



Dietary Supplementation of Urea Molasses Mineral Block for Enhancing Productive Performance of Dairy Cows

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ABSTRACT

A study was undertaken to assess the effect of supplemental urea molasses mineral block (UMMB) in crossbred cows fed paddy straw-based diet to assess its efficacy on productive performance of lactating cows and enhanced income by farm women in rural areas. In an organized dairy farm, fourteen crossbred cows were randomly divided into two groups (T1 and T2) consisting of seven animals each based on body weight (455 ± 10.55 kg) and milk yield (7.20 ± 0.78 kg). Animals were fed homemade concentrate mixture and paddy straw (40:60). An additional supplementation of block at the rate 300 g/d/animals was offered in animals in T2. Feed intake, milk yield, milk composition was recorded at fortnight intervals in a 3-month lactation trial. Daily dry matter intake through concentrate and roughage was similar. The milk yield and 4% fat corrected milk yield were higher by 16.8% and 20.2%, respectively in supplemented group of animals. The milk constituents *viz.* fat, solid not fat and total solid were also increased ($P < 0.05$) through UMMB supplementation. The blood biochemical profile except glucose and protein were not influenced by feeding block. The supplemental urea molasses mineral block fed to cows resulted improvement in net return over feed cost and feed efficiency by 35.7% and 12.5%, respectively than control group of animals. It was concluded that the supplementation of urea molasses mineral block in paddy straw-based diet economically improved the milk production, milk composition and feed efficiency of lactating crossbred cows in coastal belt of Odisha.

KEYWORDS: Concentrate, Cow, Fat, Milk, Urea molasses mineral block.

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INTRODUCTION

Dairy cows are mainly dependent upon poor quality roughage like and paddy straw-based diet resulting low milk yield, longer inter calving period with various reproductive problems (Brar et al., 2022). Farm women play a major role in dairy farming activities and usually feed homemade concentrate mixture devoid of mineral mixture which affect the productivity of the animals and hence the economic return. Supplementation of critical nutrients through dietary sources can improve the utilization of poor-quality roughages (Sahoo et al., 2017).

The supplementation of a rich source of protein, energy, and micronutrients, *i.e.*, urea molasses

mineral block (UMMB) can show promising results in improving the nutrient utilization and the productivity of lactating animals (Sahoo et al., 2009, Reshi et al., 2022). An on-farm trial was conducted to assess the effect of UMMB on a paddy straw based diet in lactating crossbred cows on productive performance and feed efficiency of cows.

MATERIALS AND METHODS

Animals and experimental design

The present study was conducted at farmers' field in the adopted village of ICAR- Central Institute for Women in Agriculture at Chamarpada of Cuttack district in coastal belt of Odisha. Twenty milch cows (*Bos indicus*) in an organized dairy farm were

randomly divided into two groups (T1; control and T2; treatment) of seven each based on body weight (455 ± 10.55 kg), days in milk (95 ± 9.75), and milk yield (7.2 ± 0.78 kg). Animals were fed on homemade concentrate mixture comprising maize (40%), rice bran (25%), pulse chunni (20%) and locally available ground nut cake (15%). Animals in T2 were additionally supplemented with urea molasses mineral block of 300 g along with concentrate mixture and paddy straw was provided *ad libitum* to the animals throughout the day during the entire experimental period. The animals were housed in a well-ventilated, clean, and concrete shed having individual feeding arrangements. Animals were dewormed before the start of the experiment and managed as per the existing practices by the farmers ensuring individual feeding in their existing housing arrangements satisfying the nutrient requirement (ICAR, 2013).

Preparation of urea molasses mineral block

The urea molasses mineral blocks (UMMB) were prepared at ICAR-Central Institute for Women in Agriculture using hot process containing molasses- 33%, urea- 08%, ground nut cake -15%, rice bran -25%, cement- 3%, lime-1%, mineral mixture-10%, and common salt-5% each. Each block of 2 kg weight was allowed to settle in a specially designed mould (Iron frame designed by Indian Veterinary Research Institute, Izatnagar) by manual pressure followed by air drying under the sunlight.

Lactation and digestibility trial

A lactation trial of 3 months duration was conducted in which intake of concentrate mixture, paddy straw and UMMB by individual animals were recorded at fortnight intervals. The daily milk yield was recorded, and milk samples were collected at fortnightly intervals for constituent analysis at the Milk Analysis Centre of the Odisha State Dairy Cooperative Society (OMFED).

Collection of biological samples and chemical analyses

A 6-day digestibility trial preceded by 3 days adaptation period was conducted at the end of the experiment. Feeds offered, residues left, and faeces voided were quantified. The representative samples offered, residues and faeces were analyzed for proximate composition as per AOAC (2005), milk fat by Gerber's method (IS:1224, Part I, 1970), milk protein by ISI (1970), SNF by modified Richmond's

formula and 4% FCM yield using Gaines'(1928) formula. Neutral detergent fibre (NDF) and acid detergent fibre (ADF) were analyzed according to Van Soest et al. (1991). The perceived attitude of farm women involved in UMMB supplementation for feed intake, health of animals was collected. The experimental data were subjected to analysis of variance for a randomized block design as per SPSS (17.0 version) and the means were assessed by least significance difference.

RESULTS AND DISCUSSION

Feed Intake and nutrient utilization

The chemical composition of UMMB, concentrate mixture and straw offered to dairy cows is shown in Table 1. The level of crude protein (CP) and other nutrients in the total diet was sufficient to meet the nutrient requirement of cows as per ICAR (2013). The CP content of UMMB, concentrate mixture and paddy straw was 35.5%, 18.5% and 4.5%, respectively. Similar nutrient composition was also reported by Meel et al. (2015) and Mengistu and Waseyehon (2017). The dry matter (DM) intake through concentrate and roughage were not changed ($P > 0.05$) due to supplementation of UMMB (Table 2). However, the total DM intake was more ($P > 0.05$) in UMMB supplemented group (11.5 kg/d) than the control (11.1 kg/d). The digestibility of nutrients *viz.* organic matter (OM), crude protein (CP), ether extract (EE), neutral detergent fibre (NDF) and total carbohydrate was higher in UMMB supplemented animals resulting better availability of nutrients to rumen microbes and host animals providing a conducive environment of rumen of buffaloes with optimum production of volatile fatty acids, resulting better nutrient utilization (Sihag et al., 2004). In consistent with present findings, the digestibility of nutrients was increased by UMMB supplementation in cows. The fibrous feeds are fermented in the rumen and broken down to particle sizes that can facilitate the flow and increased rates of rumen fermentation, mediated through a larger population of microflora and increased cellulolytic activity improving digestibility (Sudhakar et al., 2002; Mengistu and Waseyehon, 2017). The nutrient intake through CP, DCP and TDN was found to be higher in UMMB supplemented group of animals resulting in improved nutritional value of diet being attributed to better nutrient utilization efficiency in supplemented group of animals (Meel et al., 2015).

Table 1. Chemical composition (% DM basis) of feed stuff used during the on farm trial

Attributes	UMMB	Concentrate	Paddy straw
DM	82.5	90.2	88.5
OM	72.0	87.0	90.7
CP	35.5	18.5	4.5
EE	3.4	3.5	2.1
NDF	11.5	38.5	72.3
ADF	9.5	19.5	56.3

Table 2. Effect of UMMB supplementation on nutrient utilization in lactating cows

Particulars	Dietary treatments		SEM	P value
	T1	T2		
<i>Digestibility of nutrients (%)</i>				
DM	56.5	58.8	0.75	0.08
OM*	57.4 ^a	60.8 ^b	0.87	0.05
CP*	58.5 ^a	61.6 ^b	1.13	0.05
EE*	60.5 ^a	63.5 ^b	0.85	0.05
NDF*	54.2 ^a	57.1	0.86	0.05
ADF	51.2	52.8	1.03	0.15
<i>Feed (DM) Intake (kg/d)</i>				
Concentrate	4.2	4.4	0.19	0.28
Roughage	6.9	6.8	0.53	0.33
UMMB	-	0.31	-	-
Total	11.1	11.5	0.60	0.28
<i>Nutrient Intake(kg/d)</i>				
CP*	0.97 ^a	1.12 ^b	0.25	0.05
DCP*	0.56 ^a	0.81 ^b	0.22	0.04
TDN*	5.16 ^a	5.95 ^b	0.15	0.05
<i>Nutritive value (%)</i>				
CP*	8.72 ^a	9.74 ^b	0.18	0.05
DCP*	5.04 ^a	7.04 ^b	0.19	0.04
TDN*	46.45 ^a	51.71 ^b	0.25	0.05

*^{a, b} Means with different superscripts differ significantly (P<0.05)

Feed intake, Milk yield and feed efficiency in lactation trial

Average daily DM intake through concentrate (kg/d) was found to be higher (P>0.05) although values were similar (Table 3). Average consumption of UMMB during the experimental period was 300 g/day/animal. The DM intake in control and UMMB

supplemented group of animals was found to be similar. The supplemental molasses in UMMB might have improved the palatability of feed resulting more feed intake in terms of quality and quantity with subsequent increase in milk yield (Sahoo et al., 2009).

Table 3. Effect of UMMB supplementation on milk production and feed efficiency in cows

Particulars	Dietary treatments		SEM	P value
	T1	T2		
DM intake (kg/d)				
Concentrate	4.15	4.35	0.19	0.38
Roughage	6.65	6.55	0.58	0.23
UMMB	-	0.30	-	-

Total	10.80	11.20	0.65	0.28
Lactation Performance				
Milk yield (kg/d)*	7.05 ^a	8.15 ^b	0.15	0.05
4% FCM yield (kg/d)*	7.89 ^a	9.42 ^b	0.19	0.04
DM intake /Kg FCM yield*	1.38 ^b	1.17 ^a	0.25	0.05
Milk composition (%)				
Fat*	4.81 ^a	5.03 ^b	0.15	0.04
Protein*	3.08 ^a	3.3 ^b	0.12	0.05
SNF	8.59	8.73	0.22	0.10
Total solid*	13.41 ^a	13.77 ^b	0.27	0.05
Economics of feeding				
Total feed cost (Rs./d)	170	180	0.18	0.14
Total Income (Rs./d)*	320 ^a	395 ^b	0.17	0.05
Net return over feed cost (Rs./d)*	150 ^a	215 ^b	0.16	0.04
Feed cost/kg FCM yield (Rs.)*	21.5 ^b	19.1 ^a	0.21	0.05

^{a,b} Means with different superscripts differ significantly (P<0.05)

The values in Table 3 revealed that the milk yield and 4% FCM yield was augmented by 15.7% and 19.5%, respectively following UMMB supplementation in cows. The dry matter intake coupled with supply of balanced diet through UMMB resulted in significant increase (P<0.05) in milk yield and FCM yield in UMMB supplemented group with the advancement of lactation trial. In consistent with the present findings, milk production was found to be higher (P<0.05) in CB cows (35.97%) and in buffaloes (33.8%) with higher (P<0.05) DM intake without any adverse effect on body weight and health of animals (Misra et al., 2006; Tripathi et al., 2006; Singh et al., 2010). The UMMB might have been the contributing factor for the observed rise in level of milk constituents and milk yield in animals which was supported by various findings. The FCM yield was consistently increased in UMMB supplemented group of animals unlike the control group. The milk constituents *viz.* fat, SNF and TS were also significantly increased (P<0.05) by UMMB supplementation (Avila et al., 2006; Sahoo et al., 2009; Upreti et al., 2010). The Supplementation of UMMB licks increased milk yield and milk fat percent in crossbred cows during dry season feeding in rain-fed agro-ecosystem in India which may be associated with creating an efficient rumen ecosystem which favours the higher cellulolytic fibre utilization by the microbes in the presence of the optimum urea ammonia provided by UMMB (Mengistu and Waseyehon, 2017). The FCM yield was highest in 3rd fortnight (Fig. 1) and gradually declined with the advance of lactation trial resulting in a rise in the level of milk constituents. However, the declining slope in group T2 was lower which indicates more consistency in milk yield of cows

supplemented with UMMB. Higher supply of nutrients in the form of protein, energy, and minerals to animals in T2 was attributed to better productive performance of cows. UMMB provides synchronous supply of nitrogen and energy facilitating microbial protein synthesis which is in turn digested by animals using digestive enzymes and amino acids liberated helps in tissue protein synthesis used in maintenance and production by the animals. If urea is fed to dairy animals, it is inefficiently used, therefore, slow usage of urea is practicable with a simultaneous supply of carbohydrate sources like molasses which provide readily fermentable carbohydrates and thereby increases rumen microflora (Sahoo et al., 2009; Reshi et al., 2022). Molasses along with minerals increase the palatability of UMMBs by their pleasant smell and sweet taste (Upadhyay et al., 2018; Reshi et al., 2022). The economics of feeding supplemental UMMB revealed that total income was improved by 23% along with higher net return over feed cost by 43.2% in T2 than T1. The feeding cost per unit milk production was more in UMMB supplemented group. But the feed efficiency (feed intake/ unit FCM yield) was improved by 12.7% indicating better feed efficiency through UMMB supplementation. Several research workers also reported that UMMB supplementation with local diet to cows economically raised (P<0.01) milk production which agreed with our results (Sudhakar et al., 2002; Singh and Singh, 2003; Tripathi et al., 2006). The improvements in net return per day due to UMMB supplementation were 24 and 45% for the rural subsistence-oriented production system and the peri-urban dairy farming, respectively (Upreti et al., 2010; Meel et al., 2015).

Table 4. Effect of UMMB supplementation on blood biochemicals in cows

Particulars	Dietary treatments		SEM	P value
	T1	T2		
Blood glucose (mg/dL) *	52.45 ^a	58.74 ^b	0.25	0.04
Total protein (g/dL)*	6.25 ^a	7.13 ^b	0.18	0.05
Albumin (g/dL)*	3.05 ^a	3.50 ^b	0.16	0.05
Globulin (g/dL)*	3.21 ^a	3.71 ^b	0.21	0.05
Blood urea Nitrogen	30.75	37.15	0.55	0.12
Cholesterol	215	224	10.31	0.68
ALP (g/dL)	132	145	3.13	0.19
ALT (g/dL)	70	87	7.25	0.19
AST (g/dL)	135	155	9.35	0.25

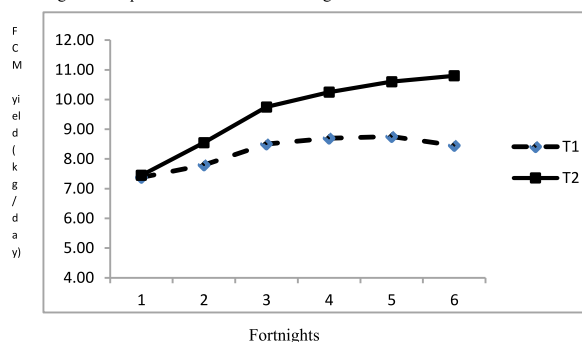
^{a, b} Means with different superscripts differ significantly (P<0.05)

The results of biochemical analysis of serum samples (Table 4) revealed significant increase in albumin, globulin, and total serum protein level (P<0.05) in UMMB supplemented group. Blood urea nitrogen level was higher (P>0.05) without any significant change and was within the normal range indicating that UMMB supplementation has not any harmful effect on liver. Although, blood urea nitrogen was higher in treatment groups, no symptoms of urea toxicity were noticed during the study period and all animals were found to be sound in health. The blood glucose level increased in UMMB supplemented group when compared with non-supplemented group which was attributed to supplementation of non-protein nitrogen and energy in the form of urea and molasses in UMMB (Sahoo et al., 2009; Kour et al., 2022). The non-protein nitrogen and energy on the fermentation in the rumen in UMMB supplemented group might have improved the production of the fatty acids in the rumen and would subsequently influence blood glucose metabolism (Kerketta et al., 2017). Biochemical and enzyme profile were not altered by UMMB supplementation. In consistent with the present findings, feeding of UMMB did not have any adverse effect on haematological and biochemical parameters in buffaloes (Sihag et al., 2009).

Almost all the participating farm women associated with the demonstration of UMMB in the lactation trial responded that by supplementing UMMB, cows consumed more concentrate mixture, maintained good health and productivity and these effects were sustained even after reduction of concentrate mixture allowance during summer

months when green fodder was scarce. All the farmers readily accepted the practice of using UMMB supplementation and were willing to continue in future, if these were available in the local market.

Fig. 1. Milk production of cows at fortnight intervals in lactation trial



CONCLUSION

Based on the above findings, it can be concluded that supplementation of 300 g urea molasses mineral block per day per cow in paddy straw-based diet economically improved milk production by 17-20% in crossbred cows in coastal belt of Odisha. Supplementation of UMMB to animals fed low quality fodder during summer months may be an appropriate alternative to other supplements (commercial feed) especially when these are short in supply and get expensive. UMMB feeding also demonstrated the potential of increasing viability of livestock production, increasing dry season milk supplies and enhancing household income. The present findings demonstrated that UMMB technology is a cost-effective approach to maximize the utilization of locally available feed resources for better animal productivity in peri urban dairy farming of Odisha.

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