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Lipid Profiles of Bhola Bhetki (*Nibea soldado*) Organs

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Abstract: The fish, namely Bhola bhetki (*Nibea soldado*) was examined for lipid composition of its specific organs. The fish had a much higher lipid content in brain in comparison with its other organ while the muscle and digestive tract had nearly equal amount of total lipids. Cholesterol content in lipid part of various organs was significantly high in Bhola (*Nibea sp*.) while the phospholipid content was low. Fatty acid compositions of eye and digestive tract of *Nibea soldado* were richer in variety than those of muscle and brain. The total saturated and poly unsaturated acids were more or less equal in muscle and brain lipid. The total monounsaturated fatty acids are more or less same in the muscle, brain and eye. Eicosapentaenoic acid ($C_{20:5}$) is very high in all the organs. Arachidonic acid ($C_{20:4}$) is also present in considerable amount in brain, eye and digestive tract. The variation of cholesterol, phospholipid and fatty acid composition in fish organs would be beneficial for human consumption from health point of view.

Key words: *Nibea soldado*, fatty acid composition

1 Introduction

Fish is a staple food item in the lunch and dinner dishes of a large segments of population in India. A variety of fish is consumed in a regular manner either as a whole after dressing or its various organs like brain, digestive tract, eye etc. individually eaten, depending on the size of fish and taste of the individual organs of fish due to their lipid composition pattern.

The lipid profiles of variety of fish, which contribute towards health and nutrition apart from providing ordinary tastes have received a lot of importance already. In fact, the characterization of the lipid profiles including the fatty acid composition as occurring in the specific organs like brain, retina, muscle, digestive tract of a fish shows considerable interest and importance (1). In comparison of wealth of information available on the lipid profiles of whole fish (2-3), the volume of work on the lipid profiles of the individual specific organs of fish is very little available. Also the variation in 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 aims at investigating the lipid composition particularly of the structural lipids like phospholipid and cholesterol and overall fatty acid composition of the total lipid of the different organs of the edible salt water fish of West Bengal like Bhola Bhetki (*Nibea soldado*) in order to reveal variation of lipid profiles in the different organs of the species.

2 Experimental

2·1 Collection of Fish

The fish *Nibea soldado* was collected from Hooghly

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estuarine area during August, 1993. The length, breath and weight of *Nibea soldado* were 19-23 cm, 4.8-6 cm, 93-143 gm respectively whereas the number of individuals taken were 6.

2·2 Tissue Collection

Brain, digestive tract and eye 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 from each fish and weighed.

2·3 Extraction of Lipid

The lipids were extracted from each organ accordingly by the method of Bligh and Dyer (4). The isolated lipids were stored under nitrogen atmosphere at −20℃ 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. (5). Cholesterol was estimated according to the standard method of Zlatkis *et al*. (6).

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 (7). The HP-5890A GLC (Hewlett Packard, Palo Alto, CA) was connected with a glass column (183 cm × 0.31 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℃, 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 ± standard deviation.

3 Results and Discussion

3·1 Total Lipid and Structural Lipids of Nibea Organs

The investigation includes the lipid composition including the fatty acids of Nibea fish species. The amount of total lipid as well as their phospholipid and cholesterol content of the extracted lipid from different organs are shown in **Table 1**. The fish Bhola shows a high lipid content in brain than in the other organs. The total lipids of the muscle and digestive tract are nearly equal in amount. The deposition of lipids as an energy reserve is encountered in the species of fish. The lipids besides providing energy serve as sources of essential fatty acids in fish tissues. The total lipid of the entire Bhola (*Nibea soldado*) fish as 1.1 g (8) which appears to tally with the present data of lipid (1.13 g) of Bhola muscle.

Cholesterol and phospholipid content of each organ varies greatly. This variation in cholesterol and phospholipid percentage in the fish compares with other brackish water fishes (9). The tissue specificity in cholesterol and phospholipid content exist in the fish. The internal factors responsible for it may be the feeding habit and habitat and different distribution of those in specific organs. Here Bhola is carnivorous. Studies

Table 1 Total Lipid and Structural Lipid Composition (%w/w) of Various Organs of **Bhola Bhetki (*Nibea soldado*)**.

	Organs			
	Muscle	Digestive tract	Brain	Eye
Total Lipid	1.13 ± 0.30	1.55 ± 0.28	12.16 ± 0.66	1.55 ± 0.48
Phospholipid	1.46 ± 0.15	1.73 ± 0.45	1.35 ± 0.34	2.61 ± 0.50
Total Cholesterol	14.76 ± 1.91	26.04 ± 1.70	14.47 ± 0.98	29.82 ± 2.42

Values are Mean ± S. D., n=5

show that dietary lipids play an important role in energy production of carnivorous fish rather than herbivorous species.

3·2 Fatty Acid Composition of the Total Lipid of Nibea Organs

The major fatty acids of the total lipid extracted from the various organs of the fish are included in **Table 2**.

The type of fatty acid composition depends upon the energy requirement of the fish and how it utilizes this fatty acid composition in different tissues to get the best function from that tissue so that it is beneficial for whole animal body. Fatty acyl group provides the hydrophobic interior of cell membranes, forming an impermeable barrier to water and polar molecules and separating the cell contents from the extra cellular medium. The physical properties of the membranes are determined by the individual phospholipids therein, the fatty acid composition of these phospholipids and their interactions with cholesterol and proteins. The degree of unsaturation of the fatty acids is important in determining the fluidity of the membrane and in providing the correct environment for membrane functions. In fish and other poikilotherms the degree of unsaturation of membrane fatty acids is also important in the process of adaptation to differential temperatures. In addition to these structural functions certain fatty acids are metabolically very active, having important roles in the provisions of precursors of prostaglandin (PG) and leukotriene production. Large number of individual fatty acids has been isolated from many animal tissues. The commonest ones found in fish tissues represent the n-6 and n-3 series of essential fatty acid (EFA) and the higher polyunsaturated fatty acids (HPUFA). These HPUFAs include two fatty acids of the linolenic acid family (n-3), eicosapentaenoic acid, docosapentaenoic acid and docosahexaenoic acid (10).

The fatty acid composition of *Nibea soldado* shows that eye and digestive tract are richer in variety than those of muscle and brain (**Table 2**). The total saturated and total poly unsaturated fatty acids are more or less equal in muscle and brain (**Table 2**). The total monounsaturated fatty acids are more or less same in the three organs muscle, brain and eye. Eicosapentaenoic acid ($C_{20:5}$) is very high in all the four organs especially in muscle. $C_{18:1}$ shows similar case (**Table 2**). This high amount of $C_{20:5}$ polyunsaturated fatty acid is found in other marine fishes like *Stromateus sinensis*, *Thrissocles kammalenis*, *Sardinella lingiceps and Euthynnu affinis* (11). Arachidonic acid ($C_{20:4}$) is also present in considerable amount in brain, eye and digestive tract.

Table 2 Fatty Acid Composition (%w/w) of the Total Lipid of the **Bhola Bhetki (*Nibea soldado*)**.

Fatty Acids (%w/w)	Name of Organs			
	Muscle	Brain	Eye	Digestive Track
Saturated				
14:0	4.8 ± 0.7	2.6 ± 0.1	2.7 ± 1.9	5.1 ± 0.2
16:0	36.5 ± 1.4	44.4 ± 0.1	43.9 ± 10.7	22.0 ± 0.1
18:0	17.2 ± 1.4	13.8 ± 8.9	24.9 ± 12.1	6.5 ± 0.2
20:0	—	—	0.6 ± 0.1	—
22:0	—	—	0.8 ± 0.1	—
Total	58.3 ± 1.8	60.1 ± 8.8	72.1 ± 15.0	33.6 ± 0.2
Monoenoic				
14:1	2.7 ± 3.8	1.5 ± 1.0	0.7 ± 0.1	1.4 ± 0.2
16:1	1.1 ± 0.1	1.7 ± 0.1	0.0	22.5 ± 0.5
18:1	12.6 ± 2.7	9.8 ± 0.12	12.5 ± 0.7	10.6 ± 0.4
Total	12.9 ± 10.4	12.9 ± 0.1	13.2 ± 0.6	34.5 ± 0.8
Polyenoics				
18:2	1.3 ± 0.4	1.3 ± 0.1	—	3.9 ± 0.2
18:4	0.5 ± 0.1	0.6 ± 0.1	1.6 ± 1.1	1.6 ± 0.1
20:2	2.3 ± 0.1	—	—	2.6 ± 0.2
20:3	3.2 ± 0.3	—	—	—
20:4	0.7 ± 0.6	5.1 ± 0.8	4.4 ± 1.6	4.1 ± 0.2
20:5	19.4 ± 9.5	9.0 ± 10.5	6.9 ± 6.9	13.6 ± 0.6
22:3	—	7.7 ± 3.6	—	—
22:4	5.1 ± 1.5		5.9 ± 2.3	2.5 ± 1.0
22:5	—	—	1.7 ± 0.3	0.9 ± 0.2
22:6	—	—	3.2 ± 1.5	1.3 ± 0.1
Others	2.4 ± 2.5	3.6 ± 3.2	2.5 ± 1.8	1.5 ± 1.5
Total	28.7 ± 10.7	27.1 ± 8.7	18.9 ± 12.9	32.0 ± 1.0

Values are Mean ± S. D., n=5

4 Conclusion

The species of the fish studied shows accumulation of a high lipid content in brain than in the other organs and also reveals that the total lipids of muscle and digestive tract are nearly equal. It is also observed that

lipid composition including fatty acid varies in the different organs of the fish.

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