

RUMINAL FLUID DYNAMICS AND GLUCOSE METABOLISM IN SHEEP GIVEN A
MAIZE-BASED DIET AND SUPPLEMENTED WITH A REACTIVE AND
UNREACTIVE SOURCE OF LIMESTONE

P.J. O'CONNELL and T.J. KEMPTON

Efficient digestion of nutrients reaching the intestines will depend on the activity of the various digestive enzymes. The activity of the starch-digesting enzymes alpha amylase and maltase is pH dependent and is substantially reduced under acid conditions. Under these conditions starch is not digested in the intestines and passes from the ruminant animal in the faeces. It has been postulated (Wheeler et al. 1981) that inclusion of finely ground, reactive sources of limestone in the diet of steers given high-starch diets will adjust intestinal pH, increase starch digestion and increase production. Sources of Australian limestone differ markedly in their rate of reactivity, i.e. rate at which the limestone neutralises weak HCl (O'Connell and Kempton 1983). The effects of feeding reactive and unreactive sources of limestone on digestion of high-starch diets given to sheep are not known.

Four sheep fitted with rumen and abomasal cannulae were given a diet of (g/d) 550 crushed maize and 150 oaten chaff and then supplemented with either 11.5 g/d Southern Lime 'Aglime' (AL) or 11.5 g/d of Southern Lime 'Microfine' (MF). The rate of reactivity of these limestones was 505 and 180 s for AL and MF, respectively. Rumen fluid outflow was determined from a single injection of ^{51}Cr -EDTA and glucose entry rate from a single injection of ($2\text{-}^3\text{H}$) glucose. Rumen fluid samples were analysed for total VFA concentrations (mM/L), molar proportions of individual fatty acids (mol/100 mol), ammonia concentration (mg $\text{NH}_3\text{N/L}$) and pH. Abomasal digesta and faecal pH were recorded at frequent intervals over a 24-hour feeding period.

The inclusion of MF in the diet increased the molar proportions of isovalerate and butyrate in ruminal fluid and prevented the post-feeding depression in pH in ruminal and abomasal fluid. There was no significant effect of either limestone source on glucose kinetics and ruminal fluid outflow kinetics. There was no effect of limestone inclusion on faecal pH. In general, inclusion of limestone in a maize-based diet fed to sheep had little effect on rumen fluid dynamics. Although the inclusion of a reactive source of limestone in the diet prevented the postprandial fall in pH of abomasal digesta, this was not reflected by a change in glucose metabolism.

O'CONNELL, P.J. and KEMPTON, T.J. (1983). Proc. Nutr. Soc. Aust. 8:191.
WHEELER, W.E., NOLLER, C.H. and WHITE, J.L. (1981). J. Anim. Sci. 52:882.

Department of Biochemistry and Nutrition, University of New England, Armidale
New South Wales 2351