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Formulation of Quality Fish Feeds From Indigenous Raw Materials and Their Effects on Growth and Maturity of *Cirrhinus Mrigala*

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Abstract

An experiment was conducted for 90 days in cemented cisterns to evaluate the effect of three dietary protein levels on the growth and body composition of Cirrhinus mrigala. Three different iso-caloric feeds containing 30%, 35% and 40% dietary protein levels were prepared from indigenous feed ingredients and were fed to Cirrhinus mrigala at the rate of 8% of total body weight. The overall growth of Cirrhinus mrigala fed with different levels of dietary protein was found to increase with the increase of dietary protein levels in feed C followed by feed B and significantly lowest in feed C. The gonadosomatic index (GSI) values of both male and female were higher in Feed-C (40% protein) compared to the Feed-A (30%) and Feed-B (35%). There was significant differences ($P<0.05$) between the gonadosomatic index values of Cirrhinus mrigala fed on different dietary protein levels. Statistical analysis showed that the feed at a level of 40% protein was significantly different from other feeds and most effective in changing the growth and maturity of Cirrhinus mrigala.

Key Words: *Formulated Feed, Maturity, Cirrhinus Mrigala, Body Composition.*

Introduction

Use of well-balanced artificial feed is the primary basis for success of intensive fish culture. To meet this requirement it is essential to formulate a low-cost fish feed from locally available ingredients. Fishmeal has been the major source of animal protein in commercial fish feeds elsewhere in the world. The main objectives of the proposed research are: to prepare low-cost fish feed using local feed ingredients for major carps, to observe the effect of feeds on growth, survival and maturity. The type of feed prepared from such ingredients should serve as a source of essential amino acid, minerals, vitamins, growth promoting substances and energy. Major carps are the most extensively reared throughout Pakistan. These constitute 40% of the local freshwater species of fish (Dars *et al*., 2010). Among the various species of carps, *Labeo rohita*, *Catla catla* and *Cirrhinus mrigala* have got a very high demand for their palatability. In spite of this, very little efforts have been made to undertake intensive culture of these species. The knowledge on specific protein requirements of these species is essential for the formulation of well-balanced diets for successful intensive culture. The results of the proposed research will help fish feed industrialists to prepare cheap and specific feed from the locally available raw materials for the better growth and survival rate of carps and also helps the fish farmers to get maximum yield in a minimum period of time. This will also enable fish farmers to improve their socio-economic condition by reduction input cost.

Materials and Methods

'A' grade fishmeal, mustard (*Brassica sp*.) oil cake and fine rice bran were collected from local market of Jamshoro; Sindh (Pakistan).Vitamin premix was collected from sales agent of Pharmaceutical Industries Ltd. All the feed ingredients were analyzed to determine its proximate composition, protein, lipid, moisture, ash, crude fiber and nitrogen free extract by the procedure of AOAC (1980) as shown in Table 1.

Table 1. Proximate composition of feed ingredients (Dry basis)

Name of ingredient	Moisture (%)	Crude protein (%)	Fat (%)	Ash (%)	Crude Fiber (%)	Nitrogen free extract (%) (100-protein % + ash% + Fiber %)
Fish meal	10.02	61.20	22.62	4.32	0.65	1.19
Mustard oil cake	11.50	27.00	29.15	16.60	11.48	24.87
Rice bran	10.90	10.80	20.60	5.35	15.00	37.35

Three different iso-caloric feeds denoted by A, B and C were prepared by mixing the ingredients in various combinations so as to give three different protein levels, *viz*. 30%, 35% and 40% in such a manner that the total metabolizable energy per 100 gm of feeds was about 300 Kcal (Table 2). The energy content of the feeds was calculated on the basis of4.0 Kcal/g carbohydrates, 4.0 Kcal/g proteins and 9.0 Kcal/g lipids (Pike and Brown, 1967).The feeds were made into pellets by adding the starch liquid and dried in oven at 45ºC for two days

Table 2. Composition of fish feed at different protein level

Ingredients	Feed A at 30% Protein level		Feed B at 35%Protein level		Feed C at 40% Protein level	
	Weight in (gm) of feeds	Total protein in feed (gm)	Weight in (gm) of feeds	Total protein in feed (gm)	Weight in (gm) of feeds	Total protein in feed (gm)
Fish meal	34.00	20.80	43.80	26.80	54.00	33.04
Mustard oil cake	14.50	3.91	15.00	4.05	14.00	3.78
Rice bran	49.00	5.29	38.70	4.16	24.50	3.18
Starch	2.00	--	2.00	--	2.00	--
Vitamin premixes	0.50	--	0.50	--	0.50	--

The ponds were prepared for rearing of *C. mrigala* by draining out of water and application of lime to the pond bottom at the rate of 250 kg/ha. After seven days of liming, the pond was filled up (about one meter) with water and after seven days cow dung was applied at the rate of 750kg/ha. Inorganic fertilizer (TSP 25kg/ha and urea 20kg/ha) were applied after the interval of five days. The experimental fish *C. mrigala* having initial body wt. of 40.3 ± 1.15 gm were collected from carp fish hatchery, Chilya, Thatta and were stocked (male: female 1:1) in the ponds at the rate of 80 individual/ decimal. The experiment was conducted for 90 days in six ponds of 3.5 decimal each. The experimental specimens were divided randomly into three treatments A, B, and C, each having 280 *C. mrigala* into three replications. The fishes were fed twice a day at the rate of 8% body weight using the prepared feeds, as per the experimental design. Gain in length and weight and development of gonads were monitored and recorded periodically, to identify Gonadosomatic Index (GSI) value of different feeding trials were collected and data on different parameters of male and female (n = 30) were recorded and analyzed. GSI values were estimated as the ratio of the wet gonad weight to somatic weight expressed in percentage by using the following formula:

$$GSI = \frac{\text{Weight of gonad}}{\text{Weight of fish}} \times 100$$

The water quality parameters such as temperature, dissolved oxygen, alkalinity and salinity were monitored fortnightly with the help of electrochemical analyzer (Model C-6020). One way analysis of variance (ANOVA) was performed on the yield data to determine treatment effects. Duncan's New Multiple Range Test (Gomez and Gomez, 1984) was used to compare the differences of means

Results and Discussion

The overall growth performance of *C. mrigala* brood fed with feeds of different levels of dietary protein is presented in Table 3. Final growth attained under Feed-A (30% protein), Feed B (35% protein) and Feed C (40% protein) were 78.47±2.43, 86.58±3.26 and 105.37±8.16g respectively. The highest growth was obtained in Feed-C (40% protein) and lowest with Feed A (30% protein). The final weight showed significant difference ($p<0.05$) in Feed C (40%protein) followed by Feed B (35% protein) and Feed A (30% protein) when ANOVA was performed. Absolute growth and absolute growth rate were higher in Feed C compared to both the feeds A and B. Specific growth rate was also higher in Feed C (0.69±0.05) followed by feed B and Feed A. From the results of growth it is clear that the Feed C is better than the Feed B followed by the Feed A, increase in weight in fish is directly related with the increase in protein levels in feed which is similar to the experimental results reported for salmon (De Long *et al*. 1958) in common carp (Ogino and Saito, 1970) in rainbow trout (Saitia, 1974; Sanaullah *et al.* 1986; Rahman *et al*. 1987) in *Clarias batrachus*.

Table 3. Growth performance of *Cirrhinus mrigala* brood fed with feeds of different levels of dietary protein

Treatments	Mean initial weight (g)	Mean final weight (g)	Absolute growth (g)	Absolute growth rate (g)	Specific growth rate (%)
Feed A (30% protein)	40.3±1.15	78.47±2.43 c	38.17±2.42	0.27±0.02	0.48 ± 0.02 c
Feed B(35% protein)	40.3±1.15	86.58±3.26 b	46.28±3.26	0.33±0.02	0.55±0.02 b
Feed C (40% protein)	40.3±1.15	105.37±8.16 a	65.07±8.16	0.46±0.06	0.69±0.05 a

Figures in the same column having the different superscripts are significantly different ($P<0.05$)

Gonado-somatic index is a very important parameter for understanding gonad development of fish. The gonado-somatic index values (GSI) of *C. mrigala* of different feeds are shown in (Fig. 1). It is observed from the (Fig. 1) that the gonado-somatic index values of both male and female were found higher in Feed C (40% protein).The average values of gonado-somatic index values for male in Feed-A, Feed-B and Feed C were 2.75, 3.0 and 3.13 respectively.

The gonado-somatic index values for female were also higher in Feed C compared to the other two feeds. There was significant differences (P<0.05) between the gonado somatic index values of *M. gulio* fed on different dietary protein levels this is an agreement with the results obtained by Mollah *et al.* (2003) and (Singh *at al* 2003).

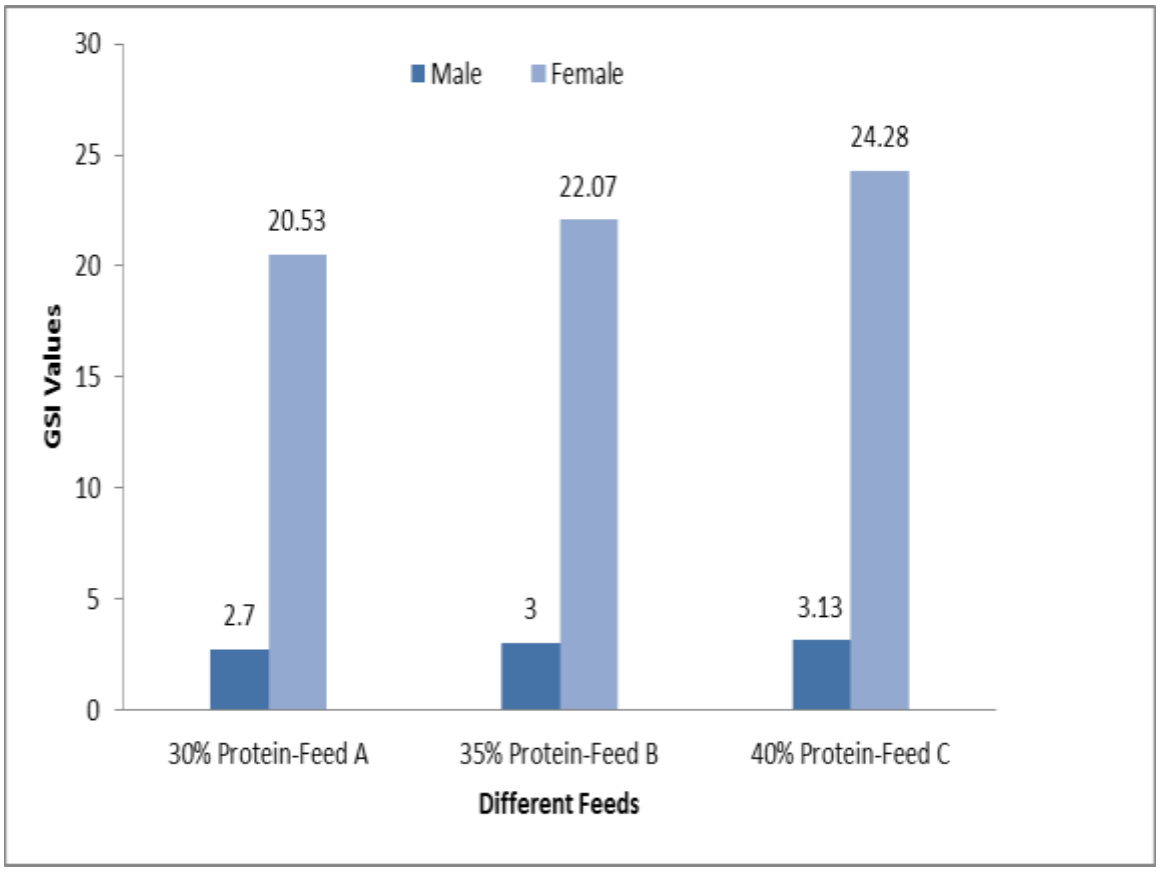

Fig. 1 The gonado-somatic index values for female and female at different feeds in different protein levels.

Oil cake as protein sources in supplementary diets for the growth of *Cirrhinus mrigala* (Ham.) fingerlings (Singh *et al* 2003) where 40% protein level in the feed gave the better gonado somatic index values in case of *Cirrhinus mrigala.* Female dwarf gourami and Nile tilapia fed on 35% protein diets recorded highest ovary weight and gonado-somatic index (Santiago *et al.* 1985; Pathmasothy 1985; Shim *et al.*1989) recorded larger ovaries and higher gonado-somatic index values of *L. hoevenii* fed diets containing 32 and 40% protein diet with 24% protein which is similar to the present study.

The quality parameters of ponds in different months are presented in Table 4. The values of water quality parameters such as temperature 24.66 ± 0.45 to 31.33 ± 0.74^{0}C, dissolved oxygen (DO) 5.32 ± 0.98 to 7.95 ± 0.52 mg/l, alkalinity 160.0 ± 11.20 to 182.50 ±12.30 mg/l and salinity 8.30 ±1.22 ppt to 8.60 ± 0.50 ppt.

Table 4. Mean value (±SD) of water quality parameters in different months

Month	Water temperature (0C)	pH	Dissolve oxygen (mg/L)	Total Alkalinity (mg/L)	Salinity (ppt)
February	24.66±0.45	7.55±0.58	5.64±0.86	160.0±11.20	8.30±1.22
March	25.57±0.12	7.43±0.31	7.95±0.52	182.50±12.30	8.65±1.10
April	28.40±0.69	7.59±0.56	7.05±0.43	176.20±15.30	8.50±1.38
May	30.60±0.57	7.94±0.51	5.38±1.12	179.30±9.86	8.70±0.32
June	31.33±0.74	7.63±0.21	5.32±0.98	176.78±10.98	8.60±0.50

Water temperature influences the physico-chemical and biological factors of a water body, the ranges of mean value of water temperature in different months in the present study were 24.66-31.33^{0}C. These values are more or less similar to that reported by (Paul 1998; Rahman1999; Kohinoor 2000; Kohinoor *et al* 2004). The pH values in all ponds were alkaline throughout the experimental period. Different authors have reported a wide variation in pH from 6.7 to 8.3 (Hossain *et al*. 1997), 7.18 to 7.24 (Kohinoor *et al*. 1998), and 7.37 to8.65 (Kohinoor *et al*. 2004) in fertilized fish ponds and found productive. The ranges and mean values of pH in the present study were alkaline indicating the productive nature of the fertilized ponds.

The ranges and mean value of dissolved oxygen concentrations were found 5.32 ± 0.98 -7.95 ± 0.52 mg/L which is similar to findings reported by several researchers (Ali *et al*. 1982; Martyshew 1983; Rahman 2000; Kohinoor 2000 and Kohinoor *et al*. 2004). Total alkalinity more than 100 mg/L should be present in high productive water bodies (Alikunhi, 1957; Paul 1998; Kohinoor 2000; Grag and Bhatnagar 2000; Kohinoor *et al* 2004) found the average total alkalinity values above 100 mg/L. The total alkalinity values found in the present study were within the suitable range.

Conclusion

In the present research work, growth performance and maturation of *C. mrigala* were studied. Somatic growth and gonado-somatic index were highest in the fish provided with 40% dietary protein in the feed.

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