

EFFECT OF ALKYLENE GLUCOSINOLATE IN RAPESEED MEAL  
ON GROWTH AND FEED UTILISATION IN RATSM. Rakowska, B. Słomiński, M. ZalińskaInstitute of Plant Breeding and Acclimatization,  
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Laboratory rats have been very useful in experiments on evaluation of nutritive quality of breeding forms of rapeseed, toxicity of glucosinolates and their derivatives and testing the quality of the meals obtained in different processing conditions.

The intention of this paper is to present different types of experiments and to comment on the most useful techniques.

In the first experiment ten diets containing 20% of myrosinase inactive rapeseed meal /RSM/ differing in alkylene glucosinolates content by 1,2; 6,9; 12,2; 20,3; 30,2; 31,5; 41,2; 47,8; 56,8; 77,0  $\mu\text{M}$  were fed to ten groups of rats. Corresponding RSM were prepared by mixing low /1.2/ and high 77  $\mu\text{M}$  RSM, in different proportions. Diets simulating pigs regime were supplemented with barley /65%/, vitamins, salt mixtures, soybean oil /7%/, and wheat starch 2% /Table 1/. 10 groups of Wistar rats /10 per group 5 ♀ and 5 ♂ / were fed ad libitum the above diets for 28 days. The maximal body mass gain /BMG/ /106-104g/ on 1-4<sup>th</sup> RSM diets with maximal feed efficiency ratios /FER/ were of 3,1-3,2 achieved /Table 2/. No thyroid enlargement 1-4<sup>th</sup> RSM diets was observed. Starting with 31,5  $\mu\text{M}$  /5<sup>th</sup> diet/ the lower BMG and FER of statistical meaning /P 0.05/ was seen.

The significant enlargement of thyroid gland started on 41,2  $\mu\text{M}$  /6<sup>th</sup> diet/. For all groups of rats high negative correlation coefficient of - 0,97 of BMG versus alkylene glucosinolate content was stated /graph.1/.

The content of 20  $\mu\text{M}$  of alkylene glucosinolate per 1 gm of RSM appears to be the highest safe level, on the base

of rat experiment.

Table 3 presents the influence of rapeseed meal deriving from several varieties of rapeseed, of different glucosinolate content, on protein digestibility and biological value /BV/ in rats.

All meals were obtained in laboratory scope by autoclaving whole seeds /10% moisture/ for 15 minutes, drying in room temperature, then the samples were milled and 3 times hexane extracted. The solvent was filtered and then for evaporation of hexane the meals were kept in room temp. for 48 hours.

Rats were fed 9,4% rapeseed meal protein diets, kept in metabolic cages and the  $D_t$  and BV coefficients were obtained in balance experiments /4 days preliminary period, 5 days collection period/. The Lehman formulas for N-metabolic in feces and N-endogenous in urine were applied. As it is shown in Table 3 there is no influence of glucosinolate level on protein digestibility.

The inhibiting activity on biological value is evident only in RSM of traditional form of rapeseed - Górczański and O-erucic Beryl while the RSM - of Librador, Start and MAH BV values are high but the differences in glucosinolate level are not correlated with BV values.

Results presented in Table 4 - of 28 days long growth experiment, performed on the same rapeseed meals suggest that the body mass gain and PER or FER are presumably best factors for evaluating the nutritive quality of RSM. Our next experiments on rats were connected with the evaluation of different strains of rapeseed seeds, fed to rats without defatting. The casein + 1% methionine with added 16% of O-erucic acid rapeseed oil was used as a control diet.

The rapeseeds /10% moisture/ were autoclaved for 15 minutes /105°C/ and then dried in the room temperature and milled. The 2 weeks growth experiments were performed. The results are presented in Table 5.

As you may see the body mass gain of rats during the 2 weeks experiment on double improved rape seeds was similar

to that on control casein diet, supplemented with fat. The correlation coefficient between growth of rats and glucosinolate content was highly significant  $r = -0,87$ . The feed efficiency ratio very high on high glucosinolate diets, is lowered almost to the FER on control diet, when double zero rapeseeds were fed. The thyroid gland enlargement very significant on high glucosinolate seed diets, is only slightly augmented by diets with double zero seeds. From the experiment on rats it might be concluded that the efficiency of full utilisation of rapeseed protein is probably related to the utilisation of energy.

Table 6 shows the data from the provocative type experiment on the influence of RSM on pregnancy and regeneration of rats. The diets of 50% of RSM deriving from Start 00 or Górczański, were fed to 10 females in a group, starting the day of mating.

The casein supplemented with methionine - 18% protein was used as control.

Female rats fed 50% Start 00 RSM reproduced normally comparing to control diet. The body mass gain during pregnancy was 20% lower and similar was the mean body mass of 3 days old pups.

### Conclusions

- Concluding from our experiments on rats the double improved rapeseed meal below 20  $\mu$ Mole of alkylene glucosinolate /A.G./ is safe for animal feeding on the level of 20% in feed mixtures.
- Probably due to low utilisation of energy from non nitrogenous components of rapeseed, the whole seeds of double improved rapeseed or meal containing more /10%/ fat might be included in mixtures with grain for monogastric animals and poultry.
- The level of 20% of RSM below 20  $\mu$ M of A.G., seems to be safe for reproducing animals.
- Body mass gain and feed efficiency ratio in growth experiments on rats are mostly valuable factors in nutritional evaluation of feeding quality of RSM.

Table 1.

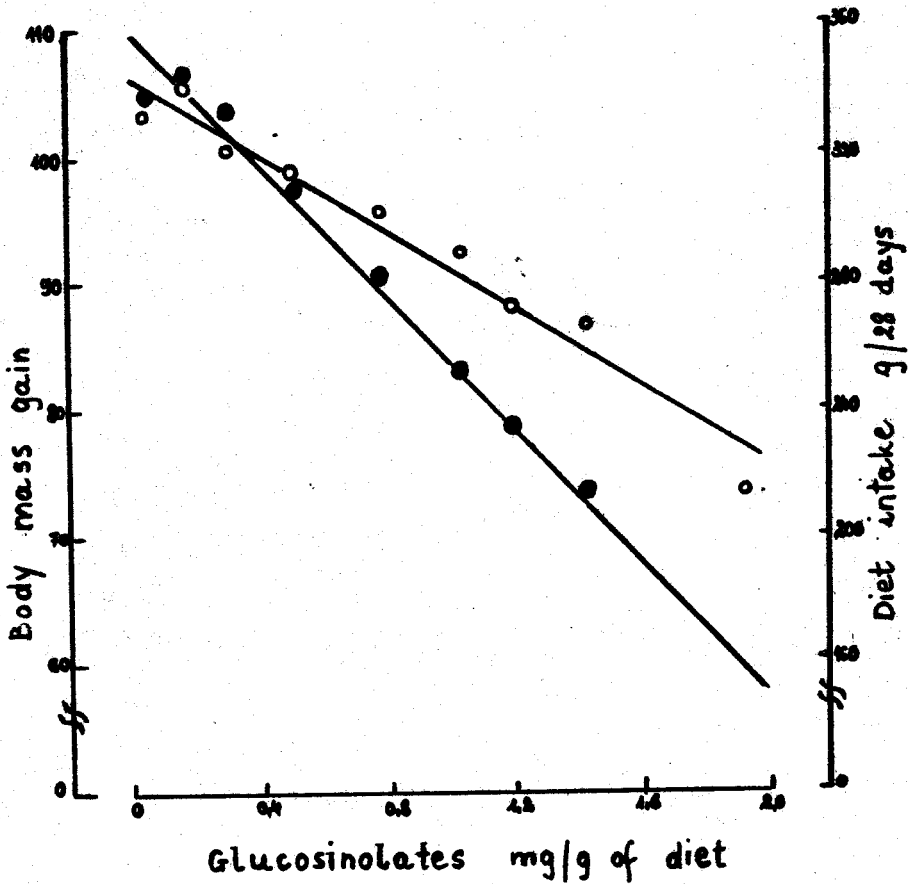
Diet composition in %	
Rapeseed meal Nr 1-10	20
Barley /12% protein/	65
Soy bean oil	8
Vit A,D + E	
Salt mixture	4
Vitamin B Group mixture	1
Wheat starch	2

Table 2.

Effect of alkylene-glucosinolate /AG/ content in rapeseed meal on growth and feed efficiency ratio /FER/ in rats /28 days experiment 10 rats group/.

group	alkylene glucosinolate µM/g RSM	AG intake mg/kg of BM	body mass gain (1) BMG g	FER	thyroid gland mg/100g of BM *
I	1,2	4	105 /a/	3,2	7,44
II	6,9	23	107 /a/	3,2	7,32
III	12,2	39	104 /a/	3,1	7,94
IV	20,3	65	97 /a,b/	3,2	7,69
V	30,2	96	93 /b,c/	3,4	7,73
VI	31,1	111	88/b,c,d/	3,4	7,97
VII	41,2	113	83/b,c,d/	3,5	8,22
VIII	47,8	145	79 /c,d/	3,5	8,52
IX	57,0	174	74 /d,c/	3,6	8,24
X	77,1	245	59 /e/	3,7	9,88

† p 0,05 stat. difference is marked by different superscript



Graph. 1. The relationship of the body mass gain and glucosinolate content in diet.

BMG/GL. :  $r = -0.99$

Diet intake/GL. :  $r = -0.98$

Table 3.

Effect of rapeseed meal /RSM/ of different alkylene glucosinolate level on protein digestibility /D<sub>2</sub>/ and biological value /BV/.

product tested	alkylene glucosinolate mg/g of meal	D <sub>2</sub> %	BV %
control casein +1% methionine	0	96,7	94,2
RSM Górczański	7,2	84,8	63,0
RSM Beryl	6,77	86,8	60,0
RSM Librador	5,1	85,3	87,4
RSM Start "00"	2,43	85,5	87,2
RSM MAH	0,22	83,9	91,8

Table 4.

The influence of rapeseed meal of different level of glucosinolate on body mass gain /BMG/ and protein efficiency ratios /28 days experiment/.

Product tested	glucosinolate mg/g of meal	body mass gain g/28 days	PER
control casein + 1% methionine	0	109,7	3,24
RSM Górczański	7,20	12,2	0,77
O-erutic-acid Beryl	6,77	29,0	1,06
RSM Start "00"	2,43	82,3	2,23
RSM MAH	0,22	85,3	2,80

Table 5.

Comparison of nutritive value of whole rapeseed strains differing in alkylene glucosinolate /AG/ contents in rats /two weeks growth experiments on 10% rapeseed protein/ - 40% of whole seeds.

Diet	AG mg/g	PER	BMG g/14 days	FER	Thyroid mg/100gBM
control casein + 1% met.	0	4,02	51,0	2,64	9,1
Górczański	6,77	0,77	4,2	14,33	29,2
"0" erucic:					
Janpol	7,25	0,92	7,3	8,65	27,1
Beryl	4,54	1,92	18,2	5,69	23,1
Ledos	2,22	2,86	28,0	3,80	21,5
"00" forms:					
Bronowski	0,21	3,55	47,6	3,00	11,8
Strain <sup>x</sup>					
962/3	0,14	3,5	51,0	3,08	13,9
Strain	0,13	3,8	51,0	2,81	11,5

42 strains of "00" rapeseed were tested.

<sup>x</sup> 16% of 0-erucic acid oil added instead of part of the wheat starch.

Table 6.

Effect of RSM meal of different A.G. content on rat pregnancy and reproduction in provocative type experiment /50% of RSM/.

Protein source	num- ber of fe- males	b.mass gain in preg- nancy	mean No of pups per litter	mean No of pups living dead	mean body mass of pups 3 days old g
control casein +1% methionine	12	104	10	0,5	8,2
RSM Start "00"	12	82	10	0,0	7,2
RSM Górczański	11	1	-	-	-