DIGESTIBILITY AND ENERGY VALUE OF LOW-GLUCOSINOLATE RAPESEED MEAL FOR CHICKS AS AFFECTED BY OIL AND FIBRE CONTENT

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ABSTRACT

Polish low-glucosinolate rapeseed oil meal (LG-RM) was segregated into 3 fractions: flour (F), bran (B) and hulls (H). These fractions were combined with various proportions of rapeseed oil in order to obtain 25 model rapeseed meals (M-RMs), containing from 8.8 to 15.7% crude fibre (CF) and from 4.3 to 12.1% crude fat (C-fat) in dry matter (DM). The effect of CF and C-fat contents on digestibility of nutrients and on the metabolizable energy ($AME_{N)}$ of M-RMs for chickens was determined. CF showed a significant, negative, linear effect on energy value (AME_N) and digestibility of DM, C-fat and N-free extractives (NFE), while the effect of fat content on these parameters was exponential. Digestibility of CP was significantly affected in linear, quadratic and interactive terms by both CF and C-fat contents.

INTRODUCTION

The metabolizable energy value of LG-RM for poultry is low and ranges from 7.5 to 13.7 MJ/kg DM (European Table of Energy Values for Poultry Feedstuffs, 1989; Nutrient Requirements of Poultry, 1993). It has been found earlier that AME_N of LG-RM was significantly negatively ($r=-0.90$) affected by the CF content (Chibowska et al., 1994) and positively ($r=0.79$) by its C-fat content (Nwokolo et al., 1977). Also digestible energy value of LG-RM evaluated on pigs (Bourdon, 1986) depended mainly on CF and fat contents.

This study was undertaken to determine the regression equations for predicting the metabolizable energy value and digestibility of LG-RM nutrients for chicks from its chemical composition.

EXPERIMENTAL

Material and methods

LG-RM of the Polish variety Bolko was separated in a Quadrumat Senior Mill on sieves of 150, 270 and 450 μm into 3 fractions: flour, bran and hulls in a proportion of 3:2:1. Hulls were further defatted with petroleum ether and designated as dH. Bran, dH and oil were added to flour in order to obtain M-RMs differing in CF (8.8; 10.3; 11.9; 13.2; 14.7% DM) and fat (4.3; 6.3; 8.2; 10.2; 12.1% DM) contents in a two-factorial design.

AME_N and digestibility of DM, CP, C-fat, CF and NFE was determined in a balance experiment performed on 99 broiler cockerels divided into 25 groups. The method of Hill and Andersen modified by Smulikowska (1992) was used. The basal diet (wheat 50, soyabean 20, wheat flour 24, casein 2, mineral-vitamin premix 4%) was fed alone or mixed with one of the 25 M-RMs in a proportion 60:40. The excreta of chicks were quantitatively collected. DM, total N, C-fat and CF were determined in of M-RMs and dried excreta using standard AOAC methods; acid (ADF) and neutral (NDF) detergent fibre were determined by the Van Soest procedure on a "Fibertec" Tecator. AME_N of M-RMs was calculated according to Campbell et al. (1983). The data were subjected to multiple regression analysis using "Statgraphics Plus ver. 7" software.

Results and discussion

The fat content in the M-RMs had a significant, positive, linear effect on its AME_N value and DM digestibility, but also a negative, linear effect on CF digestibility and a significant quadratic effect on the digestibility of fat and NFE. CF had a negative, linear effect on both nutrients digestibility and AME_N of M-RMs. The digestibility of CP was significantly affected in linear, quadratic and interactive terms by CF and C-fat contents. The respective correlation coefficients with ADF and NDF were similar as with CF. The correlation coefficients between CF or fat contents and digestibility of nutrients and AME_N are given in Table 1, the regression equations are shown in Table 2.

The CF content seems to be more important for predicting digestibility of LG-RM dry matter than the C-fat content, however, the effect of both components should be taken into consideration as determinants of CP, C-fat, NFE and CF digestibility. In agreement with Nwokolo and Bragg (1978) and Bourdon (1986) we concluded that both CF and C-fat content should be used for predicting AME_N value of LG-RM for poultry from its chemical composition. The equation coefficients indicate that AME_N of LG-RM is reduced by 0.3 MJ for each per cent of increase in CF and raised by 0.2 MJ for each per cent of increase in C-fat. This observation agrees very well with the relationship found by Bourdon (1986) between CF and C-fat content of LG-RM and digestible energy for pigs.

Table 1. Partial correlation coefficients between fat and crude fibre content and digestibility of dry matter, protein, fat, N-free extractives, crude fibre and AME_N

Component	Digestibility (%)					AME_N MJ/kg DM
	DM	CP	C-fat	NFE	CF	
	Correlation coefficients (r)					
Crude fat	0.26	0.62	0.74	-0.27	-0.57	0.61
Crude fibre	-0.59	-0.48	-0.42	-0.49	-0.52	-0.60

Table 2. Prediction equations of LG-RM component digestibility (d) and AME_N for broiler chickens from its chemical characteristics (expressed in % of DM)

$dDM(\%) = 44.95 - 1.12CF + 0.27C\text{-fat}$	$S_E \pm 3.29; R^2 = 0.40; P \leq 0.01$
$dCP(\%) = 80.50 - 4.38CF + 0.20CF^2 + 9.88C\text{-fat} - 0.41C\text{-fat}^2 - 0.34(CF \times C\text{-fat})$	$S_E \pm 5.34; R^2 = 0.62; P \leq 0.05$
$dC\text{-fat}(\%) = 50.83 - 1.19CF + 7.34C\text{-fat} - 0.32C\text{-fat}^2$	$S_E \pm 4.31; R^2 = 0.65; P \leq 0.01$
$dNFE(\%) = 94.32 - 1.84CF - 9.60C\text{-fat} + 0.50C\text{-fat}^2$	$S_E \pm 7.11; R^2 = 0.42; P \leq 0.05$
$dCF(\%) = 21.78 - 1.62CF - 1.40C\text{-fat}$	$S_E \pm 5.80; R^2 = 0.43; P \leq 0.01$
$AME_N(MJ/kg\ DM) = 10.78 - 0.30CF + 0.20C\text{-fat}$	$S_E \pm 0.75; R^2 = 0.58; P \leq 0.01$

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