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# EFFECT OF DIETARY PROTEIN ON GROWTH RESPONSE OF COMMON CARP (*CYPRINUS CARPIO*)

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## ABSTRACT

The frys of common carp (*Cyprinus carpio*) were procured from Chiliya fish hatchery (Thatta- Sindh) and weighed up to 3.33-5.06 gm. All were distributed into four groups and fed @ 3% of body weight twice daily with four diets: D I, D II, D III and D IV, containing 25, 35, 45 and 55% fish meal respectively as major ingredient. Other inclusions were starch, fish oil, vitamin mixture, minerals premix, carboxymethyl cellulose, and oxytetracycline. The experimental frys respond differently throughout the study period in each group. In D I, total weight in beginning to the end was 4.193±1.567 to 5.89 ±2.86 gm and minimum weight gain was -4.53 to maximum 16.25% like wise in other diets (D II, D III & D IV as 4.4870±2.024 to 6.30±3.78 gm and 2.60 to 17.9%; 5.073±2.037 to 7.450±2.121 and -0.15 to 15.38%; and 4.633±1.568 to 7.309±2.755 and -4.51 to 17.64%. Group II fed with 45% fish meal show maximum weight gain. The growth response was calculated in term of ADG, PER, FCR, SGR and K- factor. Daily feed allowance (DFA) was similar to each group @ 3% of body weight. FCR was found to be better in D II i.e. 0.968±0.53 while SGR calculated as 2.62±1.99 in D III indicating significant effects of dietary protein on growth response of tested fish.

**Key words**: *Cyprinus carpio*, Supplemental feeding, Dietary protein

## INTRODUCTION

Traditionally semi-intensive, intensive and extensive freshwater fish farming have been practicing in Pakistan. Among these intensive fish farming has adapted to get better yield in confined water. As a result, use of supplementary feed has inevitable area of study. Supplementary feeding is known to increase the best option of culture system and can be enhanced fish production by many folds (Hepher, 1975; Devaraj, 1976). Indian major carps are efficient converters of food to flesh within the shortest possible time in the ponds. They can easily be cultured by providing protein-based diets because protein is the most important component of the diet as it generally determines growth rate of cultured organism. Proteins have different amino acid profile and divided into indispensable or non-indispensable amino acids. Protein in body tissues incorporate those amino acids, which must be supplied in the diet since fish, cannot synthesize them. These amino acids are need for maintenance, growth, reproduction and repletion of tissues. Attempts have been made to understand the gross level of nutrient requirements such as protein, lipid, carbohydrate, vitamin and mineral premix for Indian major carps (De Silva and Gunassekera, 1991; Mahboob and Sheri, 1997). Although these workers have reported different levels of artificial feeding, yet in earthen pond, but no optimum supplementary feeding level has been reported for Indian major carps. Keeping in view all these facts the underlying experiment was planned to study the effects of dietary protein on growth response of common carp (*Cyprinus carpio*) at different levels ( D I, 25; D II, 35; D III, 45 and D IV, 55% of protein).

## MATERIALS AND METHODS

### Preparation O Experimental Diets

Table 1 shows the composition of experimental diets containing Fishmeal, Starch, Fish oil, Vitamin mixer, CMC, Oxytetracyclin and Mineral premix. The ingredients were individually powdered (Approximately 250 micron). Weighed according to the composition of diets and mixed together. Approximately 40 ml of warm water (for 100 g of diet) was added to the dry mix and thoroughly homogenized until the texture of the whole mixture reached a stiff dough consistency. The dough was extruded through a hand pelletizer using 2-mm die. The resulted pellets were broken into pieces of 2- 3-mm size and were stored in airtight plastic containers at room temperature. Water stability of the pellets was determined for 2, 4 and 8 hour’s period following the method of Magurie et al, (1988).

### Rearing, Feeding Ad Collection O Fecal Matter

Each aquarium was stocked at a stocking density of 40 frys and fed at 3% of average body weight twice a day as it is closed to maintenance requirement. Daily feed allowance (DFA) was calculated before the start of experiment by using formula described by Millanena (2000).

DFA = ABW x No. Of stock x % Survival x FR.

Where

ABW = Average body weight.

FR = Feeding rate.

Fecal matter or excreta was siphoned out from 2-mm plastic delivery tube prior to the feeding in the morning. Approximately 20 % of water retains in the aquarium and rest was drained on daily basis (Hubbell, 1989).

## ANALYTICAL PROCEDURES

### Proximate Analysis

roximate analysis is the most generally accepted chemical approach for the evaluation of major macro-nutrients in the feeds and foodstuffs. The basis of this analysis is separation of feed components into groups in accordance with their value as feed (Lovell, 1975). The proximate analysis partitions foodstuffs into moisture, crude protein, crude fat, ash, carbohydrate and energy per 100 g. (AOAC, 1980).

### Analysis of Physico-Chemical Parameters of Water

Physical parameters of water including water temperature and pH were recorded by glass thermometer and pH indicator paper made by Merck. Chemical parameters including dissolved oxygen (DO) by using Wrinkler's method, (AOAC. 1980). Nitrite nitrogen, and nitrate nitrogen were estimated by using Merck chemical test kits with the range and brand numbers of 0.5- 0.8 mg/ l, 1.14400,0001; 2.0- 8.0 mg/ l, 1.10020 and 1.0- 5.0 mg/l, 1.10007,001 respectively. TDS tester manufactured by Hannah Instrument Company recorded total dissolved solids.

### Analysis of Nutrients

Specific growth rate (SGR), protein efficiency ratio ( PER), average daily weight gain (ADG), condition factor (K), daily feed allowance (DFA), food conversion ratio (FCR) were calculated by using following formulae described by Hari and Kurup (2001).

(i) $$\text{SGR} = \frac{\text{Final weight} - \text{Initial weight}}{\text{Time}} \times 100$$

(ii) $$\text{PER} = \frac{\text{Weight gained}}{\text{Protein consume}}$$

(iii) $$\text{ADG} = \frac{\text{Final weight-Initial weight}}{\text{Time}}$$

(iv) $$\text{Condition factor (K)} = \frac{W \times 100}{L^3}$$

Where,

W = Weight

L = Length

(v) DFA = ABW x no. Of stock x % survival x feeding rate

Where,

ABW = average body weight

(vi) $$\text{FCR} = \frac{\text{Wt. of food fed}}{\text{Wt. of animal gained}}$$

Comparison of the experimental results were statistically carried out by using software Minitab V.II including t- test.

## RESULTS

### Growth Response

Weight gain was significantly affect the protein level but not by the energy contents. Tables 2 & 4 revealed that the growth differences were brought about mainly by the differences between protein levels of experimental diets. Weight gain % of fish fed with 25% protein level increased although not significantly, as the ratio of food conversion (FCR) was 16.9±33 and the SGR was 0.98±2.73 compared to significantly enhanced weight gain in 35%

protein level. The weight gain was 17.9% with 0.968±0.53 FCR value followed by 1.46±2.225 SGR value subjected to be the best group of fish which attain maximum weigh and respond positively. Both treatments contain 377.53 and 377.36 k.cal energy. In case of 45 and 55% protein levels the weight gain was not correlate with amount of protein. The value of FCR was high i.e. 1.67±0.34 and 2.15±0.28 although the SGR was significantly noticed in 45 & 55% protein levels with energy contents of 383.29 & 360.40 k.cal respectively. Table 4 also show optimum enhancement in ADG (0.0098±0.027) in DII and significant enhancement of ADG in DIII (0.026±0.019) and DIV (0.02±0.024) against pre-decided daily feed allowance (DFA) @ 3% of body weigh. The values of condition factor (K) were satisfactory in all treatments.

**Water Quality**

The physico-chemical characters of all test diets were carried out in terms of pH, temperature, nitrate, nitrite, total dissolved solids (TDS), dissolved oxygen (DO) and ammonia. It was observed that the optimum protein level (25 & 35% protein) did not significantly affected on pH at same temperature and not show any sign of nitrite and nitrate level with minimum ammonia (0.05±0.077mg/l & 0.21±0.22mg/l) with respect to increased protein level (45& 55% protein), pH was recorded up to 8.00 and nitrite, nitrate and ammonia level were also climbed as shown in table 5. Collectively it is concluded that high amount of animal protein (fish meal) may alter the water quality which in tern cause deterioration in ecosystem and may affect on growth leading to heavy mortality although the optimum level of DO and TDS exist as described in table 5.

## DISCUSSION

In culturing fish in captivity, nothing is more important than sound nutrition and adequate feeding. If the feed is not consumed by the fish or if the fish are unable to utilize the feed because of some nutrient deficiency, then there will be no growth. An under nourished animal cannot maintain its health and be productive, regardless of the quality of its environment. Faulty nutrition obviously impairs fish productivity and results in a deterioration of health until recognizable diseases ensures, on the other, are very difficult to define.

Protein is the most important component of the diet of fish because protein intake generally determines growth. The protein levels in relation to the energy level of the diets for *Cyprinus carpio* fry is evident in the present study as was found earlier for several other fish species (Garling and Wilson, 1976; Murai *et al.,* 1985; Lovell, 1989). The common carp fry grew best on 25% and 45% protein diets with the P/ E ratio of 377.53 and 383.29/ 10 mg/ K cal. However a lower but not significantly different growth was attained with diets containing 35% and 55% protein with P/ E ratio of 377.36 and 360.40 mg/ K cal. (Table 1). P/ E ratio lower than the optimum led to slower growth in *Oreochromis aureus*, but growth reduction on the diets was not as marked as that on the diets with excessive P/ E ratios (Winfree and Stickney, 1981).

Chen and Lee (1985) found that practical diets with 270 K cal/ 100 g regardless of protein level and 25% protein diets with P/ E ratios ranging from 94 to 72 mg/ K cal gave low growth in young tilapia. The high dietary energy caused growth depression, particularly in fish fed the high protein diet (55%) (Fineman- Kalio and Camacho, 1987, Daniels and Robinson, 1986). In 25 and 45% protein diets that produced high growth response, 50% of the total digestible energy was in the form of protein.

The results of the study indicate better food conversion ratio (FCR) at protein levels tested up to 385 K cal/ 100g diet. The amount of nutrient necessary to produce a unit weight is termed as FCR. According to New (1987), less value of FCR reflects the more efficient feed. In feed trails of 35% and 45% protein FCR was calculated as 0.968± 0.53 and 1.67± 0.34. The specific growth rate (SGR) significantly increased as the levels of protein in diets increased T- test (P›0.05). The condition factors (K) of *Cyprinus carpio* fry were not significantly differ fed with experimental diets (Table 4).

Proteins in the body tissues incorporate about 23 amino acids and among these, 10 amino acids must be supplied in the diet since fish cannot synthesize them. Amino acids are need for maintenance, growth, reproduction and repletion of tissues. A large proportion of the amino acid consumed by a fish is catabolized for energy and fish are well adapted to using an excess protein. Catabolism of protein leads to the release of ammonia. By increasing these proportions of protein in diets, the possibility of ammonia, nitrate and nitrite excretion by the fish increase proportionally and cause serious damage to experimental fish (Alabaster and Lloyd 1980; Boyd, 1982).

In this way the increased amount of dissolved oxygen is necessary to improve the water quality. Table 5, indicates that increasing dietary protein levels directly affect on water quality having negligible amount of ammonia estimated in D I and D II followed by free $NO_2$ and $NO_3$ water. While in D III and D IV the amount of free ammonia, Nitrate nitrogen and nitrite nitrogen were significantly estimated. The pH of water in all dietary levels was observed as slightly alkaline probably the presence of free ammonia and total dissolved solids (TDS).The experimental fish respond better growth in D II because they have better SGR, PER and least FCR values (Table 4).

Table 1. Formulation and proximate composition of experimental diets.

| S.NO. | Ingredients | Diet No | | | |
|---|---|---|---|---|---|
| | | D I | D II | D III | D IV |
| 1. | Fishmeal (gm) | 250 | 350 | 450 | 550 |
| 2. | Starch (gm) | 570 | 470 | 370 | 270 |
| 3. | Vitamin Mixes (gm) | 20 | 20 | 20 | 20 |
| 4. | Minerals (gm) | 40 | 40 | 40 | 40 |
| 5. | CMC (gm) | 29.2 | 29.2 | 29.2 | 29.2 |
| 6. | Oxytetracych (gm) | 0.8 | 0.8 | 0.8 | 0.8 |
| 7. | Fish oil (ml) | 90 | 90 | 90 | 90 |

| Proximate Analysis in % | | | | | |
|---|---|---|---|---|---|
| 1. | Moisture | 5.996 | 7.2 | 5.118 | 5.706 |
| 2. | Fats | 6.09 | 9.57 | 10.56 | 8.693 |
| 3. | Ash | 12.6 | 11.14 | 13.046 | 15.71 |
| 4. | Protein | 14.89 | 12.09 | 26.19 | 20.044 |
| 5. | Carbohydrates | 65.33 | 60 | 45.086 | 67.842 |
| 6. | Energy | 377.53 | 377.36 | 383.29 | 360.40 |

Table 2. Difference of initial and final weight and weight gain % of *Cyprinus carpio* fed with different levels of dietary protein.

| FN | D I | | D II | | D III | | D IV | |
|---|---|---|---|---|---|---|---|---|
| | Weight difference | Weight gain % | Weight difference | Weight gain % | Weight difference | Weight gain % | Weight difference | Weight gain % |
| 1. | 0.19 | -4.53 | 0.8 | 17.9 | 0.78 | 15.38 | 0.24 | 4.6 |
| 2. | 0.65 | 16.25 | 0.14 | 2.66 | 0.25 | 4.27 | 0.96 | 17.64 |
| 3. | 0.01 | 2.1 | 0.28 | 5.18 | 0.43 | 7.04 | 0.38 | 6.09 |
| 4. | 0.58 | 12.44 | 0.24 | 4.22 | -0.01 | -0.15 | 0.49 | 7.21 |
| 5. | 0.38 | 7.25 | 0.22 | 3.14 | 0.69 | 10.58 | -0.11 | -1.51 |
| 6. | 0.22 | 3.91 | 0.16 | 2.60 | 0.24 | 3.32 | 0.13 | 1.81 |

Table 3. Mean ±SD of initial and final weights of *Cyprinus carpio* fed with different levels of dietary protein.

| Days | D I | D II | D III | D IV |
|---|---|---|---|---|
| 0 - 75 | 4.193 ± 1.567<br>to<br>5.84 ± 2.86 | 4.480 ± 2.024<br>To<br>6.30 ± 3.78 | 5.073 ± 2.037<br>to<br>7.450 ± 2.121 | 4.633 ± 1.568<br>to<br>7.30 ± 2.755 |

Table 4. Mean ±SD of DFA, ADG, SGR, FCR, PER and K of *Cyprinus carpio* fed with different levels of dietary protein.

| | D I | D II | D III | D IV |
|---|---|---|---|---|
| DFA | 0.903 ± 0.495 | 1.117 ± 0.461 | 1.84 ± 0.23 | 2.25 ± 0.13 |
| ADG | 0.0098 ± 0.0272 | 0.014 ± 0.022 | 0.026 ± 0.019 | 0.02 ± 0.024 |
| SGR | 0.98 ± 2.73 | 1.46 ± 2.225 | 2.62 ± 1.99 | 2.31 ± 2.42 |
| FCR | 16.9 ± 33 | 0.968 ± 0.53 | 1.67 ±0.34 | 2.15 ± 0.28 |
| PER | 0.0104 ± 0.012 | 0.0076 ± 0.006 | 0.006 ± 0.004 | 0.009 ± 0.01 |
| K | 1.511 ± 0.22 | 1.445 ± 0.18 | 1.28 ± 0.09 | 1.47 ± 0.31 |

Table 5. Mean ±SD of physico-chemical parameters of water.

| Diets | pH | Temperature (ºC) | Nitrite (mg/l) | Nitrate (mg/l) | TDS (mg/l) | D.O (mg/l) | Ammonia (mg/l) |
|---|---|---|---|---|---|---|---|
| D I | 7.833 ± 0.408 | 27.67 ± 3.72 | nil | nil | 266.7 ± 80.4 | 3.467 ± 0.532 | 0.0500 ± 0.0775 |
| D II | 7.667 ± 0.516 | 27.67 ± 3.72 | nil | nil | 228.3 ± 33.1 | 2.900 ± 0.639 | 0.2167 ± 0.2295 |
| D III | 8.000 ± 0.000 | 27.83 ± 3.82 | 5.00 ± 5.48 | 25.0 ± 27.4 | 240.0 ± 32.9 | 3.917 ± 0.601 | 0.433 ± 0.313 |
| D IV | 8.000 ± 0.000 | 27.67 ± 3.72 | 5.00 ± 3.16 | 33.33 ± 20.41 | 235.0 ± 31.5 | 3.217 ± 0.859 | 0.433 ± 0.320 |

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