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Effect of graded protein levels on growth performance, survival and feed conversion ratio of *Ctenopharyngodon idella* from Pakistan

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Abstract: The study was conducted to assess the effect of different levels of protein against control diet on different aspects of growth of *Ctenopharyngodon idella* fingerlings. Trial period was 90 days. Fingerlings were reared in four ponds of one acre each. Stocking density was 2000/acre. The fingerlings were hand fed @4% of body weight amid morning & evening during trial period six days a week on various diets T1,T2,T3 and T4 (control) with 15%, 20%, 25% crude protein level and rice polish (control) only respectively. Standardized methods were used in the whole trial. Studies showed on average increased & percent increased in live weight & total length gain. Maximum daily growth rate, production, survival and specific growth rate in the fingerlings fed on a diet T2 (20%) as compared to other diets having low or high crude protein. The lowest FCR value (6.64) showed T2 is best feed composition. *Ctenopharyngodon idella* fed diet having 20% crude showed maximum growth performance, Specific growth rate, production, survival rate in T2 is the best feed composition for optimum growth.

Keywords: Growth performance, Lab prepared diets, SGR, PER, *Cetnopharyngodon idella*

1. INTRODUCTION

The growth implies the change in length or weight, volume or mass, either animals entire body or of its different organs and tissues or it might be identified with the body parts (Weatherley and Gill, 1987). In fish, weight is thought to be an element of length as indicated by (Wootton 1990; Chilton and Mouneke, 1992). Protein is a standout amongst the most imperative segments in a fish diet (De-Silva and Andersoni, 1995; Kaushik, 1995).

Fish has a higher protein demand as compared to any land animals. (Lovell, 1989). As per Dabrowski (1977) concentrates on the determination of ideal protein diet for fish are entangled, on the grounds that protein level is impressively influenced by the parts of the weight control plans and by the exploratory conditions. Choice of components for the plan of fish food is extremely pivotal and it ought to be modest and accessible in the nearby market (Zamal *et al.*, 2009). Cost of fish feed is about 60% of total cost of product and most expensive component of fish feed is proteins. Production of fish increases as protein component is increase upto a certain limit in fish feed, as its excessive level in feed is not good for fish culture (Sheun *et al.*, 2003; Erondu *et al.*, 2006).

Fish growth depends upon feeding, digestion, absorption, assimilation, metabolic processes of nourishment material. The past studies show that the digestive, absorptive, and metabolic capacities of supplements have relation with fish size (Beamish, 1972; Fernandez *et al*., 1998; Usmani and Jafri, 2002; Luo *et al.*, 2013). With the increase in size of fish, growth rate of fish and feed proficiency bit by bit diminish. (Jobling, 1983a; Liu *et al*., 2016). One reason is connected with a higher body dry matter and lipid substance as fish growth, which prompts a lessening in food protein and vitality affidavit rate (Azevedo *et al*., 2004). Moreover, study of carp showed that low protein diets are not only cost effective but also indicate good health status of fish (Iqbal and Naeem, 2016). Data about growth is accessible for around 5% of the 27000 known types of fish (Binohlan and Pauly, 2000).

Researchers played out a few studies to know the nutrients prerequisite of *Ctenopharyngodon idella* (Hossain *et al*., 2002; Du *et al*., 2006 and 2009; Jana *et al*., 2006; Sa *et al*., 2008; Gao *et al*., 2009). Therefore, the study on the effect of graded levels of protein in diet on growth of *Ctenopharyngodon Idella* fingerlings was conducted. *Ctenopharyngodon idella* is viewed as appropriate for culture purpose, on account of their high resilience to contaminations, their generally quick growth and breeding case maximum use of provided feed, immunity against various diseases, its high meat quality and palatability with good taste to its user. The aim of this study was to investigate the effects of diets having difference crude proteins levels on growth of *Ctenopharyngodon Idella*.

2. MATERIALS AND METHODS

The study was done to observe the growth performance of *Ctenopharyngodon Idella* in earthen fish ponds in a polyculture system with other major carps at Mushtaq Fish Farm Muzafar Garh, Punjab Pakistan. Trial period was 90 days. *Ctenopharyngodon Idella* fingerlings were reared in

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four fish ponds of one acre each. The stocking density was 2000 fish/acre. The 10% *Ctenopharyngodon Idella* fingerling of total stocking density were added in each pond with other major carps. Fingerlings were hand fed @ 4% of their body weight a mid morning and evening on various diets T1, T2, T3 and T4 (control) with 15%, 20%, 25%, and rice polish (control) respectively. On daily basis during trial period the temperature of pond, dissolved oxygen and pH of the ponds water was monitored, maintained within the required normal range by the help of standard techniques.

Four fish diets were prepared in laboratory from various locally available components i.e. fish meal, gluten of maize, brawn of wheat, rice polish, soya bean, sunflower meal. Weighted amounts of diet components were altogether combined, and were putted in mixing machine for complete mixing for forty minutes. To get powder form of these mixed components were grinded in grinding machine and to get in pellet form pelleting machine was used. *Ctenopharyngodon idella* were observed separately for their total body weight (in grams) and total length (in centimeters) amid initial stocking and after at regular intervals of one month for 90 days trial period. The information on protein efficiency ratio (PER), Survival rate (SR), specific growth rate (SGR), percentage weight gain (PWG), average daily growth (ADG), Feed conversion ratio (FCR), net weight gain (NWG). Protein productivity value (PPV), feed per day, production, live weight gain, length gain, total weight gain (TWG), condition factor (K) were figured by taking after formulae (Ahmad *et al*., 2012):

NWG = Mean fish final weight (in grams) – Mean fish initial weight (g).

PWG=Body weight (Final)–body weight(Initial)× 100

$$SGR = \frac{\text{In body wt (final) of fish} - \text{In body wt (Initial)}}{\text{Total number experimental investigation days}} \times 100$$

$$FCR = \frac{\text{Feed provided in grams}}{\text{Gain in weight (wet) in grams}}$$

$$\text{Percent SR} = \frac{\text{No. of captured fishes}}{\text{No. of loaded fishes}} \times 100$$

$$PER = \frac{\text{Live weight gain in trial perod of 8 weeks in grams}}{\text{Protein used in total period}}$$

$$K = \frac{\text{Fish weight taken in grams}}{\text{Fish length taken in centimeter cube}} \times 100$$

Average daily Growth (ADG)

$$ADG = \frac{\text{Net gain in weigth (g)}}{\text{Number of days}}$$

Percent Protein productivity Value (%PPV)

$$\%\ PPV = \left[\frac{\text{Gain in protein pick up (g)}}{\text{intake of protein}}\right] \times 100$$

Feed per day (in grams)

Feed per day taken (in grams)= $\frac{\text{Total fish weight (g)}}{100} \times$ % age of feed.

Total Weight gain

Gain in Total weight = Fish initial weight × Number of taken samples.

Production (P)

$$P = \frac{Wt(kg)}{m^2} \times \text{days}$$

Percent gain in live weight

$$\text{Percent gain in live weight} = \left[\frac{\text{Gain in live weight}}{\text{Average initial weight}}\right] \times 100$$

Percent gain in length

$$\text{Percent gain in Length} = \frac{\text{Increase in the length in centimeter}}{\text{Average initial length taken in centimeter}} \times 100$$

Total weight gain (TWG)

$$TWG = \frac{\text{Increase in the weigth (mean of definite wt. gain)} - \text{mean of init. wt. gain}}{\text{No. of samples taken}}$$

3. RESULTS

Ctenopharyngodon idella showed maximum live weight gain and % weight gain in response to given diet T2 having 20% crude protein level. Live weight gain was 598.1 ± 5336 gram and % weight gain were 544.22 for T2 (20%). It was followed by T3, T4, and T1 respectively. Maximum increase in length (cm) and % length gain was 1.7.97 ± 0.44 (cm) and 93.16 (%) in T2 as compared to T3 (15.02 ± 1.07 and 68.8 (%) and T1 (14.4 ± 0.738, 68.7) T4 (17.93 ± 0.95, 86.24).

The average daily growth rate was maximum (1.04) for T2 (20%) followed by T4, T1, T3 respectively. The average condition factor for T1 (15%), T2 (20%), T3 (25%), T4 (controlled) was 1.29 ± 0.1, 1.37 ± 0.14, 1.33 ± 0.14 1.08 ± 0.12. FCR value is best indicator of finest feed formula and the ingredients (%) of that feed formula gives least value of FCR. At the end of 90 days trial period least FCR value was 6.64 for T2 (20%). While FCR value 7.44 was maximum for T1 (15%).

The PER value was 1.19 for T4 0.57 for T3 (25%) while for T2 (20%) 0.5 and 0.38 for T1 (15%). SGR value of 0.92 for T2 (20%) was highest among them. Production in Kg/m^2/90 days was highest in T2 (20% crude protein level) during trial period. It was 1.26×10^{-4}. The highest percent survival rate was (94.75 ± 0.03) in pond two where T2 (20%) was used and minimum was in T3 (25%) 86.84 ± 0.06 at the end of trial period (Table I).

Different water parameters were kept maintain in normal limits as describe in Table II.

Table: I. Growth performance, survival, production and feed utilization of Grass carp reared at three different feeds for 90 days in 3 ponds (one acre each) at Mushtaq Fish Farm Muzafar Garh under polyculture system.

Parameters	T1(15%)	T2(20%)	T3 (25%)	T4 (Controlled)
Average initial weight (g)	137.64± 43.01	109.9 ± 29.32	153.0 ± 24.3	133.38 ± 16.51
Average final weight (g)	569.2 ± 90.2	708.0 ± 82.68	678.75 ± 170.47	632.83 ± 128.35
Live weight gain (g)	431.56 ± 47.29	598.1 ± 53.361	2525.75 ± 146.17	499.45 ± 111.84
Live weight gain (%)	313.54	544.22	343.63	374.46
Average initial length (cm)	20.88 ± 2.38	19.29± 1.54	21.83 ± 1.16	20.79 ± 0.86
Average final length (cm)	35.28 ± 1.65	37.26 ± 1.98	36.85 ± 2.23	38.72 ± 1.81
Length gain (cm)	14.4 ± 0.73	17.97 ± 0.44	15.02 ± 1.07	17.93 ± 0.95
Length gain (%)	68.97	93.16	68.8	86.24
Av. Daily Growth rate	0.77	1.04	0.76	0.96
Survival (%)	92.11 ± 0.01	94.74 ± 0.03	86.84 ± 0.06	89.47 ± 0.1
Av. Condition Factor	1.29 ± 0.11	1.37 ± 0.14	1.33 ± 0.14	1.08 ± 0.12
Feed conversion ratio	7.44	6.64	7.06	7.02
Protein efficiency ratio	0.38	0.50	0.57	1.19
Specific Growth rate	0.68	0.92	0.72	0.75
Production g/m^2/90days	9.11×10^{-5}	1.26×10^{-4}	1.11×10^{-4}	1.05×10^{-4}

Table: II. Various parameters water quality of experimental aquaria

Parameters	Mean ± S.D	Mean ± S.D	Mean ± S.D	Mean ± S.D
	Pond 1	Pond 2	Pond 3	Pond 4
Water temperature (°C)	27.45 ± 0.66	27.45 ± 0.66	27.45 ± 0.66	27.45 ± 0.66
Dissolved Oxygen (mg/l)	5.875± 0.57	5.875 ± 0.57	5.875 ± 0.57	5.875 ± 0.57
pH	7.525	7.525	7.525	7.525

4. DISCUSSION

The impact of various diets having different crude protein levels on different aspects of growth, average percentage weight gain, length gain and percent length gain, (SGR), FCR, average daily growth with survival rate (%) on *Ctenopharyngodon idella* was highly significant in the trial period of 90 days. *Ctenopharyngodon idella* showed maximum growth (live weight and total length gain) to T_2 (20%). It shows the significance of requirement of optimum digestible protein to enhance the live body weight along with total length and trend towards the fish demand for optimum higher level of dietary protein.

The probable reason for maximum growth on diet T_2 (20) was its optimum level of protein contents with essential amino acids. It is supported by the findings of (Soltan *et al.*, 2002; Rivas-vega *et al.*, 2013). However, many researchers have informed that optimum growth of Grass carp *Cetenopharyngodon idella* was observed with 30% protein diets. The ame result has been observed for other few species of fishes which also need 30%–35% protein level for their optimal growth (Siddique *et al.*, 1988; Hossain, 1998; Narejo *et al*., 2002 and 2003; Soltaan *et al*., 2002 and 2006; Bahnasawy, 2009, Farhat and Khan 2011; Giri *et al.*, 2011; Paul *et al.*, 2010 and 2012; Khan *et al.*, 2013; Opiyo *et al.*, 2014).

Few researchers also reported that some species of fishes required above 35% to 40% protein level in their diet for their optimum growth (Muthukumar and Kandeepan, 2009; Giri *et al*., 2011; Baruah *et al*., 2015). The literature shows that fishes need optimum protein level ranging from 30 to 45% (Pandian, 1989). It is contrary to our findings, probably due to variation in species, food composition, culture system and environmental condition and herbivorous nature of *Cetnopharyngodon idella*.

The growth as well as survival (%) of *Cetnopharyngodon idella* increased successively with the increase of protein level in diet from 15% to 20% and then decrease in 25% protein level. The possible reason behind it may be more production and excretion of amino acids due to high level of protein in diet than optimum level or it may be due to production of excess ammonia. This excess ammonia not only affects the intake of food but also food conversion efficiency along with switching over the excretion of urea which cause extra energy usage and demand. (Degani *et al.*, 1985). The low FCR value (6.64) for diet having 20% dietary protein showed that 20% protein is well suited for rapid growth of Grass carp. Similar results for low FCR value ware reported in *Oreochromis niloticus* (Soltan *et al.*, 2002), Red Tilapia fingerlings (Soltan *et al*., 2006).

The value of PER and dietary protein level in fish feed showed direct relation in present work i.e. Highest PER value was T4 observed (Control) followed by T3 (25% in present study. Such type of results were also reported in Grass carp, Tilapia (*Sarotherodon mossambicus preters*) and cat fish (*Mystius nemurus*) by (Dabrowski, 1977; Khan *et al*., 1996, Ronald and Paul, 1997; Adewolu and Adoti, 2010). SGR was least in T_1 (15%). SGR was highest in T_2 (20%). Condition factors value for T_1 (15%), T_2(20%) T_3 (25%), T4 (controlled) was 1.29 ± 0.01, 1.37 ± 0.14 ± 1.33 ± .1.08 ± 0.12. Maximum value of

SGR was found in which fish were fed diet containing 20%CP. It showed that increase in weight is more than cube of length in diet T_2 (20%CP) which is according to findings of previous works.

In present work least growth of *Cetnopharyngodon idella* was observed in feed having least protein value i.e. T1 among three lab prepared diets T1 (15%CP), T2(20%CP) and T3 (25%CP). These findings were found according to Bahanaswy (2009) and Opiyo (2014).

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