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INFLUENCE OF DIETARY PROTEIN ON PROXIMATE COMPOSITION OF MORI, *CIRRHINUSMRIGALA*(HAMILTON)

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ABSTRACT

Present study was undertaken to observe the influence of dietary protein on proximate body composition of Mori (*Cirrhinusmrigala*) from Govt. Fish Hatchery, Mian Chanu, District Khanewal. Mean percentage values for water, fat, protein and ash contents determined in the whole wet body weight of *Cirrhinusmrigala* were 76.86, 2.91, 16.89 and 3.33% respectively. Higher average protein, fat, ash and minimum water percentage were observed with increasing crude protein in artificial fed. Percentage of fat, ash, protein and water observed (35% crude protein) was 3.18%, 2.87%, 18.48% and 75.46% respectively. This was estimated that with the increase of protein level in diet, fish highly grow in size. Body composition of fish was affected with dietary protein in artificial diet. The information of these parameters helps to select *Cirrhinusmrigala* as major diet because it contains higher protein content and is suitable for human consumption.

1. INTRODUCTION

Water, lipids, protein and ash are the major components of edible portion of fish. The analysis of water, protein, fats and ash content in the body of fish is called proximate body composition. Non-protein (compounds and carbohydrates) are ignored for analysis of body composition. In proximate composition, protein is the best source in fish because it is composed of amino acids and easily digestible [1].

The measurement of proximate body composition (fats, proteins, lipids and minerals) of fish is necessary for determining its commercial value. Appropriate industrial and commercial processes can be planned by the knowledge of proximate composition of fish [2]. Fish meat contains low amount of lipids and comparatively higher amount of water as compared to beef and chicken. The best indicators of physiological condition of fish are body composition parameters. The water percentage in fish body is best indicator of relative energy, lipids and proteins of fish. When the percentage of water is low, the percentage of lipids and protein is higher so the energy density of fish will be high. Primarily the fish body is composed of lipids and proteins excluding water [3].

Physiological condition and health of fish can be illustrated by their chemical body composition. In general, 70-80% water is present in the live fish, 20-30% proteins and 2-12% lipids are present. Temperature is the main factor which affects the metabolism. Body composition is also influenced by regional variations. The use of condition indices is very successful for determining body composition of fish [4]. A big amount of polysaturated fatty acids are present in fish oil and meal and these fatty acids are important for minimizing the blood cholesterol level. Minimum cholesterol prevents the heart disease. Developing dementia including Alzheimer's diseases can be reduced by fish meal. The premature delivery of baby can be prevented if mother eat fish during pregnancy [5]. Most of freshwater aquaculture is predominated by carps (*Labeorohita, Catlacatla and Cirrhinusmrigala*) and 87% aquaculture production is produced by these carps. *Cirrhinusmrigala* is one of the major carps and because of its high commercial value *Cirrhinusmrigala* is used in carp polyculture practice [6]. This fish is naturally found in rivers of India (northern and central India), Pakistan, Bangladesh and Myanmar. This species is also introduced in other countries like Sri Lanka, the former USSR, Japan and China, Philippines, Malaysia, Nepal and some Countries of Africa. The best candidate of carp polyculture systems is Mori due to its compatibility with river ecosystem. The contribution of *Cirrhinusmrigala* is 15% to freshwater aquaculture production in whole world. It is column feeder and feed on planktons from water column. Mori feed on both zooplanktons and phytoplanktons. It feed on zooplanktons as fingerlings and in adult stage they feed on phytoplanktons [7]. *Cirrhinusmrigala* spawns only in monsoon season from June to July once in a year (annual breeder). On average *Cirrhinusmrigala* lays 200000-300000 eggs/kg. Suitable temperature for spawning of this fish is 22-30 °C[8]. This fish does not breed in perennial tanks; hypophysation is used to induce breeding in Mori [9]. The olfactory system helps in the perception of external stimuli and chemical signals that controls the regulation of central reproductive system [10].

Generally, the information of body composition of fish is important for nutritionists who are interested in low fat and high protein foods (freshwater fish). This information is also important for scientists who are working on developing these foods into high quality foods which may have high protein. This will ensure the fine quality of meat, texture, flavor, odor and color [11]. The aim of present study is to evaluate the influence of dietary protein levels on the whole-body composition of *Cirrhinusmrigala.*

2. MATERIALS AND METHODS

2.1 Experimental method

For determination of influence of different dietary levels of protein on body composition of *Cirrhinusmrigala*, an experiment was conducted at Govt. Fish Seed Hatchery, MianChannu, District Khanewal, Southern Punjab, Pakistan. This experiment was conducted for 3 months, from October 2016 to Jan 2017. 10 samples of fish fry were taken as initial group for the analysis of proximate body composition.

The experimental group was stocked in earthen pond with the stocking density of 1000 per acre. This was fed with 35% crude protein in artificial diet. After 3 months 10 samples of *Cirrhinusmrigala* were collected randomly. In laboratory, different test was applied on these samples for the determination of proximate body composition. The weight (ranging 6.1-7.3mg) of each specimen was weighed on an electronic balance and the length (ranging from 8.3-9.2cm) of each specimen was measured by using wooden measuring tray.

2.2 Proximate analysis

For approximate calculation of water quantity in each individual fish, the dead fish was wrapped in weighted aluminum foil and placed in electric oven at temperature of 60-65 °C and weight was determined by difference before and after the oven drying. For determination of fats, dry extraction method is used [12] and it was determined by extraction by mixture of chloroform and ethanol (1:2 respectively). By subtracting the initial weight of bottles from final weight, the weight of fats was analyzed in each individual fish. For determining ash content, pre-weighed powder was taken in pre-weighed china clay crucibles and placed in Muffle furnace at 450-500 °C for 24 hours. The difference between initial and final weight of crucibles determine the fats in each individual fish. Protein content was determined by using difference from water, fats and ash in dry mass of *Cirrhinusmrigala*.

2.3 Statistical analysis

3. RESULTS

Total 10 specimens were evaluated for the analysis of influence of dietary protein on the proximate body composition of *Cirrhinusmrigala*. Average percentage of water, ash, fat and protein in wet weight calculated was 75.46, 2.87, 3.18 and 18.48 respectively and in case of dry weight the average percentage of ash, fat and protein calculated was 11.72, 12.99 and 75.29 respectively (Table 1). These values show that the body composition of *Cirrhinusmrigala*is affected by protein in artificial diets. Maximum growth of fish is shown at 35% protein diet.

Table 1: Means and range of body contents of *Cirrhinusmrigala*

Body contents	Mean standard deviation	Range
Percentage Water content	75.46±0.48	74.92-76.16
Percentage wet weight of Ash content	2.87±0.54	1.92-3.78
Percentage dry weight of Ash content	11.72±2.31	7.69-15.52
Fat content (%wet weight)	3.18±0.52	2.40-4.20
Fat content (% dry weight)	12.99±2.29	9.62-17.24
Protein contents (%wet weight)	18.48±1.30	16.37-20.67
Protein contents (%dry weight)	75.29±4.35	67.24-82.69

n = 10 (35% crude protein)

3.1. Relationship between percentage of water and other body contents (wet and dry wt.)

The relationship of water with fat and ash is non-significant while this relation of water with protein is least significant ($P<0.05$) and between organic content and water it is significant ($P<0.01$) in case of wet weight (Table 2). In case of dry weight, the correlation between water and other body constituents is non-significant (Table 3).

Table 2: Relationship of percentage water versus percentage other body contents of *Cirrhinusmrigala*(in wet body weight) (35% crude protein)

Relationships	r	a	b	Standard error (b)	t value when b=0
Percentage water (x) Percentage fat wet wt. (y)	0.50^{ns}	-38.45	0.55	0.336	1.643
Percentage water (x) Percentage Protein wet wt. (y)	0.72*	165.6	-1.95	0.664	-2.938
Percentage water (x) Percentage ash wet wt. (y)	0.34^{ns}	-27.2	0.39	0.378	1.055
Percentage water (x) Percentage organic contents wet wt. (y)	0.79**	127.2	-1.39	0.378	-3.699

Table 3: Relationship of percentage water and % other body contents of Cirrhinusmrigala (in dry body weight) (35% crude protein)

Relationships	r	a	b	Standard error (b)	t value when b=0
Percentage water (x) Percentage Fat dry wt. (y)	0.58^{ns}	-197.1	2.78	1.368	2.036
Percentage water (x) Percentage protein dry wt. (y)	0.53^{ns}	443.8	-4.88	2.697	-1.811
Percentage water (x) Percentage ash dry wt. (y)	0.43^{ns}	-146.7	2.10	1.533	1.370
Percentage water (x) Percentage organic contents dry wt. (y)	0.43^{ns}	246.7	-2.10	1.533	-1.370

3.2 Relationship between body wt. and body contents (wet and dry wt.)

Body weight has non-significant relationship with fat and ash, significant relationship with organic content and protein and with water highly significant relationship in case of wet wt. (Table 4). In case of dry weight, body weight has non-significant relationship with ash and organic content while least significant ($P<0.05$) relationship with fats and ash (Table 5).

Table 4: Relationship of body wt. versus % body contents (wet wt.) of *Cirrhinusmrigala*(35% crude protein)

Relationships	r	a	b	Standard error (b)	t value when b=0
Body wt. (x) Percentage water (y)	0.93***	68.29	1.06	0.138	7.731
Body wt. (x) Percentage fat wet wt. (y)	0.56^{ns}	-1.58	0.70	0.362	1.953
Body wt. (x) Percentage protein wet wt. (y)	0.79**	34.91	-2.43	0.657	-3.714
Body wt. (x) Percentage ash wet wt. (y)	0.51^{ns}	-1.63	0.66	0.391	1.711
Body wt. (x) Percentage organic contents wet wt. (y)	0.86**	33.33	-1.73	0.349	-4.963

Table 5: Relationship of body wt. versus % other body contents (dry wt.) of *Cirrhinusmrigala* (35% crude protein)

Relationship	r	a	b	Standard error (b)	t value when b=0
Body wt. (x) % Fat dry wt. (y)	0.63*	-10.14	3.43	1.472	2.332
Body wt. (x) % Protein dry wt. (y)	0.64*	120.0	-6.64	2.760	-2.409
Body wt. (x) % Ash dry wt. (y)	0.59^{ns}	-9.95	3.21	1.557	2.066
Body wt. (x) % Organic contents dry wt. (y)	0.59^{ns}	109.9	-3.21	1.557	-2.066

3.3 Relationships between TL and body contents (wet and dry wt.)

Length has non-significant relationship with fat and ash, least significant with water and protein and significant relationship with organic content in case of wet weight (Table 6). In case of dry weight, length has non-significant relationship with fat and protein while least significant relationship with ash and organic contents (Table 7).

Table 6: Relationship of TL and % body constituents (wet weight) of *Cirrhinusmrigala*(35% crude protein)

Relationship	r	a	b	Standard error (b)	t value when b=0
TL (x) Percentage water (y)	0.70*	66.35	1.03	0.373	2.771
TL (x) Percentage fat wet wt. (y)	0.39ns	-2.40	0.63	0.527	1.201
TL (x) Percentage protein wet wt. (y)	0.67*	42.11	-2.67	1.048	-2.557
TL (x) Percentage ash wet wt. (y)	0.60ns	-6.06	1.01	0.476	2.129
TL (x) Percentage organic contents wet wt. (y)	0.78**	39.70	-2.04	0.566	-3.612

Table 7: Relationship of TL and % body contents (dry weight) of *Cirrhinusmrigala*(35% crude protein)

Relationship	r	a	b	Standard error (b)	t value when b=0
TL (x) Percentage Fat dry wt. (y)	0.44ns	-14.78	3.14	2.223	1.416
TL (x) Percentage Protein dry wt. (y)	0.57ns	143.4	-7.73	3.853	-2.007
TL (x) Percentage Ash dry wt. (y)	0.64*	-28.71	4.58	1.920	2.388
TL (x) Percentage Organic contents dry wt. (y)	0.64*	128.7	-4.58	1.920	-2.388

3.4 Relationship between body weight and total body constituents (wet body weight)

Body weight has non-significant relationship with protein, least significant with fat and ash, significant with organic content and highly significant with water content (Table 8). Log of body weight shows non-significant relationship with log of protein, least significant with log ash content, significant with log fat and log organic content and highly significant relationship with log of water content (Table 9).

Table 8: Relationship of body weight (g) versus body contents (wet wt.) of*Cirrhinusmrigala*(35% crude protein)

Relationship	r	a	b	Standard error (b)	t value when b=1
Body wt. (x) Water (y)	0.99***	-0.48	0.82	0.010	-98.2876
Body wt. (x) Fat (y)	0.74*	-0.31	0.07	0.025	-40.5788
Body wt. (x) Protein (y)	0.18ns	1.08	0.02	0.044	-22.6485
Body wt. (x) Ash (y)	0.70*	-0.29	0.07	0.026	-38.5973
Body wt. (x) Organic contents (y)	0.84**	0.77	0.10	0.023	-43.0394

Table 9: Relationship of body wt. (w, g) versus body contents (wet wt.) of *Cirrhinusmrigala*(35% crude protein)

Relationship	r	a	b	Standard error (b)	t value when b=1
Logarithm body wt. (x) Logarithm water (y)	0.99***	-0.20	1.09	0.013	-77.86
Logarithm body wt. (x) Logarithm fat (y)	0.77**	-2.77	2.53	0.726	1.15
Logarithm body wt. (x) Logarithm protein (y)	0.17ns	-0.00	0.12	0.242	-4.00
Logarithm body wt. (x) Logarithm ash (y)	0.72*	-2.99	2.74	0.926	1.65
Logarithm body wt. (x) Logarithm organic (y)	0.83**	-0.22	0.46	0.107	-8.83

3.5. Relationship between total length and total body constituents

Length has non-significant relationship with protein, fat and organic content and least significant relationship with water and ash (Table 10). Log of length shows non-significant relationship with log of fat, protein and organic content and least significant relationship with log of water and ash (Table 11).

Table 10: Statistical relationship of length versus body contents (g) of *Cirrhinusmrigala* (35% crude protein)

Relationships	r	a	b	Standard error (b)	t value when b=3
TL (x) Water (y)	0.69*	-1.53	0.75	0.273	-10.22
TL (x) Fat (y)	0.52ns	-0.41	0.07	0.041	-72.88
TL (x) Protein (y)	0.06ns	1.33	-0.01	0.058	-51.39
TL (x) Ash (y)	0.68*	-0.60	0.09	0.035	-86.50
TL (x) Organic contents (y)	0.38ns	0.92	0.06	0.052	-58.12

Table 11: Statistical relationship of length versus total body constituents

(g) of *Cirrhinusmrigala* (35% crude protein)

Relationship	r	a	b	Standard error (b)	t value when b=3
Logarithm TL (x) Logarithm water (y)	0.70*	-0.53	1.31	0.47	-5.04
Logarithm TL (x) Logarithm fat (y)	0.52ns	-3.46	2.94	1.67	1.15
Logarithm TL (x) Logarithm protein (y)	0.06ns	0.16	-0.07	0.42	-7.22
Logarithm TL (x) Logarithm ash (y)	0.68*	-4.92	4.44	1.66	2.64
Logarithm TL (x) Logarithm organic content (y)	0.38ns	-0.18	0.36	0.31	-9.26

3.6. Relationship between condition factor and body constituents (wet weight)

Condition factor has non-significant relationship with all body constituents (water, fat, ash, protein and organic content) (Table 12).

Table 12: Relationship of K and % body constituent (wet weight) of *Cirrhinusmrigala* (35% crude protein)

Relationships	r	a	b	Standard error (b)	t value when b=0
K (x) Percentage water (y)	0.27ns	77.11	-1.67	2.116	-0.792
K (x) Percentage fat (y)	0.10ns	3.85	-0.68	2.402	-0.283
K (x) Percentage protein (y)	0.31ns	13.28	5.27	5.651	0.933
K (x) Percentage ash (y)	0.41ns	5.74	-2.91	2.287	-1.275
K (x) Percentage organic contents (y)	0.42ns	17.14	4.59	3.513	1.307

4. DISCUSSION

Cirrhinusmrigala performed best in ponds regardless of depth of pond. That's why the growth of *Cirrhinusmrigala*is independent of the depth of pond [13]. The average values of protein, water, ash and fats in *Cirrhinusmrigala*determined in the whole wet body weight were almost similar to the values of overall means of body constituents of many other fish species [14]. Similar results were found by Salam *et al.,*in *P.gonionotus*and Mazumder*et al.,*in *Amblypharyngodon mola, Gucluria chapra*[15, 16]. In present study moisture content present in *Cirrhinusmrigala*was 78.71 almost similar to these findings.

In present studied fish, the amount of water decreases with the increase in the body size and it affect the percentage body constituents. Percentage fat content (wet weight), protein and organic contents in case of wet weight and dry weight increased and there was no impact on the ash content with the increasing growth of fish and these findings are compatible with many previous findings. In larger sized fish, higher percentage of protein and fat contents has been reported in *Oreochromis mossambicus*.Several workers find success to calculate the approximate body composition of fish by using condition factor [13,14, 17] and most of the investigators are also unsuccessful to determine the close correlation between condition factor and body components [18]. In *Oreochromis niloticus*insignificant relationship between % water, protein and fat was found by Naeem et al.,(2010). Condition factor, % water and fat content in hatchery reared *Tor putitora,Mystusbleekeri*and between percentage of water protein and fat in wild *Colisalalia*. Still close relationship of condition factor with percent fat, protein and water was reported in *Aristichthysnobilis*[19]. In present study, non-significant relationship of condition factor with percent all four body contents i.e., water, fat, protein, ash and organic contents and this suggests that there was no impact of condition factor on these body contents.

According to a researcher higher water content is present in the fish body which contains low fat content and the color of these fish is white [20]. Memon*et al.,* (2011) found higher moisture content of about 76.05% and 2.57% fats in *C. catla*while in *L. rohita*percentage of water detected was 72.10% and 3.11% fat content [21]. In present study, with the increase in fat content, the moisture content decreased. In *Cirrhinusmrigala,* 3.18% fats with 75.46 % water content at 35% crude protein were found.Begum *et al.,* (2012)found 12.78 ± 0.16 percentage of protein in Pangas (*Pangasianodonhypophthalmus*) [22]. Similar findings were reported by Mazumder*et al.,* (2008) in *G. chapra*and *P. chola.* Present study also showed similarity with previous findings [16]. In present experiment, percentage of protein in the body of *Cirrhinusmrigala*was found 18.48 when the fish was fed with 35% protein level in diet.Begum *et al.,* (2012) estimated ash content percentage of 1.78 in Pangas (*Pangasianodonhypophthalmus*) [22]. Abimbola et al., (2010) investigated 1.30%ash in *Tilapia guineensis and* 1.06% ash in *Tilapia melanotheron*[23].Mazumder*et al.,* (2008) reported ash contents range of 1.6% to 3.2% in *A. coila*and in *A. mola.*[16].Chukwuand Shaba, (2009)estimated 3.06% ash content in *C. gariepinus* which is almost similar to the studied fish [24]. In present studied fish, percentage ash content estimated was 2.87 at 35% protein level in diet.

5. CONCLUSION

This experimental study provides the information about the influence of different protein levels on the body composition of *Cirrhinusmrigala.* The results obtained confirmed the proximate body composition of fish, body size and condition factor vary with dietary protein. The findings of our study confirm that *Cirrhinusmrigala*has considerable nutritional value because it contains high protein content. It is best diet for consumption of human beings. That's why in order to increase the consumption of this fish as a diet in Pakistan, it is important to promote the benefits of Mori in the diet.

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