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## RESEARCH ARTICLE

# THE ROLE OF INDIAN MAJOR CARPS IN HUMAN DIET WITH SPECIAL REFERENCE TO PROTEIN

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**ABSTRACT**

The four fishes were selected for the study of protein includes *Catla catla, Labeo rohita, Cirrihinus mrigala, Cyprinus carpio* from the Nathsagar region, Tal. Paithan dist. Aurangabad, from the present estimation. The experimental fishes were collected in the live condition in the local fresh water sources brought to the laboratory. The fishes of similar size were selected. Lowry's 'C' method is used to calculate the protein value in muscle sample of selected fishes. The principle of Lowry's 'C' method is the blue color developed by the reduction of phosphomolybdotungstic compounds in the folin's reagent. All reagent's by the amino acids the color developed by the burette reaction of the protein with the alkaline measured in the Lowry's method from the Lowry's C method for estimation of protein in muscle sample is incubate the following protein contain in selected fishes.

1. *Catla catla* is showed protein contain in muscle 28 cal/100mg
2. *Labeo rohita* is showed protein contain in muscle 23 cal/100mg
3. *Cirrihinus mrigala* is showed protein contain in muscle 25 cal/100mg
4. *Cyprinus carpio* is showed protein contain in muscle 21 cal/100m



## INTRODUCTION

Fish plays an important role in human nutrition in India, particularly to people of coastal areas. Good and adequate nutrition plays a very important role in the expression of mental, physical and intellectual qualities in humans. To ensure access to the nutritionally adequate food for the improvement in the quality of diet of a poor person in the society, fish is the only medium which can serve the very purpose. They have the ability to reduce blood lipid level, particularly serum triglycerides and also have a good source for human nutrition due to their therapeutic role in reducing certain cardio vascular disorders. Fish is the constituting the only animal protein source among rural poor households. Small Indigenous Fish Species (SIS) dominates the rural Indian diet. The general approach adopted to reduce cost has been to develop low-cost diets by replacing expensive animal protein sources such as fish meal with relatively cheaper than plant protein sources (Keembiyhetty and De Silva, 1993).

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Fish require diets relatively higher in protein than those of commercially reared terrestrial homeotherms. Protein, the most expensive component in fish feeds, is required by fish for maintenance and growth, and the protein level needed for these functions varies with species and the culture environment. Fish protein is easy for digestion, absorption and assimilation as compared with plants protein as well as animal proteins. Growth can be adversely affected by both low and high protein diets. Excessive protein content is wasteful and causes the diets to be unnecessarily expensive. Hence, knowledge of the optimum dietary protein requirement is essential for the formulation of well-balanced and low-cost artificial diets (Mazid, 1979). Fish have high dietary protein requirement. The significance of qualitative and quantitative feeds is well recognized (Mohanty and Samantary, 1996; Gunasekera, 2000; Yang, 2002; Yang, 2003; Sales, 2003; Kalla, 2004; Islam, 2004; Luo, 2004; Kim and Lee, 2005; Tibbetts, 2005). Level of dietary protein is of fundamental importance, because it significantly influences growth, survival, and yield of fish as well as economics of a farming industry by determining the feed cost which is typically the largest operational cost. However, there is a certain level beyond which further growth is not supported, and may even decrease. Considerable research effort has been expended to

determine the quantity and quality of dietary protein necessary to achieve optimum performance of fish. Rapid increase in world population needs food for its growth. Shortage of food especially protein is very serious problem for human population. Fish is a good source of protein and also has essential amino acids with minerals like Zinc, Magnesium, Sodium etc. (Barlas, 1986). Fish farming and aquaculture industry play significant role in contributing fish protein to large Asian population (Ravenhalt, 1982). Advancement of Aquaculture is largely depended on availability of compatible and acceptable diet. For the formation of fish diet Feed Conversion Ratio (FCR) is a good tool to compute the acceptability and suitability of artificial diet. The value of conversion of rate besides depending upon nutrient content of the feed, also varies with

- Method of presentation of food to fish
- Environmental factors such as temperature, dissolved oxygen concentration etc.
- Size of fish
- Stocking density of fish.
- Stage of sexual maturity of fish.

The normal supply of animal protein has been insufficient to meet the demands of ever increasing requirements of proteins of high nutritional value. Such proteins are usually considered to have a biological value lower than those of animal origin. The fish supply offers a large reserve of available protein which according to the experiments with human subjects has a high digestibility. To culture fish in captivity, nothing is more important than sound nutrition and adequate feeding. Our diet influences our health throughout our entire life. Nutrition and diet have a major impact on growth and development in the fetal, infant, child and youth years. The diet in the early stages of life influences the risk of developing chronic illnesses as an adult. Fish and seafood are important sources for vital nutrients such as proteins, Vitamin D, Vitamin B12, Selenium and Iodine. Seafood has a favorable fatty acid composition. The Feed Conversion Ratio (FCR) is an appropriate way to judge the acceptability and suitability of artificial feed for fish. The information of FCR on locally available ingredients will provide the basis to develop acceptable fish feed. The FCR has also been termed as food quotient or food coefficient. Stated that was value of feed conversion rate, besides depending upon the nutrient contents of feed, varies with method of presentation of food to the fish. Keeping in mind view the importance is FCR in formulation of fish diet.

Major carps, *Catla catla, Labeo rohita, Cirrhinus mrigala, Cyprinus carpio* and their hybrids are reared on the simple dietary combination of one or two feed ingredients. The formulation of nutritionally balanced and compatible feed for optimal growth of fish is possible only if information regarding feed conversion ratio and its digestibility in fish is available. It is well known that these two parameters play a key role for the development of artificial feed for fish. Artificial feed plays an important role in semi-intensive fish farming, where it is required to maintain a high density of fish than the natural carrying capacity of water (Jhingran, 1991). The importance of fish as source of high quality, balanced and easily digestible protein, vitamins and poly-saturated fatty acids is well understood now. They are most important source of animal protein and have been widely accepted as a good source of protein and other elements for the maintenance of healthy body. These fishes are good source which possess immense antimicrobial peptide in defending against dreadful human pathogens. They have significant role in nutrition, income, employment and foreign exchange earning of the country. Fish and shellfish are the primary sources of animal protein and valuable in the diet because they provide a good quantity usually 70% or more or protein of high biological value, particularly Sulphur containing amino acids (Latham, 1997). Next to meat, fish is the only protein source that contains all the essential amino acids in right proportion and called complete protein. Consumption of fish provides important nutrients to a large number of people in the world and makes a very significant contribution to nutrition.

Small indigenous fish species are valuable sources of macro and micronutrients. Fish farming and aquaculture industry play a significant role in contributing the fish protein to a large human population (Ravenhalt, 1982). (Hoffman.1993). Fish body composition appeared to be largely influenced by feed composition and also increase in other parameters such as feed ratio and fish size also resulted in enhanced adipose deposition and decreased in water contents in the fish body (Rasmussen, 2001). Wintering of fishes is an important factor of influence on composition of flesh, especially with respect to the common carps (Grozev.1999). Long winter period with low daily water temperatures (bellow $40^{C}$) decreased body weight of 2-year-old carps up to 6%. Part of carp ready for human consumption is sold after wintering in spring time (March to May).

Composition of meat is changed and influenced on quality of product. Wintering period is related to energy reserves of the fish body. Spangenberg and Schreckenbach, considered crude body fat contents for carp *(Cyprinus carpio* L.*)* from 10 to 14 %, as optimal values before the wintering period. The goal of this study was to evaluate parameters of meat composition and meat reflectance of 2 year old common carp, ready for human consumption after wintering. Compared to beef and chicken, fish meat contains higher levels of n-3PUFAs, which are known to be cardio-protective, anti-atherosclerotic, antithrombotic and anti-arithmetic. It also plays a role in reducing the cholesterol level. Lipids are one of the most important components of fish muscle providing energy reserves and components of all bio-membranes. The lipid is extracted from the flasher the analysis of lipid composition. The main objective of this study was to determine the fatty acids profile and composition percentages of four species *Catla catla, Labeo rohita, Cirrihinus mrigala and Cyprinus carpio*. These species are selected for the study because of their economical importance and consumer demand in the Indian aquaculture. Therefore, detailed information about their fatty acids composition was important from nutritional point of view and was needed because it influenced the quality in frozen storage of some fish species.

Thus; this study was carried out to evaluate the protein content and fatty acid profile of commercially important fresh water fishes from Indian waters. One of the major issues of serious concern which directly influences human life is the availability of quality protein. Human population is increasing day by day and the situation puts more pressure on the existing resources for food supply.

## MATERIAL AND METHODS

The four fishes were selected for the study of protein percentage in *Catla catla, Labeo rohita, Cirrihinus mrigala, Cyprinus carpio,* from the Nathsagar dam, Tal. Paithan dist. Aurangabad, from the present estimation, are found in rivers and ponds and Marathwada region and available throughout the year. The experimental test fish species were collected in the live condition from the local fresh water sources brought to the laboratory. The fishes of similar size were selected and the acclimatized to laboratory condition for period of 20 days prior to experiment. During the period acclimatization the fishes were feed at every alternate day. The water was replaced daily after the feeding the fish. The necessary care was taken to avoid mechanical disturbance to the test fishes in aquaria having capacity of 20 liters. The fishes were scarified the muscles samples were taken and protein estimation was carried out by the Lowry's method.

**Principle:** The blue color developed by the reduction of phosphamolydiephosohatangstic compounds in the follinciocate all reagent by the amino acids hyrosplus the color developed by the bunet reaction of the protein with the alkaline cypritrtateaare measured in the Lowry's method.

1. **Lowry's 'A' solution:-** Dissolve 2 gm of NaCO3 in 100 ml of 0.1N NaOH [400 mg NaOH in 100 ml of distilled water = 0.1 N NaOH]
2. **Lowry's 'B' solution:- $B_1$:-** 1% CuSo4 [1 gm CuSo4 in 100 ml distilled water ]

**$B_2$:-** 2% Sodium Citrate [2 gm of Sodium Citrate in 100 ml distilled water]

3. **Lowry's 'C':-** 1 ml of $B_1$ + 2 ml of $B_2$ diluted to 100 ml with Lowry's "A" solution (always prepare fresh)
4. **10% TCA solution: -** Dissolve 10 gm of Trichloro Acetic Acid (TCA) in distilled water.
5. **1N NaOH: -** Dissolved 4 gm of 1N NaOH in 100 ml distilled water.
6. Folin phenol reagent:- This reagent is diluted by distilled water in proportion of 1:1

**Note**: - Folin phenol adding should be made by vigorous shaking Lowry's 'C' solution must be prepared freshly and must be used within 15 minutes.

**Procedure for protein estimation**

- Take 100 mg of wet tissue.
- Add 10 ml, 10% TCA
- Homogenate for 15 minutes.
- Centrifuge for 15 minute at 3000 rpm.
- Dissolved remove the supernatant [this can be used for estimation of ascorbic acid]
- Dissolved the precipitated in 10 ml of 1N NaOH.
- Take 0.1 ml solution + 4 ml Lowry's "C" solution.
- Add 0.4 ml folin phenol reagent and cool it for 30 minute [ keep test tube in dark]
- Take optical dencity [O.D] at 660 mu filter.

**Blank: -** 0.1 ml [1n NaOH ] + 4 ml Lowry's 'C' solution + 0.4 ml folin phenol reagent.

**Standard stock solution: -** 10 mg of BSA in 10 ml distilled water.

## RESULTS

***Catla catla*:**

**Classifiaction:**

| | | |
|---|---|---|
| **Phylum** | : - | Chordata |
| **Sub-phylum** | :- | Gnathostomata |
| **Super class** | : - | Pisces |
| **Sub-class** | :- | Actinopterygii |
| **Order** | : - | Cypriniformes |
| **Family** | : - | Cyprinidae |
| **Genus** | : - | *Catla* |
| **Species** | : - | *catla* |

**Fin formula:-**D-17-19, A.8, L.I.40-43 ltr 7 $^{1\backslash 2}$

**Distribution:** It is commonly found in rivers and lakes in northern India, Nepal, Myanmar, Bangladesh, and Pakistan. In Assam, it is known as bahu, bhokua and baudhekera.

**Observation Table 1.**

| Sr. no. | Stock solution [ml] | Lowry's "C" [ml] | Distilled water[ml] | Follin phenol reagent[ml] | Optical density |
|---|---|---|---|---|---|
| 1 | 0.2 ml | 5 ml | 0.8 ml | 0.5 ml | 0.0 |
| 2 | 0.4 ml | 5 ml | 0.6 ml | 0.5 ml | 0.8 |
| 3 | 0.6 ml | 5 ml | 0.4 ml | 0.5 ml | 0.12 |
| 4 | 0.8 ml | 5 ml | 0.2 ml | 0.5 ml | 0.18 |
| 5 | 1.0 ml | 5 ml | 0.0 ml | 0.5 ml | 0.21 |
| 6 | Unknown | 5 ml | | 0.5 ml | 0.76 |

**2] *Labeo rohita:-***

**Classifiacton:-**

| | | |
|---|---|---|
| **Phylum** | : - | Chordata |
| **Sub-phylum** | :- | Gnathostomata |
| **Super class** | : - | Pisces |
| **Sub-class** | :- | Actinopterygii |
| **Order** | : - | Cypriniformes |
| **Family** | : - | Cyprinidae |
| **Genus** | : - | *Labeo* |
| **Species** | : - | *rohita* |

**Fin formula:-** D-15-16. L.I. 40-42,ltr $6^{1/2}$/ 9-4

**Distribution:**

It is widely distributed in tropical and temperate region specially found in India. (Punjab and Assam)

**Observation Table 2.**

| Sr. no. | Stock solution [ml] | Lowry's "C" [ml] | Distilled water[ml] | Follin phenol reagent[ml] | Optical Density |
|---|---|---|---|---|---|
| 1 | 0.2 ml | 5 ml | 0.8 ml | 0.5 ml | 0.0 |
| 2 | 0.4 ml | 5 ml | 0.6 ml | 0.5 ml | 0.8 |
| 3 | 0.6 ml | 5 ml | 0.4 ml | 0.5 ml | 1.12 |
| 4 | 0.8 ml | 5 ml | 0.2 ml | 0.5 ml | 1.18 |
| 5 | 1.0 ml | 5 ml | 0.0 ml | 0.5 ml | 1.21 |
| 6 | Unknown | 5 ml | | 0.5 ml | 1.1 |

**3] *Cirrihinus mrigala*:**

**Classifiaction:**

**Phylum** : - Chordata
**Sub-phylum** :- Gnathostomata
**Super class** : - Pisces
**Sub-class** :- Actinopterygii
**Order** : - Cypriniformes
**Family** : - Cyprinidae
**Genus** : - *Cirrihinus*
**Species** : - *mrigala*

**Fin formula:** - D;16 P1. 17; P2. 9; A. 8

**Distribution:**

It is found throughout India

**Observation Table 3.**

| Sr. no. | Stock solution [ml] | Lowry's "C" [ml] | Distilled water[ml] | Follin phenol reagent[ml] | Optical density |
|---|---|---|---|---|---|
| 1 | 0.2 ml | 5 ml | 0.8 ml | 0.5 ml | 0.3 |
| 2 | 0.4 ml | 5 ml | 0.6 ml | 0.5 ml | 0.6 |
| 3 | 0.6 ml | 5 ml | 0.4 ml | 0.5 ml | 0.9 |
| 4 | 0.8 ml | 5 ml | 0.2 ml | 0.5 ml | 0.12 |
| 5 | 1.0 ml | 5 ml | 0.0 ml | 0.5 ml | 0.17 |
| 6 | Unknown | 5 ml | | 0.5 ml | 0.78 |

**4] *Cyprinus carpio:***

**Classification**:

**Phylum** : - Chordate
**Sub-phylum** :- Gnathostomata
**Super class** : - Pisces
**Sub-class** :- Actinopterygii
**Order** : - Cypriniformes
**Family** : - Cyprinidae
**Genus** : - *Cyprinus*
**Species** : - *carpio*

**Fin formula: -** D. 3-4/14-19, $P_1$.1/16-18, $P_2$.1/7-8, A. 2-3/5.

**Distribution:** It is not a native of India it has been introduced in to lakes of Nilgiri to comountain ranges from china and south East Asia. It was first introduced in to Ceylon and later in south India.

**Observation Table 4.**

| Sr. no. | Stock solution [ml] | Lowry's 'C' [ml] | Distilled water[ml] | Follin phenol reagent[ml] | Optical density |
|---|---|---|---|---|---|
| 1 | 0.2 ml | 5 ml | 0.8 ml | 0.5 ml | 0.2 |
| 2 | 0.4 ml | 5 ml | 0.6 ml | 0.5 ml | 0.5 |
| 3 | 0.6 ml | 5 ml | 0.4 ml | 0.5 ml | 0.8 |
| 4 | 0.8 ml | 5 ml | 0.2 ml | 0.5 ml | 0.12 |
| 5 | 1.0 ml | 5 ml | 0.0 ml | 0.5 ml | 0.16 |
| 6 | Unknown | 5 ml | | 0.5 ml | 0.6 |

## DISCUSSION

In the present study the role of Indian major carp in human diet was calculated to know the percentage of protein value of fish in there muscle sample. The fishes which were used for study was *Catla catla , Labeo rohita, Cirrihinus mrigala* and *Cyprinus carpio. Catla catla* is surface feeder fish. In the present investigation, the protein content in muscle sample of

*Catla catla* was found 28 cal/100mg. The percentage of water in body is good indicator of its relative content of energy, protein and lipid. Lower the percentage of water shows greater the lipid and protein content [*Dempson IB Schwarz Cj*, 2004]. Body composition of protein of fish *Catla catla* is well shown in table no.1 and graphically represented in fig. No.1 which shows that percentage of protein content in muscle is 28cal/100mg. Some kind of work carried out previously, similar results were obtained by [*S Mahboob 1992*] in there study that *Catla catla* gave 19.92% of protein content. *Labeo rohita* is column feeder fish. In the present investigation, the protein content in muscle sample of *Labeo rohita* was found 23cal/100mg. Suresh Babu, Shailendra and Kishor [2013] while studying on protein content of *Labeo rohita*, observed that protein contributed from natural diet combination might be efficiently utilized by fish for synthesis of tissue protein. In further study it was seen that before reaching critical low level protein began to utilized for energetic purpose and ultimately reduction in their protein content with increased water content was resulted [*Mahboob 1992, Hassan 1996*]. Body composition in muscle of protein of *Labeo rohhita* is well shown in table no.2 and graphically represented in fig. no.2. which shows that percentage of protein content in muscle of *Labio rohita* is 23 cal/100mg. As like present study of protein content, similar result were obtained by Chandra shekhar, A.P. rao and A.B. abidi[2004] in which it was seen that protein content ranged from 15.9 to 16.8%.

*Cirrihinus mrigala* is bottom feeder fish. In the present investigation, the protein content in muscle sample of *Cirrihinus mrigala* was found 25cal/100mg. when studying on biochemical constituents of fresh water fish *Cirrihinus mrigala, Vasanthi, J. S. Binukumari, and N. Saradhamani* [2013] was observed that decrease in total protein is due to proteolysis that result in production of free amino acid. Protein is also used in TCA cycle for energy for the production in stress condition. Body compostion of protein *Cirrihinus mrigala* is well shown in table no. 3 and graphically represent in fig. no. 3 which showed that percentage of protein content in muscle of *Cirrihinus mrigala is 25 cal/100mg. Cyprinus carpio* is also bottom feeder, In the present study, the protein content in muscle sample of *Cyprinus carpio* was found 25cal/100mg. Majid afkhami, A. Miklesh *et al.* [2011] observed that protein content is very important when considering quality of texture of fish muscle, they also found that fish muscle that contain small amount of protein tend to lose much of water on cocking. Protein content in muscle is well shown in table no. 4 and graphically represent in fig. no. 4 which is shows that percentage of protein content in muscle of *Cyprinus carpio* was 25 cal/100mg. In comparison to this study majid afkhami, A. Miklesh *et al*. observed the similar result about protein content in muscle of *Cyprinus carpio.* Complete laboratory work on protein content present in muscle were carried out at Fishery lab. of Dept. of Zoology, Dr. Babasaheb Ambedkar Matarhwada university, Aurangabad. Maharastra, India.

Now a day's fish becomes an important source of food for mankind all over the world. The importance of fish as source of high quality, balanced and easily digestible protein, vitamins and polysaturated fatty acids. Fishes are also valuable sources of high grade protein and other organic products [*Sandhya Pawar and Smita Sonawane 2013*]. They are most important source of animal protein and have been widely accepted as a good source of protein and other elements for the maintenance of healthy body. Fishes are good source which possess immense antimicrobial peptide in defending against dreadful human pathogens. Fish and shellfish are the primary sources of animal protein and valuable in the diet because they provide a good quantity (usually 70% or more) or protein of high biological value, particularly sulphur containing amino acids (Latham, 1997). Next to meat, fish is the only protein source that contains all the essential amino acids in right proportion and called complete protein. Consumption of fish provides important nutrients to a large number of people in the world and makes a very significant contribution to nutrition. Small indigenous fish species are valuable sources of macro and micronutrients and play an important role to provide essential nutrient to the people. They provide a major protein i.e. animal protein. Small fish, eaten whole, with head, organs and bones are particularly rich in calcium; some are also rich in vitamin A, iron and zinc, and these nutrients in fish are more effectively absorbed those in plant source foods. In addition, fish has an enhancing effect on the absorption of iron and zinc from the food in a meal. Small fish are more frequently consumed by the poor, and are likely to be distributed more evenly among household members than large fish or other animal source foods. Small fish species can be used as a cost effective, food-based strategy to enhance micronutrient intakes in vulnerable populations, such as malnourished children, pregnant and lactating women, and people living with HIV/AIDS. As compare to fish food of animal origin, particularly meat suffers from a bad image in terms of dietetic value. It is often not recognized that meat substantially contributes to the supply with several valuable or even essential nutrient. As this chicken is also not as effective as fish because it couldn't fulfill demand of dietary value as compared to fish. Fish can make positive contribution to the diet of those on low incomes and it is also easily available in local area. They have significant role in nutrition, income, employment and foreign exchange earning of the country.

## Conclusion

Fish in one form or other forms is an important and indispensable item in human diet. Since prehistoric time fish and its products are highly nutrition and are excellent sources for dietary essentials such as protein, minerals and vitamins. The energy content of fish is more [193k.cal/100gms] than that of beef [114kcal/100gms] chicken egg [173 k.cal /100gms] a serving of 100 grams of fish could supply half the total protein required by the body about 90 to 100% of fish protein is digestible. Hence, fish foods are included in many special diets for people with digestive disorders and convalescent ulcer patients further more due to the unique chemical nature of fish fats, fish foods, are often recommended to people who suffer by heart disease, The vitamin A content of fish livers such as Phosphorus, Potassium and Iron help in normal growth of human body. The level of Calcium, Magnesium and Chorine in fish is also greater than of meat, several trace minerals like Copper, Zinc, Manganese, Cobalt, Molybdenum and Selenium are found in fish eggs [ROE]. Due to rich Iodine content of marine fish, fish eating people has been attributed to high consumption of fish more recent medical evidence suggested that a high dietary intake of fish. Which contain fluoride may prevent certain bone diseases. The average annual consumption of fish in India is very poor compared to many.

In India the higher consumption of fish is generally observed in the maritime states of west cost Kerala has the highest annual percapita consumption [10kg] followed Bombay [6 kg] Karnataka [3.5kg] Tamilnadu [2.5]. Bihar [1kg] Delhi 0.5kg and Punjab [24kg].

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