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Estimation of proximate protein content from locally available freshwater fish from Ahmednagar city (M.S.) India

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ABSTRACT
Fish are equally important as food and for trade. Fisheries is an employment and income generating industry for millions all over the world. In present times of population explosion leading to food insecurity and malnutrition; especially, protein deficiency, fish as a source of animal protein has great significance. Keeping this in view, the present study was undertaken to evaluate the proximate protein content in various tissues of freshwater fish viz., *Clarius*, *Channa*, *Pangasius* and *Oreochromis* available in the local fish markets of Ahmednagar city of Maharashtra, India. The protein content estimated from tissues such as skeletal muscle, liver tissue, gill tissue and brain tissue provide nutritional information and points towards the protein rich tissues present in the fish under study. Maximum value of protein content i.e., 275.86 (µg/ml) was observed in the skeletal muscle of the fish *Pangasius*; which point towards the nutritional value of the freshwater fish from the study area. Minimum value of protein content i.e., 82.76 (µg/ml) was observed in the gill tissue of the fish *Clarias* and *Pangasius*.
Keywords—Freshwater fish, Muscle, Tissues, Proximate protein content, Ahmednagar city

1. Introduction

Increasing human population in developing countries has resulted in scarcity of food resources leading to malnutrition [1]. Fish protein contains all the essential amino acids in required proportions, and hence has a high nutritional value, which contribute to their high biological value. A larger percentage of consumers do eat fish because of its availability, flavour and palatability, while fewer do so because of its nutritive valve [2].

A wide range of proteins occur, which are mainly composed of 20 amino acids combined in different arrangement; wherein 10 of the amino acids are classified as essential as they cannot be synthesised by man and therefore fish is important in maintaining a correct dietary balance [3]. In addition of being the major source of n-3 LC PUFA, fish and other seafood have also a well-balanced amino acid composition, contain high proportions of taurine and choline, the vitamins D3 and B12 and the minerals calcium, phosphorus, iodine, and selenium [4]. Knowledge of the proximate composition of fishes can be used to estimate the food value of fishes and plan the most appropriate industrial and commercial processing [5].

Variation of biochemical composition of fish flesh may occur within same species depending upon the fishing ground, fishing season, age and sex of the individual and reproductive status; whereas, the spawning cycle and food supply are the main factors responsible for this variation [6]. Studies on the body composition of the freshwater fishes have not really caught attention of researchers in fisheries; and there is lack of adequate information on fish; hence the consumer and fishery workers are left with limited or paucity of information on the importance of some particular fish species in their daily diets [7]. Measurement of proximate profiles such as protein, lipids, and moisture content is often necessary to ensure that they meet the requirements of food regulations and commercial specifications [8]. They also influence postharvest processing and the shelf-life of the fish [9].

Additionally, consumption of fish by humans has been recommended for its role in prevention of heart diseases [10, 11]. Strong links between fish and seafood consumption and positive health effects, especially with the decreased risk of coronary heart and cardiovascular diseases, decreased

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inflammatory disease as arthritis and prevention of cancer have been shown by many researchers [12, 13, 14, 4]. Scientists reported that societies with high fish intake have considerably lower rates of acute myocardial infarctions, other ischemic heart diseases and atherosclerosis [15, 16].
It has also been reported that factor such as feed composition, environment, fish size, and genetic trait all have an impact on the composition and quality of aquaculture fish [17]. [18] reported that the proximate composition of fish depends on various factors such as sex, size, stages of maturity and season. Emphasis has been on finding out nutritional value of different fish by assessing their nutrient composition, especially protein. Protein composition of various fish has been estimated and some studies have worked out the protein content of different organs and tissues of fish. Protein content varies from fish to fish at species level as well as individual level. Further, protein content in different tissues of fish is variable too. Keeping this in view, the present study was undertaken to evaluate the proximate protein content in various tissues of few freshwater fish available in the local fish markets of Ahmednagar city.

2. Methodology

2.1 Collection of Fish Samples

Freshwater fish samples were collected from local fish markets in Ahmednagar City. The samples were transported to the laboratory in fresh condition and were thoroughly washed with cold water to remove blood, slime, dirt, etc. and sacrificed.

2.2 Identification and Classification

For identification and classification of fishes, standard keys like ‘Fishes of India’ by [19] and ‘Freshwater Fishes of the Indian Region’ by [20] was followed.

2.3 Processing of Fish Tissue

Sample of each fish species was dissected and skeletal muscle and organs like liver, gill and brain, were collected, sliced into smaller pieces, washed with distilled water, blotted with blotting paper and placed in sterile bottles. A weighed portion (1 gm) of tissue sample was homogenised in ice cold saline (0.89% NaCl solution) using a homogeniser. The homogenate was stirred on magnetic stirrer for 3 hours and was filtered using filter paper. The filtrate (i.e., aqueous tissue extracts in ice cold saline) was used for estimation of protein content using Folin-Lowry method [21] as follows:
i) Standard protein solution, distilled water, Lowry solution ‘C’ and FCR were added according to the Standard Protein & Reagent Addition Table (see below) and the resulting mixture was kept at room temperature for 10 minutes.
ii) After which the values of optical density of standard protein (200 µg/ml) solution and sample protein solutions were recorded at 660 nm using colorimeter.
iii) Total protein was calculated using the formula:

$$\textbf{Concentration of Total Protein (µg/ml)} = \frac{\text{Optical Density of Sample}}{\text{Optical Density of Std.}} \times \text{Conc. of Std.}$$

3. Results and Discussion

The protein content of the fish under investigation and its percentage is given in Table 1. Following discussion by [22] in their work entitled ‘Total protein and lipid content in edible tissues of fishes from Kasimodu fish landing centre, Chennai, Tamilnadu’; gives the significance of proteins in living systems: Biochemical studies are very important from the nutritional point of view. In various fish species, proteins are important as structural compounds, biocatalysts and hormones for control of growth and differentiations [23]. Protein in fish is a main component constituent of tissue and organs. They are precursors of other nitrogen compounds (enzymes, hormones, slurry, neurotransmitters, cofactors, etc.) and constitute an important energy source [24].

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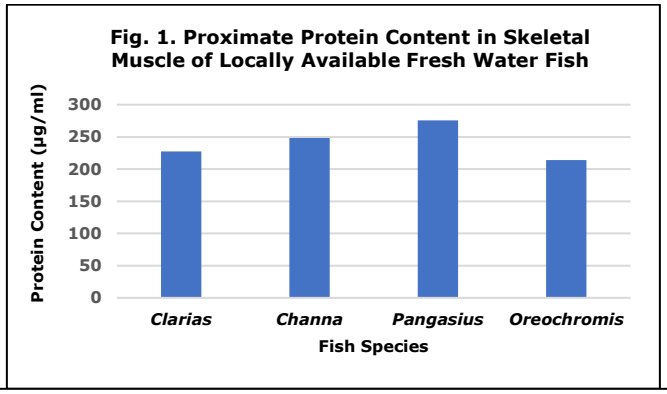
Table. 1. Proximate Protein Content in Freshwater Fish

Sr. No.	Fish Tissue	Protein Content							
		Clarias		*Channa*		*Pangasius*		*Oreochromis*	
		(µg/ml)	(%)	(µg/ml)	(%)	(µg/ml)	(%)	(µg/ml)	(%)
1	Skeletal Muscle	227.58	40.73	248.27	38.7	275.86	42.1	213.79	32.63
2	Liver Tissue	144.83	25.92	165.52	25.8	172.41	26.31	220.69	33.68
3	Gill Tissue	82.76	14.81	96.55	15.05	82.76	12.63	89.65	13.68
4	Brain Tissue	103.45	18.51	131.03	20.42	124.14	18.94	131.03	19.99



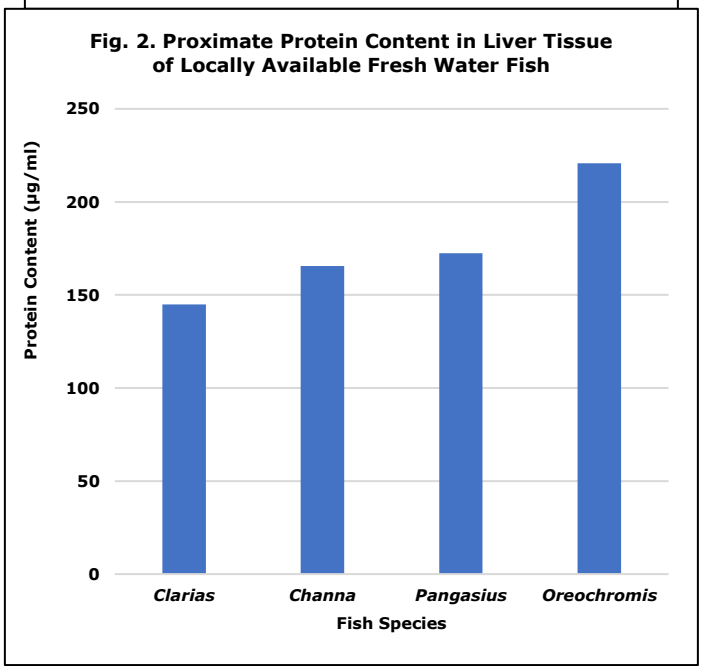


Fig. 1. Proximate Protein Content in Skeletal Muscle of Locally Available Fresh Water Fish

Fig. 2. Proximate Protein Content in Liver Tissue of Locally Available Fresh Water Fish

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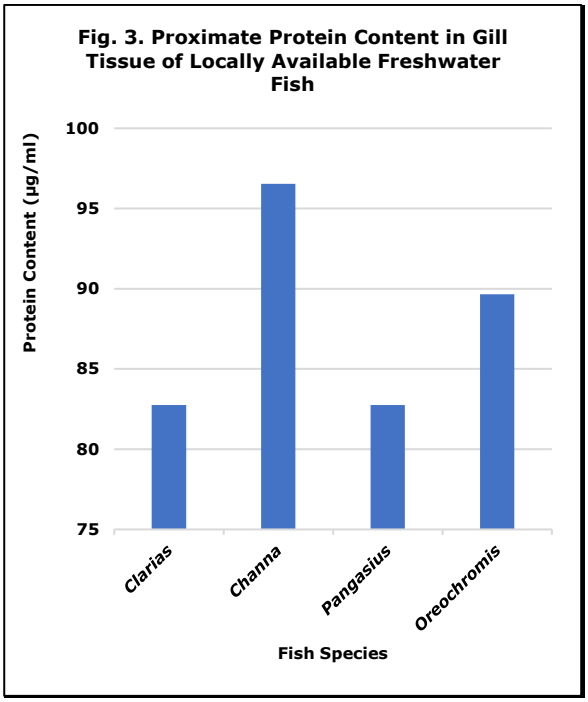

Fig. 3. Proximate Protein Content in Gill Tissue of Locally Available Freshwater Fish

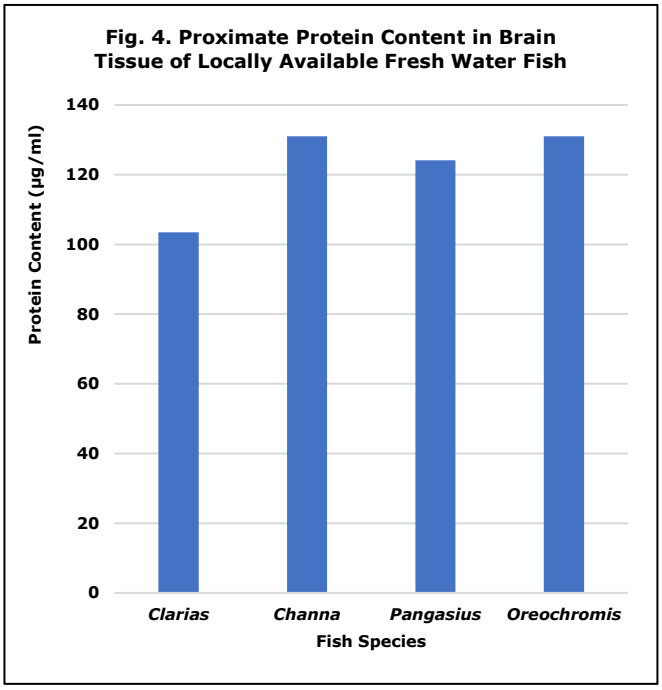

Fig. 4. Proximate Protein Content in Brain Tissue of Locally Available Fresh Water Fish

Fig. 1 shows the proximate protein content in **skeletal muscle** of the above-mentioned freshwater fish. Maximum protein content was found to be in the fish *Pangasius* (275.86 µg/ml) and minimum was observed in *Oreochromis* (213.79 µg/ml). Fig. 2 shows the proximate protein content in **liver tissue** of the above-mentioned freshwater fish. Maximum protein content was found to be in the fish *Oreochromis* (220.69 µg/ml) and minimum was observed in *Clarias* (144.83 µg/ml). Fig. 3 shows the proximate protein content in **gill tissue** of the above-mentioned freshwater fish. Maximum protein content was found to be in the fish *Channa* (96.55 µg/ml) and minimum was observed in *Clarias* as well as *Pangasius* (82.76 µg/ml). Fig. 4 shows the proximate protein content in **brain tissue** of the above-mentioned freshwater fish. Maximum protein content was found to be in the fish *Channa* and *Oreochromis* (131.03 µg/ml) and minimum was observed in *Clarias* (103.45 µg/ml).

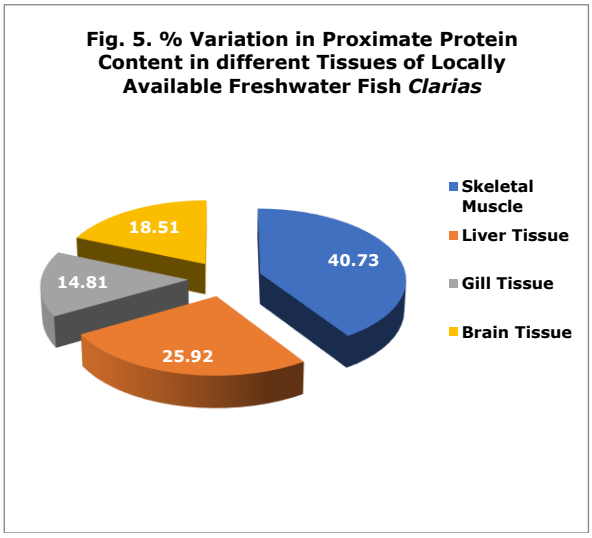

Fig. 5. % Variation in Proximate Protein Content in different Tissues of Locally Available Freshwater Fish *Clarias*

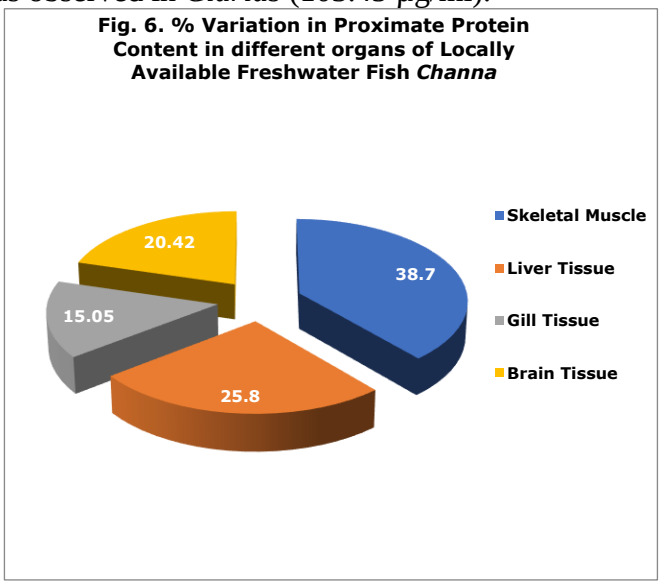

Fig. 6. % Variation in Proximate Protein Content in different organs of Locally Available Freshwater Fish *Channa*

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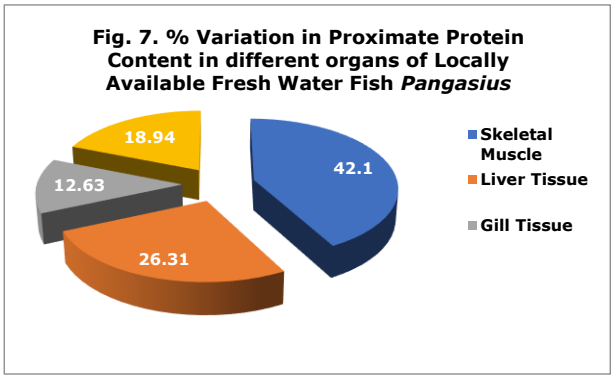

Fig. 7. % Variation in Proximate Protein Content in different organs of Locally Available Fresh Water Fish *Pangasius*

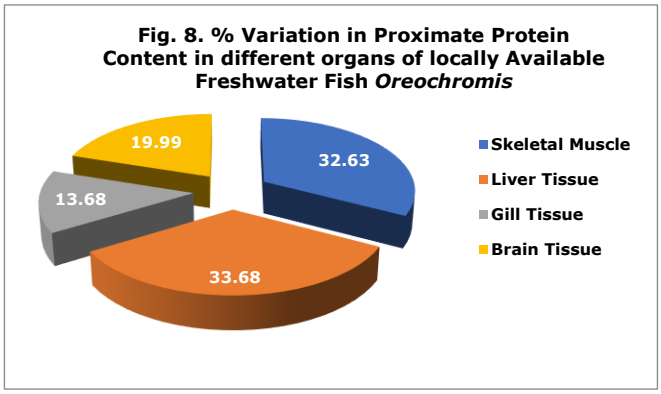

Fig. 8. % Variation in Proximate Protein Content in different organs of locally Available Freshwater Fish *Oreochromis*

Fig. 5 shows the variation in protein content of the different tissues of the freshwater fish ***Clarias***. Maximum protein content was found to be in the skeletal muscle (40.73%); whereas minimum was found to be in gill tissue (14.81%). The protein content was found to be in the order of skeletal muscle > liver tissue > brain tissue > gill tissue. Fig. 6 shows the variation in protein content of the different tissues of the freshwater fish ***Channa***. Maximum protein content was found to be in the skeletal muscle (38.7%); whereas minimum was found to be in gill tissue (15.05%). The protein content was found to be in the order of skeletal muscle > liver tissue > brain tissue > gill tissue. Fig. 7 shows the variation in protein content of the different tissues of the freshwater fish ***Pangasius***. Maximum protein content was found to be in the skeletal muscle (42.1%); whereas minimum was found to be in gill tissue (12.63%). The protein content was found to be in the order of skeletal muscle >liver tissue > brain tissue > gill tissue. Fig. 8 shows the variation in protein content of the different tissues of the freshwater fish ***Oreochromis***. Maximum protein content was found to be in the liver tissue (33.68%); whereas minimum was found to be in gill tissue (13.68%). The protein content was found to be in the order of liver tissue > skeletal muscle > brain tissue > gill tissue.

From the above results, it is clear that the protein content (µg/ml) varies from fish to fish and tissue to tissue. Table 1. shows the variation in the proximate protein content in different tissues of locally available freshwater fish namely - *Clarias*, *Channa*, *Pangasius* and *Oreochromis*. Out of the total protein estimated in a particular fish under study, the proportion of protein from each of the tissue examined was calculated so as to get an idea of the nutritional value of different parts of the fish.

The proximate protein content estimated from different tissues of locally available freshwater fish species was compared so as to understand the nutritional value of each tissue. Of the four fish investigated maximum protein content was found to be in the skeletal muscle of *Clarias, Channa* and *Pangasius*; whereas it was maximum in the liver tissue of *Oreochromis*. However, the minimum protein content was found to be in the gill tissue of all the fish.

Protein is useful for maintenance of good health [25]. [26] analysed the proximate composition of some small indigenous fish species in Bangladesh and found that the protein content varied from species to species. [27] during his studies on freshwater fish *Channa gachua* recorded the total fish protein in different organs to be 107.28 (Brain), 87.04 (Gill), 121.13 (Kidney), 135.35 (Liver) and 131.25 (Muscle) mg/g wet weight of tissue.

[28] during their studies on freshwater fish *Labeo rohita* recorded the total fish protein in different organs to be 118.2 (Brain), 109.3 (Gill), 136.2 (Kidney), 177.26 (Liver) and 143.4 (Muscle) mg/g wet weight of tissue. The total protein in *Labeo rohita* content was found to be in the order of Muscle > Liver > Brain > Gill > Kidney.

The crude protein content in fishes of Lakshadweep Sea was found to be (*E. tauvina*) 11.54, (*C. orthogrammus*) 11.51, (*T. crocodilus*) 13.26, (*L. gibbus*) 10.58, (*S. lalandi*) 12.53, (*T. albacares* 13.69), (*P. bifasciatus*) 10.58, (*C. undulates*) 10.54, (*L. bohar*) 11.67 and (*H. dussumieri*) 10.51% dry

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weight by [29]. Their results showed that the fishes are a good source of high-quality protein. [30] estimated the protein content of the muscle tissue extract of *Mugil cephalus* (marine finfish) to be 27.20 (µg ml^{-1}). [22] studied the muscle of *Rastrelliger kanagurta* and the brain of *Arius caelatus* and found them to be rich in protein content which was estimated to be 180.07 and 38.60 µg/100 mg of tissue, respectively.

[31] estimated the proximate compostion of *Clupeidae* and *Engraulidae* inhabiting Thengaithittu Estuary Puducherry- south east coast of India. Their results revealed that the protein composition % were as high as in *S. indicus* (19.2), *S. commersonii* (18.6), *T. mystax* (21.3), *T. malabarica* (19.7), *N. nasus* (17.4), *S. gibbosa* (16.3), *S. longiceps* (14.57), & *I. melastoma* (17.3). From the above observation it is clear that the estuarine fishes with rich nutritive value can be used for alternate source as a regular sea food which supplies nutrients for the growing children, pregnant women and people suffering from malnutrition. [32] estimated the crude protein to be 19.2 and 23.19% from wild and farmed *Clarias gariepinus* and suggested that both are a good source of protein for human consumption.

CONCLUSION

The present study was planned to estimate the proximate protein content from various tissues of locally available freshwater fish from Ahmednagar city. Variation in the protein content with respect to fish species and the tissues was observed. The protein content estimated from tissues such as skeletal muscle, liver tissue, gill tissue and brain tissue provide nutritional information and points towards the protein rich tissues present in the fish under study. Maximum value of protein content i.e., 275.86 (µg/ml) was observed in the skeletal muscle of fish *Pangasius*; which point towards the nutritional value of the freshwater fish from the study area. Minimum value of protein content i.e., 82.76 (µg/ml) was observed in the gill tissue of fish *Clarias* and *Pangasius*. It can be thus concluded from the observations that the fish are a rich source of protein and thus can be recommended for consumption to eradicate protein deficiencies and malnutrition.

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