

## Amino Acids Content of Sea Squids

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(Received 28th May, 1991, revised 7th May, 1992)

**Summary:** The protein content and amino acid composition of three species of sea squid *Loligo duvaucellii*, *Symplectotendipes oualaniensis* and *Speciella inermis* were determined very little qualitative and quantitative variation in amino acid profile was found among the various species studied. The essential amino acids were in a good balance compared with the FAO/WHO recommendations. The chemical score was 97 and the first limiting amino acid was valine.

### Introduction

World trade in Cephalopods has increased significantly during the last decade. According to the FAO (Fisheries department data bank) [1]. World Squid landing was, 1,800 thousand tons accounting for almost 80 percent of the total Cephalopod catch. In countries like Japan, Spain, Korea and Italy' squid is much appreciated and utilized in various forms of food mainly as a source of protein. Squid meat is very rich in proteins and all the essential amino acids. It also contains a large percentage of lysine which is essential for growth [2]. On the contrary, in Pakistan squid at present are caught mainly as a bycatch and are generally utilized for making fish meal and fish manure. PCSIR scientists have recently directed their attention to exploit sea squid as a possible source of animal protein and a promising commercial species for the future [3]. This possible source of full value protein food may be exploited and promoted extensively in Pakistan, provided it is preserved efficiently and hygienically after catch on board to ensure a quality product and information on its high nutritional values especially protein are available.

The nutritive value and quality of a dietary protein depends upon the pattern and quantity of amino acids present in it. A number of methods are available for evaluating the protein quality of meats e.g. Protein efficiency ratio (PER), as determined in rat bioassays. [4]. The net protein ratio (NPR), and amino acid score is determined by comparing the amino acid pattern derived from chemical analysis with a reference pattern.

The accepted relationship between the amino acid balance of a protein and its nutritional value may be affected by an amino acid imbalance. The

proportion of total amino acids that must be supplied as essential amino acid (E/ratio) is suggested to be 36.0% of protein (FAO/WHO) [5,6]. The expert work group [7], recommended the use of accurate amino acid composition data as a simple method for assessing the protein quality. The purpose of this study was to determine the protein quality of different species of sea squid, found abundantly in coastal waters of Karachi and to compare it with other commonly available animal proteins.

### Results and Discussion

The total protein (Nx 6.25) Table 1 in different species of squid ranged from 19.28 to 20.17 g/100 g with *Sepiella inermis* and *Symplectotendipes oualaniensis* containing the lowest and highest amount respectively. A total of 18 amino acids were identified in all the three species (Table 1). Similar to protein content, no significant difference was found in the concentration of amino acids in the different species. The major amino acids were aspartic acid, lysine, glutamic acid followed by leucine, serine and arginine in a decreasing order. Cystine, histidine and tryptophan showed the smallest values ranging from 1.53 to 1.1 % of protein. Similar to the finding of this study, Konosu *et al* [8] also reported 17 amino acid which were detected microbiologically in muscle extract of squid. The proportion of total amino acids that must be supplied as essential amino acids (E/T ratio) is proposed to be 36.0% of protein [6].

The E/T ratio of *Symplectotendipes oualaniensis*, *Loligo duvaucellii* and *Speciella inermis* was found to be 43.2, 44.6 and 43.98% respectively,

Table-1: Protein Content and amino acid composition of different species of sea squid

	Symplectonellia qualaniensis	Loligo duvaucell	Sepectiella inermis	Av + SD
Crude Protein (Nx 6.25) g/100 g of squid amino acid (g/100 g of protein)	20.17	19.44	19.28	19.63 ± 0.54
alanine	4.90	4.00	4.50	4.47 ± 0.47
arginine	5.30	5.60	5.00	5.30 ± 0.30
aspartic acid	8.80	8.90	8.90	8.73 ± 0.23
Cystine <sup>a</sup>	1.53	1.20	1.40	1.38 ± 0.18
glutamic acid	8.00	7.90	8.10	8.0 ± 0.10
glycine	3.92	3.82	4.02	3.92 ± 0.10
histidine	1.40	1.70	1.51	1.53 ± 0.13
Isoleucine	4.50	4.50	4.60	4.53 ± 0.07
leucine	7.20	7.90	7.70	7.60 ± 0.40
Lysine	8.20	8.80	8.50	8.50 ± 0.30
methionine <sup>b</sup>	3.52	3.51	3.61	3.54 ± 0.07
phenylalanine	3.90	4.20	4.10	4.06 ± 0.16
proline	5.30	5.10	4.98	5.12 ± 0.14
Serine	6.10	6.00	5.81	5.97 ± 0.16
threonine	5.20	5.00	4.24	4.81 ± 0.18
typtophan	1.20	1.10	1.00	1.1 ± 0.10
tyrosine	5.00	4.90	3.90	4.6 ± 0.70
valine	4.50	4.30	5.8	4.86 ± 0.56
total amino acid	88.47	88.03	87.67	
essential amino acid	38.2	39.31	38.56	
E/T Ratio	43.2	44.6	43.98	

a determined as cysteic acid

b determined as methionine sulphone

which is better than the recommended E/T ratios by FAO/WHO, showing significant nutritive importance of squid proteins. Comparison of essential amino acid content and chemical score of squid with fish, cow milk, hen egg and with FAO/WHO scoring pattern is presented in Table 2. Squid may be considered as a high quality protein source on account of its essential amino acids content and is comparable with other marine fish such as Baltic hearing roe, hen egg and reference pattern. On account of its high lysine content it may, therefore, very well complement cereal proteins which are generally poor in lysine. In squid protein valine the first limiting amino acid gave the score 97.2, whereas all the other amino acids exceeded the respective levels in the reference pattern. In cow milk protein the sulphur containing amino acids gave almost the same score 97.4 whereas chemical scores reported for Baltic hearing roe and Rain bow trout [9] were 80.0 and 90.0 respectively, where

Table 2: Essential amino acid content (g/100 g of protein) and amino acid score of squid, different fish, Cow's milk, hen egg and the FAO/WHO Provisional Scoring Pattern

	Squid <sup>a</sup>	Baltic hearing roe	rain-bow trout	Whole cow's milk <sup>b</sup>	Hen egg	FAO/WHO <sup>a</sup>
Isoleucine	4.53	4.2	4.8	6.51	5.8	4.0
lysine	7.60	7.7	7.9	10.02	8.9	7.0
total sulphur a.d.	8.50	6.3	6.4	7.93	6.7	5.5
cystine	4.92	2.8	6.2	3.40	5.3	3.5
cystine	1.38g	1.3	3.8	0.91	3.0	
methionine	3.54h	1.5	2.4	2.49	2.3	
total aromatic aa	8.66	9.8	10.0	11.14	10.3	6.0
phenylalanine	4.06	4.7	5.1	5.94	6.7	
tyrosine	4.60	5.1	4.9	5.20	3.6	
threonine	4.81	4.7	4.2	4.70	5.1	4.0
tryptophan	1.10	1.6	0.9	1.44	1.5	1.0
valine	4.86	4.9	5.8	7.01	7.5	5.0
amino acid	97.2	80.0	90.0			

a average of 3 species in this study

b Jukkak *et al* (1980)

c M.L. Cr and B.K. watt (1966)

d Sikka and Johri (1979)

e FAO/WHO (1973)

aa amino acid

g determined as cysteic acid

h determined as methionine sulphone

total sulphur containing amino acids and tryptophan were the limiting amino acids.

## Experimental

Duly identified samples of sea squids were procured from Marine Fisheries Department (MFD) Government of Pakistan Fish Harbour, Karachi. Ink sacs were removed and the sample were degutted and minced. The minced meat was dried at 70-80°C to constant weight in a drying oven. The dried material was finely ground to pass through 40 mesh sieve. Crude protein was determined by the standard kjeldhal technique [4].

The amino acids analysis were carried out by cation exchange chromatography process according to the procedure of Spackman *et al.* [10] using Alpha plus LKB Biochrom automatic Amino Acid Analyser. Cystine, cysteine and methionine were determined separately as cysteic acid and methionine sulphone respectively according to the procedure described by Moore [11]. Tryptophan was determine by the spectrophotometric method [12] after hydrolysing with 5 M NaOH. Quantitative analysis of each amino acid was performed by determining the area under each peak on the chart recorder. Amino acid quantities were calculated from 570 nm trace where as the imino acid

(proline) was calculated from 440 nm trace. The instrument was calibrated by analysing the standard mixture of known amount of amino acid. A colour constant (K) was calculated for each amino acid according to the formula.

$$K = \frac{\text{Area below peak}^a}{\text{Nanomoles loaded}}$$

Knowing K for each amino acid, the unknown values were calculated as follows.

$$Y = \frac{\text{Area below peak}^a}{K}$$

a = Height of the peak X width of the peak at 1/2 height; Y = Amount of unknown amino acid.

#### Conclusion

The overall quality of squid protein studied is comparable to the FAO/WHO recommended amino acid pattern of protein and to the egg protein which is also used as reference. Its amino acid composition is also equivalent and may even surpass it. Thus squid meat may be considered nutritionally a perfect source of protein. The squid may be highly appreciated in Pakistan and in other

countries of the world provided such methods of cooking and processing are found that suit the regional habits.

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