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Estimation of proximate, amino acids, fatty acids and mineral composition of mullet (*Mugil cephalus)* of Parangipettai, Southeast Coast of India

R. Kumaran, V.Ravi, B. Gunalan, S. Murugan and A. Sundramanickam

Centre of Advanced Study in Marine Biology, Annamalai University, Parangipettai, India

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ABSTRACT

Proximate, Amino acids, fatty acids and mineral composition of Mullet (Mugil cephalus) in the Parangipettai coastal waters analyzed in the muscles. The results revealed that the moisture, carbohydrate, lipid, protein and crude ash content of the fish species was 75.27, 1.2, 2.42, 17.56 and 1.15 , respectively. This present study shows that the muscle of flesh of Mugil cephalus contains important w-3 and w-6 fatty acids and it is best suitable for consumption. In this present study ten essential amino acids like phenylalanine, valine, tryptophan, threonine, isoleucine, methionine, histidine, arginine, leucine and lysine were detected and all are required daily by human for healthy living. Among the eight nutrient elements investigated the most abundant was K followed by Na and Ca. The rest of the other elements Fe,Zn,Mn,Mg and Se.

Key words: Proximate, Amino acids, fatty acids, mullet, *Mugil cephalus*, minerals and Parangipettai

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INTRODUCTION

Proximate composition generally means percentage composition of basic constituents such as water, protein, lipids, carbohydrate and minerals. The energy yielding nutrients like protein, lipid and carbohydrate are considered as macronutrients are present in high level where as non energy yielding nutrients like vitamins and minerals are micronutrients and are present in small quantities(1). Fish has long been recognized as a valuable source of high quality protein in the human diet. In recent years, fish lipids have also assumed great nutritional significance owing to their protective role against the development of cardiovascular disease and rheumatoid arthritis (2). Hence, consumption of fish, both freshwater and marine, is therefore being encouraged. Mullet is commonly preferred and consumed by all the economic group of people and it is also considered low cost fishes. Hence, the present work was undertaken to study the proximate, Amino acids, fatty acids and mineral composition of Mullet (*Mugil cephalus)* of Parangipettai coast.

Description of the Study Area

The study area was a coastal town Parangipettai station (Lat. 11º30'N; Long.79º6' E): This station is situated at the mouth of the Vellar estuary in the marine zone, near Annankoil fishing hamlet. The Vellar estuary is a highly productive estuary located at Porto novo originated at Servarayan hills in Salem Dist, Tamil Nadu flows over a distance of 480km, forming an excellent estuarine system at Porto novo before it drains into the Bay of Bengal (Fig. 1).

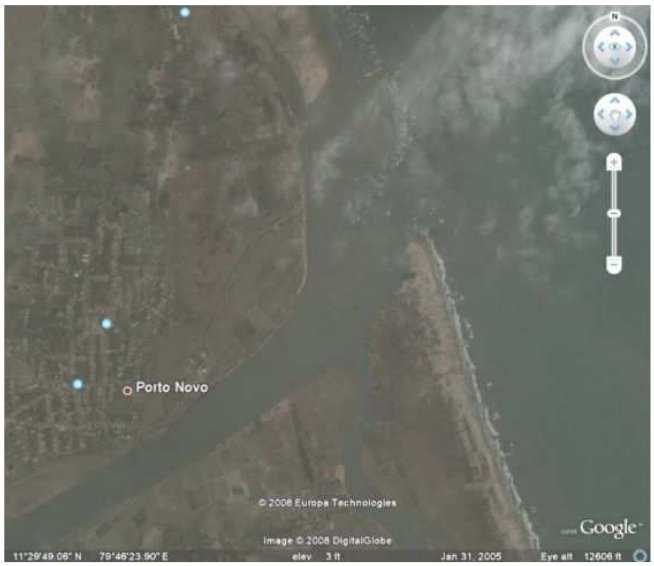

Fig 1. Showing the study area

MATERIALS AND METHODS

Specimens were collected from local landing centers. Samples were handled with cleaned stainless steel equipments. All samples were stored frozen until analysis. Only muscle tissue was analyzed in triplicate for the determination of proximate composition, fatty acids, amino acids and minerals. The ash content was estimated by burning oven-dried sample in a muffle furnace at 550c [3]. The Folin-Ciocalten Phenol method of (4) was used for the determination of the total protein in the tissue. The lipid content was estimated by the procedure given by (5). The total carbohydrate was estimated by Phenol- Sulphuric acid method described by (6). The total amount of water content in the fish was estimated by drying a known mass of fish muscle in a hot air oven at 70°C for 24hrs. To estimate the trace metal content (Fe, Mn, Mg, Ni) samples were digested (1g) with conc. HNO_3 and conc. $HClO_4$ (4:1) and analysed in ICP- AES (Optima 2100 DV, Perkin-Elmer, USA) (7). The preparation and analysis of fatty acid methyl esters (FAMEs) from these fish tissues ware performed according to the method described by (8 and 9). FAMEs profiles of the tissues were identified by comparing the commercial Eucary data base with MIS Software package (MIS Ver. No. 3.8, Microbial ID. Inc., Newark, Delaware)

RESULTS AND DISCUSSION

Compositional analysis

The proximate compositions from edible tissues were determined in triplicate and the results were tabulated. Table 1 gives the data on moisture, protein, fat and ash content expressed as percentage (%) composition per 100% of edible portion.

Table 1: Proximate composition of *Mugil cephalus* (mean $\pm$ SD)

Species	Moisture	Carbohydrate	Lipid	protein	Ash
Mugil cephalus	75.27$\pm$0.12	1.2$\pm$0.1	2.42$\pm$0.21	17.56$\pm$0.22	1.15$\pm$0.09

In this study the moisture, carbohydrate, lipid, protein and crude ash content of the fish species was 75.27 , 1.2, 2.42, 17.56 and 1.15 , respectively. These results were similar with results determined by (10), in their study. In conclusion the routine analysis of fish proximate composition is an important in determining the nutrient composition of fishes and better understanding of human nutrition.

Fatty acid profile

Lipids and fatty acids play a significant role in membrane biochemistry and have a direct impact on membrane mediated processes such as osmoregulation, nutrient assimilation and transport. On the other hand, the nature and quantity of these lipids in fish vary according to species and habit (11,12).Table 2 shows the saturated fatty acid and unsaturated fatty acids in the flesh of *Mugil cephalus.* There was a significant amount of Palmitic acid (C16:0) in all of the fish tissues compared with other Saturated Fatty Acids (SFAs) like Lauric acid (C12:0), Myristic acid (C14:0), Stearic acid (C18:0) and Arachidonic acid (C20:0).Fatty acid composition of these fish species were found to be 40.24% Saturated (SFA), 33.48% Monounsaturated (MUFA) and 26.28% Polyunsaturated fatty acids (PUFA).

Among those, those occurring in the highest proportions of this fish species were Palmitic acid (C16:0,27.45 %), Myristic acid (C14:0,9.0 %), Stearic acid (C18:0, 3.68%), and Oleic acid (C18:1n9, 10.77%). These results are in agreement with previous studies on fatty acids of other species (13,14 and 15). The values for MUFA (33.48%) are lower than the SFA . This study has shown that marine fish were richer in ω-3 PUFAs (21.83%) than ω-6 PUFAs (3.73%). (16) reported similar findings, in that marine fish were rich in ω-3, especially DHA and EPA.

Table 2. Saturated fatty acid and unsaturated fatty acids in the flesh of *Mugil cephalus* (mean ± SD)

S. No.	Saturated fatty acids	%
1	12:0	0.11±0.001
2	14:0	9.00±0.12
3	16:0	27.45±0.2
4	18:0	3.68±0.15
	Total	40.24±0.22
	Mono Unsaturated fatty acids	
1	16:1 n-6	20.73±0.21
2	18:1 n-9	10.77±0.25
3	20:1 n-9	0.85±0.05
4	20:1 n-7	1.14±0.21
	Total	33.48±0.34
	Polyunsaturated fatty acids	
1	18:2 n-3	3.23±0.16
2	18:3 n-6	0.92±0.22
3	18:4 n-3	3.01±0.19
4	20:4 n-6 AA	3.53±0.09
5	20:5 n-3 EPA	7.98±0.17
6	22:5 n-3 DPA	3.64±0.25
7	22:6 n-3 DHA	3.97±0.06
	Total	26.28±0.30

(AA- Arachidonic acid ,EPA- Eicosapentaenoic acid, DPA- Dicosapentaenoic acid, DHA- Docasahexaenoic acid)

The content of Arachidonic acid (AA), Eicosapentaenoic acid (EPA) and Docasahexaenoic acid (DHA) of these fishes analyzed, value was 3.53%; 7.98% and 3.97%, respectively. (17) reported that Arachidonic acid (C20:4 ω-6) is a precursor for prostaglandin and thromboxan which will influence the blood clot and its attachment to the endothelial tissue during wound healing. Apart from that, the acid also plays a role in growth. This present study shows that the muscle of flesh of *Mugil cephalus* contain almost all important ω -3 and ω -6 fatty acids and it is best suitable for consumption.

Table 3. Essential and non essential amino acids in the flesh of *Mugil cephalus* (mean ± SD)

No	Essential amino acids (EAA)	EAA (%)
1.	Phenylalanine	3.96±0.03
2.	Valine	5.42±0.25
3.	Tryptophan	0.71±0.13
4.	Threonine	4.52±0.15
5.	Isoleucine	4.78±0.19
6.	Methionine	2.86±0.21
7.	Histidine	2.84±0.18
8.	Arginine	6.39±0.11
9	Leucine	8.89±0.12
10.	Lysine	10.13±0.21
	Total	50.48±0.13
	Non essential amino acids (NEAA)	**NEAA (%)**
11.	Alanine	6.16±0.12
12.	Aspartic acid	11.06±0.03
13.	Cystine	0.95±0.04
14.	Glutamic acid	16.54±0.19
15.	Glycine	4.70±0.35
16.	Proline	3.22±0.21
17.	Serine	3.86±0.11
18.	Tyrosine	3.04±0.14
	Total	49.53±0.25

Amino acids

Fish is widely consumed in many parts of the world by humans because it has high protein content, Fish muscle is consistent of an excellent amino acid composition and is a unique source for nutrients and easily digestible protein (18, 19). Its proteins and amino acid profiles are quite similar to the muscle of terrestrial animals, but the fish bodies

are supported by a mass of water so the muscle fibres require less structural support than the muscles of land animals (20). Table 3 shows the essential and non essential amino acids in the flesh of *Mugil cephalus.*

There were ten essential amino acids like phenylalanine, valine, tryptophan, threonine, isoleucine, methionine, histidine, arginine, leucine and lysine and eight non essential aminoacids like alanine, aspartic acid, cysteine, glutamic acid, glycine, proline, serine , tyrosine and asparagines detected in the samples.

In this present study ten essential amino acids like phenylalanine, valine, tryptophan, threonine, isoleucine, methionine, histidine, arginine, leucine and lysine were detected and all are required daily by human for healthy living. This is similar to the report of (21) expert consultation on protein and amino acid requirement of human. The report says that the following amount (mg/g) of essential amino acid required by an adult for healthy living. {Histidine (15), isoleucine(30), leucine(59), lysine(45), methionine (16), cysteine (6), threonine (15) , tryptophan (6) and valine (26)}.

(22) reported that the higher amount of glutamic acid in all their four species (*Clupea harengus, Scomber scombrus, Trachurus trachurus* and *Urophycis tenuis)* studied. This is similar to the present study that, the glutamic acid was the dominant non essential amino acids.

Minerals

Marine foods are very rich sources of mineral components. The total content of minerals in the flesh of marine fish and invertebrates is in the range of 0.6-1.5% wet weight. (23).Fish is also a potential source of minerals such as potassium, phosphorus, iron, sodium, magnesium, iodine and calcium. Mineral components are important for human nutrition. (24). Trace elements like Iron, manganese and iodine which are essential for normal tissue metabolism and for maintenance of health are adequate in fish (25).

Table 4 shows the mineral composition in the flesh of *Mugil cephalus* The elemental concentrations of the fishes are expressed in mg/100g except for Se which are expressed in µg/100g wet weight for greater accuracy. Among the eight nutrient elements investigated the most abundant was K followed by Na and Ca. The rest of the other elements Fe,Zn,Mn,Mg and Se. Zn, an essential mineral for humans (26), was present in the amount of 0.75mg. These observations suggest that these species could provide significant portion of the USRDA for Zn if consumed regularly (27).

Table 4. Mineral composition in the flesh of *Mugil cephalus* (mean ± SD)

Minerals	Mg/100g
Ca (mg)	48+0.03
Fe	0.42+0.02
Mg	28+0.2
Na	68+0.3
Zn	0.75+0.02
Mn	0.04+0.01
K	265+0.15
Se (µg)	11.6+0.11

Iron has several vital functions in the body. Iron deficiency occurs when the demand for iron is high, e.g., in growth, high menstrual loss and pregnancy and the intake is quantitatively inadequate for or contains elements that render their on unavailable for absorption (28).in this present study the iron level was 0.42mg. The Mg content was found to be higher level as 28mg. This value was higher than that by reported (29,30) a mean value of these results 0.25 µg/g. The Mn content of these fishes were found to as0.04 mg. Similar Mn values were reported by other authors (30,29).

CONCLUSION

Mullet is commonly preferred and consumed by all the economic group of people and it is also considered low cost fishes. This study demonstrates that this low cost specie is able to compete with more commercially utilized species in terms of nutritional value, and they can definitely also compete when it comes to taste .

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