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DIGESTIBLE ENERGY OF DIFFERENT WHEAT BRANS FOR RABBITS

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ABSTRACT

Ninety New Zealand × Californian rabbits were used to determine the energy value of eight samples of wheat bran (4 of coarse wheat bran and 4 of fine wheat bran) for rabbits. There were no significant differences in the mean chemical composition of the different types (coarse and fine) of wheat bran analysed. Wheat brans showed similar mean acid-detergent fibre content (119 and 116 g ADF kg^{-1} DM for coarse and fine wheat bran, respectively) and mean crude protein content (170 and 172 g CP kg^{-1} DM, respectively). As a consequence of the individual differences in composition of the eight brans, a relatively great range of variation of digestible energy was observed (10.72 to 13.74 MJ/kg DM). Both crude fibre and ADF were good predictors of the DE values (R^2 = 0.83 and 0.84, respectively; $P<0.001$).

INTRODUCTION

Rabbit needs for fibre are usually met by including in diets 25-35% of lucerne hay and 15-25 % of cereal by-products, mainly wheat bran that also provides a substantial amount of protein. The values for the energy value of wheat bran, so far available come from experimental works (Maertens and De Groote, 1984; Villamide *et al.*, 1989; Fernández-Carmona *et al.*, 1996) and tables or feeding standards published by institutions or individual workers (N.R.C., 1977; I.N.R.A., 1989; Maertens *et al.*, 1990; Villamide *et al.*, 1998).

The methodological procedure used in the digestibility trial, the different chemical composition or particle size of wheat varieties, their different denomination and the manufacturing process can all account for variations and discrepancies among the results. The present work tried to determine the energy value for rabbits of several wheat by-products, sold with the commercial terms of coarse and fine wheat bran.

MATERIAL AND METHODS

Diets

The chemical analysis of the different wheat brans evaluated, four named coarse wheat bran (C1, C2, C3 and C4) and four named fine wheat bran (F1, F2, F3 and F4), is summarised in Table 1. Nine experimental diets were prepared for the digestibility trial: a basal diet with the base mixture (63 parts of lucerne, 25 of barley and 10 of soya-bean meal) and 2% of a vitamin-mineral premix, and the other 8 diets with 49% of the base mixture, 49% of wheat bran and 2% of the premix. Apparent digestibility coefficient for gross energy (GE) was determined for each diet on 10 crossbred New Zealand × Californian rabbits, of 42 days of age and 1.13 kg weight, as described by Pérez *et al.*, 1995.

Analytical methods

Chemical analyses of diets and faeces followed the method of the Association of Official Analytical Chemists (1996) for DM, EE, CP and CF and Van Soest *et al.* (1991) for neutral-detergent fibre (NDF), acid-detergent fibre (ADF) and acid-detergent lignin (ADL) with a thermostable amylase pre-treatment. Starch was hydrolysed according to a two-step enzymatic procedure, using a thermostable amylase followed by amyloglucosidase, the resulting glucose being measured by the hexokinase glucose-6-phosphate dehydrogenase/NADP system (Boheringer). GE was measured using adiabatic bomb calorimetry.

Statistical analysis

A linear regression procedure (PROC REG) of SAS (Statistical Analysis System Institute, 1990) was used to fit the least squares estimates to the regression model. The predicted sum of squares, expected total error of estimation, residual standard deviations (RSD), the R^2 were taken into account in selecting the prediction model.

RESULTS

Feed intake and live weight gain of the animals during the experimental period may be considered as normal. The ingestion of diets during the faecal collection varied between 95 and 139 g DM day^{-1} and the live weight gain during the whole trial varied from 32 to 47 g day^{-1}.

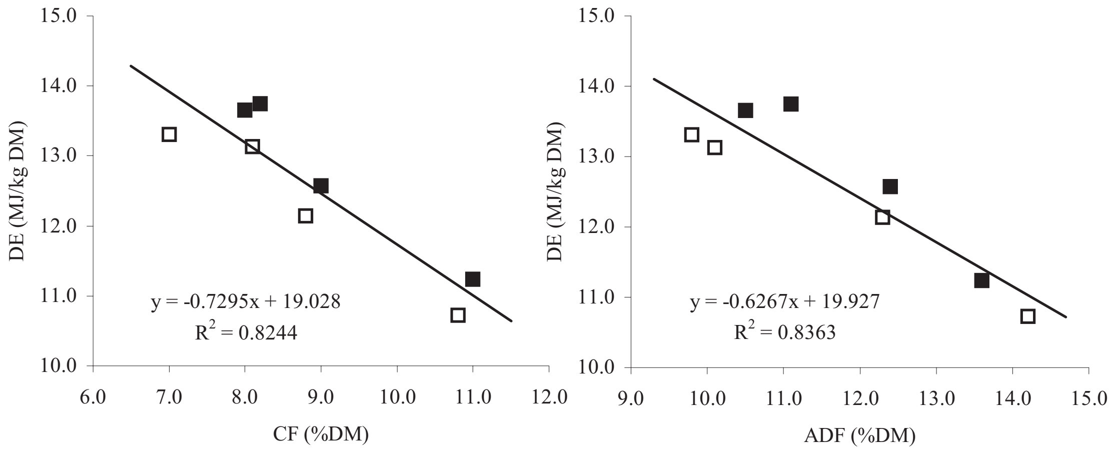
There were no significant differences in the main chemical composition of the different types of wheat bran, showing similar ADF content (119 and 116 g ADF kg^{-1} DM for coarse and fine bran, respectively) and CP content (170 and 172 g CP kg^{-1} DM, respectively). As a consequence of the individual differences in composition of the eight brans (Table 1), a relatively great range of variation of digestible energy was observed (10.72 to 13.74 MJ/kg DM).

Table 1. Chemical composition (% DM) and digestible energy content (MJ/kg DM) of different wheat bran samples.

Wheat bran samples	CP	EE	Starch	CF	NDF	ADF	ADL	DE
Coarse:								
C1	17.4	3.93	23.9	8.2	42.1	11.1	4.03	13.74
C2	19.0	4.36	23.8	8.0	40.6	10.5	3.32	13.65
C3	16.1	4.26	23.4	9.0	43.9	12.4	4.31	12.57
C4	15.5	4.66	13.6	11.0	52.1	13.6	4.44	11.24
Fine:								
F1	16.7	4.27	14.8	10.8	48.4	14.2	4.74	10.72
F2	18.2	4.35	26.8	8.1	32.8	10.1	3.58	13.13
F3	16.9	4.45	30.4	7.0	33.9	9.8	4.27	13.31
F4	16.9	3.85	22.2	8.8	40.9	12.3	4.46	12.14

The relationship between CF and ADF with DE is represented in Figure 1. The best single predictor of DE was ADF (R^2 = 0.84):

DE (MJ/kg DM) = 19.028 - 0.7295 CF(%DM) R^2 = 0.824   SE = 0.5064



DE (MJ/kg DM) = 19.927 - 0.6267 ADF(%DM) R^2 = 0.836   SE = 0.4890

Figure 1. Effect of dietary CF and ADF content on energy value of the coarse (■) and fine (□) wheat bran.

DISCUSSION

The values obtained for the chemical composition of different samples of wheat bran evaluated showed a higher variability between samples of the same class of bran than with respect to the other class, showing a similar mean chemical composition of the components that characterise these by-products (fibre and protein). Consequently, and taking into account that ADF and CP are the main components affecting the DE value of feed, both brans showed similar DE content. It is true that fine wheat bran showed no significantly higher value for starch and a lower cell-wall content (NDF), but these were not sufficiently weighty to classify fine and coarse brans as different in themselves.

It is commonly accepted that the energy value of the main feedstuffs is clearly related to the fibre content, because of the low digestibility of this fraction. The results of the present work indicate that both CF and ADF predicted DE content of wheat bran with similar accuraccy, as other authors also found for other feedstuffs (de Blas *et al.*, 1992; Fernández-Carmona *et al.,* 1996). The predicted values for DE obtained from our equations were similar to those calculated from other DE=*f*(ADF) equations (Battaglini and Grandi, 1984; Maertens *et al.*, 1988; Fernández-Carmona *et al.*, 1996), so if ADF = 11, the predicted values for DE should be 13.0, 13.4, 13.0 and 13.4, respectively.

From the results obtained in the present work, it can be concluded that the high variability of their nutritive values does not seem to be related to the bran denomination, in fact both types of bran show similar DE content.

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