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Relationship Between Feeding Frequency and Growth of One Indian Major Carp *Labeo rohita* (Ham.) Fingerlings Fed on Different Formulated Diets

¹Biplab Bikash Paul Choudhury, ²David Rintu Das, ³Md. Ibrahim and ⁴S.C. Chakraborty

¹Upazilla Fisheries Office Shahzadpur, Sirajganj, Bangladesh

²Bangladesh Fisheries Research Institute, Fresh Water Substation, Chanchra, Jessore, Bangladesh

³Rice Farming Systems Division, BRRI, Gazipur, Bangladesh

⁴Department of Fisheries Technology, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Abstract: A 50-days feeding trial was conducted with the fingerlings of rohu (*Labeo rohita* Ham.) using three diets A, B and C containing fish meal, mixed animal protein and mixed plant protein each having 2, 4 and 6 times feeding frequencies per day to observe the growth performance. The highest and lowest mean growth percent of 130.60 and 70.00 % was observed in fish fed on diet A and diet C with 6 times and 2 times feeding frequencies per day respectively. Food conversion ratio of 1.95 was significantly higher ($p < 0.05$) in fish fed on diet C having 2 times feeding frequencies while the least value of 1.29 was obtained in fish fed on diet A having 6 times daily feeding frequency. Protein efficiency ratio ranged from 1.52 in fish fed on diet 'C' with 2 times feeding frequency to 2.32 in fish fed on diet 'A' with 6 times feeding frequency. Other growth parameters viz., specific growth rate apparent net protein utilization and apparent protein digestibility were also studied. The results of the present observation demonstrated that the growth performance of *L. rohita* were the best at 6 times feeding in a day by using either diet A or diet B.

Key words: Feeding frequency, growth, *Labeo rohita*, formulated diets

Introduction

The growth of biomass of fish in case of semi-intensive and intensive culture system depends on various factors notably on feeding regime. In this aspect the feeding rate and feeding frequency should be determined for individual feeds and carefully monitored for feed consumption, growth and feed efficiency over a period of significant growth time. Feeding frequency may provide maximum utilization of diet. It is evident from earlier studies that rate of feeding nutrient intake and feed efficiency as excess feeding may lead to leaching of nutrient and limited feeding may suppress growth due to starvation. Therefore, it is important to standardize the feeding frequency and feeding rate for the target species in aquaculture in getting optimum production. There has been numerous experiments on feeding trial with formulated diets on the Indian major carp rohu, *Labeo rohita* which is a leading, popular and commercially cultured fish species in Bangladesh (Chiu *et al.*, 1987; Carlos, 1988; Jayram and Shetty, 1980 and Rangachoryulu *et al.*, 1991). However reports on experiments regarding feeding frequency of this species are very few. Therefore, this experiment has been designed to study the growth response and feed efficiencies of Indian major carp rohu, *Labeo rohita* fed on different formulated diets having different feeding frequencies of two, four and six times every day.

Materials and Methods

The fifty days feeding trial was conducted in eighteen rectangular glass aquaria of static indoor fish rearing system in the laboratory of Fisheries Technology, Bangladesh Agricultural University, Mymensingh in the months of July to September 1998. Adequate aeration in each aquarium water was maintained by using an air pump (Daivo pump NS 4200). The experimental fish were collected from a local fish farm of Mymensingh and were then transferred to acclimation tank. Prophylactic treatment with 0.2 ppm methylene blue solution for first 24 hours was applied in the acclimation tank. The fish fingerlings were fed pelleted diet at the rate of 1.0 % body weight containing 32 % crude protein during two weeks acclimation period. Natural photoperiod was maintained during the experimental period. Temperature during the experiment ranged between 27 and 32°C. For the three diets different feed ingredients viz. fish meal, meat and bone meal, protein concentrate, mustard oil cake soybean meal, sesame cake rice bran and wheat flour were selected (Table 1). All the dietary

ingredients were finely ground and sieved to pass through a 0.5 mm mesh. Proximate analysis was done for each ingredient before using in the diet. Formulation of three experimental diets were made to contain 33 % dietary protein were designated as A, B and C containing fish meal, mixed animal protein (fish meal plus protein concentrate plus meat and bone meal) and mixed plant protein (master oil cake, soybean meal, sesame cake, rice bran) respectively (Table 1). Vitamin and mineral premix, chromic oxide, soybean oil were mixed homogeneously with the ingredient and some warm water added to make the mixture moist. This resultant dough was extruded through 2 mm diameter die of a pelleted machine (Alexanderwerk, GKM, Germany). The pelleted feeds were then sun-dried for two days followed by an oven drying at 70°C for about 10 h. All the diets were separately packed in plastic cans and stored in deep freezer for further use and analysis.

Fish in three treatments having two replicates were scheduled and were fed in daily ration in three frequencies of 2, 4 and 6 times daily. In this purpose 12 fingerlings of rohu, *Labeo rohita* of 0.99 ± 0.11 g size from the acclimation tanks were taken and released in experimental aquaria each of two replicates in 3 treatments. The feeding frequencies of the three treatments were 2, 4 and 6 times for each diet per day at regular interval starting at 9.00 am to 4.30 pm. Any uneaten food or faeces from each aquarium was removed by siphoning method. About one-third water from each aquarium was changed every morning to keep the water quality as good as possible. Close observation was made during feeding so that no pelleted diets were left uneaten in the aquaria. The total amount of food fed was recorded for each replicate in order to subsequent calculation of food conversion ratio, (FCR) protein efficiency ratio (PER), apparent net protein utilization (ANPU) and specific growth rate (SGR). Fish were bulk weighed every tenth day to adjust feeding rate for the subsequent week and they were fed up to satiation level. Important water quality parameters such as dissolved oxygen, temperature, pH were monitored weekly throughout the experimental period. Ammonia was not measured because partial water in the aquaria were replaced by fresh water regularly. The proximate composition of dietary ingredients, diets, faeces and fish samples were analyzed according to standard procedures given in Association of Official Analytical Chemists (Anonymous, 1980). All diets formulated were isocaloric and the gross energy content

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(Kcal/g) was estimated after Smith (1971), Pike and Brown (1967). To study protein digestibility of the formulated diets, 0.5 % chromic oxide was used as a marker and was determined as followed by Furukawa and Tsukahara (1966). The digestibility was determined by the formula of Maynard and Loosli (1969). For statistical analysis two-way ANOVA was done (Zar, 1984) to observe the treatment variation over different frequencies of feeding.

Results and Discussion

The diets had crude protein level of 33.34, 33.13, 33.36 % respectively whereas lipid ranged from 11.35 to 12.60 %. The gross energy in A, B and C was 4.35, 4.22 and 4.25 Kcal/g dry diet (Table 1). Water quality parameters such as temperature, dissolved oxygen and pH ranged from 27 to 30°C, 6.8 to 7.3 and 5.1 to 6.5 mg/l respectively. The crude protein level in the formulated diets was scheduled as 33 % which was near 28-29 % protein level for the same fingerling of *Labeo rohita*. Mohanty and Swamy (1986), Hanifa *et al.* (1987) and Rangacharyulu *et al.* (1991) used 30.2 % crude protein in diet of *L. rohita* in another experiment. The same species where 38 % dietary protein was satisfactory for growth of *Labeo rohita* fingerlings has been reported by Das *et al.* (1991). Nandeesh *et al.* (1993) used 31.8 % protein level and Hossain and Juncey (1989) used 30 % dietary protein for same fish species.

Table 1: Formulation of different experimental diets and Proximate composition (dry wt. basis) of the prepared diets

Ingredients dry wt. (g)	Diets		
	A	B	C
Fish meal	43.00	13.60	-
Protein concentrate	-	17.20	-
Meat and bone meal	-	15.90	-
Mustard oil cake	-	-	13.00
Soybean meal	-	-	49.50
Sesame cake	-	-	10.50
Rice bran	-	-	15.00
Wheat flour	30.00	30.00	10.00
Carboxy methyl Cellulose	2.00	2.00	-
Tasting salt	0.50	0.50	0.50
Vit. Premix	1.00	1.00	1.00
Chromic Oxide	0.50	0.50	0.50
L-Cellulose	19.00	16.00	-
Soybean oil	4.00	3.30	-
Total	100.00	100.00	100.00
Proximate composition (%)			
Dry matter	92.92	93.13	92.28
Crude protein	33.34	33.13	33.36
Crude lipid	11.53	11.32	12.60
Ash	9.65	12.67	13.53
+NFE	45.48	43.04	40.51
Gross energy (Kcal/g)	4.35	4.22	4.25

+ Nitrogen Free Extract calculated as:
100 - (Moisture + Crude protein + Crude lipid + Ash) %

Maximum mean percent weight gain during the feeding trial was observed in the group of fish fed on diet A containing fish meal at different feeding frequencies. Significantly higher (p < 0.05) percent growth was observed in the fish fed 6 times daily on diet A. Similar results of significantly higher (p < 0.05) growth was observed in fish fed 6 times a day on the diets B and C (Table 2). Thus, increase of feeding frequencies of all the three diets showed an increased growth of fish. Significantly different and lowest (p < 0.05) growth was found in fish fed on diet C having a feeding frequency of 2 times per day (Table 2). Similar results were observed by Mohanty and Swamy (1986), Nandeesh *et al.* (1994) in the same species of *Labeo rohita*. Increase of feeding frequencies in this study showed significantly (p < 0.05) increased growth in all treatments. Similar results were also reported by Chiu *et al.* (1987) on growth of milk fish (*Chanos chanos*), Brandles *et al.* (1988) and Carlos (1988) in big head carp fry. Consequently, a significantly (p < 0.05) lower and the minimum SGR (%) was obtained with the fish fed twice in all three diets. Jarboe *et al.* (1997) found that increased feeding frequency significantly (p < 0.05) improved specific growth rate and feed conversion rate of channel cat fish. Also Golden *et al.* (1997) had similar findings on gilthead seabream (*Sparus aurata*) and Josekutty *et al.* (1996) in case of prawns. In this study FCR varied from 1.29 to 1.40 in A, 1.47 to 1.60 in B and 1.56 to 1.95 in C at different feeding frequencies. Diet A had least FCR at 6 times feeding frequencies than in others. Different authors have reported values of FCR on different fishes such as 1.12 to 1.35 for *Cyprinus carpio* with formulated diet (38.74 % protein level) at five times feeding by Capper *et al.* (1982); 3.68 to 3.82 for *Labeo rohita* (23.9 % protein level) in cages by Ahmed *et al.* (1983); 3.08 in *L. rohita* by Rangacharyulu *et al.* (1991) and 1.79 to 2.16 for *L. rohita* by Ahsan (1995), for diet containing (33.92 % protein) which were very close to the findings of the present study. Protein efficiency ratio (PER) of the present study ranged from 1.52 to 2.32. Significantly highest (p < 0.05) PER produced by treatment A at six times feeding per day followed by B and C respectively. The effect of diets on ANPU was found to be significantly (p < 0.05) different from each other. It was seen that the ANPU value in general was largest and smallest with fish fed on diets A and C respectively. At different feeding regimes there was difference between ANPU values of different sources of A, B and C. It was clear that the protein utilization capacity of fish at 4 and 6 times feeding frequency was higher than 2 times feeding. Apparent protein digestibility (APD) values of various treatment groups were presented which ranged at different feeding schedules from 81.70 to 82.0 (Treatment A), 77.16 to 78.69 (Treatment B) and 72.88 to 74.68 (Treatment C). Feeding at 6 times per day showed the highest APD values.

However, no significant difference was observed between the APD value of fish fed 2, 4 and 6 times on diet A containing fish meal. Jayaram and Shetty (1980) reported APD value of 91.88 % in rohu fish fed on formulated diets. Anonymous (1977) has reported 90 % of APD value of channel catfish. Alexis *et al.* (1988)

Table 2: Growth parameters of *Labeo rohita* fed on three experimental diets for 50 days of feeding trial

Treatments (Diet x Frequency)	Initial wt. (g)	Final wt. (g)	Wt. gain (g)	Feed intake (g)	% of wt. gain	SGR %	FCR	PER %	ANPU %	APD %	
A	A ₂ *	12.10	24.10	12.00	16.80	99.17 ^a	1.37 ^d	1.40 ^{bd}	2.14 ^{bc}	29.18 ^c	81.70 ^a
	A ₄	12.20	25.98	13.79	18.61	112.90 ^b	1.50 ^c	1.35 ^b	2.21 ^b	34.16 ^a	81.40 ^a
	A ₆	11.50	26.52	15.37	19.98	130.60 ^a	1.73 ^a	1.29 ^a	2.32 ^a	31.67 ^b	82.00 ^a
B	B ₂	12.30	23.71	11.41	18.26	92.76 ^c	1.31 ^d	1.60 ^c	1.88 ^f	18.19 ^e	77.16 ^c
	B ₄	12.00	25.26	12.96	20.08	110.51 ^b	1.48 ^c	1.51 ^{cd}	1.99 ^{de}	18.18 ^e	78.10 ^b
	B ₆	11.60	26.03	14.43	21.29	124.39 ^a	1.61 ^b	1.47 ^{bd}	2.04 ^{cd}	21.68 ^d	78.69 ^b
C	C ₂	11.50	19.55	8.05	15.77	70.00 ^e	1.05 ^f	1.95 ^d	1.52 ^d	12.80 ^f	72.88 ^e
	C ₄	12.10	22.18	10.08	17.29	83.30 ^d	1.21 ^e	1.71 ^f	1.74 ^d	17.52 ^e	73.36 ^e
	C ₆	11.50	22.88	11.38	17.85	98.09 ^a	1.37 ^d	1.56 ^{cd}	1.90 ^{de}	28.22 ^d	74.68 ^d

* Figures in the same column having the same superscripts are non significantly different.

* A₂, A₄, A₆, B₂, B₄, B₆, C₂, C₄, C₆, indicates the means of replicates of fish fed at 2, 4 and 6 times feeding frequencies on diets A, B and C respectively. SGR = Specific growth rate FCR = Feed conversion ratio PER = Protein efficiency ratio ANPU = Apparent net protein utilization APD = Apparent protein digestibility

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found 60-80 % APD of rainbow trout's. Biswas (1997) reported in case of *Puntius gonionotus* as APD value of 80.50 % fed on fishmeal diet and 72.10 % for mixed plant diet. This experiment shows a direct relationship between the feeding frequency and growth performance. By using various diets the best result on growth of fish was obtained with the diet A having "fish meal" with 6 times feeding frequency followed by the diet B having mixed animal protein. But the diet C showed a poor response which contained plant protein. Therefore, it can be concluded that feeding frequency and type of dietary protein content plays a significant role on growth performance of *Labeo rohita* to make the feed for its best utilization to increase total biomass.

References

- Ahmed, G.U., A.K.M. Haque, M.A. Islam and M.M. Haque, 1983. Intensive culture of *Labeo rohita* (Hamilton) in floating ponds with special references to different stocking densities. *Bangla. J. Fish.*, 6: 11-17.
- Ahsan, M.N., 1995. Growth of rohu *Labeo rohita* (Ham.) fingerlings Originating from hatcheries and those from wild sources fed on two formulated diets., M.Sc. thesis. Bangladesh Agricultural University. Mymensingh, pp: 59.
- Alexis, M., M. Filioglov and V. Theochari, 1988. Apparent digestibility measurement of feed stuffs having potential for use in rainbow trout's diets. *Thalassographica*, 11: 19-26.
- Anonymous, 1977. Nutrition Requirement of Warm Water Fishes, National Academy of Sciences, Washington D.C., (National Research Council) 31: 2.
- Anonymous, 1980. Official Methods of Analysis. Association of Official Analytical Chemists, W. Horwitz (Ed.) 13th ed., Washington D.C., pp: 305.
- Biswas, M.R., 1997. Animal and Plant Protein diets in the growth of *Puntius gonionotus* fingerlings. M.Sc. thesis Dep. Fisheries Technol., Bangladesh Agricultural University, Mymensingh, pp: 61.
- Brandles, R. and I. Nelsen, 1988. Feeding frequency of black Bird stud, *Aquaculture*, 35: 137-141.
- Brown, M.E., 1957. Experimental studies on growth. In: *The Physiology of Fishes* (M.E. Brown, Ed.), Academic Press. New York. Vol. 1, pp: 361-400.
- Capper, B.S., J.F. Wood and A.J. Jackson, 1982. The feeding value for carp of two types of mustard oil cakes from Nepal. *Aquaculture*, 29: 373-377.
- Carlos, M.H., 1988. Growth and survival comp. of big head carp (*Aristicthys nobilis*) fry fed at different intake levels and feeding frequency. *Aquaculture*, 6: 267-276.
- Chiu, Y.N., N.S. Sumagaysay and M.G.S. Sastrillo, 1987. Effect of feeding frequency and feeding rate on the growth and feed efficiency of milk fish, *Chanos chanos* (Forsk.) juveniles. *Asian Fisheries Science*, 1: 27-31.
- Das, K.M., S.N. Mohanty and S. Sarker, 1991. Optimum dietary protein to energy ratio for *Labeo rohita* fingerlings. *Fish Nutrition- Research: In Asia. Proceedings of the fourth Asian Fish Nutrition Workshop*. Silva, S. S. de (ed.) No. 5, pp: 69 - 73.
- Furukawa, A. and H. Tsukahara, 1966. On the acid digestion method for determination of Chromic oxide as an indicator substance in the study of digestibility in fish. *Bull. Jpn. Soc. Sci. Fish.*, 32: 502-506.
- Golden, O., D. Popper and I. Karplus, 1997. Management of size variation in Juvenile gilthead sea bream (*Sparus auratus*) 1:1 Particle size and frequency of feeding dry and live food. *Aquaculture*, 152: 181-190.
- Hanifa, M.A., A.G. Murugesan and A.T. Fleming, 1987. Influence of plant animal food on food utilization of the freshwater carp *Labeo rohita* (Ham.) *Curr. Sci.*, 56: 846-848.
- Hossain, M.A. and K. Juncey, 1989. Studies on the protein energy and amino acid digestibility of fish meal, mustard oil cake, linseed and sesame meal for common carp (*Cyprinus carpio* L.). *Aquaculture*, 83: 59-72.
- Jarboe, H.H. and W.J. Grant, 1997. The influence of feeding time and frequency on the growth, Survival, feed conversion and body composition of channel catfish, *Ictalurus punctatus*, cultured in a three tier, close, recirculating raceway. *J. Appl. Aquacult.*, 7: 13-62.
- Jayram, M.G. and H.P.C. Shetty, 1980. Studies on the growth rates Catla, rohu and common carp fed on different formulated feeds, *Mysore J. Agric. Sci.*, 14: 589-606.
- Josekutty, P.A. and S. Jose, 1996. Optimum ration size and feeding frequency for rearing of *Peneaus monodon* Fabricus fish Technol. Soc. Fish. Technol. India, 33: 16-20.
- Maynard, L.A. and J.K. Loosli, 1969. Animal nutrition 6th ed. Mc Graw-Hill. Book Company, pp: 613.
- Mohanty, S.N. and D.N. Swamy, 1986. Enriched conventional feed for Indian major carps. The First Asian Fisheries Forum Proceedings of the First Asian Fisheries forum Manila, Philippines, 26-31, May 1986. Maclean, J.L., Dizan, L. B., Hosillos. L.V., (Eds.) pp: 597 -598.
- Nandeesh, M.C., S.S. De Silva and Krishnamurthy, 1993. Evaluation of mixed feeding schedules in two Indian major carps. *Catla* (*Catla catla*) and rohu (*Labeo rohita*). In: *Fish Nutrition in Practice*: Kaushik, S.J.J. and Lequet P. (Eds.) Paris, France, Institute National De-la Recherche Agronomique. no. 61. pp: 753-765.
- Nandeesh, M.C., S.S. De- Silva, D.K. Murthy and K. Dathatri, 1994. Used of mixed feeding schedules in fish culture Field trials on *Catla catla*, *Labeo rohita* (Hem.) and *Cyprinus carpio* L., *Aquaculture Fish. Manage.*, 25: 659-670.
- Pike, R.L. and M.L. Brown, 1967. Nutrition: an integrated approach, John Willey and Sons. Inc. New York, pp: 542.
- Rangachoryulu, P.V., S. Sarker, S.N. Mohanty and P.K. Mukhopadhyay, 1991. Growth and protein utilization in rohu (*Labeo rohita*) under different feeding levels. National Symposium on New Horizons in Freshwater Aquaculture, pp: 95-97.
- Smith, R.R., 1971. A method for measuring digestibility and metabolized energy of fish feeds, *Prog. Fish. Cult.*, 33: 132-134.
- Zar, J.H., 1984. Biostatistical Analysis 2nd ed. Prentice Hall International. Inc. Newjersey, pp: 718.