NUTRITIONAL VALUE OF RAPESEED MEALS OBTAINED FROM HYDROTHERMALLY TREATED SEEDS

KOZŁOWSKA HALINA,ROTKIEWICZ DANIELA,KOZŁOWSKI MARIAN,
FARUGA ANDRZEJ,MIKULSKI DARIUSZ
UNIVERSITY OF AGRICULTURE AND TECHNOLOGY
10-718 Olsztyn, POLAND

PASTUSZEWSKA BARBARA
INSTITUTE OF ANIMAL PHYSIOLOGY AND NUTRITION
05-110 Jabłonna near Warszawa, POLAND

Numerous countries cultivating rapeseed attempt at improving technology of rapeseeds processing in order to obtain meal and oil of possibly highest quality. One of such methods seems to be rapeseed hydrothermal treatment which inactivates myrosinase and other enzymes in whole seeds before they are flaked. In a traditional technological process myrosinase is most often inactivated during meal toasting / Kozłowska et al.1977 /, also in the case of double improved rapeseed varieties. Hence, both during crushing, cooking and defatting seeds there are made conditions convinient for glucosinolates decomposition. Eventually fat-soluble isothiocyanates penetrate to oil which makes hydrogenation process difficult. Besides, steaming whole seeds in controlled conditions aims at improving not only the quality of oil but also the quality of meal which then needs not to be toasted. Toasting, as is commonly known, causes deep denaturational changes of proteins and results in decrease of lysine availability.

Our research was aimed at establishing the influence of hydrothermal treatment of seeds on the quality of meals obtained from seeds steamed for 20 minutes with omission of toasting.

MATERIALS AND METHODS

Meals of rapeseed varieties of various improvement degres were estimated chemically and biologically / table 2 /. Chemical estimation of meals obtained from non-steamed R and steamed S seeds was based on the analysis of oil, protein / Nx6.25 /, NSI and glucosinolates derivatives / Youngs et al.1967 /.

Biological estimation was based on tests with rats A broilers B.

A. Body weight gain, feed intake and weight of thyroid gland were measured in growing rats fed on diets containing evaluated rapeseed meals as the only source of protein. The meals were included into diets in the amounts varying from 24.4 to 26.7 per cent, the level of inclusion corresponded to 9.5% of Nx6.25 in the diet. Commercial soybean oil meal was used as a standard protein. The test was performed during 20 days on 25-days old male rats of IFZ/Jaz strain, semisynthetic diets were fed ad libitum, each to 7 rats maintained individually.

B. Broiler chickens of the Astra B / C87XW74 / strain between 1st and 56th day of life were fed on full-portion meals with 5% of high glucosinolate Skrzeszowicki and Beryl varieties from 1st to 26th day life and with 10% from 22nd to 56th. BOH meal was introduced to the diets as, respectively, 10 and 15%.

RESULTS

Protein and glucosinolates changes under the steaming influence

The amount of the most essential component of rapeseed meals, i.e. of proteins, was hardly affected during the applied process. Yet there were observed some substancial changes in their solubility. Meals obtained from steamed Skrzeszowicki and BOH rapeseeds contained ab.50% less soluble proteins than those obtained from the non-steamed ones. Beryl proteins were ab. 10% more resistant to steaming / table 1 /. Meals obtained from steamed rapeseeds conteined less oil though they were defatted in the analogical conditions. This observation is very advantageous as far as industrially obtained oil amound is

concerned. No active myrosinase was found in any of the steamed meals / table 2 /. Inactivation of this enzyme caused also decrease of glucosinolates derivatives / ITC, OZT and SCN^- /. Also in this case quantitative changes were smaller for Beryl. Total ITC and OZT lose for this variety was 13% whereas for Skrzeszowicki nad BOH - ab.17%. There were also ab.10% less of SCN^- ions in the steamed Beryl rapeseed compared with the remaining meals.

Nutritional evaluation of steamed RSM in tests with rats

Body weight gain and feed intake depended both on the type of rapeseed and on the treatment / table 3 /. The rats fed on raw Skrzeszowicki diet decreased and those fed on Beryl only maintained initial body weight while in animals fed on raw BOH the growth was higher than in those fed on soya meal. The effect of steaming was far more evident in groups fed on Skrzeszowicki and Beryl than on BOH, improvement due to steaming was 31.8, 26.7 and 5.5 g, respectively. Feed intake was also higher in animals fed on steamed than on raw rapeseed, the effect being greater in Skrzeszowicki and Beryl than in BOH.

The effect of steaming may be only partly attributed to the decrease of glucosinolates in the meals since in spite of similar level of glucosinolates in raw Beryl and steamed Skrzeszowicki both feed intake and growth rate were higher in rats fed on steamed Skrzeszowicki.

The weight of thyroid gland per 100 g of body weight was higher in animals fed on Skrzeszowicki and Beryl than on BOH, the effect of steaming was found only Skrzeszowicki and Beryl, whereas in BOH thyroid glands of rats were observed to have been enlarged.

Better performance of rats fed on low-glucosinolate rapeseed / BOH / than on soybean meal may be related to higher level of sulfur amino acids content in rapeseed than in soybean protein.

Nutritional evaluation of steamed RSM in tests with broilers

The greatest body weight on 56^{th} day of life were found in chicken fed on soyabean meal and the diet containing steamed BOH / table 4 /. They were considerably greater

than the weights of chicken from the remaining groups. There is a noticable influence of glucosinolates presence and steaming of seed on the body weight.

Feed intake per 1 kg of body weight gain was greater in all groups fed on the diet containing steamed and non-steamed RSM compared with a control group. Only a slightly positive influence of steaming whole seeds was observed.

The weight of thyroid gland of chicken fed on the diet with RSM was considerably higher compared to a group fed on soyabean meal. Steaming of high-glucosinolate rapeseed / Skrzeszowicki and Beryl / resulted in considerable decrease of thyroid weight, 3 and 4 times respectively, whereas in the case of low-glucosinolate content rapeseed thyroid gland of chicken were observed to have been enlarged, like those of rats. Yet, thyroid weight gain was not accompanied by lowering of nutritional effects measured by body weight and feed intake.

CONCLUSIONS

Seeds steaming resulted in:

- improved nutritional effects measured with body weight gain and feed intake of animals used for the experiment. The effect of steaming was far more evident in groups fed on high glucosinolate RSM than on low,
- considerable decrease of thyroid gland weight in the groups fed on high glucosinolate meal and slight increase in the case of those fed on low-glucosinolate meal,
- improved quality of low glucosinolate meal to the level of soybean meal in the case of chickens and even exceeding soybean meal quality in tests with rats.

REFERENCES

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Table 1

Protein and fat content in raw /R/ and steamed /S/ RSM

Material		Protein % dm		NSJ	Fat % dm
		total	soluble		
Skrzeszowicki					
	R	43.0	25.1	58.4	2.0
	S	42.8	11.7	27.3	1.1
Beryl					
	R	42.6	22.7	54.0	1.9
	S	42.7	13.8	32.3	1.5
BOH					
	R	43.4	24.4	56.2	2.2
	S	42.7	12.7	29.7	1.9

Table 2

Myrosinase activity and glucosinolate derivatives in RSM

Material		Myrosinase activity	ITC+OZT mg/g	SCN mg/g
Skrzeszowicki				
	R	735	15.2	1.4
	S	0	12.7	0.9
Beryl				
	R	602	12.7	1.2
	S	0	11.1	0.8
BOH				
	R	814	2.6	1.6
	S	0	2.2	0.9

Table 3

Performance of rats fed on different RSM and SBOM

Material		ITC+OZT mg/g of diets	Body weight gain g	Feed intake g	Thyroid mg/100g
Skrzeszowicki					
	R	4,04	-10.6	74.2	31.5
	S	3.39	21.2	122.9	25.3
Beryl					
	R	3.19	5.7	93.0	28.6
	S	2.72	32.4	145.1	15.0
BOH					
	R	0.63	66.0	226.6	11.8
	S	0.55	71.5	246.4	14.1
Soya meal					
	R	-	52.8	218.5	9.5

Table 4

Performance of chicken fed on different RSM and SBOM

Material		ITC+OZT intake with diets g	Body weight gain g	Feed intake g	Thyroid mg/kg
Skrzeszowicki					
	R	6.74	2057	2.4	155.0
	S	5.81	2141	2.4	51.8
Beryl					
	R	5.82	2177	2.3	236.6
	S	5.13	2220	2.3	55.8
BOH					
	R	1.96	2245	2.3	44.6
	S	1.67	2337	2.4	54.0
Soya meal		-	2332	2.2	32.9