The nutritive value of low glucosinolate rapeseed meal processed at different heat-moisture conditions

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Introduction

Since the double improved variety of winter rapeseed should be soon introduced in Poland, evaluation of the best temperature-moisture conditions for the seed processing is important. Therefore the cooperation with Oil Industry was undertaken for evaluation of nutritional quality of the meals processed in four different combinations of steam preasure and temperature in the toaster-desolventizer.

Materials and methods

Four different combinations of steaming were applied during a toasting of meal from the low glucosinolate variety Start "00". Preasure of steam and temperature of meal on the last four shelves of the toaster were as follows: Meal I - 3.2 atm., 78 ÷ 105°C; Meal II - 2.5 atm., 102 ÷ 105°C; Meal III - 2.0 atm., 87 ÷ 104°C; Meal IV - 2.2 atm., 70 ÷ 95°C. Control meal from the same batch of seed was prepared as follows: myrosinase was deactivated by autoclaving. The seeds were than dried, ground and extracted with hexane to remove the oil. The glucosinolate content of rapeseed meals as determined by GLC method of Daxenbichler et al. /1970/ is given in Table 1.

Weanling male and female rats weighing 45-50 g were divided into six experimental groups of 10 rats each /5♂ + 5♀/. The control group was fed with diet containing 10% protein from casein supplemented with methionine. The groups 2,3,4,5 and 6 were fed the test diets containing the same level of rapeseed meal /25%/ and protein /10%/. The body weight and feed intake were recorded every 2 or 3 days. At the end of 4 weeks the rats were killed and thyroids were removed and weighed.

Results and discussion

Results of the feeding test are given in Table 2. The best body weight gain and feed intake were obtained for meals I and II processed at higher preasure of steam and temperature. Although the amount of glucosinolates in double improved rapeseed is fairly low, steaming of the meal is necessary to destroy the myrosinase activity and to remove part of the glucosinolates. This was proved by good growth and almost normal thyroid weight. The similar results were reported for Bronowski meal by Josefsson and Munck /1972/ and Josefsson /1975/. On the other hand, myrosinase activity and glucosinolate content was less affected by seed processing at lower heat-moisture level /Meal III and IV, Table 1/. Consequently when fed to animals, less heated meals caused lower feed intake, significant thyroid enlargement and about 15% lower body weight gain during four weeks of experiment.

The feeding quality of the Start meal processed at higher temperature was equal to casein supplemented with methionine and better than the nutritive value of the rapeseed meal obtained in laboratory conditions.

References

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Table 1. Glucosinolate content /mg/g/ in the laboratory and industrial rapeseed meals

The method applied	Laboratory meal	Industrial meals			
		I	II	III	IV
1. "As is" /without addition of myrosinase/					
1-cyano-2-hydroxy-3-butene	0.00	0.41	0.27	0.07	0.08
2. Autolysis products of intact glucosinolate					
5-vinyloxazolidine-2-thione	0.26	0.21	0.42	1.26	1.45
3-butenyl-isothiocyanate	0.04	0.03	0.14	0.05	0.05
3. Hydrolysis products of intact glucosinolate /with addition of myrosinase/					
5-vinyloxazolidine-2-thione	1.53	0.46	0.86	1.27	1.43
3-butenyl-isothiocyanate	0.68	0.21	0.36	0.48	0.56
4-pentenyl-isothiocyanate	0.10	0.03	0.06	0.08	0.10

Table 2. The effect of low glucosinolate rapeseed meal cv. Start "00" processed at different heat-moisture conditions on body weight gain, feed intake and thyroid weight of rats.

Protein source	Feed intake /g/day/	Body weight gain /g/day/	Thyroid weight /mg/100g body wt/
Casein + 1% methionine	10.5 ± 0.9 [1],a,b	3.3 ± 0.5 a	6.6 ± 0.9 a
Control meal	10.7 ± 0.7 a,b	3.0 ± 0.2 a,b	10.4 ± 1.2 b
Meal I	12.1 ± 1.4 c,d	3.3 ± 0.5 a	8.6 ± 1.0 c
Meal II	12.7 ± 1.3 d	3.4 ± 0.5 a	9.9 ± 1.1 b,c
Meal III	11.2 ± 1.2 a,c	3.0 ± 0.4 a,b	16.8 ± 1.5 d
Meal IV	9.8 ± 0.7 b	2.7 ± 0.3 b	20.4 ± 2.5 e

[1] Mean ± standard deviation, a,b,c,d,e Values having different superscripts vary significantly from each other /$p<0.05$/