Use of urea-molasses mineral blocks in lambs fed with straw

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SUMMARY

This study was carried out to investigate whether using urea-molasses mineral blocks (UMMB) prevent weight losses of lambs fed with poor quality forages in winter conditions of north-east Turkey. Eighteen, 7 month old, Tuj lambs weighing 35.4 ± 0.4 kg were divided into three equal groups and fed individually for 66 days ad libitum with either barley straw alone (Group I, Control), or with barley straw + UMMB (Group II) or with barley straw + UMMB + 100 g crushed barley (Group III). A metabolism trial was carried out in the last 6 days of feeding trial to determine nutrient digestibility. The dry matter intake of barley straw was increased significantly (P<0.01) in groups supplemented with UMMB. Dry matter and organic matter digestibilities increased significantly (P<0.05) in UMMB-fed groups. CP digestibility also increased significantly (P<0.01) even higher in UMMB-fed groups. Significant (P<0.05) higher blood urea, rumen ammonia-N and total volatile fatty acids concentration were observed in UMMB-supplemented groups. Using UMMB as supplement did not prevent weight losses of lambs, but decreased it. It is concluded that using UMMB in lambs fed with poor quality forages may decrease body weight losses and prevent sporadic mortalities in winter conditions of Northeast Turkey.

Keywords : Barley straw - lamb - urea-molasses block - weight loss - digestibility.

Introduction

Northeast Turkey (the altitude is 1850-1900 m above sea level and ambient temperature range from - 40 to 25° C) is one of regions in Turkey, which has an important potential in terms of animal production. However, vegetation period of forages is relatively short (from mid April to mid July) and sheep may graze generally from mid May to end of October. Therefore sheep are fed in shed every winter for 5 to 6 months. After dry seasons, forage shortage may also occur in some years and sheep are fed with crop residues transported from other regions. This leads to insufficient nutrition of animals especially of lambs and they lose weight, even sporadic mortalities may occur in some herds since crop residues are insufficient to ensure even maintenance requirements. Crop residues can be better utilised by the animals if the requirements of the rumen bacteria balanced by supplying deficient nutrients [6]. One of the most efficient ways of increasing utilisation of crop residues is supplementation of nitrogen (N) and energy in the form of urea molasses mineral blocks (UMMB). UMMB have been used in large and small ruminants as supplementation to improve intake and digestibility of crop residues especially in developing countries [3, 9, 13, 15]. Most of these studies have been done with large ruminants and in the regions with hot climate. The objective of this study was to prevent weight losses and sporadic mortalities of lambs fed with crop residues by using UMMB in winter conditions of northeast Turkey.

Materials and methods

FORMULATION OF UMMB

UMMB were prepared by a cold mixing process and the mixture was poured into specially designed mould to form blocks weighing 3 kg each. Mould was made with three metal pieces, which gives cylindric shape to the block and makes it possible to mould blocks with a hole at the center, which enables to tie blocks, somewhere in shed. The UMMB contained molasses, urea, cottonseed cake, wheat bran, derz (used in construction to point between bricks in a wall and
99% of it consist of cement and calcite powder, also includes cellulose, common salt and vitamin-mineral premix. Their respective proportions were 350, 100, 140, 230, 100, 70 and 10 g kg⁻¹. The mixture was prepared by adding molasses to a large plastic container, followed by salt, vitamin-mineral premix, urea and derz. Afterwards, cottonseed cake and wheat bran were added to the mixture little by little to avoid lumps and mixed thoroughly. The mixture was poured into mould and pressed by stepping up by two persons (pressure 0.8 kg/cm²) for 15-20 seconds, mould was assembled and blocks were allowed to dry for 20 days at room temperature.

ANIMALS, FEEDING AND MANAGEMENT

Eighteen tuj lambs aged 7 months were divided into three equal groups according to their weights (average body weight 35.4 ± 0.4 kg) and housed individually in 1.0 x 1.8 m² metal metabolic cages with grid wooden floors suitable for collection of faeces and urine separately. Animals were accustomed to the metabolic cages for 5 days before the start of experiment. Animals were given only barley straw (Group I, Control), barley straw + UMMB (Group II) and barley straw + UMMB + 100 g crushed barley (Group III) for 66 days. All animals in each group received barley straw ad libitum and had free access to clean water. Fortnightly body weight changes were recorded before feeding. The amounts of blocks licked and refusals were recorded after 24 h consumption.

A metabolism trial was conducted in the last 6 days of experiment. Samples of feeds offered and refusals were taken for chemical analysis. Weight of faeces was recorded daily at 09:00. Faeces were mixed thoroughly and representative samples were taken for chemical analysis. Faecal samples were dried at 60°C and ground through a 1mm screen. Blood samples were taken by puncturing the jugular vein before feeding, sera were separated and stored frozen until analysed. The samples of strained rumen liquor (SRL) were taken 2 hours after feeding by using an intraruminal tube, followed by measuring pH. Samples were then acidified and analysed freshly.

ANALYTICAL PROCEDURES

Chemical composition of barley straw, UMMB, barley and faeces were analysed using methods recommended by AOAC [2], acid detergent fibre (ADF) and neutral detergent fibre (NDF) by methods of VAN SOEST et al. [14]. Total volatile fatty acids (TVFA) and Ammoniac-N in rumen liquor were determined according to the methods recommended by MARCHAM [7]. The pH of SRL was measured with a digital pH meter (Accumet Model 25; Fisher Scientific, Loughborough, UK). Blood urea was analysed by spectrophotometric method (Spectramax plus 384; Molecular Devices, Sunnyvale, CA, USA) using a commercial kit (Urea-Kit S180; bioMerieux, Marcy-l’Etoile, France). Block consumption was analysed statistically using t-test and other results were using analysis of variance (ANOVA). The significant differences between means were compared using Duncan’s multiple range tests. The difference was considered as significant when p < 0.05.

Results and discussion

CHEMICAL COMPOSITION

Chemical compositions of straws and supplements are presented in Table I. The UMMB had high crude protein (CP), low ADF and NDF. The CP content of UMMB was similar to values reported by DE and SINGH [3].

<table>
<thead>
<tr>
<th>Feed</th>
<th>OM</th>
<th>CP</th>
<th>EE</th>
<th>CF</th>
<th>ADF</th>
<th>NDF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straw</td>
<td>92.28</td>
<td>3.97</td>
<td>2.18</td>
<td>1.12</td>
<td>54.74</td>
<td>79.80</td>
</tr>
<tr>
<td>Barley</td>
<td>95.92</td>
<td>10.60</td>
<td>2.25</td>
<td>5.68</td>
<td>9.75</td>
<td>34.15</td>
</tr>
<tr>
<td>UMMB</td>
<td>74.09</td>
<td>26.98</td>
<td>1.37</td>
<td>4.14</td>
<td>7.44</td>
<td>12.99</td>
</tr>
</tbody>
</table>


INTAKE AND DIGESTIBILITY OF NUTRIENTS

The mean dry matter (DM) intake (DMI) and other nutrients with their digestibility coefficients are presented in Table II. The DMI of barley straw by UMMB supplemented groups were higher (P<0.01) than those without UMMB, but did not differ due to crushed barley supplementation. Total DMI, accordingly organic matter (OM), CP, crude fibre (CF)

### TABLE II

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Group I</th>
<th>Group II</th>
<th>Group III</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMI</td>
<td>793.4</td>
<td>890.8</td>
<td>890.8</td>
<td>42.2</td>
</tr>
<tr>
<td>UMMB</td>
<td>151.5</td>
<td>129.6</td>
<td>110.9</td>
<td>10.4</td>
</tr>
<tr>
<td>Total</td>
<td>973.4</td>
<td>1016.4</td>
<td>977.5</td>
<td>46.77</td>
</tr>
<tr>
<td>Digestibility</td>
<td>58.5</td>
<td>63.9</td>
<td>66.6</td>
<td>1.27</td>
</tr>
<tr>
<td>OM Intake</td>
<td>732.1</td>
<td>1004.4</td>
<td>715.6</td>
<td>43.69</td>
</tr>
<tr>
<td>Digestibility</td>
<td>61.6</td>
<td>67.5</td>
<td>77.6</td>
<td>1.02</td>
</tr>
<tr>
<td>CP Intake</td>
<td>31.5</td>
<td>49.4</td>
<td>49.6</td>
<td>6.24</td>
</tr>
<tr>
<td>Digestibility</td>
<td>15.7</td>
<td>40.3</td>
<td>46.1</td>
<td>2.15</td>
</tr>
<tr>
<td>EE Intake</td>
<td>11.3</td>
<td>14.4</td>
<td>19.8</td>
<td>0.96</td>
</tr>
<tr>
<td>Digestibility</td>
<td>45.1</td>
<td>48.4</td>
<td>51.3</td>
<td>1.01</td>
</tr>
<tr>
<td>CF Intake</td>
<td>327.1</td>
<td>362.9</td>
<td>377.9</td>
<td>17.87</td>
</tr>
<tr>
<td>Digestibility</td>
<td>67.4</td>
<td>60.7</td>
<td>52.6</td>
<td>1.45</td>
</tr>
<tr>
<td>ADF Intake</td>
<td>432.4</td>
<td>492.8</td>
<td>506.4</td>
<td>28.44</td>
</tr>
<tr>
<td>Digestibility</td>
<td>50.2</td>
<td>56.4</td>
<td>53.1</td>
<td>0.69</td>
</tr>
<tr>
<td>NDF Intake</td>
<td>633.1</td>
<td>709.9</td>
<td>758.3</td>
<td>38.62</td>
</tr>
<tr>
<td>Digestibility</td>
<td>51.4</td>
<td>59.3</td>
<td>55.8</td>
<td>0.87</td>
</tr>
</tbody>
</table>

Table II. — Intake (grams per day) and digestibility (%) of nutrient in the different groups of lambs (Group I: control, barley straw alone, Group II: barley straw + UMMB, Group III: barley straw + UMMB + crushed barley (100g)).

Means with different superscripts in a row differ significantly * P<0.05 ** P<0.01 *** P<0.001

intakes (P<0.01) and ether extract (EE), ADF and NDF intakes (P<0.05) increased significantly with UMMB supplementation, EE and NDF intakes were further enhanced significantly (P<0.05) when the basal ration supplemented with crushed barley. On average, the UMMB supplementation increased forage DMI by 9%, which was lower, compared to reported studies in cattle. TOPPO et al. [12] reported 30% (P<0.05) and DE and SINGH [3] reported 23% (P<0.01) increase in forage DMI with UMMB supplementation in cattle fed with straw. Similarly, GREENWOOD et al. [4] reported 22% (P<0.05) increase in OM intake in cattle fed with tallgrass-prairie hay. However, ANINDO et al. [1] reported 7% increase in forage DMI (P<0.05) in grazing lambs.

Crushed barley supplementation resulted in lower UMMB consumption (P<0.001) in the group III. TOPPO et al. [12] reported an insignificant increase in UMMB intake with concentrate supplementation in cattle, however an insignificant decrease in UMMB intake was also reported with increased concentrate supplementation in cattle [12] and buffaloes [5]. Similarly, an increased intake of UMMB was reported by MEHRA et al. [8] when the level of bran was increased in the ration of buffaloes.

DM and OM digestibilities increased significantly (P<0.05) in UMMB-fed groups. Improvement in OM digestibility showed that more readily fermentable nutrients supplied to rumen bacteria through UMMB supplementation, which might have led to optimum growth of rumen bacteria and forage utilisation. CP digestibility also increased significantly (P<0.01) even higher CP intake in UMMB-fed groups, which was directly proportional to its level in the diet as reported by TOPPO et al. [12]. CP digestibility was further increased significantly (P<0.01) when the straw and UMMB supplemented crushed barley. ADF and NDF digestibilities tended to be higher in UMMB-fed groups over the control group, but it was depressed with crushed barley supplementation, probably due to the availability of easily fermentable carbohydrates supplied through UMMB and crushed barley. Similar results were reported by TOPPO et al. [12] in cattle and by HOSAMANI et al. [5] in buffaloes.

In spite of insignificant improvement in ADF and NDF digestibilities, CF digestibility decreased significantly (P<0.01) in the groups fed with UMMB. Similar result was reported by TOPPO et al. [12] in cattle. This unexpected relationship between ADF, NDF and CF digestibilities might be sourced from analysis errors that explained by THEANDER and WESTERLUND [11]. They reported that the analysis methods of ADF, NDF and CF had some disadvantages; firstly a majority of the noncellulosic polysaccharides and part of lignin was lost during the treatments of CF analysis. Secondly, some noncellulosic polysaccharides were dissolved during the NDF treatment. Lastly, THEANDER and AMAN [10] have reported that NDF-fraction contained 10 to 60 g kg⁻¹ CP besides the expected hemi-cellulose, cellulose and lignin. The ADF-fraction contained 70 to 140 g kg⁻¹ hemi-cellulose and 10 to 40 g kg⁻¹ CP besides cellulose and lignin and the cellulose-residue also contained 80 to 130 g kg⁻¹ hemi-cellulose and 20 to 70 g kg⁻¹ lignins.

BLOOD UREA AND RUMEN PARAMETERS

Blood urea and rumen ammonia-N concentrations were significantly higher (P<0.05) in UMMB-fed groups, but slightly lower in group III compared to group II where crushed barley was supplied (Table III). This may be due to lower UMMB intake in this group or to the available carbon skeleton came from crushed barley to capture ammonia-N for microbial amino acids synthesis. Similar results were reported by TOPPO et al. [12] and by HOSAMANI et al. [5].

Rumen pH was significantly lower in group II compared to group I, which may be due to consumption of easily fermentable carbohydrates from UMMB which was led to higher production of volatile fatty acids. UMMB supplementation significantly increased (P<0.05) rumen TVFA concentration compared to group I. This is due to increased rumen fermentation pattern because of more readily carbohydrates and ammonia-N in the rumen supplied through UMMB.

BODY WEIGHT CHANGE

One of the objectives of this work was to investigate whether using UMMB prevent weight losses of lambs fed with low quality forages in winter conditions of northeast Turkey. Using UMMB did not prevent weight losses, but decreased it (Table III). Weight losses were 21.4%, 16.5% and 10.0% in groups I, II and III, respectively. TOPPO et al. [12] reported 9.2%, 4.0% and 5.2% weight losses in cattle in their study which had similar experimental design. Higher weight losses in this study might be due to winter conditions and colder ambient temperature (in shed +3 to +5) that animals spent more energy to keep body temperature constant.

Sporadic lamb mortalities may occur in some herds in winter conditions of the region if lambs fed with low quality forages only. In the present study, two lambs from the group I (where animals received barley straw only) died on day 56 and 57 of the experimental period. This probably caused by extreme cachexia. Lambs were removed from the experiment and supported with glucose and methionine serum but they were not able to survive. These results showed that using UMMB would decrease weight losses and prevent sporadic deaths in winter conditions of northeast Turkey.

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Group I</th>
<th>Group II</th>
<th>Group III</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial body weight (kg)</td>
<td>35.41</td>
<td>35.42</td>
<td>35.42</td>
<td>2.14</td>
</tr>
<tr>
<td>Final body weight (kg)</td>
<td>27.83</td>
<td>29.58</td>
<td>31.86</td>
<td>2.60</td>
</tr>
<tr>
<td>Ruminal pH</td>
<td>6.80</td>
<td>6.64</td>
<td>6.70</td>
<td>0.03</td>
</tr>
<tr>
<td>Ruminal NH₃ (g/l of SRL)</td>
<td>0.113</td>
<td>0.237</td>
<td>0.208</td>
<td>0.062</td>
</tr>
<tr>
<td>TVFA (mM in SRL)</td>
<td>40</td>
<td>72</td>
<td>74</td>
<td>1.7</td>
</tr>
<tr>
<td>Serum urea (g/L)</td>
<td>0.160</td>
<td>0.344</td>
<td>0.309</td>
<td>0.019</td>
</tr>
</tbody>
</table>

TABLE III. — Body weight and rumen fermentation patterns obtained in the different groups of lambs : Group I : control, barley straw alone, Group II : barley straw + UMMB, Group III : barley straw + UMMB + crushed barley (100g).

Means with different superscripts in a row differ significantly * P<0.05 SRL : Strained Rumen Liquor, TVFA : Total Volatile Fatty Acids, UMMB : Urea Molasses Mineral Block.
Conclusion

The results of this study show that UMMB is a useful tool to improve utilisation of low quality forages. Using UMMB did not prevent weight losses of lambs fed with low quality forage alone but decreased it. Therefore it is useful to prevent sporadic mortality of lambs in winter conditions of northeast Turkey.

References