Pak. J. Biotechnol. Vol. 20(1), 51-58**, 2023** http://doi.org/10.34016/pjbt.2023.20.01.772

Research Article

OPEN ACCESS

Available on http://www.pjbt.org
Pakistan Journal of Biotechnology
(PJBT)
(P-ISSN: 1812-1837 and E-ISSN: 2312-7791)

COMPARATIVE STUDIES ON BODY COMPOSITION OF FARMED AND WILD ROHU (*LABEO ROHITA*) FROM DISTRICT JHELUM, PUNJAB, PAKISTAN

Sundas Asghar*[1], Muhammad Zohaib[1], Hira Anum[1], Ijaz Hussain[2], Shabana Rafique[1], Asma Ashraf[3]

[1]Institute of Molecular Biology & Biotechnology, The University of Lahore, Sargodha Campus, Punjab, Pakistan

.[2]Department of Mathematics & Statistics, The University of Lahore, Sargodha Campus, Punjab, Pakistan.

[3]Department of Zoology, Division of Science & Technology, The University of Education, Lahore, Punjab, Pakistan.

E-mails: sundas.asghar@imbb.uol.edu.pk ; sundaskth@gmail.com

Article Received 22-11-2022, Article Revised 11-01-2023, Article Accepted 12-04-2023.

ABSTRACT

This study was aimed to raise public awareness about the importance of consuming high-quality fish as a healthy protein source for a sustainable lifestyle. Proximate body composition analysis including water, fat, protein, and ash content of farmed and wild caught fish was determined. Fish species i.e. *Labeo rohita* was selected being one of the most preferred edible fish in the region. The fish samples were collected both from the river and farm using gill nets. To avoid any compromise in fish quality, the fish were kept separately in polythene bags under the laboratory conditions until dispatched for analysis. Statistical analysis using Analysis of Variance (ANOVA) revealed that farmed fish had higher protein content (83.91 %) than wild caught fish (81.42 %). The ash (6.23 %) and moisture (76.12 %) levels in wild fish were higher than in farmed fish (5.59 % and 73.74 %, respectively). Fat content was also higher in wild fish (12.66 %) than in farmed fish (10.53 %). According to the findings, farmed *Labeo rohita* is of extravagant quality than wild *Labeo rohita* due to consistent accumulation of heavy metals and pollutants in riverine ecosystems. It is suggested that water and food quality parameters particularly for fish should be under controlled surveillance for health risk assessment and quality assurance.

Key Words: *Labeo rohita, proximate parameters, farm, wild, heavy metals, Jhelum, Punjab, Pakistan*

INTRODUCTION

Fish is a globally recognized essential and prominent source of protein (Hawk and Oser 1965and it is playing a pivotal role in aquaculture research (Loring et al., 2013; Olson et al., 2014). More than 4.5 billion people rely on fish for a higher proportion of easily digestible protein intake (Beneet et al., 2015). Fish contains 65-80 percent moisture, 15-20 percent protein, 5-20 percent fat, and 0.25% ash (Mohanty, 2015). Fish protein is consumed by 60% of people in developing countries. The total global fisheries production was 158 million tones, with aquaculture accounting for 42 percent, or approximately 66.6 million tones. Over the last 30 years, the price of aquaculture has risen by 8% per year. In 2009, the aquaculture industry was worth $86 billion. Fish is the primary protein source that is still foraged rather than farmed. According to the FAO, fish is the primary source of animal protein for nearly one billion people worldwide. Total landings from marine fisheries increased fivefold between 1950 and 1990, a period of four decades (Mace, 1997). Animal protein is consumed at a rate of 10% in North America and Europe, 17% in Africa, 26% in Asia, and 22% in China. "Nutrition is the consumption of food with regard to the nutritional values of the body," according to WHO. Good nutrition is defined as a well-balanced weight loss plan combined with regular physical activity, which is the foundation of fitness. Among the three Indian main carp species (*Labeo rohita, Cirrhinus mrigala*, and *Catla catla*), *Labeo rohita* (rohu) is the most common due to its increased capacity and abundant customer choice. It contains a lot of protein and is high in omega-3 fatty acids, which are good for heart. It contains a lot of vitamin D and C and is recommended for pregnant women and nursing mothers. The protein content is easily digestible and the internal protein usage is precise. The omega-3 fatty acid found in rohu also lowers the risk of cardiovascular diseases.The quantitative assessment of macromolecules in food is known as proximate analysis. Extraction, Kjeldahl, and NIR methods are used to determine the protein, fat, moisture, ash, and carbohydrate contents. On standardized nutritional labels, protein, fat, moisture, ash, and carbohydrate content information is required, with the ingredients themselves referred to as "proximate" and the technique of determining their quantities as "proximate analysis." Fish chemical makeup varies greatly between species and even within species, depending on age, sex, habitat, and season. Protein and ash levels are fairly consistent. The amount of lipids in the body varies greatly and is inversely proportional to the amount of water in the body.

MATERIAL AND METHODS

The research was carried out on the Jhelum river, which flows through northern and eastern Pakistan and northwestern India. Fish were sampled from the river and farms. To ensure quality, the samples were handled with care. The fillets were carefully prepared for proximate analysis and stored in separate polythene bags until dispatched (Fig.1). Fish samples were collected in two parts: 30 samples from the river and 30 samples from the pond with the assistance of a local trained fisherman using gill nets and mesh nets. Fish were collected and transported to the laboratory of Department of Zoology at the University of Lahore, Sargodha campus. Before sending to the lab, fish samples were dissected, converted into fillets and refrigerated at 200º C for proximate analysis.

Fig. 1. Fillets stored in packets

Sample size: The average total length of samples from river was 19.97±2.41 cm, average standard length 16.75±2.48 cm, average width 7.65±0.78 cm and average weight 2031.68±179.08 g was observed. The average total length of sample from pond was 19.38±2.01 cm, average standard length 16.04±2.12 cm, average width 8.02±0.96 cm and average weight 2069.68±382.89 g was observed.

Table:1 Name of selected fish species along with number, site, A.T.L, A.S.L, A.W and A. Weight

Scientific name	Replicate	Collection side	Average total length	Average standard length	Average width	Average weight
Labeo rohita	30	Farm	19.38±2.01	16.04±2.12	8.02±0.96	2069.36±179.08
	30	River	19.97±2.41	16.75±2.48	7.65±0.781	2031.68±382.89

Moisture Content Determination: For moisture determination, 2g of each fish sample was weighed with help of digital balance and then put in already weighed low heft plates that are made of aluminum foil. Then samples were transferred into oven (135°C) for almost 2 hours, and then placed in desiccators to be cooled. It was weighed again using the moisture content determination.

$$\textbf{Moisture\%} = \frac{\text{weight loss after dehydration in gram}}{\text{Weight of sample in gram}} \times 100$$

Ash Content Determination: 2g sample of fish was weighed using a computerized weighing scale and placed in a ceramic crucible. The crucible was placed in the preheat incinerator for nearly two hours at a temperature of 600 °C. Following this process, the crucible was immediately moved to the desiccators for cooling. It was then weighed again using the moisture content determination technique.

$$\textbf{Ash\%} = \frac{\text{weight of sample after ashing} \times 100}{\text{Weight of sample}}$$

Fatty Content Determination: The fatty content was determined using a dry extraction procedure. In a glass tube, 20 milligrams of dry sample in the form of fine powder were collected. After that, a 10-milliliter combination of methyl alcohol and dichloromethane was placed in a glass tube of sample and thoroughly mixed. It was kept overnight and then centrifuged. For supernatant buildup, small pre-weighed glass vials were utilized. The supernatant-containing vials were heated in an oven at 70 degrees Celsius for 30 minutes to evaporate the solvent, after which the residual sample was weighed again. The fat content was calculated using the procedure below.

$$\textbf{Percentage of fat} = \frac{\text{weight of fat} \times 100}{\text{Sample weight}}$$

Protein Content Determination: Kjeldhal's technique was used to calculate protein content. Digestion amalgamation was made up of Ferrous Sulfate, Copper Sulfate, and Potassium Sulfate in proportions of 1, 2, and 20 multiplied by 5. In a Kjeldahl flask, 1g of dried fish sample, 5g of digestion amalgamation, and 25 to 30 mm of Sulphuric acid were mixed with Sodium Hydroxide (40 percent), Sulphuric Acid (concentrated), H_2SO_4 (0.1 Normality), and Boric acid. It was cooked for 3 hours during which time the solution became greenish. In the digester, a 10-milliliter digest sample and 40% Sodium Hydroxide were combined, and steam distillation was performed. When pinkish boron changed into golden ammonia collection was done for about two minutes, NH_3 was accumulated in the boric solution flask, then sulphuric acid (0.1 normality) was titrated in opposition of NH_3 and the employed quantity of sulphuric acid was determined.

$$\textbf{Percentage of nitrogen} = \frac{\text{acid in milliliter} \times \text{standard solution normality} \times 0.014 \times 100}{\text{weight of sample}}$$

Protein percentage in samples was calculated by multiplying the nitrogen percentage with 6.25.

Protein percentage = nitrogen content (%) × 6. 25. Further, the results were analyzed statistically by using R studio software (version 3.5.3) and applying ANOVA and T-TEST to determine the differences among the select proximate parameters of wild and farm rohu.

RESULT

Proximate analysis of selected fish species of farm: For the proximate analysis of pond selected area was Jhelum. The selected fish species was Rohu as it is the priority as food in this area than any other fish species. The results obtained for farmed rohu showed value of crude protein as (83.913±1.494 %, fat 10.534±1.138 %, Ash 5.591±0.464 % and moisture 73.745±1.640 % givn in the table 2

Proximate analysis of selected fish species of river: For the proximate analysis of river selected area was Jhelum river. The selected fish species was Rohu as it is taken as priority in this area than any other fish species. The result obtained for wild rohu showed values of crude protein as 81.423±1.0.616 %, fat 12.662±0.307 %, Ash 6.229±0.576 % and moisture 76.124±0.941 % given in the table 3

Comparative proximate analysis of wild and farmed *Labeo rohita:* The comparative study of present research showed the proximate parameters including moisture, ash, fat, and protein content of both wild and pond *Labeo rohita* are as in table no 04

Table: 2 Mean and S.D of Proximate parameters of pond *Labeo rohita*

Proximate Parameters	**Sight**		**Mean± S. D (%age)**
1. Crude protein	Farm	30	83.913±1.494
2. Fat	Farm	30	10.534±1.138
3. Ash	Farm	30	5.591±0.464
4. Moisture	Farm	30	73.745±1.640

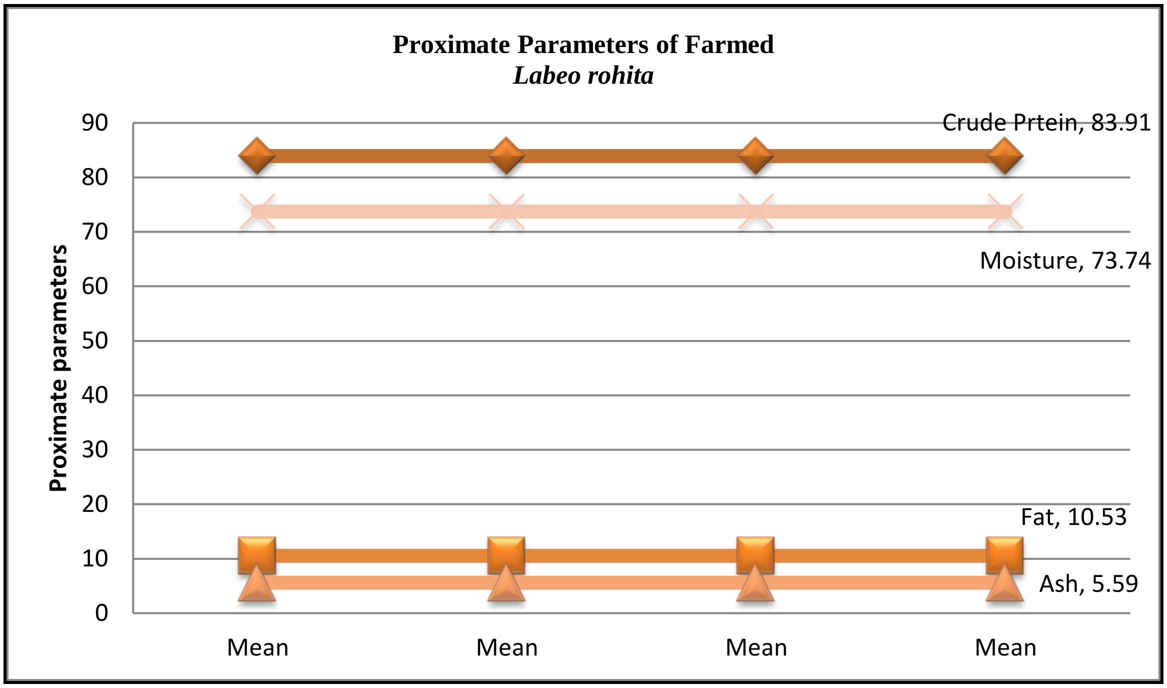

Fig 2. Proximate parameters of Farmed *Labeo rohita*

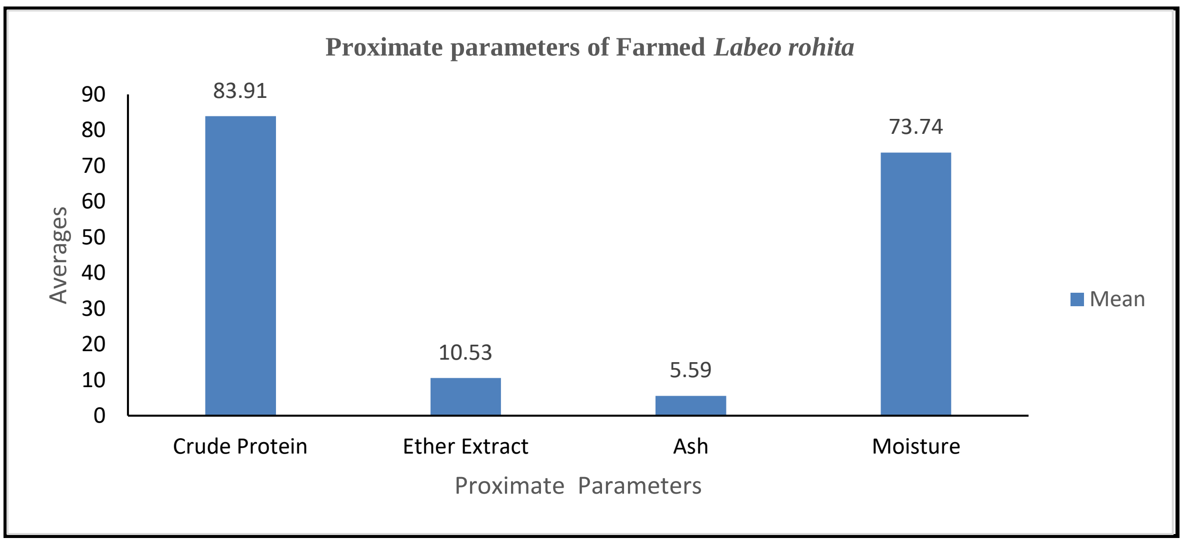

Fig 3. Proximate parameters of Farmed *Labeo rohita*

Table: 3 Mean and S.D of Proximate parameters of wild *Labeo rohita*

Proximate Parameters	**Sight**	**Replicates**	**Mean ± S D (%age)**
Crude protein	River	30	81.42 ± 0.616
Fat	River	30	12.66 ±0 .307
Ash	River	30	6.23 ± 0.577
Moisture	River	30	76.12 ± 0.941

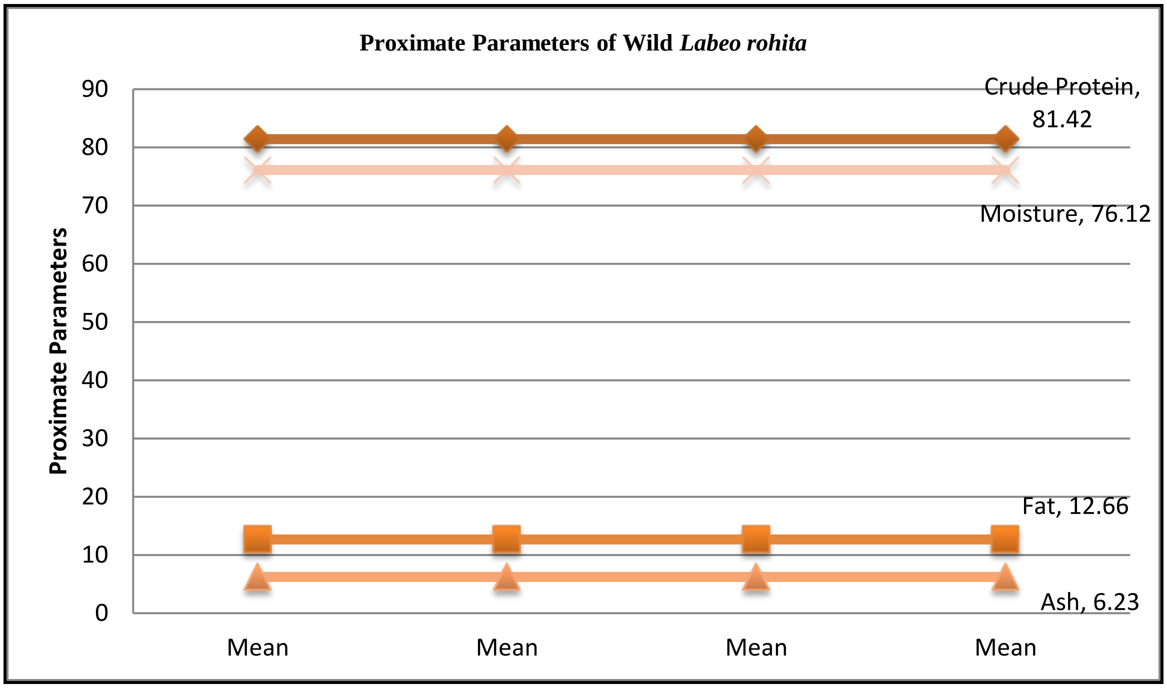

Fig 4. Proximate Parameters of Wild *Labeo rohita*

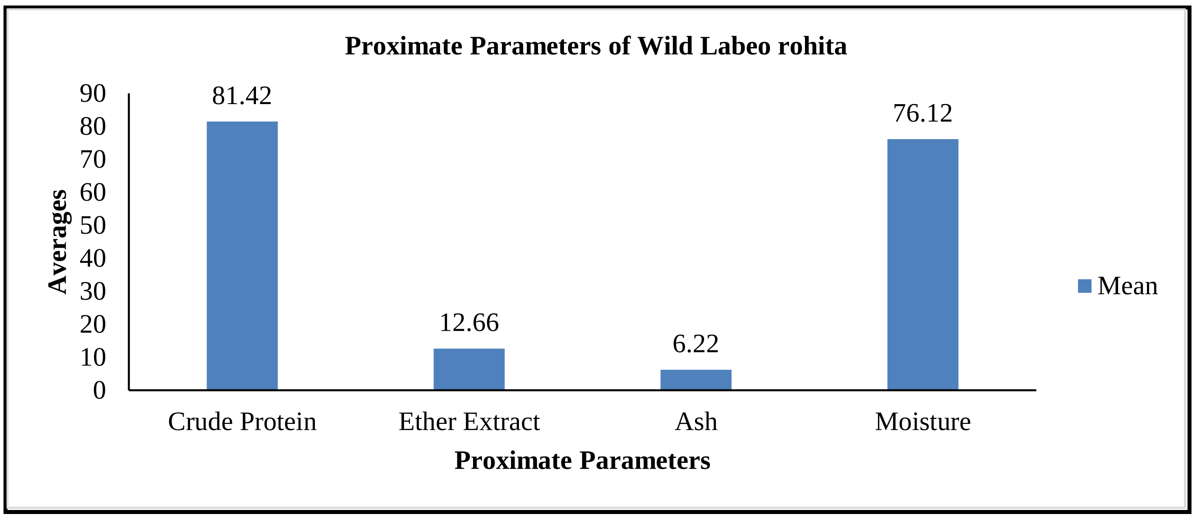

Fig 5. Proximate Parameters of Wild *Labeo rohita*

Table. 4 Comparative Mean and S.D of Proximate parameters ofwild and farmed *Labeo rohita*

Proximate Parameters	**Mean ± S.D (Wild)**	**Mean ±S.D (Farmed)**
Crude protein	81.42 ± 0.616	83.913±1.494
Fat	12.66 ±0 .307	10.534±1.138
Ash	6.23 ± 0.577	5.591±0.464
Moisture	76.12 ± 0.941	73.745±1.640

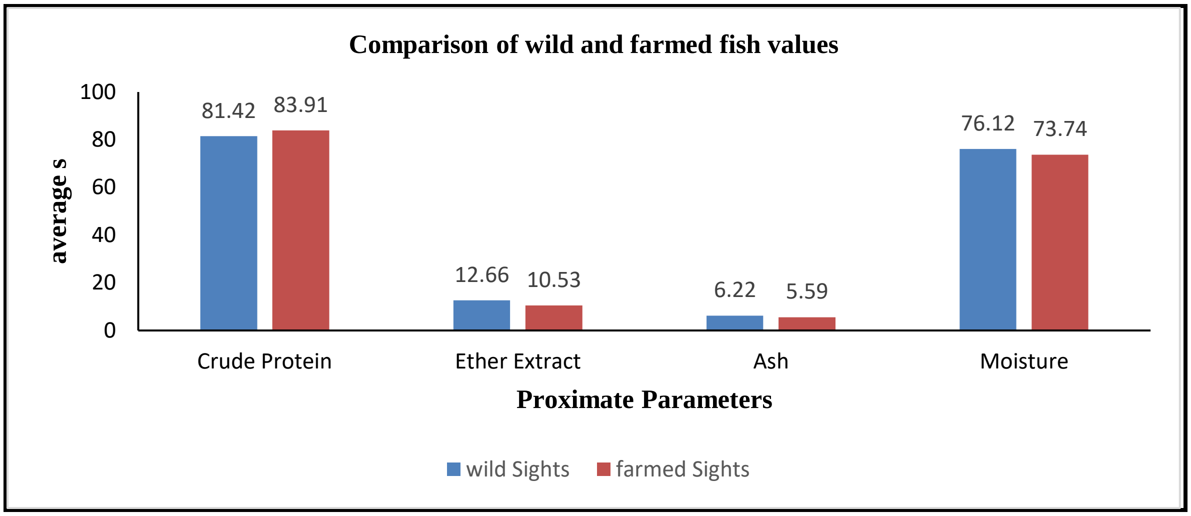

Fig 6: Comparison of proximate parameters of both wild and pond *Labeo rohita*

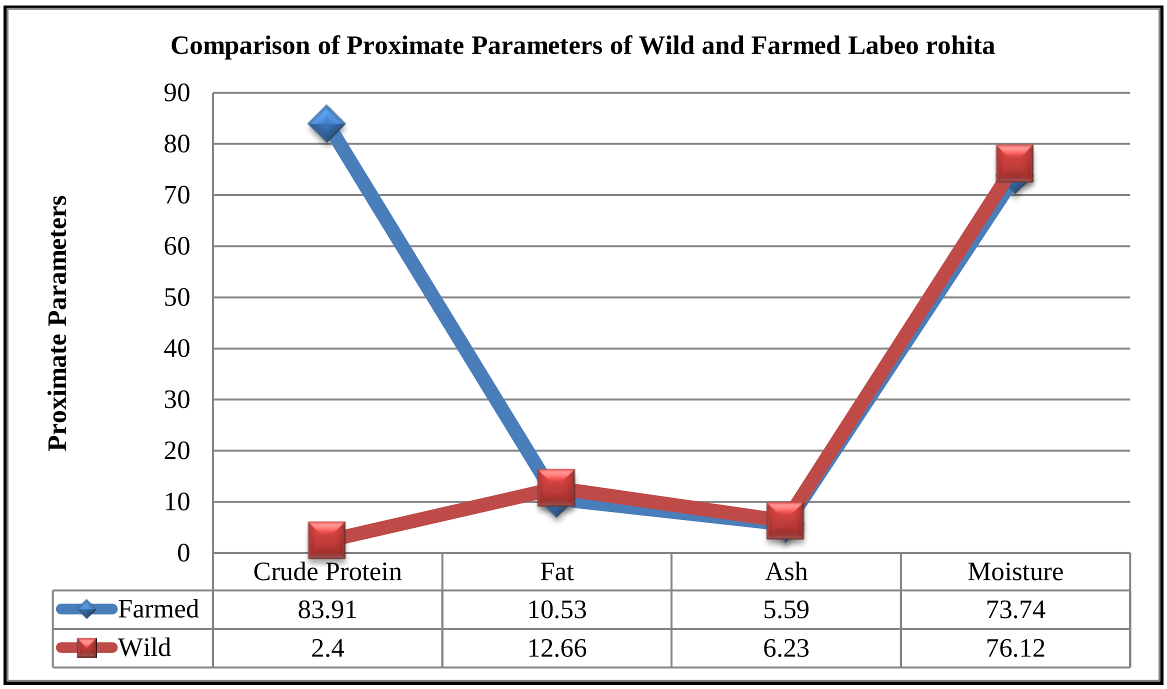

Fig 7: Comparison of proximate parameters of wild and farmed *Labeo rohita*

Table. 5 Maximum and minimum value of river samples

Parameter	**Maximum value**	**Minimum value**
Moisture	77.58	74.97
Crude protein	82.23	80.42
Crude fat	13.04	12.28
ash	7.02	5.30

Table. 6 Maximum and minimum value of farm samples

Parameter	**Maximum value**	**Minimum value**
Moisture	76.19	71.45
Crude protein	86.38	81.79
Crude fat	11.98	8.76
Ash	6.08	4.9

Water quality of river Jhelum: The River Jhelum, which has 24 tributaries, is the principal water supply of the Kashmir valley, with enormous socioeconomic significance. The Jhelum River is heavily used for its water and food, particularly fish. The Jhelum River is contaminated by sewage from communities, agricultural runoff, and effluent discharges from different small and big scale industrial units since it flows through many rural and urban populations.

Table 7. Water quality of river Jhelum

Sr no	Parameters	Values
1	D.O	5.5-6.5 mg/L
2	pH	7.1-8.8
3	Temperature	15-17^{0}C

DISCUSSION

Fish is an important indicator of heavy metals in an ecosystem because of their delicate nature and tolerance at the community level. Moisture, ash, protein, and fat are all determined by proximate composition. Environmental conditions, feeding behavior, and water quality can all cause significant differences within the same species. We devised a study to compare the proximate parameters of wild and pond fish. According to various studies, pond fish performs better in terms of nutritional and commercial value than wild fish (Naz et al.,2020) It has been demonstrated that the farmed species of Rahu is nutritionally superior to the wild species.

The moisture content according to Naz et al. (2020) for the fish samples collected from pond was 71.196.32 %, while the moisture content of the river specie was 78.985.50. This river had a lot of moisture, and my study showed the same thing. The moisture content of my farmed sample is 73.7451.64, while the moisture content of the river is 76.12 0.941. Their research backs up my findings. Ashraf et al. also demonstrated that river water has a higher moisture content than farmed water, which supports my findings. According to Hadayait et al., (2018), farm fish has higher moisture levels than river fish, indicating that farm fish is good for food.

The protein content of Naz et al.,(2020) for farmed was 91.75 2.76 and 85.89 3.91 for river. Farmed species had higher protein content, indicating that they are healthier to eat as food. It is due to the control of food quality and every parameter in farming rather than in rivers where all types of food are present and water quality is poor due to water pollution. In my study, farmed rohu had a higher protein content (83.9131.494), whereas wild rohu had a lower protein content (81.4230.616). As a result, their findings support my findings. Hadayait et al. (2018) found the same level of protein in wild and farm fish. Their research found that farm protein was higher than wild protein.

According to Naz et al. (2020), the farmed ash content was 4.812.09 and the river ash content was 10.282.64. Because of the presence of heavy metals in the river, there was more ash in this river. Due to water quality control, the ash content of farmed crops is under control. My study yielded the same results, so it is also in my favour. The ash content of farmed fish is 5.5910.464, while that of river fish is 6.23 0.577. Hadayait et al. (2018) discovered a higher ash content in the wild than in the farm.

The fat content of Nazet al., (2020) for farmed was 14.873.79 and 7.002.10 for river. This result contradicts my result. My research found that river fish had more fat (12.66 0.307) than farmed fish (10.5341.13). Hidayait et al., 2018 discovered that river fat was 4.80 and farmed fat was 3.84. This study backs up my conclusion. Fatty fish also contains omega-3 fatty acids, which are necessary for proper body and brain function and have been linked to a lower risk of a variety of ailments. It is recommended that you consume fatty fish at least once or twice a week to meet your omega-3 requirements. Use omega-3 supplements made from microalgae if you are a vegan.

Ash content represents the inorganic residue (minerals) left after fire and complete oxidation of organic materials. As a result of heavy metal accumulation, the ash content rises. The moisture, protein, and fat content are all affected by heavy metal accumulation. Heavy metals accumulate as a result of water pollution. Poor renal (Pb, Cd, Hg) and liver (Pb and Cd) function, reduced cognitive function (Pb, Hg), impaired reproductive capacity (Cd, Pb), hypertension (Cd), neurological alterations (Hg, Pb), teratogenic effects (Hg), and malignancies are all symptoms of heavy metal toxicity (Cd).

Humans get their protein from fish. If humans consume fish that have heavy metal accumulations, the nutritional quality of the fish suffers. This is happening in river fish as a result of the surrounding areas' poor sanitation system. Many industries and laboratories can be found along the Jhelum River. There is waste material in the river, which distorts the quality of the fish. The mining culture in this area has an impact on the water quality of fish, which has an indirect impact on humans. Humans can contract a variety of deadly diseases after consuming river fish. The quality of water and fish feed is closely monitored on the farm and can be easily checked every two weeks. As a result, the risk of disease after eating is lower than that of the river.

CONCLUSION

The current study concludes that farmed *Labeo rohita* is better than wild on the basis of its ameliorate nutritional values. The variation among body pattern and size is also observed due to difference of habitat in both environments. Furthermore, the threat of heavy metals bioaccumulation is higher in wild environment which is also a potential risk to human health. trends in biotechnology paved the way to counter these hazardous effects of noxious compounds. Floating gardens can minimize the anaerobic bacterial stress which ultimately will reduce the aquatic toxicity burden. Furthermore, advances in cyanobacteria and algae technology along with genetically modified zooplanktons and phytoplankton can consume these heavy metals and other chemical compounds resulting in reduced toxicity.

REFERENCES

Pervin, T., Yeasmin, S., Islam, R., Rahman, A., & Sattar, A. Studies on nutritional composition and characterization of lipids of Latescalcarifer (Bhetki). Bangladesh Journal of Scientific and Industrial Research, **47**(4), 393-400(2012).

Loring, P. A. The political ecology of gear bans in two fisheries: Florida's net ban and Alaska's salmon wars. Fish and Fisheries, **18**(1), 94-104. (2017).

Olson, R. J., Duffy, L. M., Kuhnert, P. M., Galván-Magaña, F., Bocanegra-Castillo, N., &Alatorre-Ramírez, V. Decadal diet shift in yellowfin tuna Thunnusalbacares suggests broad-scale food web changes in the eastern tropical Pacific Ocean. Marine Ecology Progress Series, **497**, 157-178. (2014).

Bennett, A., Basurto, X., Virdin, J., Lin, X., Betances, S. J., Smith, M. D., & Zoubek, S. Recognize fish as food in policy discourse and development funding. Ambio, **50**(5), 981-989. (2021).

Mohanty, B. P., Mahanty, A., Ganguly, S., Mitra, T., Karunakaran, D., &Anandan, R. Nutritional composition of food fishes and their importance in providing food and nutritional security.Food chemistry, **293**, 561-570. (2019).

Tidwell, J. H., & Allan, G. L. Fish as food: aquaculture's contribution. EMBO reports, **2**(11), 958-963. (2001).

Sikandar M.A., Hassan Z., Basit A., Khan R., Ozdemir F.A. Virtual Analysis on Proximate Body Composition of Labeo rohita and Cirrhinus mrigala. Turkish Journal of Agriculture Food Science and Technology. **8**(1):105-109. 2812. (2020).

Naz et al., Comparative Study of Proximate Parameters of both Farmed and Wild Selected Fish Species. Society of Education, India (2020).

Ashraf, M., Zafar, A., Rauf, A., Mehboob, S., & Qureshi, N. A. Nutritional values of wild and cultivated silver carp (Hypophthalmichthys molitrix) and grass carp (Ctenopharyngodon idella). Int. J. Agric. Biol, **13**(2), 210-214. (2011).

Naz, S., Nawab, K., Bano, N., Rafique, S., Ali, U., Khubaib, M. Ali. Comparative Study of Proximate Parameters of both Farmed and Wild Selected Fish Species. Advances in Bioresearch, **11**(5):21-29. (2020).

Hadyait, M. I., Ali, A., Bhatti, E. M., Qayyum, A., &Ullah, M. Z. Study of Proximate Composition of Some Wild and Farmed Labeorohita and Cirrhinusmrigala Fishes. PSM Biol. Res, **3**(1), 34-38.(2018).