

HEALTH RELATED FATTY ACIDS IN DIFFERENT FISH SPECIES OF FAMILY LEIOGNATHIDAE , SAMPLED FROM THE WEST COAST OF SRI LANKA

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INTRODUCTION

Sea food plays a very important role in human food and nutrition. It contains lysine and sulphur containing amino acids which complement cereal based diet (Edirisinghe *et.al.* 1998). Fish fats can be divided into three categories namely saturated fatty acids, monounsaturated fatty acids and polyunsaturated fatty acids. Omega 3 fatty acids found in fish oil comes under the polyunsaturated group. They are categorized as Essential Fatty Acids or EFA as the body cannot produce them by itself and these fatty acids should be contained in the diet. The two most important types of the Omega 3 are, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). These essential nutrients are found in high quantities in oily fish such as Mackerel, Halibut, Tuna , Herring, Trout, Sardines and Salmon (Alison, 2004). Karunaratna and Attygalle (2010) reported that polyunsaturated fatty acids in tuna family varied from 55-72% of the total lipid and considered fish as an excellent nutritive source. Omega -6 fatty acids are also considered as essential fatty acids (EFA). Both Omega -3 and Omega -6 fatty acids play a crucial role on normal growth and development and brain functions in human (Alison, 2004). On the other hand, it was found that in Sri Lanka, both urban and rural sectors, consumption of fish is higher than the consumption of meat (Jayasinghe, *et.al* 1996).

Pony fishes (family Leiognathidae) consist of three genera namely; Leiognathus, Gazza & Secutor. Pony fishes are also known as Silver bellies or Slip mouths. The species of this family are widespread in tropical Indo- Pacific region, ranging from South East Asia through the Indian sub continent and to East Africa. Fish species in Leiognathidae were highly recommended to be used for patients curing from infectious diseases and feeding mothers traditionally. Therefore, this study was carried out to determined fatty acid compositions of different species of family Leiognathidae and its dynamics with age in most available pony fishes sampled in the west coast of Sri Lanka.

METHODOLOGY

Pony fish (family; Leiognathidae) were collected from major landing sites of the west coast of Sri Lanka (Negombo, Panadura, Wadduwa and Beruwala,) and fish markets of Pettah, Maharagama, Kesbewa and Horana once a fortnight. These fish samples were directly transported to the Zoology Department laboratory of the Open University of Sri Lanka and stored at -18 C⁰ in polythene packs for further use. Twelve species of family Leiognathidae were identified as abundant species at all the landing and marketing sites sampled. Those 12 species identified were used for fatty acid analysis. Total fat contents were extracted from whole fish by modified Bligh & Dyer method. For fatty acid profile analysis, the methyl esters of fatty acids were analysed by Gas chromatography (Supelco wax 10). The temperature of injector and detector was 25 C⁰. The oven was first maintained at 190 C⁰ and then programmed to 220 C⁰ at the rate of 5 C⁰ / minute. Same analysis were done for different age groups of the two most abundant species of the family Leiognathidae (*Gazza minuta* and *L.dussumieri*) identified. The results were statistically analyzed using single anova.

RESULTS

1. Thirteen different species belonged to three genera were identified in family Leiongnathidae from the samples obtained are given below.

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|------------------------------------|-----------------------------------|-----------------------------|
| 1. <i>Gazza achlamys</i> | 7. <i>Leiognathus leuciscus</i> | 13. <i>Secutor ruconius</i> |
| 2. <i>Gazza minuta</i> | 8. <i>Leiognathus lineolatus</i> | |
| 3. <i>Leiognathus equulus</i> | 9. <i>Leiognathus daura</i> | |
| 4. <i>Leiognathus splendens</i> | 10. <i>Leiognathus dussumieri</i> | |
| 5. <i>Leiognathus brevirostris</i> | 11. <i>Leiognathus bindus</i> | |
| 6. <i>Leiognathus faciatus</i> | 12. <i>Secutor insidiator</i> | |

It was observed that among the fatty acid compositions in species in family Leiongnathidae, the more abundant fatty acids were Myristic (C14), Palmitic (C16), Palmitoleic acid (C16:1), Stearic acid (C 18:1), Oleic (C18:1), Linolenic acid (C20:3n-6), Arachidonic acid (C20:4n-6), eicosapentanoic acid (C20:5n-3), Heneicosapentanoic acid (C21:5n-3), Docosapentaenoic acid (C22:5n-3) and Docosahexaenoic acid (C22:6n-3)

Saturated fatty acids

Palmitic acid was predominant in all the studied species in family leiongnathidae. Myristic acid and stearic acid also found in considerable proportions but the contributions of pentadecaenoic acid (C15) and heptadecanoic acid (C17:0) were comparatively low. The highest percentages of saturated fatty acids were recorded in *L. dussumieri*, and *L. splendens*. The lowest percentages were recorded in *G. minuta* (Table.01). It was observed that the highest contents of saturated fatty acids recorded in smaller size of (7-8 cm size class) *L. dussumieri* (Table. 03) .

Mono unsaturated fatty acids

Monounsaturated fatty acids consisted mainly of palmitoleic acid (C16:1) and Oleic acid (C18:1) while minor quantities of eicosenoic acid (C20:1) and erucateic acid (C22:1) were also recorded. The highest percentage of mono unsaturated fatty acid content was recorded in *L. dussumieri* and the lowest value was recorded in *G. minuta* (Table. 01). It was observed that the highest monounsaturated fatty acids were recorded in size classes 11-13cm and 7-8cm in *L. dussumieri* while the lowest monounsaturated fatty acids were recorded in size class 11-13cm in *G. minuta* .(Table.03)

Polyunsaturated fatty acids

Polyunsaturated fatty acids mainly consisted in two types; Omega 3 and Omega 6 . The Omega-3 fatty acids were C18:4n-3, C20:4n-3, eicosapentanoic acid (EPA) (C20:5n-3), Heneicosapentaenoic (C21:5n-3), docosapentaenoic acid (C22:5n-3) and docohexaenoic acid (DHA) (C22:6n-3). Among the species studied the highest Heneicosapentaenoic fatty acid content was observed in *G. minuta* and the lowest in *L. dussumieri* (Table.01). Percentage of poly unsaturated fatty acid contents of *G. minuta* were significantly higher ($p < 0.05$) than that of other eleven species studied.

The Omega 6 fatty acids consist of C18:2n-6, C20:2n-6, C20:3n-6 (Linolenic acid), C20:4n-6 (arachidonic acid), C22:4n-6 and C22:5n-6. Percentage of omega-6 fatty acid contents in *L. leuciscus* were significantly higher ($P < .05$) than that of other species in family Leiongnathidae.

It was observed that high poly unsaturated fatty acid contents in all different size classes in *G. minuta* but low values were observed in all size classes in *L. dussumieri* (Table- 03).

Table 01- Percentage of fatty acid profiles of twelve different fish species in family Leiognathidae

Fatty acids	<i>L. brevirostris</i>	<i>S. ruconius</i>	<i>L. datura</i>	<i>L. lineolatus</i>	<i>L. dussumieri</i>	<i>L. equulus</i>	<i>Gazza minuta</i>	<i>L. leuciscus</i>	<i>L. splendens</i>	<i>S. insidiator</i>	<i>G. ahlamys</i>	<i>L. Faciatus</i>
C14:0	1.8	3.8	3	1.7	5.3	4.1	1	3.3	2.5	2.8	1	3.8
C15:0	0.7	0.5	0.5	0.5	1	1.2	0.2	0.8	4.3	0.3	0.1	1.1
C16:0	13.8	11.1	12.7	8.6	22.6	21.7	8.7	23.7	21	10.9	8.2	20.1
C16:1	3.1	4.2	4.7	2.5	6	4.5	1.3	4	5.9	3.2	1.2	4.3
C17:0	0.9	0.6	0.9	0.6	1.8	1.6	0.3	1	4	0.7	0.3	1.6
C18:0	5.8	4.7	6.7	4.5	12.2	8.5	3.5	10.5	11.4	3.8	4.5	6.3
C18:1	7	3.6	7.4	3.4	11.1	9.5	3.9	10.2	9.3	3.7	3.7	3.9
C18:2n-6	0.5	0.5	0.5	0.5	0.9	1.6	0.4	1.1	1.2	0.5	0.35	0.3
C18:3n-3	0.3	0.4	0.1	0.3	0.3	0.9	0.2	0.4	0.5	0.3	0.2	0.2
C18:4n-3	0.1	0.4	0.2	0.3	0.8	0.5	0	0.3	0	0.3	0	0.4
C20:1	1.3	0	0.5	0.1	1.7	0.5	0	0.4	1	0.1	0.1	0.4
C20:2n-6	0.3	0.1	0.2	0.1	0.5	0.7	5.9	0.3	0	0.2	4.8	5.3
C20:3n-6	4.6	8.6	5.1	5.6	0.4	1.8	0	0	0.8	7.5	0	0.5
C20:4n-6	1.4	1	2.2	1.5	2.6	1.6	1.3	4.2	4.4	1.2	1.3	1.5
C20:3n-3	0.4	0.2	0.3	0.2	0	0	0.2	0.1	0	0.2	0.1	0
C20:4n-3	0.1	0.2	0.2	0.1	0	0.4	0.1	0.5	0.5	0.2	0.1	0.4
C20:5n-3	1.9	5	6.3	4.4	8.2	5.3	1.5	4.8	4.3	4.8	1.4	5.1
C22:1	0.4	0	0.4	0	0.5	0	0	0	0.5	0.4	0	0
C21:5n-3	31.4	27.2	21	31.3	0.4	10.2	51.9	0.2	0.7	25.1	49.3	9.6
C22:4n-6	0.5	1	1.2	0.8	0.9	1.6	0	2.2	1.1	0.5	0	1.2
C22:5n-6	0.6	0.6	0.5	0.3	0	0	0	0	0	0.4	0	0
C22:5n-3	3	3.5	3.9	5.5	2.8	2.2	2.8	2.6	2.1	2.9	2.5	2.2
C22:6n-3	2.8	5.8	3.2	9.6	8.8	5.8	6	22.2	5.9	4.8	5.9	5.4

DISCUSSION AND CONCLUSIONS

Main saturated fatty acids in Sri Lankan fish oils, contain Palmitic, Stearic and myristic acids. It was seen that Palmitic acid was the main saturated fatty acid in family Leiognathidae followed by Stearic acid, myristic acid. According to the results, saturated fatty acids in family Leiognathidae recorded as Palmitic acid and Stearic acid. Gopakumar *et.al.* (1972) and Jayasingha *et.al.* (1996) have also shown that the tropical fish oils are relatively saturated and the results of the present study also agrees with them. It was shown that arachidonic acid (20:4n-6) is the major component of the fish oil but present study showed that the low levels, of n-6 found in the species of Leiognathidae except *L.dussumieri*, *L. leuciscus* and *L.splendens*.

Table 02 –Percentage of Omega-3 and omega -6 fatty acids found in two most abundant species in family Leiognathidae.

Fatty acids	<i>G. minuta</i>			<i>L. dussumieri</i>		
	11-13cm	10-11cm	8-9 cm	11-13 cm	7-8cm	
Omega 3						
C18:3n-3	0.2	0.5	0.3	0.2	0.5	
C18:4n-3	0	0.4	0.3	0.6	0.5	
C20:3n-3	0.2	0.5	0.2	0	0.1	
C20:4n-3	0.1	5.1	2.8	0	0.5	
C20:5n-3	1.5	0.3	0	6.4	6.3	
C21:5n-3	51.9	2	0.6	0.4	0.6	
C22:5n-3	2.8	20.5	7.3	3.3	2.4	
C22:6n-3	6	6.6	16.4	5.4	8.1	
	62.7	35.9	27.9	16.3	19	
Total	17.92196876	6.902057147	5.773940843	2.628382175	3.095042118	
Omega 6						
C18:2n-6	0.4	1.3	1.5	0.6	1	
C20:2n-6	5.9	0	0.8	0.4	0.4	
C20:3n-6	0	4	2.7	0	0	
C20:4n-6	1.3	0.1	0	4	2.8	
C22:4n-6	0	0	0	0.9	1	
C22:5n-6	0	2.2	2.3	0	1.2	
	7.6	7.6	7.3	5.9	6.4	
Total	2.325224004	1.607067723	1.147896627	1.518442184	0.960555395	

Table 03 - Fatty acid profiles in different size classes in most abundant two species of family Leiognathidae (SFA- Saturated fatty acids, MUFA- Monounsaturated fatty acids, PUFA- Polyunsaturated fatty acids)

	<i>G. minuta</i>			<i>L. dussumieri</i>	
	11-13cm	10-11cm	8-9 cm	11-13 cm	7-8cm
SFA	13.7	40.9	30.8	43.2	44.4
MUFA	5.2	14.1	31	22.1	18.8
PUFA	70.3	43.5	35.2	22.2	25.4

Jayasingha *et.al.*(1996) reported that trace amounts of 22:4n-6 have been found in most commercial species of fish in the cold waters of the Northern hemisphere. They also reported that shark also contains relatively higher level of 22:5n-6 whereas, Seer had the least content of archidonic acid. The n-3 acids (20:5n, 22:5n, 22:6n, 21:5n) were present in high concentrations in most of the fish oil samples examined in all samples except *L. dussumieri*, *L. leuciscus* and *L. splendens*. Heneicosapentaenoic acid (21:5n-3) was recorded as the predominant n-3 fatty acid. Karunarathna and Attygalle (2010) reported that the highest percentage of polyunsaturated fatty acids in white muscle in yellowfin tuna (72.36%) and red muscle (73.94%) in Kawakawa. Present study indicated that *G. minuta* is also having the almost same percentage of polyunsaturated fatty acids (70% of the total lipid) although it is very low in market value. In conclusion, according to the results of the present study, five species contain higher percentages of poly unsaturated fatty acids (widely accepted as heart friendly fatty acids) than saturated fatty acids. However, the fully grown *G. minuta* (Mas Karalla in Sinhala) which is considered as the most popular Pony fish species in Sri Lanka recorded the highest percentage of Omega-3 (n-3) fatty acids. Further studies are being conducted in investigating other components of nutrients in family Leiognathidae.

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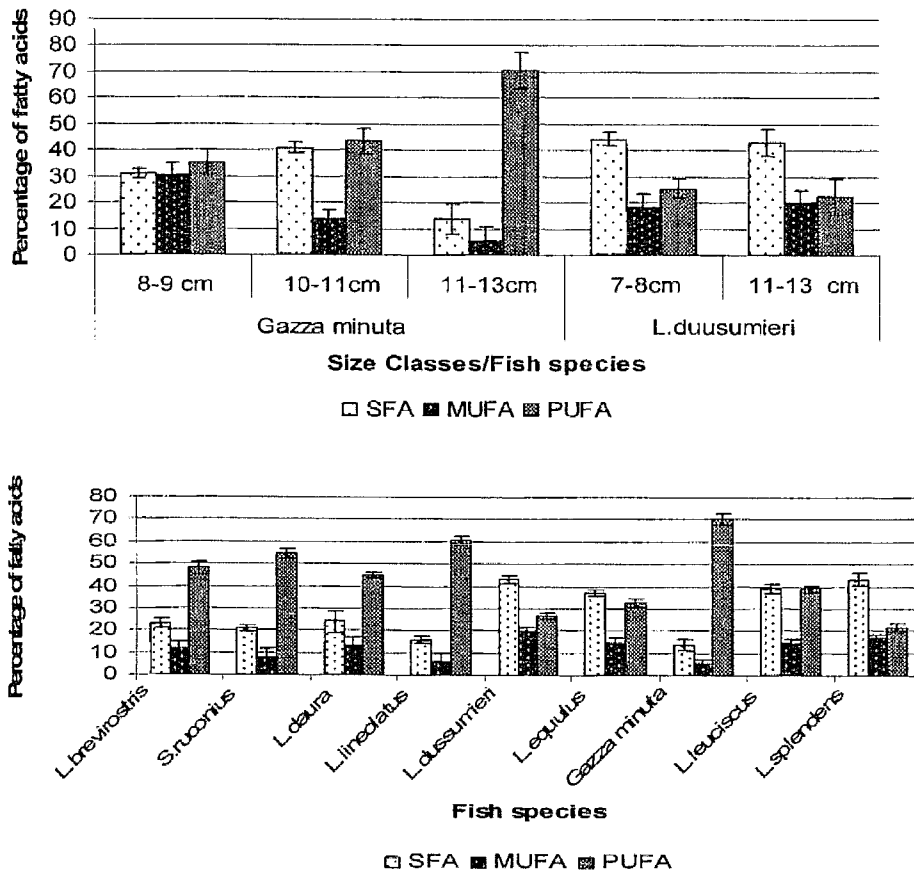


Figure 1: Fatty acid profiles in different species of Family Leiognathidae

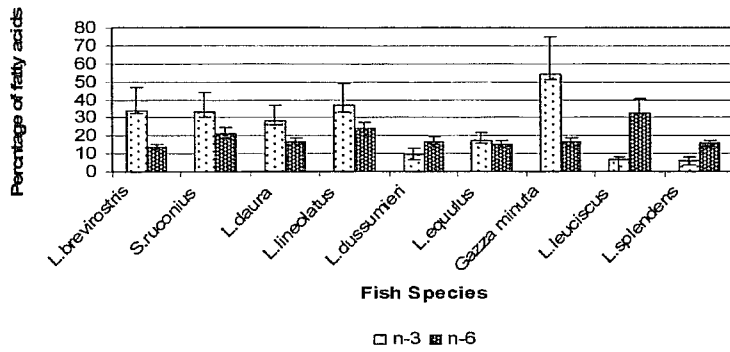


Figure 2. Percentages of Omega -3 and omega-6 fatty acids found in different species of Family Leiognathidae

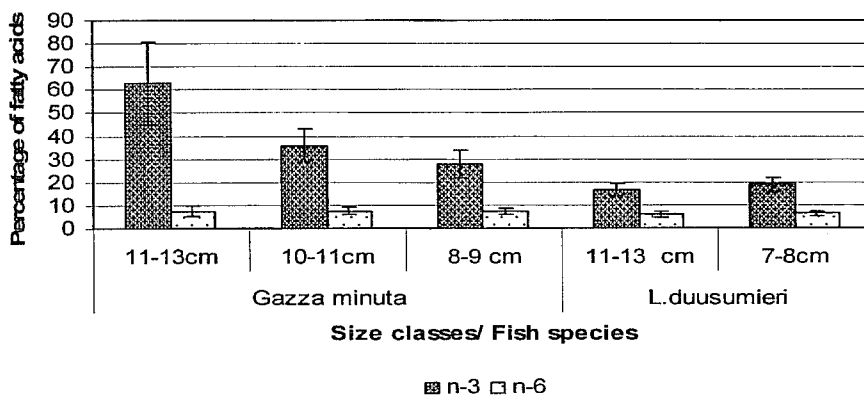


Figure 4. Omega-3 and Omega -6 fatty acids found in two most abundant species in Family Leiognathidae.

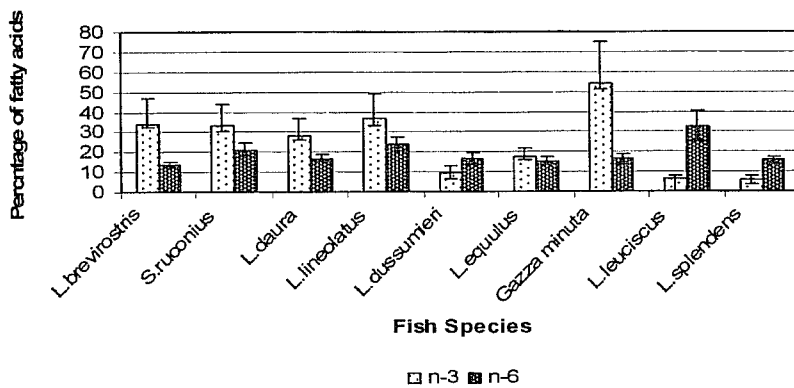


Figure 2. Percentages of Omega -3 and omega-6 fatty acids found in different species of Family Leiognathidae