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A note on the chemical composition of low glucosinolate rape seed produced in North-Eastern Poland

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INTRODUCTION

Rape seed is the basic raw material of food industry and is a very important crop grown in Poland. The acreage put into rape, which has increased with years, is evidence of that.

The residue after extraction of oil from low glucosinolate (LG) rape seed, LG-rapeseed oil meal, is used for feeding purposes. The chemical composition as well as nutritive value of LG-rapeseed oil meal were determined in many investigations. The good results of breeding to eliminate glucosinolates and erucic acid from rape seed (Krzymański, 1985) have permitted the full fat seed of low glucosinolate varieties to be used also as a feed component for poultry and pigs. Utilization of full fat LG-rape seed of new varieties in animal feeding requires accurate knowledge of its chemical composition. The aim of this paper is to supplement the data on the chemical composition of LG-rape grown in North-Eastern Poland in 1990.

MATERIAL AND METHODS

Thirty three samples of full fat low glucosinolate rape seed (mainly var. Bolko) were taken from the Feed Mill in Wyszków equipped with a technological line for rape seed cleaning and drying. Each sample represented a lot of rape seed (5.000 kg or more) which was used daily in the production of mixed feeds in the feed mill.

Analyses of basic nutrients were performed in all 33 samples. Samples of each

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3 consecutive days were pooled and the 11 samples obtained so were subjected to analysis. Aliquots were taken from these samples and pooled for determination of carotene and xanthophyll. All samples were finely ground before analysis.

Chemical composition was determined using conventional methods. Amino acids were determined in defatted samples on a Beckman Model 119 CL automatic amino acid analyser. Analysis of sulphur amino acid were carried out on samples oxidised before hydrolysis (Moore et al., 1958). Macro- and microelements and toxic metals were determined after ashing the samples using atomic spectrometry (Pye Unicam SP 1900 spectrometer). Phosphorus was determined by the colorimetric molybdate method (Fiske and Subbarow, 1925), molybdenum with the tiocyanate method of Czuba et al. (1970).

The tannin content in defatted samples was estimated by a spectrometric method (Tyczkowska, 1977). Glucosinolates were determined using a semi-quantitative glucose test according to the Polish Standard (1990).

The isothiocyanate level was estimated by gas chromatography (Polish Standard, 1986) and expressed as isobuthylthiocyanate. Fatty acids were analysed by gas chromatography (Siemens, Model L 102) of methyl esters (Matyka, 1976), carotene and xantophyll contents according to Roche (Keller, 1988). The phytate level was assayed by the Oberleas method (1971).

Standard deviations of average values were calculated.

RESULTS AND DISCUSSION

The chemical and amino acid composition of LG-rape seed are presented in Table 1. The results were similar to those obtained 10 years ago by Kinal and Króliczek (1981) for Polish LG-rape seed varietes, Start, Janpol and Vipol. The investigated LG-rape seed contained higher level of fat and lower level of crude fibre in comparison with Canadian full fat Canola, Candle and Tower seeds (Nwokolo and Sim, 1989; Sibbald, 1986). The amino acid composition of rape seed protein was generally similar to the composition of solvent extracted Canola meal protein (Allen, 1990).

The fatty acid composition of the rape seed (Table 2) confirmed that the analysed seed samples originated from low erucic varieties. The erucic acid content ranged from 0.42 to 2.28% of total fatty acids. The high levels of polyunsaturated fatty acids, linoleic and linolenic acids, may indicate the high nutritive value of the lipid fraction of the investigated seed. Drozdowski et al. (1990) obtained a similarly low erucic acid content (0.2 – 2.0%) in Polish low glucosinolate rape seed.

The lipid fraction of rape seed also contains compounds which colour poultry carcasses and eggs. The carotene and xanthophyll contents, determined in a pooled representative sample of the analysed material, were 2.1 and 18.4 mg/kg, respectively. Similar data concerning the xanthophyll content in

TABLE 1

Chemical and amino acid composition, % of dry matter

Indices	Mean	SD
Chemical composition (n = 33)		
Dry matter	93.7	0.80
Crude protein (N × 6.25)	23.3	1.08
Crude fat	44.8	1.32
Crude fibre	7.14	0.46
Ash	4.35	0.22
Amino acids (n = 11)		
Aspartic acid	1.82	0.08
Threonine	1.03	0.03
Serine	1.00	0.04
Glutamic acid	4.39	0.31
Glycine	1.26	0.06
Alanine	1.06	0.05
Cystine	0.61	0.04
Valine	1.04	0.14
Methionine	0.48	0.03
Isoleucine	0.92	0.06
Leucine	1.66	0.09
Tyrosine	0.60	0.03
Phenylalanine	0.91	0.05
Lysine	1.65	0.10
Histidine	0.73	0.04
Arginine	1.54	0.08
Tryptophan	0.25	0.02

TABLE 2

Fatty acids content, % of total fatty acids

Acids	Mean	SD
C 14 : 0 – Myristic	0.09	0.02
C 16 : 0 – Palmitic	5.58	0.24
C 16 : 1 – Palmitoleic	0.39	0.04
C 17 : 0 – Margaric	1.29	0.71
C 18 : 0 – Stearic	1.89	0.19
C 18 : 1 – Oleic	56.9	0.63
C 18 : 2 – Linoleic	20.3	0.82
C 18 : 3 – Linolenic	10.4	0.52
C 20 : 1 – Eicosenoic	1.57	0.24
C 22 : 0 – Behenic	0.32	0.15
C 22 : 1 – Erucic	1.01	0.66
others	0.16	0.14

TABLE 3

Mineral content (mean of 11 samples) including heavy metals (mean of 22 samples), g or mg per kg dry matter

Elements	Mean	SD
g		
Ca	3.84	0.32
P	7.83	0.81
Mg	2.60	0.21
Na	0.08	0.02
K	8.27	0.52
mg		
Fe	111.4	21.8
Zn	54.0	7.13
Mn	42.5	5.89
Cu	3.12	0.30
Ni	1.94	0.95
Co	0.54	0.05
Mo	0.75	0.12
mg		
Pb	1.36	0.22
Cd	0.24	0.06

full–fat Canola seed (19.2 mg/kg) were reported by Blair and March (1989).

Macro- and microelements as well as the heavy metals content in rape seed are shown in Table 3. A similar mineral content of full fat Canola seed was reported by Nwokolo and Sim (1989). Also data outhe mineral content of solvent extracted Canola meal presented by Allen (1990) were generally similar to ours after recalculating both sets of results on fat free matter.

Lead and cadmium contents in rape seed were higher than in cereal grain (Matyka et al., 1990), still however below the permitted content for these toxic elements in complete feeds – Cd 0.5 mg/kg; Pb 5 mg/kg (Harenza et al., 1988).

The level of antinutrients (Table 4) – tannin, isothiocyanate and phytate – were rather low and characteristic for low glucosinolate rape seed. The

TABLE 4

The content of antinutritional factors (mean of 11 samples), % of dry matter

Antinutrients	Value range	Mean	SD
Tannin	0.90 – 1.33	1.07	0.11
Isothiocyanate	0.0026 – 0.0498	0.0228	0.016
Phytate	1.54 – 2.24	1.93	0.233
Phytic phosphorus	0.436 – 0.635	0.546	0.066

glucosinolate content, estimated by the glucose test, was low and did not exceed 25 μmol/g of defatted matter in all of the investigated samples. A rape seed tannin level in excess of 1% is indicative of possible diminished protein digestibility. Removal of the hull which accumulates tannin and fibre can be efficient but is an expensive method for improving the nutritive value of LG-rape seed (Żernicki, 1980). The phytate level amounted to 2%. Phytic phosphorus, poorly utilized by young monogastric animals (Matyka et al., 1990a), comprised 69.7% of the total phosphorus content.

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STRESZCZENIE

Skład chemiczny niskoglukozynolanowych nasion rzepaku, uprawianego w północno-wschodniej części Polski

W 33 próbach nasion rzepaku niskoglukozynolanowego (głównie odm. Bolko), pobranych w Wytwórni Pasz w Wyszkowie, oznaczono zawartość podstawowych składników pokarmowych, w 11 zbiorczych próbach (po 3) – skład aminokwasowy, zawartość makro- i mikroelementów oraz związków antyżywieniowych i kwasów tłuszczowych, w 22 próbach – zawartość ołowiu i kadmu.

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