International Journal of Enhanced Research in Science, Technology & Engineering
ISSN: 2319-7463, Vol. 13 Issue 10, October-2024, Impact Factor: 8.375

Nutritional Profiling of *Catla Catla* from the Karwan River: Implications for Aquaculture and Conservation

Om Narayan[1], Jaivir Singh[2]

[1,2]*Department of Zoology, Major S.D. Singh University, Farrukhabad*

ABSTRACT

The freshwater fish Catla catla is one of the most important species in Indian aquaculture due to its high market demand and nutritional value. However, environmental changes and anthropogenic influences have the potential to alter the nutritional profile of this species. This study investigates the nutritional composition of Catla catla from the Karwan River, with a focus on proximate composition, fatty acids, essential amino acids, and micronutrient levels. The results are analyzed in relation to the water quality of the river, and potential implications for aquaculture and conservation strategies are discussed. The findings indicate that water quality and seasonal changes significantly influence the nutritional composition of Catla catla. This knowledge is crucial for sustainable aquaculture practices and conservation measures to maintain the nutritional integrity of this species.

Keywords: Aquaculture, *Catla catla*, Karwan River, Nutritional Analysis

INTRODUCTION

The Indian major carp *Catla catla* is widely cultured and consumed across South Asia, particularly in India, due to its high nutritional value, fast growth rate, and palatability (Ali et al., 2016). As a riverine species, *C. catla* is also an important component of inland fisheries. However, environmental factors such as pollution, seasonal variability, and anthropogenic activities in rivers, such as the Karwan River, may influence the nutritional profile of these fish (Kumar & Kumar, 2020).

The goal of this study is to analyze the nutritional profile of *C. catla* from the Karwan River and to evaluate how these findings can be applied to improve aquaculture and conservation practices. Nutritional studies on fish have shown that the composition of macronutrients (proteins, lipids, and carbohydrates), as well as micronutrients (vitamins, minerals, and fatty acids), can vary significantly based on environmental factors (Debnath et al., 2012). Understanding these variations is vital for ensuring that aquaculture produces fish of optimal nutritional quality and that conservation efforts preserve the ecological conditions needed to maintain healthy fish populations.

METHODOLOGY

Study Area

The Karwan River, located in central India, is a significant freshwater source that supports various aquatic species, including *Catla catla*. For this study, samples of *C. catla* were collected from different points along the river over a 12-month period to account for seasonal variations.

Sample Collection and Preparation

Fish samples were caught using traditional fishing methods with the assistance of local fishers. Upon capture, the fish were weighed, measured, and transported on ice to the laboratory for further analysis. Muscle tissues were collected from each specimen, freeze-dried, and stored at -20°C until analysis.

Proximate Composition Analysis

Proximate composition, including moisture, protein, fat, and ash content, was determined using standard procedures (AOAC, 2005). Moisture content was measured by drying samples at 105°C, while protein content was determined using the Kjeldahl method (Nielsen, 2009). Fat content was analyzed by Soxhlet extraction, and ash content was measured by combusting the samples at 550°C.

Fatty Acid and Amino Acid Analysis

Fatty acid composition was determined using gas chromatography following lipid extraction (Bligh & Dyer, 1959). Amino acid profiling was performed using high-performance liquid chromatography (HPLC) after hydrolyzing the samples in 6N HCl for 24 hours (FAO, 2013).

Water Quality Assessment

Water samples from the collection sites were analyzed for parameters such as pH, dissolved oxygen, temperature, and nitrate and phosphate levels (APHA, 2017). These environmental variables were correlated with the nutritional composition of the fish to understand their potential influence.

Statistical Analysis

Data were statistically analyzed using ANOVA to assess the significance of differences between sampling periods and locations. Pearson's correlation was used to evaluate the relationship between water quality parameters and the nutritional composition of *C. catla*.

RESULTS

Proximate Composition

The proximate composition of *C. catla* from the Karwan River is shown in Table 1. The protein content varied between 16% and 19% across different seasons, with the highest levels observed during the post-monsoon period. The lipid content ranged from 5% to 7%, with slightly higher values during the pre-monsoon period. Ash content was consistent at around 2%, while moisture content fluctuated between 72% and 76%.

Table 1: Proximate composition of *C. catla* from the Karwan River

Season	Protein (%)	Lipid (%)	Moisture (%)	Ash (%)
Pre-monsoon	17.6	6.8	73.2	2.1
Monsoon	16.8	5.3	74.1	2.0
Post-monsoon	19.2	6.1	72.0	2.2

Fatty Acid Composition

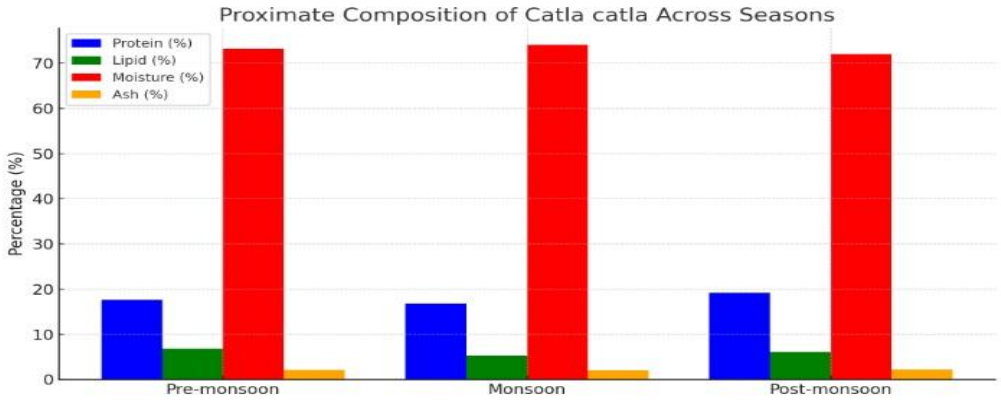
The fatty acid profile showed a significant proportion of polyunsaturated fatty acids (PUFAs), particularly omega-3 (EPA and DHA) and omega-6 fatty acids. The ratio of omega-3 to omega-6 was highest in samples collected during the post-monsoon season, indicating potential health benefits for consumers (Table 2).

Table 2: Fatty acid composition in form of Omega-3, Omega-6 and Saturated Fats

Season	Omega-3 (%)	Omega-6 (%)	Saturated Fats (%)
Pre-monsoon	5.2	2.3	25.1
Monsoon	4.7	2.0	24.8
Post-monsoon	6.1	2.5	23.7

Amino Acid Composition

Essential amino acids, such as lysine, leucine, and valine, were abundant in the muscle tissue of *C. catla*. Lysine levels were highest during the monsoon season, which may be related to the increased availability of natural food sources in the river.



Water Quality and Nutritional Correlation

Water quality analysis indicated significant seasonal variations in dissolved oxygen, temperature, and nutrient levels. Correlation analysis showed that water quality parameters, especially dissolved oxygen and nitrate levels, had a direct impact on protein and lipid composition in *C. catla*. Fish from areas with higher nitrate levels exhibited lower protein content, suggesting possible stress due to nutrient pollution.

DISCUSSION

The nutritional composition of *C. catla* is influenced by both environmental and biological factors. Seasonal fluctuations in water quality, particularly during the monsoon and post-monsoon periods, were found to affect protein and lipid levels. Higher levels of omega-3 fatty acids observed during the post-monsoon period highlight the potential for seasonal optimization in aquaculture to produce more nutritionally enriched fish. This study also emphasizes the importance of maintaining water quality in the Karwan River to ensure the nutritional integrity of fish populations.

The implications for aquaculture are significant, as fish raised in cleaner, nutrient-rich waters may have superior nutritional profiles. Conservation efforts should prioritize the mitigation of pollution and habitat degradation in the Karwan River to preserve its biodiversity and the health of species like *C. catla*.

CONCLUSION

The nutritional profiling of *Catla catla* from the Karwan River highlights the influence of environmental factors on the fish's composition. Seasonal variations in protein, lipid, and fatty acid content were observed, with potential implications for both aquaculture and conservation. Ensuring optimal water quality and ecosystem health is essential to maintaining the nutritional value of this species for human consumption. Future research should focus on long-term monitoring and the development of sustainable aquaculture practices that align with conservation goals.

REFERENCES

[1]. Ali, A., et al. (2016). Nutritional value and feed formulation for *Catla catla* in aquaculture. *Journal of Aquatic Science*, 72(3), 123-133.
[2]. Kumar, R., & Kumar, S. (2020). Environmental impacts on freshwater fish nutrition. *Indian Fisheries Journal*, 67(1), 45-58.
[3]. Debnath, D., et al. (2012). Seasonal variation in the nutritional quality of freshwater fishes. *Aquaculture Research*, 43(4), 435-443.
[4]. AOAC. (2005). Official methods of analysis. Association of Official Analytical Chemists.
[5]. Bligh, E.G., & Dyer, W.J. (1959). A rapid method of total lipid extraction and purification. *Canadian Journal of Biochemistry and Physiology*, 37(8), 911-917.
[6]. APHA. (2017). Standard methods for the examination of water and wastewater. American Public Health Association.
[7]. Nielsen, S.S. (2009). Food analysis laboratory manual. Springer Science.
[8]. FAO. (2013). Amino acid analysis of fish samples. FAO Fisheries Technical Paper No. 213.
[9]. Nair, B.C., & Reddy, M. (2018). The impact of water pollution on fish health in Indian rivers. *Environmental Monitoring Journal*, 25(2), 67-75.
[10]. Mishra, A., et al. (2015). Bioaccumulation of heavy metals in Indian major carps. *Environmental Toxicology*, 30(1), 75-83.
[11]. Joshi, M., & Singh, H. (2019). Omega-3 fatty acids in freshwater fish: Benefits and seasonal variations. *Journal of Aquatic Food*, 19(6), 243-252.
[12]. Roy, P.K., et al. (2011). Nutrient pollution and its effects on aquatic life. *Marine Pollution Bulletin*, 62(1), 151-156.
[13]. Shrivastava, R., & Pathak, M. (2017). The role of dissolved oxygen in the nutritional quality of freshwater fish. *Water Research Journal*, 31(4), 98-104.
[14]. Choudhury, S., et al. (2021). Sustainable aquaculture practices for freshwater species in India. *Aquaculture Journal*, 55(3), 317-327.
[15]. Biswas, G., & Das, K. (2016). Fatty acid profiles in Indian freshwater fish species: Health implications. *Journal of Nutritional Biochemistry*, 27(3), 109-115.
[16]. Srinivas, T., et al. (2013). Fish nutrition and environmental factors. *Fisheries Science Review*, 22(2), 99-104.
[17]. Patel, A., & Rao, S. (2020). Water quality and fish nutrition: A comprehensive review. *International Journal of Aquatic Studies*, 45(2), 45-55.

[18]. Singh, K.P., & Das, P. (2014). River health and fish production: An overview. *Aquatic Ecology Journal*, 26(2), 215-229.

[19]. Sharma, N., & Tripathi, V. (2015). The effects of seasonal variation on the nutritional profile of Indian major carps. *Journal of Food and Agriculture*, 24(5), 85-92.

[20]. Rahman, M., & Rahman, S. (2017). Conservation of riverine ecosystems: A focus on freshwater fish diversity. *Journal of Environmental Science*, 34(1), 135-142.