Sabina Sultana
Associate Professor, Department
of Zoology, University of
Rajshahi, Rajshahi, Bangladesh

Shihab Alam
Department of Zoology,
University of Rajshahi,
Rajshahi, Bangladesh

Sahadat Hossain
Department of Zoology,
University of Rajshahi,
Rajshahi, Bangladesh

Growth and survival rate of two indigenous fish species with three different feeds under tank condition

Sabina Sultana, Shihab Alam and Sahadat Hossain

Abstract
The objective of this present investigation was to inspect the growth and survival rate of *Labeo rohita* and *Cirrhinus mrigala* after feeding different mixture feeds in tank condition. The study was conducted during the period February, 2016 to December, 2016 at Field Laboratory, Department of Zoology, University of Rajshahi, Bangladesh. The maximum growth in length and weight was calculated for *L. rohita* as 46.79% and 185.17% respectively in Tank-1 with Mustard oil cake and Rice bran mixture diet. In survival test, at the end of study period *L. rohita* and *C. mrigala* showed 57.16% survival with T1 with Mustard oil cake and Rice bran mixture diet and T3 with Wheat flour and Mustard oil cake mixture diet; 57.16% and 71.45% survival in T2 with Maize bran and Mustard oil cake mixture diet respectively; while without supplementary food *L. rohita* and *C. mrigala* showed 14.29% and 0% survival respectively at the end of study period.

Keywords: Growth, survival, indigenous, *Labeo rohita*, *Cirrhinus mrigala*

1. Introduction

Bangladesh possesses the largest flooded wetland of the world, and recently considered as one of the fittest areas of the world for culturing different fish species due to its advantageous geographical position [1]. At present, fish is considered to be the second most valuable agricultural crop of Bangladesh and its production serves as a huge source of national revenue as well as to the employment of millions of people [2]. Fisheries division plays a key role in the domestic economy, subsidizing to the Gross Domestic Product (GDP) as 3.69% to the country and 22.60% to the agricultural GDP [3]. Indigenous fish are a critical component of healthy aquatic ecosystems as they form an important part of the aquatic food web and fulfill several important ecological functions. These fish need suitable habitat and good quality water, free of sediment and agrichemicals, in order to survive. About 260 species of freshwater indigenous fish are available in Bangladesh [4]. In Bangladesh, aquaculture production systems are mainly extensive and improved extensive, with some semi-intensive, and intensive systems, in very few cases [5]. Tank culture is now being considered as a good substitute for pond or cage culture. Intensive tank culture offers several advantages over pond culture. It allows both the male and female fish to be grown together to sellable size within a short time as with tank feeding it requires much less time and labor compared to ponds. Small tank volumes also make it easy and economical to treat varieties of diseases with healing chemicals liquefied in the culture water [6]. Different fishes consume different types of food items. So studies of food and feeding habit have immense value. Fishes have become adapted to a wide variety of food. Some of them feed exclusively on plants, other feed on animals, while a large number of species are omnivorous, deriving from requirements from both animals and plants. *Labeo rohita*, commonly known as "Rui" and *Cirrhinus mrigala*, known as "Mrigal" are two indigenous fish species that are treated as good fish for food as well as for special nutritive value. These fishes supply a moderate percentage of protein for the increasing population in Bangladesh. *L. rohita* is predominantly a planktivorous surface feeder at fry stage. From fingerling stage they change their feeding habit and start to feed on the bottom, basically on algae, decayed vegetation, mud, sand etc. The adapted gill rakers also recommend that it is also a filter feeding fish species [7]. *C. mrigala* is primarily olligophagous, feeding on the bottom on decayed vegetation, although it can also move to a filter feeding manner. To pick up the food materials from the substratum, the thin terminal lips are highly adapted of this fish species [8]. Variety of fish feed ingredients are available in Bangladesh.

Correspondence
Sabina Sultana
Associate Professor, Department
of Zoology, University of
Rajshahi, Rajshahi, Bangladesh

A huge percentages of these ingredients are gained from different plants or plant derivatives. Fish feed have a vital role in the value chain which confirms the ideal growth and development of diverse fish species cultured under a diversity of unlike circumstances [9]. Aquaculture systems that produced economically are highly dependent upon a moderate amount of low cost feeds with maximum nutritious feeds. The feed need to be nutritionally satisfactory and advantageous for operating a fish farm perfectly [10]. Commercially produced feeds are costly as maximum of the components are imported from another country and the expenses are now rising day by day. Consequently, it is essential to pursue cost effective alternative to supply the nutritious substances from locally produced low-priced ingredients to keep the feed costs within limit [11]. Nevertheless, bearing in mind the economic capability of maximum fish farmers in Bangladesh, plant-derived feeds ingredients are well recommended for aquaculture. In this study, three different feeds composed from four plant-derived feeds ingredients- Mustard oil cake, Rice bran, Wheat flour and Maize bran at different proportion, were fed to *L. rohita* and *C. mrigala* as supplementary feeds to check out the growth and survival rate after feeding different mixture feeds in tank condition.

2. Materials and Methods
2.1 Collection and transformation of fish
The specimens, Rui *(Labeo rohita)* and Mrigal *(Cirrhinus mrigala)* were collected from Nursery pond of Binodpur and Meherchondi, Rajshahi, Bangladesh. The fish was transported from Nursery ponds in container to the Field Laboratory.

Table 1: Length and weight of *L. rohita* and *C. mrigala* used in the start of experiment

Diet	Fish species	Average length (cm)	Average weight (cm)
T1	*L. rohita*	10.9	12.14
	C. mrigala	10.53	10.64
T2	*L. rohita*	10.56	12.57
	C. mrigala	11.35	11.71
T3	*L. rohita*	10.47	11.36
	C. mrigala	10.91	12.14
T4	*L. rohita*	10.44	10.64
	C. mrigala	10.87	11.07

2.2 Experimental set up with diets
The feeding trial was performed in tank. Each tank was made by Brick and Cement. The size of each tank was the length of 2 feet 9 inch, width of 1 feet 9 inch, and height of 1 feet 9 inch. Water capacity was 150 liters for all two species together. Tap water was used as the main source of water supply. Arrangements were made to ensure proper supply of dissolved Oxygen. Three different types of feed were used that were procured from Shaheb bazar feed market, Rajshahi, Bangladesh. The conventional mixture of Rice bran 50% + Mustard oil Cake 50% was used as the T1 diet whereas the 2nd diet was Maize bran 70% + Mustard oil Cake 30% used as the T2 and the 3rd diet was Wheat flour 60%+ Mustard oil Cake 40% as the T3. Prior to prepare pellet feed, all the ingredients were finely powdered. The feeding experiment was conducted in two phases. In phase-1: Each feed was tested in separate tank that held together of two species and study continued for 4 months. In phase-2: T4 was tested without feed of 2 fish species held together. After taking the initial length (cm) and

weight (g), the fish were immediately transferred to large tank, each species in separate tank. The fish were then acclimatized in running water for about 24 hrs. Then 7 fish for each species were transferred to a tank. Thus making total 14 fish for each tank prior to release of fish the tank were filled with tap water.

2.3 Sampling of fish for growth study
The fishes were sampled following a monthly schedule. On the sampling day, the fish were by scoop net and kept in plastic bucket with water and oxygenation arrangement. The fish were brought to the measurement table for taking measurement and weight.

2.4 Observations on fish
Observations were also made on mortality of fish for testing the survival rate. The first were inspected each day and any death observed was recorded. Observations were also on the preference of feed by individual fish species. In practice the acceptance of feed by the fish, preference of feed, approach to feed etc. were observed and recorded. Finally the average length and weight were also measured with the help of meter scale and electric balance machine.

2.5 Statistical analysis
All the calculations in the present study were done with the help of a scientific calculator. A total 56 specimens were studied through out of observation. The percentage growth was calculated by this following formula,

$$\text{Percentage growth (Length/weight)} = \frac{\text{Final data} - \text{Initial data}}{\text{Initial data}} \times 100$$

The survival rate was calculated by this following formula,

$$\text{Survival rate} = \frac{\text{No.of fish alive}}{\text{No.of fish used}} \times 100$$

3 Results
3.1 Growth
The fish species held together, fed with Rice bran 50% + Mustard oil Cake 50% pellet feed showed comparatively higher growth both in length and weight than other two feed types during the study period. In case of Rice bran 50% + Mustard oil Cake 50% pellet feed, in Tank-1, Mrigal showed comparatively lower growth increase in length and weight by the end of 4th month than Rui. By the end of 4th month, Rui and Mrigal showed about 41.74% and 40.55% in length; 175.04% and 140.98% in weight respectively. The fish feed by Maize bran (70%) + Mustard oil Cake (30%) pellet feed, in Tank-2, Mrigal showed comparatively lower growth increase in length and weight by the end of 4th month then other species. By the end of 4th month, Rui and Mrigal increased by 41.19% and 33.13% in length; 155.13% and 96.50% in weight respectively. The fish species held together, fed with Wheat flour (60%) + Mustard oil Cake (40%) pellet feed, in Tank-3, Mrigal showed little increase in length by the end of 4th month then other species. By the end of 4th month, Rui and Mrigal increased by 35.53% and 45.37% in length; 157.57% and 109.14% in weight respectively. In case of without feed (control) the fish species found no growth in length and decrease by weight at the end of the study period.

Table 2: Percentage growth of two fish species at average final length and weight

Diet	Fish species	Final length (cm)	Final weight (cm)	Percentage growth (%)	
				Length	Weight
T1	*L. rohita*	16	34.62	46.79	185.17
	C. mrigala	14.95	25.75	41.98	142.01
T2	*L. rohita*	15.25	32.5	44.41	158.55
	C. mrigala	15.02	22.7	32.33	93.85
T3	*L. rohita*	14.25	29.87	36.10	162.94
	C. mrigala	15.95	26.15	46.20	115.40
T4	*L. rohita*	10	5.5	-4.21	-48.31
	C. mrigala	10	8.5	-8.00	-23.22

3.2 Survival Rate

Survival rate with 3 types feed (Rice bran 50% + Mustard oil Cake 50%, Maize bran 70% + Mustard oil Cake 30% and Wheat flour 60% + Mustard oil Cake 40% pellet feed) Rui showed 57.16% rates up to the 4th month of rearing. Survival rate with 3 types feed (Rice bran 50% + Mustard oil Cake 50%, Maize bran 70% + Mustard oil Cake 30% and Wheat flour 60% + Mustard oil Cake 40% pellet feed) Mrigal showed 57.16% and 71.45% rates up to the 4th month of rearing. The fish species held together without feed, Rui showed only 14.29% survival rate up to the 4th month of rearing. By the end of 4th month while 100% mortality occurred in Mrigal.

Table 3: Survival rate of *L. rohita, C. mrigal* held together with different diets during experimental period

Diet	Fish species	May		June		July		August	
		No. of alive fish	Survival rate (%)	No. of alive fish	Survival rate (%)	No. of alive fish	Survival rate (%)	No. of alive fish	Survival rate (%)
T1	*L. rohita*	6	85.74	5	71.45	4	57.16	4	57.16
	C. mrigala	7	100	6	85.74	5	71.45	4	57.16
T2	*L. rohita*	6	85.74	5	71.45	4	57.16	4	57.16
	C. mrigala	7	100	6	85.74	5	71.45	5	71.45
T3	*L. rohita*	6	85.74	6	85.74	5	71.45	4	57.16
	C. mrigala	6	85.74	5	71.45	4	57.16	4	57.16
T4	*L. rohita*	5	71.45	4	57.16	3	42.87	1	14.29
	C. mrigala	4	57.16	3	42.87	1	14.29	0	0

4 Discussion

Bangladesh is basically an agricultural country, a wide range of agricultural crops byproducts and surpluses are recycled as fish feed. The traditionally fish feed constituents were found to be available as broken rice, mustard oil cake, maize, fish meal, pulse, soybean oil cake, snail shell meal, wheat flour, rice bran, wheat bran etc. [12]. In this investigation, the ingredients e.g. Mustard oil cake, Rice bran, Wheat flour and Maize bran at different proportion, were fed to as three mixtures to *L. rohita* and *C. mrigala* as supplementary feeds.

The results of the present study receive supports from the experiment done on growth and survival tests with different supplementary diets to different fish species conducted by previous researchers [13, 14]. The outcome is in agreement with the earlier accounts of Ahmad [15] and Huet [16], who revealed that fish growth is highly accelerated by using rice bran, wheat bran, slaughter-house intestines and blood in the composition and in varies forms and proportions as supplementary feed. The occurrence of positive influence of supplementary feeds on growth and survival rate of *L. rohita* and *C. mrigala* in tank condition found in this study agrees with that of Veerina *et al.* [17], Liang *et al.* [18] and Keshavanath *et al.* [19], who proved that cotton seed meal, deoiled rice bran, ground nut oil cake and sunflower meal extracts mixture accompanied by organic manure give to high yield in polyculture of different carp fishes.

In the present study, the growth and survival rate of two fish species, *L. rohita* and *C. mrigala* found to be increased gradually in each tank with different diets. Parallel observations were done by Hossain [20]. A series of experiment were conducted with purified test diets in common carp *(C. carpio)* and perceived that the carp spawn, fry and fingerlings were reached up to the optimum growth with the test diets having 45% protein and 26% carbohydrate [21]. The results of this current investigation also agree with that of Sing *et al.* [22], who independently reported that a mixture of fish meal plus ground nut oil cake plus wheat bran and yeast in a ratio of 25:65:5:5 having a protein content of about 45% was found to be better employed and gave significantly better renovation rate than the orthodox feed, while a mixture of ground nut oil cake and wheat in the proportion of 1:1 demonstrating that the portion of the conventional feed may be successfully reduced and fish meal used as alternative for obtaining significantly higher rate of growth and survival rate. As reported by Azim *et al.* [23] and Islam *et al.* [24], the growth and survival of carp fingerlings had greatly influenced by the artificial diet such as fish meal, soybean meal vitamin, vegetable oil, mineral, and rice bran mixture. The findings are in agreement with Jhingran [25], who reported that supplementary feed boosted the fish growth and survival in culture systems in the rearing ponds and nursery.

5 Conclusion

It was observed in the study that the culture of two indigenous fish species *(Labeo rohita, Cirrhinus mrigala)* with supplementary feed is easily possible in Bangladesh. Though two types of supplementary feeds were accepted but feed Type-1 (Rice bran + Mustard oil cake) was more favourable to the fishes as Rui and Mrigal showed more or less equal survival performance in this regard. From this investigation it can be concluded that the handling of carp fishes provided by supplementary feed boosted the growth along with survival

rate in tank condition. So, the people of Bangladesh can easily culture the carp fishes in tank condition by providing supplementary feeds. Moreover, culturing fishes in tank condition is very much effective in the present perspective of Bangladesh as there is a scarcity of cultivable land available for culturing fish.

6 Acknowledgement

7 References

1. Shamsuzzaman MM, Islam MM, Tania NJ, Al-Mamun MA, Barman PP, Xu X. Fisheries resources of Bangladesh: Present status and future direction, Aquaculture and Fisheries. 2017; 15:1-12.
2. Ghose B. Fisheries and Aquaculture in Bangladesh: Challenges and Opportunities. Journal of Aquaculture Research. 2014; 1(1):1001.
3. FRSS. Fisheries resources survey system (FRSS), fisheries statistical report of Bangladesh. Vol. 32, Bangladesh: Department of Fisheries. 2016, 1-57.
4. Rahman AKA. Freshwater Fishes of Bangladesh. Zoological Society of Bangladesh, Department of Zoology, University of Dhaka, Dhaka-1000, 1989, 1-285.
5. Hossain MAR. An overview of fisheries sector of Bangladesh. Research in Agriculture, Livestock and Fisheries. 2014; 1(1):109-126.
6. Rakocy JE. Tank culture of Tilapia. Southern Regional Aquaculture Center (SRAC). Publication Number 282, Texas Agricultural Extension Service, Texas A&M University, College Station, Texas, USA, 1989, 4.
7. Chondar SL. Biology of Finfish and Shell fish. SCSC Publishers (India), Howrah, 1999, 514.
8. Jhingran VG, Khan HA. Synopsis of biological data on *Labeo rohita*, *Cirrhinus mrigala* (Hamilton, 1822), FAO Fish Synopsis No. 32, FAO, Rome, Italy, 1979.
9. Thorarinsdottir RI, Jokumsen A, Bjornsson BT, Torrissen O. Local raw materials for production of fish feed for aquaculture. Nordic Innovation Centre. Project no. 10102. University of Gothenburg, Sweden, 2011, 64.
10. Akiyama DM, Dominy WG, Lawrence AL. Penaeid shrimp nutrition. In: Fast, A.W. Lester, L.J. (eds.), Marine Shrimp Culture: Principles and Practices. Elsevier, Amsterdam, 1992, 535-568.
11. Posadas BC. Economic analysis of various prawn farming systems. In: Chiu, Y.N. Santos, L.M. Juliano, R.O. (eds.), Technical Consideration for the management and operation of Intensive Prawn farms. U.P. Aquaculture Society, Iloilo City, Philippines, 1988, 12-24.
12. Mahmud NA, Hasan MDR, Hossain MB, Minar MH. Proximate Composition of Fish Feed Ingredients Availablein Lakshmipur Region, Bangladesh. American-Eurasian Journal of Agricultural & Environmental Sciences. 2012; 12(5):556-560.
13. Abbas S, Ahmed I, Salim M, Rehman K. Comparative effects of fertilization and supplementary feed on growth performance of three fish species. International Journal of Agriculture and Biology. 2010; 12(2): 276-280.
14. Rahman MA, Rahman MS. Effects of artificial feeds on production of fish in polyculture. Bangladesh Journal of Fisheries Research. 1999; 3(2):165-172.
15. Ahmad N. Fish Wealth of East Pakistan. Directorate of Fisheries, Govt. of East Pakistan, 1957, 2.
16. Huet M. Text Book of Fish Culture, Breeding and Cultivation of fish. Fishing News Books Ltd., England, 1989, 437.
17. Veerina SS, Nandeesha MC, De Silva SS, Ahmed M. An analysis of production factors in carp farming in Andhra Pradesh, India. Aquaculture Research. 1999; 30:805-814.
18. Liang Y, Cheung RYH, Everitt S, Wong WH. Reclaimation of wastewater for polyculture of freshwater fish: Fish culture in ponds. Water Research. 1999; 33:2099-2109.
19. Keshavanath P, Shivanna, Gangadhara B. Evaluation of sugarcane by-product pressmud as a manure in carp culture. Bioresource Technology. 2006; 97: 628-634.
20. Hossain MA, Parween S. Effect of supplementary feed on the growth of shingfish (*Heteropneustes fossilis* Bloch). Bangladesh Journal of Fisheries Research. 1998; 2(2):205-207.
21. Sen PR. Observation on the protein and carbohydrate requirements of carps. Aquaculture. 1978; 13: 245-255.
22. Sing BN, Sinha VRP, Chakraborty PD. Feed intake absorption, conversion and growth of fry and fingerlings of Rohu (*Labeo rohita*). Indian Journal of Fisheries. 1980; 27(1&2):193-200.
23. Azim ME, Verdegem MCJ, Rahman MM, Wahab MA, Van Dam AA, Beveridge MCM. Evaluation of polyculture of Indian major carps in periphyton-based ponds. Aquaculture. 2002; 213:131-149.
24. Islam MS, Huq KA, Rahman MA. Polyculture of Thai pangus (*Pangasius hypophthalmus*, Sauvage 1878) with carp and prawn: a new approach in polyculture technology regarding growth performance and economic returns. Aquaculture Research. 2008; 39: 1620-1627.
25. Jhingran VG. Fish and Fisheries of India. Edn 3, Hindustan Publishing Corporation, Delhi, India, 1991, 727.