

Effects of Different Levels of Dietary Protein on Growth Performance of Stunted Fingerlings of *L. rohita*

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Received 4 June 2016; Accepted 11 July 2016; Published online 4 August 2016

Abstract A study was conducted for 90 days to evaluate the growth performance of stunted fingerlings of *Labeo rohita* fed with diet containing 30%, 24%, 36% and 42% crude protein. Fish were fed daily at the rate of 3% of the body weight. After 90 days of feeding trial, significantly higher growth ($p < 0.05$) was observed in 36% protein level then other treatments. Average weight obtained was 346.66 g and the lowest weight gain was recorded in 24% level of protein. Water quality parameters such water temperature, pH, DO and total ammonia at fortnightly basis. The highest value of total ammonia nitrogen was recorded in the tank having fishes fed with 42% protein level. This could be attributed to excess protein gain entry into the culture medium through fecal matter.

Keywords Stunted fingerlings, *L. rohita*, Crude protein.

Introduction

Aquaculture has become one of the important activities because the global aquaculture production has continued to show significant growth over last few decades. In India, aquaculture system dominated by the carp culture due to its high demand and at present it contributes over 85% of the total aquaculture production [1]. Of late, encouraging result has been reported from grow out culture of stunted fingerlings and are produced to make stocking material available throughout the year [2]. Among the Indian Major Carps, *L. rohita* commonly known as rohu occupies a special position for its taste and growth rate.

In Assam, fish culture can be started from the month of March due to rise of environmental temperature, but flood is a chronic problem in this part of India starting from the month of June. For this reason, short duration fish culture is also an answer to avoid the devastating floods in Assam during monsoon season. Therefore the period from March to May was selected to observe the growth of rohu on the different protein levels within this short period of time. In order to grow and survive, fish required adequate nutritionally rich diet in culture operation and supplementary feed can be considered as a nutritionally balanced diet because it plays an important role in achieving higher production specially in the high stocking condition. Fish production could be enhanced further through supplementary feeding in culture system. Protein is considered to be the most important feed elements in the growth of cultured

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Table 1. Average initial and final weight and length of the experimental fish fingerlings.

Treatments	Initial weight (g)	Final weight (g)	Initial length (cm)	Final length (cm)
T _c	52.26±1.18	357.50±1.67	13.20±0.11	25.86±0.15
T ₁	51.48±1.06	314.84±2.38	13.15±0.10	25.22±0.09
T ₂	51.69±1.12	398.36±1.38	13.15±0.10	27.50±0.10
T ₃	52.00±1.09	321.3±2.33	13.20±0.10	13.20±0.10

species as it provide required amino acids for fish growth. As protein is the most expensive macronutrient in fish diet [3] therefore, the diet should contain that much of protein which is enough for optimum growth of fish therefore it is necessary to study the effects of protein diets on the growth of fish [4]. Lack of good quality feed for economic production adversely affects growth rates, disease manifestation and total harvest of fish [5]. Hence, the formulation of nutritionally balanced and economically viable feed is very much essential for the sustainable development of aquaculture industry. The objective of present study is to ascertain the level of protein for optimum growth performance of stunted fingerlings of *L. rohita* in grow-out phase within short period.

Materials and Methods

The effects of different levels of protein on growth performance of stunted fingerlings of *L. rohita* were carried out with stunted fingerlings. The experimental fishes were stocked with 10,000 fingerlings/ha and acclimatized in cement cistern having the size of 6 m × 4 m × 1.25 m, with 1m water level for one week prior to actual experiment, where they were fed with a formulated diet consisting of rice polish and mustard oil cake @ 3% body weight twice in the morning and the evening. It was done to train the fishes to accept supplementary feed. Four experimental diets were prepared mixing with rice polish, wheat flour, mustard oil cake, ground nut oil cake, fishmeal, soybean meal, mineral mixture and vitamin premix containing 24 (D₁), 36 (D₂) and 42 (D₃)% protein (Table 1). The mineral

Table 2. Weight gain and length gain of rohu in different treatment groups.

Treatments	Weight gain (g)	Length gain (cm)
T _c	305.24 ± 1.68	12.67 ± 0.16
T ₁	263.36 ± 1.84	12.08 ± 0.14
T ₂	346.66 ± 1.38	14.350 ± 0.11
T ₃	269.30 ± 2.33	12.08 ± 0.11
Mean	296.14	12.79

mixture and vitamin were added @ 1%. A reference diet was also given with protein level 30% (D_c) to the fishes @ 3% of the body weight.

Ingredient proportion of the experimental diets.

Ingredients	Parts			
	Control D _c (30% CP)	D ₁ (24% CP)	D ₂ (36% CP)	D ₃ (42% CP)
Rice polish	13	23.5	4	2
Mustard oil cake	15	15	15	4
Groundnut oil cake	15	15	15	4
Fish meal	20	10	32	35
Soybean meal	22	11	30	51
Mineral mixture	1	1	1	1
Vegetable oil	1	1	1	1

The experiment was carried out for a period of 90 days in 12 cement cisterns having the size of 6m × 4m × 1.25m. The cisterns were stocked with stunted fingerlings of *Labeo rohita* (rohu) at a stocking density of 10,000 nos./ha. Fishes were equally distributed into four treatment groups viz. T_c, T₁, T₂ and T₃. The initial weight and length of the stunted fingerlings were recorded individually. Four different diets, D_c, D₁, D₂ and D₃ were fed to the fingerlings in T_c, T₁, T₂ and T₃ respectively. The body weights of each fingerling were recorded initially than at 15 days interval till 90 days. The tanks were drained out at the end of the experiment to collect the entire fishes and record the individual weight and length of each fish, as well as number of survivors.

Sub-surface water sample were collected for

Table 3. Changes of water temperature at 15 days interval during the experimental period. SEM for Treatment means (T): 0.06, CD5% : NS, SEM for Days means (D) : 0.08, CD5% : 0.22, SEM for T×D means : 0.17, CD5% : NS.

Treatments	Experimental period in days							Mean
	0 (°C)	15 (°C)	30 (°C)	45 (°C)	60 (°C)	75 (°C)	90 (°C)	
T _c	24.97	25.23	26.47	27.47	28.90	29.87	30.43	27.62
T ₁	24.93	25.30	26.50	27.47	29.00	29.77	30.40	27.62
T ₂	24.93	25.20	26.53	27.67	28.93	29.93	30.57	27.68
T ₃	24.83	25.33	26.63	27.87	28.33	29.96	30.67	27.73
Mean	24.92	25.27	26.53	27.62	28.92	29.88	30.52	

physico-chemical analysis of the water at 15 days interval from four sites from each experimental tank.

Results and Discussion

Growth performance of fish

In the present study, the higher growth rates of rohu was obtained when fishes were fed with diet containing 36% crude protein level than the other levels, while lowest growth was recorded with diet containing 24% crude (Tables 1 and 2). In contrast to the above findings, some reserachers observed that maximum weight gain was observed with 40% crude protein level in three species viz. *Catla catla*, *Labeo rohita* and *Cirrhinus mrigala* [6]. While, few scientists reported good growth performance in stunted fingerlings of rohu and mrigal fed with diet containing 25% dietary protein level reared in manured pond [7]. In another study on stunted fingerlings of *Labeo rohita*, it was reported that 25% crude protein was optimum in terms of weight gain (g) and specific growth rate (%) in the presence of natural food [8]. The variations in gain in body weight might be due to environmental factors and protein source. The higher body weight gain in treatment group T₂ fed with diet containing 36% crude protein may be the level of protein. However, the decreased growth rate in higher level of protein in T₃ (42%) might be due to reduction in dietary energy available for growth and due to excretion of excess absorbed amino acid [9]. Present studies therefore indicated that optimum protein levels not only reduce the waste input in the holding water but also results in higher growth rates. Further, the reduced growth rate observed in fish fed with higher protein level

(42% CP) in the present study could be due to deamination process and excretion of excess protein through fecal matter [10].

Water quality parameters

The important water quality parameters viz. temperature, pH, dissolved oxygen (DO), and total ammonia nitrogen (TAN) were observed at 15 days interval during experimental period. During the experimental Period temperature ranges from 24.92 to 30.52° C in all the treatment, which was considered to be favourable for fish culture. The pH values in all the treatment were in the range of 7.57 to 8.22, which is slightly alkaline and favourable for fish culture. Fluctuation of dissolved oxygen was observed in all the treatment and the minimum dissolved oxygen recorded was 4.67 mg l⁻¹. The total ammonia-nitrogen values in all the treatment were in the range of 0.02 to 0.4, which showed significant different ($p < 0.05$) among all the

Table 4. Changes of pH at 15 days interval during the experimental period. SEM for treatment means (T) : 0.05, CD5% : NS, SEM for days mean (D) : 0.07, CD5% : 0.19, SEM for T × D means : 0.13, CD5% : NS.

Treatments	Experimental period in days							Mean
	0	15	30	45	60	75	90	
T _c	8.17	8.07	8.03	7.83	7.86	7.67	7.70	7.91
T ₁	8.23	8.23	7.86	7.87	7.80	7.63	7.63	7.89
T ₂	8.27	8.13	7.87	7.80	7.80	7.63	7.60	7.87
T ₃	8.20	8.13	7.83	7.77	7.50	7.37	7.33	7.73
Mean	8.22	8.14	7.90	7.81	7.74	7.57	7.57	

Table 5. Changes of dissolved oxygen at 15 days interval during the experimental period. SEM for treatment means (T) : 0.05, CD5% : NS, SEM for days mean (D) : 0.06, CD5% : 0.17, SEM for T × D means : 0.12, CD5% : NS.

Treat-ments	Experimental period in days							Mean
	0	15	30	45	60	75	90	
T _c	4.93	4.70	4.87	4.83	4.90	4.83	4.97	4.86
T ₁	4.80	4.80	4.80	4.87	4.97	4.87	4.87	4.85
T ₂	5.07	4.63	4.80	4.83	4.90	4.87	4.73	4.83
T ₃	5.07	4.67	4.67	4.87	4.83	4.80	4.67	4.80
Mean	4.97	4.70	4.78	4.85	4.90	4.84	4.80	

treatment (Tables 3 to 6).

Composition of the diet

Four diets were prepared with conventional feed ingredients in such a way that the percentage of protein of each diet was 30, 24, 36 and 42% in D_c, D₁, D₂ and D₃ respectively. The levels of protein percent in control diet in the present investigation have been prepared according to a research work [11] i.e. 30%. Some research findings also reported that 32 to 35% crude protein was found to be optimum for the fish [12]. Various workers have shown variability in protein requirement for different species [8, 13—15]. In the experimental diet D₁, the level was kept 20% below and in other experimental diet D₂ and D₃ the levels were 20% and 40% above the control.

Water quality analysis

Water quality parameters of experimental tanks were at desired level. The important water quality parameters like temperature, pH, dissolved oxygen and total ammonia nitrogen were measured. Temperature ranges from 24.92 to 30.52°C in all the treatment. The pH values in all the treatment were in the ranged of 7.57 to 8.22, which is slightly alkaline and favorable for fish culture. Fluctuation of dissolved oxygen was observed in all the treatment and the minimum dissolved oxygen recorded was 4.67 mg l⁻¹. The different values of water temperature, pH and dissolved oxy-

Table 6. Changes of total ammonia-nitrogen at 15 days interval during the experimental period. SEM for treatment means (T) : 0.004, CD5% : 0.011, SEM for days means (D) : 0.006, CD5% : 0.001, SEM for T × D means : 0.012, CD5% : 0.033.

Treat-ments	Experimental period in days							Mean
	0	15	30	45	60	75	90	
T _c	0.01	0.11	0.16	0.21	0.26	0.31	0.36	0.20
T ₁	0.02	0.07	0.14	0.17	0.22	0.27	0.32	0.17
T ₂	0.01	0.12	0.18	0.23	0.29	0.35	0.38	0.22
T ₃	0.03	0.15	0.22	0.27	0.34	0.43	0.53	0.28
Mean	0.02	0.11	0.18	0.22	0.28	0.34	0.40	

gen recorded in experimental period found to be insignificant among all the treatment. However, the total ammonia-nitrogen values in all the treatments were in the range of 0.02 to 0.4, which showed significant difference ($p < 0.05$) among all the treatments. The highest value was recorded in T₃ and the lowest value was found in T₁. The total ammonia nitrogen was increased along with increasing protein levels diet. This might be related to the fact that excess protein gained entry in the water through fecal matter ultimately converted into ammonia.

Conclusion

Culture of stunted fingerlings is a recent concept as they show improves growth performance than the normal fingerlings. The culture of stunted fingerlings can play a significant role in the agro-climatic condition of Assam. Since the fish culture can be started from the month of February onward taking the advantage of raising temperature and pre-monsoon shower. For successful fish culture feed plays a critical role. The quantity and quality of feed consumed have a pronounced effect on growth rate. Protein is the most important factor affecting growth performance of fish; therefore, it is necessary to determine the protein level in diet for optimum growth of fish. The results of the present study indicated that the experimental diet containing 36% crude protein appears to be suitable for highest growth in terms of parameters like weight gain and length gain of stunted

fingerlings of *L. rohita*. The present experiment could pave the way of scientific short term fish culture of *L. rohita* during the period of February to May.

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