Assessment of the Nutritive Value of Three Pasture Grasses for Growing Goats

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Abstract: This study was carried out to assess the nutritive value of three pasture grasses collected from Baja area (Central Sudan). The grasses are Aristida mutabilis, Eragrostis termula and Cenchrus biflorus. The chemical composition, digestibility coefficient and feed intake of grasses as silage, hay and straw were determined. Nine healthy male desert goats were used. They were divided into three groups (3X3 Latin square design). The goats were individually penned and the three grasses were tested as feed each at a time for seven days as an adaptation period, followed by seven days as collection period. The results of the experiments showed that digestibility of the dry matter was a significantly different (P<0.05) for Aristida and Cenchrus as straw compared to hay and silage. The dry matter digestibility of Eragrostis was significantly different between the three feed forms. Also, significant different (P<0.05) for Eragrostis and Cenchrus as straw compared to hay and silage. The chemical composition of Aristida, Eragrostis and Cenchrus as hay showed a high crude protein content of 6.1, 6.4 and 6.4%, respectively. The three species of grasses as silage showed a higher crude protein content of 6.7, 9.9 and 10.9%, respectively. Goat Feed intake values for Aristida showed significant difference (P<0.05) between hay and silage, but not between its other feed forms, while with Eragrostis and Cenchrus there was no significant difference between feed forms, except for Cenchrus as straw and hay (P<0.05).

Key words: straw, hay, silage

INTRODUCTION

Natural rangelands support and provide feed for large number of livestock. It plays a vital role in national economy through provision of animal products for local consumption and exports. The Sudan is predominantly an agricultural country with the largest livestock population in the Arab world and is second to Ethiopia in Africa. The latest estimation of livestock is about 21.6 million head of cattle, 23.0 million for sheep, 18.7 million for goat and 2.8 million for camel (Ministry of Animal Resources). Most of the livestock in the Sudan are kept under extensive management system and are fed exclusively on range land resources. During dry season, most range land grasses and perennials become completely dry, his result in a reduction in their nutritional value.

The nutritive value of pasture and rangeland in the Sudan is greatly affected by seasonal changes. In the summer (the dry period) the moisture content, crude protein and total soluble sugar decrease and the plant tend to be fibrous with high ash content and a relatively poor nutritive value. Hay and silage-making are effective means of conservation for solving the problems of in adequate quality feed during dry season.

The target of the present study is to assess the chemical composition, digestibility coefficient and feed intake of some grasses (Aristida mutabilis, Eragrostis termula and Cenchrus biflorus) as straw, hay and silage for feeding growing goats.

MATERIALS AND METHODS

Experimental Grasses: Three range plants; Aristida mutabilis, Eragrostis termula and Cenchrus biflorus, each in three forms; straw, hay and silage were used. The grasses as straw collected from the field two months after seed setting (mature) then chopped and stored to feeding goats later. Hay was made from green grasses collected from the field at blooming stage, then chopped and dried under shade. Silage was made from wilted chopped grasses using molasses as carbohydrate additives (levels of 2% w/w). molasses added after it has been diluted with water in the ratio 1:2 then grasses were carefully backed in plastic bags and stored for four weeks.

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Table 1: Chemical composition percentages of the grasses as straw, hay and silage on dry matter basis.

<table>
<thead>
<tr>
<th>Feed form</th>
<th>Grass species</th>
<th>Ash</th>
<th>Crude protein</th>
<th>Crude fiber</th>
<th>Ether extract</th>
<th>Nitrogen free extract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straw</td>
<td>Aristida</td>
<td>5.5</td>
<td>4.6</td>
<td>46.5</td>
<td>1.9</td>
<td>41.8</td>
</tr>
<tr>
<td></td>
<td>Eragrostis</td>
<td>4.4</td>
<td>2.9</td>
<td>49.9</td>
<td>1.6</td>
<td>41.2</td>
</tr>
<tr>
<td></td>
<td>Cencrhus</td>
<td>9.0</td>
<td>3.4</td>
<td>42.7</td>
<td>2.2</td>
<td>42.7</td>
</tr>
<tr>
<td>Hay</td>
<td>Aristida</td>
<td>7.6</td>
<td>6.5</td>
<td>40.5</td>
<td>1.4</td>
<td>44.0</td>
</tr>
<tr>
<td></td>
<td>Eragrostis</td>
<td>8.4</td>
<td>6.8</td>
<td>39.0</td>
<td>2.4</td>
<td>43.4</td>
</tr>
<tr>
<td></td>
<td>Cencrhus</td>
<td>13.8</td>
<td>6.8</td>
<td>41.9</td>
<td>1.7</td>
<td>35.8</td>
</tr>
<tr>
<td>Silage</td>
<td>Aristida</td>
<td>7.5</td>
<td>7.1</td>
<td>38.3</td>
<td>2.5</td>
<td>44.6</td>
</tr>
<tr>
<td></td>
<td>Eragrostis</td>
<td>15.5</td>
<td>10.5</td>
<td>40.5</td>
<td>1.7</td>
<td>31.7</td>
</tr>
<tr>
<td></td>
<td>Cencrhus</td>
<td>8.3</td>
<td>8.3</td>
<td>41.2</td>
<td>3.7</td>
<td>35.1</td>
</tr>
</tbody>
</table>

Experimental Animals: Nine male desert goats of average age 7-9 months were used for feed intake and digestibility trials, with average body weight 10-13 Kg. The animals were divided into three groups.

Experimental Procedure and Data Collection: Samples of grasses as straw, hay and silage were subjected to the proximate analysis, dry matter DM, crude protein CP, ether extract EE, Ash, crude fiber CF and nitrogen free extract NFE[2]. Total digestible nutrient TDN was calculated according to McDonald et al.,[3][4]. The metabolizable energy value was calculated from chemical composition, Ellis[5]. The chemical compositions of the three grasses are shown in table 1.

The digestibility trial consists of preliminary adaptation period of seven days followed by seven days collection period. Each animals in each group was offered the diet allotted to the group at ad libitum basis, at 8:00 a.m. every day at 7:00 a.m, all feed residues and faeces were collected and weighted. A sample of 10% from each animal's feed and faeces were taken and dried. The samples of seven days were pooled and thoroughly mixed for each animal. Proximate analysis of the pooled samples has been done according to[2].

Statistical Analysis: Latin square method was used for the analysis of digestibility trials according to Steel and Torrie[6][7]. Means were separated using Duncan's multiple tests.

RESULT AND DISCUSSIONS

The results of the present study (table 2) and (figure 1) apparently revealed that the apparent digestibility (%) and averages of grasses as straw, hay and silage. Aristida, Eragrostis and Cencrhus as hay showed a high crude protein contents of 6.1, 6.4 and 6.4% compared to crude contents of 4.4, 2.8 and 3.2% as straw respectively. Also the three species of grasses as silage showed a higher crude protein content of 6.7, 9.9 and 10.9% in the same order compared to hay (table 1). The value for crude fiber (CF) ranged from 35.9 to 47.6% for the three species at different forms. While Aristida as silage showed the lowest value of (CF), Eragrostis as straw was the highest.

The findings of this study indicated that the crude protein contents of the three pasture grasses as straw (mature) and hay (at early blooming stage) is on average of 2.3-6.4%, even though their crude...
protein contents as straw was lowest than hay. This may be attributed to age and maturity of grasses, this result is similar to observation of Hherzelz and Oxenham\cite{10} who mentioned the crude protein content in pasture declined with maturity and age. The present findings showed relatively high level of cured fiber contents for grasses as straw 40.6-46.7% compared to 36.7-39.3% as hay. This may be due to the fact that, at early growth stage plants contain low fiber. Bulter and Baily\cite{16} reported that, at early growth stage of forage plant leaves contain high protein and low fiber. For silage, the crude protein content increased by about 9, 35 and 41.3% for Aristida, Eragrostis and Cenchrus respectively, compared to hay. This high level of crude protein could be due to anaerobic fermentation of silage which enhances the production of sufficient amount of lactic acid bacteria (microbial nitrogen). This result agreed with Holm\cite{17} who reported that, fermentation stimulates rapid increase or dominance of lactic acid bacteria.

The dry matter intake of the three grasses as straw, hay and silage is shown in figure (1). Eragrostis as hay and silage showed the lowest feed intake of 192.2 and 205.7gDM/day respectively, while the Cenchrus as hay and silage showed the highest values 434.0 and 379.8gDM/day respectively. The feed intake values for Aristida showed significant difference (P<0.05) between hay and silage, but showed no significant difference between Eragrostis and Cenchrus except for Cenchrus as straw and hay (P<0.05). This response in feed intake could be explained by the difference in grasses palatability. The high intake of Cenchrus as hay and silage compared to the low intake of Eragrostis, this might be attributed to the superior palatability and quality of the former (crude protein of Cenchrus as hay and silage was 9.9, 10.9%, respectively and 6.4% for Eragrostis as hay). The lower intake of Eragrostis as hay and silage compared to the Cenchrus were in harmony with the findings of Zimmerlink et al.,\cite{20} and Laen,\cite{21} who said that the voluntary intake of forages by ruminant is limited to forage crude protein contents (fall below 7%). The lower intake of Aristida as straw, hay and silage compared to Cenchrus might be attributed to its high cell wall content (44.4, 37.9 and 35.9% respectively), which ultimately result in restricted intake\cite{14}. More over, individual variation in feed intake between animals was also observed in this study. Poppie et al.,\cite{17} observed that animals given the same amount of feed showed substantial differences ion intake.

The apparent digestibilities of the three grasses are shown in Table (2). In DMD there are significant difference (P<0.05) for Aristida and Cenchrus as straw compared to hay and as straw compared to silage but not between hay and silage. For Eragrostis there was significant difference (P<0.05) between the three feed form. The comparison of the apparent digestibility of total digestible nutrient for Aristida showed no significant difference between feeding form. The three forms of Eragrostis there were significant difference (P<0.05) between straw and silage only. For Cenchrus there were significant differences between straw and hay, and straw and silage but not between hay and silage. The crude protein digestibility of Aristida, Eragrostis and Cenchrus as silage were higher than hay but as straw, the digestibility coefficient was negative.

In the present study the digestibility of the three grasses were improved by making them silage. The dry matter digestibility of the Cenchrus as silage and hay was found to be higher than straw. This could be due to different chemical composition at different stage of maturity of the species. McDonald et al.,\cite{12} reported that the present of dry matter digestibility of range grasses is closely related to their nutrient content. Also Harrington and Wilson\cite{17} stated that the digestibility of grasses decreased radibly with age.

It is observed that Cenchrus, Eragrostis and Aristida as straw showed very low crude protein content 3.2, 2.8 and 4.4% respectively, this result in their negative crude protein digestibility. Findings are in line with Millfod and Minson\cite{15}, who reported that

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**Table 2:** Apparent digestibility (%) of the dry matter (DMD), organic matter (DOM), crude fiber (DCF), crude protein (DCP) and total digestible nutrient (TDN) of the three experimental grasses as straw, hay and silage.

<table>
<thead>
<tr>
<th></th>
<th>Aristida</th>
<th>Eragrostis</th>
<th>Cenchrus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Straw</td>
<td>Hay</td>
<td>Silage</td>
</tr>
<tr>
<td>DMD</td>
<td>47.6*</td>
<td>53.6*</td>
<td>56.5*</td>
</tr>
<tr>
<td>DOM</td>
<td>56.6*</td>
<td>57.2*</td>
<td>64.1*</td>
</tr>
<tr>
<td>DCF</td>
<td>58.3*</td>
<td>64.6*</td>
<td>66.5*</td>
</tr>
<tr>
<td>DCP</td>
<td>-27.3*</td>
<td>43.1*</td>
<td>47.2*</td>
</tr>
<tr>
<td>TDN</td>
<td>48.1*</td>
<td>49.0*</td>
<td>47.7*</td>
</tr>
</tbody>
</table>

*a-b-c values within the same raw with different superscripts are significant (P<0.05) different for one type of grass."
the critical value is about 3.6% crude protein content in the food below which the apparent crude protein digestibility is negative. This means that the crude protein content of each of the three grasses as straw is not sufficient for animal maintenance. The total digestible nutrient (TDN) of the three grasses as hay were higher than straw, this could be due to stage of maturity. Bredon et al., \cite{3} reported that TDN was affected by stage of maturity of the plant.

\textbf{REFERENCES}