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Intraruminal infusion technique for the estimation of ruminal VFA production

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The data from two 4 x 4 Latin square studies were used to estimate ruminal VFA production without radioactive isotopes. In Experiment A, a mixture of acetate (Ac) and propionate (Pr) (3:1 on molar basis) was replaced iso-energetically with 0, 200, 400 and 600 g/d of butyrate (Bu), and in Experiment B, Pr was gradually replaced with Bu as follows (g/d) : Pr 900 + Bu 0, Pr 600 + Bu 250, Pr 300 + Bu 500 and Pr 0 + Bu 750. The cows were fed a basal diet of grass silage and concentrate (app 0.6 : 0.4 on DM basis) twice daily. The mean dry matter (DM) intakes were 13.3 (Exp A) and 16.4 kg/d (Exp B). Rumen fluid samples were taken at 1.5 h intervals for 10.5 h.

A regression approach of the technique used by Bath *et al* (1962, Proc Nutr Soc, 21, ix) was used to estimate ruminal VFA production of individual VFA. Production of Bu (or Pr) was calculated by dividing the intercept by the slope of the regression : y (mmol/l or mmol/mol) = a + bx, in which x is the amount of Bu (or Pr) infused (g/d). Production of Ac (or other VFA) was calculated as [((mmol/mol Ac) / (mmol/mol Bu)) x Bu production (mmol/d)] - amount of Ac infused (mmol/d). These estimations are based on assumptions that there is an equilibrium between ruminal concentration and rate of absorption, and that the infusions did not alter the fermentation of the basal diet. Fairly high mean ruminal pH (6.34 and 6.35) and the fact that all cows received infusions may validitate these assumptions.

There was a close linear relationship between the amount of acid infused and molar proportion or concentration (not shown) in the rumen as the following regression equations show :

Exp A : Butyrate $y = 124.2$ (s.e. 0.94) + 0.163 (s.e. 0.0025) x, $r = 0.9998$

Exp B : Butyrate $y = 131.5$ (s.e. 4.91) + 0.112 (s.e. 0.0105) x, $r = 0.9913$

Propionate $y = 162.3$ (s.e. 2.98) + 0.113 (s.e. 0.0077) x, $r = 0.9977$

The highest rate of propionate infusion showed a quadratic trend (probably because of increased rate of absorption), and that point was not used to calculate the regression. The estimates of production of individual VFA are given in Table. The values calculated from Bu and Pr in Exp B were similar, which suggests that there were no differences in the rate of absorption of these two acids. The energy value of VFA absorbed from the rumen was equivalent to 52 and 70 % of the estimated ME which appear to be reasonable estimates. In terms of mol VFA per kg digestible DM the values are within the range reported by Sutton (1985, J Dairy Sci, 68, 3376-3393).

The results suggest that this method can give reasonable estimates of ruminal VFA production. It is recommended to use at least three rates of VFA infusion which makes the method laborious to be only used for estimation of VFA production.

	Experiment A	Experiment B	
	From Bu	From Bu	From Pr
Acetate (mol/d)	37.48	63.93	62.31
Propionate (mol/d)	10.05	17.08	16.60
Butyrate (mol/d)	9.23	14.90	14.31
Other VFA (mol/d)	2.63	3.86	3.82
Total (mol/d)	59.39	99.77	97.04