CHEMICAL AND BIOLOGICAL EVALUATION OF RAPESEED MEALS, DERIVED FROM 5 COUNTRIES, OBTAINED WITH DIFFERENT PROCESSING PROCEDURES.

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ABSTRACT

The 15 samples of rapeseed meal, appeared on EC market, were chemically analysed and biologically evaluated. The best nutritional results were obtained in European extracted meals. The cakes, in spite of the best chemical composition, got slightly worse biological results: body mass gain and protein efficiency ratio (PER). The lowest results were obtained in biological trials with Chinese rapeseeds . The comparison of the biological results with chemical analyses showed, that the glucosinolate content is still the main limiting factor in utilization of rapeseed meal in animal feeding. The protein solubility in KOH and content of 4-OH-glucobrassicin are good indicators in chemical evaluation of nutritional quality of rapeseed meals.

INTRODUCTION

The biological utilization of the rapeseed meal in animal nutrition depends on content of glucosinolates and the processing conditions applied in oil production [Rakowska et al., 1980; Słomiński et al., 1983]. The both factors affect the palatability of meals, body mass gain, protein and energy utilization by animals. Since a great variability of rapeseed meals appear on the market, there is a need of a simple tests for the quality evaluation,that would be highly correlated to the most relevant biological tests. The aim of this study was to select the chemical method(s) highly correlated with the results from biological tests on laboratory rats as the model animals.

EXPERIMENTAL

The 15 samples of rapeseed meal available on EC market, derived from 4 European countries (Denmark, Germany, England, Poland) and from China, produced by different technological procedures were analyzed. Samples were divided into three groups: group 1- cake (4 samples), group 2 - extracted European meals (6 samples), and group 3 - extracted Chinese meals (5 samples).

Chemical analyses

Table 1 shows the results of chemical analyses of rapeseed meals. The mean content of glucosinolates 15.0 μmol/g in the group 1 is higher in comparison with the group 2 (9.6 μmol/g), but lower compared to the group 3 (25.3 μmol/g).

Table 1. Results of chemical analyses of rapeseed meals and biological trials on rats.

	Group 1 (n=4)	Group 2 (n=6)	Group 3 (n=5)
Ash [%d.m.]	7.2	7.9	9.2
Fat [%d.m.]	10.4	5.0	4.1
Crude protein (N*6.25) [%d.m.]	33.9	38.1	41.2
Protein soluble in 1M KOH [% protein]	73.6	56.4	40.4
Lysin avail. [g/16g N]	4.2	4.0	3.8
Dietary fibre DF [%d.m.]	43.5	41.7	38.4
Glucosinolates [μM/g]	15.0	9.6	25.3
Protein digest. TD [%]	88.2	87.6	83.1
Biological value BV [%]	81.8	79.7	67.1
Protein efficiency ratio PER[%]	2.5	2.6	1.3
Body mass gain[g/21days]	54.3	63.2	19.5
Organic matter digest. OMD [%]	87.9	87.5	89.0

The applied technological process reduced strongly the protein solubility in group 3 (40.2%) compared to group 1 and 2 (73% and 55.8%, respectively). It corresponds with changes in thermolabile 4-OH-glucobrassicin content. Low content of this glucosinolate and low content of soluble protein suggest long time of meal heating in all of samples of the group 3.

Biological trials

The nutritional experiments comprised 9-days N-balance trial and 21-day growth experiment on rats. The meal was the only source of protein in diet. Table 2 shows correlation coefficients between selected chemical and biological data.

Table 2. Correlation coefficients of selected chemical features od rapeseed meals and cakes and biological responses of rats fed with diets containing these meals.

Independent	Dependent	Correlation coefficient R (n=15)
Soluble protein	4-OH-glucobrassicin (% glucosin.)	0.949
Soluble protein	TD	0.782
Soluble protein	BV	0.799
DF	TD	0.482
Lysin available	BV	0.579
Lysin available	PER	0.471
Total glucosinolates	PER	0.443
Total glucosinolates	Body mass gain	0.535
4-OH-glucobrassicin (% glucosin.)	TD	0.760

Comparison of protein solubility and 4-OH-glucobrassicin (Fig.1) content shows a strong correlation between glucosinolate degradation and protein denaturation (Table 2), and seems to be a good indicator of rapeseed meal processing damage. Mean values of biological data obtained from rat trials are highly correlated with glucosinolate content and with protein solubility.

The lowest results in biological trials were obtained in group 3, where the highest content of glucosinolates and lowest protein solubility was found. The biological value (BV) of protein is more sensitive to protein solubility than TD (Fig. 2).

Fig.1 Influence of protein solubility on 4-OHglubobrassicin content

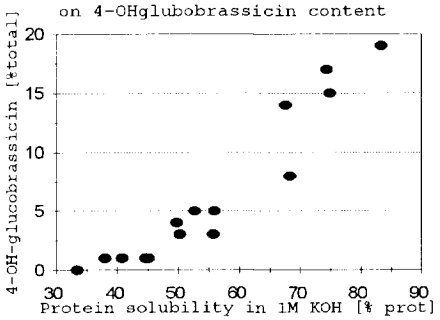
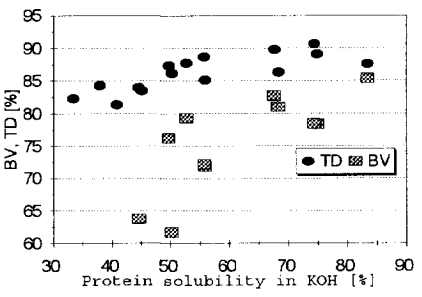


Fig.2 Influence of protein solubility on BV and TD in rats.



The glucosinolate content at the level of 15.0 μM/g seems to be still too high from nutritional point of view. The short-term N-balance experiment did not show significant differences between group 1 and group 2; the 3-week growth experiment showed significant difference in body mass gain (54.3g and 63.2g, respectively). Rapeseed cakes obtained by seed pressing contain the higher amount of KOH-soluble protein and the highest available lysin content, but on the other hand, since the higher glucosinolate content, inhibits the body mass gain of rats. This effect is not evident in shorter biological test for TD and BV evaluations.

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