Lipid and Fatty Acid Profile of Ladyfish Dhother, Sua, Sole, Aal and Khagga From Karachi Coast

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Summary: An awareness of the protective role of n-3 polyunsaturated fatty acid against development of cardiovascular disease has prompted the promotion of fish consumption. The total fat and fatty acid compositional data are reported for ladyfish, dother, sua, sole. aal and khagga marine species of fish that are found in coastal waters of Pakistan and are consumed locally. This information may be useful to consumers and health care professionals.

Introduction

Fish oil are recognized by researchers as the best natural source of highly unsaturated fatty acids. From nutritional point of view, consumers are increasingly aware of the importance of fish oil as source of polyunsaturated fatty acids (PUFA), particularly omega-3 PUFA i.e. eicosapantaenoic acid (EPA) and docosahexanoic acid (DHA) [1]

The awareness of the protective role of n-3 PUFA against cardiovascular diseases has advocated the promotion of fish and other seafood consumption [2]. In addition, seafood also provide significant benefits to a broad range of health issues such as hypertension, rheumatoid arthritis, skin disorders, cancers, diabetes, obesity etc. [3,4,5,6].

The growing awareness of usefulness and importance of seafood lipids as a source of highly unsaturated fatty acids has opened the field in the biochemical and nutritional research to search the health benefits of these fatty acids.

In previous communication, fatty acid profile of some commercially important popular fish species has been presented [7]. The present study reports the lipid and fatty acid composition of six more marine species abundantly available around the area and consumed locally.

Results and Discussion

The lipid content of ladyfish (*Sillago* sp.), dother (*Pomadasys* sp.), sua (*Johnius sp.),* sole (*Cynoglossus* sp.), aal (*Chorinemus* sp.), and khagga (*Arridae sp.)* is presented in Table-1. The lipid content varied among the fish species and ranged from 0.4% for sole to 3.8% for khagga. Similar findings have been reported previously [7].

Table-1:The Total Lipid Content (G/100g) In Fish Muscle (The Data Denoted The Mean And Standard De+viation Collected During The Period.

SPECIES	LIPID (G/100g)
LADYFISH	1.12 ± .55
DHOTHER	1.00 ± .50
SUA	.88 ± .44
SOLE	.50 ± .44
AAL	.40 ± .20
KHAGGA	3.8 ± 1.9

Environmental factors such as diet season and temperature beside biological differences such as age, sex and size have been reported to effect between and within the species [8].

The fatty acid profile of the six fish species is reported in Table-2. The values are as weight percent of total fatty acid methyl esters. Fatty acids are designated by number of carbon atoms: number of double bonds. Common names are not indicated because fatty acids in fish are primarily unsaturated and they are mixture of several isomers.

The main fatty acid were C 14:0, C16:0, C16:1, C18:0, C18:1, C20:4, C20:5, and C22:6 common to all the six species but the data indicates that their percentage varied widely among the species. The percentage of the total saturated fatty acid (TSF) was found to be 37.23% in ladyfish, 37.39% in dother, 45.14% in sua, 36.26%in sole, 37.23% in aal and 43.6% in khagga respectively. Palmitic acid was found to be the major contributor in all the fish species examined contributing 54.0% to 62.76% of the TSF in ladyfish and sole respectively. Ackman and Eaton [9] pointed out that

Table-2: Fatty Acid Composition In Lipid of Six Fish Species (The Data Denote The Mean & Standard Deviation of Three Different Samples Of Each Species Collected During The Period)

FATTY ACID	LADY FISH	DHOTHER	SUA	SOLE	AAL	KHAGGA
C14:0	1.63+.01	1.04±.01	2.18±.01	1.39+.01	2.64±.06	9.48±.55
C15:0	0.54±.04	0.27±0	0.58±.0	0.50+.01	0.46±.01	0.66±.0
C16:0	16.39±.40	22.82±.25	26.79±.45	22.76+.32	22.02±1.8	24.30±.57
C17:0	0.46±.05	0.32±.03	0.60±.01	0.42+.02	1.03±.05	0.85±.08
C18:0	8.46±.55	12.46±.32	14.00±.8	10.00+1.2	10.24±1.2	7.56±.08
C19:0	0.34±.01	0.33±.0	0.46±.02	0.32+.02	0.39±.0	0.54±.01
C20:0	1.08±.02	0.10±.01	0.59±.05	0.75+.14	0.45±.0	0.17±.01
C22:0	1.48±.09	0.05±.01	-	0.12+.0		0.04±.0
Total Saturates	30.38	37.39	45.14	36.26	37.23	43.6
C14:1	0.88±.01		-	-	-	-
C15:1	0.24±.01	0.11±.01	-	0.09±.01	-	-
C16:1	3.53±.03	3.06±.20	3.26±.25	2.21±.11	5.54±.50	9.56±.50
C17:1	0.31±.02	0.10±.05	0.74±.22	-	0.11±.02	-
C18:1	2.66±.33	7.33±.08	3.00±.01	5.70±.51	5.13±.52	10.20±.55
C19:1	-	0.11±.01	-	-	-	-
C20:1	0.49±0	0.15±.01	-	0.06±.01	-	1.06±.06
C22:1	0.18±.01	-	-	0.12±.01	7.58±.70	0.24±.0
Total Saturates	6.29	10.86	7.0	8.18	10.78	21.06
C14:2	0.14±.01	-	-	-	-	-
C15:2		0.38±.05	-	-	-	-
C16:2	0.19±.01	0.29±0	0.07±.0	0.42±2.8	0.33±.05	0.23±.0
C16:3	0.35±.005	0.85±.01	0.87±.0	0.60±.01	0.52±.0	0.04±.01
C16:4	0.84±.03	0.24±.17	0.89±.02	1.08±.05		0.45±.02
C17:2	0.11±.05	0.31±.18	0.19±.05	0.23±.02		0.17±.0
C17:3	7.21±1.2	0.06±0	11.9±1.24		1.70±.11	0.10±.01
C18:2	0.25±.02	0.03±.0	0.11±.0	1.45±.02	0.39±.01	0.59±.01
C18:3	0.12±.01	-	0.12±.0	0.37±.1	-	0.20±.01
C18:4	0.20±.05	0.15±.07	0.11±.01		-	-
C20:2	0.70±.05	0.01±.01	0.16±.0	0.06±.01	-	-
C20:3	0.10±.01	5.79±.10	0.14±.01	0.61±.01	0.49±.01	0.15±.0
C20:4	0.40±.02	5.79±.10	6.18±.20	9.42±.29	0.49±.01	3.78±.17
C20:5	9.54±1.6	4.38±.10	3.57±.26	6.06±.04	6.22±.20	6.07±.07
C22:2	1.23±.24	0.07±.0	-	0.11±.0	-	0.26±.02
C22:3	3.92±.05	1.04±.01	1.09±.01	0.54±.0	1.72±.05	1.04±.05
C22:4	2.31±.20	1.51±.05		1.70±.05	1.00±.01	0.85±.01
C22:5	3.96±.05	2.94±.05	0.21±.01	3.75±.12	3.14±.11	2.15±.01
C22:6	17.85±2.7	25.69±2.3	14.48±.5	7.76±.15	24.70±.5	17.78±.15
Total Saturates	49.92	43.74	40.10	34.16	40.21	33.83
Unknown	13.91	8.01	7.76	21.4	11.78	1.51

this particular fatty acid was a key metabolite in fish and that its level was not influenced by diet. Myristic acid (C16:0) 16.39% to 26.79% in ladyfish and sua while stearic acid (C18:0) ranged from 7.65% to 14.0% in khagga and sua respectively.

The saturates were higher than mono and polyunsaturates in all species. However, total unsaturates were more than total saturates. A well established characteristic feature of fish both from temperate and cold water is its marked ability to synthesize more unsaturates [10]. The TSF determined in this study were found in agreement with previous studies [7,11] but slightly higher compared to temperate and cold water region [12]. These differences may be attributed to the high temperature of Pakistani waters [12, 13, 14].

The distribution of total monounsaturates (MUFA) was 6.29% in ladyfish, 10.86% in dother, 7.0% in sua, 8.18% in sole, 10.78% in aal and 21.06% in khagga. While the predominant MUFA were palmitolic and oleic acids. Palmitolic acid varied between 3.06%, to 9.56% in dother and khagga and oleic acid from 2.66% and 10.20% in ladyfish and khagga. In general, these values except for khagga, are lower than the values reported by Fatima *et.al.* [11].

As already discussed, polyunsaturated fatty acids (PUFAs) having medicinal importance constitute the major fraction of total fatty acids. Total PUFAs were found to be 49.42% in ladyfish, 61.31% in dother, 40.10% in sua, 34.16% in sole, 40.21% in aal and 33.83% in khagga. Among the PUFAs the omega-3 fatty acid particularly eicosapantenoic acid (EPA C20:5) and docosahexanoic acid (DHA C22:6) are of therapeutic value. The EPA (C20:5) ranged from 3.57 to 9.54% in sua and ladyfish, while DHA C22:6 was the major PUFA in all the species and ranged from 7.76 to 25.65% in khagga and dother respectively. The EPA and DHA accounted for almost 40.48% of the total PUFAs in sole and aal respectively. The reported EPA values with slight variation are similar to the values reported for black pomfrot, mackerel, mushka, sardine and palla [7,11]. With the exception of mushka (32.0%) similar values of DHA have been previously reported for sardine, mullet and palla [7, 11, 15].

Present data indicates that all the species examined are good sources of omega-3 PUFA (EPA & DHA). The values however, varied among the different species. This variation could possible be attributed to the variations in the environmental factors and nutritional status of fish (10,16). EPA was predominant in ladyfish and DHA in dother.

The present study may be an important addition to the nutritional information of marine fish from Pakistan waters.

Experimental

Sample of six different species of fish were obtained from Karachi fish harbor, samples were frozen immediately after collection and kept frozen until assayed. Three different fish samples of each species (100gm.) were extracted for total lipid content by the method of Bligh and Dyer [17]. Extracted lipids of three different fish sample of each species were stored at -40°C under nitrogen until used. For G.C. analysis extracted lipid was methylated with 0.5% sodium methoxide in methanol and refluxed. After 45.minutes the solution was diluted with distilled water and extracted with hexane, dried over sodium sulphate (anhydrous) and diluted in hexane [18].

The recovered methylesters were analysed on fuse silicacapillary 30 m x 0.32 mm I.D. coated with SUPEL COWEX 10 in G.C.9A Shimadzu gas chromatography equipped with a flame ionization detector.

Chromatographic conditions used were same as reported earlier [11] Compounds were tentatively identified by comparison with retention time of known standards (Sigma Chemical Co., St. Louis, MO).

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