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Lipid Profiles of Pomfret Fish (*Pampus argenteus*) Organs

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Abstract: The study of the lipid matter content from the different organs of Pomfret (*Pampus argenteus*) fish indicates that a major amount of lipid accumulates in the brain while the organs like digestive tract and muscle contain relatively much lower amount. The composition of the lipid matter of various organs points out that cholesterol is in much greater proportion than that of the phospholipid. Cholesterol is present in highest amount in the brain lipid compared with other organs while the content of phospholipid is lowest in the digestive tract. The fatty acid composition reveals that the lipids of each organ of pomfret fish are enriched in the saturated fatty acids. Also a distinct variation exists in the amount of the individual saturated fatty acids. The eye ball lipid has the highest amount of saturated fatty acid (84%) followed by digestive tract (69%), muscle (52%) and brain (34%). The polyunsaturated fatty acids are the next major fatty acids, with significant amount of C_{22:6} fatty acid.

Key words: fatty acid composition, *Pampus argenteus*, pomfret

1 Introduction

Pomfret (*Pampus argenteus*) is a well known fish for direct consumption as a whole as well as of its organs like brain, muscle, digestive tract and eye ball. The lipid profiles including fatty acid composition of the organs of pomfret fish need to be evaluated from health and nutrition aspect. In fact, the information on the lipid profile of the individual specific organs of pomfret fish is lacking. Also the variation of the lipid profile with salinity of fish constitutes an interesting aspect but the literature information points out that very little is known on this aspect. It is therefore important to generate more information on these two important matters namely the lipid spectrum of organs of a fish and the influence of salinity in the lipid composition.

The present study investigates the lipid composition particularly the structure lipids like phospholipid and

cholesterol and the fatty acid composition of the total lipid of the different organs of pomfret, which is edible salt-water fish of India.

2 Experimental

2.1 Collection of Fish

The fish *Pampus argenteus* was collected from Digha, West Bengal, India during March-April. The length, breadth and weight of *Pampus argenteus* were 14-16.4 cm, 7.6-8.8 cm, 50-50.2 g, respectively whereas the number of individuals taken were six.

2.2 Tissue Collection

Brain, digestive tract and eye balls were collected separately from each fish, wiped with the blotting paper and weighed. To obtain representative sample one square cm of muscle were collected near all the fins

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from each fish and weighed.

2.3 Extraction of Lipid

The lipids were extracted from each organ according to the process of Bligh and Dyer (1). The isolated lipids were stored under nitrogen atmosphere and stored at -20°C for further analysis.

2.4 Determination of Phospholipid and Cholesterol

Phospholipid content was estimated by measuring phosphorous in the lipid using the standard method of A.O.C.S. (2). Cholesterol was estimated according to the standard method of Zlatkis *et al.* (3).

2.5 Fatty Acid Analysis by Gas Liquid Chromatography

The total fatty acid composition of the lipid was determined by Gas-liquid chromatography (GLC) after derivatization into methyl esters (4). The HP-5890A GLC (Hewlett Packard, Palo Alto, CA) was connected with a glass column ($183\text{ cm} \times 0.31\text{ cm i.d.}$) packed with 10% diethylene glycol succinate (DEGS) supported on Chromosorb-WHP (100/200 mesh) of HP make. The oven, injector and detector block temperatures were maintained at 190, 230, and 240°C , respectively. IOLAR-2 nitrogen (BOC India Ltd, Kolkata, India) was used as the carrier gas (flow rate 45 ml per min). The fatty acid esters peaks were identified and calibrated with standard methyl esters supplied by Sigma Chemical Co. (ST. Louis, MO).

2.6 Statistical Analysis

The results are given as the mean \pm standard deviation.

3 Results and Discussion

The investigation includes the determination of lipid content and its composition including the fatty acids of pomfret fish species. The content of total lipid and the amount of phospholipid and cholesterol content in the extracted lipid from different organs are shown in **Table 1**. The present work on *Pampus argenteus* shows a fat content of muscle at 1.43% that confirms the published report (5). However, this species of pomfret varies greatly with black pomfret (*Formio niger*) where fat content in the whole body is 2.6%. The pomfret shows a high lipid content in brain than in the other organs (**Table 1**) like the muscle and digestive tract. The cholesterol and phospholipid content of each organ varies greatly and the phospholipid-cholesterol ratios also vary as indicated for muscle - 0.22, digestive tract - 0.02, brain - 0.33 and eye ball - 0.014. Cholesterol content in brain of pomfret is very much higher than other tissues. The phospholipid content of digestive tract is lowest than all the other organs. Muscle and eye ball phospholipid are nearly equal.

In pomfret the digestive tract and muscle shows a wide variety of fatty acids than those of eye ball and brain (**Table 2**). The chief fatty acids are palmitic ($\text{C}_{16:0}$) and stearic ($\text{C}_{18:0}$) in all the four organs. The palmitic acid is maximum in *Pampus* eye ball, followed by digestive tract, muscle and brain respectively. The polyunsaturated fatty acids like $\text{C}_{22:6}$ and $\text{C}_{22:4}$ are high in muscle while in digestive tract $\text{C}_{22:5}$ is quite prominent. Black pomfret and Surmai (both marine water) were potent dietary sources of the n-3 fatty acids, $\text{C}_{20:5}$ and $\text{C}_{22:6}$ which are known to prevent symptoms to cardiovascular disease. The sea water fishes are well known to possess abundant amount of highly unsaturat-

Table 1 Total Lipid and Structural Lipid Composition (%w/w) of Various Organs of Pomfret (*Pampus argenteus*).

	Organs			
	Digestive tract	Muscle	Brain	Eye
Total Lipid	1.01 \pm 0.15	1.43 \pm 0.2	8.22 \pm 0.45	1.81 \pm 0.23
Phospholipid	0.35 \pm 0.20	2.76 \pm 0.18	19.79 \pm 0.87	1.74 \pm 1.09
Total Cholesterol	14.48 \pm 1.15	12.19 \pm 7.03	59.29 \pm 0.78	12.24 \pm 0.29

Values are Mean \pm S. D., n = 6

Table 2 Fatty Acid Composition (%w/w) of the Lipid Present in Various Organs of Pomfret (*Pampus argenteus*).

Fatty Acids (%w/w)	Name of Organs			
	Digestive Tract	Muscle	Brain	Eye
Saturated				
14:0	2.5 ± 2.33	6.5 ± 2.05	1.5 ± 0.14	4.9 ± 1.41
16:0	48.0 ± 2.82	34.9 ± 4.10	24.3 ± 1.20	53.3 ± 5.65
18:0	18.7 ± 0.14	10.2 ± 2.4	9.8 ± 0.35	25.9 ± 3.28
20:0	0.5 ± 0.17	1.1 ± 0.14	-	-
Total	69.4 ± 5.79	52.7 ± 0.49	34.2 ± 0.70	84.1 ± 3.52
Monoenoic				
14:1	0.5 ± 0.21	0.5 ± 0.07	3.2 ± 0.42	0.8 ± 0.6
16:1	3.1 ± 3.95	-	-	-
18:1	10.1 ± 1.27	11.2 ± 0.98	-	-
20:1	0.6 ± 0.14	1.1 ± 0.21	-	-
Total	14.25 ± 4.87	12.8 ± 1.27	3.2 ± 0.42	0.8 ± 0.6
Polyenoics				
18:2	-	1.3 ± 0.14	-	-
18:3	-	1.2 ± 0.21	-	-
20:3	1.8 ± 0.56	1.9 ± 0.35	-	3.4 ± 0.25
20:4	1.7 ± 0.49	3.7 ± 0.7	2.2 ± 0.49	4.2 ± 0.78
20:5	1.3 ± 0.07	-	-	-
22:3	2.2 ± 0.49	2.9 ± 0.07	59.7 ± 0.56	-
22:4	2.2 ± 0.34	5.3 ± 2.54	-	4.5 ± 2.6
22:5	5.5 ± 1.27	3.0 ± 2.61	-	1.9 ± 1.3
22:6	-	11.2 ± 0.77	-	-
Others	1.1 ± 0.77	3.8 ± 0.42	0.7 ± 0.07	2.9 ± 2.24
Total	16.0 ± 0.49	32.5 ± 0.98	62.6 ± 1.13	15.0 ± 3.95

Values are Mean ± S. D., n = 6

ed acids to maintain homeostasis of the body, fluid and osmo regulation in sea water (6).

It is observed that the total monounsaturated fatty acids of muscle and digestive tract of *Pampus argenteus* are very low. The content of saturated fatty acids is high in all the organs of Pomfret. The total polyunsaturated fatty acid of the brain of pomfret is maximum but the physiologically important HUFAs like C_{20:5} and C_{22:6} are actually lacking. On the other hand lipids of muscle have significant amount of C_{22:6} along with C_{20:4} acid and the digestive tract lipid has C_{20:4} and C_{22:6}.

4 Conclusion

Pomfret (*Pampus argenteus*) fish studied shows accumulation of a high lipid content in brain than in the other organs. The lipid composition including fatty acids in the different organs of pomfret fish vary significantly.

References

1. E.G. BLIGH and W.J. DYER, A Rapid Method of Total Lipid Extraction and Purification, *Can. J. Biochem. Physiol.*, Vol. 37,

- 911-917 (1959).
2. *Official Methods and Recommended Practice of American Oil Chemists' Society*, Method No. Ja 7-86 4th edn. (D. FIRESTONE, ed.), AOCS, Washington DC, (1991).
 3. A. ZLTKIS, B. ZAK and A.J. BOYLE, A Method for the Determination of Serum Cholesterol, *J. Lab. Clin. Med.*, Vol. **41**, 486 (1953).
 4. L.D. METCALFE and A.A. SCHMITZ, The Rapid Preparation of Fatty Acid Esters for Gas Chromatographic Analysis, *Anal. Chem.*, Vol. **33**, 363-364 (1961).
 5. *Indian Council of Medical Research (ICMR), Proximate Principles, Minerals and Vitamins, Fishes and Other Sea Foods, Report Series, 542*, Sl. no. 434, ICMR Publication, New Delhi, p. 95 (1966).
 6. P.G. SARENSEN, Phospholipids and Fatty Acid Esters from Flounder (*Platichthys flesus*) Erythrocyte Plasma Membrane and Changes of the Lipids from the Membrane as a Result of Long Term Temperature Acclimation, *Comp. Biochem. Physiol.*, Vol. **96**, 571-572 (1990).
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