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Amino Acid Composition of Cumin Seed (*Cuminum cyminum* L.)

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ABSTRACT

The crude protein, true protein, non-protein nitrogen and amino acid composition were determined in cumin seeds supplied by Bulgaria, Egypt and Turkey for two seasons. The Bulgarian cumin showed the highest content of crude protein (23%) whereas the Egyptian seeds contained the lowest percentage (18%). Generally, 18 amino acids were identified in all cumin seeds of which eight were essential amino acids. The biological value of the protein was calculated. The first limiting amino acid was tryptophan.

INTRODUCTION

Cumin is one of the most widespread spices in the world. Its fruits are characterised by a high concentration of minerals, fixed oil, carbohydrates, protein and essential oil. The fixed oil content ranges from 10% to 22%, protein 15% to 25% and essential oil 4% to 6% (Georgiev *et al.*, 1971; Shankaracharya & Natarajan, 1971; Toghrol & Daneshpelouh, 1974; Orabi, 1977; El-Wakeil *et al.*, 1986).

Flavour and aroma of cumin seeds are ascribed to the essential oil content. The residue remaining after volatile and fixed oils extraction is rich in protein and carbohydrates and can be used as a cattle feed or a source of protein concentrate (Shankaracharya & Natarajan, 1971; Orabi, 1977).

Toghrol and Daneshpelouh (1974) have reported the amino acid composition, free amino acid, total nitrogen and protein nitrogen content of

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Iranian cumin seeds. They found that the cumin seed protein contains 14 amino acids of which five are essential.

The Bulgarian literature lacks information on this problem. So, this work was performed to study the amino acid composition and biological value of Bulgarian, Egyptian and Turkish cumin fruits.

MATERIALS AND METHODS

Sources of cumin seeds

Cumin fruits were supplied by Bulgaria, Egypt and Turkey from 1985 and 1986 crops.

Methods

Total protein
The micro-Kjeldahl technique was followed for determination of total protein content applying the method described by Ermakov *et al.* (1972).

Protein nitrogen (true protein) and non-protein nitrogen
These were determined according to the method reported by Genadiev *et al.* (1968).

Amino acid analysis
Amino acids were determined and identified in defatted material according to the method reported by Pochinok (1976) after acid hydrolysis according to the method of Block *et al.* (1958). The hydrolysate was subjected to the amino acid analyser (AAA-881 of Microtechna Praha).

Determination of tryptophan
The tryptophan was colorimetrically determined according to Miller (1967) at a wavelength of 512 nm. A Specol colorimeter (Carl Zeiss, GDR) was used. A standard curve was plotted using pure tryptophan.

Amino acid score
Amino acid scores of protein were calculated using the FAO/WHO pattern (1973) as follows:

$$\text{Amino acid score} = \frac{\text{mg of amino acid in 1 g of test protein}}{\text{mg of amino acid in the FAO/WHO pattern}}$$

RESULTS AND DISCUSSION

The crude protein content, true protein, non-protein nitrogen and amino acid composition of cumin seeds are shown in Table 1.

Results obtained show that there was a generally slight difference in the crude protein, true protein and non-protein nitrogen content between the crops of 1985 and 1986. Such a difference was negligible in the amino acid composition which falls within the range of the experimental error. The Bulgarian cumin had the highest protein content, whereas the Egyptian seeds contained the lowest percentage; this could be due to the variety and the different local conditions under which the cumin is grown.

Concerning the amino acid composition, results (Table 1) showed that the cumin contained 18 amino acids of which eight are essential amino acids.

TABLE 1
Crude Protein Content, True Protein, Non-protein Nitrogen and Amino Acid Composition of the Cumin Seeds (% DWB)

Amino acids	*Content in cumin seeds (%)*					
	Bulgarian		*Egyptian*		*Turkish*	
	1985	*1986*	*1985*	*1986*	*1985*	*1986*
Crude protein	22·6	23·1	18·6	17·9	19·6	20·4
True protein	21·1	21·5	17·2	16·7	18·1	18·8
Non-protein nitrogen	1·65	1·64	1·43	1·24	1·53	1·65
Amino acids						
Lysine[a]	0·77	0·78	0·76	0·40	0·75	0·49
Histidine	0·29	0·28	0·32	0·25	0·39	0·31
Arginine	0·77	0·84	0·73	0·75	0·72	0·89
Aspartic acid	1·44	1·54	1·43	1·40	1·74	1·39
Threonine[a]	0·38	0·38	0·36	0·40	0·37	0·42
Serine	0·41	0·41	0·37	0·63	0·37	0·62
Glutamic acid	3·02	3·17	2·81	3·17	3·01	3·19
Proline	0·79	0·82	0·66	0·65	0·72	0·53
Alanine	0·61	0·62	0·59	0·47	0·56	0·60
Glycine	0·90	0·90	0·81	1·02	0·89	1·37
Cystine[a]	0·10	0·08	0·06	0·05	0·07	0·07
Valine[a]	0·68	0·72	0·63	0·42	0·67	0·54
Methionine[a]	0·08	0·08	0·05	0·04	0·08	0·05
Isoleucine[a]	0·52	0·53	0·51	0·41	0·53	0·35
Leucine[a]	0·69	0·70	0·62	0·72	0·67	0·70
Tyrosine[a]	0·25	0·25	0·23	0·30	0·26	0·31
Phenylalanine[a]	0·48	0·54	0·47	0·61	0·52	0·68
Tryptophan[a]	0·01	0·01	0·01	0·01	0·01	0·01

[a] Essential amino acids.

TABLE 2
Amino Acid Scores

Amino acids (AA)	*Requirement (g/16 g N) (FAO/WHO, 1973)*	*Bulgarian cumin*				*Egyptian cumin*				*Turkish cumin*			
		Crop 1985		*Crop 1986*		*Crop 1985*		*Crop 1986*		*Crop 1985*		*Crop 1986*	
		AA (g/16 g N)	*AA score (%)*	*AA (g/16 g N)*	*AA score (%)*	*AA (g/16 g N)*	*AA score (%)*	*AA (g/16 g N)*	*AA score (%)*	*AA (g/16 g N)*	*AA score (%)*	*AA (g/16 g N)*	*AA score (%)*
Lysine	5·5	3·40	62	3·37	61	4·08	74	2·23	41	3·82	69	2·40	44
Methionine and Cystine	3·5	0·80	23	0·69	20	0·70	20	0·50	14	0·76	22	0·59	17
Threonine	4·0	1·68	42	1·64	41	1·93	48	2·23	56	1·88	47	2·06	52
Isoleucine	4·0	2·30	58	2·29	57	2·74	69	0·30	8	2·70	68	1·72	43
Leucine	7·0	3·05	44	3·03	43	3·33	48	4·02	57	3·41	49	3·34	49
Valine	5·0	3·00	60	3·11	62	3·38	68	2·35	47	3·41	68	2·65	53
Phenylalanine and Tyrosine	6·0	3·23	54	3·46	58	3·76	63	5·08	58	3·97	66	4·85	81
Tryptophan	1·0	0·04	4	0·04	4	0·05	5	0·05	5	0·055	5	0·04	4

This finding differs from those reported by Toghrol and Daneshpelouh (1974) who found that the Iranian cumin contained only 14 amino acids of which five are essential.

This could be due to the methods applied for the protein hydrolysis or the method used for amino acid determination.

Generally, glutamic and aspartic acids were found in highest amounts in the three kinds of cumin followed by glycine, proline, lysine, arginine and leucine. Methionine and cystine were at the lowest concentrations. It has been reported by Antipov and Kretov (1985) that anis and coriander, which are from the same cumin family (Umbelliferae), are free from proline and contain a little leucine and threonine.

The amino acid composition of the Bulgarian cumin was unchanged during the two years. In the Egyptian and Turkish cumin, the lysine, leucine, histidine, valine and isoleucine decreased in the seeds during the second year (1986). On the other hand the serine, glutamic acid and phenylalanine increased.

From Table 2 it is obvious that the amino acid scores and, accordingly, the biological value ranged from 4 to 70%. The first limiting amino acid was tryptophan and the second was the sum of methionine and cystine.

So, it could be concluded that the cumin protein is of a low biological value; it is useless as a protein source alone and could be useful only if mixed with other sources of protein that supply adequate amounts of methionine, cystine, phenylalanine and tyrosine, since the protein is virtually devoid of these amino acids.

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