Session 4 Comparative herbivore nutrition

In vitro digestibility of plants normally consumed by the kudu, Tragelaphus strepsiceros

Elizabeth A. Boomker* and W. van Hoven

Eugene Marais Chair of Wildlife Management,
University of Pretoria, Pretoria 0002, Republic of South Africa

*To whom correspondence should be addressed

Leaves of 10 different plant species utilized by the kudu were collected, dried and ground. This material was used to determine DM digestibility, gas production and VFA production during in vitro fermentation with rumen fluid obtained from kudu. Plants preferred by the kudu had a higher IVDMD and VFA energy yield than those not eaten so readily. Peltophorum africanum produced less VFA energy than the control, probably due to inhibition of fermentation by phenolic compounds.

The present study was conducted using plant material utilized by kudu in the study area (S. Cooper, pers. comm.) and is part of a survey on digestion in this species. In vitro digestibilities were used to determine the extent of plant utilization by the kudu.

Methods

This study was carried out in March 1982 on the Provincial Nature Reserve, Nylsvley, in the Transvaal, South Africa. Culled kudu were used as a source of rumen fluid.

Prior to the field work, leaves of 10 different plant species were collected and dried at 60°C in a draught oven. The dry plant material was ground through a 1 mm screen using a hammermill. A small amount of the plant material (1g) was weighed into each fermentation flask. Two duplicate sets of flasks were prepared. These were used in the field for the in vitro digestibilities (Tilley & Terry, 1963). The first set was used to measure DM disappearance and gas production, while the second was used to determine volatile fatty acid (VFA) production.

Each flask containing buffer, rumen fluid and the plant material was placed in the waterbath at 39°C. Anaerobic conditions were ensured by bubbling CO₂ through the mixture for 1 min and then sealing with a rubber stopper. Gas production was measured using a well lubricated 10 ml syringe (glass) and metal needle passed through the rubber stopper. Gas volume was recorded every hour for 20 h.

Samples for VFA production were taken prior to and then after 2, 8, and 20 h of incubation. Each sample (1 ml) was placed in a test tube containing 0.1 ml 5N-NaOH to stop fermentation, and analysed according to the method of Boomker (1983).

After 20 h, the incubations were stopped using 1 ml HgCl₂. In the laboratory the plant samples were filtered into tared crucibles. The residue was dried to constant mass and then weighed. The mass digested was then calculated.

Results and Discussion

Each plant species studied differed in the amount of VFA and methane produced, as well as in the amount of dry matter digested (Table 1). Plants preferred by the kudu such as Grewia flavescens and the Acacia's have a higher volatile

<table>
<thead>
<tr>
<th>Plant species</th>
<th>IVDMD (%)</th>
<th>VFA (J)*</th>
<th>CH₄ (J)**</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. flavescens</td>
<td>221</td>
<td>2038</td>
<td>522</td>
</tr>
<tr>
<td>A. nilotica</td>
<td>164</td>
<td>2948</td>
<td>291</td>
</tr>
<tr>
<td>A. tortilis</td>
<td>160</td>
<td>2811</td>
<td>348</td>
</tr>
<tr>
<td>D. cinerea</td>
<td>167</td>
<td>2247</td>
<td>389</td>
</tr>
<tr>
<td>Z. miconrotia</td>
<td>193</td>
<td>2741</td>
<td>492</td>
</tr>
<tr>
<td>P. africanum</td>
<td>76</td>
<td>1279</td>
<td>275</td>
</tr>
<tr>
<td>B. africana</td>
<td>101</td>
<td>1916</td>
<td>310</td>
</tr>
<tr>
<td>Control</td>
<td>—</td>
<td>1721</td>
<td>200</td>
</tr>
</tbody>
</table>

* Calculated using the method of Allo, Oh, Longhurst and Connolly (1973).
** 1l methane = 39.54 kJ.
fatty acid energy yield, and those not eaten so readily, such as *Peltophorum africanum*, have a lower energy production. In fact *Peltophorum africanum* produced less VFA energy than the control, which contained buffer and rumen fluid, but no plant substrate (Table 1). This may be due to inhibition of fermentation as a result of phenolic compounds in the plant material. When the amount of plant material digested was related to the VFA energy produced, a correlation coefficient of 0.65 ($P < 0.05$) was found. The correlation between the amount digested and the methane energy produced, was smaller ($r = 0.61; NS$). When a multiple regression analysis was applied to the data the following equation was obtained:

$$Y = 0.054X + 0.354Z - 99.39$$

where $Y$ is the mg substrate digested, $X$ is the VFA energy produced (J), and $Z$ is the methane energy produced (J).

The coefficient of determination ($r^2$) for this equation was 0.84. This shows that the amount of plant material digested is closely related to the amount of energy produced in the form of VFA and methane.

If the $X$ and $Z$ values respectively, are fixed at the levels found in the control, 2 two-dimensional regression equations are obtained:

$$Y = 0.0509X + 50.27$$
$$Y = 0.329Z + 38.04$$

These equations do not, however represent the true relationship and are only useful in obtaining a graphic representation.

**References**


