NUTRIENT UTILIZATION, GROWTH RATE AND BODY COMPOSITION OF CROSSBRED CALVES SUPPLEMENTED WITH UREA MOLASSES MINERAL BLOCK LICKS

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Summary

Twenty male crossbred (Sahiwal × HF) calves of about 6-9 months of age were divided into four groups of five animals each. All the animals were offered wheat straw *ad lib.* as the basal feed. However, animals in group I were fed concentrate mixture while the animals in groups II, III and IV had free access to urea molasses mineral block (UMMB) lick (I), (II) and (III) respectively as a partial substitute of concentrate mixture.

The average concentrate offered (kg/day) to the animals was significantly ($p < 0.01$) higher in group I (2.69 ± 0.18) compared to groups II (1.76 ± 0.15), III (1.70 ± 0.06) and IV (1.65 ± 0.12). The UMMB lick consumed was non-significantly different amongst different groups. Live weight gains (g/day) were not significantly different amongst groups I (535.40 ± 38.14), II (525.60 ± 31.82), III (551.00 ± 38.49) and IV (548.80 ± 45.46). Except ether extract, the digestibility coefficients of CP, ADF and NDF were non-significantly different in different groups. Similarly, N balance (g/day) and percent N retention of intake was not affected in different groups on supplementation of UMMB lick. Body composition of animals was similar in different groups supplemented with either concentrate mixture or concentrate mixture and UMMB licks.

It may be concluded from these studies that UMMB lick can partially replace the concentrate mixture in the diet of growing calves without affecting the growth rate, nutrient utilization and body composition. The UMMB lick, thus, can form a part of the ration economically in the diet of growing ruminants especially in developing countries.

(**Key Words**: Urea Molasses Block, Body Composition, N Retention, Growth Rate)

Introduction

Crop residues form the bulk of ruminants' diet in most of the developing countries (Jayasurya, 1987). These crop residues are deficient in protein, energy and minerals and can't support even body maintenance of the animals. One of the methods of increasing utilization of straws is the supplementation of deficient nutrients in the form of fermentable N, energy and minerals through urea, molasses and mineral mixture respectively (Pathak and Ranjhan, 1976; McLennan et al., 1981; Daniel et al., 1986). Spraying of these ingredients on the straw could not become popular due to the risk of urea toxicity and problem of distribution, handling and storage of molasses under field conditions. The problem has been overcome in India by the introduction of urea molasses mineral block (UMMB) licks developed at the National Dairy Development Board, Anand, India (Kunju, 1986). In the present study, UMMB lick was offered to the growing male crossbred calves to observe whether the partial substitution of concentrate mixture with UMMB lick can sustain growth rate and the effect on nutrient utilization and body composition.

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Materials and Methods

UMMB licks preparation

The UMMB licks (I), (II) and (III) were manufactured using hot process (Kunju, 1986). The ingredient composition of different UMMB licks is given in table 2. The UMMB lick (I) contained 10 percent cotton seed meal whereas, UMMB lick (II) contained 10 percent groundnut meal in place of cotton seed meal. The UMMB lick (III) had both cottonseed as well as ground-

nut meal. These combinations were tried to study the effect of source and level of protein meal on the nutrient utilization from different UMMB licks.

Animals and management

Twenty male crossbred (Sahiwal × HF) calves of 6-9 months of age were divided into four groups of five animals each following a randomised block design.

Animals in all the groups were fed on wheat straw *ad lib.* as the sole roughage. In addition, animals in group Ⅰ, Ⅱ, Ⅲ and Ⅳ were fed concentrate mixture. However, animals in groups Ⅱ, Ⅲ and Ⅳ had free access to UMMB lick (Ⅰ), (Ⅱ) and (Ⅲ) respectively. The growing animals were fed concentrate to meet nutrient requirements (ARC, 1980). A growth trial was conducted for a period of 180 days after a preliminary adaptation period of 40 days. The animals were weighed at fortnight intervals on two consecutive days in the morning before offering feed and water. A 7 day metabolism trial was conducted at the end of growth trial. The feed, feces and urine samples were analysed (AOAC, 1975).

The body water of calves was estimated by injecting 30 percent solution of antipyrine (2, 3 dimethyl-1-phenyl-3-pyrazolin-5-one; phenazone) and by using the formula devised by Soberman (1950). Body fat (%) was estimated as per the equation of Reid et al. (1955). Body protein (%) was estimated by using the equation of Reid et al. (1963). The ash (%) was estimated by deducting percent body water, body fat and body protein from 100. The data were analysed statistically using randomised block design (Snedecor and Cochran, 1981).

Results and Discussion

Chemical composition, feed intake and growth rate

Chemical composition of different feed ingredients and ingredient composition of different UMMB licks has been shown in table 1. The UMMB licks had high crude protein content due to the addition of urea @ 15 percent. The UMMB lick (Ⅰ) contained 10 percent cotton seed meal whereas, UMMB lick (Ⅱ) contained 10 percent groundnut extraction. The cotton seed and groundnut meal were put together in UMMB lick (Ⅲ) by reducing mineral mixture and salt content.

TABLE 1. CHEMICAL COMPOSITION (%) OF FEED INGREDIENTS AND INGREDIENT COMPOSITION OF UMMB LICKS FED UNDER VARIOUS GROUPS

Particulars	Crude protein	Ether extract	Acid detergent fibre	Neutral detergent fibre	% Ingredient composition of different UMMB licks			
					Particular	Ⅰ	Ⅱ	Ⅲ
Wheat straw	3.25	0.82	52.5	77.2	Urea	15	15	15
					Molasses	45	45	45
					Mineral mixture[2]	15	15	10
Concentrate mixture	20.82	3.96	16.9	42.2	Common salt	8	8	2
					Calcite powder	4	4	4
UMMB (Ⅰ)	60.25	0.62	4.9	10.3	Sodium bentonite	3	3	3
UMMB (Ⅱ)	60.87	0.65	5.0	10.8	Cotton seed meal	10	–	10
UMMB (Ⅲ)	62.87	0.60	7.8	14.0	Groundnut meal	–	10	11

[1] Urea molasses block lick.
[2] Prepared as per ISI: 1664 (Indian Standrad Institute, India).

Feed intake and daily body weight gain are shown in tabel 2. Concentrate mixture offered to animals in groups Ⅱ, Ⅲ and Ⅳ was significantly ($p < 0.01$) lower compared to group Ⅰ. However, wheat straw intake was significantly ($p < 0.05$) higher in groups Ⅱ, Ⅲ and Ⅳ as compared to group Ⅰ. Different UMMB licks were consumed at the same rate in different groups. The daily weight gain (g/day) was non-significantly different amongst different groups.

TABLE 2. FEED INTAKE AND DAILY BODY WEIGHT GAIN BY CROSSBRED CALVES UNDER VARIOUS GROUPS

Groups	Initial body weight (kg)	Concentrate intake** (kg/day)	Wheat straw intake* (kg/day)	UMMB intake (kg/day)	Live weight gain (g/day)
I	139 ± 13.35	2.69^{a} ± 0.18	3.16^{a} ± 0.33	–	535.40 ± 38.14
II	139 ± 12.05	1.76^{b} ± 0.15	3.68^{b} ± 0.19	0.320 ± 0.02	525.60 ± 31.82
III	139 ± 10.85	1.70^{b} ± 0.06	3.88^{b} ± 0.29	0.320 ± 0.02	551.00 ± 38.49
IV	139 ± 8.40	1.65^{b} ± 0.12	4.03^{b} ± 0.26	0.310 ± 0.02	548.80 ± 45.46

^{a,b} Figures with different superscripts in a column differ significantly.
** $p < 0.01$.

Concentrate fed in groups II, III and IV was less as compared to group I as UMMB licks were supplemented in these groups which substituted a part of their requirement of concentrate mixture. Since, N and energy requirements of all the animals were met, the animals in groups II, III and IV tended to meet their DM requirements through wheat straw which explains the higher consumption of wheat straw by the animals in these groups.

The results of the growth study revealed that the UMMB licks supplemented to wheat straw based diet can partially substitute concentrate mixture. Thus, it was safe to incorporate UMMB lick in the ration of growing calves. However, no additional advantage was obtained in growth rate on feeding UMMB lick (II) or (III) compared to (I). The UMMB lick (III) contained 11 percent groundnut and 10 percent cottonseed meal, it was expected that the growth rate could be slightly better in animals having access to this type of UMMB licks. The results of this study clearly revealed that small amount of protein (12.0, 12.8 and 24.8 in groups II, III and IV respectively) provided by UMMB lick had no significant effect on the growth rate of the animals. Beams (1963) used UMMB lick in the ration of growing cattle where UMMB lick significantly reduced loss in body weight. Coombe and Mulholland (1983) used UMMB lick as supplement for grazing sheep. There was less loss of weight in UMMB supplemented sheep compared to unsupplemented one. Similarly, effect of UMMB lick supplementation on growth rate was studied and reported by several other workers (Neric et al., 1985; Sudana and Leng, 1986; Mirza et al., 1988; Tiwari et al., 1990).

Digestibility of nutrients and N balance

Digestibility coefficient of various nutrients and N balance in different groups is shown in table 3. The ether extract digestibility coefficient was significantly ($p < 0.01$) lower in groups II, III and IV as compared to group I. However, digestibility coefficients of CP, ADF and NDF were not significantly different in different groups. Similarly N balance (g/day) and percent N retention of intake were not significantly different amongst groups I to IV.

Digestibility coefficient of ether extract was higher in group I compared to groups II, III and IV due to the fact that concentrate mixture was fed at higher rate in this group which is a source of highly digestible ether extract (Palmquist and Jenkins, 1980). It seems that the rate of fermentation was not significantly different in the rumen of animals fed under different treatments due to which no difference in digestibility coefficients of CP, NDF and ADF was observed. There was no significant difference in the N balance data amongst different groups which indicated that urea-N supplied through UMMB licks in groups II, III and IV was efficiently utilized due to slow and continuous ingestion of urea through UMMB licks. Putnam et al. (1964) reported that when urea and molasses were fed to steers, digestibilities of different nutrients was not affected. Similarly other workers also reported positive N balance on supplementation of urea and molasses (Gupta et al., 1968, 1970; Gill et al., 1971; Sudana and Leng, 1986; Mirza et al., 1988).

Body composition of calves

Body composition of calves fed under different

treatments is shown in table 4. The percent body water, portein, fat and ash were not different in calves amongst different groups. When crossbred calves were fed either urea or SRUFC (slow release urea formaldehyde complex), no difference in body composition was observed (Sharma, 1983). Singh (1983) and Puri (1988) observed no difference in body composition when ammoniated wheat straw was fed to buffalo calves and urea (ammonia) treated paddy straw was fed to crossbred calves, respectively. Similarly, Reid et al. (1963) reported that in cattle, percent body protein and ash remained constant and did not differ with diet.

These studies indicated when different UMMB licks were incorporated in the diet of growing crossbred calves by substituting a part of the concentrate mixture, growth rate, digestibility of nutrients and body composition was not affected.

TABLE 3. DIGESTIBILITY COEFFICIENTS OF VARIOUS NUTRIENTS AND N BALANCE IN DIFFERENT GROUPS

Groups	Crude protein	Ether** extract	Acid detergent fibre	Neutral detergent fibre	N balance (g/day)			
					Intake	Outgo	Balance	% Retention of intake
I	60.81 ±1.07	61.20[a] ±1.02	44.11 ±1.12	50.25 ±0.71	106.27 ±7.65	77.19 ±3.52	29.08 ±1.23	27.78 ±1.78
II	61.35 ±1.07	51.20[b] ±0.87	44.87 ±0.98	50.84 ±0.95	108.54 ±6.59	79.36 ±4.22	29.18 ±1.65	27.57 ±2.96
III	61.29 ±1.43	51.27[b] ±0.67	44.06 ±1.17	50.83 ±0.75	107.84 ±4.59	77.98 ±2.85	29.86 ±0.71	28.57 ±1.43
IV	61.11 ±1.56	51.63[b] ±1.07	44.46 ±0.84	50.81 ±1.21	106.66 ±6.36	77.12 ±3.47	29.54 ±1.05	28.01 ±1.52

[a,b] Figures with different superscripts in a row differ significantly.
** $p < 0.01$.

TABLE 4. PERCENT BODY COMPOSITION OF ANIMALS FED UNDER DIFFERENT GROUPS (%)

Groups	Water	Protein	Fat	Ash
I	66.10 ± 0.22	18.71 ± 0.07	10.05 ± 0.21	5.14 ± 0.08
II	65.96 ± 0.21	18.67 ± 0.06	10.18 ± 0.20	5.18 ± 0.07
III	66.11 ± 0.39	18.71 ± 0.12	10.05 ± 0.38	5.13 ± 0.13
IV	65.84 ± 0.25	18.64 ± 0.07	10.30 ± 0.24	5.22 ± 0.08

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Literature Cited

Association of Official Analytical Chemists. 1975. Official methods of analysis. A.O.A.C., Washington D.C., 12th edn.

ARC. 1980. The nutrient requirement of ruminant livestock. Commonwealth Agricultural Bureaux, Farnham, Royal.

Beams, R. M. 1963. Provision of urea to cattle in a salt/urea/molasses block. Queensland J. Agric. Sci. 20:213-218.

Coombe, J. B. and J. G. Mulholland. 1983. Utilization of urea and molasses supplements by sheep grazing oat subtle. Aust. J. Agric. Res. 34:767-774.

Daniel, S. J., Q. Z. Hasan and K. Nath. 1986. Urea molasses liquid diet as a feed for calves. Indian J. Anim. Sci. 56:149-151.

Gill, R. S., D. D. Sharma and V. D. Mudgal. 1971. Studies on non-protein nitrogen utilization in ruminants. I. Effect of different levels of energy on the utilization of urea in growing (zebu) heifers. Indian J. Dairy Sci. 24:47-52.

Gupta, B. N., V. N. Murthy and S. A. Khan. 1968. Rumen digestion studies on improving the feeding quality of coarse fodders by urea and molasses impregnation. Indian Vet. J. 45:858-865.

Gupta, B. N., S. A. Khan and V. N. Murty. Rumen digestion studies on feeding urea-molasses enriched cereal straws to adult ruminants. Indian Vet. J. 47:773-781.

Jayasurya, M. C. N. 1987. Improvement of poor quality roughages. In: U. B. Singh (Editor), Advances in Animal Nutrition for Developing Countries. Indo vision, Ghaziabad. pp. 236-259.

Kunju, P. J. G. 1986. Urea molasses block lick: A feed supplement for ruminants. In: Ibrahim, M. N. M. and Schiere, J. B. S. (eds). Rice Straw and Related Feeds in Ruminant Rations. Proc. International Workshop held in Kandy, Sri Lanka, 24th to 28th March, pp. 261-274.

McLennan, S. R., G. S. Wright and G. W. Blight. 1981. Effect of supplements of urea molasses and sodium sulphate on the intake and live weight of steers fed rice straw. Aust. J. Expt. Agric. Husb. 21:367-370.

Mirza, T. H., J. K. Jadoon, M. A. Naqvi and A. Ali. 1988. Performance of lambs fed urea-molasses blocks vs. concentrate. Asian Aust. J. Anim. Sci. 1:27-34.

Neric, S. P., D. L. Aquino, P. C. Dela Cruz and S. K. Ranjhan. 1985. Effect of urea molasses mineral block lick on the performance of caracows. Indian J. Anim. Nutr. 2:84-88.

Palmquist, D. L. and T. C. Jenkins. 1980. Fat in lactation ration: Review. J. Dairy Sci. 63:1-14.

Pathak, N. N. and S. K. Ranjhan. 1976. Effect of urea molasses liquid diet feeding as the main source of nitrogen and energy alongwith limited amount of cereal forage and intact proteins on voluntary intake, growth response and utilization of nutrients in crossbred calves. Indian J. Anim. Sci. 46:515-520.

Puri, J. P. 1988. Effect of ammonia treatment of low and high lignified cellulosic feeds on chemical composition, fibre degradability, growth and nutrient utilization in cattle Ph. D. Thesis, submitted to Kurukshetra University, Kurukshetra, India.

Putnam, P. A., M. Cisae and R. E. Davi. 1964. Growth and N balance with steers fed Hi-N-molasses. J. Anim. Sci. 23:339-347.

Reid, J. T., A. Bensadoun, O. L. Paledines and B. D. H. Van Niekerk. 1963. Body water estimation in relation to body composition and indirect colorimetry in ruminants. Ann. N. Y. Acad. Sci. 110: 327-334.

Reid, J. T., G. H. Wellington and H. O. Dunn. 1955. Some relationships among the major chemical components of the bovine body and their applications to nutritional investigations. J. Dairy Sci. 38:1344-1352.

Sharma, V. K. 1983. Effect of Urea formaldehyde complexes as partial replacers of protein on the rumen fermentation pattern, nutrient utilization and growth in crossbred cattle. Ph. D. Thesis, Kurukshetra University, Kurukshetra, India.

Singh, S. P. 1983. Effect of ammonia treatment of wheat straw on rumen metabolism, nutrient utilization and growth in buffaloes. Ph. D. Thesis, Kurukshetra University, Kurukshetra, India.

Snedecor, G. W. and G. W. Cochran. 1981. Statistical Methods, 7th edn. The Iowa State University Press, IA. p. 267.

Soberman, R. J. 1950. Use of antipyrine in measurement of total body water in animals. Proc. Soc. Expt. Biol. and Med. 74:789-792.

Sudana, I. B. and R. A. Leng. 1986. Effect of supplementing wheat straw diet with urea or urea molasses block and/or cotton seed meal on intake and live weight changes of lambs. Anim. Feed Sci. Technical. 16:25-35.

Tiwari, S. P., U. B. Singh and U. R. Mehra. 1990. Urea molasses mineral blocks as a feed supplement: Effect on growth and nutrient utilization in buffalo calves. Anim. Feed Sci. and Technol. 20:333-341.