EFFECT OF PARTIAL REPLACEMENT OF CONCENTRATE WITH UREA-MOLASSES-MINERAL LICK IN GROWING ANIMAL RATION ON GROWTH AND ECONOMICS OF FEEDING

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Summary

Fifteen Karan-Swiss male calves of 9-12 months of age were divided into three groups of five each in a randomised block design. Animals in group Ⅰ were fed wheat straw *ad lib.* and concentrate mixture according to their requirements, while in group Ⅱ and Ⅲ the animals were fed with 1/3 of the required concentrate mixture replaced by UMM licks 'Ex' and 'F', respectively. The DMI (kg/day as well as per 100 kg b.wt.) were similar ($p > 0.05$) among different groups of animals, however, the digestibility of DM as well as OM enhanced from 52.85 ± 1.48 to 58.36 ± 1.89 and 55.33 ± 1.48 to 60.12 ± 1.75, respectively. Growth rates of the calves were 533.8 ± 27.25, 532.3 ± 42.24 and 538.4 ± 18.68 g/d in groups Ⅰ, Ⅱ and Ⅲ ($p > 0.05$), respectively. Body composition and N balances of the animals were not affected by supplementation of UMM licks, however, protein retention efficiency was higher in group Ⅲ (82.57 ± 2.54) though nonsignificant. Feed cost/day was reduced from Rs. 7.92 (group Ⅰ) to Rs. 4.62 (group Ⅱ) and Rs. 3.44 (group Ⅲ). Hence, partial replacement of concentrates by UMM licks reduced the cost of feeding of growing calves by 41.7 to 56.6 % without affecting the growth performance.

(**Key Words** : UMM, Growth, Cattle)

Introduction

In most of the developing countries cereal straws are the major feed for ruminants. However, cereal straws are poor source of nitrogen and minerals and most of the energy is locked in the form of cellulose and hemicellulose with lignin, therefore the straws could not meet the nutrient requirement of rumen microbes (Singh and Oosting, 1992). Urea, molasses and minerals, in the form of solid blocks, are the easiest and handy way to provide deficient nutrients to the ruminants. Urea- molasses-mineral (UMM) lick provides essential nutrients which improved the straw intake (Garg and Gupta, 1992) and maintenance of the animals (Tiwari et al., 1990). Further it could be utilized in replacing part of the concentrate mixture in the ration of growing buffalo (Madhu Mohini and Gupta, 1993) and cattle (Mangat Ram et al., 1990) with the hypothesis of providing maintenance requirement with UMM lick and straw and growth requirement through concentrate mixture. These blocks could also be utilized to supplement the growth promoters or methane inhibitors like substances by mixing while preparing. Therefore an attempt was made to study the effect of partial replacement of concentrate mixture with UMM licks (Ex, exixting, prepared originally and F) in growing calves on the growth performance. However UMM lick F contains 'Farmore', consisting a feed supplement of non toxic plant enzyme extract to assist in the maintenance of microbial population in the gut.

Materials and Methods

Fifteen Karan-Swiss male calves of 9-12 months of age were divided into three equal groups in randomised block design. The animals of group Ⅰ were fed control diet of concentrate mixture according to their requirements (NRC, 1980) and wheat straw *ad lib.* Group Ⅱ was provided wheat straw *ad lib.* + concentrate mixture to meet 2/3 of the requirement + free choice of UMM 'Ex' lick and in group Ⅲ animals were given similar feed as those in group Ⅱ except UMM 'F' was given in place of UMM 'Ex'. The ingredient and chemical compositions (table 1) of the lick Ex and F were similar except that lick

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F contained, Farmore, a herbal extract. Licks were kept in the trough in seperate manger so that it was available all the time. Animals were kept in clean dry and airy byres. Daily record of feed intake through wheat straw, concentrate mixture and UMM licks was maintained. Fresh clean water was provided twice a day. Body weights of the animals were recorded fortnightly before feeding for two consecutive days for estimating the growth rate and feeding schedule was changed according to their changed body weights.

TABLE 1. INGREDIENT AND CHEMICAL COMPOSITION OF LICKS

Ingredient	Composition				
	Ex	F*	Chemical	Ex	F
Urea	15	15	OM	62.15	63.28
Molasses	45	45	N	9.25	9.53
Mineral mixture	15	15	EE	0.75	0.78
Salt	8	8	CF	1.65	1.78
Sod. Bentonite	3	3	NFE	50.50	51.19
Calcite powder	4	4	TA	37.85	36.72
Cotton seed cake	10	10			

* Contains farmore a herbal extract.

The animals were fed for a period of 130 days and a 7 days metabolism trial was conducted in the last stage of growth experiment. The samples of feed, feaces and urine were analysed for proximate principles (AOAC, 1984). Body composition of the animals was determined by antipyrine dilution technique (Wellington et al., 1956). Total body water was calculated from antipyrine levels in plasma water (Soberman, 1950) and the body fat, protein and ash content in empty body weight were calculated using equations as given by Reid et al. (1955). TDN and ME values were calculated from digestibility data and with these values Protein retention efficiency (PRE) and Gross energetic efficiency (GEE) was calculated by the formulas developed by Nagpal et al. (1982). All the data were analysed statistically (Snedecor and Cochran, 1968) for interpretation.

Results

Effect of UMM lick supplementation on growth

Initial and final body weights of the animals are given in table 2. While the animals of group I (control) gained body weight at the rate of 533.8 ± 27.25 g/d, the animals in group II and III also grew well at rates of 532.3 ± 42.24 and 538.4 ± 18.68 g/d, respectively ($p > 0.05$). Total gain in body weights during 130 d experiment was 69.4 ± 3.54, 69.2 ± 4.54 and 70.0 ± 2.43 kg in the three groups, respectively. Growth rate of animals fed control ration as well as rations in which 1/3rd of the concentrate mixture was replaced by UMM lick was similar through out the experimental period (figure 3).

TABLE 2. GROWTH RATE OF CATTLE ON 1 /3 REPLACEMENT OF CONCENTRATE MIXTURE WITH UMM LICKS

Particulars	Groups		
	I	II	III
Initial body weight (kg)	158.0 ± 8.73	158.4 ±12.53	153.8 ± 9.48
Final body weight (kg)	227.4 ± 7.40	227.6 ±19.43	223.8 ±10.52
Total gain (kg)	69.4 ± 3.54	69.2 ± 4.54	70.0 ± 2.43
Body weight gain (g/day)	533.8 ± 27.25	532.3 ±42.24	538.4 ±18.68

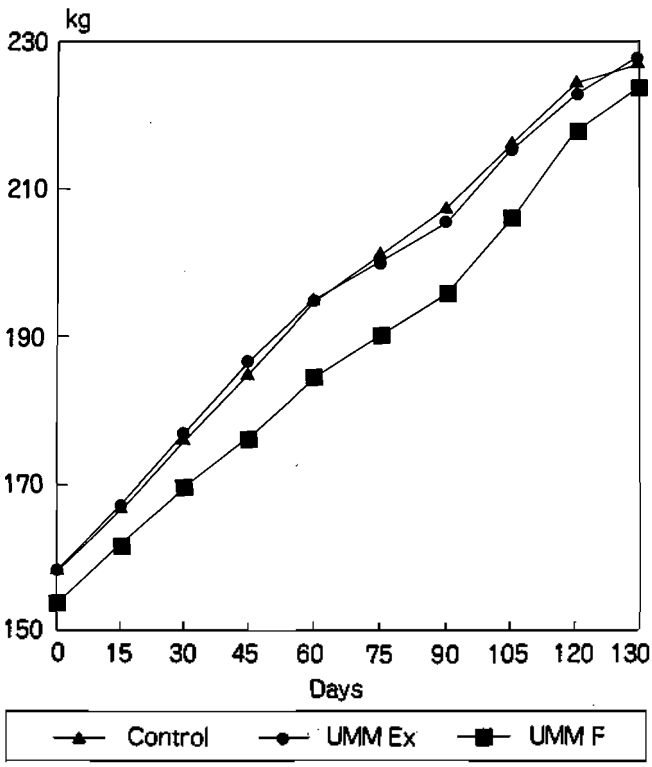

Figure 1. Growth pattern in animal fed on control ration and UMM licks Ex and F.

DMI and nutrient digestibility

Chemical composition of feeds is given in table 3.

Wheat straw intake (kg/d) were higher in group Ⅱ (3.75 ± 0.23) and Ⅲ (3.76 ± 0.19) as compared to group Ⅰ (3.46 ± 0.32) though the differences were not significant. UMM 'F' lick consumption was lower than UMM Ex and that too was not significant. Total DM intake (kg/d) was not significantly ($p > 0.05$) different and the values were 5.67 ± 0.28, 5.74 ± 0.31 and 5.62 ± 0.24 in groups Ⅰ, Ⅱ and Ⅲ, respectively (table 4). DMI based on kg/100 kg b. wt. as well as g/kg $w^{0.75}$ were also not affected significantly ($p > 0.05$) due to replacement of 1/3rd concentrate mixture with UMM licks. DMI (kg/100 kg b. wt). was 2.54 ± 0.14, 2.58 ± 0.11 and 2.55 ± 0.08 in groups Ⅰ, Ⅱ and Ⅲ, respectively.

Dry matter digestibility (DMD) was significantly ($p < 0.05$) higher in group Ⅲ (58.36 ± 1.89) than in group Ⅱ (52.85 ± 1.48), however, DMD in group Ⅰ (54.62 ± 1.68) was not significantly affected due to the replacement of concentrate mixture with UMM lick. Organic matter digestibility (OMD) was also higher ($p < 0.05$) in group Ⅲ (60.12 ± 1.75) as compared to group Ⅰ (56.40 ± 1.38) and Ⅱ (55.33 ± 1.48). However digestibility of EE was higher ($p < 0.01$) in group Ⅰ (59.98 ± 1.05) than in group Ⅱ (52.41 ± 0.75) and Ⅲ (52.32 ± 1.00). CF, CP and NFE digestibilities were similar in all the three groups.

TABLE 3. CHEMICAL COMPOSITION OF FEEDS (% DM BASIS)

	Wheat straw	Concentrate mixture
OM	89.02	92.11
CP	3.88	20.18
EE	0.68	4.15
CF	35.13	8.03
NFE	49.33	59.75
TA	10.98	7.89

TABLE 4. DRY MATTER INTAKE AND DIGESTIBILITY COEFFICIENTS OF DIFFERENT NUTRIENTS

Parameters	Groups		
	Ⅰ	Ⅱ	Ⅲ
	Dry matter intake		
Wheat straw (kg/d)	3.46 ± 0.32	3.75 ± 0.23	3.76 ± 0.19
Conc. Mix. (kg/d)	2.21 ± 0.05	1.74 ± 0.05	1.73 ± 0.05
UMM lick (kg/d)	–	0.23 ± 0.05	0.13 ± 0.02
Total (kg/d)	5.67 ± 0.28	5.74 ± 0.31	5.62 ± 0.24
kg/100 kg body wt.	2.54 ± 0.14	2.58 ± 0.11	2.55 ± 0.08
g/kg $W^{0.75}$	98.21 ± 6.73	99.24 ± 2.94	98.12 ± 2.51
	Digestibility coefficients		
DM*	54.62^{ab} ± 1.68	52.85^{a} ± 1.48	58.36^{b} ± 1.89
OM*	56.40^{a} ± 1.38	55.33^{a} ± 1.48	60.12^{b} ± 1.75
CP	60.66 ± 0.27	59.73 ± 0.35	60.38 ± 0.36
EE*	59.98^{a} ± 1.05	52.41^{b} ± 0.75	52.32^{b} ± 1.00
CF	49.71 ± 0.89	49.91 ± 0.76	50.72 ± 1.19
NFE	62.40 ± 0.62	61.98 ± 0.63	62.50 ± 0.78

* $p < 0.05$.

N balances, body composition and nutrient utilization efficiency

As there were no differences in the DMI and digestibility of N and its loss in urine, the balances were also not different among the three groups (table 5). Total N intake (g/d) values through various feeds were 92.99 ± 1.22, 100.94 ± 6.99 and 90.93 ± 3.98 in group Ⅰ, Ⅱ and Ⅲ, respectively and the N retained (g/d) values were 22.03 ± 0.68, 22.48 ± 0.90 and 19.56 ± 1.10 in the three groups respectively.

TABLE 5. NITROGEN BALANCES OF ANIMALS IN VARIOUS GROUPS

Parameters	Groups		
	Ⅰ	Ⅱ	Ⅲ
Intake (g/d)	92.99 ± 1.22	100.94 ± 6.99	90.93 ± 3.98
Loss in faeces (g/d)	35.58 ± 0.46	40.76 ± 3.14	36.05 ± 1.74
Loss in urine (g/d)	34.38 ± 0.72	37.74 ± 3.15	35.31 ± 1.60
Balances	22.03 ± 0.68	22.48 ± 0.90	19.56 ± 1.10

Similarly body composition of the animals were also not affected due to UMM lick feeding and was the same

in the three groups of animals. Body water (%) was 65.56 ± 0.36, 65.82 ± 0.24 and 65.56 ± 0.27 in groups Ⅰ, Ⅱ and Ⅲ. Body protein and body fat as percent of empty body weight were 18.80 ± 0.17, 10.62 ± 0.29 in group Ⅰ, 18.57 ± 0.34, 10.64 ± 0.29 in group Ⅱ and 18.65 ± 0.17, 10.45 ± 0.29 in group Ⅲ (table 6). Dry matter intake per kg gain was also not affected significantly in the three groups (10.69 ± 0.88, 10.87 ± 1.10 and 10.42 ± 0.93) (table 7). Though the PRE was higher in group Ⅲ (82.57 ± 2.54) than in group Ⅰ (73.10 ± 4.24) and Ⅱ (70.33 ± 5.14), the differences were not significant ($p > 0.05$) (table 7). GEE did also not differ significantly in various groups. Though there was no difference in intake, digestibility and growth yet the cost of feeding per day, per kg DM and per kg DOM was significantly lower in UMM licks fed groups and for per kg DM and per kg DOM it was still lower in group Ⅲ. The values were 1.42, 0.89 and 0.79 for per kg DM, 2.26, 1.68 and 1.19 for per kg DOM and 7.92, 4.63 and 3.44 for feed/d in group Ⅰ, Ⅱ and Ⅲ respectively.

TABLE 6. BODY COMPOSITION (%) OF THE ANIMALS IN VARIOUS GROUPS

Parameters	Groups		
	Ⅰ	Ⅱ	Ⅲ
Water	65.56 ±0.36	65.82 ±0.24	65.56 ±0.27
Protein	18.80 ±0.17	18.57 ±0.34	18.65 ±0.17
Fat	10.62 ±0.29	10.64 ±0.29	10.45 ±0.29
Ash	5.03 ±0.27	4.98 ±0.33	5.33 ±0.31

TABLE 7. EFFICIENCY OF NUTRIENT UTILIZATION AND COST OF FEEDING ON PARTIAL REPLACEMENT OF CONCENTRATE MIXTURE WITH UMM EX AND F

Parameters	Groups		
	Ⅰ	Ⅱ	Ⅲ
DM intake/kg gain	10.69 ±0.88	10.87 ±1.10	10.42 ±0.93
Protein retention efficiency (PRE)	73.10 ±4.24	70.33 ±5.14	82.57 ±2.54
GE ratention efficiency	12.78 ±0.56	12.62 ±0.49	13.02 ±0.33
Cost/kg DM** (Rs)	1.42[a]	0.89[b]	0.79[c]
Cost of feed/day** (Rs)	7.92[a]	4.63[b]	3.44[b]
Cost/kg DOM** (Rs)	2.26[a]	1.68[b]	1.19[c]

** $p < 0.01$.

Discussion

It has been reported that UMM 'Ex' lick can support the maintenance requirement of the animals with straw as staple feed (Mangat Ram and Kunju, 1986) and for growing animals, concentrate mixture was reduced and the growth of the animals was not affected (Mangat Ram, 1989 and Madhu Mohini and Gupta 1993). UMM lick F contained Farmore a herbal extract which improves the metabolism and affects the growth. The composition of both licks was the same. As DM provided through concentrate mixture was less in UMM lick given groups, and UMM lick was condensed form of nutrients also provided very little DM, this was compensated by higher straw intake. So total DMI was not different significantly in the various groups. DMD and OMD increased significantly by adding Farmore which is apperant in group Ⅲ and growth rate was higher in group Ⅲ inspite of less consumption of UMM F, though the differences were not significant. It has been reported that the supplementation of UMM lick in the ration of calves had not affected the growth rate as compared to only concentrate ration fed calves (Madhu Mohini and Gupta, 1994).

As there was no difference in the DMI and digestibility of CP, nitrogen balances were also not different in the three groups. Body composition of the animals of the three groups were similar. It showed that nutrients of UMM lick were utilized efficiently and these had not made any difference in body protein and body fat percentage. It indicated that the body weight gain in all the groups was due to proper growth rather than the deposition of excess fat or water in the body (Singh and Gupta, 1989; Nagpal et al., 1982). However, retention efficiency of protein and energy were similar in three groups of animals inspite of replacement of 1/3rd concentrate with UMM lick. Protein retention efficiency was similar as reported earlier by Singh and Gupta (1989) on feeding wheat straw and concentrate mixture to crossbred calves while Upadhyaya (1989) reported only 47.37% PRE in crossbred calves. In buffalo, on supplementation of UMM lick PRE was 54.78% (Madhu Mohini and Gupta, 1994). Cost of feed per day was also reduced on supplementation of UMM lick in the ration which was further decreased with UMM F which

contained a herbal extract.

Hence, it is evident from this study that replacement of one third concentrate mixture with UMM lick in the ration of growing calves resulted in growth performance at par with control ration and supplementation of UMM lick to the growing animal ration was very economical.

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