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Effect of Studying Varying Levels of Dietary Protein on Growth And Survival of Juveniles of *Cyprinus Carpio* (Koi)

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ABSTRACT

Main objective of present study was to evaluate the impact of varying level of dietary protein on growth of the juveniles of *Cyprinus carpio* (koi carp) (0.240±0.003). For this, five iso-nitrogenous experimental diets containing 25%, 30%, 35%, 40% and 45% percent protein was formulated and fed @ 5% of body weight, for a period of 60 days. Results shows that dietary protein content influence the growth of the fishes. Specific growth rate was found to be 0.112, 2.05, 2.20, 2.35 and 2.16 in 25%, 30%, 35%, 40% and 45% .It was observed that FCR reduced as dietary protein level increased while the FCE increased with then increase n protein content in the diet. The minimum FCR i.e 9.35% was found in 25% protein diet and maximum with 40% i.e 18.95. Also, the FCE was minimum at 40% (5.27) and maximum with 25% (10.69). On the basis of weight gain, the trend for FCR and FCE emerged as 40% > 45% > 35% > 30%> 25%. Thus, the results confirmed that the best protein level for optimum growth of fingerlings of *cyprinus carpio* seems to be 45%.

KEYWORDS: Dietary protein, Specific Growth rate, FCR, FCE and, koi carp.

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INTRODUCTION

Ornamental fishes are very attractive and beautiful fishes which are kept at aquariums for the purpose of enjoying their beauty.[1] Recently, ornamental sector gaining popularity and is one of the economical and profitable areas of fish farming. Between 2000 to 2011, global exports of ornamental fish increased from US$181 million to US$372 million. (FAO 2017) Most of the market supplies originate from Asia, with Singapore dominating as the top exporting country in the world. In 2013, Singapore exported around US$56 million worth of ornamental fish to over 80 countries. Among ornamental fishes, *Cyprinus carpio*, also known as fancy carp or koi is one of the highly valued commercial fish. It belongs to Cyprinidae family which is one of the largest families of fresh water fishes. Fishes whether ornamental or others, serves as good source of human nutrition and plays very important therapeutic roles.

As we know that world population is increasing with tremendous pace, so it is necessary to ensure food security by new modern techniques to meet the demands of growing population. These modern techniques are being used in aquaculture practices and feed formulation to get desired results. Feed accounts for 40-50% of aquaculture production costs [2]and is considered one of the major constraints for small and large scale commercial aquaculture[3] In order to get best production from confined water, in minuscule possible time, use of artificial feed is very much necessary.

World population is increasing with tremendous pace. To cope up with nutritional requirements of increasing population it is necessary to ensure food security by new modern techniques. These same techniques should be used in aquaculture practices and feed formulation to get desired results. Information on the nutritional requirements of many ornamental fish is still relatively unknown in comparison with those of food fish. The dietary nutrient requirements of ornamental fish, firstly under commercial farming conditions are concentrated on maximum growth rate, and afterward in a public or home aquaria environment shifts to other variables such as coloration and gonad maturation, rather than fast growth[456]

As the main and most costly component of the diet, protein draws greater attention in nutrition requirement studies. Protein (most costly macronutrient) needed for fish fry is high and ranges from 35% to 56%[5] Furthermore, dietary protein need decreased with the development size and age of fish. Juveniles feed generally contains higher level of protein because the latter and energy demand are higher in the early stages of life. So, it is essential to recommend the suitable protein level of juvenile feed for economic production of healthy juveniles and maximize its lifespan as well. The main objective of this study was to determine the optimum protein level which is necessary for optimum growth of *Cyprinus carpio* juveniles in laboratory conditions.

2. MATERIAL AND METHODS

1. *Experimental Fish and Acclimatization.*

Juveniles of *Cyprinus carpio* were brought from Govt. Fish farm Dhoomi Akhnoor lying near about 25 km Jammu city to the Department of Zoology, University of Jammu, where they were kept in plastic troughs of 20 L capacity. Fingerlings captured, were then acclimated in plastic troughs at a temperature of about 22–25°C for about 7 days and were fed on a mixture of rice bran and mustard oil cake.

2. *Experimental design.*

Juveniles of *Cyprinus carpio* at the beginning of experiment were stocked at a density of 25 in each plastic trough of 20 L capacity in triplicates. The experiment was conducted for 60 days. Initial weight and proximate composition of muscle of fish were determined prior to the commencement of the experiment. Juveniles of *Cyprinus carpio* were fed @ 5% of their body weight twice daily. The left over feed and excreta were removed on every second day by siphoning method separately from each tub. Before stocking, weight of the fingerlings were recorded.

3. Analysis.

At the end of the experiment (after 60 days), juveniles were observed for weight increment followed by biochemical analysis. Proximate composition of the feed ingredients and experimental diets were determined in the laboratory using standard methods. The crude protein and lipid contents of feed ingredients were determined by Lowery method and Filch method. The ash content was determined by first igniting the sample and then heating it in the muffle furnace at 550ºC (±10ºC) for 6h[7]. Crude fibre was determined by acid and alkali digestion[8]

4. Statistical Analysis.

Differences between treatments were analyzed using independent-measures one-way ANOVA. The values were expressed as mean ± SE. values <0.05 were considered as significant and p values <0.001were considered as highly significant *p*.

5. Preparation of experimental diets.

Five experimental diets viz. D1, D2, D3, D4 and D5 containing different dietary protein levels i.e., 25%, 30%, 35%, 40% and 45% respectively were made[8] (Table 1). Dietary ingredients were cleaned, milled and mixed in definite proportions. Therefore, thick dough was made using luke warm water. Using a hand pelletizer. 0.5mm thick pellets were obtained and dried in oven at 40ºC.

6. Growth performance of the experimental juveniles was calculated as described[7]:-

1. Weight gain = Final weight (g) – Initial weight (g).

2. Specific growth rate (SGR) = In final weight (g) – In initialweight (g) × 100/ time (days).

3. Feed conversion ratio = Diet fed (g)/ total weight gain (g).

4. Feed conversion efficiency = [(Gain in wet weight of fish /feed fed)] ×100.

Table 1 Proportion (%) of different ingredients used in formulated diets for Koi carp.

Feed ingredients	Diets				
	25% (D1)	30% (D2)	35% (D3)	40% (D4)	45% (D5)
Fish meal	--------	26	32	38	46
Rice bran	49.50	20	15	05	02
Wheat bran	-----	24	15	05	02
Soyabean	------	15	22	24	24
Mustard oil cake	49.50	14	18	22	25
Vegetable waste	-------	----	05	05	---
vitamin + minerals*	01	01	01	01	01
Total	100	100	100	100	100

Vitamin A 700,0001.U	Vitamin D3 140,0001.U	Folic acid 100 mg
Vitamin E 250 mg	Niacin amide 100 mg	Iron 1500 mg
Iodine 325 mg	Cobalt 150 mg	Magnesium 6000 mg
Manganese 1500 mg	Zinc 3000 mg	Selenium 10 mg
Potassium 100 mg	Sulphur 7.2gm	Calcium 270 gm
Phosphorous 130 gm	Copper 1200 mg	Fluorine 300 mg

* Nutrition super forte (Rejuvenating combination of multivitamin and multi minerals, AROSOL chemicals PVT. Limited)

Table 2. Proximate composition of the experimental diets.

Diets	Dry matter	Crude protein	Crude lipid	Ash	Nitrogen free extract	Calorific content KJ/g
25% (D1)	90.88	23.30	5.39	14.39	34.12	13.79
30% (D2)	91.55	28.23	5.26	17.39	32.32	14.23
35% (D3)	91.49	32.95	5.79	17.45	28.50	14.56
40% (D4)	91.29	38.10	5.95	17.48	25.65	14.87
45% (D5)	92.01	43.60	6.95	17.35	20.89	15.09

Table 3- Showing growth parameters

Treatment					
Parameters	**25%**	**30%**	**35%**	**40%**	**45%**
Initial weight g/fish	0.240±0.003	0.234±0.01	0.245±0.04	0.238±0.01	0.240±0.05
Final weight g/fish	0.341±0.004	0.360±0.03	0.409±0.07	0.435±0.02	0.411±0.02
Weight gain g/fish	0.101±0.003	0.125±0.01	0.164±0.05	0.203±0.03	0.195±0.02
SGR	0.112±0.002	0.205±0.05	0.220±0.03	0.235±0.04	0.216±0.02
FCE	10.69±0.01	8.35±0.02	6.72±0.01	5.27±0.03	5.60±0.02
FCR	9.35±0.05	11.96±0.02	14.87±0.003	18.95±0.02	17.85±0.01
Survival rate	80.31%	84.18%	85.71%	88.97%	87.99%

RESULTS AND DISCUSSIONS:

Present study on growth response of juveniles of *Cyprinus carpio* fed on varying level of protein diets i.e. 40%, 45%, 35%, 30% and 25% shows that juveniles which were fed on 40% diet show maximum growth rate while the juveniles which were fed on 25% diet show least growth rate.

On the basis of growth response, the following trend emerges 40% < 45% < 35% < 30% < 25%. 0.01). Similar growth pattern has been observed for mrigal fry[9], walking cat fish fry, *Clarias batrachus*[10] and for *Heterobranchu bidorsalis*[11]. Average weight gain of the fish fed on 40% diet was 0.203±0.003 followed by 0.195±0.002 in 45% diet. Average weight gain shows significant increase up to 40% protein diet but shows insignificant growth for 45% diet. The present study clearly shows that maximum growth was found with 40% diet i.e 0.235 followed with 45% diet i.e 0.216, diet 35% with 0.220, diet 30% with 0.205 and least with 25% i.e 0.112. Thus it is clearly revealed that SGR increases with increase in percentage of protein up to an optimum level and then decreases. Similar trend has been found[12] while working on the effect of dietary protein on growth performance of Claroteid catfish, *Chrysichthys nigrodigitatus.* He found that that body weight gain show an increase with increasing level of dietary protein up to 42.8% but a decline at 47.1%. [13]reported 40% crude protein to be the optimum requirement for the growth of *Catla catla* fry. FCR and FCE show inverse relation. Maximum FCR was recorded with diet 40% i.e 18.95±0.02, followed with diet 45% with 17.85, diet 35% with 14.87%, diet 30% with 11.96 and least with 25% i.e 9.35. However, maximum FCE was recorded with 25% i.e 10.69, followed with diet 30% i.e 8.35, diet 35% with 6.72, diet 45% with 5.60 and least with diet 40% i.e 5.27. Similarly[1415] who also reported that FCR decreases with increasing the dietary protein level above the optimum dietary protein level i.e., 45% dietary protein level. In the present studies, it might be due to the fact that more proper the diet, the less the feed is required to produce unit weight gain i.e., lower FCR. Similar observations were reported[1617] It may be due to might be due to higher ration size (feed at 5% body weight), poor digestibility, inefficient utilization of feed, and wastage of feed. The inverse of feed conversion ratio (FCR) i.e., feed conversion efficiency (FCE) is the induction of feed utilization for the purpose of growth. Similar to present observation[18] in *Oreochromis niloticus* [19]in *Mystus nemurus,* [20,21]in *Tor putitora* in *Catla catla*[14] fry. The maximum survival rate was recorded with diet 40% i.e., 88.97% and least with 25% i.e., 80.31%.

CONCLUSIONS:

Considering the results of the present study, it can be concluded that the diet containing 40% protein diet is optimal for growth and efficient feed utilization of juvenile red- and white-colored fancy carp *Cyprinus carpio* (Koi carp).

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