

METABOLIC STATE AND ROUGHAGE CONSUMPTION IN SHEEP

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The major factor limiting the intake of roughage diets by the non-pregnant, non-lactating sheep is the rate of removal of dietary organic matter from the rumen, the resultant of the rates of absorption or eructation of digestion end-products and of propulsion of undigested materials to the omasum. Roughage consumption may increase, however, with increase in energy demand such as occurs during cold exposure and lactation. The importance of different physiological processes in effecting the increased rate of removal of organic matter from the rumen under these conditions has not been established; accordingly, the studies reported here are concerned with the effect of the metabolic state of the sheep on processes relating to ruminal digestion. Cold exposure and thyroxin administration were used to create metabolic states consistent with enhanced feed intake, whereas the administration of fluoracetate and various amino acids in excessive amounts were used to create the reverse situation.

The adult sheep used had been prepared surgically with rumen and abomasal fistulae and received 100 g of medium quality roughage each 3 hr. Cold exposure was imposed by maintaining sheep with short fleeces at 8° or 10°. Amino acids or fluoracetate were administered for 4 days or more by a continuous infusion pump. Liquor volume in the rumen and the residence time of the marker ⁵¹Cr-EDTA were measured as described by Weston & Hogan (1967).

Total chewing time (ruminating + eating) and the size of feed particles that passed to the abomasum in digesta were not affected by cold exposure. However, rate of propulsion of digesta to the omasum appeared to increase as marker residence time and rumen liquor volume were 22-26% lower ($p < 0.01$) and more dietary fibre was excreted in the faeces. Changes in volume and residence time persisted for at least 5 weeks. Intramuscular injection of DL-thyroxin for 16 days in sheep (> 10 cm fleece) maintained at 24° also decreased liquor volume and residence time. During the period 15-28 days after the start of thyroxin treatment, heart rate was elevated ($p < 0.01$) and liquor volume and residence time were 26-28% lower ($p < 0.05$).

In contrast, the administration of amino acids in amounts to cause an imbalance increased liquor volume and residence time. A mixture (2:3) of glycine and glutamic acid given either per abomasum or intravenously at 40-60 g/day increased ($p < 0.05$) both liquor volume (16%-20%) and residence time (45%-50%); similar effects were observed with methionine given via the same routes at 10-15 g/day. The metabolic antagonist fluoracetate, when given intravenously at 1.0-1.5 mg/day also caused increases (16%-20%) in both parameters in the two sheep studied.

The data suggest that change in roughage intake with varying metabolic state could be mediated in part by change in the rate of digesta propulsion to the omasum.

WESTON, R.H. and HOGAN, J.P. (1967). Aust. J. agric. Res. 18: 789.

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