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Growth Response and Feed Conversion Ratio of *Labeo rohita* Fingerlings for Rice Polishing, Sunflower Meal and Fish Meal

TAYYABA ALI AND MUHAMMAD SALIM
Department of Zoology and Fisheries, University of Agriculture, Faisalabad–38040, Pakistan

ABSTRACT

Soybean meal, wheat bran, maize gluten (30%), fish oil, vitamins premix and minerals premix were mixed to formulate reference diet (30% protein). Three test diets viz. test diet-1 (fish meal), test diet-2 (sunflower meal) and test diet -3 (rice polishing), were formulated by mixing 70% of reference diet and 30% of test ingredient i.e. fish meal, sunflower meal and rice polishing. The diets were offered at 4% of wet body weight of fingerlings. Higher increase in body weight 3.205±0.0305 g was from test diet-1 (fish meal) followed by 2.635±0.455 g on test diet-2 (sunflower meal) and 2.515±0.035 g from test diet-3 (rice polishing); whereas, on reference diet it was 2.810±0.016 g. Maximum increase in average total body length on test diet 3 (rice polishing) was 6.625±0.005 cm and next higher increase was 6.54±0.04 cm on test diet-1 (fish meal) and 6.07±0.054 cm test diet-2 (sunflower meal). Average total body length obtained from reference diet was 5.985±0.025 cm. FCR value calculated for reference diet was 396. Among test diets, FCR value was 5.27 for test diet 3 (rice polishing) followed by 3.026 for test diet-1 (fishmeal) and 3.021 for test diet-2 (sunflower meal).

Key Words: *Labeo rohita*; FCR; Rice polishing; Sunflower meal; Fish meal

INTRODUCTION

Rapid increase in world population needs food for its growth. Shortage of food especially protein is very serious problem for human population. Fish is a good source of protein and also has essential amino acids with minerals like zinc, magnesium, sodium etc. (Barlas, 1986). Fish farming and aquaculture industry play significant role in contributing fish protein to large Asian population (Ravenhalt, 1982). Advancement of Aquaculture is largely depended on availability of compatible and acceptable diet. For the formation of fish diet feed conversion ratio (FCR) is a good tool to compute the acceptability and suitability of artificial diet. The information of FCR of locally available ingredients will provide the basis to develop acceptable fish feed. The feed conversion ratio (FCR) that expresses food consumed per unit weight gained by the body has been variously termed as food quotient or food coefficient etc. Borgstorm (1961) termed it as growth coefficient. The FCR values of various feed ingredients have been estimated for *Cirrhinus mrigala* using single feed ingredient by Seema *et al*. (2002); Shabbir *et al*. (2003) and Jabeen *et al*. (2004). The value of conversion of rate besides depending upon nutrient content of the feed, also varies with (i) method of presentation of food to fish (ii) environmental factors such as temperature, dissolved oxygen concentration etc. (iii) size of fish (iv) stocking density of fish (v) stage of sexual maturity of fish etc.

There is a need to evaluate the locally available feed ingredients for obtaining reliable data. In the present study, the feed conversion ratio (FCR), of rice, polishing, fish meal and sunflower meal for *Labeo rohita* fingerlings was evaluated.

MATERIALS AND METHODS

Labeo rohita fingerlings were collected from Govt. 'Fish Seed Hatchery Satiana Road, Faisalabad, and kept in cemented tanks for 15 days of acclimatization where they were fed on reference diets.

The experiment was conducted in eight glass aquaria especially designed for the collection of resting diets in Fish Nutrition lab. Each aquarium had a feeding and non feeding chamber. Non feeding chamber has dimension 35x36.5x35 cm^3 and feeding chamber is broad above (60X36.5 cm^2) and narrow below (16 & 10 cm^2). After acclimatization fingerlings were transferred into glass aquaria. For each treatment two replicates were used and in each replicate 10 finglinergs were stocked (1.905±0.95 g). Fingerlings were fed at the rate of 4% of live net weight twice a day in feeding chambers for two hours then shifted to non feeding chambers. Remaining diet was collected at the end of the day. Each aquarium was filled with water up to the level of 25 cm and the level was maintained throughout experimental period.

The ingredients in reference diet were included on the basis of previous results of Seema *et al*. (2002), Shabbir *et al*. (2003) and Jabeen *et al*. (2004). The three test diets were composed of 70% reference diet and 30% test ingredient on dry weight basis (Table I). The ingredients used in reference and test diets were sieved. All dry ingredients were mixed in mixer for 30 minutes. Fish oil was gradually added while mixing constantly eighty 5 mL of water /100 g of feed was slowly blended into mixer resulting in suitability texture dough as for fish food (Lovell, 1989). Drying was carried out in a convection oven at 35°C for 48 hrs. The dry product was cut into pellets of 3 mm. The above procedure was

Table I. Percentage composition of different ingredients on dry matter basis

Ingriedient	Test diet –1	Test diet-2	Test diet-3	Reference diet
Soybean meal	35	35	35	50
Wheat bean	15.4	15.4	15.4	22
Maize gluten 30%	14.7	14.7	14.7	
Fish oil	3.5	3.5	3.5	5.0
Minerals	0.7	0.7	0.7	1.0
Vitamins premix	0.7	0.7	0.7	1.0
Fish meal	30	-	-	-
Sunflower meal	-	30	-	-
Rice Polishing	-	-	30	-
Total	100	100	100	100

followed to produce a reference and three test diets.

The morphometric characteristics i.e. body weight and total body length of randomly taken five fingerlings of each replicate was recorded. Body weight of fingerlings was used to estimate feed of fingerlings for next week. The diet used by fingerlings was calculated by subtracting resting diet from quantity of diet given. Feed conversion ratio (FCR) of reference and test diets was worked out according to Jhingran (1991).

$$Feed\ Conversation\ Ratio = \frac{Quantity\ of\ \ feed\ Consumed}{Weight\ Increased}$$

The data of body weight total body length and FCR were analyzed using analysis of variance (ANOVA). The comparison of mean values of various parameters was followed by Duncan's multiple Range Test (DMR) according to procedure described by Steel and Torrie (1992).

RESULTS AND DISCUSSION

Body weight, total body length, and FCR values in *Labeo rohita* fed on reference and test diets are given in Table II. Statistical analysis revealed that effect of diets on body weight, total body length and FCR was significant (P>0.05). The comparison of mean values of average body weight, average body length and FCR on reference and test diets is presented in Table III. It indicated that mean average body weight on test diet-I (fish meal) was significantly different from test diet-2 (sunflower meal) and test diet-3 (rice polishing) but was non significantly different from reference diet because difference between their mean was less than least significant difference (LSD) value (0.2876). The average body weight among test diet- 2 (sunflower meal) test diet-3 (rice polishing) and reference diet revealed that these diets were non significantly different from each other. The comparisons of mean values of average total body length among different diets revealed that length increased on test diet-1 (fish meal) was non significantly different from test diet-3 (rice polishing) but significantly different from test diet-2 (sunflower meal) and reference diet as the difference between their mean was greater than LSD value (0.2579). The length increased on test diet-2 (sunflower meal) was significantly different from test diet-3 (rice polishing) whereas with reference diet it was non significantly different. The length increased on test diet-3 (rice polishing) was, however significantly different from reference diet. The comparison of mean values of average FCR on reference and three test diets revealed that the FCR value on test diet-1 (fish meal) differ non significantly from test diet-2 (sunflower meal) as difference between their mean was less than LSD value (0.7940), but significantly differ from test diet-3 (rice polishing) and reference diet. The FCR value of test diet-2 (sunflower meal) differs significantly from test diet-3 (rice polishing) and reference diet. Test diet-3 (rice polishing) differs significantly from reference diet. Regression lines (Fig. 1 & 2) showed trend in body weight gain and increase in total body length by *Labeo rohita* fingerlings under the influence of four diets throughout experimental period was linear. Regression equations for test diet-1 (fish meal) were T_1=1.67+0.224X

Table II. Weekly variations of average body weight, average total body length and FCR of *Labeo rohita* fed on different diets

Week	Test diet-1 (fish meal)			Test diet-2 (sunflower meal)		
	Av. Body wt.	Av. Total body length	FCR	Av. Body wt.	Av. Total body length	FCR
Initial	192±0.100	5.66±0.02	-	1.635±0.455	5.250±0.450	-
1	2.042±0.135	5.76±0.45	4.060±1.120	1.770±0.500	5.38±0.030	2.660±0.140
2	2.365±0.185	5.955±0.45	1.705±0.125	1.905±0.455	5.51±0.450	4.020±0.250
3	2.590±0.230	6.125±0.005	2.740±0.340	2.095±0.455	5.705±0.505	2.655±0.645
4	2.785±0.245	6.30±0.020	3.635±0.315	2.265±0.455	5.48±0.535	2.890±0.630
5	3.04±0.32	6.440±0.030	2.798±0.722	2.455±0.455	5.955±0.535	3.080±0.55
6	3.205±0.305	6.540±0.040	3.220±0.190	0.635±0.455	6.07±0.540	2.820±0.640
	Test diet -3 (rice polishing)			Reference diet		
Initial	1.905±0.95	5.705±0.955	-	2.005±0.095	5.090±0.02	-
1	1.995±0.95	5.94±0.06	5.670±0.07	2.100±0.010	5.22±0.010	4.310±0.100
2	2.085±0.95	6.215±0.015	5.30±0.020	2.190±0.010	5.43±0.02	4.770±0.610
3	2.230±0.040	6.29±0.02	5.120±0.090	2.325±0.005	5.54±0.020	4.565±1.245
4	2.330±0.030	6.405±0.025	5.250±0.090	2.480±0.035	5.655±0.015	3.318±0.172
5	2.42±0.30	6.535±0.025	5.075±6.025	2.655±0.025	5.82±0.030	3.485±0.145
6	2.515±0.035	6.625±0.005	5.165±0.045	2.810±0.010	5.985±0.025	3.330±0.010

Table III. Overall comparing of average body weight, average total body length and FCR of *Labeo rohita* on different diets

Diets	Test diet-1 (Fish meal)	Test diet -2 (Sunflower meal)	Test diet-3 (Rice polishing)	Reference diet
Body weight	2.50a	2.11b	2.21b	2.36ab
Body length	6.11a	6.74b	6.24a	5.53b
FCR	3.026c	3.021a	5.263a	3.963b

(r^2=99.4%) and T_1=5.49+0.155X (r^2=99.3%) for weight and length, respectively.

Although trend remains different but overall increase was linear. Regression equations for test diet-2 (sunflower meal) were T_2=1.43+0.169X (r^2=99.6%) and T_2=5.11+ 0.141X (r2=99.4%) for both parameters. Regression equation for test diet -3 (rice polishing) were T3 = 1.79+0.104X (r^2=99.6%) and T3 = 5.65 + 0.148 X (r2=99.4%) for weight and length respectively. For reference diet, regression equations were T_4=1.82+0.130X. (r^2=98.6%) and T_4=4.95+0.148X (r^2= 95.4%) for both parameters. It showed that maximum linear increase was for test diet-2 (sunflower meal) and test diet-3 (rice polishing) which was followed by test diet-1 (fish meal) and reference diet. High value of r^2 >90 for reference and test diets showed that increase in body weight and body length of fish was due to effect of these diets. The higher average body weight on test diet-1 (fish meal) showed the feeding preference of fish. The preference might be due to presence of higher crude protein contents in fish meal (48.15%) and sunflower meal (40.33%). The inference could be drawn that the *Labeo rohita* prefer to eat the diet having higher crude protein contents. The present results are in line with the findings of Rajbanshi *et al*. (1989). The possible reason for better growth of fish on fish meal might be the presence of balanced profile amino acids in the fish meal and sunflower meal than rice polishing. Deshimaru and Shigueno (1972) calculated the amino acid composition of the diet with their performance. Diets lower in arginine, lysine and histidine gave poor conversion. Kitabayashi *et al* (1971) found that the addition of 0.5% methionine and 0.83% arginine to squid meal improve it further. The methionine may be balancing the deficiency of cystine in the diet. The percent of growth limiting amino acids (arginine, histidine, lysine and methionine) in fish meal and sunflower meal is comparatively higher than rice polishing and these amino acids might be played important role for higher growth of fish. They reported that 45 days old rohu (*Labeo rohita*) fingerlings gave the highest growth rate on diets containing 39.18% protein than diets containing 25.4% protein. Similar results were obtained by Salim and Sheri (1999). They observed significant influence of high protein diets (50%) on growth performance of *Labeo rohita* fingerlings followed by medium protein diets (45%) and low protein diet (40%) respectively. The overall feed conversion ratio (FCR) was observed to be high for test diet-3 (rice polishing) 5.26 followed by reference diet 3.96, test diet -1 (fish meal) 3.17 and for test diet -2 (sunflower meal) FCR calculated was 3.03. This means that greater quantity of test diet-3 (rice polishing) was required for a unit weight of fish where as test diet-2 (sunflower meal) and test diet-1 (fish meal) was required in lowest quantity for a unit weight gain of fish. The findings revealed that sunflower meal and fish meal in diets were more acceptable ingredients for fish as compared to rice polishing. The results were in accordance with results presented by Das and Ray (1991). They observed the growth response and feed conversion in *Labeo rohita* fingerlings at varying dietary protein levels. FCR increased with increasing dietary Protein up to 35% and therefore decreased being minimum for the diet with 55%

Fig. 1. Regression line of body weight of Labeo rohita for different diets at various weeks

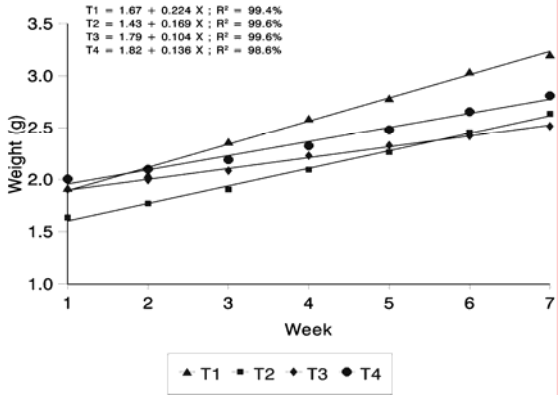
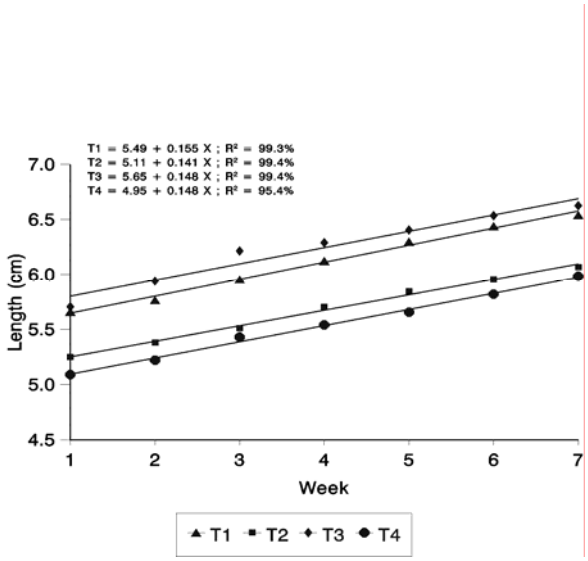


Fig. 2. Regression line of body length of *Labeo rohita* for different diets at various weeks



protein. Protein and a feed efficiency ratio values were negatively correlated with dietary Protein concentration. Similar results were observed by Seema *et al.* (2002) who reported that fingerlings of *Cirrhinus mrigala* gained higher body weight and lowest FCR on maize oil cake as compare to other ingredients i.e. rice polishing and rice broken. This means that fish had used less quantity of maize oil cake for gaining higher body weight. Saima (2002) observed that fingerlings of *Cirrhinus mrigala* gained maximum weight and lowest FCR value on fish meal and cotton seed meal. The rate of feed application also plays an important role in determining the growth trend 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).They reported that feeding beyond 4% was wasteful and accumulation of feed caused deterioration of water quality. The same results also reported by Salim and Sheri (1999). They reported that *Labeo rohita* gave significant growth on 4% level of feeding than 2% level of feeding. In conclusion the present study revealed that growth performance of *Labeo rohita* fingerlings was higher and FCR was lower on test diet - 1(fish meal) and test diet-2 (sunflower meal). This show that fishmeal and sunflower meal are the suitable and compatible ingredients for *Labeo rohita* fingerlings and these ingredients could preferably be included in fish feed formulation.

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