



## PREPARATION OF LOW-COST FISH FEED FOR THE CULTURE OF *LABEO ROHITA* (HAMILTON) IN GLASS AQUARIA

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### Abstract

To prepare a low-cost feed for the growth and survival of *Labeo rohita* reared in glass aquaria. An experiment was conducted in four glass aquaria (size 90 × 30 cm) for a period of six months from March to August 2009. Ten fish of same size (age group) of *Labeo rohita*, with mean initial length and weight of 5.5 ± 1.40 cm and 6.4 ± 1.6 g respectively were assigned to each aquaria. Two iso-caloric diets (about 40% protein) were prepared with locally available ingredients. In feed B about 10% rice milling was replaced by soybean meal. The cost of feed A and feed B were Rs. 20.60/kg and Rs. 22.50/kg respectively. Each diet was supplied at a rate of 8% of the body weight of fish twice daily. The variations in weight gain of fish under different dietary conditions were not statistically significant. The weight gain of fish fed feed A and B was 73.85g and 70.44g respectively. But the growth rate varied with different months during the study period. The production and feed conversion ratio of fish was 5.350kg/m<sup>2</sup> and 5.122kg/m<sup>2</sup> and 4.40 and 4.44 for feed A and B respectively.

**Keywords:** Low- cost feed, Indigenous raw materials, *Labeo rohita*.

### 1. Introduction

Fish, like other organisms, required food (energy) in order to grow, survive and reproduce. The food items (source of energy) in aquatic habitat are in the form of plankton, periphyton, nuston, benthose, nekton and plants are available through out the year. The success of intensive fish culture depends on the formulation of a fish feed that contains an optimum level of protein and energy necessary for the growth of fish and is also cheap. It is obviously necessary to formulate and manufacture fish feed from locally available feed ingredients. This type of feed prepared from such ingredients should serve as a source of essential amino acid, minerals, vitamins, growth promoting substances and energy. Major carp are the most extensively reared (cultured) in Pakistan. These constitute nearly 40% of the local freshwater species of fish (Ashraf *et al.*, 2008). Among the various species of carps; Rahu, Thaila and morakhi have got a very high demand for their palatability. In spite of this very little efforts have been made to undertake intensive culture. The knowledge on the specific protein requirements of these fish species is essential for the formulation of a well-balanced feed 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 fish *Labeo rohita* (Hamilton) and also helps the fish farmers to get maximum yield in a minimum period of time for the carps fed with cheap

and proper feed. Traditionally, fishmeal has been the major source of protein in commercial fish feeds elsewhere in the world. There are some ingredients which are locally available that can replace the fishmeal without changing the protein level and cost of feeds become lower. Sun flower seed cake and cotton seed cake is most important locally available protein rich ingredients, which can be used instead of fish meal. Beside this a variety of indigenous raw materials mainly poultry by-product meal, blood meal, various other oilcakes, cereal by-products, leaf meals, live and dead small fish of non-commercial value are available (Ashraf *et al.*, 2008). These raw materials can be used in developing supplementary feed for the rearing and culture of carps such as Rahu (*Labeo rohita*), is particularly important for their fast growth. Lucrative size, good taste and high market demand in Pakistan. Various workers have prepared low-cost fish feed for the artificial culture and rearing of different fish species from India and Bangladesh such as Devaraj (1973) in *channa morulus*. Rahman *et al.*, (1982) for *Hetrogneustes fossils*. Ravindranath (1988) in *Channa striatus*. Rashid *et al.*, (1996) in *pangasius sutchi* Hossain *et al.*, (2000) in gaint fresh water prawn *Macrobranchium rosenberjii*. Presently no published information is available regarding the formulation of low-cost quality fish feed technology from locally available (indigenous) raw materials for the rearing commercial carps from Pakistan. The present study has been undertaken with the following objectives:

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1. To prepare low-cost fish feed using local feed ingredients for *Labeo rohita*.
2. To observe the effect of these feeds on the growth of *L. rohita* in aquaria

## 2. Materials and Methods

### Collection and Stocking of Fingerlings

The experimental fingerlings of *Labeo rohita* were collected from Government Carp Fish Hatchery, Badin. For the feed trial experiment 04 glass aquaria (size 90 × 30 cm) were selected for a period of six months starting from March to August 2009. Two feed regimes (treatments) i. e. Feed A with 39.9%, Feed B with 39.6% (gross protein) were replicated twice. The experimental fish belongs to the same age group having mean length and weight of 5.5 ± 1.40 cm and 6.4 ± 1.6 g respectively and were stocked at the rate of 10 fish/aquaria.

### Collection of feed ingredients

To prepare the low-cost quality fish feeds of same protein level some locally available ingredients such as rice bran, rice protein, rice milling and soybean meal were collected from the market of Hyderabad and Thatta.

### Feed Formulation

Two iso-caloric feeds containing about 40% protein levels (39.98% and 39.63%) were formulated. The feed ingredients were tested for proximate (biochemical composition). The prepared feeds were subjected to proximate composition analysis, according to the methods given in AOAC (1980).

### Preparation and packaging of Feeds

All the collected dietary ingredients were grounded thoroughly and sieved to pass through 0.5 mm mesh. The ingredients were mixed according to the formulae (Table 1). The well-mixed ingredients were 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, packed in air tight bottles marked as Feed A, and Feed B.

**Table-1. Formation of the experiment low-cost fish feed.**

Ingredients	Feed A	Feed B
Rice Protein	50g	50g
Rice bran	30g	35g
Rice Milling	15g	00g
Soybean meal	00g	10g
Wheat Flour	4g	4g
Salt + Vitamin premix	1g	1g
Total	100g	100g

### 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 weight of experimental fish was measured to the nearest g by a sensitive portable electronic balance (Model AK- 3000H AFD).

### Statistical Analysis

One-way analysis of variance (ANOVA) was used for statistical analysis of the data to determine the significance of variation among the treatment means.

## 3. Results.

### (a) Proximate Composition Analysis of the Experimental Feeds

The proximate composition analysis of three experimental feeds is shown in (Table 2). There was slight variation observed in protein, lipid and NFE (Nitrogen Free Extract) content between the feeds. In the present trial, experimental feeds contained 39.98 and 39.63% protein.

**Table 2. Proximate composition of the experimental feeds.**

Feeds	Moisture %	Crude protein %	Crude lipid %	Ash %	Crude fiber %	NFE* %
Feed-A	10.63	39.98	10.56	9.76	10.85	18.22
Feed B	10.98	39.63	10.03	9.98	9.67	19.71

Nitrogen Free Extract calculated as:

100-% (Moisture + Protein +Lipid +Ash + Crude Fiber)

### b) Cost of Experimental Feeds

The costs of experimental feeds are shown in (Table 3). All the prices were based on the prices of Hyderabad and Thatta markets (2009). Feed A had the price of Rs. 20.60/kg, Feed B Rs. 22.50/kg. So, the cost difference between the experimental feeds was Rs. 1.90/kg (one rupee and ninety paisa only).

**Table 3. Costs of the Experimental Feeds (Rs. /kg)**

Feed Ingredients	Feed A		Feed B	
	Quantity (g)	Cost (Rs.)	Quantity (g)	Cost (Rs.)
Rice bran	300	1.80	350	2.00
Rice milling	150	1.80	-----	-----
Rice protein	500	15.0	500	15.0
Soybean meal	-----	-----	100g	3.50
Wheat flour	48	1.00	48	1.00
Salt +Vitamin	2	1.00	2	1.00
Total	1000 g	20.60	1000 g	22.50

**(c) Growth Performance of Fish Fed Experimental Feeds**

The growth responses of *Labeo rohita* in terms of initial and final mean weight, weight gain, specific growth rate (SGR), feed conversion rate (FCR), survival rate and production are presented in (Table 4).

**Table 4. Growth performance of *Labeo rohita* (Hamilton) fed with experimental feeds in glass aquaria for the period of six months.**

Parameters	Feed A	Feed B
Mean initial weight (g)	6.4 ± 1.6 g	6.4 ± 1.6 g
Final weight (g)	80.25 ± 1.55	76.84 ± 1.80
Weight gain (g)	73.85 ± 0.55	70.44 ± 1.00
% weight gain	1253	1200
SGR (%/day)	1.40	1.38
FCR	4.40	4.44
Survival rate %	100	100
Production (g/m <sup>2</sup> )	5.350	5.122

SGR= Specific Growth Rate  
FCR= Food Conversion Ratio

The initial average weight of 6.4g reached a final weight of 80.25g and 76.84g for feed A and B respectively which is shown in Table 4. The maximum gain in weight were 28.91g and 28.05g and the minimum gain were 6.0g and 5.60g recorded in the month of July and March respectively for feed A and B respectively Table 5. The net gain in weight during the study period was 73.85g and 70.44g for feed A and B respectively Table 4. The percent weight gain for feed A was 1253 and for feed B was 1200 (Table 5).

**Table 5. Growth of *Labeo rohita* (Hamilton) in terms of increase in weight (g) under different diets over a period of six months in glass aquaria.**

Feed	March	April	May	June	July	August	Net gain
Feed A	6.4	12.40	19.88	30.73	58.64	80.25	73.85
Feed B	6.4	12.0	18.77	29.93	57.98	76.84	70.44

The specific growth rate (SGR) at the end of the study period was 1.40 (%/day) for feed A and 1.38 (%/day) for feed B. There was no significant difference between the SGR's of the feed A and B. The feed conversion ratio (FCR) and survival rate values were 4.40 and 4.44 100% for feed A and B respectively. There was no significant difference ( $P > 0.05$ ) between the FCR's and survival rate of the feed A and B. The fish production for feed A was recorded 5.350kg/m<sup>2</sup>

and for feed B 5.122kg/m<sup>2</sup>. There was no significant difference between the productions of fish fed two feeds but there was a significant difference between the costs of feeds (Rs. 20.50 and 22.60) for feed A and B respectively.

#### 4. Discussions

The experiment was conducted to determine the suitability of artificial diet prepared by replacing rice milling with soybean meal. Growth in terms of increase in weight of *L. rohita* during the experimental period in both treatments was not so encouraging. There was no significant difference between weight gain of fish. But there were a significant difference between the growth rates of fish in months and as well as temperature of water. One of the reasons for such poor growth performance may be due to the comparatively low water temperature during the months of March and April. The lowest growth rate was observed in the month of March. This may be due to the low water temperature. The highest growth rates of *L. rohita* during the month of July might be due to the optimum temperature (28-30°C). Narejo *et al.*, (2003a and b) obtained maximum growth rates of eels during the period of optimum temperature. The *L. rohita* is an indigenous fish of South East Asia where the temperature varies from 25-30°C through out the year. So, in low temperature the growth rate of the fish declined. Brown (1957) reported that temperature altered the rates metabolic process and could be expected to have a considerable effect on the growth of poikilothermous animals. Nikolsky (1963) observed that metabolic rates were most closely connected with changes in temperature of the surrounding water. The above findings support the present study. The reduced growth of *L. rohita* with diet replacing 10% of dietary rice milling by soybean meal in the present study was similar to the findings of Jackson *et al.*, (1982). They reported reduced growth of tilapia at 50% level of fishmeal protein substitution by soybean meal. 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. Rashid *et al.*, (1996) observed poor growth in *Pangasius sutchi* when replaced 10% fishmeal by soybean meal in low-cost feed, which accords with the present study. The results of the present study showed that the substitution of rice milling with soybean meal resulted in the same growth rate, feed conversion ratio and protein utilization compared to the rice milling based diet. Olukunle (1982) and Richards (1983) reported comparatively better growth of *Oreochromis mossambicus* when fed diets containing combinations of plant sources. Sarker (1996) found that diet containing 22% soybean meal,

replacing 30% of the dietary fishmeal resulted good growth in *Puntius gonionotus*. The effectiveness of using various combinations of ingredients in fish feed has also been reported by Tacon *et al.*, (1984). They successfully reduced the fishmeal level from 50% to 10% by substituting with soybean, brewers yeast, puffer maize and blood meal in the diet of *Oreochromis niloticus* with out reducing the growth performance. The results of the present study demonstrated that growth rate, FCR values are not satisfactory but the soybean meal may be replaced of rice milling. Soybean meal is high priced feed ingredient but rice bran and milling are low-cost and locally available feed ingredient. So, to decrease the production cost certain amount of fishmeal, rice bran and rice milling easily can be replaced with soybean meal.

### References

- AOAC, (1980) Official methods of Analysis of the Association of Official Analytical Chemists, W. Horwitz (Editor), 13<sup>th</sup> edition, Washington, D.C.1018Pp.
- Ashraf, M., M. Ayoub and M. Rauf. (2008). Effect of different feed ingredients and low-temperature on diet acceptability, growth and survival of mrigal, *Cirrhinus mrigala*, fingerlings. *Pakistan J. Zool.*, 40 (2): 83-90.
- Brown, M. F. (1957) *The Physiology of Fishes*. Academic Press. Inc. Publisher. New York. Vol. (1): 390-392.
- Devaraj, M., (1973) Experiments on the culture of the large snakehead *Ophiocephalus marulius* (Ham.). *Indian J. Fish.*, 20 (1): 138-147.
- Hossain, M. A., M. A. L. Siddique and M. A. H. Miaje. (2000) Development of low-cost feed for culture of giant freshwater prawn (*Macrobrachium rosenbergii* de Man) in ponds. *Bangladesh J. Fish. Res.*, 4 (2): 127-134.
- Jackson, A. J., B. S. Capper and A. J. Matty. (1982) Evaluation of some plant protein in complete diets for tilapia, (*Sarotherodon mossambicus*) at 50% level of fishmeal by soybean meal. *Aquaculture*, (27): 97-109.
- Mazid, M. A., M. A. Rahman, S. Gheyasuddin, M. A. Hossain and M. B. Rashid. (1987) Nutritional requirements of major carp-1. Optimum level of dietary protein for *Labeo rohita*. *Bangladesh J. Fish.*, 10 (2): 75-82.
- Narejo, N.T., S.M. Rahmatullah and M. Mamnur Rashid (2003a) Effect of different feeds on growth, survival and production of freshwater mud eel, *Monopterusuchia* (Hamilton) reared in cemented cisterns. *Indian J. Fish.*, 50 (4): 473-477.
- Narejo, N.T., S.M. Rahmatullah and M. Mamnur Rashid (2003b) Effect of different feeds on growth and survival of freshwater spiny eel, *Mastacembelus armatus* (Lacepede) reared in cemented cisterns. *J. Asiat. Soc. Bangladesh (Sci)*. 29 (2): 113-118.
- Nikolsky, G. V. (1963) *The Ecology of Fishes* (translated by L. Birkett). Academic Press. Inc. London and New York 17-19.
- Olukunle, O. A. (1982) Partial plant protein substitution in diets of fish feeding stage fry of tilapia, *Oreochromis mossambicus*. M. Sc. Thesis, Stirling University, U.K. 55pp.
- Rahman, M. A., S. Geyasuddin and S. C. Chakraborty. (1982) Formulation of quality fish feed from indigenous raw materials and its effect on the growth of catfish (*Heteropneustes fossilis*). *Bangladesh J. Fish.*, 2-5 (1-2): 65-72.
- Rashid, M. H., S. M. Rahmatullah and M. R. Amin. (1996) Preparation of low-cost feed for cage culture of pangus, *Pangasius sutchi* (Fowler). *Bangladesh J. Fish.*, 19 (1-2): 45-52.
- Ravindranath, K. (1988) Some observations on the culture of the air-breathing fish *Channa striata* (Bloch) in farm ponds. *Indian J. Fish.*, 35 (1): 13-17.
- Richards, A. (1983) The potential of sunflower and sesame meals as alternative source of protein in diets for *Oreochromis niloticus*. M.Sc. Thesis, Stirling University, U.K. 82pp.
- Sarker, M. S. A. (1996) Effects of treated and untreated soybean meal on the growth of Thai sharputi (*Pantius gonionotus* Bleeker) M. Sc. Thesis, Department of Fisheries Technology, Bangladesh Agricultural University, Mymensingh 60Pp.
- Tacon, A. G. J., K. Jauncy, A. Falaye, M. Partha, I. MacGowan and E. A. Stafford. (1984) The use of meat and bone meal, hydrolysed feather meal and soyabean meal in practical fry and fingerlings diets for *Oreochromis niloticus*. In: (L. Fishelson and X. Yaron Editors) *Proc. First. Int. Symp. Tilapia in Aquaculture*. 356-365.