

## Effects of supplementary concentrate level and separate or mixed feeding of grass silage and concentrates on rumen fluid composition in steers

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**Introduction** The effects of dietary concentrate level and method of feeding (separate or mixed) on performance and carcass traits of steers may be mediated through changes in rumen fluid composition. The objectives of this study were to determine the effects on rumen fluid composition of (1) supplementary concentrate level with grass silage, and (2) separate or mixed feeding of silage and concentrates,

**Materials and methods** In a 5 x 5 latin square design experiment, five rumen cannulated Friesian steers were offered five feeding treatments for five periods of 28 d each. The feeding treatments were:

1. Silage only (SO)
2. Silage + 3kg concentrate dry matter (DM) per day fed separately (LS)
3. Silage + 3kg concentrate DM per day fed mixed by feeder wagon (LM)
4. Silage + 6kg concentrate DM per day fed separately (HS)
5. Silage + 6kg concentrate DM per day fed mixed by feeder wagon (HM)

Rumen fluid samples were collected on day 28 of each period in the morning immediately before feeding and at 1, 2, 4, 8, 14 and 24 h after feeding. The pH, ammonia and volatile fatty acid (VFA) concentrations were measured.

**Results** There was no significant feeding treatment by sampling time interaction. Mean rumen pH was significantly lower for the high concentrate level than for silage only (Table 1). Differences between treatments in ammonia concentration were not significant but the silage only treatment had the lowest value. Total VFA was significantly higher for the high concentrates fed separately than for silage only but other differences between treatments were not significant. The acetate to propionate ratio tended to be lower for the silage only than for the concentrate supplemented groups. There was no effect of mixing but the acetate to propionate ratio tended to be lower for mixed compared with separate feeding.

**Table 1** The effect of concentrate level and separate or mixed feeding on rumen fermentation variables

	Treatment					s.e.d.	Sig
	SO	LS	LM	HS	HM		
pH	6.81 <sup>b</sup>	6.64 <sup>ab</sup>	6.55 <sup>ab</sup>	6.38 <sup>a</sup>	6.48 <sup>a</sup>	0.121	*
Ammonia <sup>1</sup>	12.60	15.10	14.30	15.79	13.19	1.685	NS
Total VFA <sup>2</sup>	85.6 <sup>a</sup>	91.3 <sup>ab</sup>	98.8 <sup>ab</sup>	104.5 <sup>b</sup>	94.5 <sup>ab</sup>	8.53	*
Acet:prop. ratio <sup>3</sup>	3.58	4.12	3.82	4.14	3.99	0.191	P<0.07

<sup>1</sup>mg/l; <sup>2</sup>mmol/l; <sup>3</sup>acetate:propionate ratio

The effects of sampling time are shown in Table 2. There was a decrease in pH after feeding for 8 h, and then an increase to 24 h. Ammonia and VFA increased for 2-4 h after feeding and then decreased to 24 h. Acetate to propionate ratio decreased up to 8 h and then increased to 24 h.

**Table 2** The effect of sampling time on rumen fermentation variables

	Time(h)							s.e.d	Sig
	0	1	2	4	8	14	24		
pH	6.80 <sup>a</sup>	6.66 <sup>ab</sup>	6.44 <sup>b</sup>	6.28 <sup>bc</sup>	6.24 <sup>bc</sup>	6.45 <sup>b</sup>	7.14 <sup>d</sup>	0.143	***
Ammonia <sup>1</sup>	7.67 <sup>a</sup>	14.34 <sup>b</sup>	20.02 <sup>c</sup>	18.85 <sup>c</sup>	17.85 <sup>bc</sup>	13.03 <sup>b</sup>	7.59 <sup>a</sup>	1.994	***
Total VFA <sup>2</sup>	75.8 <sup>a</sup>	94.7 <sup>ab</sup>	107.7 <sup>b</sup>	108.9 <sup>b</sup>	105.5 <sup>b</sup>	101.8 <sup>b</sup>	70.1 <sup>f</sup>	10.10	***
Acet:prop. ratio <sup>3</sup>	4.60 <sup>a</sup>	3.92 <sup>b</sup>	3.63 <sup>bc</sup>	3.67 <sup>bc</sup>	3.37 <sup>c</sup>	3.68 <sup>bc</sup>	4.62 <sup>a</sup>	0.226	***

<sup>1</sup>mg/l; <sup>2</sup>mmol/l; <sup>3</sup>acetate:propionate ratio

**Conclusions** Rumen pH decreased as concentrate level increased but ammonia concentration was not affected. Mixing had no effect on rumen pH or total VFA concentration. All rumen fermentation variables varied with time of sampling.