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FATTY ACID AND AMINO ACID COMPOSITIONS OF THE GASTROPODS, *TONNA DOLIUM* (LINNAEUS, 1758) AND *PHALIUM GLAUCUM* (LINNAEUS, 1758) FROM THE GULF OF MANNAR, SOUTHEAST COAST OF INDIA

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Abstract
The amino acid and fatty acid contents of two gastropods viz. Tonna dolium and Phalium glaucum were determined from the Gulf of Mannar. The presences of 7 fatty acids were recorded in both species. The total fatty acid contents in T. dolium and P. glaucum were 7.63% and 6.34 % respectively. PUFA were the dominant fatty acid group, followed by SFA in both the species. For T. dolium, the most abundant fatty acids were, in decreasing order, C18:2ω-6, C18:0, C18:3ω-3, and C16:0 whereas in P. glaucum it were C18:2ω6, C18:3ω-3, C18:0 and C16:0. The total amino acid (TAA) contents of T. dolium and P. glaucum were 19.07% and 17.3% respectively. Among the TAA contents, the percentage of EAA and NEAA in T. dolium and P. glaucum were found to be 9.96%, 8.05% and 9.11%, 9.25% respectively. Methionine (1.40%), phenylalanine (1.31%), isoleucine (1.20%) and leucine (1.20%) in T. dolium and isoleucine (1.24%), methionine (1.12%) and phenylalanine (1.06%) in P. glaucum were determined as the most abundant EAA whereas alanine (1.40%) arginine (1.34%) and glycine (1.18%) in T. dolium and alanine (1.15%) arginine (1.15%) and glutamic acid (1.14%) in P. glaucum contributed as major non-essential amino acids.

Keywords: gastropods, *Tonna dolium, Phalium glaucum*, Fatty acids, amino acids.

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1. INTRODUCTION

Fatty acids are very essential in the physiology and reproductive processes of marine animals and reflect the special biochemical and ecological conditions of the marine environment (Pazos *et al.*, 1996). Fatty acids are major sources of metabolic energy and of essential materials for the formation of cell and tissue membranes (Sargent, 1995). The amount of fatty acid and the proportions of saturated, monounsaturated and polyunsaturated fatty acids in shellfish contribute to a healthful diet (Ersoy and Sereflisan, 2010).
A sufficient quantity of dietary protein is required for growth, survival, and development, reproduction and maintaining good health throughout life. Amino acids play a vital role both as building blocks of proteins and as intermediates in metabolism. Tissue proteins contain 20 different amino acids including essential and non essential of nutritional importance. Both types are indispensable for the nutrition of cells and for normal cell and organ function. Shellfish also provide high quality protein with all the dietary essential amino acids for maintenance and growth of the human body. For this reason, shellfish should be considered a low-fat, high-protein food-one that can be included in a low-fat diet (King *et al*., 1990).
Certain species of class Gastropoda form important groups of marine invertebrates, are consumed throughout the Mandapam coast as food by local fishermen. Two gastropod's species (*T. dolium* and *P. glaucum)* landed in the landing centres of this region as a trawl by-catch was used for the present study. It is of great importance to know the quantity and quality of the nutritional composition of food so as to set diet formulation and to avoid nutritional disorders. No study has been done so far to assess the amino acid and fatty acid composition of these mesogastropods in India. Therefore this study has been performed to investigate the same.

2. MATERIALS AND METHODS

The gastropods were collected from the landing centres of Mandapam (Lat. 9° 17"N; Long.79°. 11"E), the Gulf of Mannar coast of India. Immediately after collecting, they were stored on ice in an insulated box and transferred to the laboratory. Shells of the gastropod samples were removed and only edible portions were used for analysis. The whole body was washed thoroughly to remove any adhered materials and covered with bolting paper to remove excess water. The whole meats were used for the analysis of biochemical composition. Preparation of samples for fatty acid analysis was carried out by drying the pre-weighed wet samples of tissue at 70 °C in a hot air-oven for 24 hours until a constant weight was obtained. After that samples were grounded finely with pestle and mortar. 100-200 mg of finely ground tissue samples were used for fatty acid composition analysis by following the (GC Kashiwagi *et al.*, 1997) method.
Preparation of samples for amino acid analysis was carried out by drying the pre-weighed wet samples of tissue at 60 °C in a hot air-oven for 24 hours until a constant weight was obtained. They were packed in airtight polyethylene covers and kept in desiccators. The oven-dried samples were finely grounded before estimating amino acid profile. Amino acids were estimated in HPLC – Lachrom e merck in SPD- 10A VP Detector.

3. RESULTS AND DISCUSSION

Fatty acid composition

Total fatty acid composition of *T. dolium* and *P. glaucum* are shown in Table 1 and 2 respectively. The total fatty acid contents in *T. dolium* and *P. glaucum* were 7.63% and 6.34 % respectively. The present study showed that the presence of 7 fatty acids in which total polyunsaturated fatty acids [PUFA](3.55%, 3.16 %) were the dominant fatty acids group, followed by total saturated fatty acids [SFA] (3.13%, 2.22 %) and total monounsaturated fatty acids [MUFA] (1.05 %, 0.96%) in both the species.

Table 1. Fatty Acid profile of *T. dolium*

Carbon chain	Fatty acids	% Composition
C16:0	Palmitic	1.11
C17:0	Margaric	0.8
C18:0	Stearic acid	1.22
∑SFA		3.13
C18:0 (n-9)	Oleic acid	1.05
∑MUFA		1.05
C18:2 (n-6)	Linoleic acid	1.99
C18:3 (n-3)	Linolenic acid	1.15
C18:4	Morotic	0.41
∑PUFA		3.55

SFA: saturated fatty acid; MUFA: monounsaturated fatty acid; PUFA: polyunsaturated fatty acid

Table 2. Fatty Acid profile of *P. glaucum*

Carbon chain	Fatty acids	% Composition
C16:0	Palmitic	0.8
C17:0	Margaric	0.52
C18:0	Stearic acid	0.9
∑SFA		2.22
C18:0 (n-9)	Oleic acid	0.96
∑MUFA		0.96
C18:2 (n-6)	Linoleic acid	1.75
C18:3 (n-3)	Linolenic acid	1.09
C18:4	Morotic	0.32
∑PUFA		3.16

SFA: saturated fatty acid; MUFA: monounsaturated fatty acid; PUFA: polyunsaturated fatty acid

As it can be observed from Table 1&2, linoleic (C18:2ω6) (1.99%) and stearic (C18:0) (1.22%) were the dominant fatty acids in *T. dolium* whereas the most abundant fatty acids in *P. glaucum* were found to be linoleic (C18:2ω6) and linolenic (C18:3ω-3).

Amino acid composition

The amino acid composition of the *T. dolium* and *P. glaucum* are given in Fig. 1 & 2. The total amino acid content of *T. dolium* and *P. glaucum* were 19.07% and 17.3% respectively. Total essential amino acids [∑EAA] (9.96 %)

have the highest percentage compared with total nonessential amino acids [∑NEAA] (9.11%) in *T. dolium* whereas in *P.glaucum*, the percentage of ∑NEAA (9.25%) is found to be dominant than ∑EAA (8.05%).

Among the total amino acids, methionine (1.40%), phenylalanine (1.31%), isoleucine (1.20%) and leucine (1.20%) in *T. dolium* and isoleucine (1.24%), methionine(1.12%) and phenylalanine(1.06%) in *P. glaucum* formed as a major EAA. alanine (1.40%) arginine (1.34%) and glycine (1.18%) in *T. dolium* and alanine (1.15%) arginine (1.15%) and glutamic acid (1.14%) in *P. glaucum* contributed as major NEAA. Lysine (0.48%) and proline (0.51%) as EAA and serine and asparagine (0.01% & 0.45%) as non-essential amino acids in both the species showed the lowest concentrations.

The aim of the present study was fatty acid and amino acid composition of the gastropods *T. dolium* and *P. glaucum.* PUFA content of both the species was higher than SFA and MUFA. Murphy *et al.*, (2003) observed that the freeze dried and frozen samples of green lipped mussels of *Perna canaliculus*, among the 30 individual fatty acids, polyunsaturated fatty acids were found to be dominant. Suhendan Mol *et al.*, (2008) recorded the similar observation in the sea urchin roe. Gulsun Ozyurt *et al.*, (2004) observed the similar pattern in cuttlefish.

The majority of marine species are rich sources of long chain PUFA, particularly 22:6 n-3 and 20:5 n-3. The α 3 and α 6 long chain poly unsaturated fatty acids (LCPUFA) contents in brain increased up to at least 2 years of age (Yoshida *et al.*, 1998). In the adult biosystem, an optimal balance between omega-3 and omega-6 fatty acids is likely essential for normal neuronal function, and it has been suggested that the current imbalance in the omega-6 to omega-3 fatty acid ratio.

In marine and estuarine invertebrates amino acids play vital roles as substrates of energy-yielding metabolic pathways, as constituents of proteins, enzymes and hormones, and in intracellular processes of osmotic regulation and buffering of the body fluid. There is also confirmation that certain amino acids are closely involved in reproduction and development (Hochachka and Somero, 1984; Livingstone, 1985).

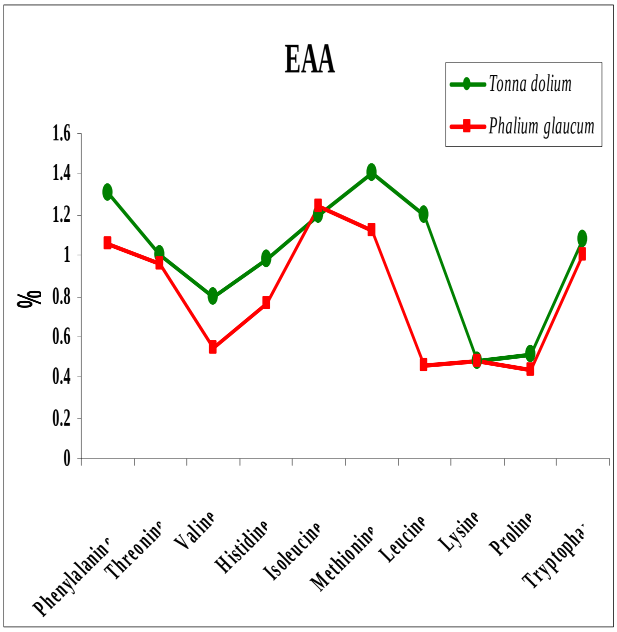

Fig.1. Essential Amino acid composition of *T. dolium* and *P. glaucum* (g amino acid/100g Protein)

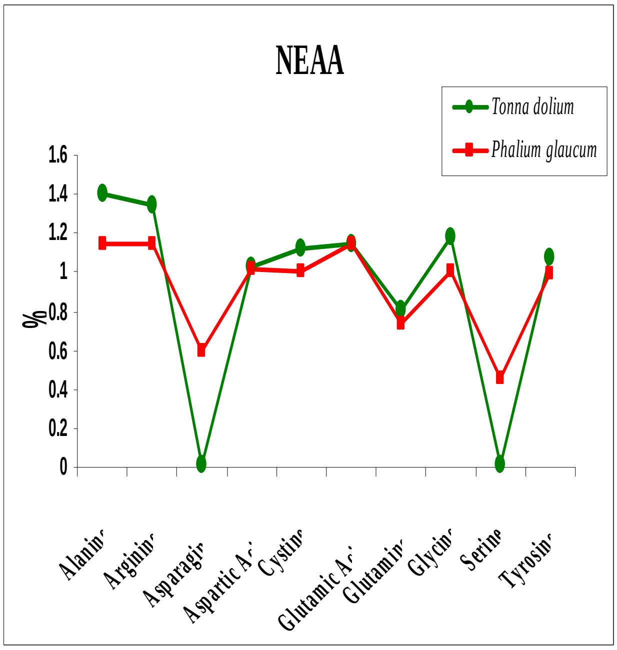

Fig. 2. Non essential amino acid composition of *T. dolium* and *P. glaucum* (g amino acid/100g Protein)

Wesselinova (2000) reported that the amino acid contents of fish vary depending on a variety of factors such as the species, size, seasonal conditions and geographical location. Babu *et al.,* (2009) reported totally 19 amino acids in the mesogastropod of *Bursa spinosa*. In the present study similar result of 20 amino acids were recorded in the mesogastropods of *T. dolium* and *P. glaucum.* Domah *et al.,* (1984) reported that fresh, cooked, and canned mussels are richer in terms of lysine, Methionine, Cystine, Threonine, Phenylalanine, Tyrosine, Tryptophan, and Arginine when compared to those of beef or FAO reference protein.

Comparison between the amino acid composition of the present study and the reference values of FAO/WHO/UNU (1985) showed that most of the amino acids would meet the recommended range of amino acid requirements for children and adults. However, in the present study, lysine (0.48%) and proline (0.51%) as EAA and serine and asparagine (0.01% & 0.45%) as non-essential amino acids in both the species showed the lowest concentrations. Arginine and histidine are particularly essential for children (FAO/WHO/UNU, 1985). The present study showed that the mesogastropod tissues were good sources of both amino acids.

In the present investigation, methionine was recorded as 1.4 and 1.12g/100g protein in *T. dolium* and *P. glaucum* respectively. Seo *et al.,* (1998) recorded the similar methionine content in the myctophid fishes (1.9 – 3.3 g/100g protein). Methionine, phenylalanine, isoleucine and leucine in *T. dolium* and isoleucine methionine and phenylalanine in *P. glaucum* formed as a major EAA and alanine, arginine and glycine in *T. dolium* and alanine, arginine and glutamic acid in *P. glaucum* contributed as major NEAA. Xavier Ramesh (1996) reported in *Chicoreus virginineus* and *Rapana rapiformis* shows that similar observation that Glycine Alanine and Arginine content was remarkably higher then the other amino acids.

The ratio of essential and non essential amino acids in *T. dolium* and *P. glaucum* were 5:4 and 1:1 respectively. Iwasaki and Harada (1985) reported that essential and non essential amino acid ratio of many fish species is 0.70 on average. But this ratio in green tiger shrimp and speckled shrimp were reported to be 0.60 and 0.59 respectively (Yasemen and Mehmet, 2006).

4. CONCLUSION

It could also be added that the consumption of marine gastropods is a nutritional assurance to millions of malnourished hungry people. The malnutrition problem in our country can be overcome by effective utilization of nutrient rich molluscan seafood. Further the presence of 18:3ω3 and 18:2ω6 fatty acids add more value on these mesogastropods species and convince us for the possibility of utilizing them as a human diet. The British Nutrition Foundation has recommended that for a balanced and healthy diet, we should all consume the molluscan species.

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