



Growth Performance of *Clarias gariepinus* on the Basis of Formulated Feed Supply

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Abstract

Best diet of the fish is the sole of production of aquaculture. Growth performance of *Clarias gariepinus* on the basis of formulated feed supply was carried out from 7th March to 6th May, 2019 in the laboratory of P.G.Campus, Biratnagar in which 130 juveniles (each of 10 ± 0.11 g.) of catfish were cultured in 13 aquaria feeding with treatment diets having crude protein level 35%, 40%, 45% and 50% for treatment and commercial diet for control. There are no significant differences between the water quality parameters and body weight gain ($p > 0.05$) in all treatments. The highest body weight gain (7.31 ± 0.11 g; 65.20%) and SGR (13.051 ± 1.15 g) was observed in fish fed with T C (45% protein level). This value was lowered than value of control (C) i.e. 7.59 ± 0 g; 69.88% and 13.55 ± 0 g respectively. Feed conversion ratio (FCR) was best (13.28 ± 1.89 g) in T D (50% protein level feed). Its value was larger (7.52 ± 1.11 g) in T C than C (7.15 ± 0 g). Mortality rate was highest in T C and C i.e. 30% and lowest in T A and T B i.e. 23.33%. Weight gain of the fish increased with increasing protein level in diet till crude protein level 45% then it was dropped at the diet with protein level 50%. The best weight gain was observed in 7th week having crude protein level 45%. The diet with protein level 45% is suggested for farmers concerning the fish (*Clarias gariepinus*) in the aquaculture.

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1. Introduction

Nepal ($26^{\circ}22'$ to $30^{\circ}27'N$ and $80^{\circ}4'$ to $88^{\circ}12'E$) has a large inland water resources like rivers, lakes and reservoirs collectively comprise 48.8%, paddy fields 49%, swamps around irrigated fields 1.4% and village ponds 0.8% (Shrestha, 2001). The availability of the surface water is estimated to be about 225 billion cubic meters per annum equivalent to an average flow of 7125 m³/s (WECS, 2005). About 10% of the total precipitation falls as snow and 23% of total area lies above 5000m in permanent snowline (MoPE, 2004). Further, 3.6% of total area is covered by glaciers (WECS, 2011).

Nepal's water bodies are suitable for aquaculture and fisheries development. Aquaculture in Nepal has a relatively short history initiated in the mid 1940s on a small scale in ponds with Indian major carp seeds imported from India. The improvement of fish farming and aquaculture was done by government of Nepal in recent time with the help of international agencies like

ADB, UNDP, JICA, FAO etc. (Shrestha, 2001).

Among 19 alien fish species in Nepal, *Clarias gariepinus* is one of them (Budha, 2015). It is indigenous to inland waters of much of Africa and also endemic in Asian countries such as Israel, Syria and the south of Turkey (Teugles, 1986). Its natural habitats are lakes, rivers, swamps floodplains and ponds or urban sewage system. It is a major economic fish because it has fast growth rate, feeds on a large varieties of agricultural by-products, hardy and tolerates adverse water quality conditions, can raised in high densities resulting in high net yields, easily reproduced in captivity and can sale alive in the markets. Its meat has low cholesterol level. The farming of the fish was extended outside the natural habitat in Argentina, Brazil, Cambodia, China, India, Iraq, Indonesia etc. Polyculture of the fish is widely practiced with tilapia in Nigeria. However, it was expanded all over the world for farming purpose in the early 1980s. It was also unofficially introduced into the Nepal in 1996-97

by the traders from India and Bangladesh. It is nocturnal and carnivorous fish. Many researchers have been worked on growth of the fish on various diets. Ochang et al. (2007) studied on growth performance, body composition, haematology and product quality of the African catfish (*Clarias gariepinus*) by fed diets with palm oil. Differential growth patterns of the fish fed on commercially prepared diets was studied by Ekelemu (2010). Adewumi (2015) studied on the growth performance and survival of *C. gariepinus* hatchlings fed different starter diets. Similarly Farahiyah et al. (2016) studied on evaluation of local feed ingredients based diets on growth performance of *C. gariepinus*. Okomoda et al. (2017) worked on growth performance of *C. gariepinus* fingerlings fed diets containing varying levels of groundnut oil.

Proper growth of the fish depends largely on good nutrition and this is more pronounced with fish enclosure as they require adequate nutrition (Omoruwou and Edema, 2011). Overfeeding and waste food disrupts the water quality (Ng et al. 2000) as well as inadequate food supply has direct impact on production cost (Mihelakakis et al., 2002). In spite of these works, which protein level diet is good for growth of *C. gariepinus* in Nepal was not done by any one. This inspired me to know the diet of which protein level is good for better growth of *C. gariepinus* based on locally formulated feed.

2. Materials and Methods

2.1 Study sites

The experimental fishes (*Clarias gariepinus*) were bought from New Everest fish farm (26°39'40'' N and 87°24'36''E), Belbari, Morang and the study was conducted in laboratory of Zoology Department, Post Graduate Campus, Biratnagar, Morang, Province No. 1, Nepal.

2.2 Source of ingredients and formulation of experimental diets

Food ingredients were local materials like dry fish and mustard oil cake as source of protein and wheat and rice bran as carbohydrate source. Food having different protein levels (35%, 40%, 45% and 50%) for different treatments were prepared by Pearson square method. Treatment diets (T A, T B, T C and T D) having protein level 35%, 40%, 45% and 50% respectively and commercial diet (C) for control treatment were used.

2.3 Preparation of experimental aquaria

Thirteen glass aquaria, each of 47cm x 31cm x 32cm dimension and 25 liter capacity, were selected for experiment. The experimental aquaria were disinfected by using KMnO₄ solution of 2 ppm for 10 minutes. After proper washing the aquaria with tap water, each aquarium was filled by 20 liters of dechlorinated tap water and then aeration was done for 24 hours before stocking the fishes.

2.4 Experimental procedure

The experiment was carried out in 13 aquaria from 7th March to 6th May, 2019. A total of 150 juveniles African catfish *Clarias gariepinus* were collected from the New Everest Fish Farm on 22nd February, 2019. The fishes were acclimatized for 15 days fed with commercial diet in the laboratory of Zoology Department, P.G. Campus, Biratnagar, Morang. The fishes and treatments were randomly assigned in triplicate. Three aquaria for each treatment of diet with protein level 35%, 40%, 45%, and 50% and one aquarium for control were taken. The acclimatized fishes were deprived of feed for 24 hours. A total of 130 *Clarias* juveniles with average weight of 10±0.11 g. were randomly allotted at the ratio of 10 juveniles per aquarium into each of 13 aquaria. Aeration and mosquito net cover were maintained in the aquaria. The formulated feed by 5% body weight was fed twice a day at 8 am and 5 pm. Left over feed and waste excreta were removed twice a day by siphoning pipe with minimal disturbance to the fishes. Fishes from each aquarium were collected, counted and weighted (nearest gram) for 8 weeks at the interval of 7 days. The physico-chemical parameters like water temperature, dissolved oxygen and pH were measured weekly. Water temperature was recorded by using laboratory thermometer; dissolved oxygen was measured by Wrinkle's method and pH by using pH meter. The weight of individual fish was determined with an electronic balance. Similarly the standard length was determined with a measuring board. The experimental aquaria were inspected daily to remove dead fish and mortality rate was measured. The experiment was run for 8 weeks.

3. Results and Discussion

3.1 Feed formulation

Composition of different ingredients used in preparing fish feed in different treatment is shown in Table 1.

Table 1: Composition of different feed ingredients used in preparing fish meal for different treatments using protein level in percentage.

Ingredients (gm)	TA(35%)	TB(40%)	TC(45%)	TD(50%)
Dry fish	29.5	36.48	43.24	50
Mustard cake	29.5	36.48	43.24	50
Rice bran	20.5	13.51	6.76	0
Wheat	20.5	13.51	6.76	0

3.2 Physico-chemical parameters

Month wise water quality parameters (pH, DO and temperature) of experimental aquaria are given in Table 2.

Table 2: Water quality parameters of experimental aquaria (\pm SE).

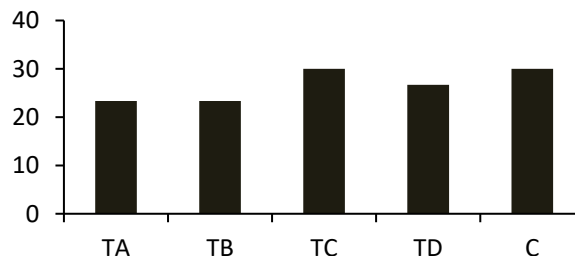
Month	pH	Dissolved oxygen (mg/l)	Water temperature ($^{\circ}$ C)
March	7.52 \pm 0.02	3.65 \pm 0.06	21.07 \pm 0.15
April	7.38 \pm 0.03	3.34 \pm 0.02	22.30 \pm 0.18
May	7.36 \pm 0.03	3.43 \pm 0.05	21.15 \pm 0.27

There are no significant differences between the water quality parameters (three months) and body weight gain ($p>0.05$) in all treatments.

3.3 Growth response

Growth performance of African cat fish (*Clarias gariepinus*) fingerlings fed with different feed treatments is presented in Table 3. The highest body weight gain (7.31 \pm 0.11 g; 65.20%) and SGR (13.051 \pm 1.15 g) was observed in fish fed with T C (45% protein level). This value was lowered than value

of control (C) i.e. 7.59 \pm 0 g; 69.88% and 13.55 \pm 0 g respectively. Feed conversion ratio (FCR) was best (13.28 \pm 1.89 g) in T D (50% protein level feed). Its value was larger (7.52 \pm 1.11 g) in T C than C (7.15 \pm 0 g) (Table 3). Mortality rate was highest in T C and C i.e. 30% and lowest in T A and T B i.e. 23.33 (Table 3 and Fig. 1).

**Fig. 1:** Mortality rate in different treatment diets

The average weight gain of fishes per week in varying level of treatments was given in Table 4 and Fig. 2. Treatment TC had highest average weight gain of a fish in 1st, 3rd, 7th and 8th week i.e. 1.31 gm., 1.04 gm. and 1.79 gm. respectively. Treatment TA had highest growth in 2nd, 5th and 6th week i.e. 1.01 gm, 1.2 gm and 1.86 gm respectively. While treatment TB had highest the weight gain (0.58 gm) in 4th week. Over all weight gain of the fish increased with increasing protein level in diet till crude protein level 45% then it was dropped at the diet with protein level 50%. The best weight gain was observed in 7th week having crude protein level 45%. Growth of the fish was best in commercial diets (7.58 gm and 65.2%) than formulated feed (7.31 gm and 69.88%).

Table 3: Growth performance of *Clarias gariepinus* fry fed with different protein level feeds in different treatments (\pm SE)

Parameters	Protein level in different treatments				
	TA(35%)	TB (40%)	TC (45%)	TD (50%)	C
Mean wt. of stocking (g)	10.75 \pm 0.45	10.65 \pm 0.44	11.18 \pm 0.59	10.75 \pm 0.47	10.86 \pm 0.677
Mean wt. of harvest (g)	17.24 \pm 1.36	17.20 \pm 1.05	18.52 \pm 1.73	14.74 \pm 1.12	18.45 \pm 1.6
Body wt. gain (g)	6.49 \pm 0.79	6.55 \pm 0.62	7.31 \pm 0.11	3.99 \pm 1.08	7.59 \pm 0
Growth rate (g/a day)	0.115 \pm 0.01	0.116 \pm 0.008	0.13 \pm 0.009	0.07 \pm 0.009	0.13 \pm 01
Body wt. gain (%)	60.37	61.54	65.20	37.11	69.88
Specific growth rate (SGR)	11.58 \pm 1.28	11.69 \pm 1.11	13.05 \pm 1.15	7.12 \pm 1.18	13.55 \pm 0
Feed conversion ratio (FCR)	8.16 \pm 0.34	8.09 \pm 1.20	7.52 \pm 1.11	13.28 \pm 1.89	7.15 \pm 0
Mortality rate (%)	23.33	23.33	30	26.67	30

Table 4: Average weight gain of a fish in each week in different treatments

Weight gain (g)	1st week	2nd week	3rd week	4th week	5th week	6th week	7th week	8th week	Total wt. gain
TA	0.08	1.01	0.65	0.38	1.2	1.86	0.96	0.75	6.89
T B	0.49	0.23	0.45	0.58	0.86	0.91	1.5	0.53	5.55
T C	1.31	0.23	1.04	0.2	0.65	0.92	1.79	1.17	7.31
T D	0.49	0.12	0.32	0.46	0.59	0.77	1.19	0.05	3.99
C	0.77	0.71	1.5	0.54	0.82	0.82	1.9	0.52	7.58
Total	3.14	2.30	3.96	2.16	4.12	5.28	7.34	3.02	31.32

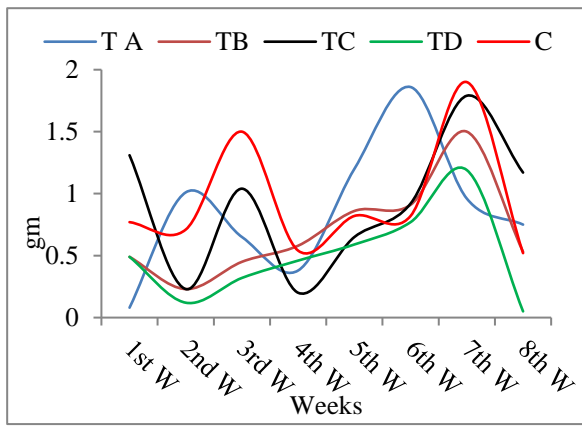


Fig. 2: Average weight gain of a fish per week.

Experimental diets of different protein levels (35%, 40%, 45% and 50%) were formulated from locally available materials like dry fish, mustard cake, rice bran and wheat. The pH ranged from 7.38 ± 0.03 to 7.52 ± 0.02 ; DO from 3.34 ± 0.02 mg/l to 3.65 ± 0.06 mg/l and temperature from 21.07 ± 0.15 °C to 22.30 ± 0.18 °C. The correlation coefficient between body weight gain and these physico-chemical parameters was not significant. It is perhaps because of very little variation on them. As protein level increased in diet, the growth performance is also increased till crude protein level 45%. Then it is decreased. The best growth performance was found in diet with crude protein level 45% at 7th week where as lowest was in diet with protein level 50%. The commercial diet has higher growth rate than formulated diets perhaps because of absence of antibiotic and micronutrients like vitamins, minerals etc.

All experimental fishes had low growth performance as compared to fishes in pond or riverine condition. It might be high concentration of uneaten foods and faeces which increase the bacterial activities with the depletion of oxygen level in water and reduce the respiratory efficiency and appetite of the fishes. Fishes in the ponds or rivers also get natural environment and plenty of foods including larvae of small fishes and aquatic insects.

Dupree and Huner (1984) reported that weight gain in fish is directly proportional to the protein content of the diet provided the level of protein does not exceed 50%. It supports the finding of the study i.e. growth rates appeared to increase with increase protein levels up to 45% though further increase in protein level (50%) did not result in significant increase in the growth of *C. gariepinus*. Fish (*C. gariepinus*) fed a diet containing 40% protein showed the highest growth and

the rate of growth decreased with decreasing protein content of the diet (Degani et al., 1989) as result similar to the study i.e. rate of growth decreased with decreasing protein content in the diet but highest growth was in 45 % crude protein content in the diet. The diet being 42.5% protein produced the highest mean final weight and specific growth rate of the fish (*C. gariepinus*) (Effiong and Esenowo, 2018). Maximum live weight gain percentage was obtained in the fish fed a diet containing 35 % protein level (Farhat and Khan, 2011). Growth rate and weight gain of the fish increased progressively with dietary protein level to a maximum at 40% (Jamabo and Alfred-Ockiya, 2008). But in present study the growth rate and weight gain was increased progressively up to 45% then dropped suddenly.

4. Conclusions

The crude protein level in diet impacts on the rate of growth of the fish (*Clarias gariepinus*) in the aquaculture. It is increased progressively up to 45% protein level in the diet then dropped suddenly. Maximum growth of the fish can be achieved using the diet with 45% crude protein level. So the diet with protein level 45% is suggested for farmers concerning the fish (*Clarias gariepinus*) in the aquaculture.

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Conflicts of Interest

The authors state no conflicts of interest.

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