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ORIGINAL RESEARCH ARTICLE

Fatty Acid and Amino Acid Composition of Marine Eels, *Congresox talabanoides* and *Thyrsoidea macrura* from Parangipettai Coastal Waters

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ABSTRACT

The aim of this present study was to elucidate the biochemical composition of two Marine eels (*Thyrsoidea macrura* and *Congresox talabanoides*) from Annankovil landing centre southeast coast of India. The proximate analysis exposed that the protein content of *T. macrura* and *C. talabanoides* was 22.7%, 25.8%, respectively, the total lipid content was high, ranging from 5.8% and 7.9%, the crude ash ranged from 6.9% and 7.1%. The major amino acids were glutamic acid, histidine and glycine ranging from (0.28 and 4.7%). The other dominant fatty acids detected were C18:1, C18:3, C20:5, and C22:6 ranging from 0.00212 and 24.12% in *T. macrura* and *C. talabanoides*. The level of Arachidonic Acid (AA) in Conger eel was 2.31% and Moray eel was about 2.01. The high levels of Eicosapentaenoic Acid (EPA) and Docosahexaenoic Acid (DHA) content of Moray and Conger eel makes its fatty acid profile more favorable.

Key words: Proximate composition, Amino acid, Fatty acid, Conger and Moray eel.

1. INTRODUCTION

Eels are comes under the order Anguilliformes, which consists of four suborders, 20 families, 111 genera and approximately 800 species. Most of the eels were living as a predatory fish throughout their lifespan. The genus Conger comes under Congridae family. Moray eels are cosmopolitan in nature which is comes under the family Muraenidae. Approximately 200 species in 15 genera are almost exclusively marine, but several species are regularly seen in brackish water and a few Morays (*Gymnothorax polyuranodon*) can sometimes be found in freshwater.

Fish is known to contain certain polyunsaturated fatty acids that can regulate prostaglandin synthesis and hence, induce wound healing [1]. During the last two decades Polyunsaturated Fatty Acids (PUFA) has attracted great interest among scientists for their medicinal and nutritional properties. PUFA have been shown to have positive effects on cardiovascular diseases and cancers [2]. Certain amino acids like aspartic acid, glycine and glutamic acid are also known to play a key role in the process of wound healing [3]. Fish and other marine life forms possess rich in saturated fat and dietary cholesterol that, avoiding excess calories, which can lead to obesity. This remains the basis of the dietary approach to decreasing risk of atherosclerotic vascular disease. Polyunsaturated fatty acids (PUFA) especially DHA has a role in maintaining the structure and functional integrity of fish cells. Studies have shown that Arachidonic Acid (AA) and DHA are present in human milk and health agencies have recommended that infant formulas are supplemented with AA and DHA [4]. Now, Arachidonic acid is produced from certain marine fish, mammals and microorganisms while DHA is obtained from certain coldwater fishes. However, the eel contains high level of fatty acids such as DHA, EPA and amino acids like alanine and glutamine. Thus, this study was carried out to determine the amount of fatty acid and amino acid composition in these two eels.

2. MATERIALS AND METHODS

Sampling Methods

The fresh fish sample of moray and conger eel (*T.macrura* and *C.talabonoides)* purchased from the Annan Kovil fish auction centre (**Fig 1**). The samples were drawn to the laboratory immediately in an ice box *T. macrura* and *C. talabonoides*

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were identified based on Morphometric and Meristic characteristics [5]. The size group of Moray eel and conger was to about the length of 138cm and weighs to about 1.5kg and conger eel to about the length of 58 cm and weighs to about 2 kg was used to determine the biochemical composition. Proximate analysis to determine ash, moisture and crude protein were analysed by Association of the Official Analytical Chemists [6].

Fig 1: Map showing Annan kovil auction centre

Estimation of Moisture

The moisture content of fish tissue was estimated gravimetrically. The initial weight of the samples were taken and dried in an oven at about 105°C for about 8 to 10 hours until a constant weight was reached and cooled in a desiccators and weighed again. The difference in weight was taken as moisture content. The percentage of moisture content was calculated by the following equation:

Percentage (%) of moisture = (weight loss/ original weight of sample) × 100

Estimation of Ash

The ash content of the sample is the residue left after ashing in a muffle furnace (Gerhardt) at about 550-600°C. Till the residue become white the percentage of ash was calculated as follows:

Percentage of ash = (weight of ash/ weight of sample) × 100

Estimation of Carbohydrates

The total carbohydrate was estimated by Phenol-sulphuric acid method[7] 5 mg of oven dried tissue was taken and to this 1ml of distilled water, 1ml of 5% phenol solution and 5ml of concentrated sulphuric acid were added in quick succession. The optical density was measured in a spectrophotometer at a wavelength of about 490nm against a blank reading. D-glucose was used as the standard carbohydrate. The percentage of carbohydrates was calculated from the formula:

Percentage of carbohydrate = standard value × optical density/ weight of tissue taken

Estimation of Protein

Crude protein was estimated by multiplying the nitrogen content of the dried sample by 6.25. Nitrogen content was determined by Kjeldahl method [6]

Estimation of Lipid

The extraction of lipid was carried out by the chloroform, methanol mixture by method [8]. 500mg of powdered oven dried tissue was taken in test tubes to which chloroform- methanol (2:1) mixture was added and allowed to stand overnight. The extract was filtered and filtrate was collected in a pre weighed beaker again. The difference in weight was taken as the lipid content and the percentage was calculated from the formula:

Percentage of lipid = weight of the lipid/ wet weight of the tissue taken × 100

Estimation of Amino Acid

For amino acid analysis standard method was employed [9]. Triplicate samples were hydrolyzed with 6N hydrochloric acid for 24 hrs at 110°C. The hydrolysed samples were then analysed using an automatic amino acid analyzer L-8500 (Hitachi, Japan) with Ninhydrin reagent and lithium buffer system by injecting 20 µL [10].The reproducibility of the results was within approximately 3%. The net height of each peak produced by the chart recorder of the analyzer (each representing an amino acid) was measured and calculated.

Estimation of Fatty Acid

Lipid extraction was carried by the method [11]. The sample was then collected for the fatty acid analysis [12]. The fatty acid composition was analyzed by GC (Hewlett Packard 6890) equipped with a flame ionization detector (FID) and a fused silica capillary BPX-70 column (60 m x 0.32 mm i.d., 0.25µm film thickness). The oven temperature was set at 115°C, raised to 180°C at a rate of 8°C/min and held for 10 min and finally raised to 240°C at rate of 8°C/min and held for 10 min. The sample size was 1 µL and flashed with carrier gas (helium) at a rate of 1.6 ml/min. Identifications of the methyl esters were made by comparison of retention times of FAME.

Statistical Analysis

Data collected in this study was analyzed using SPSS (Scientific Package of Social Science) version 17.0. One way ANOVA test was used to compare differences in the means of the proximate composition, amino acid and lipid content of eel.

3. RESULTS AND DISCUSSION

The proximate analysis of Moray and Conger showed in (**Table 1**). In this study, moisture content (% wet weight) was determined which was ranged from 75.3% and 75.9%. The percentage of water is a good indicator of its relative contents of its energy; protein and lipids. The lower the percentage of moisture, greater the lipids and higher the energy of fish [13]. Moray and Conger eel had the highest concentration of moisture. This finding was similar to the previous report in Mackerel and *Conger conger* [14, 15]. Crude ash ranged from 6.9%, 7.08% (% dry weight); ash content was higher in both Moray and Conger eel. In this observation ranges of ash content indicated that, these species are a good source of minerals such as calcium iron; magnesium. The range of Ash content in *C.conger* and *Monopterus albus* in similar manner [15,16] .The higher values of ash might be due to the accumulation of inorganic salts in the muscle. Carbohydrate content of Moray and Conger eel ranged from 0.96% and 1.08% respectively. The carbohydrate content was least denoting that the muscle tissue does not store carbohydrate in appreciable quantity [16].

The crude protein content was estimated as *T. macrura* (22.7%) and in *C. talabonoides* (25.8%). The protein content of moray and conger eels was higher and correlated with the report in African catfish and Tilapia [17]. Protein content of fish varies widely depending on many factors such as natural feeding habits and availability of feed, spawning and migration. The properties of fish proteins are affected by the environmental temperature at which they are synthesized [18].

Lipid content was about 5.81% and 7.9% in both of them. Fishes with lipid content below 5% are considered as a lean fish [19]. So, these two eels are not considered as a lean fish. This result was more or less similar with the report in *M. albus*, Japanese sardine and Mackerel [16,20,21]. The availability of food at different time of the year has a considerable effect on the tissue component, particularly fat [22].

Moray and Conger eels were rich in amino acids (**Table 2**). The major amino acids are glutamic acid, histidine and glycine (1.92% to 4.7%). Levels of different amino acids are ranged from (0.28% and 4.7%). Present study showed that, Moray and Conger eels contain predominant level of glycine, lysine and lower concentration of tryptophan.

This result was more or less similar to the previous results reported in large mouth Sea bass [23]. Glycine, which is one of the major components of human skin collagen, together with other essential amino acids such as alanine form a polypeptide that promotes regrowth and tissue healing [24]. The amino acid composition of *P. scrofa* was high in lysine and methionine but low in cysteine/cystine [25].

A reduced supply of lysine in the diet may lead to mental and physical retardation because it is an important precursor for the de novo synthesis of glutamate, the most significant neurotransmitter in the mammalian central nervous system. Fish muscle is known to contain an excellent amino acid composition and found lysine was in higher concentration and tryptophan in lower concentration in three Indian fishes [26] Threonine is important to help in the balancing of amino acids. The present study showed the presence of threonine in the Moray and Conger eel and this result was similar in Nile fishes [27].

The fatty acid composition (% of total fatty acid) of the two fish species were summarized in (**Table 3**). Fatty acids like EPA and DHA were most abundant in *T. macrura* and *C. talabonoides*. The other major fatty acids C18:1 and C18:3 ranging from 0.00212% to 24.12% in Conger and Moray eel. The level of AA in conger eel was 2.09% to 2.31% respectively. Moray and conger eels contain Arachidonic acid (C20:4), which is a precursor for prostaglandin and thromboxane biosynthesis [28]. This interferes in blood clotting process and attach to endothelial cells during wound healing [29]. AA and DHA have been recommended as infant food supplements by the health agencies. Higher range of DHA content in Moray and Conger muscle was also reported in this study, so it can be used as supplement in the production of infant milk and Milk products.

Polyunsaturated fatty acids especially DHA has a role in maintaining the structure and functional integrity of fish cells. In addition, DHA has a specific and important role in neural (brain and eyes) cell membranes [4]. Moreover, DHA is considered a desirable property in fish for human nutrition and health. The EPA and DHA content of moray and conger eel make its fatty acid profile more favorable. By the consumption of eel can prevent coronary problems and can have a wound healing property due to the higher level of PUFA especially EPA and DHA. Results of clinical and Epidemiological research suggest that EPA and DHA found only in fish and sea foods possess extremely beneficial properties for the

prevention of human coronary artery diseases [30]. The higher levels of DHA in fish have a wound healing effect [31].

Nowadays, the need of AA and DHA is high so it is obtained by means of culturing microorganisms. *Mortierella elongate* SC-208 was cultured under controlled mediums gave high yields of AA about 32.2% out of total Lipid. However, the DHA produced in that medium was only 1.1%. In another medium which gave high content of both fatty acids, the AA and DHA contents were 9.85 and 11.6% respectively [32]. In the present study, moray and conger eel are rich sources of Omega 3 fatty acid especially DHA and EPA present in the muscle as the Natural source.

Table 1: Proximate composition of *T. macrura* and *C.talabonoides*

Species	Moisture (%WW)	Crude ash (%DW)	Carbohydrates (%DW)	Crude protein (%DW)	Lipid (%DW)
T. macrura	75.3±0.08	6.9±0.12	0.96±0.08	22.67±0.05	5.87±0.08
C.talabonoides	75.9±0.1	7.08±0.01	1.08±0.01	25.77±0.01	7.9 ±0.01

**Values are mean ±SD of three separate determinations.*
DW= Dry weight; WW= wet weight

Table 2: Fatty acid composition of *T. macrura* and *C.talabonoides*

Fatty acid	*T.macrura*	*C.talabanoides*
Alpha linolenic acid	10.89±0.08	10.31±0.10
Arachidonic acid	2.31±0.01	2.09±0.01
Bururic acid	1.69±0.01	1.65±0.08
Docosapentaenoic acid	22.98±1.1	21.33±1.0
Eicosapentaenoic acid	24.12±1.01	22.98±1.1
Linolenic acid	13.87±0.02	12.87±0.03
Margaric acid	0.0023±0.1	0.00212±0.01
Moroctic acid	2.81±0.1	2.4±0.01
Oleic acid	12.39±0.01	11.75±0.01
Palmitic acid	3.61±0.09	3.55±0.05
Stearic acid	4.78±0.01	4.19±0.01

***Values are mean ± SD of three separate determinations*

Table 3: Amino acid composition of *T. macrura* and *C.talabonoides*

Amino acid	*T.macrura*	*C.talabanoides*
Aspartic acid	1.32 ±0.10	1.92 ±0.01
Glutamic acid	2.83 ± 1.0	3.95 ±0.6
Asparagine	0.83± 0.1	0.94 0.01
Serine	0.52 ±0.01	0.81± 0.1
Glutamine	1.04± 0.6	1.15 ±0.6
Glycine	3.92 ±0.01	4.7 ±0.1
Threonine	0.28± 0.05	1.25 ±0.6
Histidine	1.92 ±0.05	2.46 ±1.0
Valine	0.78± 0.01	2.19± 0.1
Methionine	1.29 ±0.02	1.96±0.02
Isoleucine	1.16 ±0.02	1.58 ±0.06
Phenylalanine	0.72 ±0.09	0.89 ±0.1
Leucine	0.92± 0.02	1.82±0.02
Proline	0.48 ±0.02	0.99 ±0.12
Tyrptophan	0.89 ±0.02	0.72 ±0.1
Lysine	1.95± 0.02	2.91± 0.06

**Values are mean ± SD of three separate determinations*

4. CONCLUSION

The aim of this investigation is to make the consumers aware of the nutritive value of eels so that they could be better utilized. Therefore when fish are suggested for health benefits as this Moray and Conger eel are potential sources of EPA and DHA it must be considered. In future eel has to be used as a supplement in the products or it has to be used in the form of value added products or by-products. Consumption of this nutritious and less popular fishes, we can able to prevent over exploitation of other food fishes and can conserve the fish stock for future generations. These fishes may provide an alternate source of protein and fat for the population of developing countries.

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