NUTRITIONAL VALUE OF PRESS CAKE FROM YELLOW- OR BLACK-SEEDED WINTER RAPESEED FOR GROWING PIGS

S. Smulikowska, St. Raj, A. Piotrowska[1], I. Bartkowiak-Broda[1]
The Kielanowski Institute of Animal Physiology and Nutrition PAS, Instytucka 3
05-110 Jablonna, Poland
[1]Oil Crop Department, Plant Breeding and Acclimatization Institute, Strzeszynska 36
60-479 Poznan, Poland

INTRODUCTION

Yellow-seeded *B. napus* canola was found to contain less dietary fibre than brown-seeded *B. napus* canola, however, there were no differences in a weight gain of broiler chickens fed meals prepared in laboratory from the seeds (Slominski et al. 1999). The study was conducted to determine the nutritional value for pigs of press cakes derived from 3 lines of yellow-seeded winter *B. napus* 00 rapeseed selected in Plant Breeding and Acclimatization Institute, Poznan, Poland and compare it with the value of a press cake derived from black-seeded winter *B. napus* 00 rapeseed.

MATERIAL AND METHODS

Rape seeds of 3 yellow-seeded winter 00 lines (041/06, 036/06 and 022/06) and 1 black-seeded commercial winter 00 Bojan variety of rapeseed harvested in 2006 year were cold- pressed with the same hydraulic press-shed in a local small plant. Chemical composition and glucosinolate content of press cakes were determined.

Five diets based on barley, wheat and maize were prepared, control diet did not contain rapeseed products, in experimental diets about 22% of ME was supplied by respective press cakes (Table 1). All diets were balanced in relation to energy (about 13.9 MJ ME kg), digestible protein, digestible amino acids (Lys, Met + Cys, Thr and Trp), Ca and P.

Table 1. Composition of experimental diets, g/kg

Component	Type of rapeseed (y - yellow-, b - black-seeded)				control
	041/06 - y	036/06- y	022/06 - y	Bojan - b	
Rapeseed press cake	200	200	200	200	-
Barley	350	350	350	350	355
Wheat	200	200	200	190	230
Maize	145	155	145	140	180
Soybean meal	80	70	80	70	200
Rapeseed oil	-	-	-	25	10
Mineral-vitamin premix[1]	25	25	25	25	25
Analyzed					
Crude protein	173.7	174.4	179.4	181.9	181.9
Crude fat	69.1	67.2	70.1	83.3	32.2

[1] contained vitamins, minerals, Lys, Met, Thr and Trp

Thirty female crossbred pigs (♀Polish Large White x ♂Danish Landrace) of initial body weight about 20 kg were randomly allotted to 5 treatment groups. Pigs were kept in individual pens (2.6 m^2) on concrete floor without straw, with free access to drinking water, in thermo-neutral air temperature of 18-20^oC and humidity of 60-70%. Animals were fed experimental diets at a level of 85% *ad libitum,* daily portion was provided twice a day at 8.00 and 14.00 h. Pigs were weighed every week and feed allowance was changed weekly according the BW. The apparent digestibility of nutrients was measured when pigs reached about 45 kg BW. Chromic oxide (2 g/kg) was included in the diets as a digestibility marker. Five days adaptation period was followed by a 3 days faeces collection. Feaces were collected at 8.00 and 15.00 h and were immediately frozen at –18^oC. At the end of collection period the faeces were pooled within pig, ground, mixed and representative subsample was used for chemical analysis. Live weight gain and feed conversion ratio was calculated for the period from 20 to 60 kg BW.

Press cakes, diets and faeces were analyzed for DM, N, crude fat, ash and crude fibre (AOAC 1990), glucosinolates according to ISO (1992), chromic oxide according to Fenton and Fenton (1979), neutral detergent fibre (NDF) and acid detergent fibre (ADF) contents were determined using

a Fibertec System M by Van Soest (1973) method. The apparent total tract digestibility of nutrients was calculated. Metabolizable energy of diets was calculated based on digestible protein, fat, starch and sugars according to Jentsch et al. (2003). The pigs were slaughtered at about 60 kg BW, thyroids were excised and weighed.

Data were analyzed by one way analysis of variance. The significance of differences between the means were compared with the Tukey test. All calculations were performed using STATGAFICS Centurion Software version XV [2005].

RESULTS AND DISCUSSION

Press cakes from yellow seeds (yellow cakes) contained from 255 to 273 g crude fat/kg DM, the press cake from black rapeseed (black cake) 190 g crude fat/kg DM, respectively. It indicates on lower extractability of yellow rape. The content of total glucosinolates was in the yellow cakes from 8 to 9.4 µmol/g, in the black cake 11.2 µmol/g, which was well below upper limit of 25 µmol/g accepted for commercial rapeseed meals, and below the value 11.4 µmol/g reported by Slominski et al. (1999) in yellow-seeded *B. napus*. The glucosinolate profiles of yellow cakes showed a relatively low proportion of aliphatic glucosinolates in comparison with the black cake, and very low progoitrin content. Aliphatic glucosinolates in yellow cakes ranged from 2.3 to 3.8 µmol/g, progoitrin from 0.5 to 1.4 µmol/g, in the black cake respective values were 7.1 and 3.9 µmol/g. Pigs ate well all diets, the performance of pigs fed experimental diets was comparable to the control group (Table 2).

Table 2. Effect of press cake type on performance of pigs

Item	Dietary treatments (y – yellow, b – black cake)					SEM	P
	041/06 - y	036/06- y	022/06-y	Bojan - b	control		
Initial weight, kg	20.3	20.3	20.2	20.5	20.0	0.12	0.340
Final weight, kg	64.5	59.8	58.9	60.7	56.9	1.28	0.176
Days of fattening	56.8	52.2	54.0	56.7	50.5	0.19	0.125
Feed intake, kg/d	1.93	1.89	1.91	1.93	1.87	0.018	0.184
Live weight gain, g/d	725	756	719	716	734	0.023	0.762
FCR, kg feed/kg gain	2.68	2.50	2.66	2.72	2.56	0.108	0.605

The apparent total tract digestibility (TTD) of crude protein and starch did not differ significantly between groups, but TTD of fat was significantly lower in group fed diet with 022/06 yellow cake. The TTD of neutral-detergent fibre (NDF) and acid-detergent fibre (ADF) was significantly higher in groups fed yellow cakes than in control group and in group fed diet with the black cake (Table 3). However, there was no relationship between the NDF and ADF digestibility and the digestibility of protein and starch, or performance of pigs. Similar results were found by Slominski et al (1999) in a study on broilers. Therefore, it may be inferred that yellow rape fibre is more easily fermented in a large intestine of pigs in comparison with the black cake fibre, but it did not affect positively nutrients digestion in a small intestine. Thyroid weight was 6.1 mg/100g BW in control group, from 7.5 to 8 mg/100 g BW in pigs fed yellow cakes, 9.6 mg/100 g BW in pigs fed black cake.

Table 3. Total tract digestibility of experimental diets

Item	Dietary treatments (y – yellow, b – black cake)					SEM	P
	041/06-y	036/06-y	022/06-y	Bojan - b	control		
Organic matter	0.848 ^{B}	0.855 ^{A}	0.842 ^{B}	0.846 ^{B}	0.864 ^{A}	0.0038	0.0079
Ash	0.430 ^{B}	0.460 ^{B}	0.443 ^{B}	0.453 ^{B}	0.506 ^{A}	0.0086	0.0002
Crude protein	0.774	0.793	0.775	0.788	0.786	0.0097	0.6038
Crude fat	0.646 ^{A}	0.679 ^{A}	0.601 ^{B}	0.655 ^{A}	0.636 ^{A}	0.0139	0.0069
Starch	0.979	0.980	0.980	0.981	0.982	0.0017	0.8922
NDF	0.669 ^{A}	0.712 ^{A}	0.719 ^{A}	0.549 ^{C}	0.585 ^{B}	0.0131	0.0001
ADF	0.579 ^{A}	0.584 ^{A}	0.600 ^{A}	0.459 ^{C}	0.500 ^{B}	0.0151	0.0001
ADL	0.419 ^{B}	0.304 ^{C}	0.493 ^{A}	0.239 ^{D}	0.412 ^{B}	0.0321	0.0005
ME MJ/kg	13.9 ^{B}	14.1 ^{A}	13.8 ^{B}	14.2 ^{A}	13.6 ^{B}	0.071	0.0001

^{A,B} - means within rows with different superscripts are significantly different

CONCLUSIONS

The current data showed that yellow-seeded lines of rapeseed studied are superior to black-seeded commercial 00 rapeseed with regard to glucosinolate contents. Dietary fibre of cold-pressed yellow cakes is digested better than of black rapeseed cake. It indicates that yellow cakes are suitable as protein-energy component in organic as well as conventional pig feeds.

ACKNOWLEDGEMENTS

The financial support was provided by the Polish Ministry for Scientific Research and Information Technology - grant no. R12 047 03.

REFERENCES

AOAC, 1990. Association of Official Analytical Chemists, Official Methods of Analysis. 15th Edition, Washington, DC

Fenton T.W., Fenton M., 1979. An improved procedure for the determination of chromic oxide in feed and faeces. Can. J. Anim. Sci. 59, 631-634

ISO, 1992. 9167-1. Rapeseeds. Determination of glucosinolate content. Part 1. Method using gradient elution high performance liquid chromatography. ISO, Geneva

Jentsch W., Chudy A., Beyer M., 2003. Rostock Feed Evaluation System. Reference numbers of feed value and requirement on the base of net energy. Research Unit Nutritional Physiology OSKAR KELLNER, Dummerstorf, Germany

Slominski B.A., Simbaya J., Campbell L.D., Rakow G., Guenter W., 1999. Nutritive value for broilers of meals derived from newly developed varieties of yellow-seeded canola. Animal Feed Science and Technology 78, 249-262

Van Soest P.J., 1973. Collaborative study of acid detergent fiber and lignin. J. Assn. Off. Chem. 56, 513-530