I. INTRODUCTION

The practice of grinding and pelleting poor quality forage diets in order to improve their utilization by ruminants has been of interest in recent years, particularly in the U.S.A. However, the inclusion by many workers of some concentrates in pelleted diets obscures the effect of the physical treatment on roughages since the effect may vary with the quality of the diet fed (Minson 1963).

The efficiency of food utilization of chopped and of pelleted material, given at the same level of intake, has been compared by Blaxter and Graham (1956) and by King, Brannon and Webb (1963). Both groups of workers noted a reduction in digestibility coefficients on grinding and pelleting. In the present experiment two roughages were fed ad libitum in two forms and the overall effects of the physical treatment and quality of the roughages were investigated.

II. MATERIAL AND METHODS

Four Corriedale wethers, two to three years old, were fed lucerne or oat straw in chopped or ground and pelleted forms in a 4 x 4 Latin square design experiment. The sheep had rumen and oesophageal fistulae and were harnessed for faeces collection (Jarrett 1948).

The chopped straw had been hammer-milled through a 3/4 in. (20 mm) screen and the pelleted straw had been ground using a hammer mill with a 3/8 in. (5 mm) screen followed by treatment in a Christy and Norris laboratory mill with a 3 mm screen. The resulting finely ground material was pelleted in a Templewood Junior Provender Press. The pellets had a diameter of 1.1 cm.

Animals were fed once daily at 10.30 a.m. and feed intake was recorded during the 14 day preliminary period and during the collection period. Samples of the feed and bulked residue samples were analysed for nitrogen, crude fibre, ether extract and ash using A.O.A.C. (1960) methods of analysis. Twenty g of feed stained with basic fuchsin (Castle 1956) was given at the beginning of the collection period immediately prior to feeding, and faeces collections were made at six hour intervals for six days to estimate the rate of passage of the diets through the sheep as described by Coombe and Tribe (1963). The faeces collections were bulked over 24 hours and sampled for dry matter determinations; the oven dried material was bulked over six days and analysed for nitrogen and crude fibre.

Urine was collected each day into 200 ml of 0.5 N sulphuric acid and a

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TABLE 1

The effect of quality and physical treatment of roughage on intake, digestibility and mean retention time of the diet and the nitrogen balance and level of rumen volatile fatty acids in the animal.

<table>
<thead>
<tr>
<th>Diet</th>
<th>Daily Dry Matter Intake (g/kg DM)</th>
<th>Apparent Digestibility Dry Matter (%)</th>
<th>Apparent Digestibility Crude fibre (%)</th>
<th>Mean Retention Time (hr)</th>
<th>Nitrogen Balance (g/day)</th>
<th>Level of Volatile Fatty Acids in Rumen Contents 3½ hr after Feeding (m-equiv/1.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pelleted lucerne</td>
<td>97.3 ± 9.9</td>
<td>58.8 ± 1.2</td>
<td>39.4 ± 2.3</td>
<td>29.2 ± 2.9</td>
<td>+12.8 ± 1.9</td>
<td>60.2 ± 8.2</td>
</tr>
<tr>
<td>Chopped lucerne</td>
<td>73.9 ± 2.4</td>
<td>62.6 ± 0.4</td>
<td>43.8 ± 3.1</td>
<td>40.3 ± 2.1</td>
<td>+8.8 ± 2.9</td>
<td>74.2 ± 5.3</td>
</tr>
<tr>
<td>Pelleted oat straw</td>
<td>35.7 ± 6.2†</td>
<td>43.6 ± 9.2†</td>
<td>38.1 ± 4.0†</td>
<td>56.1 ± 2.4†</td>
<td>—2.3 ± 0.8†</td>
<td>41.9 ± 6.2†</td>
</tr>
<tr>
<td>Chopped oat straw</td>
<td>29.8 ± 2.1†</td>
<td>41.5 ± 4.2†</td>
<td>46.0 ± 6.3†</td>
<td>65.9 ± 4.4†</td>
<td>—2.4 ± 0.4</td>
<td>34.5 ± 1.7</td>
</tr>
</tbody>
</table>

†Mean includes one calculated value.
constant proportion of the daily volume was used to form a composite sample for the six days. This was analysed for nitrogen.

Subsequent to the collection period, daily food intake was restricted to 400 g, and after three days rumen liquor samples were taken at two hourly intervals for ten hours for total volatile fatty acid estimation by steam distillation.

Saliva was collected from two of the animals, through the oesophageal fistula for intervals prior to, during and after feeding, as described by Tribe and Peel (1963) and the relative rates of salivation estimated.

III. RESULTS AND DISCUSSION

Pelleting greatly increased food intake of lucerne (Table 1) but on the lower quality roughage the effect was much less marked. This may partly account for the decrease in digestibility of lucerne dry matter when pelleted, while the digestibilities of the different physical forms of straw were similar. Crude fibre digestibilities of both roughages were reduced by physical treatment. Blaxter and Graham (1956) found that the grinding and pelleting processes mainly depressed the digestibility of cell wall constituents. These workers suggested that, since fermentative dissimilation of structural carbohydrate is a relatively slow process, any increase in the rate of passage might be expected to have more effect on the digestibility of the cell wall components than on the cell contents which are broken down faster. In the present experiment (Table 1) there were marked differences in the mean retention times of chopped and of ground and pelleted material in both lucerne hay and oat straw ($P<0.05$).

Nitrogen balances tended to be higher on the pelleted rations and were positive on lucerne diets and negative on straw diets (Table 1).

Grinding and pelleting oat straw increased the level of volatile fatty acids in the rumen, but the opposite effect was observed for lucerne hay. This discrepancy could again be explained in terms of differing rates of passage. In lucerne hay, the short time the pelleted material remained in the rumen may have restricted fatty acid production. The mean retention time of pelleted oat straw was about twice that of pelleted lucerne, and was greater than that of chopped lucerne, so the production of fatty acids is unlikely to have been limited by a short retention time in the rumen.

Salivation tended to be higher in animals fed pelleted rations, particularly on lucerne hay. When the animals were eating, the saliva produced per unit of feed consumed was higher on chopped diets (Table 2).

<table>
<thead>
<tr>
<th>Diet</th>
<th>Saliva Produced During 15 min. Period (g)</th>
<th>Saliva Produced During 10 min. Feeding Period (g)</th>
<th>Saliva Produced During Feeding (corrected for feed intake) (g saliva/g feed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pelleted lucerne</td>
<td>61.5</td>
<td>257.5</td>
<td>1.44</td>
</tr>
<tr>
<td>Chopped lucerne</td>
<td>26.5</td>
<td>238.5</td>
<td>2.34</td>
</tr>
<tr>
<td>Pelleted oat straw</td>
<td>38.5</td>
<td>155.5</td>
<td>3.56</td>
</tr>
<tr>
<td>Chopped oat straw</td>
<td>34.0</td>
<td>85.5</td>
<td>4.67</td>
</tr>
</tbody>
</table>

TABLE 2

Mean saliva production of two sheep.
IV. REFERENCES


