Characterising the Fermentation Capabilities of Gut Microbial Populations from Different Breeds of Cattle and Sheep Grazing Heathland

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Introduction Previous studies have demonstrated differences in the diet composition of sheep and cattle when grazing heather moorland, and such differences may in turn lead to differences in rumen fermentation characteristics and associated adaptation to diet. To investigate this further an *in vitro* gas production experiment was conducted using inocula from different breeds of cattle and sheep grazing heathland.

Material and methods Representative sub-samples of *Calluna vulgaris* (heather)- and *Nardus stricta*-dominated semi-natural rough grazing (grass) were cut in early August, freeze-dried and ground and used as the substrate for the gas production technique. Two breeds of sheep (Welsh Mountain and Scottish Blackface) and two breeds of cattle (Welsh Black and Simmental/Belgian Blue cross (Continental)) had grazed the area for over 4 weeks from which the substrate samples were cut. Fresh faecal material was collected from six mature, non-productive females of each animal type. Individual faecal samples were prepared by diluting (1:1 w/v) in anaerobic medium and homogenising, with the resultant faecal liquor used as inoculum for the *in vitro* procedure. Gas pressure and volume was measured at time points over the initial 6-d period of growth of the faecally-derived microbial populations, and the data fitted to a model of gas production.

Results The fermentation data showed differences between the digestion of grass compared with heather, with the former having a significantly (P<0.001) shorter lag time and greater total gas pool size. In addition the grass substrate had a significantly greater (P<0.001) final dry matter (DM) loss than the heather. With respect to animal type, there were significant differences between animal species but few differences between animal breeds within a species (Table 1). For heather substrate, only DM loss was significantly (P<0.001) different between animal types, with greater digestion with the sheep inocula. In contrast, all fermentation parameters were significantly different between animal species for the grass substrate, with the initial and secondary rates and final DM losses significantly (P<0.001) higher for sheep inocula.

Table 1 Effect of substrate and inocula source on rate of gas production and dry matter loss

Substrate		Scottish Blackface	Welsh Mountain	Simmental/ Belgian Blue	Welsh Black	s.e.d.	Significance
Heather	P1	0.988	0.984	0.986	0.979	0.0040	ns
	P4	201	187	179	163	16.6	ns
	Lag (h)	3.93	3.96	4.37	4.05	0.303	ns
	DM loss (g/g)	0.403^{a}	0.416^{a}	0.303^{b}	0.269^{b}	0.0236	***
Grass	P1	0.982^{a}	0.975^{a}	0.996^{b}	0.994^{b}	0.0039	***
	P4	262^{a}	245^{a}	308^{b}	279^{ab}	17.6	*
	Lag (h)	1.95^{a}	2.57^{ab}	3.33^{b}	3.25^{ab}	0.364	**
	DM loss (g/g)	0.521^{a}	0.523^{a}	0.417^{b}	0.399^{b}	0.0246	***

where P1 = initial rate constant; P4 = Predicted asymptote

Conclusions The data confirm that heath grasses are more digestible than heather. The data also indicate that the sheep and cattle possessed gut microflora showing different activities, despite being exposed to the same forage for more than one month. The results from this study, together with corresponding diet selection and intake data, will be used to explore the consequences of different foraging strategies.

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