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Growth response of common carp (*Cyprinus carpio*) to different feed ingredients incorporate diets

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ABSTRACT

An experiment was conducted in glass aquaria to study the growth performance of common carp fry fed on four different feeds for 120 days. Four different feed ingredients used were fish meal + soybean+ Groundnut cake+ rice bran +wheat flour, fish meal + Groundnut cake + rice bran + wheat flour, soybean + Groundnut cake + rice bran + wheat flour and commercial cattle feed. The feed was supplied @ 5% of wet body weight of fish. The crude protein ranges from 27.1 to 35.2%. Protein content(35.2%) feed containing ingredients of Trt.-I was better for the fish growth (0.056 gm day^{-1}) but was the lowest survival rate (75%) followed by 30% protein content feed of Trt.-II. 28% protein content feed Diet (Trt.-III) without animal protein was the poorest growth rate (0.039 g day-1) with highest survival rate (90%) among the tasted feed. It was observed that feed with higher protein level was better for the fish growth and the growth of fish was different significantly among the treatment except the treatment fish meal+ Groundnut cake+ rice bran + wheat flour and commercial cattle feed. Thus animal protein containing artificial feed, on the basis of growth performance can be induced in the feed formulation of fry of common carp.

Keywords: Diet, Feed ingredients, Growth performance, *Cyprinus carpio*

INTRODUCTION

The common carp (*Cyprinus carpio*) has been one of the oldest domesticated species of fish for food[1].Carps are omnivorous, with high tendency towards the consumption of benthic organisms, such as water insects, larvae of insects, worms, molluscs and zooplankton. Digging in the bottom in search for food items results in turbid water. Zooplankton consumption is dominant in fish ponds where the stocking density is high [2]. Feed represents the single largest input in aquaculture production. At present both protein and energy rich conventional dietary ingredients are of short supply. Therefore, there is need to incorporate unexplored unconventional locally available cheaper feed stuffs in fish feeds. To reduce the dependence on animal based protein in fish diet, plant based protein feedstuffs are used which also decreases feed cost of artificial fish meal [3].

For the past several years, one of the main directions in improving fish feeds has been the search for protein source alternatives to fish meal and determining their nutritional suitability in diets [4].This trend is, firstly, a response to growing demands for formulated diets, and secondly, a response to limited resources of fish meal that will soon hit the upper threshold of exploitation. Additionally, according to Hardy R.W. 2008 [5] one of methods to develop less expensive and effective formulations is lowering fish meal levels in diets. The total replacement of fish meal with soybean protein was successful only in a few cases [6, 7].

Fish meal has been an important source of protein in fish diets because of its high protein quality and palatability. However, fish meal is very expensive and can substantially increase feed costs. Since fish meal is used as the main protein source in aqua-feeds, recent researches have been concentrated on the partial or total replacement of fish meal with less expensive and locally available protein sources for tilapia [8]. Total or partial replacement of fish meal with less expensive animal protein, such as poultry by-product meal (PBM) may help to reduce feed costs, although these sources may be lower in digestibility, palatability and essential amino acids [9, 10 and11].

The choice of *Cyprinus carpio* is necessary in this study because of its remarkable fast growth rate. It is highly esteemed in Odisha and command very high commercial value in our markets due to its ability to adapt readily to poor conditions, fast growth rate, acceptability and high conversion of artificial feeds, tolerance to crowded conditions and high quality of its flesh. *Cyprinus carpio* has the ability to survive under various climatic conditions and is found to be most suitable for many farming system [12].

Having considered the above facts, this study was carried out therefore, to assess the effect of different feed ingredients with and without supplemented fish meal.

MATERIALS AND METHODS

Experimental Fish

Cyprinous carpio (Common carp) was selected for the present experiment. The rationale of its selection was that it has excellent growth rate, easy availability, wide distribution, commercial importance etc. It is tolerant and hardy fish for better survival in a wide variety of aquatic habitats. Its seed has been high demand by the aqua-farmers for variety of purposes such as monoculture and polyculture. In view of consistent demand for fry and fingerlings, studies were therefore undertaken in aquaria and ponds.

Experimental Design

The experimental was conducted in eight glass aquaria each having 50 L of filtrate pond water with 15 fish (*Cypriruns carpio* fry, mean weight 1.5. ±0.2gm, n=15) per aquarium. The fry were procured from a local fish farm and acclimatized to the laboratory conditions for 48 hours prior to the commencement of the experiment. Fifteen fishes were used for analysis of initial whole body proximate composition. The fry were randomly distributed at the rate of 15 fish per aquaria with three replications for each diets treatment. Aeration was continuously provided from air compressors through air stones daily and about 50% water from each aquarium was replaced with clean stored pond water. The aquaria were maintained indoor and natural photoperiod conditions. The experimental fish were fed twice daily at morning and evening at a fixed feeding rate of 5% of the total biomass for a period of 120 days and during this period certain physico-chemical parameters were recorded (Table-1).

Table 1: Water quality parameters of experimental aquaria (±SE)

Month	Temp. (^{0}C)	pH	DO(mg/l)	Alkalinity(mg/l)
February	26.4±0.24	7.3±0.26	5.6±0.16	141.29±2.36
March	27.3±0.25	7.2±0.21	5.5±0.15	140.72±2.35
April	28.8±0.30	7.4±0.26	5.5±0.21	139.26±3.21
May	30.3±0.35	7.3±0.28	5.2±0.22	138.9±3.56

Table 2: Composition of different feed ingredients used in preparing fish meal in different treatment (Trt.)

Ingredients	Trt.-I	Trt.-II	Trt.-III	Control
Fish meal (%)	20	25	0	0
Soybean (%)	20	0	25	0
Groundnut cake(%)	23	36	45	0
Rice bran (%)	20	25	25	0
Wheat flour (%)	17	14	05	0
Commercial cattle feed (%)	0	0	0	100
Mixed vitamin	01	01	01	0
Mineral	01	01	01	0

Common carp fish fry were stocked at the rate of 15 members in each aquarium and cultured by feeding different feed ingredients having 27.1-35.2% crude protein including 27.1% in control commercial cattle feed. The experimental feed ingredients with percentage inclusion and proximate composition of experimental feeds are given

in Table-2 and Table-3. The feed were made pallet and fed at the rate of 5% body weight of fish. Twenty percent of fish were sampled monthly for their growth check-up. The water temperature was also measured during the fish sampling.

Table 3: Proximate Composition of Experimental feeds

Parameters	Trt.-I	Trt.-II	Trt.-III	Control
Crude protein (%)	35.2	30	28	27.1
Crude fat (%)	16	19.5	10.2	3.0
Ash (%)	7.8	7.8	5.9	10.5
Moisture (%)	7.5	8.5	11.2	9.5

Statistical Analysis

The data collected were subjected to analysis of variance (ANOVA) using Microsoft software Statistica followed by Duncan's multiple range tests to compare the result.

RESULTS AND DISCUSSION

The fish fed with fish meal + soybean + Groundnut cake +rice bran + wheat flour had better growth (0.056g day^{-1}) followed by fish meal + Groundnut cake + rice bran + wheat flour (0.051g day^{-1}), commercial feed (0.047g day^{-1}) and soybean + Groundnut cake + rice bran + wheat flour (0.039g day^{-1}), respectively (Table-4). The survival rate was the highest (90%) when the fish were fed with soybean + Groundnut cake + rice bran + wheat flour and it was the lowest (75%) with fish meal + soybean + Groundnut cake + rice bran + wheat flour.

The largest fish fry size (8.4g) was obtained when fed with fish meal + soybean + Groundnut cake + rice bran + wheat flour and the smallest size of fish (6.21g) was obtained when fed with soybean + Groundnut cake + rice bran + wheat flour. The fish growth was higher when fed higher protein containing feed (35.2%) and lower growth when fed without having fish meal. The fish growth containing lower protein feed (27.1%) the commercial cattle feed was better than the fish fed having fish meal but contained higher protein level (30%).

The fish growth had no regular pattern though the growth of fish was less without fish meal than with fish meal. The growth was very slow from 15th February to 15th March when water temperature was below 28^{0}C. The growth pattern was better after 15th April as the water temperature increased about 30^{0}C Table-1. The highest growth rate of the fish was 0.056g day^{-1} in May/ June in Trt.I when fed with fish meal + soybean + Groundnut cake + rice bran + wheat flour (Fig.-I, II and III).Water temperature is the most important factor for fish growth[13,14]. The growth rate increases with increasing water temperature, but when the temperature becomes super optimal, it has negative instead of a stimulatory influence [15].

Common carp are omnivorous fish and they eat any food, which can be digested. However, their habit are to dig and burrow into the soil in search of organic matter such as larvae of insects, worms, molluscs and decayed matters containing bottom dwelling organisms, pieces of plants the young shoots of aquatic weeds[16-18].

In case of aquarium culture, common carp fish can't get their natural proteinous food. Therefore, the fish might not grow satisfactorily. It also indicates that the fish growth would be better when fed with higher protein containing feed especially animal protein. The fish growth was better when fed with cattle feed containing animal protein than the fish fed with higher protein containing feed without fish meal. It means that the fish need higher protein containing feed with necessary animal protein too.

Table 4: Growth performances of common carp fry fed with different feed ingredients (±SE)

Parameters	Trt.-I	Trt.-II	Trt.-III	Control
Mean weight at stocking(g)	1.62±0.19	1.51±0.17	1.51±0.17	1.62±0.19
Mean weight at harvest(g)	8.4±0.42	7.7±0.41	6.2±0.36	7.3±0.40
Total wt. gain(g)	6.78±0.41	6.19±0.35	4.69±0.37	5.68±0.38
Growth rate (g /day)	0.056±0.02	0.051±0.02	0.039±0.01	0.047±0.01
Body weight gain (%)	425±2.3	413±2.2	313±1.8	356±1.9
Survival rate (%)	75	80	90	86.66

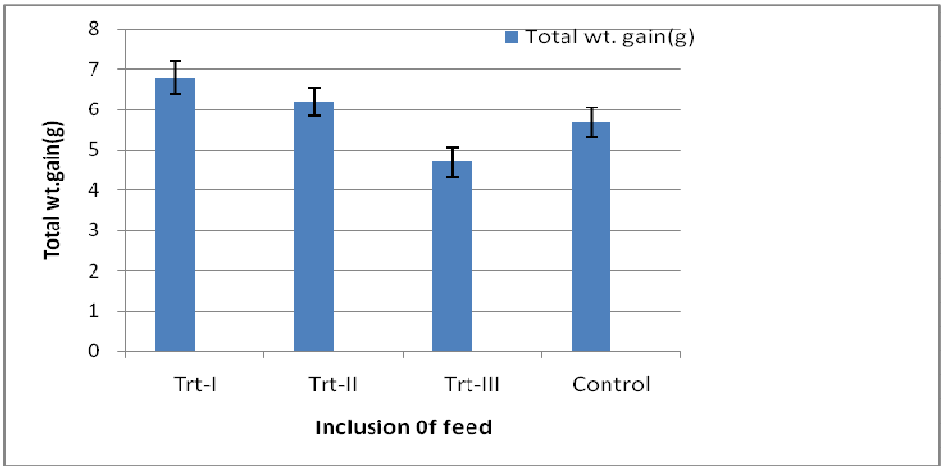

Fig.-I. Total weight (g) of fry fed with four different inclusion of feed

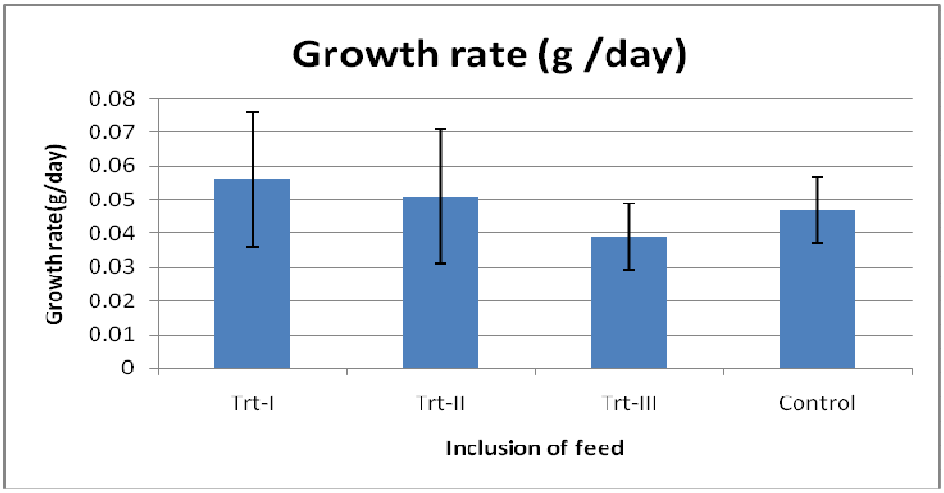

Fig. II. Growth rate (g) per day of carp fry fed with four different inclusion of feed

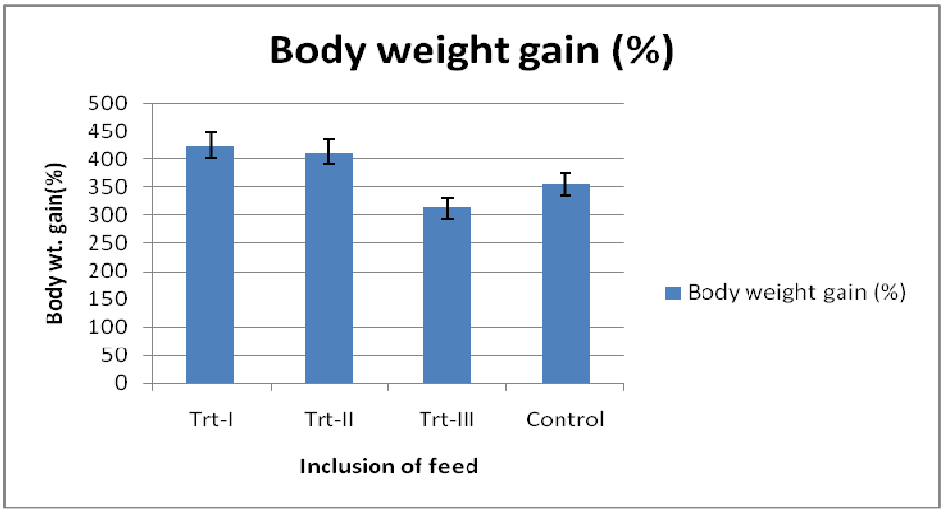

Fig.III. Body wt gain percentage of carp fry in four different inclusion of feed

CONCLUSION

Fish nutritionists have tried since years to replace the expensive fish meal component of fish feeds with less expensive plant protein feed stuffs. For maximum growth of fish, optimum protein content in the feed is necessary. For optimal growth fish require not only a minimum level of protein, but also the essential amino acids that are balanced to meet the requirements of each single one. This can easily be done by using fishmeal as the main protein source. The study clearly showed that fish fed diet with 20% fish meal dietary inclusion (Treatment- I) perform excellently well compared to other treatments. The experiments conclude that the high quality of fishmeal proteins makes substitution difficult. However, partial substitution can be possible to an optimum level.

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