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EFFECT OF DIFFERENT PROTEIN ON GROWTH AND SURVIVAL OF *CATLA CATLA* (HAMILTON) REARED IN GLASS AQUARIA

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Abstract

To study the effect of different protein levels on growth and survival of *Catla catla* (Hamilton) reared in glass aquaria during May to August 2009. Three iso-caloric feeds were formulated with locally available ingredients (rice protein, rice bran and wheat bran) of different protein levels such as 30%, 35% and 40% (dietary protein levels) of 2 mm dia were prepared with the help of manually operated pellet machine. The feed ingredients were tested for proximate (bio-chemical composition) analysis according to the methods given in AOAC (1980) and found 13%, 12% and 40% protein respectively. Each feed was supplied at a rate of 8% of the body weight of fish twice a day. The results of the various growth parameters like suitability of protein level requirement, specific growth rate, mean total weight gain, percentage weight gain, feed conversion ratio, survival rate and production of the experimental fish showed significantly ($p<0.05$) highest growth and production was observed in feed B followed by feed C while significantly ($p<0.05$) lowest growth and production was recorded from feed A. It is therefore concluded that the feed with 35% protein found to be suitable for the better growth and production of *Catla catla.*

Keywords*:* Growth and Survival, Suitability of Protein, *Catla catla* and Glass aquaria.

1. Introduction

Nutritionally well-balanced feeds are needed for intensive culture. Thus, knowledge on the specific requirements of *Catla catla* is essential for the formulation of a well-balanced supplemental feed for successful intensive culture (Mazid *et al.,* 1987). However, very little work has been done to determine the nutritional requirements of any of the indigenous varieties of fish. Since protein is the most expensive component in the diet and known to required in relatively large amounts by several fishes (Delong *et al*, 1958; Ogino and Saito, 1970; Nose and Arai, 1972; Sabuat and Luquet, 1973; Satia, 1974; Dabrowsky, 1977; Anderson *et al,*. 1981; Mazid *et al*., 1979; Wee and Tacon, 1982), the exact level of its requirement must be estimated for formulation of a well-balanced feed. Besides, the protein requirement is varied widely for different species of fish, their age (Page and Andrews, 1973, environmental conditions, Delong *et al*., 1958) the energy source and energy level of the diets affect the efficiency of protein utilization (Cowey *et al.*, 1975; Andron *et al*., 1976; Garling and Wilson, 1976; Ogino *et al.*, 1976). The objective of the present study was therefore, to estimate the minimum protein requirement for the maximum growth of the fingerlings of *Catla catla* in glass aquaria.

2. Materials and Methods

Collection of Fingerlings

The fingerlings of the major carp, *Catla catla* were collected from Government Carp Fish Hatchery, Badin. For the feed trial experiment, 10 glass aquaria (size 90 × 30 cm) were selected for a period of four months from May to August 2009. Three feed regimes (treatments) *viz*. Feed A with 30%, Feed B with 35% and Feed C 40% (gross protein) were used in triplicate with one control with natural food only.

The feed ingredients were ground and mixed thoroughly then put into the manually operated pellet machine for the preparation of pelleted feed of size 2 mm. The pellets were then allowed to dry in the sun light in order to protect from moisture and were kept in three plastic bottles and marked as Feed A, Feed B and Feed C **(Table 1)**.

Table 1. Formulation of the experimental feed.

Ingredients	Feed A	Feed B	Feed C
Rice Protein	500 g	500 g	500 g
Rice bran	300 g	350 g	400 g
Rice Milling	150 g	100 g	50 g
Wheat Flour	40 g	40 g	40 g
Salt + Vitamin premix	10 g	10 g	10 g
Total	1000 g	1000 g	1000 g

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Proximate Composition of Feed Ingredients

The prepared feeds were subjected to proximate composition analysis, according to the methods given in AOAC (1980). The analysis was done in the laboratory Institute of Bio-chemistry, University of Sindh, Jamshoro and the results are shown in **Table-2.** The fish feed were made

Table 2. Proximate composition of the experimental feeds

Feeds	Moisture %	Crude protein %	Crude lipid %	Ash %	Crude fiber %	NFE* %
A	12.60	30.00	11.60	11.80	11.90	22.10
B	11.00	35.05	10.10	11.0	11.60	21.25
C	10.00	40.00	10.00	10.80	10.00	19.20

*Nitrogen Free Extract calculated as:
100-% (Moisture + Protein+Lipid+Ash+Crude Fiber)

isocaloric and different protein levels of 30%, 35% and 40% by different combination of ingredients. Theoretically obtainable percentage of metabolizeable energy from carbohydrate, lipid and protein were calculated at the rate of 4.0 kacl/g of carbohydrate, 9.0 kacl/g of lipid and 4.0 kacl/g of protein as suggested by Pike and Brown, (1967). The essential amino acid spectrum was determined by descending paper chromatographic method given by Saperstein (1966) modified by Gheyasuddin and Mohafez (1975).

Feeding and Sampling

The experimental feeds were supplied twice daily morning at 9.00 AM and evening at 5.00 PM at a rate of 8% of the body weight. Sampling was done at an interval of one month to adjust the feeding rate, by measuring the weight of fish and to observe the health condition of fish. The length of experimental fish was measured to the nearest mm with an ordinary scale graduated with tenth of centimeters. Weight was measured to the nearest g by a portable electronic balance (Model AK- 3000H AFD). The 50% water of the aquaria was replaced every alternate day, to prevent growth inhabitant ammonia.

Statistical Analysis

One-way analysis of variance (ANOVA) was used to determine the effects of feed on the growth of carps. This was followed by Duncan's New Multiple Range Test (DNMRT), Duncan (1995) at 5% level of significance to observe any difference among treatment means.

3. Results

Energy Input

The total obtainable energy (kcal) in 100g of feed at various protein levels is shown in **(Table 3).** The total energy coming from each of the feeds was 320.0 kcal/100g. In all the major source of energy was protein. The feed were made isocaloric of different protein levels of 30%, 35% and 40% by different combination of ingredients. The essential amino acid

Table 3. Energy input (kacl) in 100 g of feed at various protein levels.

Name of energy source	Feed A 30% protein	Feed B 35% protein	Feed C 40% protein
Protein	120.00 kacl	140.00 kacl	160.00 kacl
Fat	99.80 kacl	92.30 kacl	84.80 kacl
Carbohydrate	100.20 kacl	87.70 kacl	75.20 kacl
Gross energy content	320.00 kacl	320.00 kacl	320.00 kacl
P/ E ratio	93.75	109.37	125.0

composition of various feeds is shown in **(Table 4)**. The highest growth rate of experimental fish was obtained with feed B containing 35% protein with a P/E ratio of 109.37 (Table 5). The rate of growth of the experimental fish increased almost proportionally to the protein level and then decreased slowly beyond this level (Table 5). This diet also showed the lowest feed conversion indicating the most efficient

Table 4. The essential amino acid composition of the experimental feeds

Amino acid	Gram amino acid per 100 g protein			
	Feed A 30% protein	Feed B 35% protein	Feed C 40% protein	FAO Reference protein
Lysine	4.26	5.20	6.30	5.50
Leucine	6.35	6. 90	7.20	7.00
Isoleucine	4.11	3.99	3.69	4.00
Valine	4.11	5.10	5.20	5.00
Arginin	4.93	5.00	5.15	----
Phenylalamine	3.64	4.55	5.86	4.00
Methionine	4.32	5.25	5.60	3.50
Histidine	2.00	1.80	1.29	----
Threonine	4.24	4.30	4.35	4.00
Tryptophan	1.29	1.50	1.68	1.00
Total	39.25	43.59	46.32	34.0

utilization of feed at this protein level. This indicated that the fish couldn't utilize excess levels of protein in the diet above the optimum. According to these results, a level of 35% protein in the diet with a P/E ratio of 109.37 is optimum for the growth of *C. catla*.

Growth Performance

The growth responses of the indigenous carp, *C. catla* fed with three different protein levels diets (iso-caloric) in terms of initial and final mean weight gain, percentage weight gain, specific growth rate (SGR), Food Conversion Rate (FCR), survival rate and production of the experimental fish are presented in the Table 5. The fish with an initial average weight of 6.4 ± 1.6 g reached to a final weight of 135.50 ± 2.66, 110. 30 ± 1.44 and 120.50 ± 2.11 g in feed B with 35% gross protein. Results of these parameters indicated that the feed B containing 35% gross protein shows significantly ($p<0.05$) highest growth in terms all parameters like (weight gain, percentage weight gain, specific growth rate, food conversion and production followed by feed C while significantly ($p<0.05$) lowest growth and production was recorded in feed A **(Table 5).** No mortality was recorded (100% survival rate) in the experimental fish throughout the study period.

Table 5. Effects of various feeds on growth parameters of *Catla catla* reared in glass aquaria.

Parameters	Feed A (30%)	Feed B (35%)	Feed C (40%)	Control* With natural feed
Rearing Period (days)	120	120	120	120
Mean Initial Weight (g)	6.4[a1] ± 1.6	6.4 [a1] ± 1.6	6.4 [a1] ± 1.6	6.4 [a1] ± 1.6
Mean final weight (g)	80.25[b] ± 1.55	110.30 ± 1.44	91.75 ± 1.99	33.55 ± 1.66
Weight gain (g)	73.85[b]	103.90	85.11	27.15
(%) Weight gain	1253[b]	1723	1433	524
SGR (% per day)	1.40[b]	1.58	1.47	0.92
FCR	4.40[b]	3.90	4.20	----
Survival (%)	100[a]	100 [a]	100 [a]	100 [a]
Production Kg/m^2/120 days	5.350[b]	7.353	6.116	2.236

*Feed D=Control without feed, only with natural food.

1. Fig. in the same row having same superscripts are not significantly different ($p>0.05$).

2. Standard deviation

4. Discussion

The effect of different protein content on various growth parameters like mean weight gain, percentage weight gain, specific growth rate, survival rate and production in the present study showed significantly ($p<0.05$) highest growth and production in experimental fish fed with feed B (35% gross protein) followed by feed C (40% gross protein) while lowest was recorded in fish fed with feed A (30% gross protein). Mazid *et al.* (1987) studied nutritional requirements of *Labeo rohita* and commented that major carp fed with 38% gross protein showed better growth in terms of weight gain. Their findings more or less similar as obtained in the present study. The decreasing trend in growth of *C. catla* with the increasing level of protein above the optimum in the present study is similar to those reported for eel (Nose and Arai, 1972), plaice (Cowey *et al*., 1972) and grass carp (Dabrowsky, 1977). Various workers like Sanaullah *et al.* (1986) reported better weight gain in catfish, *Clarias batrachus* fed with 40% gross protein. Rashid *et al.* (1996) published information on *Pangasius sutchi* fed with 35% protein for highest growth and production in cage culture. Yasmin and Mollah (1997) reared African catfish *Clarias gariepinus* with 35% gross protein in low-cost feed and observed good growth, survival and production. Hossain and Parween (1998) reported better growth net gain and production in *Heteropneustes fossilis* fed with 38% gross protein. Nahar *et al*. (2000) studied effect of different food items on growth, survival and production of African catfish fed with 33% gross protein. Narejo *et al*. (2002) worked on the growth performance of snake eel *Pisodonophis boro* and found that the fish fed with 35% protein yielded significantly highest growth as compared to 40% and 45%. Narejo *et al.* (2003) reported 35% gross protein for the better growth, survival and production for the rearing of *Mastacembelus armatus* in cemented cisterns. All these above observations support the present study findings.

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