

## Inter-animal variation in aspects of ruminal digestion when cattle were offered a range of rations

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**Introduction** Knowledge of the variability within a group of animals for a particular measurement is a key requirement when estimating the power of an experiment and the number of replicates required to conclude that a particular scale of difference between treatments is statistically significant. Studies on ruminal digestion using surgically modified animals frequently use a small number of animals and change-over experimental designs, so estimation of variances “a priori” can be difficult. In addition, knowledge of inter-animal variability in aspects of ruminal digestion could facilitate identification of animals with a more desirable pattern and/or extent of digestion. The objective of this study was to document the variation in aspects of ruminal digestion within a group of genetically similar beef cattle when offered contrasting rations.

**Material and methods** A group of 15 Rotbunde x Friesian steers, (from the same sire) fitted with ruminal cannulae were individually offered in sequence, a concentrate/straw ration (C: 20 g dry matter (DM)/kg body weight(W)), this ration supplemented with fish/plant oil (CO: 17.8 g DM/kg W), zero-grazed grass (G: 18 g DM/kg W) and zero-grazed grass supplemented with fish/plant oil (GO: 15.5 g DM/kg W). During the final week of each period of 7 weeks duration, ruminants were emptied on three consecutive days at 1 hour prior to feeding (Day 1), 5 hours post-feeding (Day 2) and 11 hours post-feeding (Day 3). Both liquid and solid fractions of ruminal digesta were weighed and sampled at each evacuation for chemical analysis. Pool sizes of various components were mathematically reconstructed. The rate of disappearance of selected components was calculated as the difference in pool size/time interval. Variances compared by a Levene’s test using SAS.

**Results** The variances for pools of volatile fatty acids at each sampling time were similar across the rations examined (Table 1). The variances for the ammonia pool were lower ( $P < 0.05$ ) for the oil-supplemented rations at 5 and 11 hours post-feeding. Across the rations examined, variances were homogenous at each sampling time for the pools of organic matter (OM) and neutral detergent fibre (NDF). The variance for OM disappearance was highest for C and lowest for GO but was homogenous for NDF disappearance.

**Table 1** Variances (mean<sup>1</sup>) of ruminal digesta pools at different times post-feeding and digesta disappearance in steers

Ration	Time	C	CO	G	GO	P
Acetate	0	0.249 (1.91)	0.137 (1.73)	0.251 (1.69)	0.677 (2.92)	NS
	5	0.392 (2.20)	0.261 (2.58)	0.765 (3.57)	0.372 (3.21)	NS
	11	0.449 (2.54)	0.263 (1.97)	0.262 (2.63)	0.184 (2.41)	NS
Propionate	0	0.011 (0.43)	0.006 (0.42)	0.011 (0.36)	0.028 (0.67)	NS
	5	0.048 (0.62)	0.019 (0.77)	0.056 (1.04)	0.029 (0.94)	NS
	11	0.055 (0.65)	0.014 (0.52)	0.016 (0.60)	0.011 (0.60)	NS
Butyrate	0	0.014 (0.43)	0.014 (0.32)	0.010 (0.26)	0.018 (0.47)	NS
	5	0.037 (0.53)	0.022 (0.50)	0.043 (0.76)	0.016 (0.70)	NS
	11	0.036 (0.52)	0.012 (0.37)	0.013 (0.44)	0.009 (0.43)	NS
Ammonia	0	0.010 (5.88)	0.002 (4.74)	0.001 (2.64)	0.002 (1.90)	NS
	5	0.008 (4.17)	0.003 (1.90)	0.009 (5.38)	0.003 (2.13)	*
	11	0.007 (3.76)	0.003 (2.98)	0.002 (3.64)	0.001 (1.73)	*
OM	0	1.4 (8.35)	1.3 (8.09)	1.0 (7.22)	1.0 (8.06)	NS
	5	1.3 (6.76)	0.8 (6.08)	0.7 (5.17)	0.5 (5.47)	NS
	11	1.0 (4.99)	0.9 (5.04)	0.7 (3.97)	0.6 (4.27)	NS
NDF	0	0.7 (4.60)	0.5 (4.09)	0.3 (3.70)	0.4 (4.02)	NS
	5	0.5 (4.11)	0.3 (3.53)	0.2 (2.73)	0.2 (3.17)	NS
	11	0.5 (2.9)	0.4 (3.22)	0.3 (2.37)	0.3 (2.60)	NS
OM disappearance	-	0.03 (0.29)	0.01 (0.17)	0.01 (0.20)	0.002 (0.19)	*
NDF disappearance	-	0.006 (0.14)	0.004 (0.07)	0.002 (0.07)	0.002 (0.09)	NS

<sup>1</sup>Units =mol for acetate, propionate and butyrate; g for ammonia; kg for OM and NDF and kg/h for OM and NDF disappearance

**Conclusions** This study provides baseline data on the variances around the means of several aspects of ruminal digestion. In general, variances were homogenous across diverse rations indicating that a statistical procedure such as analysis of variance can be applied with confidence.

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