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Nutritive value of commercially important *Catla catla*, Indian Major Carp of Madhepura District, Bihar

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ABSTRACT

Freshwater fish, such as Indian major carps, are a significant source of protein and provide beneficial lipids, including Polyunsaturated fatty acids (PUFAs), carbohydrates, vitamins, minerals, ash, and energy, which are essentials for various bodily functions in humans, such as growth, disease prevention, development, cardiovascular health, and reproduction. The commercially cultured fish in India and the Indian subcontinent are catla (*Catla catla*), rohu (*Labeo rohita*) and mrigal (*Cirrhinus mrigala*) are considered the three major carps of India. The Investigation aiming to analyses the nutritional composition of fish species, *Catla catla*, was collected from the Kosi River in Madhepura district, Bihar, India, which is exposed to high anthropogenic pressure. The fish samples ranged from 10.5 to 14.0 cm in length and 18.5 to 56.5 gm weight. The results showed that the moisture, ash, protein, carbohydrate, lipid, and energy levels of fish species were 77.64 - 87.75 %, 92.92-93.95 %, 17.96-21.76 %, 1.41-2.82%, 6.85-11.62 g/100g, and 142.15-302.62 cal/100 gm, respectively. Notably, a higher moisture percentage (87.75 %) was found in *C. catla* collected from the Kosi River. Additionally, the proximate composition of protein, carbohydrate, and lipid was not specific to the species and reflected the influence of the contaminated water body. The energy conversion level of selected fish species found to be *Catla catla* > *Labeo rohita*. These results were discussed considering the quality of water in the Kosi River and the suitability of the chosen fish species for diet. The nutritional profile of fish varies widely depending on the species or even within the same species from the Kosi River. This dynamic nutritional profile of fish makes it an excellent dietary option

Key Words - *Catla catla*, Fish tissue, Kosi River, Nutrition, Proximate composition.

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INTRODUCTION

During the past 20 years, the consumption of fish and fish products has experienced a significant rise, according to the Food and Agriculture Organization. This increase in popularity can be attributed to the high nutritional quality and positive effects on human health that fish offer. Compared to other protein-rich foods, fish generally has a higher nutritional value due to the superior quality and palatability of its protein. Fish meat is a valuable source of essential nutrients and energy for humans. The easily digestible fish proteins have high biological and growth-promoting value. The protein, lipid, and moisture contents of fish are important to consumers, scientists, and seafood processors for various reasons such as nutritional value, seasonal variations, and processing considerations. The primary composition of fish includes 16-21% protein, 0.2-25% lipid, 1.2-1.5% minerals, 0-0.5% carbohydrates, and 66-81% moisture (Bieniarz *et al.* 2000). Consuming fish has been linked to a lower risk of colon, breast, and prostate cancers, as well as a reduced risk of developing dementia, including Alzheimer's disease. Breastfed infants of mothers who consume fish have better eyesight, possibly due to the omega-3-fatty acids present in breast milk. Fish oil may be beneficial in treating dyslipidemia in diabetes. Eating fish during pregnancy may help reduce the risk of premature delivery of baby.

India holds a significant third position in global fisheries, ranking third in overall fish production and second in aquaculture. Contributing approximately 7% to the world's total fish output (Ngasotter *et al*., 2020), the nation also boasts over 10% of the planet's fish biodiversity. The fisheries sector and related activities employ roughly 14 million people in India. Andhra Pradesh leads the country in fish production, followed by West Bengal and Gujarat. India exports more than 50 varieties of fish and shellfish products to 75 countries worldwide. Analyzing the proximate composition of fish is crucial to understanding both the benefits and potential risks of its consumption. Biochemical composition and nutritive value are key determinants of fish quality, influenced by factors such as feeding habits, seasonality, environmental conditions, and fertility (Mohamed *et al.,* 2013). The nutritional profiles of fish vary across species, with fluctuations in environmental factors and water quality parameters contributing to differences in nutrient levels. Fish protein serves as a valuable source of amino acids, particularly for developing nations facing protein and amino acid deficiencies in their diets.

The nutritional value of fish, a popular food source, can be assessed through proximate analysis, revealing variations both between and within species (Fawole *et al*., 2007). Traditionally, the chemical composition, particularly protein, lipid, and moisture content, serves as an indicator of a fish's nutritional quality (Moghaddam *et al*., 2007). This study focuses on the proximate composition specifically protein, lipid, carbohydrate, moisture, and ash content of the Indian major carp, *Catla catla*. Understanding the proximate composition, or the percentage of water, protein, fat, and lipids, is crucial. Chemical analysis provides nutritionists with valuable insights into the easily digestible, high-quality protein found in fish. This information is beneficial for scientists, dieticians, physicians, and food manufacturers in the production and value addition of fish products, as well as for consumer guidance. *Catla catla* was selected for this study due to its desirable flavor and high nutritional value. This carp, also known as Katla, is characterized by its large size, broad head, prominent lower jaw, and upturned mouth. Catla typically reaches sexual maturity at around 2 years of age, weighing approximately 2 kg, with a breeding season in June-July. As a surface feeder, adult Catla consume zooplankton, while younger fish feed on both zooplankton and phytoplankton.

MATERIALS & METHODS

Specimens of the Catla test fish were gathered from the Madhepura district in Bihar's local market, specifically from three different locations: Singheshwar (latitude 25.9835° N, longitude 86.7993° S), Madhepura (latitude 25.9240° N, longitude 86.7946° E), and Sukhasan (latitude 25.8792° N, longitude 86.7824° E). The collection took place in July 2024. Fish samples with comparable body lengths and weights were selected, and a variety of species were obtained for the laboratory using an icebox. Standard literature, including the work of Fischer and Bianchi *et al.* (1984), was used to perform taxonomic identification. The initial body weight (in grams) and length (in centimeters) of the test fish were measured for the purpose of the study. The fish were rinsed with water to remove slime, then dissected to isolate the muscles, which were weighed on a digital scale with precision.

BIOCHMECIAL ANALYSIS

The present research study involved the measurement of Ash and Moisture content according to the AOAC (2005) method. Protein

(Lowry *et al*., 1951), Lipid (Folch *et al*., 1957), and carbohydrate (Dubois *et al*., 1956) were estimated from the fish tissue. The energy value of the selected fish samples was calculated and determined as the sum of each micronutrient present in the sample using conversion factors for nutrients that provide energy to humans.

RESULTS

The collected samples underwent taxonomic identification for subsequent study, and their respective classifications are presented. Table 1 displays the biochemical composition and nutritional profiles of the fish species collected from various locations within the Madhepura district of Bihar. The analysis revealed a high protein content (21.76%) in *C. catla* from Sukhasan, while a lower protein content (17.96%) was observed in *Catla catla* from Madhepura. Notably, the energy value was high (302.62 Cal/100g) in the *Catla catla* species from Madhepura. The total protein content ranged from 17.96 to 21.76 g/100g, and the lipid content ranged from 6.85 to 11.62 g/100g. Moisture content varied from 77.64% to 87.75%, and ash content ranged from 92.92 to 93.95 g/100g. Ash represents the inorganic residue remaining after organic material is combusted. The energy value was recorded between 142.15 and 302.62 Cal/100g.

Table – 1 Biochemical composition of Catla fish

Study Area	Species	Moisture %	Ash (g/100g)	Protein (g/100g)	Carbohydrate (g/100g)	Lipids (g/100)	Energy (g/100g)
Singheshwar	*Catla catla*	77.64	93.95	18.94	1.44	11.20	251.14
Madhepura	*Catla catla*	77.81	93.81	17.96	2.82	6.85	302.62
Sukhasan	*Catla catla*	87.75	92.92	21.76	1.41	11.62	142.15

Further analysis indicated the following trends for protein, carbohydrate, lipid, and energy content: the highest protein concentration was found in *C. catla* from Sukhasan (21.76 g/100g), while the lowest was detected in *Catla catla* from Madhepura (17.96 g/100g). *Catla catla* from Madhepura exhibited the maximum carbohydrate content (2.82 g/100g), and *Catla catla* from Sukhasan showed the minimum (1.41 g/100g). The highest lipid content was measured in *C. catla* from Sukhasan (11.62 g/100g), whereas the lowest was found in *C. catla* from Madhepura (6.85 g/100g). Likewise, the highest energy value was calculated for *Catla catla* from Madhepura (302.62 Cal/100g), and the lowest was for *Catla catla* collected from Sukhasan (142.15 Cal/100g).

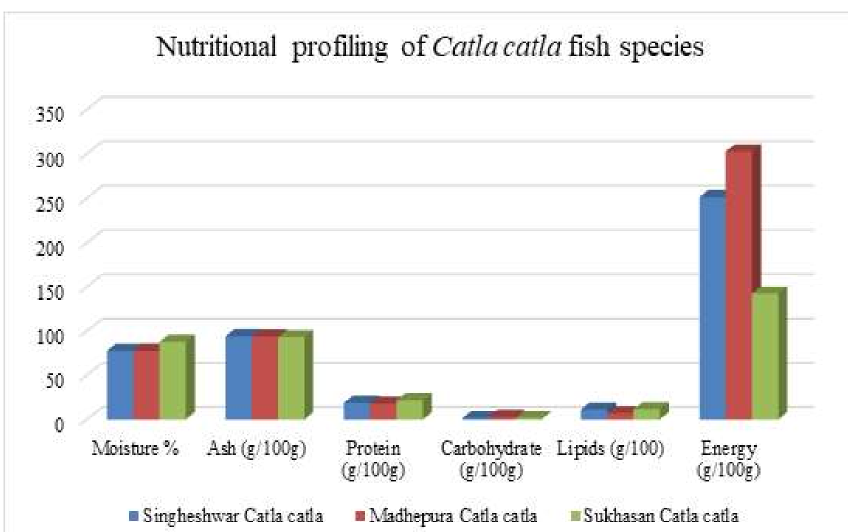

Figure 1- Showing a nutritional profiling of *Calta catla* fish species

Figure 2-Showing *Calta catla* fish species for study

DISCUSSION

Numerous studies have indicated that fish muscle is easily digestible due to its lower connective tissue content (Venkatraman and Chezhian, 2015; Tidwell *et al.,* 2001). In this study, a high moisture percentage was observed in all fish samples collected from the three locations. Similarly, *C. catla* specimens from Sukhasan exhibited the highest protein content, and variations in protein levels among the fish examined may be related to their spawning season. The protein content of the fish species ranged from 17.96 to 21.76 g/100g, with *C. catla* from Sukhasan showing the highest value (21.76 g/100g) and *C. catla* from Madhepura the lowest (17.96 g/100g). These findings align with previous research (Job *et al*., 2015). It is hypothesized that stress on fish metabolism in *C. catla* from Madhepura, possibly due to higher levels of contamination compared to Sukhasan, may have contributed to the lower protein content. The moisture content, ranging from 77.64 to 87.65%, falls within acceptable limits and suggests favorable water quality and market stability in the studied areas (Tsegay *et al*., 2016). These moisture level results are consistent with earlier studies, such as Khan *et al*. (2017) who reported levels between 80-90%. However, the present findings show a slight increase, potentially due to contamination affecting the feeding and reproductive behavior of the fish in comparison to fish from other markets.

The ash content ranged from 92.92 to 93.95 g/100g, with Singheshwar *Catla catla* exhibiting the highest level and *Catla catla* from Sukhasan the lowest. These fluctuations in nutritional value in both fish species may be attributed to adverse effects caused by pollutants, a finding consistent with Laghari *et al*. (2019). Carbohydrate and lipid content ranged from 1.41 to 2.82 g/100g and 6.85 to 11.62 g/100g, respectively. Carbohydrate content was lower compared to protein and lipid, and this variability is likely due to climatic influences that alter the biochemical profiles of the fish. The low carbohydrate levels suggest a minimal role in energy reserves for these aquatic animals (Love *et al*., 1970), aligning with Selvaraj's (1984) findings of a maximum 2.0-2.05 g/100g carbohydrate content in fish liver cells. The significant lipid content observed (6.85 – 11.62 g/100g), including essential amino acids, is consistent with Mary *et al*. (2015). Energy levels ranged from 142.15 to 302.62 cal/100g; the relatively low levels may be linked to exposure to toxicants in the Kosi River water due to waste disposal. The balance of a fish's diet is crucial for its efficiency and meeting the specific needs of the species Kosi River.

CONCLUSION

This research provides significant insights into the nutritional value and profiling of select fish species consumed by local communities, while also investigating the impact of water contaminants on these fish. Species were sourced from local markets, providing information on contaminant levels in different areas of the Madhepura district. The findings suggest that contamination from the Kosi River does not significantly affect the tested edible fish, remaining within acceptable limits. However, the study acknowledges that exceeding tolerable limits could lead to harmful bioaccumulation. The biochemical comparative data gathered on these fish will serve as a foundation for future research in fish nutritional profiling, ultimately benefiting human health. Therefore, in addition to assessing texture, flesh quality, and freshness, consumers are encouraged to consider the nutritional profile when purchasing fish.

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