Oat Hay Apparent Digestibility, Rumen Ammonia Nitrogen and Bun in Goats Supplemented with Fermented Molasses-Poultry Litter

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Abstract: The study was conducted to determine oat hay apparent digestibility, blood urea nitrogen and ammonia nitrogen in goats supplemented with fermented molasses-poultry litter. About 20 young Alpine Frances goats with 16.6±1.8 kg initial body weight were used. Goats were randomly assigned to 1 of 4 treatments in a complete randomize design. The evaluated treatments were oat hay (C); oat hay plus 150 g of Molasses-Poultry litter-Soybean Meal mix (MPSM); oat hay plus 150 g of Molasses-Poultry litter-Wheat Meddling mix (MPWM) and oat hay plus 150 g of Molasses-Poultry litter-Sorghum Grain mix (MPSG). Supplements and basal diet (oat hay) were individuallly fed. Apparent digestibility of DM, OM, NDF, ADF and N were determined. Blood urea nitrogen and ammonia nitrogen were also determined. Feed intake was higher (p = 0.0001) in supplemented goats compared to goats in the control group. Supplemented goats consumed more DM than those in the control group (p = 0.0003). Dry matter retention was not affected by supplementation (p = 0.11). Organic dry matter tended to increase (p = 0.08) in supplemented goats. Supplemented goats retained more nitrogen (p = 0.0001) than those in the control group with values of 6.37, 10.43, 8.59 and 8.00 g day−1 for treatments C, MSPM, MPWM and MPSG, respectively. The concentration of N-NH3 in rumen fluid tended to increase (p = 0.08) as the quantity of nitrogen in the supplement increase. The results shows that supplementation with molasses-poultry litter plus soybean meal, wheat middlings or sorghum grain can increase feed intake and nitrogen retention in growing goats fed oat hay.

Key words: Goats, by-products, rumen fermentation, supplementation, quantity, supplementation

INTRODUCTION

Goat population in the Comarca Lagunera (Durango and Coahuila) Mexico is around 458 271 heads. Forage quality and availability is low especially during the winter and early spring as a consequence goats nutritional status is poor. Supplementation with medium quality hay and by-products can alleviate the problem in grazing goats.

Feed intake and digestibility of low to medium quality forages can be increased by an adequate supplementation program. By-products such as poultry litter and molasses increases intake of low quality forages by ruminants. Sweetness of molasses may stimulate the intake of roughages and non desirable feeds. Processing of poultry litter such as anaerobic fermentation can improve feed intake, facilitate management and reduce pathogen organisms for ruminants, especially when mixed with carbon sources. Madrid et al. (1997) and Maity et al. (1999) reported increases on feed intake and digestibility of low quality roughages in goats supplemented with different sources of nitrogen.

An experiment was conducted to evaluate the effect of supplementation with a mix of molasses-poultry litter plus soybean meal, wheat meddlig or sorghum grain on feed intake, apparent digestibility of oat hay, blood urea nitrogen and ammonia nitrogen in rumen fluid in growing goats.

MATERIALS AND METHODS

The experiment was carried out in Lucero, Durango, Mexico (25° 56′ N, 103° 26′ W, 1110 m above sea level). Mean yearly precipitation is around 240 mm. About

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Table 1: Oat hay and supplements chemical composition used in the experiment

<table>
<thead>
<tr>
<th>Component (%)</th>
<th>Oat hay</th>
<th>MPSM</th>
<th>MPWM</th>
<th>MPSG</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM</td>
<td>92.00</td>
<td>69.87</td>
<td>77.33</td>
<td>74.71</td>
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<tr>
<td>OM</td>
<td>91.80</td>
<td>86.76</td>
<td>89.50</td>
<td>89.40</td>
</tr>
<tr>
<td>N</td>
<td>1.28</td>
<td>4.08</td>
<td>2.68</td>
<td>2.03</td>
</tr>
<tr>
<td>CP</td>
<td>8.00</td>
<td>25.55</td>
<td>17.09</td>
<td>12.69</td>
</tr>
<tr>
<td>NDF</td>
<td>66.05</td>
<td>16.22</td>
<td>24.91</td>
<td>17.12</td>
</tr>
<tr>
<td>ADF</td>
<td>41.66</td>
<td>9.86</td>
<td>11.66</td>
<td>9.86</td>
</tr>
<tr>
<td>Ash</td>
<td>8.20</td>
<td>13.24</td>
<td>10.50</td>
<td>10.60</td>
</tr>
</tbody>
</table>

1MPSM = Molasses-Poultry litter-Soybean Meal mix (30:40:30); MPWM = Molasses-Poultry litter-Wheat Meddlin mix (30:40:30); MPSG = Molasses-Poultry litter-Sorghum Grain mix (30:40:30)

20 young Alpine Frances breed goats with 16.6±1.8 kg initial body weight were used. Goats were randomly allotted to 1 of 4 treatments in a complete random design with 5 goats per treatment. All goats received a basal diet of oat hay (8.2% CP) at 2.2% body weight dry matter basis. Oat hay was fed following supplemental feeding each morning. Animals were individually supplemented once daily at 0600 h, receiving 150 g of 1 of the 3 supplement treatments (Table 1).

Oat hay (C); oat hay plus 150 g of a mix 30% Molasses, 40% Poultry litter and 30% Soybean Meal (MPSM); oat hay plus 150 g of a mix 30% Molasses, 40% Poultry litter and 30% Wheat Meddlin (MPWM) and oat hay plus 150 g of a mix 30% Molasses, 40% Poultry litter and 30% Sorghum Grain (MPSG).

Supplements were processed before fed, ingredients on the supplements were mixed and placed into a container on layers 20 cm depth, compressing the material to create an anaerobic environment and covered with a black plastic film. The ensiling period lasted 30 days. Forage and supplements sub-samples were collected every week and composted for chemical analysis. Water and salt mineral mix were available at all times.

To determine feed intake a 10% over the intake on the previous day was offered. Forage intake and refusals were recorded daily and refusals were discarded each morning prior to feeding. To estimate body weight change goats were weighed in the morning of 2 consecutive days at the beginning and at the end of the experimental period. From day 29-32 fecal collection bags were fitted to the animals to assess total fecal and urine output. Every 12 h fecal collection bags were removed and replaced on each animal, fecal and urine output was recorded and thoroughly mixed.

Representative sub-samples (10% of total wet weight) were collected and frozen within 1 h after collection at -20°C for later analysis. Daily sub-samples were composited by weight (10% wet weight) within goat and treatment for DM, OM, NDF, ADF and N content. On day 35 of the experimental period goats were deprived of forage 12 h and 1 blood sample was collected before supplementation and every hour for 6 h after supplementation via jugular vein puncture. Blood samples were centrifuged at 3000×g for 20 min at room temperature within 30 min after collection. Serum was harvested and frozen at -20°C until later analysis. Serum samples were analyzed for BUN spectrophotometrically using a commercial kit (Diagnostic Chemicals Limited, Oxford, Connecticut).

On day 3 of the experimental period goats were deprived of forage 12 h and 8 mL of rumen fluid were collected in 3 goats of each treatment by stomach tube connected to a vacuum pump. Rumen fluid was collected before supplement was fed (0 h) and every 1 h for 6 h after supplementation. Liquor was strained through 4 cheesecloth layers and a 10 mL aliquot was acidified with 2 mL of 50% (v/v) hydrochloric acid. Samples were frozen at -20°C until analysis could be conducted. Ammonia concentration was determined by the phenol-hypochlorite method of Broderick and Kang (1980). Feed intake, body weight change, dry matter digestibility and nitrogen retention were analyzed by analysis of variance for a completely randomized design (Steel and Torrie, 1980) while milk yield and blood urea nitrogen were analyzed by repeated measurements. All statistical analyses were performed by using the GLM procedure of SAS (SAS Inst., Inc., Cary, NC).

RESULTS AND DISCUSSION

Feed intake was higher (p = 0.0001) in supplemented goats compared to goats in the control group (Table 2). Forage dry matter, CP and fiber contents affect voluntary intake however when CP is <7% intake is diminished due to the important role of N on rumen bacteria growth (Fox et al., 1992). Madrid et al. (1997) and Maity et al. (1999) reported increases on feed intake and digestibility in supplemented goats fed low quality forages.

Protein supplementation often stimulate feed intake in cattle consuming low quality fiber (Lusby et al., 1982; Lusby and Horn, 1983; Krysl et al., 1989). By contrast, feed intake is not affected by protein supplementation when forage CP content is 11% (Minson, 1982). Energy supplements based on cereal grains have shown to decrease the intake and digestibility of low quality forages (Moore et al., 1995). Supplemental goats gained more weight (p = 0.02) than those fed only with oat hay as shown in Table 2.

Similar body weight gain have been reported in Boer goats fed grass hay and supplemented with soybean meal and wheat meddlin (Moore et al., 2002). Brito found higher body weight gain in lambs fed silage of molasses-poultry litter than in those fed only forage. In cattle consuming low quality forage higher weight gain has been reported with supplements based on soybean
meal than with supplements based on wheat middling or corn grain (Grigsby et al., 1992; Sr Galloway et al., 1993). Probably due to the higher protein quality, essential amino acids and 55% bypass protein of soybean meal (NRC, 1996). Dry matter disappearance was similar between treatments (p = 0.11).

Effectiveness of protein supplementation in ruminants consuming low digestibility, low protein roughages may be achieved when nitrogen readily degradable to ammonia is fed to satisfy nitrogen rumen microbes requirements. Digestibility of NDF and ADF were similar (p = 0.39 and p = 0.25, respectively) between treatments. Nitrogen retention was higher in supplemented goat (p = 0.0001) compared to no supplemented goats. Goats supplemented with MPSM retained 10.43 g day⁻¹ while those receiving MPWM and MPG retained 8.59 and 8.0 g day⁻¹, respectively.

Nitrogen retention increased as the N concentration augmented in the supplement. Avitia and Serrato found a similar trend in goats supplemented with protein and fed ammoniated corn stover. Richards et al. (2006) reported an increase in nitrogen retention in cattle supplemented with soybean meal, wheat middling and molasses (16 g day⁻¹) compared to cows consuming only bromegrass hay (7.3 g day⁻¹). The results implied that soybean meal supplied amino acids, peptides or carbon chains for ruminal microbial population. Stern et al. (1994) pointed out that supplementation with soybean meal increase the uptake of amino acids, peptides or both by ruminal microbes. Supplemented goats showed a tendency to increase (p = 0.08) ammonia nitrogen in rumen fluid as nitrogen augmented in the supplement (Fig. 1).

Goats receiving the MPSM showed higher N-NH₃ concentration (7.4 mg dL⁻¹) than the goats in the control group (2.9 mg dL⁻¹) with intermediate values.
Dietary protein content may affect blood urea nitrogen in goats. Blood urea nitrogen concentration in this trial are in the normal physiological range reported by Morros and Dukes whom report a normal physiological range in goats from 6-28 mg dL⁻¹.

**CONCLUSION**

The results of the current indicate that supplementation with silage of molasses-poultry litter plus soybean meal, wheat middling or sorghum grain can increase nitrogen retention in growing goats fed oat hay. Supplementation with fermented poultry litter-molasses plus soybean meal supply the ammonia nitrogen required for rumen microbesfermentation.

**REFERENCES**


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