



# Evaluation of Fish Curry from Farmed and Wild Caught Indian Major Carps of Tarai Region, Uttarakhand

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## Abstract

The differences between pond cultured and naturally occurring (wild) Indian major carps (*Catla catla*, *Labeo rohita*, *Cirrhinus mrigala*) from the reservoirs in terms of proximate composition of the fishes and sensory evaluation of fish curry made out of them are presented in this communication. Comparatively higher protein and ash but lower fat and carbohydrate were observed in wild fish species. The cultured fishes possessed high moisture and fat content. The panelist choice went in favour of fish curry prepared from *Labeo rohita*. There was superior preference for curry prepared from the wild fish over the cultured fish owing to stronger texture, required elasticity of chewing, pleasant taste and more delicious flavor. The results clearly indicate that wild fish is preferable to cultured fish due to firm texture, excellent affable taste and flavour.

**Keywords :** Proximate analysis, fish curry, sensory evaluation, wild, cultured, Indian major carps

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## Introduction

Fish is one of the most important sources of animal protein and has been widely accepted as an excellent source of high quality proteins, low in saturated fat, rich in vitamins, minerals and other elements for the maintenance of a healthy body (Andrew, 2001). In recent times there has been an increasing awareness about health food and fish is finding more

acceptance because of its special nutritional qualities. Uttarakhand, the hill state of India has only fresh water resources having river and tributaries (2 686 km), reservoirs (20 075 ha) and flood plain waters (628 ha). Based on consumer preferences it is acclaimed that from culinary point of view fish from natural wild stock are preferred to cultured fish (Verbeke et al., 2007; Howaida & Ali, 2007). Significant biochemical differences occur when wild and cultured counterparts of the same species are compared (Howaida & Ali, 2007; Kaba et al., 2009; Chuang et al., 2010). Studies on species such as Australian snapper (Prescott & Bell, 1992), channel cat fish, (Webster et al., 1993), chinook salmon (Sylvia et al., 1995), gilthead sea bream (Grigorakis et al., 2003), red sea bream (Mustafa et al., 1995), puffer fish (Saito & Kunisaki, 1998), gilthead sea bream and seabass (Grigorakis, 2007) and rainbow trout (Fallah et al., 2011) have been done to compare the biochemical differences between wild and cultured fish. Chuang et al. (2010) compared the meat quality and chemical compositions of wild-captured and cage-cultured cobia. Proximate analysis and comparison of many cultured and wild caught specimens were also conducted (Saeki & Kumagai 1984; Chanmugan et al., 1986; Jahncke et al., 1988; Bergstrom, 1989 and Aoki et al., 1991).

There is a lack of information on the biochemical differences between cultured and wild Indian major carps of Uttarakhand region. The present communication highlights the differences in the composition of cultured fishes from ponds and wild fishes from the reservoirs and the sensory qualities of fish curry prepared out of these fishes.

## Materials and Methods

Cultured Indian major carps (*Catla catla*, *Labeo rohita*, *Cirrhinus mrigala*), raised in semi intensive interdrainable ponds under normal dietary regime

comprising of ingredients such as rice bran and oil cake, having weight of 350-450 g and length 28-32 cm were collected from the instructional fish farm of College of Fisheries, Pantnagar (29°N latitude, 79.3°E longitude at an altitude of 243.8 m). Wild fish of same species and was procured from the Dhoura reservoir (28° 53' N latitude and 79° 40' E longitude) and Baigul reservoir (28° 56' N latitude and 79° 40' E longitude) of Udham Singh Nagar district in Uttarakhand state. The procured fishes were transported in iced condition (1:1) to fish processing technology laboratory, Pantnagar and fillets separated manually.

The proximate composition of fish fillets was evaluated by estimating their protein, lipid, moisture and ash by using standard AOAC (1995) techniques and nitrogen-free extract (NFE) by Knauer's procedure (Knauer et al., 1994). Proximate composition of all experimental fishes was analyzed in triplicate.

Fish curry was prepared out of cultured and wild fish species with the incorporation of locally available ingredients as shown in Table 1.

Table 1. Ingredients for preparation of fish curry

Ingredients	Quantity
Fish (washed and sliced 5x4 cm)	200 g
Onion	75 g
Garlic (chopped)	15 g
Tomato (chopped)	50 g
Mustard Seeds	2 g
Turmeric Powder	5g
Green Chillies	5 g
Vegetable oil	75 ml
Coriander powder	10g
Ginger (minced)	5 g
Salt	As per taste

Fish curry was prepared after marinating the fish portions in salt and turmeric powder for 15 min. Onion, ginger, garlic, tomato, green chillies and turmeric powder were ground to make a fine paste. After that, pieces of fish were fried in hot oil until slightly brown in colour and kept aside. In the remaining oil, mustard seeds and the paste of all the ingredients were added and fried till it turned golden brown. Water (100 ml) and salt were added

to the final fried paste and boiled for 10 min. Fried fish was added and cooked on a slow flame for 5 min.

The prepared fish curry was qualitatively assessed for the texture, colour, taste, flavour and aroma individually by a panel of 10 judges on a 10 points hedonic scale according to Klein & Bardy (1984) viz., 10- 9 very good, 8-7 good, 6-4 fair, 3-1 poor. For colour, high score was given to darker muscles and low for light coloured muscles. Data were analyzed by one way Analysis of Variance (ANOVA) at 95% confidence level ( $P < 0.05$ ).

## Results and Discussion

Proximate composition of cultured and wild Indian major carps are presented in Table 2. Moisture content of all cultured fish species was found to be marginally higher than the wild fish species. In all the wild species, protein was found to be higher than in cultured species. This increase in average protein level was about 0.69%. The maximum differential increase of 1.21% in protein content was encountered in *C. catla*, minimum of 0.34% in *L. rohita* and *C. mrigala* accounted for an increase of 0.52% than cultured fishes of same species. The fat content in the wild fishes was found to be lower than the grow-out fish. Ozawa et al. (1993), Lanari et al. (1999), Jobling (2001), Alasavar et al. (2002), Orban et al. (2003), Boujard et al. (2004), Gonzales et al. (2006), Alvarez et al. (2009), Kaba et al. (2009), Chuang et al. (2010) and Fallah et al. (2011) have observed lesser lipid content in wild fish species than the cultured ones. The average increase in the fat content was 0.27% in cultured fish than in wild varieties. Maximum difference of 0.37% higher value of fat content was recorded in cultured *C. mrigala* followed by *C. catla*, 0.32% and minimum of 0.12% in *L. rohita*.

Howaida & Ali (2007) stated that the higher fat content in cultured fish may contribute to its whiter appearance. High lipid in cultured fish is attributed to high energy consumption and limited activity (Otwell & Rickards, 1981). Mustafa et al. (1995) stated that the active state of reserve lipid is related to physiological condition of fish. The wild fishes from reservoir spent much of their energy for intensive active behaviour and fast swimming. The demand for accelerated swimming never allows the fat to be stored in the form of adipose tissue in wild fishes from the reservoir (Gupta, 2009). Therefore wild

fishes have more protein but low level of fat than cultured fishes which have lower level of protein and higher level of fat.

The ash content was found to be higher in all the wild species than cultured fishes. The difference in ash content between wild and cultured fish species was found to vary between 0.80-1.35%. The maximum difference of 1.35% was found in *C. mrigala* and minimum (0.95%) in *C. catla* with a moderate difference of 0.80% in *L. rohita*. The percentage of ash content in natural and wild fish is usually more due to the higher inorganic content in them (Shearer, 1994; Yeannes & Almandos, 2003; and Huang et al., 2007). The main components of ash are calcium and phosphorous. The NFE value was higher for cultured fishes than wild ones. The species wise difference was found to be maximum in cultured *C. mrigala* (0.17%), followed by *L. rohita* (0.13%) and *C. catla* (0.11%). The higher value of NFE in cultured

fishes may be due to incorporation of rice bran in their supplementary feed and use of starch as binder in feed. The lower moisture and lipid levels accounted for higher protein content in wild fish species. The findings of the present study match with the findings of Howaida & Ali (2007). The findings of Jankowaska et al. (2007) in perch (*Perca fluviatilis*) is contradictory to the present work. However, in the study of Jankowska et al. (2007) the perches were raised in running water flow through system and fed with enriched formulated diets of Nutra classic comprising of 45% protein, 16% of fat, 20.8% carbohydrates, 1.2% phosphorus and high dose of vitamin A, D3 and E. The fishes cultured in such advanced system and fed with enriched diet expectedly yield higher protein and fat levels than the wild varieties. Therefore, in the present study the biochemical profile of cultured fishes showed higher level of moisture and fat and lower levels of protein and ash when compared to wild fish species.

Table 2. Proximate composition (%) of cultured and wild Indian major carps

Sl. No.	Species	Type	Moisture	Protein	Fat	Ash	NFE
1.	<i>Labeo rohita</i>	Cultured	81.20±0.23 <sup>b</sup>	12.56±0.22 <sup>a</sup>	2.68±0.03 <sup>b</sup>	3.00±0.06 <sup>a</sup>	0.56±0.15 <sup>a</sup>
		Wild	80.31±0.12 <sup>a</sup>	12.90±0.12 <sup>a</sup>	2.56±0.08 <sup>a</sup>	3.80±0.22 <sup>b</sup>	0.43±0.12 <sup>b</sup>
2.	<i>Catla catla</i>	Cultured	79.55±0.32 <sup>b</sup>	11.44±0.14 <sup>a</sup>	3.55±0.12 <sup>b</sup>	4.68±0.12 <sup>a</sup>	0.78±0.06 <sup>a</sup>
		Wild	78.70±0.18 <sup>a</sup>	12.65±0.23 <sup>b</sup>	3.23±0.11 <sup>a</sup>	4.75±0.03 <sup>a</sup>	0.67±0.12 <sup>b</sup>
3.	<i>Cirrhinus mrigala</i>	Cultured	79.83±0.25 <sup>b</sup>	13.10±0.12 <sup>a</sup>	4.00±0.03 <sup>b</sup>	2.55±0.02 <sup>a</sup>	0.52±0.10 <sup>a</sup>
		Wild	78.50±0.18 <sup>a</sup>	13.62±0.30 <sup>b</sup>	3.63±0.02 <sup>a</sup>	3.90±0.05 <sup>b</sup>	0.32±0.19 <sup>b</sup>

Values in the same column for the same species of (cultured and wild) with different superscripts are significantly different at ( $p < 0.05$ ). Values given in the table are mean  $\pm$  SD (n = 3). Values are on wet basis.

Table 3. Evaluation of fish curry made from cultured and wild fish species of Indian major carps based on sensory scores.

Fish Species	Type	Texture	Colour	Taste and flavour	Aroma	Total acceptability
<i>Labeo rohita</i>	Culture	6 <sup>b</sup>	6 <sup>b</sup>	8 <sup>d</sup>	8 <sup>d</sup>	7 <sup>c</sup>
	Wild	8 <sup>d</sup>	9 <sup>e</sup>	9 <sup>e</sup>	7 <sup>c</sup>	9 <sup>e</sup>
<i>Catla catla</i>	Culture	7 <sup>c</sup>	7 <sup>c</sup>	6 <sup>b</sup>	8 <sup>d</sup>	6 <sup>b</sup>
	Wild	9 <sup>e</sup>	9 <sup>e</sup>	7 <sup>c</sup>	8 <sup>d</sup>	7 <sup>c</sup>
<i>Cirrhinus mrigala</i>	Culture	5 <sup>a</sup>	6 <sup>b</sup>	7 <sup>c</sup>	7 <sup>c</sup>	7 <sup>c</sup>
	Wild	7 <sup>c</sup>	9 <sup>e</sup>	8 <sup>d</sup>	8 <sup>d</sup>	8 <sup>d</sup>

Values in the same column for the same species of (cultured and wild) with different superscripts are significantly different ( $p < 0.05$ ). Values given in the table are means of score given by panel of 10 judges.

Mean scores of 10 judges for the sensory evaluation of fish curry made from the cultured and wild varieties of fish are given in Table 3. Among cultured fishes, the best result for the firm texture was obtained from *C. catla*, followed by *L. rohita* and *C. mrigala*. In wild fishes, the same trend was seen but the texture of fish in curry prepared from the wild fishes was firmer than the cultured ones. Hatae et al. (1990) have stated that the species with less moisture and higher protein content became firmer when cooked. The proximate composition can affect the sensory textural properties of fish, as differences in texture of fish muscles have been related to the lipid, protein and moisture contents (Dunajki, 1979; Venugopal & Shahidi, 1996). The result clearly indicates that the texture in wild fishes which have more protein and less moisture than cultured fishes remain firm even at cooking temperature. The colour of the meat was white in the curry prepared from cultured fishes while the fish curry prepared from wild fishes indicated slightly darker colour. Based on the taste count among wild varieties the highest score was for *L. rohita*, followed by *C. mrigala* and *C. catla*. The results of both the groups of fishes firmly confirm the choice in favour of *L. rohita*, which also happen to be the choice among fresh water fishes in majority of Indian population (Jena, 2006; Mahapatra et al., 2006). The panelists however could not perfectly distinguish between fish curry made out of cultured varieties of *C. catla* and *C. mrigala*. Further questioning of panelists revealed that they attributed the preference for taste in favour of wild varieties due to the firm texture, elasticity and stretchable qualities while chewing. The firm texture also helps in easily segregating the spines and does not intermingle with muscle portion while eating. Therefore it can be concluded that the texture has immense influence on the taste of fish and aids in improvement of its culinary properties. The higher fat content in cultured fish affects taste, making it more juicy. Einen & Thomassen, (1998) have shown a very strong correlation between fat content and juiciness in salmon. The findings of Webster et al. (1993), Prescott & Bell, (1992) and Sylvia et al. (1995) on different fishes also indicated differences among cultured and wild species with more acceptability of wild fishes due to better taste and texture. However, the panelists could not distinguish the differences in the aroma of the fish curry prepared from cultured and wild fishes.

This study indicated that wild fish of all three varieties had higher value of protein and ash but

lower fat and carbohydrate content which results in superiority of curry prepared out of wild fish having stronger texture, required elasticity of chewing, pleasant taste and delicious flavour. The cultured fishes possessed high moisture and fat content which resulted in more juicy flavour. Among three tested varieties, curry prepared from *L. rohita* was most preferred. The results clearly indicate that wild fish is more preferable than cultured fish as a choice food for consumers.

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