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AMINO ACID COMPOSITION OF SOME COMMON SEAWEEDS

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ABSTRACT

The nutritive evaluation of seaweed proteins on the basis of amino acid composition has been reported in the present communication. Seventeen of the common amino acids including almost all essential amino acids have been detected in the protein hydrolysate of eighteen species of seaweeeds. Significant variations were observed in amino acid composition among the different genera of seaweeds. Little variation was noted in total nitrogen and inorganic contents. The acidic amino acids were significantly higher in species of green seaweeds.

Introduction

Exploitation of seaweed resources have attracted the attention of scientists all over the world because of theft possible economical uses in various fields (Qasim et al, 1976). The amino add composition in free or bound form has been studied in detail in several species of marine algae by many scientists; (Schwencke and Landsberger, 1969; Pellegrini and Pellegrini, 1971; Madgwick and Ralph, 1972; Lewis, 1973; Munda and Gubensek, 1976; Mateus *et al.,* 1976; Dave and Parekh, 1978; Margaret and Geyler, 1979). These workers observed pronounced differences between protein and amino acid contents of red, brown and green algae. In addition to evaluation of biomass and chemical composition of some common seaweeds from Karachi Coast (Qasim, 1980, 1981; Qasim and Baikal, 1985; Qasim, 1986; Qari and Qasim, 1988, 1990), the amino acids pool of 18 species were determined in the hydrolysate of dried seaweeds. These species (belonging to the families Rhodophyceae, Pheophyceae and Chlorophyceae) are abundantly found on the coasts of Karachi in winter season. The present work is undertaken to ascertain protein and amino acid composition so as to exploit them for useful purpose in future.

Materials and Methods

Seaweeds were collected from Manora, Bulegi and Paradise point, at low tides during winter season. In the laboratory they were washed to remove extrenous materials, dried, ground to fine powder and were stored at low temperature for analysis.

Total nitrogen was determined by microkjeldhal distillation procedure (Hawk et al., 1954). Total inorganic elements (ash) were determined by ashing the dried seaweed at 550°C for 8 hour (A.O.A.C, 1970). The dry weight was estimated

Table-1

Amino acid composition of red seaweed

	Acanthophora delillii	*Acanthophora specifera*	*Botryocladia leptopoda*	*Gracillaria corticata*	*Hypnea muciformis*	*Sebdania Polydactyla*	*Scinia indica*	*Laurencia nidifica*
Amino acid								
Alanine	82.83	62.51	52.50	24.00	46.20	52.40	63.90	60.20
Glycine	90.80	48.20	4.70	26.00	37.30	42.50	60.50	4.80
Valine	50.00	54.40	40.90	25.80	34.00	43.70	49.70	62.80
Leucine	72.20	65.40	49.30	28.70	50.80	47.80	48.40	68.90
Isoleucine	31.00	34.90	25.40	21.90	34.00	26.30	23.90	46.70
Serine	40.60	31.10	34.80	20.90	33.30	27.70	25.10	39.30
Threonine	82.80	66.70	59.90	34.10	63.40	56.20	72.00	77.90
Cystein	8.60	7.30	11.30	10.20	6.20	14.80	9.70	1.30
Methionine	11.20	15.00	11.50	12.10	13.30	10.30	13.70	16.00
Aspartate	102.70	98.70	85.20	90.60	64.90	112.80	88.20	119.80
Glutamate	110.60	89.20	56.90	42.90	56.90	55.90	90.80	104.60
Lysine	31.10	61.90	26.10	23.30	42.80	33.20	27.10	32.00
Arginine	25.90	32.60	30.90	15.90	30.30	32.90	23.40	22.80
Phenyl alanine	43.20	58.20	48.80	17.70	27.20	63.10	43.20	40.70
Tyrosine	28.30	18.20	17.20	24.50	14.40	29.10	39.20	23.20
Proline	102.40	79.50	68.10	58.50	104.60	102.30	87.70	34.60
Histidine	99.20	167.40	131.60	152.50	128.20	167.40	115.70	109.10
Total nitrogen	3.72	3.39	2.51	2.49	2.92	2.82	1.89	3.87
Total inorganic content	28.65	33.37	31.91	31.75	33.36	32.40	28.29	29.28
Dry weight	90.80	91.20	87.60	89.50	92.10	92.30	88.20	88.90

Amino acids are presented in mg g^{-1}, total nitrogen and total inorganic content in g% dry weight, Dry weight is given in g% of wet weight.)

Table-2
Amino acid composition of brown seaweed

Amino acid	*Lyengada stellellata*	*Padina pavonica*	*Stockeyia indica*	*Sargassium boveanum*	*Spathoglassum variable*
Alanine	67.90	20.70	31.80	16.90	39.80
Glycine	23.60	18.10	29.10	12.60	36.80
Valine	25.80	23.50	34.40	17.00	33.40
Leucine	18.40	23.30	45.30	15.40	44.40
Isoleucine	9.40	16.70	26.60	9.00	30.50
Serine	19.40	15.90	25.50	11.20	28.70
Threonine	19.50	21.50	46.30	23.00	52.40
Cystein	1.80	1.90	3.70	1.60	3.90
Methionine	4.70	3.20	4.40	3.10	2.90
Aspartate	33.10	39.80	51.40	20.00	58.90
Glutamate	23.60	18.11	29.10	12.60	36.40
Lysine	9.90	22.10	34.30	15.00	36.00
Arginine	14.40	12.40	19.80	5.60	19.60
Phenylalanine	27.30	9.24	27.60	11.00	18.20
Tyrosine	2.50	2.80	5.40	4.90	7.20
Proline	46.10	27.40	79.60	31.50	62.40
Histidine	17.50	8.80	9.30	11.20	15.30
Total	3.36	4.49	3.96	3.40	3.35
Total inorganic content	32.89	28.77	29.29	27.00	31.79
Dry weight	87.50	88.80	82.00	87.00	90.00

Amino acids are presented in mg total nitrogen and total inorganic content in g% dry weight, Dry weight is given in g% of wet weight.

Table-3
Amino acid composition of green seaweed

Amino acids	*Caulerpa taufolia*	*Caulerpa racemasa*	*Caulepa faridii*	*Codium lyengaria*	*Ulva lactuca*
Alanine	67.20	63.60	47.60	195.110	94.80
Glycine	56.50	31.00	41.00	147.60	67.00
Valine	63.10	58.00	45.00	144.90	65.10
Leucine	86.40	67.60	57.40	157.10	70.60
Isoleucine	50.30	43.90	33.20	97.50	41.00
Serine	47.50	43.90	35.10	117.10	51.50
Threonine	96.20	72.20	67.10	239.30	91.20
Cystein	3.20	2.5	3.60	5.30	4.80
Methionine	6.40	6.50	8.10	9.90	7.40
Aspartate	97.70	109.90	90.20	295.60	103.80
Glutamate	123.20	94.60	85.40	360.80	103.00
Lysine	57.50	29.50	28.30	92.30	42.50
Arginine	49.50	35.10	46.40	90.50	37.50
Phenylalaninc	49.50	35.10	46.40	90.50	37.50
Tyrosine	27.60	19.20	12.10	60.60	21.80
Praline	142.60	102.40	123.80	186.80	11630
Histidine	5.70	8.20	6.20	10.10	6.00
Total nitrogen	3.08	3.50	4.20	2.44	2.30
Total inorganic content	22.38	24.66	27.81	37.18	20.38
Dry weight	91.00	89.30	93.80	94.30	88.60

Amino adds are presented in mg ([i] total nitrogen and total inorganic content in g% dry weight, Dry weight is given in g% of wet weight.

after drying the seaweed at 70°C for 18 hours in a hot air oven. For amino acid determination a known amount of dried powder samples (approximately 50 mg) was hydrolysed at 105°C in 6 N HCl for 48 hrs, in evacuated sealed tubes. Aliquotes of hydrolyzed samples were analyzed on Beckman, (model 120 C) amino acid analyzer. No tryptophne determinations were made in the present study. Each amino acid is expressed in mg per g of dry seaweed.

Results and Discussion

In all, 17 amino acids have been detected in the protein hydrolysate of seaweeds. These amino acids may occur as combined or in a free state (Munda and Gubensek, 1976; Lewis, 1973; Dave and Parekh, 1978). Tables 1-3 indicate the amino acid composition of 18 seaweed species expressed as mg of each amino acid per g of dry weight. The distribution pattern of these amino acids reveals some pronounced differences among the species of Rhodophyceae, Pheophyceae and Chlorophyceae .

The species of Pheophyceae and Chlorophyceae have higher content of nitrogen (range 3.35 - 4.49 g% and 2.30 - 4.20 g % respectively) than the species of Rhodophyceae (range, 1.8 -3.8 g %). The species of Chlorophycea exhibit significant difference in amino acid composition than the species of other two families. Almost all amino acids except cystein, methionine and histidine were found in higher concentration in Codium iyengaria as compared to other species. The higher concentration of acidic amino acids are found in species of Rhodophyeae and Chlorophyeae than in Pheophyceae. The sulfur containing amino acids are detected in larger amount in species of Rhodophyeae. It is promising to note that amino add lysine, usually deficient in terresterial plants was detected in apperciable amounts in all species of seaweeds studied. The presence of all the essential amino acids in considerable quantities also indicates that the seaweed proteins are nutritionally superier than the terresterial plant proteins.

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