# Proximate Body Composition Analysis of Two Commercially Important Members of *Cyprinidae* Family (*Catla catla* and *Hypophthalmichthys molitrix*) From Southern Punjab, Pakistan

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## Abstract

The present Study proposed to evaluate the body composition of *Catla catla* and *Hypophthalmichthys molitrix* collected from southern Punjab, Pakistan. Collected fish samples were brought to fisheries lab for further analysis. The mean value for water, fat, protein and ash as water is 75.1%; Ash in wet and dry weight 4.07 and 16.4; Fat in wet and dry weight 5.2 and 20.8; Protein content in wet and dry weight 15.62 and 62.66 respectively in *C. catla*. The value for mean and ranges for water, fat, protein and ash as water is 77.27%; Ash in wet and dry weight 4.20 and 5.21; Fat in wet and dry weight 1.55 and 6.10; Protein content in wet and dry weight 3.22 and 5.27 respectively in *H. molitrix.* Percent water showed highly significant correlation with all the body constituents except percent fat dry weight which showed non-significant correlation. All of the values showed a negative correlation with percent water except with percent ash wet and dry weight which showed positive correlation in *C. catla*. Body weight showed highly significant positive correlation with all body constituents except the relationship with percent water, percent ash dry and wet weight in *C. catla*. A non-significant correlation with percent protein dry weight, a significant positive correlation with percent protein and fat wet; a least significant correlation with percent fat and ash dry weight while highly significant correlation with percent water in *H. molitrix*. Total length showed a highly significant negative correlation with log water, fat and protein content except ash which showed non-significant negative correlation in *C. catla* while highly significant negative correlation with log water, ash, fat and protein content in *H. molitrix.*

**Keywords:** Fish, Proximate composition, Protein, Fat, Water.

## 1. Introduction

Fish is widely accepted because of its delicious taste and reduced cholesterol content. It contains a variety of critical nutrients that humans require. Fish is both the most affordable and the most expensive form of animal protein at the same time. One of the most important metrics used to assess fish ecology is proximate composition, body functioning and feeding habits (Ali *et al.,*2008). The nutritional composition of the fish is significant not only for the fisherman and consumer but also for scientists and manufacturers (Murray & Burt, 2001).In general, commercially important fish are thought to be higher in nutrients than low-value fish, which is why people are more likely to eat them (Chakrabarty *et al.,*2003). Asa result, the

proximate composition of the fish is vital, as people must be aware of the nutritional values of the fish and be able to identify them more easily (Naser *et al.,* 2007). Fish is the best source to provide the best and excessive-quality of protein, however, manufacturing of fish oil, protein, vitamin and meal, arrangements from the fish ended up more and more critical (Naeem *et al.,* 2012).

The amount of water in a fish's body is an excellent indicator of protein content and relative fat. It has an inverse relationship with relative fat, protein, and different contents because as the percentage of water in fish decreases, the percent of lipid and protein increases, resulting in a higher strength content material in fish (Khan *et al.,* 2017). The present study is important to analyze proximate Body composition analysis of Cyprinidae Family (*Catla Catla and Hypophthalmichthys Molitrix*) from Southern Punjab, Pakistan. **2.**

## 2. **Material and Methods**

### **Sampling Site**

Sample were collected from Govt. fisheries complex Muzaffargarh. 40 fish samples of each type *Catla catla* and *Hypophthalmichthys molitrix* were collected for further analysis of body composition. The dried specimen was examined for the water, fat, ash and protein content by covering it with aluminum foil. Samples were measured until they became dry.

### **Analysis and Estimation of Water Content**

The oven-drying method was used to determine the amount of water. All samples were wrapped in aluminum foil and dried in a calibrated oven at 70-80°C until the weight and dry mass of the samples remained consistent. The difference between the oven-dried fish sample and the wet bodyweight of each sample was used to calculate the total water.

$$\text{Water (\%)} = \frac{\textit{Weight Loss during Oven Drying}}{\textit{Original Wet Body Weight of Sample Taken}} X100$$

Each fish specimen's dry matter was gently mashed in a pestle and mortar before being homogenized in an electronic grinding machine. Dry powder samples were stored in tiny plastic airtight jars with suitable labeling for later analysis.

### **Analysis and Estimation of Ash Content**

The overall ash content of the fish was evaluated by burning a dry powder sample of 1 gram in a muffle furnace for 24 hours at 550$^{o}$C. After cooling in the desiccator, the burned samples were weighed for ash determination. The following calculations were used to calculate the amount of ash in *Catla catla* body:

*Ash content=Initial weight of sample─Weight loss during incineration*

$$\textit{Ash}\ (\%) = \frac{\textit{Incinerated SampleWeight}}{\textit{Sample Weight}} X100$$

### **Analysis and Estimation of Fat Content**

In this technique, the fat content was extracted using a chloroform and methanol mixture (ratio 1:2 v/v). One gram fish sample's weighted powder was placed in a test tube, combined with a 10 ml solution of the above-mentioned solvents, stirred, and then covered with aluminum foil and stored overnight. After adequate washing and drying, the clear supernatant was carefully moved into pre-weighed little glass bottles. The bottles were placed in an oven for evaporation for 2-3 days to ensure that the solvent was dry,

and therefore lipid fractions were left. By deducting the weight of the residue left in the glass bottle from the original weight of the fat sample obtained for analysis, the total fat content was computed.The proportions of fat content in the samples' wet and dry weights were computed using the formula below:

$$\text{Fat (\%)} = \frac{\textit{Weight of Residue left in Bottle}}{\textit{Sample Weight}} x100$$

**Estimation of Protein and Organic Content**

The weight of other leading constituents, such as water, ash, and fat, was subtracted from the protein content of the fish samples to determine the protein concentration. Protein content percentages in the wet and dry weight of the samples were also calculated.

**Statistical Analysis**

Regression analyses was performed on data with the help of MS excel data analysis program. T-test was carried out the standard of assessment by the assistance of computer program MS excel data analysis tool.

## 3. Results

40 specimens of *Catla catla* and *Hypophthalmichthys molitrix* fish were taken as the sample size for body composition analysis. The value for mean and ranges for water, fat, protein and ash as water is 75.1%; Ash in wet and dry weight 4.07 and 16.4; Fat in wet and dry weight 5.2 and 20.8; Protein content in wet and dry weight 15.62 and 62.66 respectively in *C. catla*. The mean value for water, fat, protein and ash as water is 77.27%; Ash in wet and dry weight 4.20 and 5.21; Fat in wet and dry weight 1.55 and 6.10; Protein content in wet and dry weight 3.22 and 5.27 respectively in *Hypophthalmichthys molitrix*.

Percent water showed a highly significant correlation with all the body constituents except percent fat dry weight which showed non-significant correlation. All of the values showed a negative correlation with percent water except with percent ash wet and dry weight which showed positive correlation in *C. catla*. Analysis confirmed that opposite correlations exist between percent water and all the other percent body constituents except percent ash wet and dry weight (Table 1).

**Table 1:** Water content versus body constituents of *C. catla*

| ***Relationships*** | ***R*** | ***A*** | ***b*** | ***S. E. (b)*** | ***t value when b=0*** |
|---|---|---|---|---|---|
| %Water (x) %Ash wet weight (y) | 0.605*** | -24.151 | 0.375841 | 0.080164 | 0.375841 |
| % Water (x) %Ash dry weight (y) | 0.736*** | -148.11 | 2.191283 | 0.326158 | 2.191283 |
| % Water (x) %Fat wet weight (y) | 0.536*** | 27.72166 | -0.2998 | 0.076488 | -0.2998 |
| % Water (x) %Fat dry weight (y) | $0.165^{n.s}$ | 45.31124 | -0.32509 | 0.314186 | -0.32509 |
| % Water (x) %Protein wet weight (y) | 0.981*** | 96.42937 | -1.07604 | 0.034475 | -1.07604 |
| % Water (x) %Protein dry weight(y) | 0.907*** | 202.7991 | -1.86619 | 0.139815 | -1.86619 |

***= P<0.001; ** = P < 0.01; $^{ns}$> 0.05

Percent water showed non-significant correlation with percent ash wet weight, fat dry weight and protein dry weight. A least significant relation with ash dry weight while a highly significant correlation. All of the values showed a negative correlation with percent water except with percent ash dry weight which showed a positive correlation in *Hypophthalmichthys molitrix*.Analysis confirmed that opposite correlations exist between percent water and all the other percent body constituents except percent ash dry weight (Table 2).

**Table 2:** Water content versus body constituents of *H. molitrix* (n=40)

| Relationships | R | A | b | S. E.(b) | t value when b=0 |
|---|---|---|---|---|---|
| %Water (x) %Ash wet weight (y) | $0.213^{n.s}$ | 7.976529 | -0.04878 | 0.036145 | -1.34956 |
| % Water (x) %Ash dry weight (y) | 0.368* | -17.4714 | 0.474108 | 0.194161 | 2.441829 |
| % Water (x) %Fat wet weight (y) | 0.612*** | 21.04311 | -0.2347 | 0.049182 | -4.77207 |
| % Water (x) %Fat dry weight (y) | $0.302^{n.s}$ | 47.79868 | -0.45578 | 0.232866 | -1.95726 |
| % Water (x) %Protein wet weight (y) | 0.846*** | 67.43915 | -0.67392 | 0.068736 | -9.80447 |
| % Water (x) %Protein dry weight(y) | $0.014^{n.s}$ | 69.6727 | -0.01833 | 0.210947 | -0.08689 |

***= P<0.001; ** = P < 0.01; $^{ns}$> 0.05

Correlation of body weight with various body constituents by regression analysis showed highly significant correlation with all body constituents in *C.catla*. All showed a positive correlation except the relationship of body weight with percent water, percent ash dry and wet weight (Table 3).

**Table 3:** Body weight versus weight specific body constituents of *C. catla*

| Relationships | R | A | B | S. E. (b) | t value when b=0 |
|---|---|---|---|---|---|
| Body weight, g (x) % Water (y) | 0.821*** | 81.50892 | -0.00714 | 0.000804 | -8.8806 |
| Body weight, g (x) % Ash wet wt (y) | 0.905*** | 8.465221 | -0.00489 | 0.000371 | -13.1806 |
| Body weight, g (x) %Ash dry wt (y) | 0.948*** | 38.47894 | -0.02453 | 0.001326 | -18.4992 |
| Body weight, g (x) %Fat wet wt (y) | 0.805*** | 1.691049 | 0.003915 | 0.000467 | 8.383298 |
| Body weight, g (x) %Fat dry wt (y) | 0.568*** | 12.17249 | 0.009711 | 0.002278 | 4.26295 |
| Body weight, g (x) %Protein wet wt (y) | 0.851*** | 8.334812 | 0.008117 | 0.000812 | 9.996305 |
| Body weight, g (x) %Protein dry wt (y) | 0.829*** | 49.34857 | 0.014819 | 0.00162 | 9.147531 |

***= P<0.001; ** = P < 0.01; $^{ns}$> 0.05

Correlation of body weight with various body constituents by regression analysis showed non-significant correlation with percent protein dry weight, significant positive correlation with percent protein and fat wet; least significant correlation with percent fat and ash dry weight while highly significant correlation with percent water in *Hypophthalmichthys molitrix*. All showed a positive correlation except the relationship of body weight with percent fat dry weight, fat and protein wet weight (Table 4).

**Table 4:** Body weight versus weight specific body constituents of *H. molitrix* (n=40)

| Relationships | R | A | B | S. E. (b) | t value when b=0 |
|---|---|---|---|---|---|
| Body weight, g (x) % Water (y) | 0.579*** | 75.03641 | 0.02538 | 0.005794 | 4.380394 |
| Body weight, g (x) % Ash wet wt (y) | $0.057^{n.s}$ | 4.156352 | 0.000574 | 0.001618 | 0.354759 |
| Body weight, g (x) %Ash dry wt (y) | 0.373* | 17.30553 | 0.021084 | 0.008487 | 2.48427 |
| Body weight, g (x) %Fat wet wt (y) | 0.457** | 3.583531 | -0.00768 | 0.002424 | -3.16832 |
| Body weight, g (x) %Fat dry wt (y) | 0.344* | 14.58186 | -0.02272 | 0.010051 | -2.26047 |
| Body weight, g (x) %Protein wet wt (y) | 0.450** | 16.74655 | -0.0157 | 0.005052 | -3.10768 |
| Body weight, g (x) %Protein dry wt (y) | $0.0286^{n.s}$ | 68.11261 | 0.001632 | 0.00924 | 0.176623 |

***= P<0.001; ** = P < 0.01; $^{ns}$> 0.05

Correlation of total length with various body constituents by regression analysis showed a highly significant correlationwith all body constituents in *C. catla*. All showed a positive correlation except the relationship of body weight with percent water, percent ash dry and wet weight (Table 5).

**Table 5:**Total length versus weight specific body constituents of *C. catla*

| Relationships | R | A | B | S. E. (b) | t value when b=0 |
|---|---|---|---|---|---|
| Total length, cm (x) % Water (y) | 0.772*** | 95.05986 | -0.49437 | 0.065895 | -7.50239 |
| Total length, cm (x) % Ash wet wt (y) | 0.921*** | 18.85773 | -0.36606 | 0.02503 | -14.6249 |
| Total length, cm (x) %Ash dry wt (y) | 0.956*** | 89.95543 | -1.82009 | 0.090036 | -20.2151 |
| Total length, cm (x) %Fat wet wt (y) | 0.832*** | -6.80925 | 0.297532 | 0.032154 | 9.253343 |
| Total length, cm (x) %Fat dry wt (y) | 0.622*** | -10.7102 | 0.782528 | 0.15949 | 4.906439 |
| Total length, cm (x) %Protein wet wt (y) | 0.802*** | -7.10835 | 0.562891 | 0.067992 | 8.278783 |
| Total length, cm (x) %Protein dry wt (y) | 0.788*** | 20.75482 | 1.03756 | 0.131126 | 7.912695 |

***= P<0.001; ** = P < 0.01; $^{ns}$> 0.05

Correlation of total length with various body constituents by regression analysis showed non-significant correlation with percent ash wet weight, ash and protein dry weight, least significant correlation with percent fat dry weight while highly significant correlation with percent water, percent fat and protein dry weight in *Hypophthalmichthys molitrix*. All showed a positive correlation except the relationship of body weight with percent fat dry weight, fat, ash and protein wet weight (Table 6).

**Table 6:** Total length versus weight specific body constituents of *H. molitrix* (n=40)

| Relationships | R | A | b | S. E. (b) | t value when b=0 |
|---|---|---|---|---|---|
| Total length, cm (x) % Water (y) | 0.735*** | 70.58477 | 0.394501 | 0.059002 | 6.686231 |
| Total length, cm (x) % Ash wet wt (y) | $0.102^{n.s}$ | 4.420749 | -0.0126 | 0.019748 | -0.63804 |
| Total length, cm (x) %Ash dry wt (y) | $0.291^{n.s}$ | 15.75342 | 0.201189 | 0.1072 | 1.876763 |
| Total length, cm (x) %Fat wet wt (y) | 0.546*** | 4.813345 | -0.11245 | 0.027947 | -4.02369 |
| Total length, cm (x) %Fat dry wt (y) | 0.377* | 17.75586 | -0.30531 | 0.121382 | -2.51528 |
| Total length, cm (x) %Protein wet wt (y) | 0.514*** | 19.08778 | -0.21972 | 0.059422 | -3.69762 |
| Total length, cm (x) %Protein dry wt (y) | $0.149^{n.s}$ | 66.49072 | 0.104117 | 0.111933 | 0.930173 |

***= P<0.001; ** = P < 0.01; $^{ns}$> 0.05

Correlation of log body weight with various body constituents by regression analysis showed a highly significant negative correlation with log water, fat and protein content except ash which showed non significant negative correlation in *C. catla*. Correlation of log body weight with various body constituents by regression analysis showed a highly significant negative correlation with log water, ash, fat and protein content in *Hypophthalmichthys molitrix*. Correlation of log total length with various body constituents by regression analysis showed a highly significant negative correlation with log water, fat and protein content except for ash that showed non-significant negative correlation in *C. catla*. Correlation of log total length with various body constituents by regression analysis showed a highly significant negative correlation with log water, ash, fat and protein content in *Hypophthalmichthys molitrix*.

Each constituent of the body like, lipid, water, ash and protein may also be converted into its log value. The logs of those contents were plotted towards log of total water weight and log of the entire length. It gave direct courting.

$$Log\ Y = a + b\ log\ X$$

## 4. Discussion

In the present study parameter of body composition were examined. To determine the growth pattern in animals, one of the basic prime movers is by measuring the volume or size of the animal and the various parts which are constituted by the animals. As far as the other features such as growth, nutritional status and the bulk quantities of toxins are concerned, these should also be measured by exercising on the

morphometric characteristics of animals (Rahman, 1999). Parameters of body composition were ash, fat, water and protein content. Exceptions in this fish can take many forms. Several detectives have performed advanced calculations relating to the amount of water with the amount of fat and the amount of water with the amount of protein material, and have concluded that the composition of a body can be determined using regression formulas based on the volume of water (Salam and Davies, 1994). This observation reveals that the fish used had no excess fat and that the nutritional conditions were extremely poor. It resulted in decreased muscle protein synthesis in the quantity of water material. Changes in fish nutrition were the cause of a higher fat or protein ratio in the fish (Love *et al.*, 1970). Proximate body composition of fish is influenced by the dietary protein level in various fishes (Khan and Maqbool, 2017). The quality of these relationships in different species of fish propose a biochemical or physiological cause (Breck, 2014). So different factor are responsible for variation in various indices of body composition. As it is different in our analysis of proximate composition in *C. catla* and *H. molitrix.* Differences in the body's components were not linked to the body's size relationship. As a result, regression analysis was used to analyze the dimensions that were affected by the percentages of water, ash, fat, and protein in the material (percent of moist, dry weigh). The percentages of water, protein, fat, and ash in the body are all affected by the body's weight. The percentages of water, protein, lipids, and ash are all affected by the total length. All body component criteria, such as protein, fats, ash, and water, were plotted and log in opposition to log the wet weight of the body and log the total length of the body. It provides substantial correlations in the form of linear connections.This analysis reveals that fish growth leads to an increase in lipids and protein, but a decrease in water and skeleton (Salam and Davies, 1994). Moisture content in *Catla catla* agreed with observation of Hasan *et al.* (2015). The value of Water content in *O. mykiss* by Naeem *et al.* (2016) and *A. nobilis* by Naeem *et al.* (2013) found 70 to 88.85 and 73.86 to 84.54 respectively. These values are found very close to our result and found in general agreement. Hasan *et al.* (2015) have reported a high protein content (19.54%), moreover, Guy *et al.* (2018) Have found 72.4%, 9.9%, 8.7% and 15.4% moisture, ash, fat and protein contents, respectively, in *Ictio busniger*. Value of fat content in *O. mykiss* by Naeem *et al.* (2016) and *A. nobilis* by Naeem *et al.* (2013) found 10 to 36.99 and 1 to 25 respectively. These values are found higher than our result. While Protein contents in *O. mykiss* by Naeem *et al.* (2016) and *A. nobilis* by Naeem *et al.* (2013) found in general agreement, as these values are 53.82 to 74.59 and 59.88 to 72.44 respectively.

## 5. Conclusion

Our study concluded the relationship of body composition in *Catla catla* and *Hypophthalmichthys molitrix*. Percent water showed highly significant correlation with all the body constituents except percent fat dry weight, which showed a non-significant correlation. In *Catla catla* values of different body constituents showed negative correlation with percent water except with percent ash wet and dry weight which showed a positive correlation. Body weight showed highly significant positive correlation with all body constituents except the relationship with percent water, percent ash dry and wet weight in *C.catla*. A non-significant correlation with percent protein dry weight, a significant positive correlation with percent protein and fat wet; a least significant correlation with percent fat and ash dry weight while highly significant correlation with percent water in *H. molitrix*. Total length showed highly significant negative correlation with log water, fat and protein content except ash that showed non-significant negative correlation in *C. catla* while highly significant negative correlation with log water, ash, fat and protein content in *H. molitrix.* Finally, it is concluded that the parameters showed variability in these factor that can analyzed the impact of feed consumption and estimation of various contents as more protein content in *C. catla* than *H. molitrix*.

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