

The spatial variation in the proximate composition of common carp (*Cyprinus carpio*) in Jammu and Kashmir

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Abstract

This study analysed the proximate composition and TVB-N content of common carp collected from three locations in the Kashmir region: Dal Lake, Wular Lake, and the Jhelum River. Significant differences in proximate composition were observed ($P \leq 0.05$). The moisture content of common carp from Dal, Wular, and Jhelum was 83.05%, 80.12%, and 80.69%, respectively. The protein content was recorded at 12.22% for Dal, 17.48% for Wular, and 16.24% for Jhelum. Fat content in common carp from these locations was 1.77%, 0.9%, and 0.38%, respectively. The ash content of the fish samples was 1.39% for Dal, 1.27% for Wular, and 1.22% for Jhelum. The TVB-N content was found at 4.56 mg N/100g for Dal, 8.48 mg N/100g for Wular, and 7.66 mg N/100g for Jhelum.

Keywords: *Common Carp, Proximate composition, Total volatile base Nitrogen.*

1. Introduction

Aquaculture has emerged as a rapidly expanding sector in the global food industry, with production increasing notably over the past decade. According to the State of World Fisheries and Aquaculture (SOFIA), Global fisheries and aquaculture production reached 223.2 million tonnes in 2022, marking a 4.4% increase from 2020. Fish is a crucial source of animal protein and plays an important role in the human diet due to its high-quality protein content. The composition of fish tissue varies in terms of water, protein, fat, carbohydrates, and other essential nutrients. Saravanan et al. (2014) found that fish typically consists of 72% water, 19% protein, 8% fat, 0.5% calcium, 0.25% phosphorus, and small amounts of vitamins A, D, B, and C. Fish is low in calories and fat but rich in protein, making it a preferred choice for health-conscious consumers (Abimorad and Carneiro, 2007).

The quality of fish is determined by its biochemical composition, which is influenced by factors such as species, age, size, sex, environment, and feeding practices. Understanding the chemical makeup of fish is essential for ensuring it meets dietary needs. Proximate composition has traditionally been used to assess the nutritional value of fish. Carp species are significant in many parts of the world (Davies, 2006) and are widely cultivated due to their

ability to thrive in various environmental conditions. Carp species were first cultivated in China in the fifth century BC (Balon, 2006), and they have since spread globally. The proximate composition of carp includes 66-84% water, 15-24% protein, 0.1-24% fat, and 0.8-2% ash. The biochemical composition of fish is closely linked to their feeding habits, migration patterns, and reproductive cycles, which all impact nutrient quality. Fish body composition serves as an important indicator of their biological and functional state. Chatta et al. (1993) noted that water and moisture content reflect the body's energy content, such as lipids and protein. A higher water percentage is inversely related to these nutrients, indicating that greater water content corresponds to higher amounts of lipids and protein. This study focuses on examining the biochemical and proximate composition of common carp from various water bodies in Kashmir.

2. Materials and methods

2.1. Collection of Samples

The experiment was carried out in the Post Harvest Technology laboratory at the Faculty of Fisheries, Sher-e-Kashmir University of Agricultural Sciences and Technology, Kashmir. In this study, common carp (*Cyprinus carpio*) were collected from three different locations: Dal Lake, Wular Lake, and the Jhelum River. Upon arrival at the laboratory, the fish samples were thoroughly rinsed with tap water to remove any dirt and other impurities. The samples were then stored under appropriate conditions for biochemical analysis.

2.2. Biochemical Analysis

Freshly Body composition and mineral contents from carcasses of these fish species were analyzed by standard methods (AOAC, 1995).

2.2.1. Moisture

The moisture content was determined by placing a 5-gram sample in a hot air oven set at 105°C for 12 hours. After drying, the moisture level was calculated based on the weight loss between the initial (wet) and final (dry) sample.

2.2.2. Ash

Ash represents the total mineral or inorganic content of the sample. A 5g dry sample was placed in a crucible and heated to a constant weight. The crucible was then placed in a furnace and heated at 550°C for 12 hours, after which it was allowed to cool and transferred to a dryer. The crucible was then weighed again along with the ash.

2.2.3. Fat

In the method used, fats were extracted from the sample using petroleum ether and calculated as a percentage of the initial weight before the solvent was evaporated. The Soxhlet extraction method was employed to determine the fat content, with petroleum ether used for 8 hours.

2.2.4. Protein

The analysis was performed using Kjeldahl's method, which determines the total nitrogen content of the sample after digestion in sulfuric acid. Following the analysis, the nitrogen value obtained was multiplied by a protein conversion factor ($N \times 6.25$) to calculate the protein content of the fish.

2.3. Quality Evaluation.

2.3.1.TVBN (Total volatile base nitrogen

The measurement of Total Volatile Base Nitrogen (TVBN) helps assess the extent of protein degradation and bacterial decomposition in fish, which are key indicators of freshness. TVBN is a useful indicator of seafood freshness, particularly for fish. Elevated TVBN levels suggest advanced spoilage, whereas lower levels indicate better freshness. TVBN was determined using the micro-diffusion method described by Conway (1962). The formula for calculating TVBN is:

TVBN (mgN/100g) = 14 × N × X × 100/W

Where: N = normality of H2SO4 used,

X = volume of H2SO4 used in titration (mL),

W = weight of the sample taken.

2.4. Statistical analysis

Each test was conducted in triplicate and arranged using a completely randomized design (CRD). Statistical analysis was performed using SPSS version 24, with a significance level set at P < 0.05.

3. Result and discussions

In this study, the biochemical and quality parameters of common carp collected from various water bodies were examined. Biochemical analysis of fish tissue is important due to its relevance to the nutritional value of the fish and its role in assessing their physiological requirements at different stages of life.

Table1. Proximate composition of Common carp from different locations.

Data (n = 3) is expressed as mean ± SD.

3.1.	Parameters	Dal lake	Wular lake	Jhelum river
	Moisture	83.05±0.39 b	80.12±0.51 a	80.69±0.61 a
	Protein	12.22±0.15 a	17.48±0.28 c	16.24±0.24 b
	Fat	1.77±0.13 c	0.9±0.07 b	0.38±0.09 a
	Ash	1.39±0.04 b	1.27±0.05 ab	1.22±0.02 a
	TVB-N	4.56±0.06 a	8.48±0.05 c	7.66±0.1 b
	P value	<0.05	<0.05	<0.05

Biochemical parameters

3.1.1. Moisture

At the conclusion of the experimental trial, the moisture content of the fish samples was measured, as shown in Table 1 and Figure 1. A significant difference (p > 0.05) in moisture content was observed among the different species. Fish from Dal Lake exhibited the highest moisture content (83.05±0.39), while the lowest moisture content was found in fish from Jhelum (80.12±0.51), followed by those from Wular Lake (80.69±0.61). Our findings align with those of Khushwinderjit et al. (2018), who reported that the water content of common carp fingerlings, fed diets substituting animal protein with plant protein, ranged from

78.20% to 81.43%. The results in our study fall within this same range.

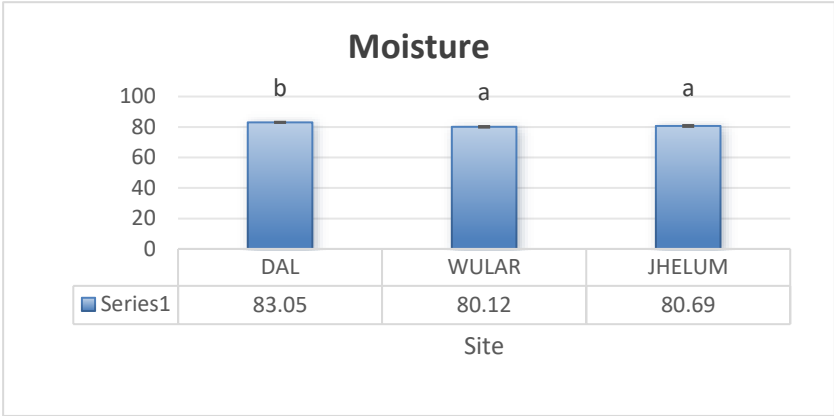


Figure 1. Changes in moisture

3.1.2. Ash

The total ash content of the fish samples is presented in Figure 2. A significant difference ($p > 0.05$) in total ash content was observed across the treatments. Our findings are consistent with those of Mehdi et al. (2006), who reported ash percentages of 1.23%, 1.19%, and 1.23% in common carp from natural waters. The results of our study fall within this similar range.

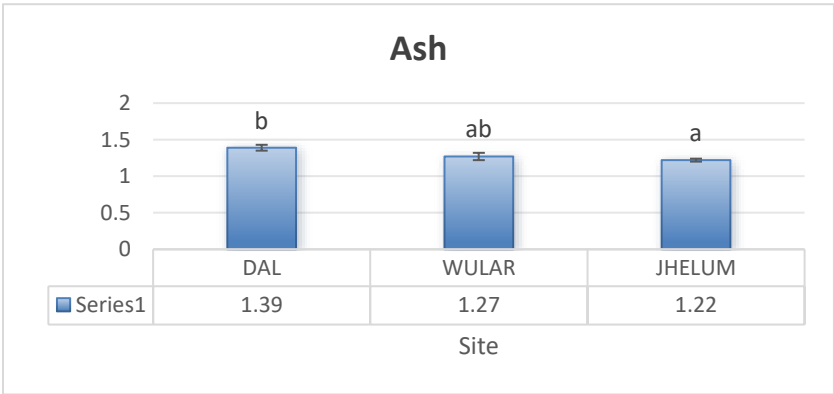


Figure 2. Changes in Ash content.

3.1.3. Fat

The fat content of the fish samples is displayed in Table 1 and Figure 3. A significant difference ($p > 0.05$) in fat content was observed among the species. The highest fat content was found in fish collected from Dal Lake (1.77 ± 0.13), while the lowest lipid content was observed in fish from Jhelum (0.38 ± 0.09). Khushwinderjit et al. (2018) also reported that the lipid content in common carp fingerlings (*C. carpio*) ranged from 1.75% to 2.73%, and the values recorded in our study are in close agreement with those reported by Kuar et al. (2017).

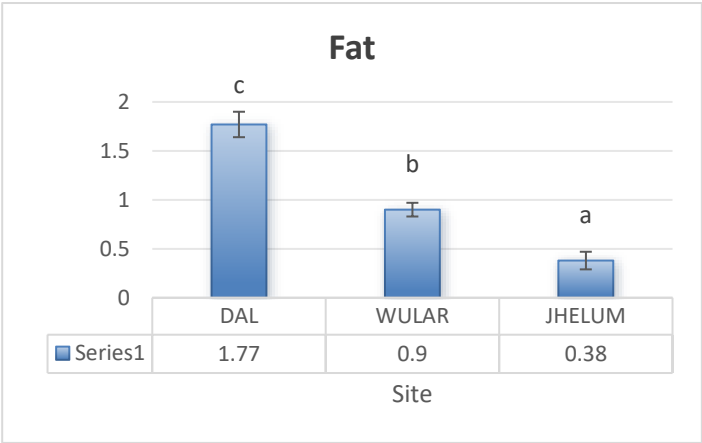


Figure 3. Changes in Fat content.

3.1.4. Protein

Figure 4 presents the estimated protein content for the fish samples. A noticeable variation in protein content was observed across the samples ($p > 0.05$). Fish from Wular Lake exhibited the highest crude protein level (17.48 ± 0.28), while those from Dal Lake showed the lowest protein content (12.22 ± 0.15). Our findings are consistent with the studies of Trbovic et al. (2009) and Cirkovic (2010), which reported that the protein content in common carp ranges from 14% to 20%. The results of our study fall within this range. Similar protein content ranges were observed by Khushwinderjit et al. (2018), where the protein content in fish flesh varied between 13.90% and 16.50%. The differences in protein content may be attributed to several factors, including the natural degradation of protein by enzymes in fish meat, nitrogen volatilization during transport, storage, and analysis, as well as variations in fish size. Furthermore, fish reared in natural waters may be more energy-efficient in searching for food, exhibit different levels of activity, and be influenced by seasonal fluctuations in food availability and environmental factors.



Figure 4. Changes in protein content.

3.1.5.TVB-N

The presence of Total Volatile Base Nitrogen (TVBN) in fish samples indicates the extent of protein breakdown and bacterial decomposition. The TVBN levels recorded in this study are presented in Table 1 and Figure 5. A significant difference ($p > 0.05$) in TVBN

content was observed among the samples. The highest TVBN level was found in fish collected from Wular Lake (8.48 ± 0.05), while the lowest was observed in fish from Dal Lake (4.56 ± 0.06). Generally, a TVBN value of fewer than 10 mg/100g is considered an indicator of freshness (Song et al., 2005; Cho et al., 2023). The results of our study show that the TVBN levels in the fish samples fall within an acceptable range.

4. Conclusion

This study, conducted in July 2024, aimed to analyze the nutritional parameters of common carp, a commercially significant fish species in the Kashmir Valley. The proximate composition of common carp varied significantly across different locations. The analysis revealed that the fish contained a good proportion of essential components. The protein content in fish from Wular Lake was particularly notable. A quality assessment was also carried out to evaluate the freshness and spoilage levels of the fish during retail. The results indicated that the fish were of good quality, as TVBN levels were within acceptable limits. All fish species exhibited sufficient nutritional value, supporting overall health and bodily functions. This study also offers valuable insights into the variations in the proximate composition of fish across different locations, highlighting the impact of environmental factors on these variations.

References

- AOAC. (Association of Official Analytical Chemists). 1995. Official Methods of Analysis. 15th Ed. Association of Official Analytical Chemists, Washington, D.C. USA, p. 1094. http://dx.doi.org/10.4194/1303-2712-v18_4_07
- Abimorad, E.G. and Carneiro, D.J. (2007) Digestibility and performance of pacu, *Piaractus mesopotamicus* juveniles fed a diet containing different protein, lipid, and carbohydrate levels. *Aquaculture Nutrition*, 13:1-9.
- Balon, E. K. (2006). The oldest domesticated fishes, and the consequences of an epigenetic dichotomy in fish culture. *Aqua: Journal of Ichthyology & Aquatic Biology*, 11(2), 47-87.
- Conway, W.J. (1962): Microdiffusion analysis and volumetric error. Crosby Lockwood, London
- Chatta, G. S., Andrews, R. G., Rodger, E., Schrag, M., Hammond, W. P., & Dale, D. C. (1993). Hematopoietic progenitors and aging: alterations in granulocytic precursors and responsiveness to recombinant human G-CSF, GM-CSF, and IL-3. *Journal of Gerontology*, 48(5), M207-M212
- Cirkovic, M. T., 2010. Meat quality of two-year-old tench and carp grown in extensive conditions. In 2nd Workshop Feed-to-Food FP7 REGPOT-3. XIV International Symposium Feed Technology, Proceedings. Novi Sad, Serbia, 19-21 October, 2010, . Institute for Food Technology. (pp. 400-404).
- Cho, J. S., Choi, B., Lim, J. H., Choi, J. H., Yun, D. Y., Park, S. K., ... & Lee, J. (2023). Determination of freshness of mackerel (*Scomber japonicus*) using shortwave infrared hyperspectral imaging. *Foods*, 12(12), 2305.
- Davies, S. J., & Gouveia, A. (2006). Comparison of yttrium and chromic oxides as inert dietary markers for the estimation of apparent digestibility coefficients in mirror carp

- Cyprinus carpio fed on diets containing soybean-, maize-and fish-derived proteins. *Aquaculture Nutrition*, 12(6), 451-458.
- Kaur J, Singh A, Datta SN, Tiwari G. Zinc uptake in flesh, liver, and bone of common carp (*Cyprinus carpio* L.) young ones at different dietary Zn ($\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$) levels. *Ecology Environment and Conservation*. 2017; 23(2):798-801.
- Khushwinderjit Singh, K. S., Ajeet Singh, A. S., & Datta, S. N. (2018). Growth performance of common carp (*Cyprinus carpio* L.) fingerlings fed diets replacing soybean meal with fish silage protein at different levels.
- Mehdi, A. A. J., Sulaimi, A. H. K., & Seraji, A. Y. J. (2006). The nutritional value of some Iraqi fish. *The Mesopotamian Journal of Marine Sciences*, 22(2), 239-253.
- Song, H. N., Lee, D. G., Han, S. W., Yoon, H. K., & Hwang, I. K. (2005). Quality changes of salted and semi-dried mackerel fillets by UV treatment during refrigerated storage. *Korean journal of food and cookery science*, 21(5), 662-668.
- Sahzadi, T., Salim, M., Um-e-Kalsoom, U. E. K., & Shahzad, K. (2006). Growth performance and feed conversion ratio (FCR) of hybrid fingerlings (*Catla catla* × *Labeo rohita*) fed on cottonseed meal, sunflower meal, and bone meal.
- Saravanan K, Saranya S, Durairaj K, Durga B. Comparative variation of Biochemical parameters in cultural and natural fishes (Indian major carps). *International Journal of Pharmaceutical & Biological Archives*. 2014; 5(2):104-107
- The State of World Fisheries and Aquaculture (SOFIA)
- Tokur, B., Ozkütük, S., Atici, E., Ozyurt, G., & Ozyurt, C. E. (2006). Chemical and sensory quality changes of fish fingers, made from mirror carp (*Cyprinus carpio* L., 1758), during frozen storage (– 18 C). *Food Chemistry*, 99(2), 335-341.
- Trbović, D., Vranić, D., Đinović, J., Borović, B., Spirić, D., Babić, J. and A. Spirić, 2009. Masnokiselinski sastav i sadržaj holesterola u mišićnom tkivu jednogodišnjeg šarana (*Cyprinus carpio*) u fazi uzgoja. *Tehnologija mesa*, 50 (5–6): 276–286 (Sr)