An evaluation of the *n*-alkane technique for determining diet composition in animals grazing complex swards

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Introduction The *n*-alkane profiles of epicuticular waxes derived from different plant species are sufficiently distinct to allow assessment of the proportions of different herbages in two-component mixtures including perennial ryegrass/white clover, heather/hill grass and rush/perennial ryegrass (Dove & Mayes, 1996). Evidence suggests the reliability of such estimates declines as the number of different dietary components increases. However, recent studies have shown analysis of additional compounds, including long-chain fatty alcohols, may improve discrimination between different dietary components. The aim of this experiment was to quantify the accuracy of such methods for determining the diet composition of animals grazing complex swards.

Material and methods Twelve mature, barren Welsh Mountain ewes were zero-grazed on defined diets of heathland plant species. After a 22-day adaptation period, the dry matter weight and botanical composition of feed offered and refused were determined over a 7-day measurement period. A representative sub-sample of each dietary component was then analysed for *n*-alkane (C21-C35) and long-chain fatty alcohol (C20-C30) concentrations. The Solver function of Microsoft Excel was used to estimate diet composition based on the relative proportional profile of *n*-alkanes and fatty alcohols in the faeces of each animal. Solver was set to alter the proportions of diet components to minimise a function consisting of the sum of squares of differences between diet and faeces profiles and the r^2 value of a linear regression of the two. Lin's concordance correlation coefficients (r_c) between estimated proportions of the major components of the diets and the actual values for each animal were calculated, as described by of Dhanoa *et al*. (1999), for a range of models (n=14 in total) using different alkanes and fatty alcohols, with measured faecal recoveries or recoveries assumed to equal to 1. Results are presented for five of the best models: C21-C35 alkanes, no alcohols, measured recoveries (P1); C23-C35 alkanes, plus alcohols, recoveries = 1 (P2); C25-C35 alkanes, no alcohols, measured recoveries (P3); C27-C35 alkanes, no alcohols, measured recoveries (P4); and C27-C35 alkanes, no alcohols, recoveries = 1 (P5).

Results No single model could predict all dietary components accurately (Table 1). One of the main components, *Calluna vulgaris*, was very well predicted in most cases (r_c close to 1), whilst *Vaccinium myrtillus* was not well estimated by any model (r_c close to 0) but accounted for a small proportion of the diet. Including alcohols in the models did not always improve the r_c, and the accuracy was not necessarily reduced by assuming recovery rates of 1.

Table 1 Mean actual and best predicted diet component percentages from a range of models, with the concordance correlation coefficient (r_c) of the best fit model for each component (all components live growth except †)

Dietary component	Actual	Prediction models (best 5 of 14)					r_c
		P1	P2	P3	P4	P5	
Molinia caerulea	41.4	35.8	42.6	40.3	42.2	35.3	0.435
Calluna vulgaris	18.2	16.9	9.0	17.9	17.7	17.4	0.970
Vaccinium myrtillus	0.21	0.25	0.15	0.25	0.25	0.24	0.081
Erica tetralix	0.17	0.08	0.15	0.11	0.11	0.08	0.647
Juncus effusus	6.96	6.55	4.74	7.04	7.40	0.55	0.547
Festuca spp.	1.72	1.60	1.95	1.52	1.49	5.74	0.118
Carex spp.	3.95	2.73	17.83	4.46	4.90	0.71	0.153
†Dead grass	21.1	17.8	12.8	21.8	19.5	25.5	0.241
Moss	6.4	18.3	10.8	6.7	6.4	14.5	0.141

Conclusions These results demonstrate that *n*-alkanes can be used to estimate several components within the diet of animals grazing complex swards. The most appropriate model for predicting diet composition will depend on which plant types are likely to be the main components within the diet.

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