

Fermentation in the rumen of faunated and fauna-free sheep

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Ruminants without ciliate protozoa in the rumen have frequently demonstrated greater productivity than do normally faunated animals (Bird, 1991). Much of this response is attributed to changes in the pattern of end-products derived from ruminal fermentation. This study sought to better define the differences in rumen metabolism between faunated and fauna-free sheep. Four defaunated and seven refaunated sheep cannulated in the rumen and abomasum were fed 800 g/d of an **oaten chaff: lucerne chaff mix** (1: 1) at hourly intervals. Four refaunated sheep used in the initial study of rumen fermentation were excluded in the subsequent digesta flow study due to loss of appetite. Rumen fluid kinetics were determined using Cr-EDTA as a marker. The rate of volatile fatty acid (VFA) and methane production in the rumen was determined from dilution of infused ¹⁴C labelled acetic acid and methane respectively.

Although feed intake was constant for all sheep, animals without rumen protozoa had a significantly greater rumen water volume than did refaunated sheep (Table 1). The absence of protozoa did not affect the total concentration or rate of VFA production in the rumen but did cause a significant decrease in the proportion of propionate and increase in the proportion of acetate in the rumen VFA. Associated with this

change in fermentation was a significant reduction in ruminal methane production in the absence of protozoa.

The increased rumen volume and reduced rumen ammonia concentration are consistent with the majority of previous studies. The reduced methane production is likely to result from the loss of habitat for methanogenic bacteria which are often attached to protozoa, which may provide hydrogen for methanogenesis (Stumm and Zwart, 1986). This result suggests that elimination of protozoa from grazing ruminants should be pursued, not only to improve animal growth (Bird, 1991), but to reduce emission of the greenhouse gas, methane.

References

- Bird, S.H. (1991). The influence of the presence of protozoa on ruminant production: A review. *Recent Advances in Animal nutrition in Australia 1991* pp. 15-27 (Ed. D.J. Farrell). University of New England, Armidale, Australia.
- Stumm, C.K. and K.B. Zwart (1986). Symbiosis of protozoa with hydrogen-utilising methanogens. *Microbiological Science* **3**, 100-105.

Table 1 Rumen fluid volume and the concentrations and production rates of key fermentation products in the rumen of defaunated and refaunated sheep (sd in parenthesis).

Parameter	Defaunated	Refaunated	Significance
Rumen volume (L)	7.33 (1.14)	4.93 (0.95)	0.018
Rumen water flux (L/d)	9.51 (1.31)	8.39 (1.05)	ns
Rumen ammonia (mgN/L)	126 (14)	197 (7.3)	<0.001
Volatile fatty acids (mmol)	91.0 (5.2)	78.1 (20.1)	ns
Molar % Acetate	75.0 (0.9)	71.0 (1.01)	0.001
Molar % Propionate	15.1 (2.10)	18.6 (1.28)	0.03
VFA production (mol/d)	3.45 (0.31)	2.95 (0.69)	ns
Methane production (gC/d)	12.8 (1.35)	18.8 (0.88)	0.001