RESPONSE OF FEED INTAKE, BLOOD METABOLITES, BODY WEIGHT GAIN AND MILK YIELD OF NILI RAVI BUFFALOES TO UREA-MOLASSES-MINERAL SUPPLEMENTATION

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ABSTRACT

A study was conducted to examine the effect of urea-molasses-mineral supplementation on feed intake, blood metabolites, body weight gain, milk yield and milk composition of Nili Ravi buffaloes. Twelve lactating cows and twelve weaned calves of Nili Ravi breed were used. The cows were divided into two groups (n=6/group) balanced by body weight (610.5±0.25 kg), length of lactation (78.5±0.15 d) and milk yield (6.6±0.01 l/d). The calves were divided into two groups (n=6/group) balanced by age (105.5±0.15 d) and body weight (67.3±0.5 kg). One group of cows and one group of calves were supplementary fed with urea-molasses-mineral block (UMMB) and urea-molasses-mineral mixture (UMMM), respectively. Both UMMB and UMMM contained 10% urea, 40% molasses and 8% mineral by weight. Measurements were obtained on daily intake of UMMB/UMMM, individual body weight, blood urea nitrogen (BUN) and beta hydroxy butyrate (BHB) of cows and calves. Daily milk yield, composition and proximate composition of feed were also determined. The nutrient contents of UMMB and UMMM were superior to that of concentrate and roughage normally offered to cows and calves. Intake of UMMB/UMMM increased over time. Supplementary feeding of UMMB/UMMM increased BUN in cows and calves, lowered BHB in cows, and increased daily milk yield in 1:1 (v/w) proportion with UMMB intake, resulting increased net profits. Milk composition was not altered. Body weight gain improvement was not significant. The results suggest that supplementary feeding of the tested UMMB improve nutritional status and milk yield of Nili Ravi buffaloes.

Key words: Urea-molasses-mineral supplementation, Milk yield, Body weight, Buffaloes

INTRODUCTION

The animal industry of Sri Lanka is in dire need of improving its productivity to meet the growing demand for animal proteins. In this context, attempts have been made in the recent past to improve buffalo production by introduction of exotic breeds, implementation of cross breeding programs, and through improvement of nutritional status via supplementary feeding of concentrate mixtures, urea treated/supplemented straw etc. However, many an attempt made to improve the nutritional status were marred by various factors such as high cost of concentrates, impracticality of the methodologies used and unacceptance by the farmers. The latest introduction to this field of supplementary feeding is urea-molasses-mineral block (UMMB), which is more practical, as its intake can be easily controlled and can be adopted by many farmers regardless of the scale of operation. Perera and Manel Devi (1996) examined the physical characteristics of UMMB of varying composition under local conditions. While it is undoubtedly important to introduce a supplementary feed which is more practical, it is equally important to ascertain that the introduced supplementary feed is effective in improving the nutritional status and productivity resulting economic benefits under local conditions. Due to novelty of its introduction, information is scarce on the response of buffaloes to UMMB supplementation in Sri Lanka. This study was designed to examine the effect of urea-molasses-

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mineral supplementation on feed intake, blood metabolites, body weight gain, milk yield, milk composition and profitability of milk production of Nili Ravi buffaloes under existing management conditions.

MATERIALS AND METHODS

The study was conducted at the National Livestock Development Board farm, Nikaweratiya located in the Kurunegala District in the dry Zone of Sri Lanka. Twelve lactating buffalo cows and twelve weaned calves of the Nili Ravi breed were used for the experiment.

The cows were divided into two groups (n=6/group) balanced by body weight (610.5±0.25 kg), length of lactation (78.5±0.15 d) and milk yield (6.6±0.01 l/d). Both groups were managed according to the general management practices adopted by the farm by allowing day time free grazing, mid-day wallowing, twice a day milking, offering of a concentrate mixture containing coconut poonac and rice bran (1:2) @ 2.5 kg/cow /day at the time of milking and night stall feeding. One group of cows was supplementary fed with prepared urea-molasses-mineral block (UMMB) while the other group served as the control.

The calves were divided into two groups (n=6/group) balanced by age (105.5±0.15 d) and body weight (67.3±0.05 kg). Both the groups of calves were also managed according to the normal management practices adopted by the farm by allowing daytime free grazing, night stall-feeding and offering of broiler finisher @ 0.5 kg/calf/day. One group of calves was supplementary fed with urea-molasses-mineral mixture (UMMM), while the other group served as the control. The composition of UMMB and UMMM offered to the animals is given in Table 1. Both UMMB and UMMM contained 10% urea, 40% molasses and 8% mineral by weight. Except for the dietary treatments, all the other general management practices were maintained identical for the two groups of cows and calves.

Representative samples of UMMB, UMMM, and concentrate mixtures offered to cows and calves by the farm were obtained periodically for proximate analysis (AOAC, 1980). Daily measurements were obtained on supplementary intake of UMMB/UMMM by individual animals and milk yield of cows. Individual body weight of cows and calves were recorded once every 10 days. Jugular vein blood samples were obtained from all the animals at 3 hr post feeding at 3 weekly intervals to determine blood urea nitrogen (BUN) and beta hydroxybutyrate (BHB) contents. These blood parameters were determined using the blood metabolite kits of the International Atomic Energy agency (IAEA) according to the IAEA protocols (IAEA, 1993). The chemical compositions of milk in the samples obtained at weekly intervals from individual cows were determined using standard methods.

Data on each parameter of the two groups of cows and calves were statistically analyzed using Student's T-test. Cost benefit analysis of supplementary feeding was performed considering the additional cost incurred in supplementary feeding of UMMB/UMMM and additional returns gained in the form of milk and bodyweight gain.

Table 1. Ingredient Composition of UMMB and UMMM

Ingredients	UMMB (% WT)	UMMM (% WT)
Urea	10	10
Molasses	40	40
Coconut poonac	20	25
Rice bran	12	17
Mineral mixture	08	08
Cement	10	-

Table 2. Proximate Composition of Supplementary Feeds (as % DM)

Item	UMMB	Farm Concentrate*	UMMM	Broiler Finisher
Dry Matter (%)	82.33 ± 1.2	83.80 ± 3.0	79.60 ± 2.2	87.17 ± 2.3
Crude protein (%)	26.10 ± 1.3	14.10 ± 0.8	28.16 ± 1.1	18.66 ± 0.9
Crude fibre (%)	13.00 ± 0.6	15.10 ± 0.3	12.10 ± 0.3	13.70 ± 2.1
Gross Energy (kcal/g)	3.37 ± 0.4	3.18 ± 0.3	3.95 ± 0.3	3.40 ± 0.1

* Coconut poonac : Rice bran = 1 : 2

RESULTS AND DISCUSSION

Proximate Composition

The chemical composition of UMMB, UMMM and concentrate mixtures offered by the farm is given in Table 2. The prepared UMMB and UMMM offered to the treatment groups were superior in crude protein content to that of the concentrate mixtures (26% vs. 14% and 28% vs. 18%, respectively) offered to all the cows and calves by the farm. Since the treatment animals consumed UMMB and UMMM in addition to the concentrate offered by the farm, a higher nutrient intake by the treatment group animals in the form of UMMB and UMMM can be expected.

Feed Intake

The intake of UMMB and UMMM by the buffalo cows and calves is presented in Table 3. Since it was not practically possible to obtain accurate measurements on the roughage intake of study animals due to the free grazing management practice adopted by the farm, it was assumed that both groups of cows as well as both groups of calves have similar roughage intake. Hence, emphasis will be paid only on the intake of UMMB and UMMM of experimental animals during the subsequent discussion. The intake of UMMB by cows and UMMM by calves increased with time suggesting acceptance and adaptation by the animals to the newly introduced supplementary feed. Cows accepted UMMB more readily than UMMM acceptance by calves. Mean daily intake of cows increased from about 100 g in the first week to about 500 g in the 12th week resulting a mean post treatment daily UMMB consumption of 0.39 kg/cow. Daily UMMM intake of calves increased from about 20 g in the first week to about 200 g in the 12th week resulting a mean post-treatment daily UMMM intake of 62 g/calf. The higher crude protein content of the UMMB/UMMM and the additional intake of UMMB/UMMM by the treatment groups of cows and calves resulted in a greater nitrogen and energy intake by these animals (Table 3). Whether this higher energy and nitrogen intake was reflected in the blood parameters and whether it could effectively and economically enhance the milk yield and body weight gain will be discussed in the next sections.

Blood Parameters

The mean values of blood urea nitrogen and beta-hydroxybutyrate of the cows and calves before and after (during) the supplementation treatment are given in Table 4. Changes in the

Table 3. Supplementary Intake of UMMB, UMMM, Energy and Nitrogen

Parameter	UMMB (Cows)	UMMM (Calves)
Mean Intake (as fed)	0.39 kg/cow/d 63.7 g/100 kg BW/d	0.06 kg/calf/d 76.9 g/100 kg BW/d
Gross Energy Intake	176.7 kcal/100 kg BW/d	241.7 kcal/100 kg BW/d
Nitrogen intake	2.19 g/100 kg BW/d	2.75 g/100 kg BW/d

Table 4: Responses of Blood Parameters, Body Weight and Milk Yield

Parameter	Pre-treatment	Post-treatment
BUN (mmol/l) :		
Cows: UMMB	1.31 ± 0.13	1.85 ± 0.08
Control	1.30 ± 0.16	1.39 ± 0.09
Calves: UMMM	2.11 ± 0.03	2.21 ± 0.07
Control	2.18 ± 0.02	2.25 ± 0.01
BHB (mmol/l)		
Cows: UMMB	0.39 ± 0.02	0.21 ± 0.07*
Control	0.31 ± 0.11	0.31 ± 0.08
Calves: UMMM	0.25 ± 0.04	0.24 ± 0.10
Control	0.23 ± 0.06	0.29 ± 0.06
Body weight (kg)		
Cows: UMMB	610.2 ± 0.3	644.8 ± 0.8*
Control	610.5 ± 0.5	632.2 ± 0.6
Calves: UMMM	67.3 ± 0.4	93.8 ± 1.5
Control	67.4 ± 0.5	88.2 ± 1.4
Milk yield (l/d)		
UMMB	5.60 ± 0.54	5.85 ± 0.3*
Control	5.26 ± 0.26	5.45 ± 0.7

*P <.05

nutritional status is reflected in certain circulating blood metabolites (Payne *et al.*, 1970; Blowey *et al.*, 1973; Lee *et al.*, 1978). Blood urea nitrogen reflects the intake of rumen degradable protein (RDP) and its balance with fermentable metabolizable energy (FME). Blood urea nitrogen concentration in both cows and calves were below the established reference levels for cattle (IAEA, 1983) and concentrations found among buffaloes in Sri Lanka (Perera and Perera, 1995). This lower than normal BUN concentrations may be indicative of inadequate RDP in the rumen. Although BUN of UMMB /UMMM supplemented animals increased in response to supplementation, the BUN levels in any of the groups did not reach the established optimum values for dairy cows. The observed increase in BUN in response to UMMB/UMMM supplementation is in agreement with the findings of the urea supplementation experiments conducted using buffalo under local conditions (Perera and Perera, 1995; Sahama *et al.*, 1994), and suggests improvement in soluble nitrogen in the rumen (RDP). Since the BUN levels did not reach the optimum levels even after supplementation, a further improvement may be possible through increasing the urea content in the block.

Circulating beta-hydroxybutyrate concentrations reflect the status of energy nutrition in the animal because BHB levels increase with the mobilization of body reserves. The pre-treatment BHB values were within optimal range established for lactating cows (Whitaker *et al*, 1983) suggesting that these cows were not suffering from energy stress. Since the experimental cows were approaching mid lactation and their level of production was not high, it can be surmised that the feeding regime adopted by the farm would have been able to meet the energy requirement of these animals. The BHB concentrations of the control cows remained comparatively unchanged through out the experimental period supporting this speculation, while the BHB of UMMB supplemented cows lowered. The observed reduction of BHB concentrations in the UMMB supplemented cows suggests an improvement in the energy status in response to UMMB supplementation. In contrast to the circulating BHB response of cows to UMMB supplementation, the response in calves was not significant. The underlying reasons were not clear. Since the concentrations were within the established optimal levels, both groups of calves might have been in a positive energy balance.

Thus, the results on blood parameters indicate that the feeding regime normally adopted for these animals is able to meet the energy requirements at their low level of production but may not be fulfilling the nitrogen requirement, and that UMMB supplementation not only improves nitrogen intake but also energy nutrition of the buffalo cows.

Body weight gain

Body weight gain experienced by the two groups of cows and calves during the treatment period are given in Table 5. Both the groups of cows gained weight during the treatment period confirming that all the animals were in a positive balance as suggested by the BHB values. However, the body weight gain experienced by the treatment cows was superior (33 kg vs. 20 kg) to that experienced by the control group cows further indicating the effectiveness of UMMB in improving the nutritional status. Such improvements in body weight change in lactating buffaloes in response to UMMB supplementation have been reported (Preston and Leng, 1987).

Both groups of calves also gained weight during the treatment period, confirming that they were in a positive energy balance as indicated by BHB values. Although the UMMM supplemented calves gained greater body weight than the non-supplemented calves, the extra body weight gained by the treatment group calves was not significant. Superior gain in body weight by calves when supplemented with UMMB or UMM lick has been reported (Preston and Leng, 1987). The lack of significance in the observed difference in gain between the two groups of calves in this experiment could be attributed to the greater variation in body weight change among the calves within each group.

Milk yield

The mean daily milk yield of the UMMB supplemented cows increased steadily from 6.6 l (pre-treatment milk yield) to reach a peak yield of 8.1 l/d in the ninth week of supplementation and plaited there after, while the milk yield of the control group cows remained around 6.6 l/d and declined slightly after the eleventh week. Significant differences in daily milk yield between the two groups of cows were evident after the third week of UMMB supplementation. The gradual increase in milk yield of the UMMB supplemented cows paralleled their gradual increase in UMMB intake further suggesting the effectiveness of UMMB in improving milk yield through improvement in nutritional status. When the improvement in milk yield was compared with the intake of UMMB, it was evident that UMMB improved milk yield in 1:1 (v/w) proportion. These observations are in agreement with the findings reported elsewhere (Preston and Leng, 1987), and suggest that improving nutritional status through supplementary feeding of UMMB brought about a significant enhancement of milk yield and improvement in persistency of lactation in the supplemented group in addition to accelerating their rate of body weight gain.

Cost-benefit analysis

Economic evaluation considering the additional cost involved in supplementary feeding of UMMB to lactating Nili Ravi buffalo cows and UMMM to weaned calves, and the additional returns gained in the form of improvement in milk yield and body weight gain under existing management conditions indicated that urea-molasses-mineral supplementation resulted a minimum of Rs 12/= increase in the net profits from every additional liter of milk produced and Rs. 27/= from every additional kg of body weight gain.

CONCLUSIONS

The results suggest that UMMB supplementation effectively improves the nutritional status, milk yield, persistency of lactation and body condition of Nili Ravi buffalo cows enhancing the net profits of dairying under existing management conditions. The nutrient content of UMMB is higher than that of concentrate mixture containing coconut poonac and rice bran, but is less expensive. Hence UMMB is a suitable substitute for the concentrate mixture to be used as a supplementary feed for buffalo cows. Further improvements in the composition of UMMM for calves should be made as the additional benefits gained were marginal although superior.

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REFERENCES

A.O.A.C. 1980. *Official Methods of Analysis* (13th Edition). Association of Analytical Chemists. Washington D.C., U.S.A.

Blowey, J.M., Wood, D.W., and Davis, J.R. 1973. Nutritional monitoring system for dairy herds based on blood glucose, urea, albumin levels. *Vet Rec.* 92:691-696.

IAEA. 1993. Nutritional Metabolite Kit Protocols. *Animal Production Unit.* IAEA, Vienna.

Lee, A.J., Twardock, A.R., Bubar, R.H., Hall, J.E. and Davis, C.L. 1978. Blood metabolic profiles: Their use and relation to nutritional status of dairy cows. *J. Dairy Sci.* 61:1652-1670.

Payne, J.M., Sally, M.D, Manston, R. And Faulks, M. 1970. The use of metabolic profile test in dairy herds. *Vet. Rec.* 87:150-157.

Perera, A.N.F. and Manel Devi, A. 1996. *Effect of different locally available binding agents on hardness and weight change of urea molasses mineral blocks.* (in press).

Perera, E.R.K. and Perera, A.N.F. 1995. Changes in Growth, Rumen Characteristics and Blood Metabolites of Indigenous Buffalo heifers in response to Supplementary Feeding of Urea-treated Straw. *Proc. SAREC / NARESA Regional Symp. on the Role of the buffalo in rural development in Asia.* Kandy, Sri Lanka. Pp.:251-260.

Preston, T.R. and Leng, R.A. 1987 *Maching Ruminant Production Systems with Available Resources in the Tropics and Sub-Tropics.* Penambul Books, Armidale, Australia Pp.:191-196.

Sahama, T.M.I.R., Perera, E.R.K. and A.N.F. Perera. 1994. Effect of improved protein nutrition on rumen parameters and blood metabolites in water buffalo (*Bubalus bubalis*) heifers. *Trop. Agric. Res.* 6:80-88.

Whitaker, D.A., Smith, E. J. and Kelly, J. M. 1983. Subclinical ketosis and serum beta-hydroxybutyrate levels in dairy cattle. *British Vet. J.* 139:462-463.