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Assessment of proximate parameters of both farmed and wild-selected fish species in Bangladesh

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Abstract
The present study was designed to analyze and compare the proximate parameters of farmed and wild-selected fish species of Bangladesh including *Labeo rohita*, *Anabas testudineus*, *Ompok pabda*, *Heteropneustes fossilis*, and *Mystus cavasius* during November 2023 to April 2024. These specimens were collected from farmed and wild sources in Faridpur district, Bangladesh and kept separately in ice bags and brought into the BCSIR laboratory, Rajshahi for further analysis. The protein, lipid, moisture, and ash contents of wild and farmed fish of each species were estimated as wet matter basis, and standard methods were used for analysis. Considering proximate composition high protein fishes are Rui 18.11±0.26% (farmed), Koi 16.96±0.17% (farmed), Pabda 15.81±0.79% (farmed), Shing 16.09±0.23% (farmed), Gulsha 16.03±0.18 % (farmed); high lipid content fishes are Rui 3.06±0.19% (farmed), Koi 11.63±0.31% (farmed), Pabda 7.19±0.22% (farmed), Shing 4.59±0.15% (farmed), Gulsha 5.68±0.22% (farmed); high ash contents are found in Rui 1.75±0.15% (wild), Koi 4.53±0.35% (wild), Pabda 1.63±0.12% (wild), Shing 2.83±0.11% (wild), Gulsha 2.66±0.05% (wild); high moisture contents are found in Rui 78.04±1.53% (wild), Koi 68.72±0.83% (wild), Pabda 75.73±1.25% (wild), Shing 77.02±2.48% (wild) and Gulsha 77.15±0.58% (wild). After a comparison of both types, it was found that the protein and lipid contents are higher in farmed fishes while the moisture and ash contents are higher in wild fishes. It showed that the farmed fishes are nutritionally superior to the wild fishes considering the protein and lipid content but the wild fishes contained higher ash contents than the farm-raised samples.

Keywords: Proximate parameters, farmed fishes, wild fishes

Introduction
Fisheries is one of most significant agricultural subsectors and is regarded as the main driver of sustainable development which significantly contributes to Bangladesh's economy by providing animal protein, creating new job opportunities, generating foreign exchange, and improving the socio-economic conditions of people. "Maache Bhate Bangali" has been a Bengali aphorism since time immemorial. In our national diet, fish is a favorite accompaniment to rice. Fish hold a special place as a high-protein food item for human consumption and are typically regarded as the most affordable, superior source of animal protein (Bezbaruah & Deka, 2021) [5]. Fish have a tremendous nutritional value, containing high-quality protein, lipids, vitamins, and minerals such as calcium, phosphorus, magnesium, and other micronutrients. According to Pawar and Sonawane (2013) [18], fish enhances the overall nutritional quality of a mixed diet since its proteins contain essential amino acids, and just 140g of fish can meet 50–60% of a person's daily needs for high-quality proteins. Fish lipids are rich in omega-3 fatty acids (n-3 PUFA), among which docosahexaenoic acid (DHA, 22:6 n-3) and eicosapentaenoic acid (EPA, 20:5 n-3) are crucial for human nutrition and health, especially in helping children's growth and preventing cardiovascular diseases (Raatz *et al*., 2013; Islam *et al*., 2021) [20, 11]. The term "proximate composition," typically used in the context of food or feed, refers to the contents of moisture, ash, fat, protein, and carbohydrates, all expressed as a percentage. Approximately 96–98% of the total tissue contents in fish are made up of these compounds (Nowsad, 2007) [17]. A precise estimation of the proximate composition of economically significant wild and farmed fishes at particular body weights could increase profitability, decrease food waste, and improve efficiency.

Generally, customers have relatively little understanding of the nutritional composition of fish, which makes them skeptical and confused while choosing and purchasing fish. Nowadays, consumers are doubting whether the nutritional profiles of wild and farmed fish are superior or comparable in terms of proximate composition, protein, lipids, vitamins, and minerals contents. Very few studies have been done to distinguish between the nutritional composition of the chosen fish species that were gathered from farms and their natural habitats in Bangladesh. Therefore, the main objectives of the current study were to evaluate and compare the nutritional composition of wild-captured and farmed five commonly consumed fish species of the country as well as to provide consumers with a suitable and verified message regarding the nutritional value of these species.

Materials and Methods

Study period and studied species

The study was conducted over six months, from November 2023 to April 2024. Five readily available and commercially important freshwater fish species (*Labeo rohita*, *Anabas testudineus*, *Ompok pabda*, *Heteropnuestes fossilis*, and *Mystus cavasius*) of both wild and cultured were chosen for the study. These species are cultured in ponds and also available in the wild sources.

Sample collection from the study site

A sizable number of fresh samples of the selected five commercially significant freshwater fish species of both wild and farmed environments were collected from the Faridpur district of Bangladesh. The samples were collected, stored in an insulated ice box, and promptly transported to the laboratory of the Applied Zoology Research Section, Bangladesh Council of Scientific and Industrial Research (BCSIR), Rajshahi, for subsequent analysis. After arriving at the research station, the samples were separated, labeled and stored at -20 °C until laboratory analysis.

Processing of samples

Dressing and gutting: At first, the scales, fines, and viscera of the fish samples were removed carefully with the help of scissors and a kitchen knife.

Washing: After dressing and gutting, the fish were rinsed with clear tap water that removed the blood, slime, dirt, microbes, and unwanted particles from the fish.

Cutting and grinding: Then the fish samples were cut into small pieces with a knife and scissors.

The processing methods are also presented in the following flowchart.

Estimation of proximate parameters

- **Determination of protein content:** Micro- Kjeldhal method (Pearson, 1999) [11] was used to determine the crude protein content of fish samples.
- **Determination of Lipid content:** The crude lipid content was determined according to Association of Official Analytical Chemists (1990).
- **Determination of ash content:** Ash content was determined according to the Association of Official Analytical Chemists (1990) [4].
- **Determination of moisture content:** Moisture content was determined according to Association of Official Analytical Chemists (1990) [4].
- **Data Analysis**
  All the experimental data were analyzed by using a computer software program MS Excel and one-way analysis of variance (ANOVA) and the results were pre-stored as the mean and standard deviation of triplicate determinations. The statistical software SPSS (Statistical Package for Social Sciences 20.0) and the significance was defined at $P<0.05$, $P<0.01$ and $P<0.001$.

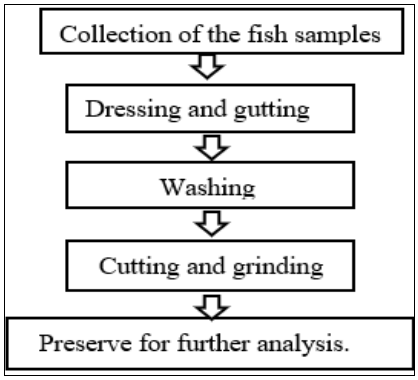

Fig 1: Flowchart of fish processing

Results and Discussion

In the present study, proximate analysis of selected fish species of farm and wild was done. The protein, lipid, ash, and moisture contents vary with different fisheries resources.

Protein content: It was found in the current study that, the protein content of the studied species varied from 14.93% (wild *Ompok pabda*) to 18.11% (farmed *Labeo rohita*). The following fish have high protein content based on proximate composition: farmed Rui (18.11±0.26%), farmed Koi (16.96±0.17%), farmed Pabda (15.81±0.79%), farmed Shing (16.09±0.23%), and farmed Gulsha (16.03±0.18 %) (Table 1). The protein contents of the studied fishes were more or less similar to the values (17.11-19.45%) found by Mustafa *et al*. (2022) [16] in three farmed and wild fishes of Bangladesh. Al Mamun *et al*. (2018) [2] reported that protein content in some freshwater fish species of Bangladesh ranged from 12.96-17.18%. Debnath *et al*. (2018) [7] stated that the protein content of riverine and marine *Tenualosa ilisha* was 15.65% and 16.39%, respectively. The findings of the study also agreed with the observation of Ullah *et al*. (2022) [23] in *L. rohita*, Alam *et al*. (2022) [3] in *O. pabda*, and Rahman *et al*. (2020) [22] in *M. cavasius* while differing to the findings of Jahan *et al*. (2021) [12] in wild Pangas.

Lipid content: In the present investigation it was found that lipid content ranged between 2.52% (wild *Labeo rohita*) to 11.63% (farmed *Anabas testudineus*). The wild Rui (*Labeo rohita*) had the lowest lipid content, whereas farmed Koi (*Anabas testudineus*) had the greatest. According to proximate composition, high lipid fishes include farmed Rui (3.06±0.19%), farmed Koi (11.63±0.31%),

Table 1: Proximate parameters of the studied species

Species	Source	Proximate parameters (%)			
		Moisture	Ash	Protein	Lipid
Rui (*Labeo rohita*)	Farmed	76.23±1.06[a]	1.59±0.19[a]	18.11±0.26[a]	3.06±0.19[a]
	Wild	78.04±1.53[b]	1.75±0.15[b]	16.51±0.26[b]	2.52±0.31[b]
Koi (*Anabas testudineus*)	Farmed	66.36±0.19[a]	3.43±0.21[a]	16.96±0.17[a]	11.63±0.31[a]
	Wild	68.72±0.83[b]	4.53±0.35[b]	16.36±0.21[b]	8.98±0.26[b]
Pabda (*Ompok pabda*)	Farmed	75.09±0.76[a]	1.20±0.09[a]	15.81±0.79[a]	7.19±0.22[a]
	Wild	75.73±1.25[b]	1.63±0.12[b]	14.93±0.18[b]	6.49±0.15[b]
Shing (*Heteropnuestes fossilis*)	Farmed	76.12±0.84[a]	2.11±0.13[a]	16.09±0.23[a]	4.59±0.15[a]
	Wild	77.02±2.48[b]	2.83±0.11[b]	15.29±0.18[b]	3.58±0.08[b]
Gulsha (*Mystus cavasius*)	Farmed	74.96±0.90[a]	2.28±0.39[a]	16.03±0.18[a]	5.68±0.22[a]
	Wild	77.15±0.58[b]	2.66±0.05[b]	15.18±0.18[b]	4.51±0.08[b]

Data are expressed as mean±standard deviation; the same letters in each column indicate the lack of significant difference (P>0.05, P>0.01).

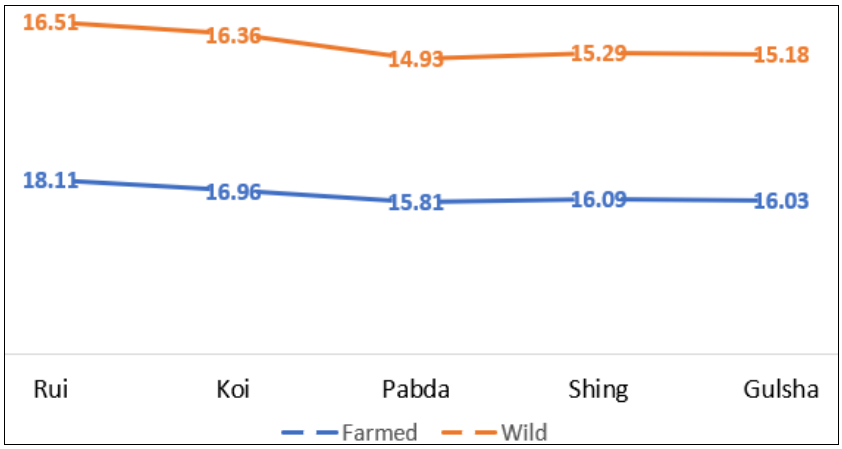

Fig 2: Showing the protein contents of the studied farmed and wild fish species

farmed Pabda (7.19±0.22%), farmed Shing (4.59±0.15%), and farmed Gulsha (5.68±0.22%). More or less similar results were reported by (Mazumder *et al*. 2008) [14] in freshwater fishes of Bangladesh where lipid content ranged from 0.09 - 2.35 % to 1.53 – 5.41 % and by (Mustafa *et al*. 2022) [16] in three farmed and wild fishes of Bangladesh which showed ranges from 0.91- 5.98%. While *T. ilisha* from the Bay of Bengal and three small indigenous fish species from the country showed slightly higher lipid content (16.39% and 3.9-8.7%, respectively) (Debnath *et al*. 2018 and Mustafa *et al*. 2015) [7, 15].

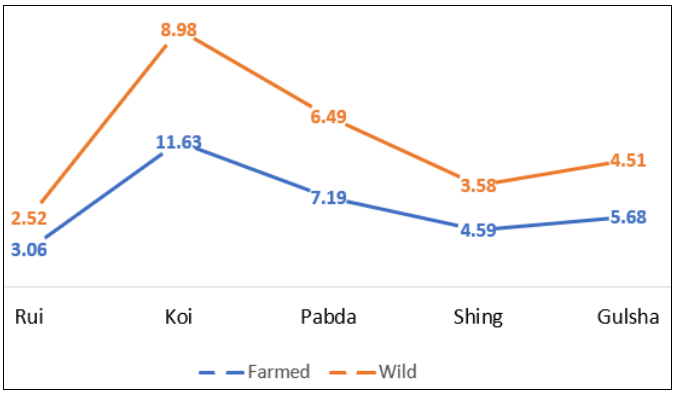

Fig 3: Showing the lipid contents of the studied farmed and wild fish species

Ash content: In the present study, the ash content varied from 1.20% to 4.53%. The highest ash content was found as 4.53% in the case of wild Koi (*Anabas testudineus*) and the lowest ash content was found as 1.20% in the case of farmed Pabda (*Ompok pabda*). Considering proximate composition high ash contents were found in wild Rui (1.75±0.15%), wild Koi (4.53±0.35%), wild Pabda (1.63±0.12%), wild Shing (2.83±0.11%), wild Gulsha (2.66±0.05%). The ash contents of the studied species were nearer to the findings of Bogard *et al*. (2015) [6] in some important fish species of Bangladesh and Ahmed *et al*. (2022) [1] in *L. rohita* and *H. fossilis*. The ash content of some selected small fishes reported by Mazumder *et al*., (2008) [14] ranged between 1.19 to 3.92% and Hossain *et al*. (1999) [10] ranged between 2.08 and 5.22%, which is more or less similar to the values of the present study.

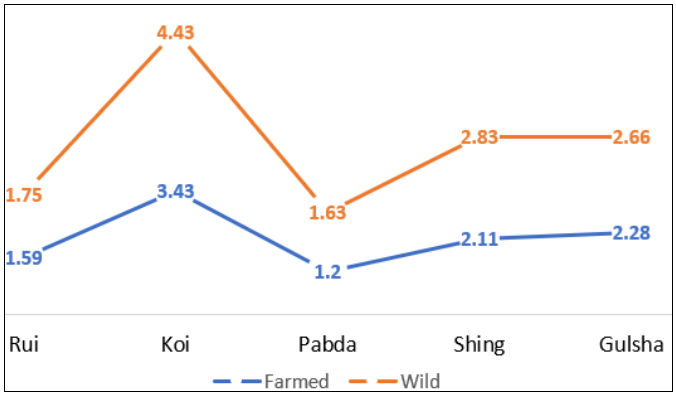

Fig 4: Showing the ash contents of the studied farmed and wild fish species

Moisture content: The study revealed that the moisture content of the studied fishes ranged from 66.36% (farmed *Anabas testudineus*) to 78.04% (wild *Labeo rohita*). High moisture contents were recorded in Rui 78.04±1.53% (wild), Koi 68.72±0.83% (wild), Pabda 75.73±1.25% (wild), Shing 77.02±2.48% (wild) and Gulsha 77.15±0.58% (wild). The

values of moisture contents found in the present study coincide with the findings of Mustafa *et al*. (2022) [16] in three farmed and wild fishes of Bangladesh, Mansur *et al*. (2019) in *A. testudineus* (64±0.10), Rahman *et al*. (2002) [21] in *O. pabda* (77.13%) and Fatema *et al*. (2017) in *M. cavasius* (75.67%).

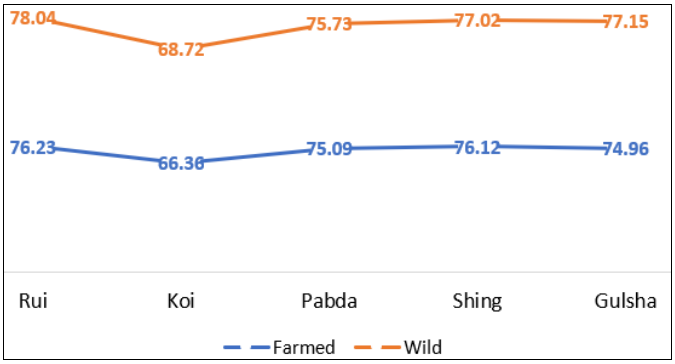

Fig 5: Showing the moisture content of the studied farmed and wild fish species

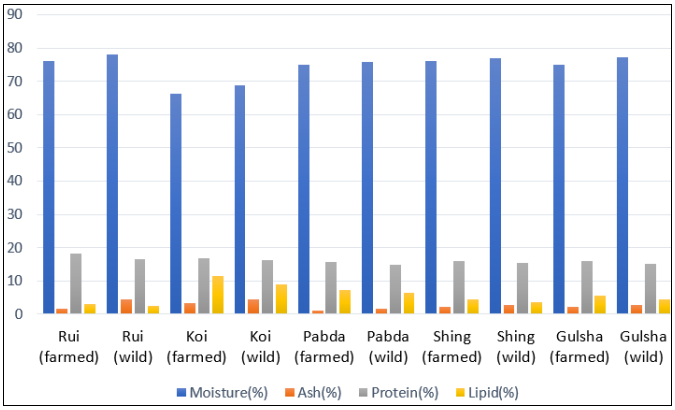

Fig 6: Distribution of proximate parameters (%) in farmed and wild Rui (*L. rohita*), Koi (*A. testudineus*), Pabda (*O. pabda*), Shing (*H. fossilis*) and Gulsha (*M. cavasius*)

Conclusion

The present study has shown the nutrient values of five commonly consumed wild and farmed fish; *Labeo rohita*, *Anabas testudineus*, *Ompok pabda*, *Heteropnuestes fossilis*, and *Mystus cavasius* by determining the proximate parameters. The present study revealed that both wild and farmed fishes are excellent sources of proteins and lipids that can meet the nutritional requirements of the nation. However, there were differences in the nutritional quality of wild and farmed *L. rohita, A. testudineus, O. pabda, H. fossilis, and M. cavasius* species, that could have been influenced by a variety of habitat-related factors. Moreover, the finding indicated that the farmed fishes are higher in protein and lipid contents than the wild fishes but the wild fish contained higher ash contents due to their food varieties. Thus, the farmed fish is nutritionally superior to the wild in some cases and can satisfy the local demand of the large population. The majority of consumers in Bangladesh eat fish because of its availability, flavor, and palatability, whereas only a handful do so for nutritional value. Therefore, it is recommended that, when purchasing a fish, a high priority be given to its nutritional profile, in addition to its flavor, size, and other relevant external aspects.

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