Effects of three Urea Molasses Blocks in indigenous lambs fed a basal diet of Kumpai Grass (*Hymenancne amplexicaulis* (Rudge) Nees) from Jambi, Indonesia

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Abstract

The effects of Urea Molasses Blocks (UMB) in ruminants may vary because UMB are constituted according to locally available feedstuffs. The aim of this study was to evaluate the effect on nutrient digestibility, rumen parameters and growth performance of lambs fed a basal diet of Kumpai grass (a local grass in Jambi, Indonesia) supplemented with three different UMB. Sixteen indigenous male lambs, of approximately 6 months of age and body weight 8.81 ± 0.96 kg were randomised into 4 blocks based on body weight and housed in single pens. The control group (group P0) was fed a Kumpai grass hay basal diet without UMB supplement and the other three groups supplemented with UMB-1 (group P1), UMB-2 (group P2) and UMB-3 (group P3) respectively. Feed and water intake, body weight changes, nutrient digestibility and rumen fluid parameters were measured. All data were subjected to ANOVA and the treatment means were compared using the Contrast orthogonal test. The results showed that the digestibility coefficient of DM, OM, CP, NFE and DE were highly significantly different ($P<0.01$) and that of EE was significantly different ($P<0.05$) in the different treatments groups. The Kumpai grass DM and water intake in the control group (P0) was lower ($P<0.05$) than that of P1, P2 and P3 while total feed DMI in the different groups was highly significantly different ($P<0.01$). The N balance between the control and the treatment groups was highly significantly different ($P<0.01$). Similarly, between the groups P1 and P2 and P3, differences were significant ($P<0.05$). However, between group P2 and P3, no significant difference ($P>0.05$) were observed. Average daily weight gain (ADG) of lambs supplemented with UMB (P1, P2 and P3) were significantly higher ($P<0.05$) than that of the control group (P0). However, no significant differences ($P>0.05$) in ADG were observed among lambs of groups P1, P2 and P3. The VFA level in rumen fluid at 3 hours after feeding was higher ($P<0.05$) in the UMB fed lambs. No differences were observed ($P>0.05$) in rumen pH of the 4 groups. The rumen fluid ammonia concentration at 3 hours after feeding was higher ($P<0.01$) in UMB fed lambs and differed significantly ($P<0.05$) among groups P1, P2 and P3. The results suggest that supplementation of lambs with the three local UMB should produce the same growth performance. However, UMB-1 (50% molasses) is more hygroscopic and easily melts during the storage. This limits its practical application.

Key words: sheep production, ruminant nutrition, Kumpai grass, Urea molasses blocks.

Introduction

Feeding is one of the limiting factors in ruminant production in Jambi Province. Farmers just offer natural grasses such as Kumpai grass and crop residue to the ruminants. These feedstuffs are often nutritionally unbalanced i.e., deficient in protein, minerals and vitamins, highly lignified and their digestibilities are low. These characteristics keep ruminants productivity low. The limitation of nutrient supply from natural grasses could be solved by providing livestock with mineral premixes and protein supplements, in form of concentrates. However, commercially prepared concentrates are often not readily available and may be too expensive for the small farmers. Problems may arise, if the farmers feed locally available cheap components such as molasses and urea separate. Either the animals may feed selective (molasses) or the amounts offered exceeds the toxic level (urea).

One convenient and inexpensive way to improve ruminant diets is through the provision of multi-nutrient Urea Molasses Blocks (UMB) **(Sansoucy et al., 1995)**. In Indonesia, the UMB is already introduced to the farmers **(Hendratno, 1996)**. However, due to different basal diets, the UMB in different areas must have different compositions. Further, they should be prepared from locally available materials, based on their nutritive values, price and the existing facilities for their use. All these factors influence the quality of the blocks and the farmers acceptance to use them.

Most of the UMB use cement as gelling agent. Cement has a negative effect to the animal health and meat quality when fed over longer periods **(Sansoucy et al., 1995).** It should be substituted with another gelling agents such as tapioca. According to **Raguati (1997)**, tapioca is better than cement to support rumen microbial growth and it can be used up to 10% of the total concentrate.

Objective of this study were to prepare a UMB for the farmers in Jambi based on various locally available and cheap materials and to evaluate the effect of supplementing lambs fed Kumpai grass with UMB on growth performance, nutrient digestibility and rumen parameters.

Materials and Methods

The feeding experiment was carried out in the animal house at the Animal Husbandry Faculty, Jambi University in Jambi Province, Indonesia, using sixteen indigenous male lambs, approximately 6 months of age and with an average body weight of 8.81 ± 0.96 kg. The animals were housed in single pens.

The experiment was done in 2 phases: a preliminary phase and a feeding trial phase. The lambs were fed Kumpai grass with and without UMB, based on the design (Table 1).

Table 1. Design of the feeding trial experiment.

	Treatments			
	P0	**P1**	**P2**	**P3**
UMB-1	-	+	-	-
UMB-2	-	-	+	-
UMB-3	-	-	-	+
Hay Kumpai grass	+	+	+	+
No. of lambs	4	4	4	4

P0 Lambs fed Kumpai grass hay alone (control)
P1 Lambs fed Kumpai grass hay + UMB-1
P2 Lambs fed Kumpai grass hay + UMB-2
P3 Lambs fed Kumpai grass hay + UMB-3

Kumpai grass growing in the village swamps was cut before blooming around 15 cm above water. Then it was weighed to get the fresh weight. Next, it was chopped to approximately 5 cm of length and finally dried until the dry matter content was around 25%.

The UMB were formulated to allow an adequate amount of crude protein and energy for maintenance and growth. It consisted of molasses, urea, rice bran, mineral mix, and salt, which were mixed with tapioca (see Table 2). Blocks were made by the warm process **(Garg et al., 1998)** i.e., the molasses was heated to bring the temperature to about 50^{o}C for 10 minutes, then mixed with urea, salt, rice bran, mineral mix and tapioca and stirred continuously until spread evenly. The mixture was poured into moulds of the size 5.5 x 3.5 x 1.5 cm and then pressed to shape and size of 50 grams each. The formed urea molasses blocks were removed from the moulds and packaged in small plastic bags and stored at room temperature until used.

Table 2. Composition of urea molasses blocks used in the study.

	Ingredients (%)					
	Molasses	**Urea**	**Mineral mix**	**Salt**	**Tapioca**	**Rice Bran**
UMB-1	50	6	9	4	10	21
UMB-2	45	6	9	4	10	26
UMB-3	40	6	9	4	10	31

Lambs were fed chopped Kumpai grass hay and drinking water *ad libitum*. The UMB was offered twice per day at 08.00 p.m. and 03.00 a.m. (local time). Each lamb ate 100 g (2 x 50g) UMB supplement every day.

Parameters were measured included feed- and water-intake, average daily body weight gain, feed conversion ratio, economic feed efficiency, nutrient digestibility, apparent digestible energy, Nitrogen balance, pH of the rumen, total volatile fatty acid, and ammonia concentration.

The data were analysed statistically according to ANOVA using the Randomised Complete Block Design experiment in SAS (Statistical Analysis System) procedure (1987). For comparison between treatment means, the Contrast orthogonal test was applied **(Steel and Torrie, 1980)**.

Results

The analysed nutrient content of the UMB is shown in Table 3 and the major findings on UMB effects on indigenous male lambs is shown in Table 4.

Table 3. Analysed nutrient content of UMB (on DM basis) prepared from locally available feedstuffs in Jambi.

Nutrient (%)	**UMB-1**	**UMB-2**	**UMB-3**
DM	85.22	85.35	84.62
OM	78.15	79.79	80.24
CP	25.62	26.66	26.44
CF	5.74	5.78	5.20
EE	2.52	2.75	3.81
NFE	44.27	44.60	44.79
GE (cal/g)	2139.00^{a}	3039.00^{b}	3439.00^{b}

Note : ^{a,b} values with different superscripts in the same row are statistically different (P<0.05).

Table 4. Summary of major findings on UMB effects on indigenous male lambs.

Parameters	**Treatments***			
	P0	**P1**	**P2**	**P3**
Kumpai grass intake (g DM/lamb/day)	$206.32 (2.12)^{A}$	$219.15 (2.50)^{B}$	$227.18 (0.88)^{B}$	$221.53 (1.95)^{B}$
Water intake (l/lamb/day)	$0.68 (0.01)^{a}$	$0.75 (0.03)^{b}$	$0.86 (0.02)^{b}$	$0.83 (0.03)^{b}$
ADG (g/lamb)	$9.38 (1.07)^{a}$	$21.88 (1.48)^{b}$	$22.55 (0.95)^{b}$	$22.10 (0.50)^{b}$
Economic feed efficiency (feed cost/ Output) **	$8.83 (0.95)^{a}$	$4.18 (0.33)^{b}$	$4.05 (0.14)^{b}$	$4.05 (0.07)^{b}$
FCR (g DMI / g ADG)	$25.75 (2.76)^{a}$	$14.67 (0.94)^{b}$	$14.17 (0.51)^{b}$	$13.92 (0.26)^{b}$
Digestibility Coefficient (%)				
DM	$59.41 (0.44)^{A}$	$71.82 (0.74)^{B}$	$75.16 (0.66)^{B}$	$72.94 (1.36)^{B}$
OM	$44.24 (0.89)^{A}$	$65.40 (0.80)^{B}$	$70.32 (0.73)^{B}$	$67.55 (5.76)^{B}$
CP	$63.32 (0.40)^{A}$	$79.91 (0.54)^{B}$	$83.71 (0.50)^{B}$	$81.28 (0.56)^{B}$
NFE	$29.39 (1.78)^{A}$	$66.06 (0.89)^{B}$	$64.69 (1.62)^{B}$	$68.00 (1.13)^{B}$
EE	$84.40 (0.50)^{a}$	$87.96 (0.56)^{a}$	$87.17 (1.60)^{a}$	$81.02 (0.56)^{b}$
ADE (cal/g)	$267.40 (4.35)^{A}$	$518.92 (23.68)^{B}$	$644.09 (8.38)^{C}$	$641.93 (18.02)^{C}$
N balance (g/lamb/day)	$1.87 (0.05)^{A}$	$5.17 (0.12)^{B}$	$5.66 (0.05)^{B}$	$5.33 (0.09)^{B}$
Total VFA (mM/l) at 3 h	$115.32 (4.28)^{a}$	$156.15 (7.70)^{b}$	$203.60 (7.45)^{b}$	$166.63 (11.42)^{b}$
Ammonia concentration (mg NH_3-N/l) at 3 h	$70.42 (2.45)^{A}$	$146.84 (5.72)^{B}$	$108.89 (5.17)^{C}$	$142.16 (5.16)^{B}$

Note : * Values in brackets represent standard error of means (MSE)
** Feed cost and output are calculated in Rupiah, 1 USD = 7000.00 Rupiah.
[A,B,C] values with different superscripts in the same row are statistically different (P<0.01).
[a,b] values with different superscripts in the same row are statistically different (P<0.05).

The dry matter intake (DMI) of Kumpai grass was highly significantly different (P<0.01) in the different treatment groups. The DMI of the control group (P0) was 206.32 g/lamb/day. It was highly significantly lower (P<0.01) than that of treatment groups fed Kumpai grass with UMB supplementation (P1, P2, P3) by 6.21% in P1, 10.11% in P2 and by 7.37% in P3. Among the treatment groups (P1, P2 and P3) there were no significant differences.

Water intake between treatment groups was significantly different (P<0.05). Lambs consumed 0.68 l water/lamb/day when they were fed Kumpai grass without UMB supplementation. When they were supplemented with UMB, water intake increased to 0.75 l/lamb/day for lambs supplemented with UMB-1 (P1), 0.86 l/lamb/day and 0.83 l/lamb/day for lamb groups P2 and P3, respectively. Among treatment groups P1, P2 and P3, the water intake was not significantly different (P>0.05). Lamb group P2 consumed most water (0.86 l/lamb/day).

Average daily weight gain in this study was significantly different (P<0.05) between the control (P0) and the treatment groups (P1, P2, P3). The ADG ranged from 9.38 g/lamb in the control group (P0) to 21.88 g/lamb in lambs group P1, 22.10 g/lamb in lambs group P3 and the highest one in lambs group P2, with 22.55 g/lamb. The ADG of lambs in groups fed Kumpai grass with UMB supplementation (P1, P2 and P3) were not significantly different (P>0.05) from each other.

The best economical feed efficiency was observed in the lamb group fed Kumpai grass with UMB-2 (P2) and UMB-3 (P3) with an input cost of 4.05 Rupiah for every 1 Rupiah output. This was followed by lamb group P1 with a ration of 4.18. The poorest feed efficiency was 8.83 and this was observed in lambs of the control group (P0).

The poorest FCR was observed in the control group (P0) with a ratio of 25.75. This was followed by 14.67 in lamb group fed Kumpai grass with UMB-1 (P1), and then 14.17 in lamb group P2. The best FCR was 13.92, and this was in lambs of group P3.

The digestibility coefficient of DM, OM, CP and apparent digestible energy (ADE) during the study were highly significantly different (P<0.01) between the different treatments groups and the control groups. Whereas the digestibility coefficient of EE was significantly different (P<0.05). The control group (P0) had the lowest digestibility coefficient value of DM (59.41%), OM (44.24%), CP (63.32%) and DE (267.40 cal/g). When lambs fed Kumpai grass were supplemented with UMB (treatments P1, P2 and P3), the digestibility coefficient values tended to increase. The highest digestibility coefficient was in P2 values of DM (75.16%), OM (70.32%), CP (83.71%) and ADE (644.08 cal/g).
The N balance in this study was highly significantly different (P<0.01) among the different treatment groups. In the control group (P0), the N balance was the lowest with 1.87 g/lamb/day. Among the treatment groups P1, P2 and P3, the values were 5.17 g/lamb/day in lamb group P1, followed by 5.33 g/lamb/day in group P3 and the highest was in the group P2

with 5.66 g/lamb/day. However, between treatment groups fed Kumpai grass with UMB supplementation (P1, P2 and P3), there were no significant differences (P>0.05).

The mean total VFA production of rumen fluid at 0 h was not significantly different (P>0.05) in the different treatment groups. The total VFA increased from 138.97 mM/l in the control group (P0) to 145.12mM/l in lambs of group P1, 174.36 mM/l in lambs of group P2 and the highest was in group P3 with 177.11 mM/l. However, at 3 h after feeding, the total VFA was significantly different (P<0.05) in the different treatment groups (P0 and P1, P2, P3). Total VFA of P0 were significantly lower (P<0.05) than those of treatment groups P1, P2 and P3. Total VFA in group P0 was 115.32 mM/l rumen fluid at 3 h after feeding. In the lamb groups fed Kumpai grass with UMB supplementation (P1, P2 and P3), the total VFA levels were not significantly different (P>0.05). They ranged from 156.15 mM/l (P1) to 166.63 mM/l (P3) and 203.60 mM/l (P2) of VFA.

There was no significant difference (P>0.05) between the mean pH of the rumen fluid of the control and treatment groups, both at 0 h and 3 h after feeding. At 0 h, the pH value of the control group (P0) was highest (6.82). The pH was 6.71 in lamb group fed Kumpai grass with UMB-1 (P1), 6.72 in P2 and 6.78 in P3. The pH of the control group (P0) at 3 h after feeding was lower by 0.88% than that of the pH at 0 h, while in group P1, the pH value decreased by 0.89%. In lamb groups P2, the pH of rumen fluid reduced by 3.42% and P3, the pH of rumen fluid reduced by 3.24%, in comparison to that of the control in each case.

The mean ammonia concentration of rumen fluid at 0 h after feeding was not significantly different (P>0.05) in the different treatment groups. The ammonia concentration increased from 22.61 mg NH_3-N/l in the control group (P0) to 25.84 mg NH_3-N/l in lamb group fed Kumpai grass with UMB-3 (P3), 40.50 mg NH_3-N/l in lamb group P2 and the highest in lamb group P1 with 47.73 mg NH_3-N/l. However, at 3 h after feeding, the ammonia concentration was highly significantly different (P<0.01) in the different treatment groups. The ammonia concentration in the control group (P0) was highly significantly lower (P<0.01) than that of the treatment groups. Among treatment groups P1, P2 and P3, the ammonia concentrations were significantly different (P<0.05) and ranged from 108.89 - 146.84 mg NH_3-N/l. The ammonia concentration of lambs in group P1 was not significantly different (P>0.05) from that of lambs in group P3, but significantly different from that of lambs in group P2. Ammonia concentration of lambs in group P2, was significantly different (P<0.05) from that of group P3. The highest ammonia concentration was in lambs of group P1.

Discussions: UMB supplementation increased the intake of Kumpai grass, water consumption, average daily live weight gain, feed conversion ratio and economic feed efficiency. These conditions could be mainly due to the high amount of carbohydrate, energy and mineral content in UMB which can stimulate rumen microbes to grow and be more able to digest crude fibre. Thus, Kumpai grass hay or other grasses and by-products will be easier to digest by the animal. The other possibility is that because molasses is a concentrated crude sugar and as such, contains a wide range of trace minerals, vitamins, sugar (sucrose, glucose, and fructose - usually in the ratio of about 2 : 1 : 1) and is particularly rich in potassium and sulphur **(Sudana and Leng, 1986)**. This stimulates the animal to increase the feed and water consumption. Higher feed intake may cause higher nutrient intake. It means, higher nutrients could be digested and utilised by animal. It can be showed in average daily live weight gain.

The treatment groups supplemented UMB had higher body weight gain than the control group.

Lambs in the control group were fed only on Kumpai grass which had high crude fibre content. High crude fibre caused lambs to be satisfied easily and lambs probably stopped eating. Another effect of high crude fibre in diets is on the lowering of the passage of digesta through the alimentary tract. These circumstances decreased the feed intake and last effect was body weight gain. When body weight gain was lower, feed conversion ratio and economic feed efficiency were worse. It may be due to feed conversion ratio and economic feed efficiency were affected by body weight gain and feed consumption.

The result of this study showed that UMB supplementation had a highly significant effect ($P<0.01$) on the digestibility of DM, OM, CP, N balance and ADE, and had a significant effect ($P<0.05$) on EE digestibility. These condition related to feed intake and nutrient intake.

The data of UMB supplementation to Kumpai grass on lambs in this study increased the total VFA production and ammonia concentration during the 3 hours post feeding. However, the UMB supplementation in lambs fed Kumpai grass had a similar effect on pH of rumen fluid. These condition related to nutrient composition in diet especially protein and carbohydrate as source of energy.

Comparison between treatment groups in this study showed that all parameters in lambs fed Kumpai grass with UMB-1 was not significantly different from that of UMB-2 and UMB-3 fed lambs. The effect was similar between UMB-2 and UMB-3, except ADE. Lambs fed UMB-2 had the highest apparent digestible energy (ADE). ADE was significantly ($P<0.01$) higher in the group P2 than group P1 but similar to group P3. This may be due to the dietary energy in UMB (Table 3). High dietary energy increased energy intake probably. GE on UMB-2 was similar to GE on UMB-3 but significantly higher than in UMB-1.

Conclusions

The three types of UMB prepared from locally available feedstuffs all have a positive effect on growth performance and nutrient digestibility of indigenous lambs in Jambi when they are used as supplement to Kumpai grass hay. The UMB-2 with 45% molasses, 10% tapioca and 26% rice bran gave the highest body weight gain. The UMB-1 with 50% molasses tended to be too hygroscopic and therefore would easily melt during storage. This creates limitations in its practical use for feeding of lambs.

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