Comparative study of variations in nutritional components of *Channa striatus* fish during pre-monsoon, post monsoon and winter season of Narmada River, Hoshangabad M.P India

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Abstract

Fish are a good nutritional source of proteins, essential fatty acids and minerals. People with high fish intake have lower rates of acute myocardial infarctions and atherosclerosis, better cognitive functions and better neural and visual development in fetus. In the present work, we evaluated the seasonal variations in nutritional value of *Channa striatus* including total carbohydrate, protein and lipid content with respect to three seasons i.e. pre-monsoon, post monsoon and winter season of Narmada River from Bandhrabhavan, Hoshangabad district of Madhya Pradesh. Nutritional components like carbohydrate, protein and lipids are severely influenced with the change in season and water quality parameters. The nutritional analysis showed that all the main three nutritional components i.e. Protein, carbohydrate and lipid content of *Channa striatus* is seen maximum in the winter season followed by post-monsoon and pre-monsoon. In general results suggested that the *Channa striatus* fish species of Narmada River of winter season contains the best nutritive value as compared to pre monsoon and post-monsoon. Hence consumption is more beneficial in winter season.

Keywords: Atherosclerosis, *Channa striatus*, Narmada river, nutritional analysis, protein, carbohydrate, lipid

Introduction

This comparative study of nutritional components with seasonal variations was carried out by taking into consideration the demand, positive health benefits, role in body metabolism and nutritional value of *Channa striatus* among the common consumers of Madhya Pradesh especially Hoshangabad district. Therefore it is anticipated to study and compare the nutritional components with seasonal variations using scientifically authorized methods and techniques to capture the interest of consumer in the market. Fishery products are important not only from a nutritional point of view, but also as an item of international trade and foreign exchange for most of the coastal countries in the world including India. The global consumption of fish and fish derived products has greatly increased the fish demand during recent decades due to the increasing world population, higher living standards and the good overall nutritive value of fish among the consumers. Thus it is imperative to process and preserve some of the fishes caught in the period of abundance and high nutritive value, so as to ensure an all-round supply.

*C. striatus* (Haruan), known as snakehead murrel, is an obligate air-breathing freshwater fish found mostly in tropical and subtropical Asian countries. *C. striatus* is consumed all over the Asia Pacific region and is considered a valuable source of protein with several therapeutic benefits. *C. striatus* has high protein content, mainly albumin and essential amino acids, good fatty acids, minerals, and vitamins. The fish is known to have nutritional benefits over other types of fish responsible for its therapeutic benefit (Vickers, 2017).

*C. striatus* has a large and slightly flattened scaled head like a snake with a big mouth and sharp teeth, a round body shape, and an extended dorsal fin and a rounded tail fin. The upper side of the body is dark, brownish, or greenish; the underside of the body is white, while the sides part of the body have thick lines.
The fish grows up to one meter in length, although bigger sizes are rarely found in the wild because of continuous fishing (Azemi et al., 2021) [2]. The common bioactive compounds attributed to <i>C. striatus</i> therapeutic effects are amino acids and fatty acids. The high protein and fat content of the fish make it an important dietary source of essential amino acids like lysine and methionine, as well as a good source of omega-3 fatty acids, particularly docosahexanoic acid (DHA) and eicosapentanoic acid (EPA). These compounds have been shown to have a beneficial effect in preventing diabetes and cardiovascular complications. In addition, the fish is also known to contain polyunsaturated fatty acids that regulate prostaglandins synthesis and hence wound healing. Amino acids, fatty acids and vitamins are also major biochemical components of the healing process, and deficiency could delay full recovery (Desai et al., 2018) [3]. Cardiovascular complications are the primary cause of morbidity and mortality in patients with diabetes. Hyperglycemia leads to increased glucose autoxidation, lipid peroxidation, and non-enzymatic protein glycosylation, leading to an increase in reactive oxygen species (ROS), advanced glycation end products (AGEs), and endothelial dysfunction. The details of studies demonstrating the pharmacological properties of <i>C. striatus</i> via hypoglycemic, hypolipidemic, antioxidant, and anti-inflammatory are highlighted in the following sections (Azemi et al., 2021) [1]. The main effects of fish consumption have been attributed to the high content of n-3 LC PUFA. But research is proving more and more, that also other nutrients from fish have positive effects on human health. In addition of being the major source of n-3 LC PUFA, fish 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. Furthermore, fish also might provide significant proportions of vitamin A, iron, and zinc to a population if other sources of these nutrients are scarce (Lund, 2013).

The composition of lipids in fish is perhaps the overall most heterogeneous component. In addition to inter-species variability, the biochemical composition also differs according to geographical region, seasonal variations, environment (water temperature, salinity, and pressure), diet/food supply and the maturity, sex, and reproduction stage of the fish. Lipids are accumulated in the form of triacylglycerol, and are heterogeneously accumulated throughout the fillet with increasing concentrations from the tail region to the head, and decreasing concentrations from dorsal to ventral. Increased levels are also found in red muscle tissue and right below the skin of the fish (IMR, 2015).

**Materials and Methods**

**Study area**
- The samples of the available *Channa striatus* used in the study was collected from Bandhrabhan Ghat of Narmada River in Hoshangabad district, of Madhya Pradesh using the seine netting and gill netting method or with the help of local fishermen.
- The samples were collected in three different seasons i.e. pre monsoon and post monsoon and winter.

Fig 1: Satellite view of the sampling site, Bhandrabhan Ghat Narmada River
Sample collection
- The samples were collected in different seasons around the year.
- The description of the water body and water quality parameters were also be taken into consideration.
- The sample of same age and size was used in the study.

Determination of protein content
Folin - Ciocalteau Phenol method of Lowry et al. was used for the determination of the total protein in the tissue. In this method the dried tissue sample weighing 10mg is thoroughly homogenized with 1 ml of deproteinising agent (10% TCA) by keeping the tube in ice. Samples are centrifuged for 20 min at 3000 rpm. The precipitate obtained will be used for protein estimation. The precipitate is dissolved in 2 ml 1N NaOH and to 1 ml of this solution, freshly prepared 5 ml alkaline reagent is added. This is kept at room temperature for 10 min, after which 0.5 ml of 1N Folin - Ciocalteau reagent (Hi-media, India) is added and mixed rapidly. A standard solution is prepared by using Bovine serum albumin (Hi-media, India) crystal at a concentration of 0.2 mg/ml from the stock solution. A blank is prepared with 1 ml 1N NaOH and treated the same way as above. The test tubes are kept for 30 min at room temperature in dark and the optical density (OD) of the blue colour developed is measured against the blank at 660 nm (Shimadzu UV-1800 UV spectrophotometer, Japan).

Determination of carbohydrate content
Total carbohydrate was estimated by Phenol-Sulphuric acid method, described by Dubois et al. About 5 mg of oven-dried tissue is taken in a test tube and 1 ml of phenol (5%) and 5 ml of concentrated sulphuric acid is added in quick succession. The tube is kept for 30 min at 30°C and the optical density of the colour developed is measured at 490 nm against the blank (Shimadzu UV-1800 UV spectrophotometer, Japan).

Determination of total lipid content
Lipid content was estimated by the procedure given by Folch et al. About 5 mg of powdered oven dried tissue is mixed with 5 mL of chloroform: methanol (2:1) mixture tightly covered with aluminum foil and kept at room temperature for 24 h. It is then filtered by using Whatman No. 1 filter paper (11 mm) and the filtered extract is taken in a pre-weighed beaker and oven dried. Beaker is weighed with lipids and the difference in weight is taken as total lipid content and percentage is calculated.

Results
Determination of total protein in fish sample,

| S. No | Concentration µg/ml | Absorbance at 660 nm (Mean±SD) |
|-------|---------------------|--------------------------------|
| 1.    | 20                  | 0.184±0.003                    |
| 2.    | 40                  | 0.292±0.0005                   |
| 3.    | 60                  | 0.385±0                        |
| 4.    | 80                  | 0.403±0                        |
| 5.    | 100                 | 0.514±0.0005                   |

Table 1: Determination of total protein in fish sample

Standard table of Bovine Serum Albumin (BSA)
Fig 4: Graph represent standard curve of BSA

\[ y = 0.0039x + 0.1248 \]

\[ R^2 = 0.9633 \]
2 Determination of Carbohydrate (Standard glucose table)

Table 2: Determination of Carbohydrate (Standard glucose table)

| S. No | Concentration µg/ml | Absorbance at 490 nm (Mean±SD) |
|-------|---------------------|---------------------------------|
| 1.    | 20                  | 0.145±0.0219                    |
| 2.    | 40                  | 0.246±0.0015                    |
| 3.    | 60                  | 0.368±0.002                     |
| 4.    | 80                  | 0.414±0.002                     |
| 5.    | 100                 | 0.507±0.0025                    |

Fig 5: Graph represent standard curve of Glucose

Table 3: Showing the comparison and change in nutritional value of *Channa striatus* between Pre-monsoon Post-monsoon and winter season

| S.no | Nutritional components | Pre-monsoon sample | Post-monsoon sample | Winter sample |
|------|------------------------|--------------------|---------------------|--------------|
| 1    | Protein                | 24.66 µg/gm        | 28.51               | 33.64 µg/gm  |
| 2    | Carbohydrate           | 502.1 mg/L         | 523.4 mg/L          | 526.51 mg/l  |
| 3    | Lipid                  | 19.07 mg           | 22.12 mg            | 24.07 mg     |

The protein component in *Channa striatus* fish of Narmada river increases in the winter season as compared to pre-monsoon and post-monsoon season. Similarly there is increase in the carbohydrate and lipid component in the winter season comparing with pre-monsoon and post-monsoon season.

Fig 6: Bar graph showing variations in protein content of Channa striatus in different season in µg/gm
Conclusion
From the study it is clearly evident that, the *Channa striatus* fish of Narmada River from Bhandrabhan, Hoshnagabad district of Madhya Pradesh shows increase in the Protein and Carbohydrate but a decrease in the lipid content in the in the post-monsoon season. So, in general we can conclude that the *Channa striatus* show increase in the nutritional components from pre-monsoon to post-monsoon season and for getting better nutritional benefits the consumption of *Channa striatus* must be increased in post-monsoon season.

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