

Evaluation of urea molasses multi-nutrient blocks enriched with area specific mineral mixture in buffaloes

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ABSTRACT

To assess the effect of supplementary feeding of urea-molasses multi-nutrient block (UMMB) enriched with area specific mineral mixture on productive and reproductive traits of buffaloes, a study was undertaken in the intermediate zone of Rajouri district in Jammu region. Buffaloes (12; age group 3–8 years) of which 11 were in anoestrus were selected and allowed to lick a UMMB @ 400–600 g daily for 30 days during February and March. Blood samples were analyzed for hemato-biochemical parameters, macro and trace elements and hormonal status (T_3 , T_4 and progesterone) at the beginning and after completion of trial. A significant increase in the total plasma protein and albumin level were observed with no significant effect on Hb, PCV, glucose, BUN, calcium, phosphorous, magnesium, copper, zinc, iron, plasma inorganic iodine (PII) and manganese. Observations on all closely monitored buffaloes revealed an average increase of 46.66% in fodder intake, 51.70% in milk yield and 13.88% in milk fat following UMMB supplementation. Moreover, none of the anoestrus buffaloes came in heat during the study period however, after 30–45 days of completion of trial 72.72% (9/11) of the buffaloes came in heat and conceived to first impregnation, which, normally show estrus from August-October. It was concluded that UMMB being a good source of energy, protein and minerals improved milk yield, milk fat, dry matter intake, general health status and reproductive performance of buffaloes.

Key words: Buffaloes, Hemato-biochemical parameters, Hormones, Milk yield, Mineral, Production, Reproduction, UMMB block, Urea molasses multi-nutrient blocks

Livestock reared in hills are generally fed variable quantity of low quality feed resources like local grasses, tree leaves, wheat straw, rice straw, maize stalk, which are characteristically low in fermentable nitrogen, mineral, and readily available carbohydrate. These deficiencies result in low animal growth, poor reproduction, long calving interval, and unthrifty condition. Inadequate nutrition is one of the factors that frequently limit the full utilization of the productive and reproductive potential of livestock in this region. Developing alternate feeding strategies for ruminant production based on agro-industrial wastes is, therefore, of prime importance. A urea molasses multinutrient blocks (UMMB) prepared from locally available agro-industrial by-products has been adoptable feed supplement which improves nutritional status of animals (Kang *et al.* 2007). Baseline survey to identify the commonly prevalent deficiencies in the livestock was carried earlier and based on plasma analysis

of buffaloes area specific mineral mixture was formulated. However, the successful treatment and control of mineral deficiencies lies in effective and practical methods of supplementation. Feeding of only the deficient minerals may not improve the general health status, production and reproduction of animals in these areas. Hence, the present study was undertaken to evaluate the effect of UMMB containing area specific mineral mixture as supplementary feeding on the general health condition, milk yield and reproductive performance of buffaloes.

MATERIALS AND METHODS

Adult Murrah graded buffaloes (12) from Rajouri district fed through grazing and variable quantity of local grasses and wheat straw by 10 farmers were selected for the present study. Trial was conducted during the period from February to March. The buffaloes were in 3–8 years' age group. Anoestrus was observed in 11 buffaloes and 10 animals were in lactation. The UMMB was prepared by cold method by mixing molasses (35%), urea (10%), deoiled rice bran (10%), oiled rice bran (10%), groundnut meal (10%), cement (10%), area specific mineral mixture 14% as per Singh (2009)

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containing DCP-70%, MgSO_4 -29%, CuSO_4 -0.5%, MnSO_4 -0.5% and K. iodate-0.09%, common salt (1%). All the animals were allowed to lick a 2 kg block of UMMB @ 400–600 gms/day for 4–6 h daily for 30 days. Close observations were made on buffaloes on changes, if any, in feed intake, milk yield, milk fat production and oestrus activity.

Sample collection and analysis

Blood samples were collected from selected buffaloes on day 0 and 30th. Haemoglobin and PCV were analysed by standard methods. Plasma concentration of glucose, total proteins, albumin, alkaline phosphatase and urea nitrogen were estimated using kits. Levels of triiodothyronine (T_3) and thyroxine (T_4) were assayed by radioimmunoassay technique using RIA kits procured from BARC (Radiopharmaceuticals Operations Board of Radiation and Isotope Technology, BARC's Vashi Complex, Navi Mumbai, India). Progesterone estimations were done by liquid phase radioimmunoassay (RIA) procedure (Kamboj and Prakash 1993). Three ml of each plasma sample was analysed for mineral analysis by digesting in concentrated nitric acid AR (15 ml) and perchloric acid (3 ml) followed by 1 cycle of hydrogen peroxide AR (2.0 ml of 30%). Digestates (approximately 1–2 ml) were diluted to 15 ml with double glass distilled water. The concentrations of micro-elements, viz. Cu, Fe, Zn, Mn and Co were measured by polarized atomic absorption spectrophotometer. Calcium and Mg were analyzed using commercial kits. Inorganic fraction of plasma phosphorus was determined by Taussky and Shorr (1953). Plasma inorganic iodine (PII) was determined by Aumont and Tressol (1987). Statistical comparison of data was done as per Snedecor and Cochran (1989).

RESULTS AND DISCUSSION

All the selected buffaloes showed poor body condition with loss of musculature, dull and depressed with rough and dried skin coat. Anoestrus was the major problem as 91.66% (11/12) of the selected buffaloes had not shown estrus for the last over 6 months. The health condition of the selected buffaloes suggested that malnutrition might have been the cause of anoestrus. However, after 30 days of supplementation marked improvement in the general health condition, shiny and soft pliable skin coat was observed. Observations on all closely monitored buffaloes revealed an

average increase of 46.66% in fodder intake, 51.70% in milk yield and 13.88% in milk fat following UMMB supplementation. At initiation of UMMB supplementation the daily fodder intake was 15 kg (10 kg dry and 5 kg green at grazing time), daily milk yield 2.05 ± 0.37 kg and milk fat percentage was $6.12 \pm 0.12\%$, which, increased to 22 kg (10 kg dry and 12 kg green), 3.11 ± 0.63 kg, $6.97 \pm 0.22\%$, respectively, at the end of trial. The increase in DM intake was due to increase in nutrient intake and their utilization, which is in agreement with the earlier findings (Singh and Singh 2003). The increased milk production and fat percentage may be attributed to higher supply of crude protein, energy and minerals to animals and increased digestibility of the ration (Rafiq *et al.* 2000). Tripathi *et al.* (2006) reported an average increase of 22.76% in DM intake in buffaloes following UMMB feeding reflected through improved milk yield by 25.91%. Brar and Nanda (2008) also reported average increase of 25% in fodder intake, 8% in milk yield and 7% in milk fat following UMMB supplementation for 4 weeks to anoestrus buffaloes from Punjab state.

Hematological parameters: The mean values of hematological indices Hb and PCV in buffaloes before the start of trial were 10.51 ± 0.66 g/dl (range 4.9–14.7 g/dl) and $31.36 \pm 1.49\%$ (range 24–41%) which were within the normal range of 8–15 g/dl and 24–46% quoted for cattle by Radostits *et al.* (2000), respectively. 91.67% (11/12) buffaloes had normal Hb (>8.0 g/dl) at day 0 and the anemic buffalo had very low (<6.0 g/dl) Hb concentration however, after 30 days of UMMB supplementation none of the animal was anaemic. On PCV basis also the prevalence of anaemia was 9.09% (1/11) and the anemic animal possessed marginal level (24%) of PCV at the beginning of trial (PCV $<24\%$). However, after 30 days of UMMB supplementation all animal were non-anemic. No significant ($P < 0.05$) effect of UMMB supplementation on the level of hemoglobin and packed cell volume was observed in buffaloes (Table 1).

Biochemical changes in blood: Significant ($P < 0.05$) increase in the average value of total plasma protein from 5.81 g/dl to 7.24 g/dl was observed as shown in Table 1. The increase in total plasma protein content was mainly due to the significant ($P < 0.05$) increase in the albumin level. As the ruminally degradable fraction of protein increases in diet blood urea nitrogen levels increase as was observed in present study. Contrary to present finding Hosamani *et al.* (1998)

Table 1. Effect of UMMB supplementation on haemato-biochemical parameters in buffaloes

Day of trial	Hb (g/dl)	PCV (%)	TPP (g/dl)	Albumin (g/dl)	Globulin (g/dl)	A : G ratio	Glucose (mg/dl)	BUN (mg/dl)	ALP (I.U. l-l)
0	10.51 ± 0.66	31.36 ± 1.49	$5.81 \pm^a 0.22$	$2.48 \pm^a 0.1$	3.33 ± 0.20	0.77 ± 0.06	48.18 ± 2.11	8.02 ± 1.08	121.13 ± 17.41
30th	10.10 ± 0.43	31.82 ± 1.25	$7.24 \pm^a 0.22$	$3.25 \pm^a 0.10$	3.98 ± 0.24	0.85 ± 0.06	59.06 ± 2.86	10.94 ± 2.19	96.11 ± 16.44

• Means marked with similar superscript a, differ significantly ($P < 0.05$) in a column.

and Brar and Nanda (2008) reported no significant ($P<0.05$) effect of UMMB supplementation on total plasma protein and albumin level in buffaloes. The average value of urea nitrogen was 8.02 mg/dl before the start of trial and it increased to 10.94 mg/dl. Qreshi *et al.* (2002) reported that excessive levels of crude protein in the diet elevated BUN levels, altered uterine pH and reduced fertility in buffaloes. However, in present study nonsignificant ($P<0.05$) increase in urea nitrogen following UMMB supplementation at daily dose of 400 g was observed which suggests that there were no related harmful effects and finding corroborates with Brar and Nanda (2008). Hosamani *et al.* (1998) also reported significant ($P<0.01$) increase in blood serum urea following UMMB supplementation in Murrah buffaloes. The glucose level of buffaloes increased significantly ($P<0.05$) from 48.18 mg/dl to 59.06 mg/dl after 30th day of supplementation of UMMB. Blood concentration may not be the real index of energy status of an animal as is affected by multiple variables (Radostits *et al.* 2000).

Nonsignificant ($P<0.05$) decrease in the alkaline phosphatase level of the plasma samples from 121.13 m/l to 96.11 m/l after 30 days of UMMB supplementation was observed. The values observed were within the normal range of 35–350 m/l quoted by Radostits *et al.* (2000). Thus, there was no harmful effect on the liver and bones.

Hormonal status

Triiodothyronine and thyroxin: The average value of T_3 in plasma samples of buffaloes at the beginning of trial was 1.21 nmol/l which showed nonsignificant ($P<0.05$) increase to 1.25 nmol/l (Table 2). The average values observed in both the categories fall within the range of 0.37 to 1.71 nmol/l reported by Khurana and Madan (1986) in buffaloes during different seasons of the year. Likewise, the mean value of T_4 in plasma samples of buffaloes at the beginning and on 30th

day were 67.99 ± 7.29 nmol/l and 67.38 ± 6.88 nmol/l, respectively. Randhawa and Randhawa (2001) also observed nonsignificant effect of plasma iodine level on the level of thyroxine.

Progesterone: The average progesterone level of plasma samples from buffaloes showing anoestrus was 0.257 ng/ml at the beginning of trial which showed nonsignificant ($P<0.05$) increase to 0.352 ng/ml. Interestingly, none of the animal came in heat during the study period. However, after 30–45 days of completion of trial 72.72% (9/11) of the anoestrus buffaloes came in heat and conceived to first impregnation, which, normally show estrus from August to October. The present trial was conducted from 20 February to 22 March.

Mineral changes in blood: The average value of calcium showed nonsignificant ($P<0.05$) increase (Table 3). The average values were within the normal range, i.e. 2.11–2.75 mmol/l quoted by Radostits *et al.* (2000) for cattle. Considering the critical level of 2.10 mmol/l, 33.33% (4/12) buffaloes showed hypocalcaemia whereas, after 30 days of supplementation none of the animal showed hypocalcaemia. The average value of inorganic phosphorous within the normal range, i.e. 1.30–2.26 mmol/l quoted by Radostits *et al.* (2000) for cattle. However, after 30 days of supplementation buffaloes showed nonsignificant ($P<0.05$) increase in inorganic phosphorous level (Table 3). Considering the critical level of 1.30 mmol/l, 50.00% buffaloes were having hypophosphataemia whereas, after 30 days of supplementation 27.27% animals were having low phosphorous level. Tiwari *et al.* (1990) reported increased ($P<0.01$) balances of calcium and phosphorous in buffalo calves supplemented UMMB and fish meal for 130 days. Magnesium level showed nonsignificant ($P<0.05$) increase. The average values were within the normal range (Radostits *et al.* 2000). Considering the critical level of 0.50 mmol/l none of the animal was having hypomagnesemia.

The mean level of copper in plasma samples of buffaloes showed nonsignificant ($P<0.05$) decline on 30th day of supplementation. The average values of copper in both the pre- and post-supplementation groups were within but at lower edge of normal range of 9.5–23.6 μ mol/l as reported by McDowell (1992) for cattle. The overall prevalence of hypocupraemia was 50.00% before the start of trial, of which 50% animals were marginally deficient and 50% were having level <7.9 mmol/l. However, at the end of supplementation

Table 2. Effect of UMMB supplementation on hormonal status in buffaloes

Day of trial	T_3 (nmol/ml)	T_4 (nmol/l)	Progesterone (ng/ml)
0	1.21 ± 0.09	67.99 ± 7.29	0.41 ± 0.15 (n=12)
30th	1.25 ± 0.13	67.38 ± 6.88	0.52 ± 0.17 (n=11)

• Figures in parenthesis indicate the number of animals.

Table 3. Effect of UMMB supplementation on mineral status in buffaloes

Day of trial	Ca (mmol/l)	Pi (mmol/l)	Mg (mmol/l)	Cu (μ mol/l)	Fe (μ mol/l)	Zn (μ mol/l)	PII (ng/ml)	Mn (μ mol/l)
0	2.54 ± 0.15	1.30 ± 0.15	1.11 ± 0.06	14.48 ± 3.17	39.39 ± 2.07	23.76 ± 6.20	71.75 ± 10.97	0.68 ± 0.23
30th	2.71 ± 0.10	2.10 ± 0.22	1.13 ± 0.05	12.94 ± 3.23	37.84 ± 5.98	42.12 ± 9.81	77.35 ± 9.81	0.98 ± 0.30

• Means marked with similar superscript a differ significantly ($P<0.05$) in a column.

trial, 45.45% animals were copper deficient of which 20% animals were marginally deficient and 80% were having level <7.9 mmol/l. Likewise, the iron level of plasma samples declined nonsignificantly. The average values observed were higher than the normal range (Radostits *et al.* 2000). Zinc level of the plasma samples from buffaloes increased nonsignificantly ($P < 0.05$). The average value was higher than the normal range quoted by Radostits *et al.* (2000) for cattle (12.2 to 18.2 mmol/l). Zn deficiency was prevalent in 45.45% animals at the beginning which declined to 20% at the end of trial. Manganese level of the plasma samples from buffaloes increased nonsignificantly ($P < 0.05$). The average value was lower than the normal range of 3.27–3.49 $\mu\text{mol/l}$ quoted by Radostits *et al.* (2000) for cattle. Considering the critical level of 3.30 $\mu\text{mol/l}$ Mn deficiency was prevalent among all the buffaloes. The overall mean value of PII in buffaloes showed nonsignificant ($P < 0.05$) increase (Table 3). The average values of PII were lower than the critical level of 104.9 ng/ml quoted by Rogers (1992). Before the supplementation of UMMB sub-clinical deficiency was observed to be prevalent in 90.90% buffaloes with marginal deficiency of PII with plasma level 50–104.90 ng/l in 54.54% animals and 36.36% animals were having low level of iodine, i.e. <50 ng/l. However, on 30th day PII deficiency was observed in 90% animals with marginal deficiency in 80.00% animals and 10% animals having low level of iodine.

Thus, it can be concluded that UMMB enriched with area-specific mineral mixture enhanced dry matter intake, milk yield, milk fat, general health status and reproductive performance of the buffaloes.

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