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Efficacy of Varying Dietary Protein Levels on Growth, Feed Conversion and Body Composition of *Cirrhinus mrigala* Fingerlings

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Abstract

The growth response of *Cirrhinus mrigala* fingerlings on 40, 35 and 30 percent dietary protein was studied for the period of four months. Fish gained higher body weight (13.66 g ± 0.371) and total body length (11.57 cm ± 0.162) on 40 percent dietary protein levels. The weight-length correlation coefficient was significant and both parameters were increased in synchronized way. The feed conversion ratio value was higher (5.30) on 40 percent dietary protein level. The effect of diets on body composition was non significant expect the body fat.

Keywords: *Cirrhinus mrigala*, Growth response, Feed conversion ratio

Introduction

Fishes like all other animals require adequate nutrition in order to grow and survive, but the natural food, made available in the ponds as a result of ongoing biological cycles is sometimes limited both in quality and quantity. Thus artificial feeding is, perhaps, the most desirable measure to increase fish yield. In the past, large quantities of fish were available from natural resources, but recently the intensive fish farming has become economically viable due to a growing demand coupled with a depletion of natural resources. So it is an efficient way of turning low value food stuffs into high value animal protein (Devaraj and Krishna, 1981).

In intensive fish culture where the only aim is to produce a large and payable crop of table sized fish, artificial feeding is all the more necessary as it allows to maintain a higher density of fish than the natural fertility of pond could support. Fish utilize dietary protein, lipids and carbohydrates as energy sources, but the utilization of these nutrients differ remarkably from species to species (Lagler et al., 1962).

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It is necessary to use artificial feed of good quality. The criteria for selection of artificial feed are (1) acceptability to fish (2) effectiveness in promoting fish growth (3) degree of cheapness and availability of food.

The present work was planned to determine the effect of varying dietary protein levels on the growth performance, feed conversion ratio and body composition of *Cirrhinus mrigala* fingerlings.

Materials and Methods

The feeding trial was conducted to study the growth performance of *Cirrhinus mrigala* fingerlings. Fingerlings were raised on diets containing 30 percent, 35 percent and 40 percent protein levels. The experiment was lasted for eight fortnights. *Cirrhinus mrigala* fingerlings were obtained from Government fish seed hatchery Satiana Road Faisalabad. The fingerlings were acclimatized to adjust to the experimental feed in a circular cemented tank for 15 days. During this period the fingerlings were fed on 30 % dietary protein.

Table 1: Percentage composition of experimental diets

Ingredients	Levels of Protein		
	30% (T1)	35% (T2)	40% (T3)
Fish meal	25	31	12
Soybean meal	21	30	28
Maize gluten 30%	22	22	-
Maize gluten 60%	-	-	35
Rice polishing	25	3	13
Berga fat	6	13	11
Vitamin per-mix	1	1	1
Total	100	100	100
Chemical Composition			
Crude Protein (%)	32.81	36.18	42.93
Fat (%)	13	16.5	8
Gross energy (kcal/g)	4.88	5.09	6.02
Ash (%)	28.96	29.0	28.6

The feeding experiment was conducted in six cemented tanks at covered hatchery area of Fisheries Research Farms Department of Zoology and Fisheries, University of Agriculture, Faisalabad. The working dimensions of each tank were 2.4 x 0.84 x 1.3 m. Each tank was filled with water upto 0.3 m

and the level was maintained throughout the experimental period. Each tank had the water changing facility. Three diets were prepared using five ingredients i.e. rice polishing, maize glutten 30%, maize glutten 60% soyabean meal and fish meal. Protein to energy ratio of three diets was maintained at 1:90. The three diets formulated having 30, 35 and 40 percent crude protein levels were pelleted from Government Fish Hatchery and Research Farms Manawaan, Lahore. The percentage composition and proximate composition of these three diets are shown in Table1.

After acclimatization 20 fingerlings (4.208 g ± 0.113) were randomly stocked in each tank (Goolish and Adelman, 1984). Two replicates were followed for each treatment. Three diets having 30 percent, 35 percent and 40 percent protein levels in pelleted form were offered at 4% of wet body weight of fingerlings twice a day. Dissolved oxygen and pH of water in each tank was monitored by changing water daily. Air pump was used to maintain the level of dissolved oxygen. The range of water temperature remained between (14.5-27.9°C) during the study period. The fingerlings were taken for recording the data of growth from each replicate on fortnightly basis after removing water from tank. The fingerlings were released in water immediately after weighing. The feed was stopped a day before the weight was recorded. The mean weight of fingerlings in each tank was calculated to work out the feeding rate for the next fortnight.

The feed conversion ratio was worked out according to Jhingran (1991).

At the end of experiment five fingerlings were randomly selected from each replicate, to determine body composition. The proximate analysis of fish and feed samples was done following (AOAC 1990).

The data on body weight, total body length, feed conversion ratio and body composition were subjected to statistical analysis. The comparison of mean values of various parameters were made by using Duncan's Multiple Range (DMR) test, according to procedures described by Steel and Torrie (1994).

Results

Cirrhinus mrigala attained higher body weight 13.66 g ± 0.371 for 40 percent dietary protein level, and this was followed by 35 protein dietary level 12.78 g ± 0.453 and 30 percent dietary protein level 11.68 g ± 0.391. The increase of total body length was maximum 11.578 ± 0.162 on 40 percent dietary protein level. The next maximum increase of total body length was 11.47 cm + 0.154 and 11.45 cm ± 0.139 for 35 and 30 percent dietary protein levels. (Table 2). The analysis showed that the effect of diets on body weight and total body length was highly significant ($P < 0.05$).

However, the difference in average body weight and total length on three diets were non significant as there values were less than least significant difference (LSD) values. The LSD values for body weight and total length were 0.6118 and 0.2887 respectively. The significant difference in average body weight was observed in 7th fortnight as this value was higher than LSD value (0.6118).

Table 2: Fortnight variation in average body weight (g) and body length (cm) of *Cirrhinus mrigala* fingerlings.

Fortnight	Dietary Protein Level					
	30% CP		35% CP		40% CP	
	Body weight	Boy length	Body weight	Boy length	Body weight	Boy length
-	4.098±.101	7.997 ±.098	4.268 ± .113	8.132 ± .062	4.527 ± .117	8.190 ± 059
1	4.397± .099	8.132 ± .062	4.481 ± .107	8.300 ± .068	4.616 ± .129	8.300 ± 081
2	4.835± .132	8.303 ± .054	5.068 ± .124	8.471 ± .059	4.865 ± .147	8.297 ± .072
3	5.210± .180	8.663 ± .093	5.412 ± .143	8.632 ±.0101	5.432 ± .125	8.538 ± .126
4	6.090± .151	9.168 ± .071	6.340 ± 1.36	9.172 ± .066	6.410 ± 1.49	9.127 ± .079
5	7.338± .208	9.497 ± .232	7.945± .168	9.688± .072	7.860 ± .212	9.950 ± 090
6	8.262± .234	9.972 ± .116	8.982 ± .228	10.173 ± .112	9.432 ± .225	10.240 ± .093
7	9.838± .310	10.928 ± .141	10.675 ±.319	10.813 ± .144	11.550 ±.334	10.902 ±.108
8	11.680± .391	11.458 ± .139	12.785 ± .453	11.478 ± .154	13.663 ± .371	11.578 ± .162

For 30 percent dietary protein level, regression equation was $4.18 + 0.48 + 0.100x^2$ and $7.74 + 0.095 + 0.043x^2$ for body weight and total length. Although growth rate remained different in different fortnight but overall increase was quadratic (γ^2 = 99.8% and γ^2= 99.5%) respectively in both parameters. Similarly, the quadratic (γ^2= 99.7% and γ^2 = 99.8%) increase under 35 percent dietary level was $4.31 + 0.035 + 0.127x^2$ and $8.13 + 0.087 + 0.042x^2$ for body weight and total body length. Fish on 40 percent

dietary protein level also showed a quadratic increase (γ^2 = 98.0% and γ^2= 99.5) with a regression equation 4.56 + 0.185 + 0.167x^2 and 8.16 +0.15+0.053x^2 for body weight and total body length respectively.

The weight length correlation coefficient for three diets was higher than table value ($\gamma > 0.8333$). This showed a significant and positive correlation between body weight and body length of *Cirrhinus mrigala.* The significant correlation revealed that increase in weight was not independent of length and vice versa. The two parameters were increased in a synchronized way. The overall feed conversion ratio (FCR) was observed to be the highest (5.30) on the 40 percent protein diet followed by 35 percent protein diet (5.08) and lowest (4.71) on 30 percent protein diet. The effect of 40, 35 and 30 percent dietary protein on the body moisture, body protein, gross energy and ash of *Cirrhinus mrigala* was non significant except the body fat where the effect of diets was significant.

Discussion

The growth performance of *Cirrhinus mrigala* fingerlings was significantly higher on 40 percent protein diet, followed by 35 and 30 percent protein diets respectively. This indicates the importance of digestible protein in the diets for increasing higher body weight and the requirements trend of fish toward higher level of dietary protein. This requirement trend may be due to the feeding preference of the fingerlings as it mainly feeds on semi-decayed organic matter, which constitutes about 45-76 percent of gut content (Jingran and Pullin, 1985). The possible reason for significant growth on 40 percent dietary protein might be due to presence of higher percentage of protein contents and essential amino acids. The calculated percentage of amino acids of 40 percent dietary protein appeared to be more required percentage of amino acids for carp as compared to percentage of amino acids in 35 percent and 30 percent dietary protein. The present result substantiates the findings of Silva and Gunasekerna (1991). They reported that dietary protein content at which maximum growth of major carps occurred was above 45 percent though the economically optimal dietary protein content was 31 percent. The results were also supported by Das and Ray (1991). They fed carp fingerlings on pelleted diet containing 5, 15, 25, 35 and 45 percent casein at 5 percent of body weight. The best growth in terms of net weight gain was obtained with 35 percent dietary protein. The preference of fingerling towards higher protein level was also confirmed by Salim and Sheri (1999). They observed significant influence of 50 percent crude protein level on growth performance of *Cirrhinus mrigala* fingerlings followed by 45 and 40 percent dietary protein. However, controversial observations reported by Kausar *et al* (1995). They reported that body weight of *Cirrhinus mrigala* fingerling was significantly higher on lower protein diet (26 percent) than medium (29 percent) and higher (32 percent) protein diets.

The higher feed conversion ratio (FCR) on 40% protein diet means that a greater quantity of 40 percent protein diet was required for a unit weight gain of fish, whereas 30 percent protein diet was required in lower quantity for a unit weight gain of fish. These results were in accordance with the values reported by Rashid (2002). He observed maximum FCR value at higher dietary protein level (45%) followed by lower 35% and medium (40%) dietary protein levels. But maximum weight was obtained at higher dietary protein level (45%) following by medium (40%) and lower 35%) dietary protein levels. Similar results were also reported by Qadoos (2000). He observed higher FCR value (2.79) for ingredient having high percentage of crude protein (maize oil cake CP = 22.4%) and lower FCR value (2.47) for ingredient having lower percentage of crude protein (rice polish CP = 12.8%). However, contradictory results were reported by Seema *et al* (2002). They observed that the value of FCR decreased with the increasing percentage of crude protein in the ingredients. Thus the ingredient having highest crude protein value (maize oil cake, CP= 22.4%) has lowest FCR value (1.11), while the ingredient having the lowest crude protein value (rice broken, CP = 7.6%) has the highest FCR value (2.70). The possible reason for higher FCR value on higher dietary level might be that in the present study the protein quantity of ingredient was comparatively lower than ingredient used by others, so to meet the nutritional requirement, intake of diet by fish was increased.

The body composition of *Cirrhinus mrigala* fingerlings as a whole was not significantly effected by dietary protein levels except body fat. The present findings are in line with results reported by Jayaram and Shetty (1980). Who concluded that effect of different manuring and feeding regimes on body composition of *Catla catla, Labeo rohita* and *Cyprinus carpio* were not significantly different. Similar results were also reported by Zeitler *et al* (1984). They observed that dietary crude protein contents over 41.3% change neither the protein contents nor fat contents of carcass significantly but below 41.3% there was a decrees of protein contents and simultaneously very high increase in the fat contents of carcass of carp.

In conclusion, the present study revealed that the growth performance of *Cirrhinus mrigala* fingerlings was higher on 40 percent dietary protein level. This showed that 40 percent dietary protein level is more suitable and compatible for meeting the growth requirements of fish.

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