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CHEMICAL COMPOSITION OF *BRASSICA* OILSEED MEAL

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The nutritional composition and glucosinolate content of *Brassica* oilseed meal were determined and compared with soybean meal. The latter contained more crude protein (47.5%) than the former (38.3%). However, *Brassica* protein scored higher than soya protein when compared with whole egg protein. Iso-leucine was the limiting amino acid in *Brassica* protein, while methionine and cystine were deficient in soya protein. Although *Brassica* meal contained better quality protein, the presence of glucosinolates (0.9 to 5.6%) impedes its efficient utilization *Brassica napus* cv. 'Tower' was found better in this respect and its meal could be used as a good protein supplement in livestock rations.

Key words: Utilization, Brassica meal, Livestock feed.

Introduction

Mustard *Brassica juncea (L.)* C zern. 8 coss) and oilseed rape *(B.napus L.* and *B Carinata A)* are important cash crops grown in Pakistan. They serve as a good domestic source of vegetable oil and protein. The growing demand for edible oils in the country have greatly changes the prospects of these crops. Both the area and production of these cultivars have been increased in the past few years. The area occupied by mustard and rapeseed in 1983-84 was 0.31 million ha. as compared to 0.35 million ha in 1985-86. Likewise, the production was increased from 0.22 million tonnes in 1983-84 to 0.25 million tonnes in 1985-86 [1]. Current estimates (1986-87) are also up than the previous years [2]. This reflects that *Brassica* oilseed cultivars are becoming popular among our farming community. It is in our national interest to exploit and utilize these cultivars for both food and feed purposes.

Brassica oilseed meal is rich in protein and can be used as a protein supplement in livestock feed. However, the presence of glucosinolate in *Brassica* meals is one of the important factors affecting their utilization as livestock feed [3,4]. Recently low glucosinolate and high yielding cultivars have been introduced in the country. It is imperative now to evaluate these cultivars with respect to their nutritional composition and anti-nutritional factor so as to utilize their meals more efficiently in livestock rations. With this aim work on three important *Brassica* cultivars grown in NWFP is reported in this paper. These informations are of interest for those involved in animal production.

Materials and Methods

Three important *Brassica* species that is *B. Juncea* (cv. 'Porrbiraya'). *B. napus* (cv. 'Tower') and *B. Carinata* (cv. 'G.M. Khan') were collected from Agriculture Research Institute, Ratta Kulachi, D.I. Khan. Defatted crushed seeds (i.e. meal) of each cultivar was analysed for their nutritional composition by the AOAC methods [5]. The crude protein content was estimated by using the factor. N x 6.25. Carbohydrates as nitrogen-free-extract were calculated by difference. Phosphorus and iron were determined by spectrophotometer while calcium and potash by flame photometer. Sulphur was estimated by gravimetric method.

For amino acid analysis 75 mg defatted meal sample was first hydrolysed with 6 N Hcl in evacuated pyrex tubes at 105° for 24 hr. Then the acid was removed and the amino acid composition of the protein hydrolysate was determined by ion-exchange chromatography [6,7] using three buffers systems. Tryptophan was estimated by colorimetric method [8].

Glucosinolates in meals were determined by titrating the enzyme liberated acids against standard NaOH solution [9]. Each determination was replicated thrice, and a randomized block design was used for the statistical analysis of the data [10].

Soybean *(Glycine max* L. cv.' Lee) was also analysed by similar methods for the purpose of comparison . Duplicate determinations for each parameter were carried out and the average is reported herein.

Results and Discussion

The results (Table 1) indicate that *Brassica* oilseed meal contained 35.8% to 41.5% crude protein and 35.3 to 45.1% carbohydrates. Significant (P = 0.05) variations in the content of both these nutrients were found among the three cultivars. *Brassica juncea* had the highest crude protein content, but lower amount of carbohydrates, while the reverse was true for *B.carinata. Brassica* meal proved to be a good source of calories like soybean meal, though the latter contained more protein than the former.

The ash content of *Brassica* meal ranged from 6.7% in *B. carinata* to 7.5% in *B. juncea.* Although there was no significant difference in the ash content among the three cultivars, significant variations existed in the distribution of the individual mineral elements. Phosphorous, calcium and potash contents were higher in *B. juncea* than the other

TABLE 1. NUTRITIONAL COMPOSITION OF *BRASSICA* SEED MEAL AND SOYBEAN MEAL.

Nutrients* (Dry matter %)	B. Juncea Cv.'porrbi-raya'	B. napus cv'Tower'	B. carinata cv.'G.M. Khan'	Mean ± SE	Soybean meal cv. 'Lee'
Crude protein	41.5a	37.6b	35.8c	38.3 ± 0.42	47.5
Crude fat	4.1a	3.8a	3.2b	3.7 ± 0.15	2.5
Crude fiber	11.6a	10.7b	9.2c	10.5 ± 0.32	7.2
Ash	7.5a	7.0a	6.7a	7.1 ± 0.28	6.2
Carbohydrates	35.3a	40.9b	45.1c	40.4 ± 0.76	36.6
Phosphorus	1.5a	1.1b	0.5c	1.2 ± 0.05	0.7
Calcium	0.8a	0.7b	0.5c	0.7 ± 0.02	0.5
Potassium	1.2a	0.9b	1.1a	1.1 ± 0.03	0.8
Sulphur	0.9a	1.2b	0.7c	0.9 ± 0.04	0.4
Iron (mg/kg)	0.6a	0.8b	0.5a	0.6 ± 0.03	0.3
K.Calories**	344a	348a	353a	348 ± 5.7	359

* Each value is the average of three determinations. In a given row values of each variable within *Brassica* cultivars followed by the same letter are not significantly different at a probability level of 5% (P = 0.05).
** Calculated by multiplying the sum of crude protein and carbohydrates by 4.0 and that of crude fat content by 9.0.

TABLE 2. AMINO ACID COMPOSITION OF *BRASSICA* SEED MEAL AND SOYBEAN MEAL

Amino acids* (g/100g protein)	*B Junncea* Cv. 'Porrbbi-raya'	*B. napus* Cv.'Tower'	*B. Carinata* Cv.'G.M.Khan'	Mean ± S.E	Soybean meal Cv. 'Lee'
Essential					
Lysine	5.8a	5.5a	6.1a	5.8 ± 0.25	6.2
Methionine	1.5a	1.8b	1.9c	1.7 ± 0.02	1.4
Threonine	4.7a	4.3b	4.5a	4.5 ± 0.06	3.8
Leucine	6.2a	6.5a	7.0b	6.6 ± 0.12	7.5
Iso-Leucine	3.5a	3.7a	4.2b	3.8 ± 0.08	4.5
Phenylalanine	3.8a	4.1b	3.5b	3.8 ± 0.06	4.2
Histidine	2.6ab	2.4a	2.8b	2.6 ± 0.07	2.2
Valine	4.7a	5.2ab	5.6b	5.2 ± 0.15	5.0
Arginine	6.0a	5.6ab	5.2b	5.6 ± 0.19	6.2
Tryptophan	1.1a	0.9b	1.3c	1.1 ± 0.04	1.2
Total:	39.9	40.0	42.1	40.7	42.2
Non-Essential					
Alanione	3.7a	4.0ab	4.6b	4.1 ± 0.18	4.3
Aspactic acid	6.6a	6.0a	8.0b	6.9 ± 0.21	10.2
Glutamic acid	17.1a	16.2a	17.8a	17.0 ± 0.65	20.0
Glycine	6.2a	4.5b	4.0b	4.9 ± 0.17	4.2
Proline	6.2a	6.5a	5.8a	6.2 ± 0.23	-
Serine	4.3a	3.8b	3.5b	3.9 ± 0.11	5.5
Cystine	2.5a	2.3a	2.0b	2.3 ± 0.05	0.8
Tyrosine	-	2.6a	3.0a	2.8 ± 0.13	1.5
Total:	46.5	45.9	48.7	47.1	46.5
Chemical score:	44.0	46.0	52.0	47.0	34.0

* Each value is the average of three replicates. In a given row values of each variable within *Brassica* cultivars followed by the same letter are not significantly different at probability level of 5% (P = 0.05). Protein recovery in all the samples varied from 86 to 91%.
** Based on the most deficient amino acid with reference to whole egg protein (12).

TABLE 3. VITAMIN CONTENT OF *BRASSICA* (RAPE SEED) MEAL COMPARED WITH SOYBEAN MEAL

Vitamins (mg/kg)	Rape seed meal (Dried)	Soybeanmeal (Dried)
Thiamin	5.2	4.5
Riboflavin	3.7	2.9
NIacin	160	29
Biotin	0.9	0.3
Pantothenic acid	9.5	16
Folic acid	2.3	1.3
Choline (g/kg)	6.7	2.8

* Bell (11), genotype not recorded

TABLE 4. GLUCOSINOLATE CONTENT OF *BRASSICA* SEED MEAL

Cultivars	Total glucosinolates (Dry matter %)
B Juncea (vc. 'Porrbiraya')	5.6
B Napus (cv. 'Tower')	0.9
B. Carinata (cv. 'G.M. Khan')	4.5
Literature values (9)	
Canadian Rapeseed meal*	0.6 - 1.0
Pakistani "	4.1
Indian "	3.1
French "	3.4
German "	2.4

* Cultivars not recorded: glucosinolate determined by the same titrimetric method as used in the present study

cultivars. While the sulphur and iron contents of *B. napus* were higher, it contained the least amount of potash as compared to the other two cultivars. *Brassica* meal. was a better source of mineral matter than soybean meal. It contained phosphorus, sulphur and iron in twice the amount present in soybean meal.

As found in this study, Vermorel *et. al* [3] also reported variation in the protein content of defeated meals of two *B. napus* cultivars. They observed 37.8 to 38.9% crude protein on dry matter basis. In an other study [11] protein content as higher as 42.8% was also recorded. These observations suggest that *Brassica* meals can serve as a good protein and mineral supplement in livestock feed.

The amino acid profile of *Brassica* protein (Table 2) shows that it contained all the essential amino acids. Differences in the content of some amino acids among the three. When compared with whole egg protein [12]. *Brassica* meal was found to be deficient in iso-leucine. On the other hand, soybean protein was deficient in sulphur-containing amino acids (methionine and cystine). Bassed on the most deficient amino acids the chemical score of *Brassica* protein was higher than that of soybean protein. Among the three *Brassica* cultivars, the protein of *B.carinata* scored higher as

compared to other cultivars. This was expected since *B.carinata* contained significantly more iso-leucine than the other two cultivars. Since both *Brassica* and soybean meals contained fairly good amount of lysine, while it is most deficient in cereals [13], these meals can balance the essential amino acid content of cereal-based poultry feed.

Glucosinolate content of the three *Brassica* meals (Table.3) indicate that *B. napus* (cv. Tower) contained the least amount of glucosinolates, that is 0.9% compared with 4.5% in *B. carinata* (cv. G.M. Khan) and 5.6% in *B. juncea* c.v. porrbiraya. These results are in fair agreement to the earlier reported values [9] of *Brassica* (rapeseed) meal, whose genotype was unknown (Table 3).

From the preceding it can be concluded that *Brassica* oilseed meal is a good source of protein and mineral matter, but the presence of glucosinolate in its meal adversely affect its utlization. Hence it is recommended that detoxified meal should be used and the cultivation of low glucosinolate *B. napus* cv. Tower should be encouraged.

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