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SOLUBLE CARBOHYDRATE IN THE CAECUM OF SHEEP OVERFED WITH BARLEY GRAIN

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Consumption of large amounts of grain by ruminants can result in starch escaping the rumen and entering the small intestine (Theurer 1986). An important consequence of a gradual introduction to grain may be a reduction in the amount of carbohydrate entering the hind gut. The concentration of glucose and starch dextrins (ie. maltose, maltriose and a dextrins) were measured in fluid collected from the rumen, small intestine and caecum of sheep (S/treatment) given 1.4 kg of barley grain either with (i) no introduction, or following pre-treatment with (ii) a probiotic containing *Saccharomyces cerevisiae* (Yea Sacc®, 4 g/day for 9 days), (iii)a gradual introduction to barley (over 8 days), (iv) virginiamycin (Vm, Stafac® 500, 60 mg/day for 4 days) or (v) rumen inoculum (600 mL/day for 4 days). Means of all measurements were compared using analysis of variance and Fishers protected LSD at the 5% level of significance.

Concentrations of glucose and starch dextrins in the rumen were low (< 0.5 mmol/L) in all but 2 animals (glucose and starch dextrin concentrations approximately 10 mmol/L) that had received the gradual introduction to barley. Differences in glucose and starch dextrin concentrations in the small intestine were not statistically significantly ($P > 0.05$). Levels of glucose in the caecum were high in 3 sheep pre-treated with virginiamycin (7.5-14.3 mmol/L vs O-2.8 mmol/L for all other sheep) indicating glucose fermentation was reduced in these sheep. Sheep which had no introduction to grain had higher concentrations of starch dextrins and L-lactate and a lower pH ($P < 0.05$) in the caecum than sheep which received a gradual introduction to grain (Table 1). When the virginiamycin treatment was excluded from the regression, the concentration of L-lactate in the caecum was correlated with the log of the starch dextrin concentration ($R = 0.790$, $P < 0.0001$) and the concentration of volatile fatty acids (VFA) ($R = -0.860$, $P < 0.0001$). The concentration of L-lactate could be predicted from a model incorporating starch dextrin and total VFA concentrations ($R = 0.924$, $P < 0.0001$). Caecal L-lactate concentration was correlated with the pH of the caecum ($R = -0.907$, $P < 0.0001$).

Table 1. pH, starch dextrins (glucose equivalents, mmol/L), lactate (mmol/L) and total volatile fatty acid (VFA) concentrations (mmol/L) measured in fluid collected from the caecum of sheep fed 1.4 kg of barley grain

	No introd'n	Probiotic	Gradual introd'n	Vm	Rumen inoculum	s.e.m.	P
pH	5.43^{ab}	5.11^{a}	6.10^{c}	5.92^{bc}	6.17^{c}	0.184	0.001
Starch dextrins	14.4^{b}	9.3^{ab}	0.5^{a}	3.8^{a}	1.1^{a}	3.30	0.027
L-lactate	72.3^{b}	88.3^{b}	15.4^{a}	15.2^{a}	25.4^{a}	9.08	0.0001
D-lactate	14.5	17.8	12.2	14.6	9.1	4.72	0.761
VFA	29.1^{a}	25.0^{a}	99.4^{c}	75.0^{bc}	61.4^{b}	9.42	0.0001

Vm = virginiamycin pre-treatment; P = level of significance.
Means within rows which have no superscript letter in common are different ($P < 0.05$).

There was evidence that virginiamycin reduced fermentation of soluble carbohydrate in some animals and prevented accumulation of lactate in the caecum. In sheep gradually adapted to grain feeding or pre-treated with rumen fluid there was less soluble carbohydrate and less accumulation of lactic acid in the caecum. Higher concentrations of soluble carbohydrate were associated with higher concentrations of lactic acid and a lower pH in the caecum of sheep fed 1.4 kg of barley grain.

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