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Growth Performance of an Indigenous Carp *Bangana dero* (Hamilton) Fed on Formulated and Commercial Diets

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ABSTRACT

A six month feeding experiment was conducted to compare between different diets and its effect on growth performance of an indigenous carp *Bangana dero.* A total of 360 uniform *B. dero* (average weight 4.9±0.02 g) were cultured in twelve circular fibreglass tanks @ 15 fish per tank (90 W X 64 H cm.). The fishes were fed by two commercial feeds (T1, T2), formulate feed (T3) and control feed (T4) in triplicates with 4% of body weight twice a day. Fish were maintained in well aerated water system. Analysis of variance showed that the growth performance in T1 was significantly higher than other groups ($p<0.05$). The formulate di*et al*so had uniform growth rate with significant positive effects on Specific Growth Rate (SGR) and final biomass gain. The present study reveals that there is potential effect of commercial and formulated fish feed on growth performances of this target species.

Key words: *Bangana dero*, Commercial feed, Fish culture, Formulate feed, Growth.

INTRODUCTION

Manipur is one of the states of North East India and 95% of the total population of the state consumed fish as staple food items. Most of the indigenous fishes in this state declined due to habitat destruction and overexploitation (Vishwanath, 2000). Development of aquaculture sector in this state is very important for mass production of target fish species.

Among the indigenous fish species of Manipur, *Bangana dero* (Hamilton, 1822), common name kalabans, khabak/ngaton in Manipuri is a target fish candidate for aquaculture in this region. It has a ready demand in the local market of Manipur fetching triple price than that of Indian major carps (IMC). Over the last two decades the occurrence of fries and fingerlings of this high priced fish in Manipur have become reduced drastically (Basudha *et al*., 2017).

Induced breeding technique have been successfully developed for this species for spawn production in Manipur (Basudha *et al.,* 2017) and molecular analysis of this species is also conducted by Basudha *et al*., 2019. With the development of large-scale spawning programs for this species in aquaculture, the need also arose to produce readily available balanced artificial diets both formulated and commercial feeds which required for the rapid growth and intensive rearing of larvae and juveniles in captivity (Nekoubin and Sudagar, 2012).

One key biological component is the availability of suitable diets that are efficiently digested and provide the required nutrients for optimum growth (Mokokusang *et al*., 2003). There are many reports on the growth analysing on Indian Major Carps and common carps using different diets (Ahmed *et al*., 2012; Mohapatra and Patra, 2014). But there is no report on growth analysis and development of suitable formulated feed of this species so far from Manipur, India. The development of new species-specific feed for the successful culture of *B. dero* is required for the mass production of this species.

The objective of the present study was to determine the effect of formulated feed and commercial diet on growth performance of *B. dero*.

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MATERIALS AND METHODS

Fish samples

A total of 360 uniform size of *B. dero* with initial weight of 4.9±0.02 g were collected from Mayang Imphal fish farm Manipur and cultured at ICAR Manipur Centre Fish farm (Fig 1). The experiment was conducted with four treatments (T1, T2, T3 and T4) fed with 26% protein content in each of two commercial feeds 1 and 2, formulated prepared fish feed and control feed with mustard oil cake and rice bran in equal proportion. The density of fish in per tank was 15 fish. The feeding experiment was set up as triplicate for each treatment in a total of twelve fibreglass tanks (a density of 2.5 fish/m^2) and the fish were fed with 4% of their body weight twice (8 a.m. and 2 p.m.) daily (Aga *et al*., 2017) for 6 months from 1st June, 2018 to 27th November, 2018. The physical and chemical parameters of water for different treatments during culture periods were observed and shown in Table 1.

Table 1: Ranges of different Physical and Chemical Parameters of Water for different treatments of *Bangana dero* during culture periods.

Treatment	Temp.(°C)	pH	Alkalinity (ppm)	Hardness (ppm)	Nitrite (mg/L)	Phosphate (mg/L)	DO (ppm)
T1	23-27	7.02-7.64	110-137	132-140	0.06-0.23	0.8-1.6	4.1-8.6
T2	22-27	7.07-7.31	105-120	137-142	0.07-0.13	0.9-1.0	5.5-9
T3	23-27	7.15-7.49	100-130	132-142	0.05-0.17	0.9-1.5	5.7-9.4
T4	22-29	7.05-7.52	110-130	135-140	0.07-0.12	0.8-1.5	5.6-9.2



Fig 1: Photograph of Ngaton (*Bangana dero*).

Table 2: List of ingredients for preparing artificial feed (26% protein content) calculated by using Pearson's Square method.

Names of feed ingredients	Amount of ingredients (for 1kg.)
Rice Brand	350 gm
Brocken Maize	350 gm
Fish Meal	150 gm
Snail Meal	150 gm
Mineral vitamin mixture	1 %
Vegetable (Soyabean refined) oil	3 %
Carboxy Methyl Cellulose (CMC)	1 %

Table 3: Proximate composition of fish feed samples used in four treatment experiments.

Parameters	T1	T2	T3	T4
Lipid (%)	4.15	3.12	16.35	16.26
Protein (%)	25.82	25.56	25.85	16.52
Ash (%)	11.52	9.25	10.66	5.53

Feed preparation

Artificial feeds were prepared by using different ingredients (Table 2) which was locally available and mixed according to the formula of Pearson's Square method.

Feed analysis

Nutritional composition of experimental diets are given in Table 3. Proximate composition of diets was carried out by using the Association of Analytical Chemists (AOAC 2003). Protein was determined by measuring nitrogen (Nx6.25) using Kjeldahl method, Crude lipid was determined by using chloroform: methanol Method (Bligh and Dyer, 1959) and moisture and ash by AOAC 2003.

Growth analysis

Sampling studies were conducted every 30th day and the growth performances were calculated as mean growth and average mean growth, Biomass(initial and final), Feed Conversion Ratio (FCR), Feed Conversion Efficiency (FCE), Specific Growth Rate (SGR) and Protein Efficiency Ratio (PER). Statistical analysis were conducted by one-way ANOVA to analyze the significance of the difference among the means of treatments by using the SPSS program. The following formulas were used to calculate different growth parameters:

Average body weight gain (g) =
Average final body weight (g)-Average initial body weight (g)

Specific Growth Rate (SGR, %) =
[ln Final body Weight - ln Initial body Weight]
/ No. of culture days ×100

Feed Conversion Ratio (FCR) =
Dry feed intake (g) /Wet weight gain (g)

Feed Conversion Efficiency (FCE) = 1/FCR × 100

Initial Biomass =
Average Initial weight × Total no. of fish

Final Biomass = Average Final Weight × Total no. of fish

Protein Efficiency Ratio =
Wet Weight gain (g) / Protein fed (g)

RESULTS AND DISCUSSION

The average mean growth pattern of *Bangana dero* fed on four diets is shown in Fig 2. The growth trend of *B. dero* during the 1st month was sharply higher in all the treatments. However, the growth after 2^{nd,} 3rd and 4th months was slightly lower for T1, T2 and T3 and upto 5th month for T4. During the 4th month onwards the fish again attained sharp growth (T1, T2 and T3). The growth pattern is uniform in the entire period of experiment fed by formulate fish feed (T3). Results showed that the effects of feeds on mean average weight is highest in treatment 1(T1) and lowest in T4 indicating commercial feed 1 have highest in growth and control have lowest (Table 2). FCR value is highest in T4 and lowest in T1. The maximum final body weight in treatment (Table 4) was observed in T1 (23.59g±0.01), followed by T3 (19.29gm±0.01) which was fed by commercial feed 1 and formulate fish feed. The statistical analysis revealed that FCR, PER, SGR, FCE and Biomass of all the treatments were significantly different (Table 4). The effects of feeds on mean average weight showed that fish fed by prepared feed (T3) have uniform growth rate with moderate SGR, PER and FCR (Fig 2, 3, 4, 5, Table 6). It indicates that the prepared fish feed in our laboratory also have better growth performance for this fish species.

In fish farming, nutrition is critical because feed represent 60% of production cost (Erondu *et al.,* 2006, Sheunn *et al*., 2003). It is necessary to obtain a balance between a rapid fish growth and optimum use of the supplied

feed. The use of commercial feed has become inevitable for the success of cyprinid culture under intensive culture conditions. The aquaculture development and increase in per unit volume of water depends upon the use of high quality and balance artificial feed. Formulation of diets and feeding strategies have often been aimed at meeting requirements for maximum growth rate for reducing production time in intensive aquaculture and therefore, achieving the fast growth in shortest possible time was the main criteria in aquaculture practice (Higgs *et al.,* 1975).

Physico-chemical parameters like temperature, dissolved oxygen, pH and hardness of water in tanks for different feed treatments did not show any significant variations. The recorded values were within the optimum range for cyprinid fingerlings rearing (Ali, *et al*., 2000, Abid and Ahmed, 2009 a and b). Survival rate of fingerlings was 100% in all treatments; it is obviously under optimum rearing conditions.

The present study reveals that commercial feed and formulated feed prepared in our laboratory are good to

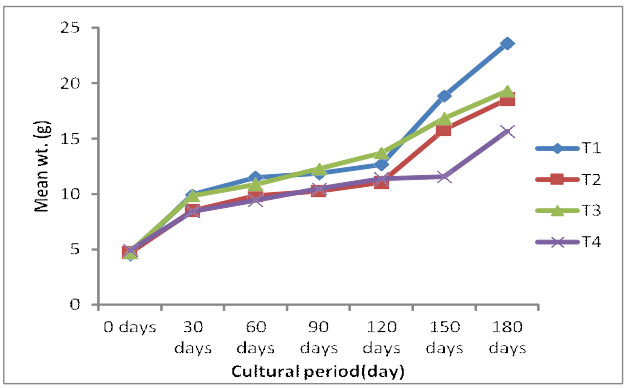


Fig 2: Temporal increase in Mean weight of Ngaton in different treatments during culture period.

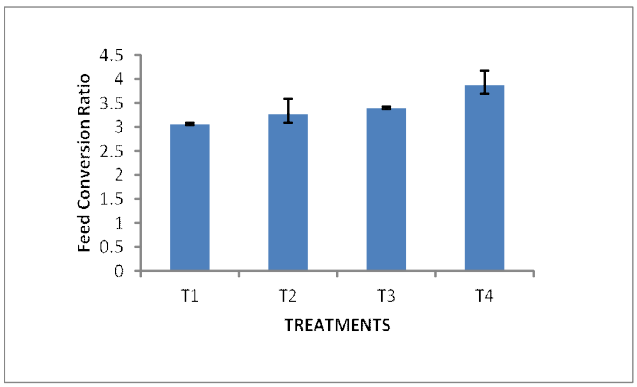


Fig 4: Mean apparent FCR ± S.E. of Ngaton for different treatments during culture period.

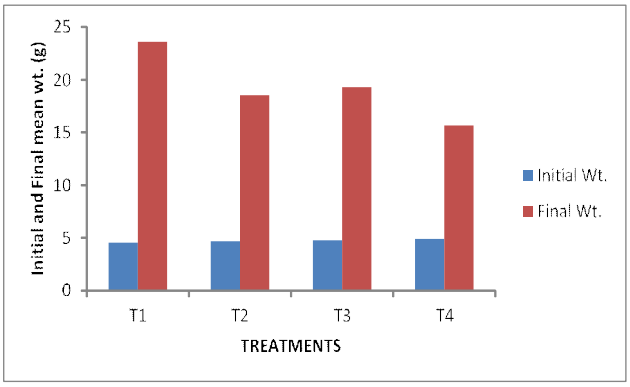


Fig 3: Mean Initial and Final weight ± S.E. of Ngaton in different treatments.

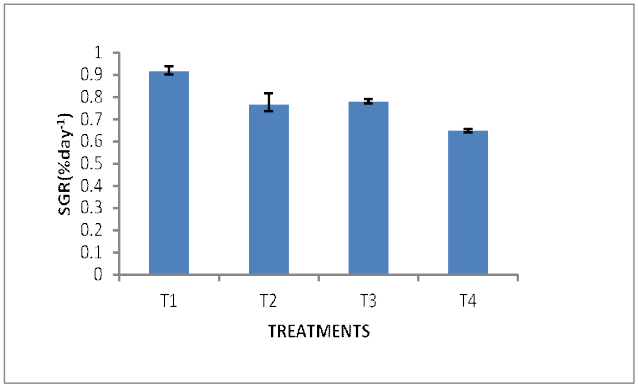


Fig 5: Specific Growth Rate (% day^{-1}) ± S.E. of Ngaton for different treatments during culture period.

Table 4: Initial and final mean weight, mean specific growth rate (SGR), Feed Conversion Ratio(FCR), Feed Conversion Efficiency (FCE) and initial and final biomass ±S.E. of Ngaton (*Bangana dero*) in four treatments (T1, T2, T3 and T4). The alphabetical superscript in column indicates significantly different at p<0.05.

Growth indices	Treatments			
	T1	T2	T3	T4
Average Initial body wt. (g)	4.54±0.01	4.68±0.01	4.77±0.01	4.89±0.01
Average Final body wt. (g)	23.59±0.01	18.53±0.01	19.29±0.01	15.67±0.01
Specific Growth Rate (SGR)	0.91±0.01^{c}	0.76±0.02^{b}	0.78±0.007^{b}	0.65±0.005^{a}
Feed Conversion Ratio (FCR)	3.05±0.01^{a}	3.26±0.05^{ab}	3.39±0.01^{b}	3.86±0.17^{c}
Feed Conversion efficiency (FCE)%	32.71±0.19^{c}	30.63±0.52^{b}	29.47±0.12^{b}	25.96±1.13^{a}
Protein Efficiency Ratio (PER)	0.89±0.006^{a}	0.74±0.019^{b}	0.69±0.003^{c}	0.62±0.003^{d}
Initial biomass	68.1±1.77^{a}	70.2±3.45^{a}	71.35±1.50^{a}	73.35±0.9^{a}
Final biomass	352.75±2.8^{c}	278±1.74^{b}	289.4±2.60^{b}	235.1±1.01^{a}

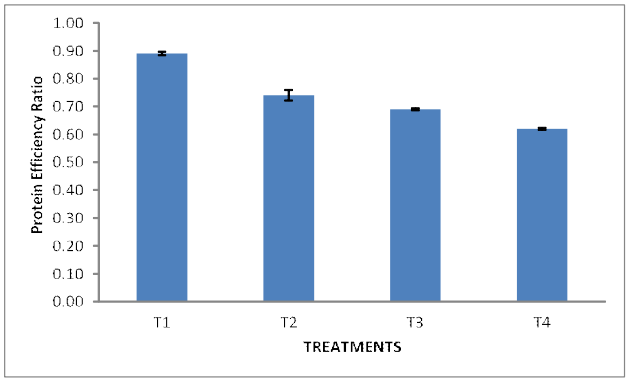


Fig 6: Protein Efficiency Ratio ± S.E. of Ngaton for different treatments during culture period.

enhance growth in the fingerling of *B. dero* and the present finding gave encouraging results which can support fish farmers and can improve the economics of the fish farming sector significantly.

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