Comparison of parameters from the Theodorou gas production technique using nitrogen-free and nitrogen-rich media as predictors of DM intake and digestibility

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Introduction Parameters from *in vitro* gas production techniques could have potential as predictors of dry matter intake (DMI) and digestibility. Fermentation is usually carried out under conditions where nitrogen (N) is not limiting. Therefore where N supply is a constraint to intake and digestibility, prediction equations may be inaccurate. This study compared the use of N-free and N-rich media in an *in vitro* fermentation method (Theodorou *et al*, 1994) and studied the relationships between *in vitro* and *in vivo* parameters obtained using both media.

Materials and Methods Twenty four individually-fed, wether sheep were offered 12 feeds over four periods in an incomplete latin square design. Six of the feeds were hays or straws with crude protein (CP) and acid detergent fibre (ADF) contents ranging from 37-95 and 40-598 g/kg DM respectively. The other six feeds were soaked sugarbeet pulp, chopped alfalfa, alfalfa pellets, maize gluten feed, wheat feed and a chopped alfalfa / oat straw mixture with CP and ADF contents ranging from 99-213 and 170-515 g/kg DM respectively. DMI and digestibility were determined over a seven day period. Feed samples were fermented in both N-free and N-rich media and cumulative gas (CG) production recorded at 12, 24, 52 and 70 hours. Coefficients of determination (R^2) were calculated for CG production, CP and ADF contents on *in vivo* parameters and for the difference between the N-free and N-rich media in CG production observed at each of the four times on CP contents.

Results CG production were greatest with the N-rich media although differences between the media decreased as CP content of the feed increased. The relationship between CP content and the difference between the N-free and N-rich media in CG production appeared to strengthen with incubation time (R^2 = 0.06, 0.41, 0.75 and 0.82 at CG12, CG24, CG52 and CG70 respectively). The strongest relationship between CP content and an *in vivo* parameter was observed for DMI of hays and straws (Table 1). For this group of feeds, values of R^2 were largest for the relationships of CG52 and CG70, determined with the N-free media and DMI. The potential for predicting DMIs of 'other' feeds appeared to be relatively poor with both media. ADF content explained more of the variation in digestibility of hays and straws than CP content and in this case values of R^2 were high for CG production parameters derived from fermentations with both media. Relationships between digestibility and CG production from the N-free media were very weak, but values of R^2 were much higher with the N-rich media.

Table 1: *Values of R^2 for the relationships between* in vitro *parameters and DM intake and digestibility*

		Dry Matter Intake		Digestibility	
		Hays and Straws	Other feeds	Hays and Straws	Other feeds
N-rich	CG12	0.411	0.410	0.806	0.655
	CG24	0.340	0.487	0.852	0.848
	CG52	0.134	0.524	0.766	0.750
	CG70	0.091	0.495	0.721	0.640
N-free	CG12	0.466	0.116	0.869	0.202
	CG24	0.604	0.016	0.895	0.099
	CG52	0.716	0.008	0.855	0.067
	CG70	0.712	0.063	0.853	0.478
	CP	0.740	0.443	0.387	0.535
	ADF	0.755	0.236	0.698	0.065

Conclusions For fibrous feeds such as hays and straws, digestibility might be predicted from CG production parameters with similar accuracy regardless of the medium used. However, where CP explained a relatively high proportion of the variation in *in vivo* parameters, such as intake of hays and straws, a N-free media may be more suitable. Amongst the 'other' feeds, some were chopped or ground. In this case, small particle sizes, resulting in rapid rates of passage, are likely to affect intake so parameters derived from gas production techniques may not predict the DMI of such feeds effectively. Gas production parameters from fermentations conducted with N-rich media appeared to offer the greatest potential for predicting the digestibility of a wide range of feeds.

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References Theodorou, M.K., Williams, B.A., Dhanoa, M.S., McAllan, A.B. and France J. (1994). A simple gas production method using a pressure transducer to determine the fermentation kinetics of ruminant feeds. *Animal Feed Science and Technology* **48**: 185-197