COMPARATIVE PROXIMATE BODY COMPOSITION OF WILD CAPTURED AND FARM CULTURED Cirrhinus mrigala

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The purpose of present study was to analyze and compare the nutritional values of wild captured and farm cultured Cirrhinus mrigala. The proximate composition of fish meat, head, scales, fins and skin were examined in this study. From both sources (wild and farm), 42 fish specimens were collected and divided into three different weight categories i.e. ≤500 g, 501-1000 g and 1001-1500 g and designated as W1, W2 and W3 for wild and F1, F2 and F3 for farm cultured fish respectively. The farm cultured species were found to have significantly (p<0.05) higher nutrients than its wild counterpart. Wild fish species showed high moisture (%) in all body parts selected in this study as compared to farm cultured fish species. The protein and fat contents in farm cultured C. mrigala were observed significantly (p<0.05) higher as compared to wild captured fish species. It was found that although scales and fins of both wild captured and farm cultured fishes were not consumed directly by human beings but they have considerable amount of nutrients. Ash (%) was observed significantly (p<0.05) higher in those body parts that have large bone matrix e.g. head, scales and fins of both wild captured and farm cultured C. mrigala.

Keywords: Nutritional values, wild and farmed fish, chemical composition, protein content

INTRODUCTION

Fish has been consumed throughout the world because of its several health benefits. Its flesh has high quality protein that can easily be digested as compared to other sources of animal proteins (Louka et al., 2004). Moreover, its intake reduces fats particularly triacylglycerides in the blood (Boberg, 1990) and also important in reducing cardiovascular disorders (Ahmed, 2011) however, it is important to analyze body proximate composition of fish prior to its consumption (Fawole et al., 2007). Cirrhinus mrigala is among one of the Indian major carps and commonly consume throughout Pakistan due to its high quality meat and taste and has acquired great attention of aqua-culturists globally, due to its high yield and meat quality (FAO, 2007). Measuring the moisture contents, protein, fat, ash and carbohydrate percentage of body in fish is called proximate composition (Aberoumad and Pourshafi, 2010; Ahmed, 2011). Proximate analysis is being commonly used by researchers to monitor the physiological condition and health of fish (Salih et al., 2007; Aberoumad and Pourshafi, 2010). Moisture contents of an organism body play an important role in the metabolism (Babu et al., 2013). As the fish size increases, moisture contents of different body parts decrease, while protein and fat contents increases (Naeem and Salam, 2010). Love (1980) reported that different body parts in various fish species showed moisture contents in range between 70-80%, protein 20-30% and fat 2-12%. Ash percentage of different fish species is directly proportional to their body size (Al-Asgh, 1992; Ahmed, 2011).

Proximate body composition of same fish species may differ in different environmental and feeding conditions, water depth and water quality (Javaid et al., 1992; Drazen, 2007 and Ahmed, 2011). Mahboob et al. (2003) observed that farm cultured fish showed better results in terms of nutritional and commercial values than that of wild. In wild habitat, fish consumed mainly crustaceans, insects and vascular plants while, in farmed or cultured environment, fish received a balanced protein rich diet. Although, a large number of researchers analyzed proximate composition of fish flesh (meat) but there is a scarcity of the data on proximate composition of head, scales, fins and skin of wild captured and farm cultured C. mrigala. The purpose of present study was to analyze proximate composition of flesh, head, scales, fins and skin of fish in relation to body weight and habitat (Natural and farmed).

MATERIALS AND METHODS

Total 42 specimens of Cirrhinus mrigala of three different weight categories (≤500g, 501-1000g and 1001-1500g), from both wild and farmed habitats were collected for the proximate body composition analysis. Fish sampling and measurements: Total 21 farm cultivated C. mrigala of three different weight categories designated as
F1 (<500g), F2 (501-1000g) and F3 (1001-1500g) were collected from local fish farm situated in Gojra. Concurrently, 21 wild C. mrigala of three different weight categories designated as W1 (<500 g), W2 (501-1000 g) and W3 (1001-1500 g) were captured with the help of gillnets from Trimu Headworks, Pakistan. All the fishes were immediately kept in cold iced boxes and transported to the Fisheries Research Laboratory, Department of Zoology, Govt. Postgraduate College, Gojra, where morphometric measurements included wet weight, length and width of each and every specimen were carried out.

**Preparation of fish samples for experiment:** On arrival, all fish specimens were washed immediately. Later on, the fish were sterilized, blotted dry with paper towels and then weighed on an electric balance to check out the total weight of fish. The fish were given longitudinal cut from the ventral side and then selected the head, scales, fins and skin from the dissected fish and weighed on electrical balance. The length, width and weight of head scales and fins were noted separately. The skin was made clear from flesh (meat) and then weighed. Bones were separated from fish flesh and weighed.

**Proximate analysis:** By following AOAC (1995) methods, various proximate components viz. moisture, crude proteins, crude fat and ash were determined. Total carbohydrate was calculated by difference of the entire proximate parameters i.e. Total carbohydrate % = 100 – (Moisture % + crude % + protein % + crude fat % + Ash %).

**Statistical analysis:** Data were analyzed by applying ANOVA using SPSS 11.5 for windows software. Duncan’s multiple range tests were used to resolve differences among means. A value of p<0.05 was used to indicate significant difference among groups (Ali and Kiumars, 2010).

**RESULTS**

**Moisture contents:** When moisture percentage was compared among both habitat fishes, significant difference was noted at p<0.05. Wild fish species showed high moisture percentage in all selected body parts (e.g. meat, head, scales, fins and skin) as compared to farm cultured fish species (Table 1). Maximum moisture (74.91%) was analyzed in meat (flesh) of wild C. mrigala as compared to farm cultured (67.43%) C. mrigala meat (flesh). The inferences further showed that moisture contents differed significantly within and among both species on the basis of weight. As the weight of both wild captured and farm reared fish specimen increases, moisture contents decreases.

**Crude protein:** The protein contents in farm cultured C. mrigala was noted significantly (p<0.05) higher as compared to wild captured fish species (Table 2). Maximum protein (25.54%) was noted in farmed C. mrigala meat as compared to its opponent habitat fish (22.63%). Protein contents when compared within wild and farm cultivated C.

### Table 1. Comparison of moisture contents (%) between wild captured and farm raised C. mrigala of different weight categories

<table>
<thead>
<tr>
<th>Fish source</th>
<th>Wild captured</th>
<th>Farm cultured</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight category</td>
<td>W1</td>
<td>W2</td>
</tr>
<tr>
<td><strong>Body parts</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meat (Flesh)</td>
<td>74.9±0.01a</td>
<td>72.6±0.01b</td>
</tr>
<tr>
<td>Head</td>
<td>67.9±0.02a</td>
<td>66.2±0.02a</td>
</tr>
<tr>
<td>Scales</td>
<td>58.4±0.08a</td>
<td>56.2±0.05b</td>
</tr>
<tr>
<td>Fins</td>
<td>67.8±0.02a</td>
<td>65.4±0.02b</td>
</tr>
<tr>
<td>Skin</td>
<td>71.8±0.01a</td>
<td>69.9±0.03b</td>
</tr>
</tbody>
</table>

Data are expressed as mean±SD; Means±SD followed by the same letter, within a row, are not significantly different (p>0.05).

### Table 2. Comparison of crude protein (%) between wild captured and farm raised C. mrigala of different weight categories

<table>
<thead>
<tr>
<th>Fish source</th>
<th>Wild captured</th>
<th>Farm cultured</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight category</td>
<td>W1</td>
<td>W2</td>
</tr>
<tr>
<td><strong>Body parts</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meat</td>
<td>21.0±0.02ef</td>
<td>21.9±0.01e</td>
</tr>
<tr>
<td>Head</td>
<td>13.7±0.05f</td>
<td>14.6±0.02e</td>
</tr>
<tr>
<td>Scales</td>
<td>12.8±0.06f</td>
<td>13.5±0.05e</td>
</tr>
<tr>
<td>Fins</td>
<td>17.7±0.01d</td>
<td>18.1±0.05bc</td>
</tr>
<tr>
<td>Skin</td>
<td>21.1±0.02f</td>
<td>22.1±0.02e</td>
</tr>
</tbody>
</table>

Data are expressed as mean±SD; Means±SD followed by the same letter, within a row, are not significantly different (p>0.05).
mirgala on the basis of weight, W3 and F3 weight category showed maximum protein contents as compared to other weight categories.

**Crude fat:** Fat contents are also called ether extract. Fat contents showed different trends as compared to other parameters of proximate composition. All body parts of farm cultured *C. mirgala* showed maximum percentage of fat contents as compared to wild cultivated fish specimen (Table 3). Head of wild and farm raised *C. mirgala* showed maximum fat content of 11.38 and 11.93% in W3 and F3 groups respectively. Lowest fat 1.57 and 2.01% was observed in scales of both wild and farm cultivated *C. mirgala*, respectively. Results also showed significant (p<0.05) difference in crude fat contents on the basis of weight within wild and farm cultivated *C. mirgala*.

**Ash percentage:** Ash percentage in both natural and cultivated fish species was recorded someone equal with slight differences due to size because a definite range of weight was selected. However, it was noted that those body parts showed maximum percentage of ash that have large bone matrix (Table 4). Maximum ash was recorded 27.58 and 27.84% in scales of both habitat *C. mirgala* underweight categories W3 and F3, respectively. Fins are secondly showed maximum percentage of ash both in wild and farmed *C. mirgala* in weight category W3 and F3.

**Carbohydrates:** Carbohydrates are usually neglected in proximate composition analysis and do not measure directly. These are calculated by measuring the difference of all parameters of proximate composition. Maximum carbohydrates (4.59%) were recorded in farm cultured fish while minimum (0.13) amount of these carbohydrates was observed in wild captured fish (Table 5).

### DISCUSSION

Fish flesh quality is considered superior than milk, eggs,
In the present study, significant differences ($p<0.05$) were observed for moisture contents in meat, head, scales, fins and skin between wild captured and farm cultured fish. Highest moisture contents were observed in wild and small sized *Cirrhinus mrigala* compared to other weight categories. Similar observations were also reported by Yeannes and Almandos (2003) in *Paralabrax clathratus*, Islam and Joadder (2005) in *Glossogobius giuris*, and Hussain et al. (2011) in *Catla catla*. Improved ($p<0.05$) crude protein contents in the present study was observed in meat and other body organs of farm cultured *C. mrigala* as compared to wild fish. Higher protein deposition in farmed fish may be attributed to protein rich supplementary diet which is usually fed during rearing in ponds. While in natural water bodies fish usually feed on crustaceans, insects and vascular plants which are poor in protein. Improved protein contents in farm raised fish in comparison of wild fish were also observed in other fish species (Mahboob et al. 2003; Dempson et al. 2004; Osman et al. 2007). Furthermore, protein percentage ranges observed in the present study were found similar as reported by FAO (2007) in Indian Major Carps.

Similarly, all studied body parts showed increased fat contents in pond raised *C. mrigala* as compare to wild captured fish. Moreover, enhanced fat deposition was recorded in larger fish. Differences in fat deposition among wild captured and farmed raised fish may due to the difference in feeding habits. Wild fish require more efforts to obtain diet and it also has more area to feed which lead to reduced fat contents in fish body as compare to pond raised fish. Yesilayer and Genc (2013) also observed higher lipid contents in farmed rainbow trout. Adeosun et al. (2014) also reported enhanced lipid deposition in pond raised *Clarias gariepinus* as compare to wild opponent. Similar findings were also reported in sea bass (Alasalvar et al. 2002) and in *Sparus aurata* (Grigorakis et al. 2002).

In this study, no statistical differences were observed among wild captured and farm cultured fish for ash contents. However, ash (%) showed variations among different weight categories showing maximum contents in larger fish. Similar findings were also reported by Hussain et al. (2011). They observed similar ash contents among wild and pond raised *Catla catla* and recorded higher ash contents in the head of large sized fish.

Fish, in contrast to human, uses lipids as energy source rather than carbohydrates. Carbohydrates are usually neglected in proximate composition analysis while they are important part of human nutrition. In this study, maximum carbohydrates were observed in farm cultured fish compared to wild opponent. Moreover, smaller sized fish showed more carbohydrates contents as compare to larger individuals. In a recent study, Babu et al. (2013) also observed higher carbohydrate (%) in the meat of farm cultured *C. mrigala*.

In conclusion, chemical composition of *C. mrigala* varied with size of fish. Farmed raised fish also showed higher meat quality as compare to wild captured fish. Information generated by present research will be helpful in the selection of appropriate sized fish for human consumption. Also, fish head, scales, fins and skin, which are usually not consumed by humans, can be utilized in the formulation of feeds for fish, poultry and livestock and in pharmaceutical products because of their higher protein and low fat contents.

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**REFERENCES**


Body composition of fish


