

**GROWTH PERFORMANCE AND FEED CONVERSION RATIO (FCR) OF HYBRID FINGERLINGS (*CATLA CATLA X LABEO ROHITA*) FED ON COTTONSEED MEAL, SUNFLOWER MEAL AND BONE MEAL**

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**ABSTRACT**

An experiment was conducted in six glass aquaria to study the growth performance and feed conversion ratio (FCR) of hybrid fingerlings (*Catla catla x Labeo rohita*) fed on sunflower meal, cottonseed meal and bone meal. Two replicates for each ingredient were followed. The feed was supplied at the rate of 4% of wet body weight of fingerlings twice a day. The hybrid (*Catla catla x Labeo rohita*) fingerlings gained highest body weight ( $1.62 \pm 0.0$  g) on sunflower meal, followed by cottonseed meal ( $1.61 \pm 0.01$  g) and bone meal ( $1.52 \pm 0.0$  g). The total length obtained by hybrid fish was  $6.35 \pm 0.05$  cm on sunflower meal,  $6.12 \pm 0.05$  cm on cottonseed meal and  $5.85 \pm 0.05$  cm on bone meal. The overall mean values of FCR were lower (better) on sunflower meal ( $1.78 \pm 0.05$ ), followed by cottonseed meal ( $2.17 \pm 0.01$ ) and bone meal ( $2.46 \pm 0.01$ ). Thus, The sunflower meal and cottonseed meal, on the basis of growth performance and better FCR, can be included in the feed formulation for hybrid fingerlings.

**Key words:** Growth performance, FCR, feed ingredients, hybrid fingerlings.

**INTRODUCTION**

The success of commercial aquaculture operations depends on a variety of factors relating to the fields of biology, engineering and economics. One key biological component is the availability of suitable diets that are efficiently digested and provide the required nutrients for optimum growth (Mokolensang *et al.*, 2003).

Semi-intensive and intensive fish farming is gaining importance in Pakistan. As a result, use of supplementary feed has become inevitable for the success of fish culture. In order to get maximum fish yield from confined water, it is essential to use supplementary feed along with fertilizer and organic manure. Supplementary feeding is known to increase the carrying capacity of culture systems and can enhance fish production by many folds (Devaraj *et al.*, 1976). It also offers the best means of fish production within the shortest possible time in the ponds. Attempts have been made to understand the gross level of nutrient requirements viz., proteins, lipids, carbohydrates, vitamins and minerals for Indian major carps (De-Silva and Gunasekera, 1991; Balogu *et al.*, 1993; Saeed, 1996).

Supplementary feeding is perhaps the most desirable measure to increase fish yield. The importance of artificial feeding varies according to the required intensity of cultivations. Artificial feed plays an important role in semi intensive fish culture where it is required to maintain a high density of fish than the

natural fertility of the water can support (Jhingran, 1991). The role of supplementary feed in intensive fish farming cannot be ignored as the whole nutritional requirements of fish depend upon the feed. The intensive culture is exclusively feed based and is expected to be mainstay for increasing fish production in years to come (Sinha, 1991).

The growth and feed conversion ratio (FCR) of a fish is remarkable tool to compute the acceptability of artificial feed. The proper information of FCR on locally available ingredients will provide the basis to develop acceptable feed, though the task of preparing acceptable and suitable artificial feed for major carps is complicating due to its feeding preference. The FCR values of various fish feeding ingredients for carps under controlled conditions have been estimated by many workers (Jhingran, 1991; Shabbir *et al.*, 2003; Jabeen *et al.*, 2004; Ali and Salim, 2004; Saeed *et al.*, 2005; Inayat and Salim, 2005; Gull *et al.*, 2005). However, the data regarding feed conversion ratio of hybrid fingerlings is not available. It is assumed that hybrids have better growth rate and high resistivity against unfavorable ecological conditions (Reddy, 2000). Hybrids of major carps are being successfully produced in public and private hatcheries and are available for farming system but commercially proper feed is not available for the hybrids. This paper describes feed conversion ratio of available feed ingredients for hybrid (*Catla catla x Labeo rohita*) fingerlings.

## MATERIALS AND METHODS

### Experimental fish

Fingerlings of hybrid (*Catla catla* x *Labeo rohita*) were collected from Government Fish Seed Hatchery, Faisalabad, Pakistan. The fingerlings were kept in glass aquaria for two weeks for acclimatization. During this period, the fingerlings were fed on rice polishing. The experiment was run in six glass aquaria in Fish Nutrition Laboratory, Department of Zoology and Fisheries, University of Agriculture, Faisalabad, Pakistan. The working dimension of each aquarium was 60 x 40 x 44 cm<sup>3</sup>. Each aquarium was filled with water up to level of 25 cm which was maintained throughout the experimental period.

### Ingredients

The three ingredients i.e. sunflower meal, cottonseed meal and bone meal were dried and grinded to powder form. The proximate composition of three ingredients is shown in Table 1. After acclimatization, 10 fingerlings were randomly transferred to each aquarium. The average initial body weight of fingerlings was 1.21 ± 0.01g. Two replicates were followed for each treatment. The feed was applied at the rate of 4% of body weight of the fingerlings throughout the experimental period of six weeks.

**Table 1: Chemical composition of three feed ingredients**

Ingredients	Dry matter (%)	Crude protein (%)	Crude fat (%)	Gross energy (Kcal/kg)
Sunflower meal	95.09	38.50	3.40	2032
Cotton seed meal	95.01	41.06	00.76	2108
Bone meal	91.52	30.0	4.49	1355

The diet was fed twice daily (morning and evening) in two equal portions. Dissolved oxygen and pH of water in each aquarium was monitored by changing water daily and by using air pump. The range of temperature remained 22-26°C during study period. Two hours after each feeding, water from aquaria was removed to collect the unconsumed feed. Each aquarium was filled with water again, immediately after the removal of unconsumed feed. The feed so collected was dried and the weight of the refused feed, thus recorded was used to calculate the actual amount of feed consumed by the fish. The fingerlings were taken from each replicate on weekly basis after removing water from the aquarium. The morphometric characteristics i.e. body weight and total length were recorded to observe their growth performance. The feed was stopped a day before the

weight was recorded. The mean weight of fingerlings in each aquarium was calculated to work out the feeding rate for next week. The FCR for each treatment was computed by the following equation:

$$\text{FCR} = F / (W_f - W_o), \text{ where}$$

- F is the weight of food supplied to fish during the study period  
 W<sub>o</sub> is the live weight of fish at the beginning of the study period  
 W<sub>f</sub> is the live weight of fish at the end of the study period

The data on body weight, total length and feed conversion ratio were subjected to statistical analysis, using analysis of variance technique. The differences of means were compared by Duncan's Multiple Range test (Steel *et al.*, 1996). A computerized programme MSTATS was used for the statistical analysis of data.

## RESULTS

The highest final body weight of hybrids (Table 2) was on sunflower meal (1.62 ± 0.01g), followed by cottonseed meal (1.61 ± 0.01g) and bone meal (1.52 ± 0.05 g). The statistical analysis revealed that the effect of three feed ingredients on body weight of fish during six weeks was significant (P<0.05). The interaction between ingredients and weeks was also significant (P<0.05).

The comparison of body weight on three feed ingredients during six weeks revealed that in the first week the mean body weight on three ingredients was non significantly different from each other. During second and third week, the means body weights on sunflower meal and cottonseed meal were non significantly different from each other but cottonseed meal showed significantly higher value than bone meal. During fourth week all the three test ingredients showed significant difference in term of body weight. In the fifth and sixth week, sunflower meal and cottonseed meal showed no difference from each other but both the ingredients showed higher values than bone meal. The overall mean body weights on sunflower meal and cottonseed meal were non significantly different from each other but were significantly higher than mean body weight on bone meal (Table 2).

The maximum total length of fish (Table 3) was on sunflower meal (6.35 ± 0.05 cm), followed by cottonseed meal (6.12 ± 0.01 cm) and bone meal (5.85 ± 0.05 cm). Effect of feed ingredients on total length was significant (P<0.05). The interaction between weeks and ingredients was also significant (P<0.05). The comparison of total length on three feed ingredients

**Table 2: Weekly variation of mean body weight (g) of hybrid (*Catla catla* x *Labeo rohita*) fish fed on three feed ingredients**

No. of weeks	Sunflower meal	Cotton seed meal	Bone meal
0	1.21±0.00 <sup>a</sup>	1.20±0.00 <sup>a</sup>	1.20±0.00 <sup>a</sup>
1	1.28±0.00 <sup>a</sup>	1.28±0.00 <sup>a</sup>	1.26±0.00 <sup>a</sup>
2	1.33±0.03 <sup>ab</sup>	1.34±0.00 <sup>a</sup>	1.30±0.00 <sup>b</sup>
3	1.37±0.00 <sup>ab</sup>	1.43±0.00 <sup>a</sup>	1.36±0.15 <sup>b</sup>
4	1.43±0.01 <sup>b</sup>	1.55±0.01 <sup>a</sup>	1.40±0.00 <sup>c</sup>
5	1.55±0.00 <sup>a</sup>	1.55±0.01 <sup>a</sup>	1.47±0.00 <sup>b</sup>
6	1.62±0.10 <sup>a</sup>	1.61±0.01 <sup>a</sup>	1.52±0.05 <sup>b</sup>
Mean	1.43±0.01 <sup>a</sup>	1.46±0.00 <sup>a</sup>	1.39±0.03 <sup>b</sup>

Mean values with different superscripts within a row differ significantly ( $P < 0.05$ ).

during six weeks showed that in the first week the total length for fish fed sunflower meal, cottonseed meal and bone meal was non significantly different from each other. During second, third and fourth week, the mean total length on sunflower meal was significantly higher than cottonseed meal and bone meal, whereas the difference between the latter two ingredients was non significant. During fifth week, the means of total length on three ingredients were non significantly different from each other. In sixth week, mean total length for sunflower meal and cottonseed meal was similar but the sunflower meal was significantly different from bone meal. The overall mean total length on sunflower meal was significantly higher than mean total length on cottonseed meal and bone meal, however, the total length on cotton seed meal was non significantly different from bone meal (Table 3).

**Table 3: Weekly variation of mean total length (cm) of hybrid fingerlings (*Catla catla* x *Labeo rohita*) fed on three feed ingredients**

No. of weeks	Sunflower meal	Cotton seed meal	Bone meal
0	5.35±0.01 <sup>a</sup>	4.90±0.05 <sup>a</sup>	5.09±0.05 <sup>a</sup>
1	5.41±0.01 <sup>a</sup>	5.15±0.03 <sup>a</sup>	5.25±0.05 <sup>a</sup>
2	5.50±0.05 <sup>a</sup>	5.39±0.05 <sup>b</sup>	5.38±0.05 <sup>b</sup>
3	5.71±0.00 <sup>a</sup>	5.48±0.05 <sup>b</sup>	5.50±0.05 <sup>b</sup>
4	5.90±0.05 <sup>a</sup>	5.57±0.05 <sup>b</sup>	5.62±0.05 <sup>b</sup>
5	6.01±0.05 <sup>a</sup>	5.70±0.05 <sup>a</sup>	5.74±0.05 <sup>a</sup>
6	6.35±0.05 <sup>a</sup>	6.12±0.05 <sup>ab</sup>	5.85±0.05 <sup>b</sup>
Mean	5.78±0.03 <sup>a</sup>	5.46±0.04 <sup>b</sup>	5.47±0.03 <sup>b</sup>

Mean values with different superscripts within a row differ significantly ( $P < 0.05$ ).

The overall highest mean FCR values of hybrids (Table 4) was for bone meal ( $2.46 \pm 0.01$ ), followed by cottonseed meal ( $2.17 \pm 0.01$ ) and sunflower meal ( $1.78 \pm 0.05$ ). The overall mean values of FCR for sunflower meal, cotton seed meal and bone meal were significantly different from each other (Table 4).

**Table 4: Weekly variation of mean FCR values of hybrid fingerlings (*Catla catla* x *Labeo rohita*) fed on three feed ingredients**

No. of weeks	Sunflower meal	Cotton seed meal	Bone meal
1	1.52±0.01 <sup>b</sup>	2.02±0.16 <sup>a</sup>	2.13±0.01 <sup>a</sup>
2	1.59±0.04 <sup>c</sup>	2.03±0.26 <sup>b</sup>	2.32±0.03 <sup>a</sup>
3	1.75±0.10 <sup>c</sup>	2.10±0.18 <sup>b</sup>	2.34±0.01 <sup>a</sup>
4	1.89±0.17 <sup>b</sup>	2.28±0.19 <sup>a</sup>	2.46±0.05 <sup>a</sup>
5	1.82±0.03 <sup>c</sup>	2.22±0.17 <sup>b</sup>	2.50±0.00 <sup>a</sup>
6	1.85±0.00 <sup>bc</sup>	2.26±0.17 <sup>b</sup>	2.72±0.01 <sup>a</sup>
Mean	1.78±0.05 <sup>c</sup>	2.17±0.01 <sup>b</sup>	2.46±0.01 <sup>a</sup>

Mean values with different superscripts within a row differ significantly ( $P < 0.05$ ).

## DISCUSSION

The hybrid fingerlings (*Catla catla* x *Labeo rohita*) gained higher body weight and maximum total length on sunflower meal, followed by cottonseed meal and bone meal. The overall growth pattern of fingerlings also remained highest for sunflower meal. The findings of Shabbir *et al.* (2003) are in agreement with the present study. They reported higher growth of *Cirrhinus mrigala* on sunflower meal, followed by maize gluten and wheat bran. Ali and Salim (2004) noted that *Labeo rohita* gained  $2.63 \pm 0.45$ g body weight on sunflower meal, which is higher than the weight gained by hybrids ( $1.62 \pm 0.05$ ) in the present study. The difference in weight gain may be due to variations in experimental fish and feed used. Ali and Salim (2004) used balanced feed, whereas in the present study single ingredient was used in the experiment. The next higher growth of hybrids (*Catla catla* x *Labeo rohita*) was on cottonseed meal. Jabeen *et al.* (2004) reported that *Cirrhinus mrigala* gained body weight of 1.17g on cottonseed meal. The body weights gained by hybrids and *Cirrhinus mrigala* were higher on cottonseed meal as compared to other ingredients in both studies.

As far as the value of FCR is concerned, the better (lower) feed conversion ratio was observed for sunflower meal, followed by cottonseed meal and bone meal. Ali and Salim (2004) noted higher FCR value for rice polish (5.27), followed by fish meal (3.026) and

sunflower meal (3.021). The FCR values on sunflower meal were comparable with present study. However, in the present study, FCR value on sunflower was comparatively lower than the value observed by Ali and Salim (2004). Similar findings were also observed by Shabbir *et al.* (2003). The FCR value on cotton seed meal (1.55) reported by Jabeen *et al.* (2004) was somewhat close to value of FCR observed in the present study.

The rate of feed application also plays an important role in the growth of the fish. The suitable and recommended rate of feed application (4% of net body weight) was applied in the present study. The 4% feeding rate was supported by Ghosh *et al.* (1984). Salim and Sheri (1999) and also reported significant growth of *Labeo rohita* on 4% level of feeding.

Based on the results of the present study, it was concluded that sunflower meal and cottonseed meal can be included in the feed formulation for hybrid fingerlings (*Catla catla* x *Labeo rohita*).

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