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Research Article

A COMPARATIVE STUDY OF VARIATIONS IN NUTRITIONAL COMPONENTS OF *CHANNA STRIATUS* FISH DURING PRE-MONSOON, POST-MONSOON AND WINTER SEASON OF NARMADA RIVER, M.P INDIA

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ABSTRACT

Fishes are considered as a good 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, it was evaluated that the seasonal variations in nutritional components of *Channa striatus* fish with respect to three different seasons during year 2021 i.e. pre-monsoon (Summers), post-monsoon and winter season taken from Aliganj, Narmada Ghat flowing through Raisen district of Madhya Pradesh was seen. 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* was seen maximum in the winter season (i.e. 33.64 µg/gm, 526.51 mg/l and 24.07mg respectively) followed by post-monsoon season (28.51 µg/gm, 523.4 mg/l and 22.12 mg respectively) and pre-monsoon (24.66 µg/gm, 502.1mg/l and 19.07 mg respectively).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* fish among the common consumers of Madhya Pradesh. 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* known as snakehead murrel or simply as mudfish, 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

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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 side's part of the body has 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)

The common bioactive compounds attributed to *C. striatus* 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).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 *C. striatus* via hypoglycemic, hypolipidemic, antioxidant, and anti-inflammatory are highlighted in the following sections (Azemi *et al.*, 2021). 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 Aliganj, Narmada Ghat flowing through Raisen district of Madhya Pradesh using the seine netting and gill netting method or with the help of local fishermen or purchased from local market. The samples were collected in three different seasons i.e. pre-monsoon season and post-monsoon/ winter season and winter season during the year 2021.

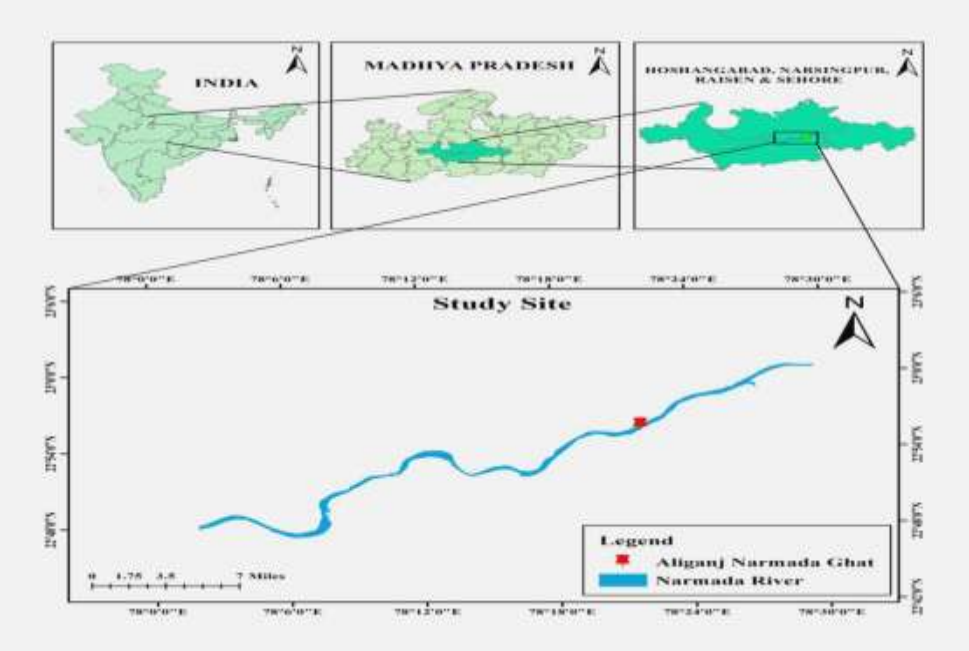

Figure 1. Satellite view of the sampling site, Aliganj Narmada Ghat Raisen District.

Sample collection and preparation

The samples were collected in different seasons around the year 2021. The description of the water body and water quality parameters were also is taken into consideration. The sample of same age and size was used in the study.

Figure 2. *Channa striatus* fish and extraction of sample.

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 - Ciocalteu 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).(Lowry *et al.*, 1951).

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 $30C^0$ and the optical density of the colour developed is measured at 490 nm against the blank (Shimadzu UV-1800 UV spectrophotometer, Japan) (Dubois *et al.*, 1956).

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 (Folch *et al.*, 1957).

RESULTS AND DISCUSSION

Results obtained are clearly showing that there variations are observed in the nutritional value of *Channa striatus* with change of season and quality of water. The protein content is seen maximum in the winter season (33.64 µg/gm.) followed by post-monsoon and then pre-monsoon (28.51 µg/gm. and 24.66 µg/gm. respectively). Similar pattern of change with season is seen in carbohydrate content, as maximum carbohydrate content is seen in winter season (526.51 mg/l)followed by post-monsoon (523.4 mg/l) and then pre-monsoon (502.1 mg/l). That the lipid content of *Channa striatus* was found 24.07 mg, 22.12 mg and 19.07 mg in winter season, post-monsoon and pre-monsoon respectively. Winter season is the best season from the nutritional point of view for *Channa striatus* because the nutritional value of fish is maximum in this season followed by post-monsoon and pre-monsoon season. So, it is highly recommended that the consumption of fish must be more in the winter season for taking benefits of better nutritional value, also storage of the fish in this season must be done for future use.

Table 1.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

Standard table of Bovine Serum Albumin (BSA).

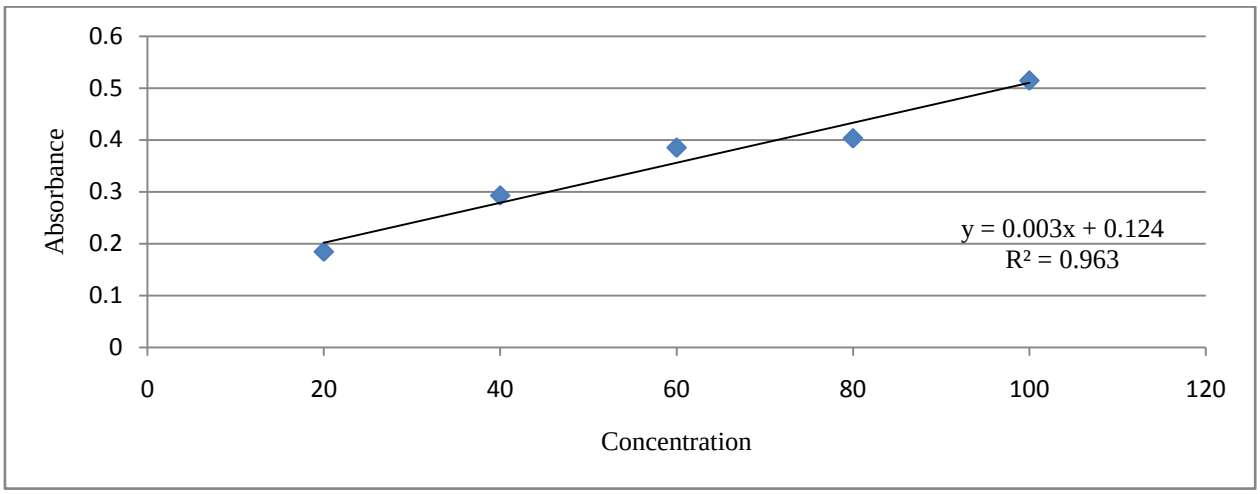

Figure 3. Graph represent standard curve of BSA.

Table 2: Total protein content in Narmada fish sample during three different seasons is shown in the table below.

S.No	Nutritional component	Season	No. of Readings	Absorbance at 660 nm	Mean ± SD	Total Protein content in g/gm
1	Protein	Season.1 (Winter season)	1	0.254	0.256±0.002	33.64µg/gm
			2	0.258		
			3	0.256		
		Season.2 (Pre-monsoon/Summer season)	1	0.221	0.221±0.006	24.66µg/gm
			2	0.228		
			3	0.215		
		Season.3 (Post-monsoon)	1	0.234	0.236±0.0025	28.51µg/gm
			2	0.239		
			3	0.237		

The Total Protein content in Narmada fish sample (*Channa striatus)* season 1(winter season), season 2 (pre-monsoon/ summer season) and season 3 (post-monsoon) using bovine serum albumin (BSA) was found 33.64 µg/gm, 24.66 µg/gm and 28.51 µg/gm respectively.

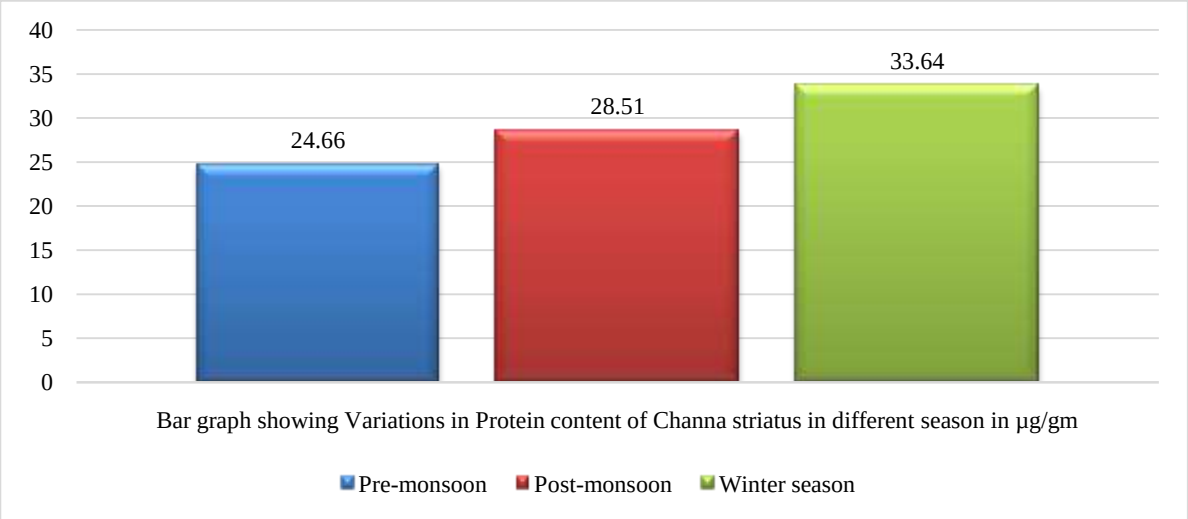

Figure 4. Bar Graph showing seasonal variations in protein content on three different seasons.

Table 3. 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

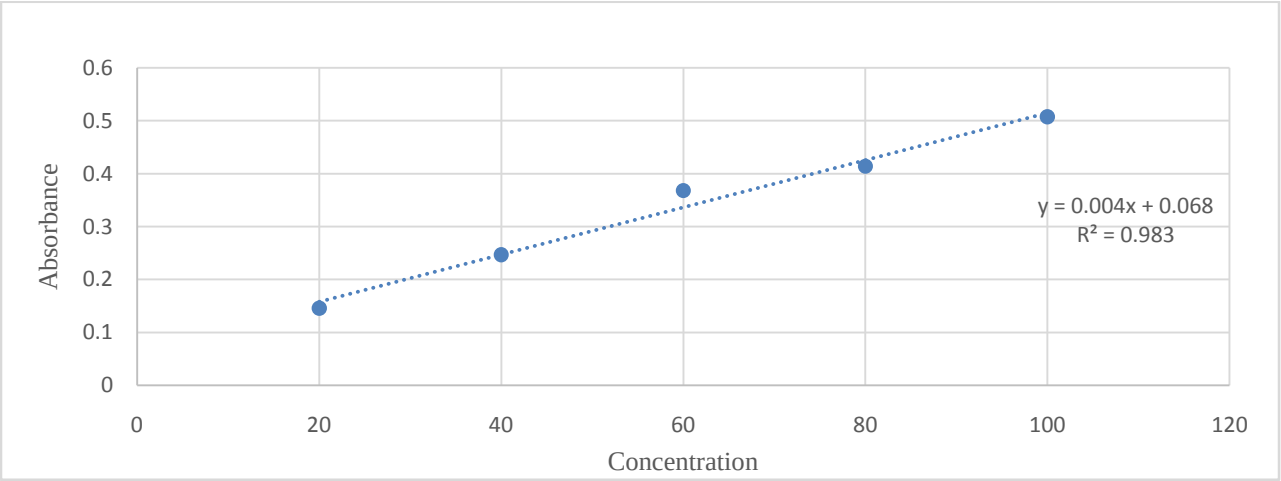

Figure 5. Graph represent standard curve of Glucose.

Table 4.Total Carbohydrate content in *Channastriatus* fish sample from Narmada during season 1 (winter season), season 2 (Pre-monsoon/ summer season) and season 3 (Post-monsoon) is shown as under.

S.No	Nutritional component	Season	No. of Readings	Absorbance at 490nm	Mean±SD	Total Carbohydrate content in mg/L
1	Carbohydrate	Season.1 (Winter season)	1 2 3	2.441 2.439 2.436	2.438±0.0025	536.51 mg/l
		Season.2 (Pre-monsoon/Summer season)	1 2 3	2.203 2.208 2.211	2.208±0.003	502.1mg/l
		Season.3 (Post-monsoon)	1 2 3	2.422 2.424 2.427	2.424±0.0025	523.4 mg/l

The total cabohydrate content in Narmada fish sample (*Channa striatus)* season 1(winter season), season 2 (pre-monsoon/ summer season) and season 3 (post-monsoon) was found 536.51 mg/l, 502.1 mg/l and 523.4 mg/l respectively.

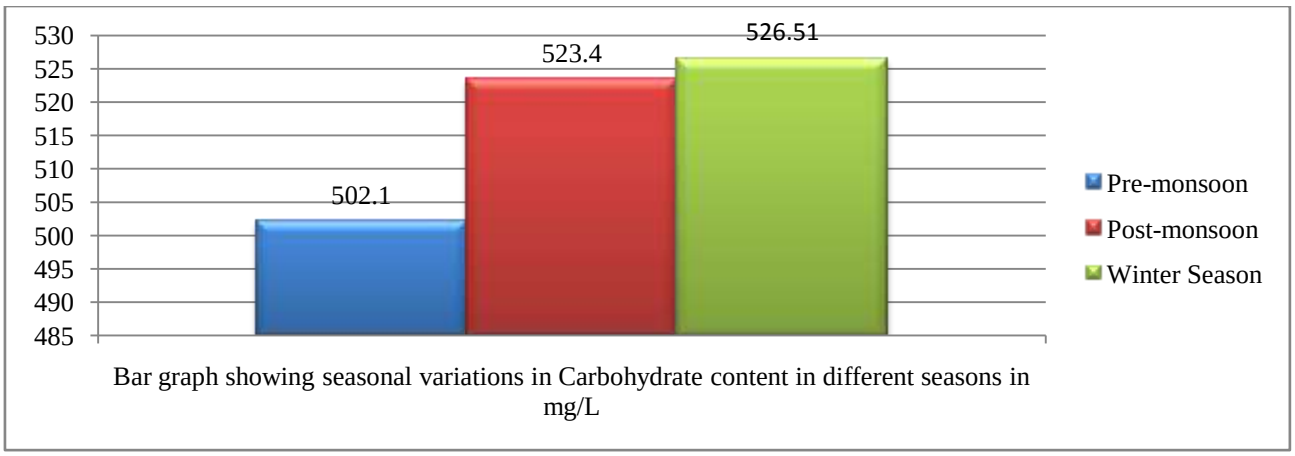

Figure 6. Bar Graph showing seasonal variations in carbohydrate content on three different seasons.

Table 5. Showing seasonal changes in Lipid content of *Channa striatus* from Narmada River in three different seasons

S.No	Nutritional components	Pre-monsoon sample	Post-monsoon sample (summers)	Winter sample
1.	Lipid	19.07 mg	22.12 mg	24.07 mg

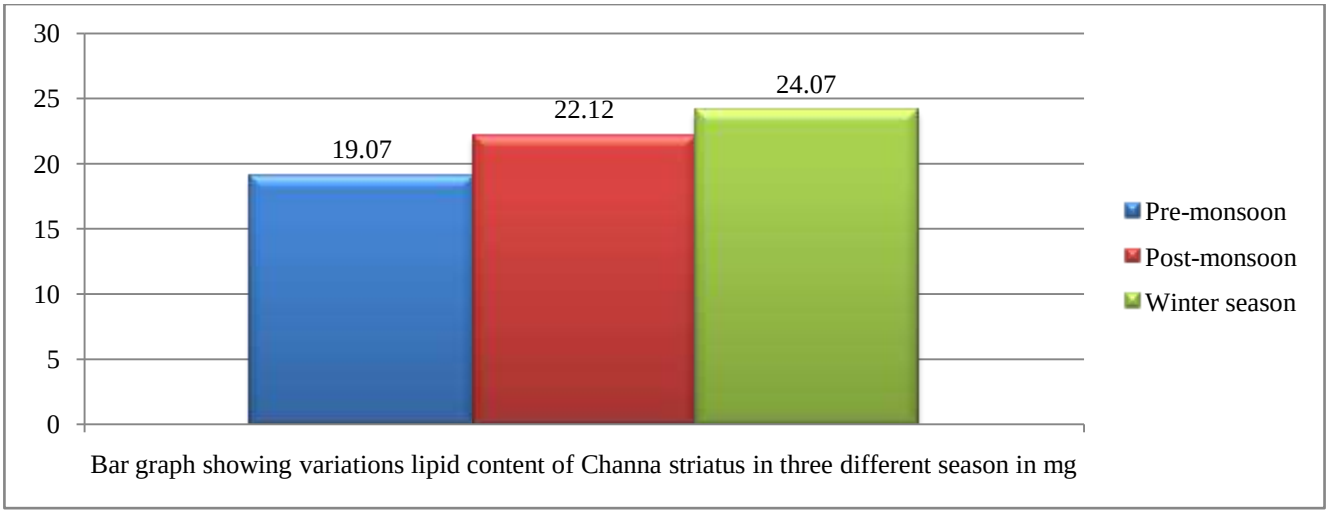

Figure 7. Bar graph representing the comparative lipid content between three seasons and three samples.

CONCLUSION

From the study it is clearly evident that, the *Channa striatus* fish from Aliganj Narmada Ghat, district Raisen of Madhya Pradesh possess maximum nutritional components i.e. Protein, Carbohydrate and the lipid content in the in the winter season. It may be due to the presence of good water quality and healthy environment for the fish due to which the nutritional value of fish also gets healthier during the winter. So, in general we can conclude that the *Channa striatus* maximum nutritional value during the winter season followed by post-monsoon and finally pre-monsoon season. For getting better nutritional benefits the consumption of *Channa striatus* must be increased in winter season.

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REFERENCES

Aberoumad, A. and Pourshafi, K. (2010). Chemical and proximate composition properties of different fish species obtained from Iran. *World Journal of Fish and Marine Science*, 2, 237-239.

Azemi AK, Mustapha S, Mohammad M, Rasool A (2021). Review of pharmacological properties Of *Channa striatus* (Haruan) in Diabetes and cardiovascular complication: *Preprints* (DOI: 10.20944/preprints202108.0200.v1).

Cheng, J. H., Sun, D. W., Qu, J. H., Pu, H. B., Zhang, X. C., Song, Z., & Zhang, H. (2016). Developing a multispectral imaging for simultaneous prediction of freshness indicators during chemical spoilage of grass carp fish fillet. *Journal of Food Engineering*, 182, 9-17.

Eilers, J. M., Loomis, D., Amand, A. S., Vogel, A., Jackson, L., Kann, J., & Sweets, R. (2007). Biological effects of repeated fish introductions in a formerly fishless lake: Diamond Lake, Oregon, USA. *Fundamental and Applied Limnology*, 169(4), 265.

Desai, A. S., Beibeia, T., Brennan, M. A., Guo, X., Zeng, X. A., & Brennan, C. S. (2018). Protein, amino acid, fatty acid composition, and in vitro digestibility of bread fortified with *Oncorhynchus tschawytscha* powder. *Nutrients*, 10(12), 1923.

FAO (2013) Fishery and aquaculture country profiles, Sri Lanka. *Food and Agriculture Organization of the United Nations, Rome, Italy*.

Haniffa, M. A. K., Sheela, P. A. J., Kavitha, K., & Jais, A. M. M. (2014). Salutary value of haruan, the striped snakehead *Channa striatus*–a review. *Asian Pacific Journal of Tropical Biomedicine*, 4, S8-S15.

Huynh, M. D., Kitts, D. D., Hu, C., & Trites, A. W. (2007). Comparison of fatty acid profiles of spawning and non-spawning Pacific herring, *Clupea harengus pallasi*. *Comparative Biochemistry and Physiology Part B: Biochemistry and Molecular Biology*, 146(4), 504-511.

Karthigarani, M., Chelladurai, M., & Buvaneshwari, N. (2017). Comparative Study of Nutritional Evaluation between Three Types of Edible Marine Fishes of Landing Site of Tuticorin Coast and Marine Market Fishes of Madurai District. *Journal of Aquatic Marine Biology*, 6(2), 00151.

Lowery, O. H., & Rosebrough, A. C. Far and RJ Randal. 1951. Journal of Biochemistry, 193, 265-275.

Nargis, A. (2006). Seasonal variation in the chemical composition of Body flesh of Koi Fish Anabas testudineus (Bloch) (Anabantidae: Perciformes). *Bangladesh Journal of Scientific and Industrial Research*, *41*(3), 219-226.

Prakash, S., & Verma, A. K. (2020). Effect of Organophosphorus pesticides on Biomolecules of fresh water fish, *Heteropneustes fossilis* (Bloch). *Indian Journal of Biology*, *7*(2).

Sankar, S., Sujith, P., & Jayalakshmi, S. (2013). Microbial study and proximate composition of six marine fish species in Mudasalodai coastal region. *International Journal of Pharmacy and Biological Sciences*, *3*(3), 398-404.

Shoba, S. P., Candida, X. V., Mary, T. A., Rajeswari, R., & Rose, M. B. (2020). Comparative analysis of biochemical composition of few freshwater and marine fishes. *International Journal of Fisheries and Aquatic Studies*, *8*(3), 115-119.

Ashraf, S. A., Adnan, M., Patel, M., Siddiqui, A. J., Sachidanandan, M., Snoussi, M., & Hadi, S. (2020). Fish-based bioactives as potent nutraceuticals: Exploring the therapeutic perspective of sustainable food from the sea. *Marine Drugs*, *18*(5), 265.

Hoke, M. E., Jahncke, M. L., Silva, J. L., Hearnsberger, J. O., Chamul, R. S., & Suriyaphan, O. (2000). Stability of washed frozen mince from channel catfish frames. *Journal of Food Science*, *65*(6), 1083-1086.

Stansby, M. E. (1985). Fish or Fish oil in the diet and heart attack. *Marine Fisheries Review*, *46*(2), 60-63.

Tidame, A., Kakulte, V., Yasmeen, S., Tidame, S., & Gangurde, J. (2021). An assessment of the biochemical composition of some fishes. *International Journal of Fisheries and Aquatic Studies*, 9(6), 07-12.

Labudzynskyi, D. O., Zaitseva, O. V., Latyshko, N. V., Gudkova, O. O., & Veliky, M. M. (2015). Vitamin D3 contribution to the regulation of oxidative metabolism in the liver of diabetic mice. *The Ukrainian Biochemical Journal*, (87, № 3), 75-90.

Silins, U., Bladon, K. D., Kelly, E. N., Esch, E., Spence, J. R., Stone, M., & Tichkowsky, I. (2014). Five-year legacy of wildfire and salvage logging impacts on nutrient runoff and aquatic plant, invertebrate, and fish productivity. *Ecohydrology*, *7*(6), 1508-1523.