The relationship between diet and the chemical composition of sheep faeces

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Introduction The use of faecal inoculum in *in vitro* feed evaluation methods was examined by Balfe (1985). However, there is limited information concerning the chemical composition of faeces and factors affecting this. The chemical composition of faeces may reflect the microbial population and hence its fermentative activity. A knowledge of the faecal composition is essential as this affects the quality of faecal inoculum. The objective of this work was therefore to study the relationships between diet and the chemical composition of faeces using data obtained from sheep.

Materials and methods The data used were from 471 digestibility studies done at ADAS Nutritional Sciences Research Unit from 1978 to 1999. Most experiments used four sheep but some used two or three sheep. There were 23 types of diet and the number of experiments per diet type ranged from 12 to 64. Diets consisted of both mixed and single component feeds. The mixed diets included palm kernel meal, feather meal, cotton seed meal, distillers' dark grains wheat, malt culms, fishmeal, brewers' grains, rape seed meal, prairie meal, untreated spring barley straw, untreated wheat straw, maize gluten feed, fresh sugar beet pulp and fresh grass. The single component diets included Rowett diet A (Rowett Research Institute, 1976), whole crop wheat, fresh grass, dried grass nuts, dried lucerne nuts, lucerne silage, grass silage (big bale and clamp) and maize silage. The data were used to investigate the relationships between the dry matter (DM), organic matter (OM), ash, crude protein (CP) and ether extract (EE) contents of faeces and the content and dietary intake of DM, ash, OM, CP, EE, NDF and water soluble carbohydrate (WSC). The mean values of each set of experimental data were statistically analysed for the relationship between faecal composition and the diet intake and its chemical composition using Minitab (1994). Matrix correlation was first applied to determine the overall association, if any, between the diet chemical contents and intake (DM, ash, OM, CP, EE, NDF and WSC) and the faecal chemical content (DM, OM, Ash, CP and EE). Subsequently, both monovariant and stepwise multiple regressions were applied to develop relationships between key parameters. Stepwise multiple regressions were arranged between each parameter response and the predictors. All associated predictors were included in the first step and variables dropped from the model if their F ratio was less than 4.0.

Results The content of CP in faeces (FCP) was positively correlated to the content of CP in the diet (DCP) and intake (ICP) per day (r = 0.680 and 0.597 respectively) but negatively correlated to the content of NDF in diet (DNDF) and intake (INDF) per day (r = -0.428 and –0.363 respectively). The content of OM in faeces (FOM) was positively correlated to the content of EE in diet (DEE) and intake (IEE) per day (r = 0.376 and 0.385 respectively). FCP was significantly (P<0.001) related to DCP and DNDF in the diet, ICP and INDF with R^2 values of 45.6, 17.3, 34.8 and 12.1 % respectively (Table 1). FOM was also significantly ((P<0.001) related to DEE and IEE with R^2 13.8 and 13.1 % respectively (Table 1).

Table 1 Regression equations between faecal (Y) and dietary composition and the total diet intake (X)

Variables	Equation	R^2 (%)	P
FCP >< DCP	Y = 58.7 + 0.569 X	45.6	< 0.001
FCP >< DNDF	Y = 324 – 0.273 X	17.3	< 0.001
FCP >< ICP	Y = 71 + 0.585 X	34.8	< 0.001
FCP >< INDF	Y = 270 - 0.207 X	12.1	< 0.001
FOM >< IEE	Y = 782 +2.01 X	13.8	< 0.001
FOM >< DEE	Y = 780 – 1.79 X	13.1	< 0.001

Conclusions None of the relationships accounted for a high proportion of the variability in faecal composition suggesting that diet composition has only a limited effect on the composition of faeces. FCP was mainly affected by dietary concentrations and intakes of CP and NDF, with CP having a positive effect and NDF a negative effect. FOM was affected slightly by with EE intake. Since FCP and FOM might reflect the microbial numbers in faeces, this information is essential for the development of the use of faecal inocula in *in vitro* feed evaluation. It would seem however that more direct measures of hydrolytic and fermentative activity in faeces are required.

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