Journal of Agriculture, Food, Environment and Animal Sciences
Tarım, Gıda, Çevre ve Hayvancılık Bilimleri Dergisi
http://www.jafeas.com, ISSN: 2757-5659

J. Agric. Food, Environ. Anim. Sci.
6(1): 50-64, 2025

Impact of Supplementing Urea-Molasses Multi-Nutrient Block (UMMB) on Growth Performance of Crossbred Sheep

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Research Article

Article History:
Received:7 August 2024
Accepted:7 March 2025
Published online: 01 June 2025

***Keywords*:**
Average Daily Gain
Grazing Hour
Live Weight
UMMB Licking
Grazing Systems

ABSTRACT

The urea-molasses-multi-nutrient block (UMMB) supplementation can be an efficient method to maximize rumen microbial activity through a balanced supply of protein, energy, minerals, and vitamins as the grazing of sheep on pastures may not meet their nutritional needs. The purpose of the study was to ascertain how crossbred ram's growth was impacted by UMMB supplementation throughout varying time periods. Twelve crossbred rams were split up into four treatment groups with three replications based on their initial body weight. The control group (T_0) continued to graze normally 10-h day^{-1}, while groups T_1, T_2, and T_3 were access to lick UMMB for 1-h, 1.5-h, and 2-h day^{-1}, respectively with 10-h grazing period. Rams licking UMMB for 2 hours was found to have the numerically highest body weight ($p>0.05$). After 13 weeks of licking UMMB, their final body weights were 17.37±2.18 kg, 19.20±2.46 kg, 21.13±5.31 kg, and 22.27±2.58 kg, respectively for T_0, T_1, T_2, and T_3 groups. At weeks 2, 5, 7, 10 and 13, ram's average daily gain (ADG) (g) differed among rams' groups licked UMMB at various durations ($p<0.05$). Similarly, at week 6, 9 and 12, the ADG (g) also differed significantly among rams' groups licked UMMB at various durations ($p<0.01$). ADG for the whole experimental period (91 days) were 34.15±4.56 g, 59.26±5.82 g, 82.96±8.19 g and 90.48±9.39 g, respectively for T_0, T_1, T_2, and T_3 groups ($p<0.001$). It can be concluded that the ADG increased linearly and significantly with increasing of the UMMB licking period and 2-h licking ensured maximum growth performance in crossbred rams.

To Cite : Rana HMA, Islam SS, Islam Md.S, Tarafder P, Sun MA, Mondol D., 2025. Impact of Supplementing Urea-Molasses Multi-Nutrient Block (UMMB) on Growth Performance of Crossbred Sheep. Agriculture, Food, Environment and Animal Sciences, 6(1): 50-64.

INTRODUCTION

Livestock is one of the most significant agricultural subsectors in Bangladesh and is essential to the growth of the nation's economy (Sarma et al., 2014). Sheep farming is becoming more popular in Bangladesh among all small ruminants. The most crucial factor to remember about sheep is that they don't have any specific feeding habits. They are able to consume pasture, grass and leaves on their own. Sheep are raised on roadsides, in fallow areas, and along canal banks according to usual feeding practices (Sultana et al., 2010). The production of sheep may be a reliable source of surplus animal protein. In Bangladesh, sheep farming has a lot of potential. Being a subtropical country, the weather is perfect for sheep farming. For the most of the part, Bangladesh and other developing nations rely on natural range vegetation and farmlands as the foundation of their livestock production systems. For grazing animals, there are seasons when weight growth and loss occur due to variations in diet quantity and quality (Kamalzadeh et al., 1997). Many farmers grow small ruminants in Bangladesh, such as goats and sheep, and they graze their flocks mostly on subpar pastures. For example, stall-fed animals have been found to have better meat quality, higher carcass weight, and higher average daily gain than grazing animals (Iqbal et al., 2018; Sun et al., 2020). Sheep fed low-quality roughages (straw, hay, and dry grasses) often suffer from a lack of protein since these roughages are low in nitrogen. Non-protein nitrogen (NPN) is obtained from urea in the UMMB and converted to ammonia by the rumen. This ammonia is then converted by rumen bacteria into microbial protein, which enhances the digestion and absorption of fibrous meals (Leng, 1990). Simone (2021) reported that urea molasses, supplemented with alfalfa (*Medicago sativa* L.) hay, provided a cost-effective growth rate compared to traditional concentrate feed supplements in local Ethiopian sheep. He also observed that when sheep were fed alfalfa hay at a rate of 2% of their body weight and 100 g of urea molasses blocked $sheep^{-1}$ day^{-1}, the digestibility of DM and CP improved compared to when sheep were fed a concentrate mixture at a rate of 2% of their body weight. By reducing the need for pricey protein-rich diets, UMMB supplementation increases the cost-effectiveness of livestock production for small-scale farmers (Leng, 1993). Urea-molasses multi-nutrient blocks (UMMBs) are purposefully fed to sheep in order to improve growth and productivity, increase nutrient intake, and enhance rumen function. Animal productivity and nutrient consumption may be enhanced by adding additional feeds to UMMB (Sahoo et al., 2009). A novel feeding approach to boost animal productivity has been inspired by the shrinking pasture lands with increased population demographics. For example, urea-molasse multi-nutrient blocks are simple to make and store, making them an excellent option for augmenting feeding regimens (Togtokhbayar, 2004). There is currently little study on the effects of urea supplementation in small ruminant animals. Urea can be provided as UMMB, which is composed of vitamins, minerals, urea, and maize meal (Hatungimana & Ndolisha, 2015). Feeding the blocks is a low-cost way to supplement the animal's diet with nutrients that the animal's microorganisms may be lacking in. Researchers have not yet done much on the supplementation of urea to small ruminant animals, but modern cattle ranchers employ urea, a nitrogen that is not protein and can be turned into protein, with good benefits on production performance (Hatungimana and Ndolisha, 2015). This study set out to determine how urea molasses block supplementation affected sheep growth performance, especially how much sheep gained in weight, and how quickly they converted feed to meat. Urea-molasse-multi-nutrient blocks are just one option for supplemental feeding, given their simplicity in production and storage (Togtokhbayar, 2004). The animal and microorganisms can receive nutrients by feeding the blocks that may be lacking in their basic diet at a little cost. Supplementing with UMMB can increase feed intake by up to 20% overall and by up to 20% for the animal's ability to digest fibrous foods (Yami, 2007). According to Jayawickrama et al. (2013), feeding UMMB together with roughages of lower quality is one of the simplest and most effective ways to meet the nutrient requirement. In order to support optimal microbial development, UMMB licks to periodically deliver fermentable nitrogen, energy, and minerals. An animal's demand for crude protein can be contributed by 30–40% by microbial protein.

This study addressed nutrient deficiencies in conventional grazing systems by using urea, a non-protein nitrogen source, as a component of a urea-molasses multi-nutrient block (UMMB). By allowing rumen microbes to produce microbial protein, urea improves nutrient absorption and fiber digestion. When combined with additional vitamins and minerals and molasses for energy, UMMB provides a well-balanced, reasonably priced supplement to enhance animal production.

This study is unique because it analyses the effects of different UMMB feeding periods on sheep development to determine the optimal time for maximum average daily gain (ADG). Unlike previous studies that looked only at cattle or urea supplementation, this one focuses on the growth performance of crossbred sheep in a field environment. By providing the optimal energy to nitrogen ratio, UMMBs encourage rumen fermentation. This enhances digestion and speeds up the breakdown of plant cell walls by increasing microbial activity (Preston & Leng, 1987). UMMBs have been demonstrated to improve rumen fermentation pathways, which raises feed digestibility and reduces methane emissions. This leads to more efficient nutrient utilization and environmental sustainability (Leng, 1993). Sheep that were allowed to graze in China shown notable productivity; the animals given a multi-nutrient block supplemented with urea molasses gained much more weight than the control group (Jian-Xin et al., 2007). These results demonstrate the ability of UMMB to improve nutrient deficiencies in grazing systems and increase sustainable livestock production. specially sheep (Hatungimana and Ndolisha, 2015). This study contributes to the larger goal of increasing livestock production in poor countries by providing a viable alternative for farmers facing resource constraints by demonstrating a direct relationship between UMMB supplementation and growth.

Objectives of the study

1. To track the average daily weight gain of crossbred rams licked urea-molasses-multi-nutrient block (UMMB).

2. To determine the optimum licking period of UMMB for growth of crossbred rams.

MATERIAL and METHOD

Ethical Consideration

Research protocols involving animal subjects in this study followed ethical standards and no unnecessary pain or disturbance was inflicted on experimental animals. The "Animal Ethics" committee of Khulna University in Bangladesh gave its approval to the current research works (approval number KUAEC-2024-07 -03).

Study Cite and Duration

This study was conducted at Khulna University in Khulna, Bangladesh, under the auspices of the Field Laboratory of Agrotechnology Discipline. Rahaman et al. (2019) stated that this area is situated inside the Ganges Tidal Flood Plain's Agro Ecological Zone (AEZ). Positions of the research facilities are N 22.80° and E 89.53° latitude and longitude. The feeding trial and data collection were continued for a period of 91 days between December 19, 2023, to March 20, 2024, and utilized in this study.

Experimental Design

Twelve crossbred rams (Indigenous x Garole, F_1) of one year age were taken to conduct the feeding trial. Every experimental animal was weighed individually for their grouping purpose. The average initial live weights for rams' group with no UMMB, 1-h, 1.5-h and 2-h licking groups were 13.48±2.84, 13.87±1.78, 13.67±4.81 and 14.12±3.40 kg, respectively. Based on their initial live weight, animals were split into four treatment groups with three replications for each treatment. The number of animals in each treatment group was three. While one treatment group of rams (T_0) stuck to their typical feeding schedule, such as grazing for 10-h without receiving urea-molasses-multi-nutrient blocks (UMMB), the other three treatment groups of rams T_1, T_2 and T_3 accessed to lick UMMB at three different durations—1-h, 1.5-h and 2-h, respectively. Licking period of UMMB is shown in Figure 1. Randomized Complete Block Design (RCBD) was the basis for the experimental design. Throughout the feeding experiment, the following traits of the rams were observed: Body weight (kg ram^{-1}) and average daily gain (ADG, g).

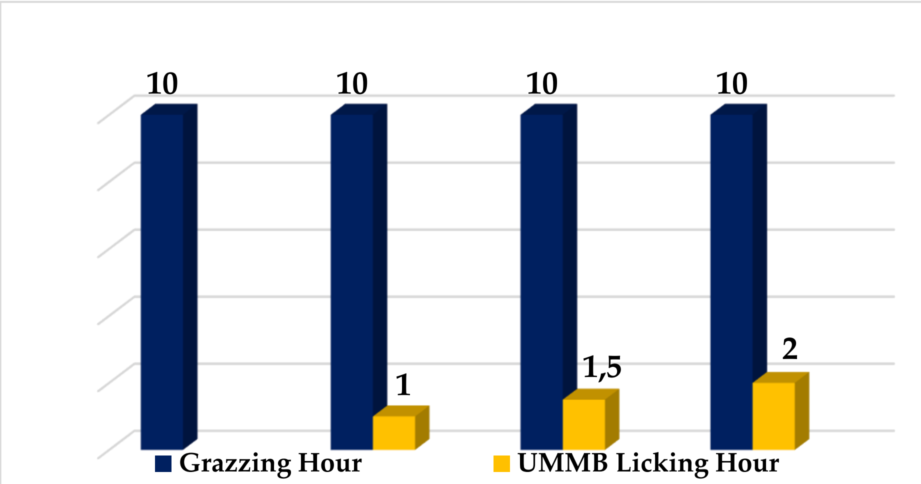

Figure 1. Grazing and UMMB licking periods

Grazing of Experimental Rams

The rams employed in the experiment were allowed to graze for 10-h during the day on natural ground grass area. They were locked in the shed at night. Daily grazing hours for the experimental rams were 9.00 am to 7.00 pm. Total pasture area was around 3.5 hectares where natural vegetations were available. Among the different species of natural grasses, *Leersia hexandra, Cynodon dactylon*, *Paspalum distichum, Alternanthera sessilis*, and *Dactyloctenium aegyptium* are mentionable.

Procedure of Making 10 kg Urea-Molasses-Multi-Nutrient Block (UMMB)

In accordance with Jayawickrama et al. (2013), urea-molasses-multi-nutrient block (UMMB) was made. The following ingredients, in the amounts of 2.3, 4.0, 1.0, 0.2, 1.0, and 1.5 kg for rice polish consisting of 12% moisture, 14% crude protein (CP), 7% crude fiber (CF), 16% ether extract (EE), 8% ash and 43% nitrogen-free-extract (NFE) 43%, molasses (28% moisture, 7% CP, 10% ash, and 45% NFE,), urea (47% nitrogen), mineral mixture (24% Ca, 10% P, 6% Na, 1% Mg, 1% K, 4% S, etc), common salt (NaCl), and lime (40% Ca, 55% CO_3, 5% Mg), were used respectively to prepare 10.0 kg of UMMB. The molasses, urea and salt were mixed well. The mixture then refrigerated for overnight. The mixture was then re-mixed by hand after 12 hours. Then rice polish, mineral mixture and & lime that were previously kept into another bowl were added with the above mixture and mixed well. The mixture was then put into a wooden disc and pressure was applied by a wooden cover to give the block its shape. The block was then be removed from the disc and placed on a polyethylene sheet where it was remained for 15-h to be harden (Garg et al., 1998). It was taken about 50 hours where 1 hour was required for mixing the ingredients, 1 hour for molding and shaping and 48 hours for drying and hardening. The average consumption level of UMMB was 45-50 g of ram^{-1} d^{-1}

Table 1. Ingredient composition of UMMB (Jayawickrama et al., 2013)

Ingredients	Percent (%)
Molasses	40.0
Rice polish	23.0
Urea	10.0
Mineral mixture	2.0
Lime	15.0
Salt	10.0

Adaptation of Animals

Urea-molasses-multi-nutrient blocks were gradually adapted over a minimum of 7 days by feeding regularly, rather than being given in full every day as soon as the feeding period began. Urea poisoning is particularly common in animals that are not used to urea and that also feed quickly. For the first three days, we offered them 20 minutes a day; the next four days, we offered them 30 minutes. Blocks were then available for use on the basis of the experimental design.

Urea-Molasses-Multi-Nutrient Block (UMMB) Supplementation

UMMB was allocated for rams under three treatment groups T_1, T_2 & T_3 for three different time periods- 1 hour, 1.5 hours and 2 hours respectively. Before being let to graze, rams had access to lick UMMB at their designated period in the morning. One group (T_1) licked UMMB from 7.00 am to 8.00 am, another one group (T_2) licked UMMB from 7.00 am to 8.30 am and another group (T_3) was allowed to lick from 7.00 am to 9.00 am. After UMMB licking they were allowed to grazing.

Chemical Composition of UMMB

The dry matter (DM), crude protein (CP), Crude fiber (CF), ether extract (EE), ash and nitrogen-free-extract (NFE) contents (%) of UMMB were 76.08 ± 0.57, 17.90 ± 0.24, 7.46 ± 0.01, 3.57 ± 0.31, 26.84 ± 0.36 and 44.23 ± 0.51, respectively (Table 2). The Bangladesh Agricultural University in Mymensingh's animal nutrition lab routinely examined the UMMB to determine their chemical composition. As for UMMB's chemical makeup, it was DM 81.57%, CP 18.75%, CF 3%, EE 2.2%, NFE 41% and Ash 16.62% (Islam et al., 2022). According to Bohra et al. (2012), urea molasses multi-nutrient blocks are lick blocks that include urea, molasses, vitamins, minerals, and other multi-nutrients.

Table 2. Proximate composition (%) of urea-molasses-multi-nutrient block (UMMB) fed to experimental rams

Proximate components	(Mean ± SEM) %
Dry matter (DM)	76.08 ± 0.57
Crude protein (CP)	17.90 ± 0.24
Crude fiber (CF)	7.46 ± 0.01
Ether extract (EE)	3.57 ± 0.31
Ash	26.84 ± 0.36
Nitrogen-free-extract (NFE)	44.23 ± 0.51

Weighing and Maintaining Records for Experimental Rams

Using a weighing balance, each experimental animal was individually weighed once every week in the morning before to being let to lick UMMB and graze. Each animal was given a unique number that was used for identification. The following records were kept regularly.

- Body weight (kg)
- Average daily gain (ADG, g)

Regular records of medication, vaccinations, and deworming were kept in a register. The average daily gain (g) was calculated by subtracting the previous weight from the present weight and dividing by the number of days.

Data Analysis

Data was recorded and analyzed using the R software in computer. Analysis of variance was used to examine the effects of UMMB on the ADG of rams, and Duncan's Multiple Range Test (DMRT) was employed to compare the treatment means, with a significance level of $p<0.05$. Excel 2019 was used to edit the data. To achieve the study's goals, data were tabulated and analyzed using a descriptive statistical technique.

RESULTS and DISCUSSION

Body weight (kg ram^{-1})

The average body weight of the crossbred rams with varying licking periods of urea-molasses-multi-nutrient block (UMMB) at week intervals is shown in Table 3. The body weight increased with the UMMB licking period extended, according to the data, however there was no significant difference among the means ($p>0.05$). Rams given a daily supplementation time of two hours with UMMB reported the highest numerical body weight in every instance. There was no discernible variation in the ram's body weight since they were let to graze on UMMB supplements. Their grazing region had a lot of natural grasses, hence the different periods of UMMB supplementation did not significantly affect their body weight.

Table 3. Body weight (kg) of rams licked UMMB at different time periods

Weight category	UMMB licking time (Kg, Mean ± SE)				
	No UMMB	1-hour	1.5-hour	2-hour	Level of significance
Initial BW	13.48±2.84	13.87±1.78	13.67±4.81	14.12±3.40	NS
Week 1	13.75±2.73	14.27±1.78	14.48±4.82	14.78±2.36	NS
Week 2	14.07±2.65	14.72±1.88	14.88±4.94	15.50±3.30	NS
Week 3	14.37±2.55	15.17±1.86	15.43±4.94	16.13±2.97	NS
Week 4	14.70±2.43	15.40±1.85	15.83±4.96	16.57±3.18	NS
Week 5	15.03±2.37	15.77±1.90	16.40±5.11	17.20±3.13	NS
Week 6	15.32±2.30	16.18±1.78	17.03±5.12	17.97±3.09	NS
Week 7	15.62±2.27	16.57±1.80	17.60±5.15	18.67±3.00	NS
Week 8	15.93±2.27	17.17±2.41	18.20±5.25	19.33±2.89	NS
Week 9	16.20±2.29	17.57±2.31	18.82±5.21	19.90±2.77	NS
Week 10	16.42±2.26	17.94±2.47	19.40±5.23	20.50±2.69	NS
Week 11	16.80±2.19	18.38±2.48	19.97±5.26	21.03±2.63	NS
Week 12	17.08±2.22	18.77±2.46	20.50±5.27	21.67±2.58	NS
Week 13	17.37±2.18	19.20±2.46	21.13±5.31	22.27±2.58	NS

UMMB = Urea molasses multi-nutrient block; NS = Not significant (p>0.05)

Hatungimana and Ndolisha (2015) reported that after 14 weeks of licking UMB supplementation, the final body weight of licking of P_0 (control; rams fed on grass only), P_1 (rams fed on grass with urea-molasses-block (UMB) containing 3.6% of urea), P_2 (rams fed on grass with UMB containing 4.8% of urea), and P_3 (rams fed on grass with UMB containing 7.2% of urea) were, respectively, 22.4 kg, 24.1 kg, 24.4 kg, and 25.4 kg. It was shown that the body weights of rams were gradually increasing as the portion of urea increases in UMB. In present research the initial body weight of T_0 (only 10 hours grazing without feeding of UMMB), T_1 (UMMB licking for 1-h with 10 hours grazing), T_2 (UMMB licking for 1.5-h with 10 hours grazing) and T_3 (UMMB licking for 2-h with 10 hours grazing) was 13.48 ± 2.84 kg, 13.87 ± 1.78 kg, 13.67 ±4.81 kg and 14.12 ± 3.40 kg respectively. Their final body weight was 17.37±2.18 kg, 19.20±2.46kg, 21.13±5.31 kg and 22.27±2.58 kg respectively after 13 weeks of UMMB supplementation in T_0, T_1, T_2 and T_3 groups, respectively. Similar results were seen where, the body weights of rams were gradually increasing as the time of UMMB licking period increased. According to Islam et al. (2022), in case of cattle, the body condition score of cows for control group was 2.30^a ± 0.64 and for the extra supplementation of solidified UMMB (250 g d^{-1} cow^{-1}) with normal feeding like as control group was 2.51 ± 0.19.

Figure 2 shows that when the UMMB licking period increased, the crossbred rams' body weight increased linearly. The correlation between rumen efficiency and nutrient availability is demonstrated by the increase in growth of rams licked a urea-molasses-multi-nutrient block (UMMB). To compensate for the protein deficiency in low-quality diets, rumen bacteria can use urea, a non-protein nitrogen source, to produce microbial proteins. Molasses, which provides readily fermentable energy required for optimal microbial activity, assists in this process. When combined, these components promote the fermentation of fibrous materials, improving feed intake and digestibility. Supplementing Menz ram lambs with urea molasses block increased their body weight and DMI compared to the non-supplemented group. Additionally, lamb supplements result in increased fat deposits (Anindo et al., 1998). After grazing pastures throughout the wet season, ewes treated with multi-nutrient blocks gained more live weight and did not experience any weight loss than the group that did not get any supplements (Salman, 1996). According to Mengistu and Hassen (2017), Marwari lambs who were block supplemented gained more live weight (26.7 kg) than those that were not (25.8 kg).

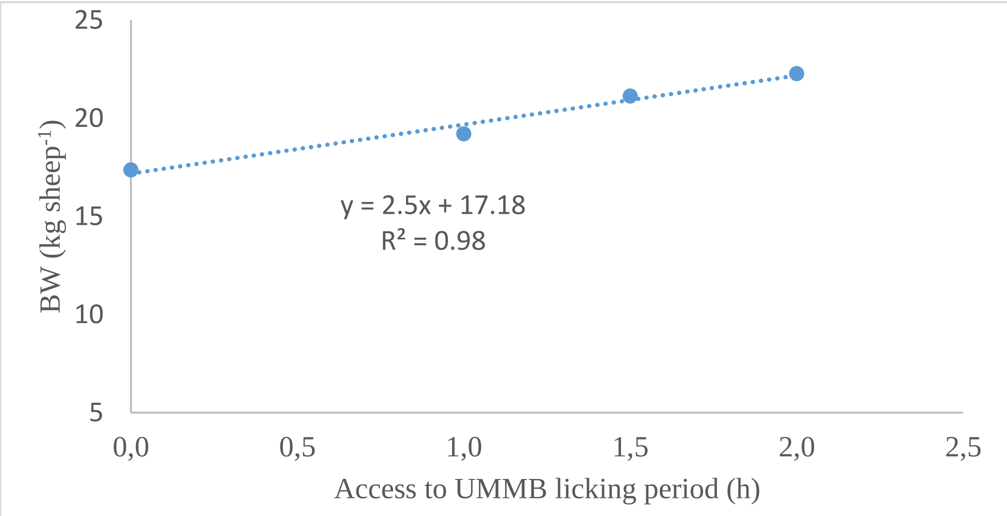

Figure 2. Relationship between access to urea-molasses multi-nutrient block (UMMB) h day^{-1} and BW (kg rams^{-1}) of crossbred rams

Average daily gain (ADG) of Crossbred Rams (g)

The average daily gain (ADG, g) of the crossbred rams under varying UMMB licking periods is shown in Table 4, which shows the data at weekly intervals. The ADG of rams at their second, fifth, seventh, tenth, and thirteenth weeks varied significantly ($p<0.05$) depending on the UMMB supplementation they received, as indicated by the data in the table. In the other case, there was no discernible difference among the means ($p>0.05$). Furthermore, between UMMB supplementations, there were highly significant difference in ADG for rams at their sixth, ninth, and twelfth weeks ($p<0.01$). This suggests that supplementing rams with UMMB for two hours is more successful in achieving a higher rate of growth. Numerically highest ADG (g) at week 6, was observed for rams licking 2-h UMMB (110.00±22.45) followed by 1.5-h (90.47±8.25), 1-h (59.52±20.62) and no UMMB group (40.48±10.91); highest ADG (g) at week 9, was observed for rams licking 2-h UMMB (80.95±16.49) followed by 1.5-h (88.10±14.87), 1-h (57.14±14.29) and no UMMB group (38.09±4.13). Similarly, highest ADG (g) at week 12, was observed for rams licking 2 hours UMMB (90.48±16.49) followed by 1.5-h (76.19±8.24), 1-h (54.76±14.87) and no UMMB group (40.48±4.13) and means were significantly varied (p<0.01).

Table 4. Average daily gain (g) of crossbred rams licked urea-molasses-multi-nutrient block (UMMB) at different time periods

Weight category	**UMMB licking time (Mean ± SE)**				**Level of significance**
	No UMMB	**1-hour**	**1.5-hour**	**2-hour**	
Week 1	38.09±16.49	57.14 ± 0.00	116.19±61.03	93.81 ± 24.18	NS
Week 2	45.24^{b}±10.91	64.28^{b}±25.75	56.67^{b}±17.63	102.86^{a}±19.80	*
Week 3	42.86±14.29	64.29±7.15	79.52±17.28	89.52±46.54	NS
Week 4	47.62±21.82	33.33±8.25	57.14±44.61	62.86±30.24	NS
Week 5	47.62^{b}±8.24	52.38^{b}±8.24	80.95^{a}±21.82	90.00^{a}±17.32	*
Week 6	40.48^{c}±10.91	59.52^{bc}±20.62	90.47^{ab}±8.25	110.00^{a}±22.45	**
Week 7	42.86^{c}±7.15	54.76^{bc}±14.87	80.95^{ab}±21.82	100.00^{a}±24.75	*
Week 8	45.24±14.87	85.71±98.98	85.71±14.29	95.24±16.50	NS
Week 9	38.09^{c}±4.13	57.14^{bc}±14.29	88.10^{a}±14.87	80.95^{ab}±16.49	**
Week 10	30.95^{b}±4.12	53.33^{ab}±23.10	83.33^{a}±10.91	85.71^{a}±24.75	*
Week 11	54.76±10.91	63.33±44.18	80.95±21.82	76.19±8.24	NS
Week 12	40.48^{c}±4.13	54.76^{bc}±14.87	76.19^{ab}±8.24	90.48^{a}±16.49	**
Week 13	40.48^{b}±10.91	61.90^{ab}±8.25	90.48^{a}±29.74	85.71^{a}±0.00	*
Total period (91 days)	34.15^{b}±4.56	59.26^{b}±5.82	82.96^{a}±8.19	90.48^{a}±9.39	***

UMMB = Urea molasses multi-nutrient block; NS = Not significant (p>0.05); * = p<0.05; ** p<0.01
[a,b,c] means with uncommon superscripts in a row differ significantly (p<0.05)

The ADG (g) at week 2 ranged from 45.24±10.91 to 102.86±19.80 with the highest in the 2-h licking UMMB period group and the lowest in the UMMB non supplemented group (p<0.05); the ADG (g) at week 5 ranged from 47.62±8.24 to 90.00±17.32 with the highest in the 2-h licking UMMB group and the lowest in the UMMB non supplemented group (p<0.05); the ADG (g) at week 7 ranged from 42.86±7.15 to 100.00±24.75 with the highest in the 2-h licking UMMB period group and the lowest in the UMMB non supplemented group (p<0.05). Similarly, the ADG (g) at week 10 ranged from 30.95±4.12 to 85.71±24.75 being highest in the 2-h licking UMMB group and the lowest in the UMMB non supplemented group (p<0.05); the ADG (g) at week 13 ranged from 40.48±10.91 to 85.71±0.00 with the highest in the 2 hours licking UMMB period group and the lowest in the UMMB non supplemented group (p<0.05). The

ADG (g) of P_0 (rams fed on grass only, control), P_1 (rams fed on grass with UMB containing 3.6% of urea), P_2 (rams fed on grass with UMB containing 4.8% of urea), and P_3 (rams fed on grass with UMB containing 7.2% of urea) were 22.0, 40, 44.0, and 54, in that order, according to Hatungimana & Ndolisha (2015). It is clear from the findings their experiment that the ADG of crossbred rams (g) was gradually increasing as the portion of urea increases in urea-molasses block (UMB). According to Islam et al. (2022), in case of calf, the growth rate for control group was (55 ± 36) g day^{-1} and for the extra supplementation of solidified UMMB with normal feeding like as control group was (84 ± 39) g day^{-1}. The effect of UMMB on rams and calf were similar with the current experiment. Yami (2007) stated that adding urea molasses multi-nutrient blocks can increase the animal's nutrient intake by 25–30% and the digestion of fibrous feed by up to 20%. Grazing sheep in China and Iraq demonstrated notable productivity, with urea molasses multi-nutrient block supplemented animals gaining significantly more weight than non-supplemented sheep (Salman, 1996; Haddad, 2000; Popkin, 2014).

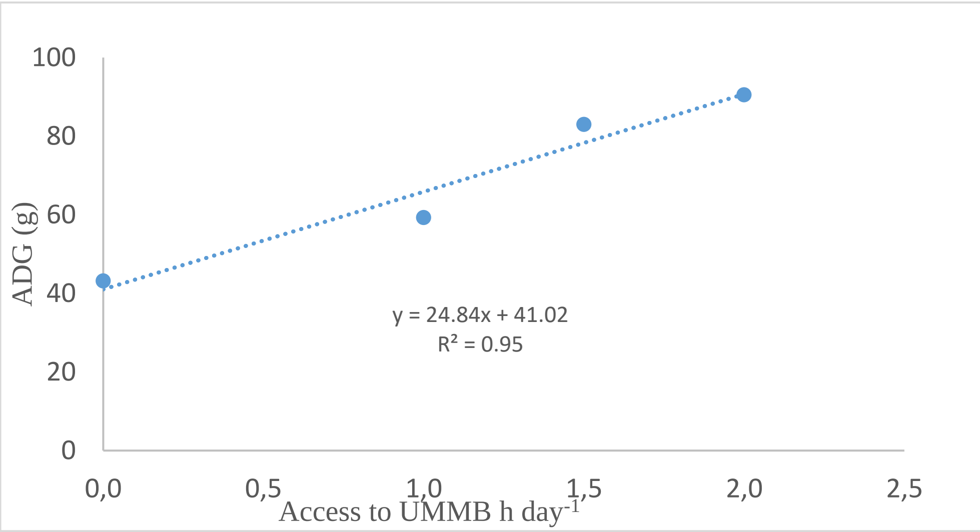

Figure 3. Relationship between access to urea-molasses multi-nutrient block (UMMB) h day^{-1} and average daily gain (g) of crossbred rams

It is shown that the ADG (g) of crossbred rams increased linearly and significantly with the increasing of access to UMMB licking period (Figure 3).

The higher microbial protein synthesis probably improved nitrogen retention and general nutrient assimilation as UMMB increased licking time, which increased average daily gain (ADG). According to Salman's (1996) study from Iraq, feeding Awassi rams a multi-nutrient block while grazing resulted in weight gain and no weight loss compared to the control group. Furthermore, by addressing micronutrient deficiencies, the minerals and vitamins contained in UMMB improved growth performance and metabolic efficiency. According to Muralidharan et al. (2015), UMMB supplementation in off-season Mecheri lambs had a positive effect on blood biochemical parameters (total protein levels, serum albumin levels, calcium values, and serum phosphorus levels). The results of the study show a clear relationship between improved growth of UMMB and nutritional supplementation. Even if the quality of the pasture fluctuates, supplementation ensures a complete diet and promotes stable weight gain, whereas grazing alone provides baseline nutrition.

CONCLUSION

This study showed that crossbred rams were significantly improved in growth rate by supplementation with urea-molasses multi-nutrient block (UMMB). Rams that were permitted to lick UMMB for 2 hours daily showed the maximum average daily gain (ADG) and final body weight after 13 weeks compared to other groups. This suggests that prolonging the UMMB licking period promotes optimal microbial activity in the rumen and improves feed intake. Especially in areas where pasture resources are scarce, UMMB supplementation has become an effective and affordable way to address this nutritional deficiency. These results highlight the potential of UMMB as a feeding strategy for increasing livestock production, providing a viable alternative for small-scale rams farming in Bangladesh and similar environments.

ACKNOWLEDGMENT

First author is grateful to the Ministry of National Science and Technology, Government of the People's Republic of Bangladesh for awarded him National Science and Technology (NST) Fellowship (2023-2024) for his experiment work.

Conflict of Interest

The authors have no conflict of interest regarding the publication of this article.

Authors Contribution

Each author made an equal contribution to the paper.

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