

Amino Acids Profiles and Chemical Properties of Four Inferior Sea Fishes in Madura, Indonesia

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Abstract: This study was intended to identify chemical properties and contents of amino acids of four inferior sea fishes in Madura, Indonesia. The studied fishes were 'bibisan' (*Apogon albimaculosus*), 'baji-baji' (*Platycephalidae cymbacephalus*), 'lidah' (*Cynoglossus lingua*) and 'sebelah' (*Psettodes erumei*). The contents of the nutritive substances in the fish products (proteins, ash, and fats) were determined. This study confirmed that in terms of both quantity and quality of the fishes as a significant source of essential amino acids and lysine present in fishes could supplement the corresponding deficiency in plant proteins. The most abundant amino acids in all the fishes were glutamic acid that roles as flavor-enhancing compounds which provide an 'umami' (savory) taste in food.

Key words: Amino Acids Profiles and Chemical Properties of Four Inferior Sea Fishes in Madura, Indonesia.

Introduction

Fish is known to be a source of protein rich in essential amino acids (lysine, methionine, cystine, threonine, and tryptophan)¹, micro- and macroelements (calcium, phosphorus, fluorine, iodine), fats that are valuable sources of energy, fat-soluble vitamins, and unsaturated fatty acids that, amongst other benefits, have a hypocholesterolemic effect (antiarteriosclerosis).^{2,3}

Free amino acids play an important role in physiological functions such as osmoregulation and buffer capacity in the tissues of aquatic animals⁴. Their biological roles have been postulated to include the potent intracellular pH buffer capacity control of enzyme activity⁵, neurotransmitter function⁶, and inhibition of oxidative reactions⁷. There are 20 amino acids that can be found in the human body, 18 of which are important in human nutrition. Eight amino acid cannot be synthesised de novo by humans and other mammals and hence must be supplied in the diet; therefore they called essential amino acids⁸. The essential amino acids are lysine,

methionine, threonine, tryptophan, isoleucine, leucine, phenylalanine and valine. Failure to obtain enough of even one of the essential amino acids results in the degradation of the muscle proteins in the body. Moreover, there is a group of amino acids which are not normally required in the diet but which must be exogenously supplied to specific populations under special conditions, such as intensive growth, stress, or in some disease states. Such amino acids have been classified as semi-essential. This group includes histidine, serine and arginine. The remaining amino acids (alanine, cystine, glycine, aspartic acid, glutamic acid, proline and tyrosine) are synthesised by the organism in sufficient amounts and hence are classified as nonessential amino acids⁹.

A majority of consumers do eat fish, because of its availability, flavor and palatability; while, few do so, because of its nutritional value. Therefore, it can be suggested that taste, size, freshness and other related external appearances should not be the only factors to be considered in making choice for marketing and consumption of the Nile fishes¹⁰.

Therefore, the aim of this study was done to identify contents of amino acids of four inferior sea fishes in Madura, Indonesia.

Materials and Methods

Four inferior sea fishes of this study include 'Bibisan' (*Apogon albimaculosus*), 'Baji-baji' (*Platycephalidae cymbacephalus*), 'Lidah' (*Cynoglossus lingua*), and 'Sebelah' (*Psettodes erumei*), were purchased from the fish market in Talango Island, Sumenep district, Madura, Indonesia.

The determinations of the crude protein and fat, and ash were carried out at the Chemistry and Bio Chemistry Laboratory, Agricultural Product Technology Department, Agricultural Technology Faculty, Jember University, Indonesia. The chemical compositions of all the samples were determined by the following AOAC (2005) procedures¹¹; crude fat, by Soxhlet extraction with benzene; crude ash, by Incineration in a muffle furnace at 500 °C for 8 hours; crude protein (N x 6.25), by the Kjeldahl methods.

Amino acid determinations were carried out at Saraswati Indo Genetech Laboratory Ltd., Bogor, Indonesia. Amino acids in the freeze-dried samples were analysed after acid hydrolysis in 6 N HCl for 22 h at 110°C in glass tubes under nitrogen. Heating is done to accelerate the hydrolysis reaction. Chromatography analysis was carried out using HPLC device, equipped with ion-exchange column and a UV-Vis detector; and post column derivatization with ninhydrin was carried out.

Results and Discussion

The inferior sea fishes investigated in this present study were Bibisan (*Apogon albimaculosus*), Baji-baji (*Platycephalidae cymbacephalus*), Lidah (*Cynoglossus lingua*) and Sebelah (*Psettodes erumei*). They are the popular market fishes in Madura Indonesia belongs to the economically to the various local grades, depending upon consumers' preference in this area. Amino acids were the major elements that had been used in assessing in the nutritional value of the study fishes.

The compositions of the four commercial sea fishes from Madura, Indonesia were shown in Table 1. Crude protein (N x 6,25), total lipids, and ash content of the fishes were 11.459 – 17.460%; 5.118 – 8.242%, and 2.490 – 2.924%, respectively, on a wet-weight basis. The highest lipid content was observed for Bibisan (about 9.461%) followed by Baji-baji, Lidah, and sebelah (8.782%, 6.907%, and 5,261%, respectively). The lowest protein content was determined in the Baji-baji, with a mean value of 11.459%. The most valuable fish with regard to the protein content is Bibisan (17.460%) followed by Lidah and Sebelah (14.117%, and 12.912%, respectively).

Table 1. Chemical characteristics of the four inferior sea fishes in Madura, Indonesia

Species of fish	Protein (g/100 g)	Lipid (g/100 g)	Ash (g/100 g)
Bibisan	17.460 ± 0.135	9.461 ± 0.362	2.576 ± 0.489
Baji-baji	11.459 ± 0.076	8.782 ± 0.120	2.924 ± 0.242
Lidah	14.117 ± 0.131	5.261 ± 0.035	2.598 ± 0.121
Sebelah	12.912 ± 0.204	6.907 ± 0.025	2.490 ± 0.286

To further investigate the quality of proteins in the tested samples, the amino acids composition was determined. The amino acids compositions of proteins in fishes are shown in Table 2. Seventeen amino acids were identified for each fish. Baji-baji contained the highest percentages of amino acids followed by Bibisan, Lidah and Sebelah (20.720%, 18.268%, 18.225%, and 15.991% respectively). The highest amino acid in all the fishes was glutamic that range from 2.014 – 3.218%; while the lowest AA in Bibisan was Histidine (0.408%); while in Lidah, Baji-baji, and Sebelah was serine (0.504%, 0.481%, and 0.316%, respectively). Seven essential amino acids were identified among the total content of amino acids of all the study fishes (Figure 1). Lidah contained the highest percentage of essential amino acids 7.858%, followed by Baji-baji 6.898%, Bibisan 6.897%, whereas Sebelah revealed having the least content 6.604%.

Table 2. Amino acid composition of the four inferior sea fishes in Madura, Indonesia (g/100 g)

Amino acids	Recommended daily intake		Bibisan	Lidah	Baji-baji	Sebelah
	mg/kg body weight	g/70 kg body weight				
Phe +Tyr ^a	12.1	0.85	1.329	1.699	1.709	1.536
Isoleucine	15.7	1.10	0.975	1.121	0.983	1.001
Leucine	9.5	0.67	1.560	1.766	1.566	1.589
Lysine	9.4	0.66	2.345	2.457	1.820	1.756
Met +Cys ^b	12.1	0.85	0.688	0.815	0.820	0.722
Threonine	6.5	0.46	0.722	0.890	0.869	0.626
Valine	11.4	0.80	1.035	1.175	1.063	1.055
Tryptophan	2.9	0.20	-	-	-	-
Σ Essential	79.6	5.59	6.897	7.858	6.898	6.604
Alanine			1.053	1.224	1.034	1.035
Arginine			1.208	1.449	1.465	0.940
Glycine			0.764	0.968	1.122	0.873
Histidine			0.408	0.532	0.554	0.498
Asp. acid ^c			1.915	2.100	1.479	1.301
Glu. acid ^d			3.150	3.218	2.541	2.014
Proline			0.632	0.802	0.719	0.729
Serine			0.484	0.504	0.481	0.316

aPhenylalanine + Tyrosine

b Methionine + Cysteine

c Aspartic acid

dGlutamic acid

f According to Gawedzki J-red. “

The predominant AAs amongst the non essential amino acids were glutamic acid and aspartic acid, and those amongst the essential amino acids (EAAs) were lysine and leucine. Glutamic acid had important roles as flavor-enhancing compounds which provide an umami (savory) taste in food. Lysine, which is severely restricted in cereals, the most important staple food in the world. A reduced supply of lysine in the diet may lead to mental and physical handicaps because it is an important precursor for the *de novo* synthesis of glutamate, the most significant neurotransmitter in the mammalian central nervous system¹². The essential amino acids requirement for adult man weighing 70 kg is about 5.59 g per day¹³. The results indicated that 100 g of all the study fishes, met the daily requirement for essential amino acids.

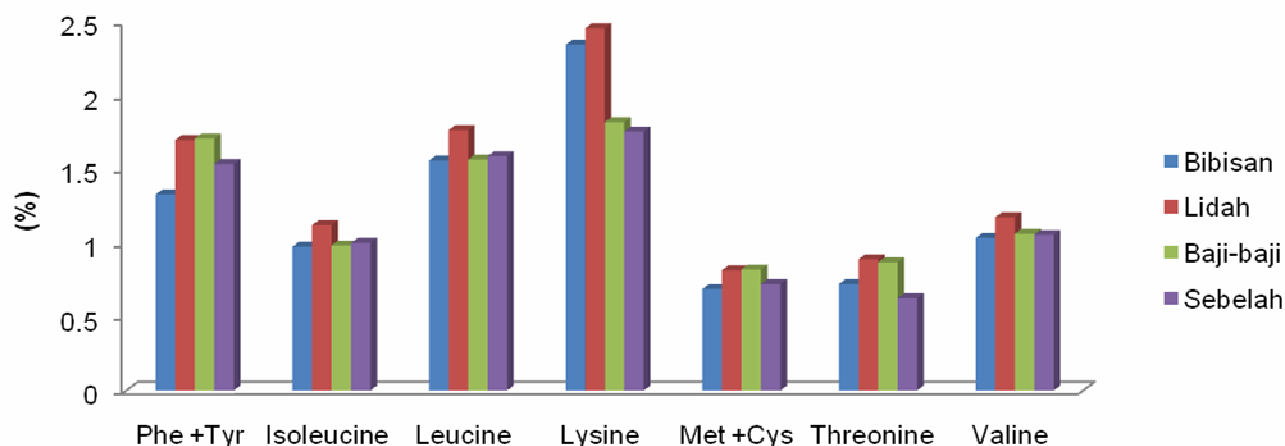


Figure 1. Profiles of Essential Amino Acids

Summarizing the results of this study, four inferior sea fishes from Madura, Indonesia can be conclude to serve as significant sources of essential amino acids, in terms of both quantity and quality. Furthermore, the sulphur-containing essential amino acids in the fishes can supplement the corresponding deficiency in plant proteins.

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