

## Fatty Acid composition of some freshwater fish species of Sri Lanka

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### Abstract

Freshwater fish are rich in nutrients, especially the omega-3 polyunsaturated fatty acids (PUFAs) which are beneficial to health. In this study, the fatty acid compositions of commonly consumed ten different fresh water fish species were determined. The most abundant fatty acid was Palmitic acid (16:0) in almost all species while, Eicosenoic acid (C 20:1 n-9) was found to be the least common fatty acid of those detected. The highest amount of saturated fatty acids (43.54%) was present in *Tor khudree*, while least amount of saturated fatty acids (30.81%) were present in *Punius tetraspilus*. The highest amount of monosaturated fatty acids was recorded in *Cyprinu scarpio* (24.25%) and minimum amount was recorded in *Channa striata* (12.28%). The highest and the lowest of PUFAs were recorded in *Oreochromis mossambicus* (45.36%) and in *Anngullia bicolor* (25.36%) respectively. The highest amount of omega 3 fatty acids were recorded in *O. mossambicus* (21.44%), followed by *O. niloticus* (19.31%). The lowest amount of omega 3 fatty acids was recorded in *Etroplus suratensis* (10.18%). In general, *O. mossambicus* would be an ideal species to obtain maximum health benefits.

**Keywords:** Fresh water fish, PUFAs, omega 3 PUFAs

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### Introduction

Sri Lanka's total fish production was 512840 MT in 2013 (FAO, 2014) and inland fish production has gradually increased over the past decade (NARA, 2014). In Sri Lanka, household fresh water fish consumption in 2002 has been 475.74 g/month. Fish contains 15%-20% of protein with essential amino acids, Vitamin A, B and D and minerals such as calcium, phosphorus, iron, copper and selenium (FAO, 2014). Apart from that, fish lipids are important in medicine as well. In marine fish it is estimated that linolenic acid content is much lower at 2%. However, they are rich with other essential polyunsaturated fatty acids which are neurologically beneficial in growing children. Omega 3 (n-3) polyunsaturated fatty acids, which are high in fish lipids have been recognized for their pharmaceutical properties in the treatment of pathophysiological and chronic generative diseases such as coronary heart disease, thrombosis and arthritics (Ackman, 1982; Kinsella, 1988). Recent studies have shown that eicosapentaenoic acid (C 20:5 n-3) reduced arteriosclerosis in group of Eskimos (FAO, 2014). Even though there are numerous research projects which have been



carried out to search for the fatty acid composition in marine fish, the knowledge of lipid content in fresh water fish in Sri Lanka remains limited. Therefore, the present study was carried out to determine the fatty acid composition and their abundance in the muscle of commonly consumed fresh water fish species in Sri Lanka.

### **Materials and methods**

Ten commonly consumed fish species were obtained from Mahakanadarawa tank in Anuradhapura (replica for each variety) and transported in ice to the Chemistry laboratory of the Department of Physical Sciences, Faculty of Applied Sciences, Rajarata University of Sri Lanka at Mihintale. The edible muscle was separated, and the amount of lipid present in 10.0 g of muscle was extracted by the Bligh and Dyer method (Hanson and Olly, 1963). The fatty acid methyl esters (FAME) of these lipids were prepared by base hydrolysis followed by transesterification (Berner and Jensen, 1994). These methyl esters were separated by capillary column gas chromatography on a Agilent 7890B gas chromatograph using DB-Wax capillary column (30m x 0.25 mm ID). The temperature program used was 160<sup>0</sup>C for 5 min, then up to 225<sup>0</sup>C at a rate of 3<sup>0</sup>C/min, and 10 min of holding time at 225<sup>0</sup>C. Separated peaks were detected using Flame Ionization Detector (FID). The temperature of the detector and the injector was maintained at 260<sup>0</sup> and 240<sup>0</sup>C respectively. The obtained peaks were identified by comparing the retention time of methyl esters in a standard mixture from Larodane Fine Chemicals AB, Sweden.

### **Results and Discussion**

The fatty acid composition variation according to fish species is shown in Table 01. The most abundant fatty acid was palmitic acid (C 16:0) in all species except *Punius tetraspilus*. The lowest percentage was shown by *P. tetraspilus* which contained 15.28% and the highest percentage of 25.60% was shown by both the *Oreochromis* species. The most abundant fatty acid in *P. tetraspilus* is arachidonic acid (C 20:4 n-6) with a percentage of 16.67. Stearic acid (C 18:0), Oleic acid (C 18:1 n-9) and docosahexaenoic acid (C 22:6 n-3) are some of the other dominant fatty acids found in fresh water varieties. Eicosenoic acid (C 20:1 n-9) was found to be the least common fatty acid and six fish species do not contain or contain this acid at negligible levels. *E. suratensis*, *P. tetraspilus* and *C. carpio* have little amount of this acid in their fat, with a percentage of 0.09, 1.61 and 3.16 respectively. *A. bicolor* showed a great variation from all the other species with respect to this particular fatty acid by having a larger proportion such as 9.97%. As it is clearly illustrated in the table 01, variation of

monosaturated fatty acids was 12.28% - 24.25%. Maximum was recorded in *C. carpio* and minimum was recorded in *C. striata*. The C 18:1 n-9 acid is the dominant group and greatly higher than all the other monosaturated acids. Its percentage varied from a lowest of 5.10% of *O. niloticus* to a highest of 15.38% in *C. carpio*. In contrast C 20:1 belongs to this group of acid contain in very little amounts in most of the species.

The polyunsaturated acid group is the largest group of six fish varieties selected, and the second largest of the other varieties except *A. bicolor*. The highest and the lowest were recorded in *O. mossambicus* (45.36%) and in *A. bicolor* (25.36%) respectively. Docosahexaenoic acid (C 22:6 n-3) is the largest group in many varieties followed by C 20:4 n-6. The least found group of acid is eicosapentaenoic acid (C 20:5 n-5) and the abundance of that acid is relatively low in all the selected fish species. In fish lipids the omega 3 (n-3) polyunsaturated fatty acids (PUFAs) contributes a larger proportion to the total PUFAs. These omega 3 PUFAs are important in human nutrition and health. The highest amount of omega 3 group was recorded in *O. mossambicus* (21.44%), followed by *O. niloticus* (19.31%). The lowest amount was recorded in *E. suratensis* with a percentage of 10.18. The two omega 3 PUFAs namely eicosapentanoic acid (EPA) and docosahexanoic acid (DHA) are the most biologically active components of fish lipids (Kinsella, 1988). The highest and the lowest of the EPA were recorded in *G. giuris* (3.39%) and in *E. surantesis* (0.70%) respectively.



Table 1: Variation of Fatty acid composition in fresh water fish species.

Fatty Acid	Tor khudree	Etroplus suratensis	Oreo chromis mossa mbicus	Oreo chromis niloticus	Mystus keleius	G giuris	Punius Tetra spilus	Cyprinu scarpio	Ann gullia bicolour	Channa striata
C 14:0	3.18	1.38	1.49	1.41	1.57	0.69	0.93	1.30	1.93	0.53
C 15:0	1.39	0.69	0.92	0.86	1.04	0.70	0.91	1.61	1.07	0.87
C 16:0	25.22	20.87	25.60	25.60	22.07	20.54	15.28	24.71	22.81	21.64
C 16:1	7.54	2.35	2.73	3.64	3.86	2.22	1.55	3.26	4.85	1.02
C 17:0	3.00	1.46	2.28	2.14	1.70	1.67	2.91	2.07	1.79	0.73
C 18:0	10.75	11.27	7.04	7.62	8.77	11.21	10.78	7.13	7.27	9.17
C 18:1 n-9	11.19	13.60	8.50	5.10	9.75	8.24	7.33	15.38	11.37	6.88
C 18:1 n-7	2.29	3.59	2.93	3.92	3.92	3.05	4.00	2.45	5.16	4.38
C 18:2 n-6	2.96	4.51	11.05	4.32	4.07	3.78	5.91	3.66	4.12	4.21
C 18:3 n-3	2.60	1.38	7.63	1.98	1.90	1.69	0.80	2.08	1.80	0.68
C 20:1 n-9	0.00	0.90	0.00	0.00	0.00	0.00	1.61	3.16	9.97	0.00
C 20:4 n-6	8.06	8.38	5.18	8.12	9.40	12.49	16.67	9.27	1.53	12.36

C 20:5 n-3	2.42	0.70	1.69	3.32	2.17	3.39	2.86	2.23	1.85	0.86
C 22:4 n-6	3.04	4.46	4.26	1.76	1.59	2.60	2.76	2.45	2.80	2.88
C 22:5 n-6	2.65	2.52	3.43	5.00	2.44	3.30	3.57	2.13	2.31	1.97
C 22:6 n-3	10.20	8.10	12.12	14.01	14.30	13.00	8.47	6.22	10.95	14.65
Satuf.a.	43.54	35.67	37.33	37.63	35.15	34.81	30.81	36.82	34.87	32.94
Monounf.a.	21.02	20.44	14.16	12.66	17.53	13.51	14.49	24.25	31.35	12.28
Polyunf.a.	31.93	30.05	45.36	38.51	35.87	40.25	41.04	28.04	25.36	37.61
Omega-3	15.22	10.18	21.44	19.31	18.37	18.08	12.13	10.53	14.60	16.19

## **Conclusion**

The muscular fatty acid content of fresh water fish varieties vary greatly. When considering all the facts it can be said that *Oreochromis* species are rich in health-beneficial lipid sources.

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