Pakistan J. Sci. Ind. Res., Vol. 30, No. 2, February 1987

COMPARISON OF VARIOUS FRACTIONS OF MUSTARD AND RAPE SEEDS FOR THEIR AMENABILITY TO DETOXIFICATION

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(Received November 27, 1985; revised September 29, 1986)

Sixteen varieties of mustard and rapeseeds were subjected to air classification after crushing. The hull fraction to kernel fraction ratio in *Brassica juncea, Brassica campestris* and *Brassica napus* varieties ranged from 11:89 to 28.6: 71.4. Moisture and fibre contents were higher in the hull fraction whereas protein, oil and allyl *iso*thiocyanate were mainly stored in the kernel fraction.

Key words: Mustard/rape seeds, glucosinolate, dehulling.

INTRODUCTION

The importance of utilizing mustard and rape seed cake as supplementary protein source in food and feed has received considerable importance in the recent years. The primary factor which limits the extended use of mustard and rapeseed cake is the presence of toxic and antinutritive factors, i.e. glucosinolates [1], phytic acid [2] and hulls [3]. The presence of hulls contributes to bitterness, colour and high fibre content. Dehulling of mustard and rapeseeds and separation of kernel fraction and hull fraction have been rarely practised in oil mills. Macfarlane *et al.* [4] and Macfarlane and Harris [5] separated the hull and kernel fractions of rapeseed by aqueous separation and aqueous fractionation respectively. Whole seed were boiled in water followed by filtration and grinding the seeds in mortar or a vertical plate mill. The ground seeds were suspended in water; the hull fraction, being lighter, was separated by decantation. The dehulling characteristics and nutritive values of various low and high glucosinolate mustard and rapeseed varieties have been reported by Herget, Leslie *et al. and Sarwar et a*l. [6-9].

Keeping in view our programme for "Detoxification of Mustard Seed Cake", the present studies were initiated to determine the kernel to hull ratio and the proximate composition of different seeds, seed fractions with respect to protein, allyl *iso*thiocyanate, and oil etc.

MATERIALS AND METHODS

Dehulling of seeds. 500 g of seeds were steamed at 5 kg/sq. cm in a partially covered stainless steel bucket (10 litre) for 15 min. The wet seeds were spread on trays 1X2.5' dried in an oven at 80 ± 2 for an hour and passed through a hand-mill to crack the hulls. The crushed seeds were allowed to fall from a hole in the centre of a drum (size, length: 90 cm, dia.: 50 cm, open on both sides) and were subjected to air draught at right angle. The hull fraction being lighter was blown away at distance and the kernel fraction settled in the form of a heap due to the difference in their particle size and rate of fall.

Mustard and rapeseeds crushed and passed through 22 mesh sieve were used for proximate analysis. Hull fraction and kernel fraction obtained after air classification were treated in a similar way. The moisture, protein, oil, ash and fibre contents of mustard and rapeseeds, kernel fraction and hull fraction were determined according to AOAC methods [10].

Moisture content. 2-3 g of the sample was kept at 100 ± 5.0 in an oven for 20 hr.

$$\% \text{ Moisture} = \frac{\textit{Loss in weight of sample}}{\text{weight of sample}} \times 100$$

Protein. Nitrogen was estimated by a micro-Kjeldhal method using K_2SO_4: $CuSO_4$: SeO_2 (9:1:0.02) mixture. A factor of 6.25 was employed for conversion of nitrogen into protein.

Oil. The oil present in the sample was extracted in a Soxhlet extractor, using n-hexane as solvent.

Crude fibre. Crude fibre was estimated by the Hemberg Acid-Alkali method.

Volatile allyl isothiocyanate. Volatile allyl *iso*thiocyanate was estimated by the method of Wetter (11).

RESULTS AND DISCUSSION

Brassica juncea, B. campestris and *B. napus* seeds were found to contain 11-18 %, 13-28.6 %, 17.5-25 % of hull fraction and 82-89 %, 71.4-87 %, 75-82.5 % of kernel fraction respectively. (Tables 1-3). The protein contents of Brassica seeds, kernel fraction and hull fraction were 23.5-35.4 %, 26.6-38.7 % and 14.0--23.3 % respectively. The oil contents of seeds, kernel fraction and hull fraction varied from 32.9 to 46.1 %, 36.4 to 51.1 %, 11.3 to 23.9 %, maximum being in kernel fraction and minimum in hull fraction. Allyl *iso*thiocyanate contents of seeds, kernel fraction and hull fraction ranged between 0.22-1.3 %, 0.23-1.59 % and 0.1-51 % respectively. Allyl *iso*thiocyanate contents of *B. napus* seeds ranged from 0.22 to 0.59 %. B. napus contains large amounts of progoitrin in comparison with glucosinolates which form *iso*thiocyanate but this study was carried out with the main objective of ascertaining the amount of allyl *iso*thiocyanate in the seeds of Brassica species. Thus only allyl *iso*thiocyanate was estimated. The amount of crude fibre varied between 4.8-9.3 %, 2.2-8.2 % and 12-22.6 % in seeds, kernel fraction and hull fraction. The moisture contents of the seeds, kernel fraction and hull fraction ranged between 3.5-9.7 %, 2.0-6.1 % and 4.7-11.2 %, the maximum being in the hull fraction and the minimum in the kernel fraction. All varieties of *Brassica juncea* and *B. campestris* from Sind contained more kernel fraction, protein and allyl *iso*thiocyanate than those from NWFP, Punjab or Sind. The variation in the proximate composition of *Brassica* seeds from the different regions appears to be due to the influence of soil and climatic conditions [12]. The sulphur contents of the soil samples collected from Sind were reported to be higher than those of the Punjab or NWFP [13]. The higher amount of allyl *iso*thiocyanate in Brassica seeds from Sind seems to be due to the higher amount of sulphur in the Sind soil.

It is evident from the results (Tables 1-3) that moisture and fibre contents were higher in hull fraction as compared to the kernel fraction of mustard and rapeseeds. However, protein, oil and allyl *iso*thiocyanate were mainly stored in kernels. Dehulling of the seeds increased the protein contents of the kernel fraction which was accompanied by a decrease in the fibre contents. These results are in accordance with the findings of Macfarlane and Harris [5]. Thus dehulling of the seeds followed by detoxification of the kernel fraction would yield a low fibre, protein rich meal suitable for use in poultry rations. The hull fraction containing higher amounts of fibre, tannins [15] and 14-19 % protein could be used as animal feed.

Table 1. Proximate composition of *Brassica juncea* seeds, kernels and hulls.

Local Name	Region	Kernels %	Hulls %	Moisture %			Protein %			Fat %			Crude fibre %			Allyl *iso*thiocyanate %		
				S	K	H	S	K	H	S	K	H	S	K	H	S	K	H
Poorbi Raya (1970-71)	Punjab	82.0	18.0	4.4	4.0	6.2	27.3	30.0	17.9	36.5	40.1	15.3	6.1	5.2	17.0	0.78	0.94	0.21
Poorbi Raya (1971-72)	"	82.5	17.5	4.6	4.4	6.6	28.3	31.4	17.9	32.9	36.4	17.6	6.2	5.2	18.6	0.92	1.03	0.22
RL-18 (1971-72)	"	83.0	17.0	9.7	3.8	7.3	28.1	29.8	17.5	38.3	43.1	15.0	5.2	3.7	14.0	0.66	0.82	0.24
RL-18 (1971-72)	N.W.F.P	84.7	15.3	5.4	5.1	8.9	23.5	26.6	15.2	45.2	50.1	22.3	5.1	3.5	19.1	0.59	0.70	0.31
S-9 (1971-72)	Sind	83.3	16.7	5.3	3.3	6.2	28.8	31.0	19.2	40.6	45.2	18.4	4.9	2.9	14.9	0.74	0.88	0.19
Dacca Rai	"	89.0	11.0	5.2	4.1	6.9	35.4	37.8	17.5	34.9	38.3	19.1	6.1	4.0	20.4	1.03	1.08	0.43
R-4	"	87.0	13.0	5.1	4.8	6.7	32.6	36.4	16.1	37.3	41.6	15.1	5.6	4.2	21.0	1.11	1.31	0.18
R-5	"	86.0	14.0	5.3	5.5	6.4	32.9	35.4	18.2	35.2	38.2	11.5	6.1	4.2	21.1	1.24	1.49	0.43
R-13	"	86.0	14.0	5.4	4.8	7.3	34.3	37.9	14.0	37.2	41.3	18.1	6.7	4.9	21.2	1.15	1.42	0.26

S = Seeds, K = Kernels ; H = Hulls

Table 2. Proximate composition of *Brassica campestris* seeds, kernels and hulls.

Local Name	Region	Kernels %	Hulls %	Moisture %			Protein %			Fat %			Crude fibre %			Allyl *iso*thio-cyanate %		
				S	K	H	S	K	H	S	K	H	S	K	H	S	K	H
Toria "A" (1971-72)	Punjab	81.0	19.0	6.0	4.9	9.6	28.7	31.5	18.6	36.5	46.8	18.7	4.9	2.2	17.2	0.70	0.91	0.12
Toria "A" (1971-72)	"	83.0	17.0	7.0	5.7	11.2	25.4	27.1	18.5	43.5	48.4	21.8	8.5	4.9	21.4	0.38	0.43	0.31
Local Sarson (1971-72)	Sind	71.4	28.6	4.5	3.2	7.6	27.4	30.2	22.5	32.2	39.5	19.3	9.1	5.7	18.7	0.62	0.71	0.28
Toria Selection (1971-72)	"	75.0	25.0	3.7	2.0	5.2	25.8	27.2	14.4	40.6	48.8	13.3	4.8	2.7	12.0	0.42	0.65	0.18
Yellow Rape (1971-72)	"	81.1	18.9	5.8	5.3	8.8	31.6	34.1	19.0	33.7	38.1	11.3	7.7	3.2	22.6	0.5	0.66	0.36
Local Sarson	"	84.0	16.0	5.1	4.8	6.4	31.7	38.7	18.6	35.1	40.0	18.4	6.9	4.9	20.1	1.16	1.19	0.51
Tara Mera	"	87.0	13.0	5.7	4.1	7.1	35.4	37.1	17.2	35.1	38.2	18.4	5.9	4.0	20.8	1.3	1.59	0.13

S = Seeds, K = Kernels; H = Hulls.

Table 3. Proximate composition of *Brassica napus* seeds, kernels and hulls.

Local Name	Region	Kernels %	Hulls %	Moisture %			Protein %			Fat %			Crude fibre %			Allyl *iso*thio-cyanate %		
				S	K	H	S	K	H	S	K	H	S	K	H	S	K	H
B.S.A. (1970-71)	Punjab	82.5	17.5	7.4	6.1	9.7	26.6	29.3	14.3	39.8	45.2	19.6	9.3	8.2	12.9	0.59	0.72	0.23
Gobi Sarson	"	78.8	21.2	9.4	5.8	8.9	27.5	29.6	15.2	40.0	47.3	18.8	7.2	4.1	18.6	0.43	0.47	0.27
Brassica napus (1971-72)	Sind	75.0	25.0	3.8	2.3	4.7	27.4	29.5	23.3	36.8	42.6	20.7	7.4	4.4	17.1	0.22	0.23	0.10
PR-7	N.W.F.P	82.2	17.8	5.9	5.1	9.3	24.7	27.8	16.5	46.1	51.1	23.9	6.1	3.8	18.6	0.26	0.31	0.12

S = Seeds, H = Hulls; K = Kernels

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