.4 per cent. Zinc contents of plasma ranged between 3.08 to 5.55 ppm in the experimental calves.

The results indicated that practical fattening rations contained about 3.3 ppm zinc which is less than minimum recommended level i.e. 40 ppm (Hillman, 1973). The supplementation of fattening ration with zinc is, therefore, suggested for proper growth rate of the animals.

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