

Comparison of Different Nutritional Parameters and Oil Properties of Two Fish Species (*Catla catla* and *Cirrhinus cirrhosus*) from Wild and Farmed Sources Found in Bangladesh

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Abstract Fishes are rich sources of different types on nutrients. Various types of fishes are available here, so Bangladeshies are called bangali of rice and fishes. Some species are only found in brine water; on the other hand some varieties are available in soft water. The soft water fishes are found almost everywhere in Bangladesh. Some soft water fishes are either found in natural sources such as ponds, rivers, lakes etc. or they may be farmed. Both wild and farmed fishes are rich sources of protein and also contain significant amount of moisture. The moisture content in wild *Catla catla* fish is higher than other species. The farmed species contain higher amount of ash than wild species. Protein content in farmed species is also higher than wild species. Calcium content in *Catla catla* wild species is significantly different from other species. *Cirrhinus cirrhosus* farmed species show higher potassium content than other species. All of the species are rich sources of iron. Iodine number is also higher in *Catla catla* wild species. The nutrients content are higher in farmed species than the wild species.

Keywords: ash, moisture, farmed fish, Reducing sugar, iodine value

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1. Introduction

Rice and fish dominate the diet of Bangladeshis to such an extent that the old proverb, "machee bhatee bangali," which can be translated as "fish and rice make a Bengali," continues to hold true. Fish is an essential and irreplaceable food in the rural Bangladeshi diet. Fish play an important role in the Bangladeshi diet, constituting the main and often irreplaceable animal source food in poor rural households [1]. The value of fish in the Bangladeshi diet should not focus on the contribution made to protein, because protein recommendations in the typical diet are met provided that the energy recommendations are met [2]. In estimating the total vitamin A content, it is estimated that the dehydroretinol isomers have 40% of the biological activity of all-*trans* retinol [3]. The mineral content of fish, unlike its vitamin A content, is apparently not species specific. Small fish are generally eaten with bones, although some bones may be discarded as plate waste, whereas in large fish most or all bones are discarded as plate waste. Therefore, small fish are an excellent source of calcium. In studies with both humans and rats it is

shown that the bioavailability of calcium from whole small fish (mola) is as high as that from milk. In humans, the fractional calcium absorption is found to be $24 \pm 6\%$ from small fish and $22 \pm 6\%$ from milk [4]. Fish oil is derived from the tissues of oily fish. Fish and fish oils contain long-chain polyunsaturated omega-3 fatty acids, more specifically, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) [5]. Fish and other marine life are rich sources of a special class of polyunsaturated fatty acids known as the omega-3 or n-3 fatty acids [6,7]. The Scottish researchers conclude that regular consumption of oil-rich fish substantially reduces the level of circulating platelet-monocyte aggregates and May, through this mechanism, helps prevent atherosclerosis and thrombosis [8]. Furthermore, n-3 polyunsaturated fatty acids may reduce the number of inflammatory cells and help prevent atherosclerosis-hardening of the arteries [9]. Fish oil is known to protect from many types of cancers of the colon, liver, breast, prostate and lung. Emerging evidences from epidemiological and experimental studies indicate a relationship between dietary fat and the risk of cancer [10,11,12,13]. The present study was under taken to compare different nutritional parameters in the selected species.

2. Materials and Methods

The *Catla catla* (Catla) and *Cirrhinus cirrhosus* (Mrigel) species were collected from the reliable sources, such as fish farming ponds of Puthia, Rajshahi, Bangladesh. The wild species are collected from various parts of Bangladesh such as Chalon bil (natore), Padma river (Goalonda ghat, Rajbari, Bangladesh) and so many places. *Catla catla* (Catla) and *Cirrhinus cirrhosus* (Mrigel) farmed fishes are available in any time but the wild fishes are collected in rainy season due to their availability. After collection, the samples were processed and stored in deep

Table 1. The nutrients content of *Catla catla* fish. Table showed that farmed fish species was good sources total protein, water soluble protein and ash. Moisture content was higher in wild species than farmed species

Parameters	Origin	
	Wild	Farmed
Moisture gm%	78.132 ± 0.478	75.289 ± 0.754
Ash gm%	1.016 ± 0.020	3.51 ± 0.066
Total lipid gm%	1.06 ± 0.036	1.90 ± 0.035
Total soluble sugar gm%	0.026 ± 0.003	0.0323 ± 0.002
Reducing sugar gm%	0.00123 ± 0.0003	0.0003 ± 0.009
Non reducing sugar gm%	0.0248 ± 0.014	0.032 ± 0.018
Glycogen gm%	0.0475 ± 0.0006	0.0373 ± 0.0004
Water soluble protein gm%	12.543 ± 0.350	18.468 ± 0.312

Table 2. The nutrient content of *Cirrhinus cirrhosus* fish

Parameters	Origin	
	Wild	Farmed
Moisture gm%	75.821 ± 0.718	72.480 ± 0.572
Ash gm%	1.501 ± 0.008	3.506 ± 0.014
Total lipid gm%	0.953 ± 0.084	1.303 ± 0.015
Total soluble sugar gm%	0.0443 ± 0.005	0.028 ± 0.003
Reducing sugar gm%	0.0013 ± 0.0002	0.0017 ± 0.0003
Non reducing sugar gm%	0.0430 ± 0.024	0.0263 ± 0.015
Glycogen gm%	0.0397 ± 0.003	0.0419 ± 0.0004
Water soluble protein gm%	15.22 ± 0.030	16.511 ± 0.386

Moisture content of wild and farmed *Catla catla*, and *Cirrhinus cirrhosus* were presented in Table 1 and Table 2 respectively. The results showed that the wild *Catla catla*, and *Cirrhinus cirrhosus* contained 78.132% and 75.821% moisture. On the other hand the farmed *Catla catla*, and *Cirrhinus cirrhosus* contained 75.2891% and 72.480% moisture. As shown in the Table 1 and Table 2, the total lipid content of wild *Catla catla*, and *Cirrhinus cirrhosus* were 1.06% and 0.953%. On the contrary, the total lipid presented in the farmed *Catla catla*, and *Cirrhinus cirrhosus* were 1.90% and 1.303% respectively. The result for protein content of both wild and farmed *Catla catla* and *Cirrhinus cirrhosus* were given in the Table 1 and Table 2. The results showed that the wild *Catla catla* and *Cirrhinus cirrhosus* contained 12.543% and 15.22% total soluble protein, and the protein content of farmed *Catla catla* and *Cirrhinus cirrhosus* were 18.468% and 16.511% respectively. The experimental data for the selected wild and farmed species were presented in the Table 1 and Table 2. From the table it was found that the sugar content of wild *Catla catla* and *Cirrhinus cirrhosus* were 0.026% and 0.0443%. On the other hand the farmed *Catla catla* and *Cirrhinus cirrhosus* contained 0.0323% and 0.028%. sugar respectively. Glycogen content of both selected wild and farmed fish species have been determined and the data were presented in the Table 1 and Table 2. From the table it was found that the quantity of glycogen presented in wild *Catla catla* and *Cirrhinus cirrhosus* were 0.0475% and 0.0397%. Again the amount of glycogen presented in farmed *Catla catla* and *Cirrhinus cirrhosus* were 0.0373% and 0.0419%. Reducing sugar is another kind of carbohydrate. The data of Reducing sugar for *Catla catla*

refrigerator. Only the flesh of fishes were used for various experimental purposes. Sun dried samples were preferred for experiments. Lipid portion of *Catla catla* and *Cirrhinus cirrhosus*, was extracted by suitable solvents under the operating condition. Continuous Soxhlet extraction device was used for the extraction of oil. The nutritional parameters were determined by using different well established convenient methods.

3. Results

obtained from the experiments were cited in the Table 1. The data showed that the value of reducing sugar of wild and farmed *Catla catla* were 0.00123 % and 0.0003% respectively. Again the experimental data for *Cirrhinus cirrhosus* were presented in Table 2. The data indicated that the reducing sugar content of wild and farmed *Cirrhinus cirrhosus* were 0.0013% and 0.0017 g% respectively. Minerals are inorganic substances required by the organism in very small amounts for their growth and maintenance of functional activities. Minute amount of mineral elements are constituents of various regulatory compounds such as vitamins, enzymes and hormones. Minerals are utilized as cofactors for many enzymes. Table 3 and Table 4 showed the mineral contents of the selected species. Tables showed that fish species are good source of minerals especially for calcium and iron. The iodine values were measured by the Hanus method were presented in Table 5 and Table 6 and were found to be 129.667, 110.853, 109.74 and 103.37 for *Catla catla* wild, *Catla catla* farmed, *Cirrhinus cirrhosus* wild and *Cirrhinus cirrhosus* farmed respectively Table 5 and Table 6 indicated that the saponification value of *Catla catla* wild and farmed species were 199.272 and 146.943. On the other hand the saponification values were determined to be 139.306 and 201.007 for *Cirrhinus cirrhosus* wild and farmed respectively. From the investigation, the acid value of the *Catla catla* wild fish was found to be 35.505. The percentage of free fatty acid of *Catla catla* wild fish calculated from acid value and was found to be 17.842%. Again the acid values of catla farmed, *Cirrhinus cirrhosus* wild and *Cirrhinus cirrhosus* farmed were found to be, 23.81, 33.90 and 29.383

respectively. The percent of free fatty acid was found to be 11.965% for *Catla catla* farmed, 17.035% for *Cirrhinus cirrhosus* wild and 14.765% for *Cirrhinus cirrhosus* farmed all of the data were presentd in Table 5 and Table 6. As shown in Table 5, the peroxide values of

Catla catla wild and farmed were 94.987 and 105.418. The Table 6 showed that the peroxide values were 102.263 and 83.94 for *Cirrhinus cirrhosus* wild and farmed respectively.

Table 3. The amount of mineral in *Catla catla* fish

Name of the minerals	Origin	
	Wild	Farmed
Calcium µg/kg	8.114 × 10 ⁴	394.725
Zinc µg/kg	93.8	176.75
Iron µg/kg	1.942 × 10 ³	2.323 × 10 ³
Potassium µg/kg	238.57	220.39
Manganese µg/kg	234.875	323.3

Table 4. The amount of mineral in *Cirrhinus cirrhosus* fish

Name of the minerals	Origin	
	Wild	Farmed
Calcium µg/kg	241.5	443.6
Zinc µg/kg	96.975	148.275
Iron µg/kg	2.054 × 10 ³	2.11 × 10 ³
Potassium µg/kg	246.05	256.31
Manganese µg/kg	212.0	305.7

Table 5. Physical and chemical characteristics of the oils obtained from catla fish

Parameters	Origin	
	Wild	Farmed
Specific gravity	0.904 ± 0.003	0.879 ± 0.004
Iodine value	129.667 ± 0.626	110.853 ± 0.179
Acid value	35.505 ± 0.186	23.81 ± 0.108
Saponification value	199.272 ± 0.780	146.943 ± 0.880
Saponification equivalent	281.528 ± 1.100	381.789 ± 2.279
Unsaponifiable matter %	9.497 ± 0.483	6.127 ± 0.230
Peroxide value	94.987 ± 0.166	105.418 ± 0.283
Percents of free fatty acid	17.842 ± 0.094	12.298 ± 0.526

Table 6. Physical and chemical characteristics of the oils obtained from mrigel fish

Parameters	Origin	
	Wild	Farmed
Specific gravity	0.810 ± 0.001	0.807 ± 0.002
Iodine value	109.74 ± 0.515	103.37 ± 0.496
Acid value	33.90 ± 0.214	29.383 ± 0.108
Saponification value	139.306 ± 0.552	201.007 ± 5.303
Saponification equivalent	402.714 ± 1.595	279.095 ± 0.194
Unsaponifiable matter g %	22.283 ± 0.368	13.72 ± 0.267
Peroxide value	102.263 ± 0.261	83.94 ± 0.171
Percents of free fatty acid	17.035 ± 0.108	14.765 ± 0.205

4. Discussion

Rice and fish are top grade food in our country. Fish is an omnipresent food in Bangladesh. Both wild and farmed fish species are meeting our demand. As population of the country is growing day by day, more and more demand of food is increasing. As a result, more food production is the demand of time. Within a short period of time people want to produce a great deal of food. Farmed fishes are provided with sufficient amount of food, so their growth rate is higher than the wild fish species. Hence the nutritional status of the farmed fishes is also different from the wild varieties. Our study showed that the ash content in the selected fish species were lower than the value 4.62% of *Teramnus nlabialis* seed totally [14]. Experiment showed that the lipid content in these fish species were lower than the values 4.00% of *Cassia fistula* seed [15] and 9.58% of *Xylopiya aethiopic*a seeds [16]. Carbohydrate plays an important role on the physiological activities of both in animal and plant. Glucose and glycogen serves important sources of energy for vital

activities. All of these values of carbohydrates in the fish species were lower than the value of 15.88-18.68 g% for *mesua ferrea* seed [17]. Water soluble proteins of wild *Catla catla*, *Cirrhinus cirrhosus* and farmed *Catla catla*, and *Cirrhinus cirrhosus* were determined and these values were higher than the value of 12.45 g% crude protein of *Xylopiya aethiopic*a seeds [16]. Some important properties such as iodine number, saponification number, acid value e.t.c. of the extracted fish oils were determined. Iodine values give an estimation of the amount of unsaturated fatty acids in the triglyceride molecules of fat and oil. Iodine values for the selected fish species were lower than the values of (136.9-137.9) [18] for tobacco seed oil and were much lower than the value 173 for *Osmium piles* [19] seed oil. In general the higher degree of unstauration i.e. the higher iodine value, the greater is the liability of the oil or fat to become rancid by oxidation [19]. Therefore the *Catla catla* fish species had higher tendency to become rancid by oxidation than the *Cirrhinus cirrhosus* species. Saponification value is inversely proportional to the average molecular weight or chain length of the fatty acids present in the fat or oil. Oils and fats consisting largely of

C₁₈ fatty acids generally have saponification value around 290.80, indicating the presence of appreciable quantity of higher fatty acids [20]. From the experiment it was found that the saponification values of *Catla catla* wild and *Cirrhinus cirrhosus* farmed were higher than those of (185.5-188.21) [21] for the tobacco seed oil and (186.37-188.40) for *Cassia fistula* [22] seed oil. But the values of *Catla catla* farmed and *Cirrhinus cirrhosus* wild were lower than the referred values. The comparatively high saponification values indicate the presence of low proportion of lower fatty acids. These results also indicated that *Catla catla* wild and *Cirrhinus cirrhosus* farmed fishes contained high proportion of higher chain fatty acids than those of tobacco oil and *cassia fistula* seed oil. Peroxide value is the milligram equivalents of peroxide oxygen combined in a kilogram of oil and able under test to liberate iodine from potassium iodide; the iodine is next estimated using standard sodium thiosulphate solution. Peroxide value is also the measure of the unsaturation of the oils. These results of peroxide value were approximately close to that reported for cotton seed oil, (102-114) [23].

5. Conclusion

Both wild and farmed fishes are good sources of various types of nutrients. Our study showed that farmed fishes were highly nutritive and specifically *Catla catla* farmed species was more favorable for consumption.

Competing Interests

The authors declare that there is no conflict of interests regarding the publication of this article.

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