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Effect of Mineral Mixture-Based Diet on the Growth Performance of Common Carp (*Cyprinus carpio*) Fingerlings

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ABSTRACT

An experiment on effect of mineral mixture-based diet on growth and survival of *Cyprinus carpio* fingerlings was conducted for 90 d. Experiment was designed in circular FRP tanks in three treatments as control, T1 and T2 having 40 fingerlings in each tank. A formulated feed with fish meal (10%), rice bran (40%), mustard oil cake (25%) and soyabean oil cake (25%) was fortified with 0.5 and 1 percent mineral mixture (Agrimin-Forte) in treatment T1 and T2 respectively. Physico-chemical parameters were observed fortnightly fluctuated within the optimum ranges and were unaffected by mineral mixture application. After 90 d, highest weight was recorded in T1 (26.94g) followed by T2 (25.35g) and control (23.20g) with survival rate of 90.0, 87.5 and 92.5 percent, respectively. The result revealed that minerals do play important role in better growth performance and may add significant values for better culture practice in common carp. Hence, mineral mixture-based diet would be a low input aquaculture practice, relevant for small and marginal farmers.

Key Words: Growth performance, Mineral mixture, Specific growth rate, Survival.

INTRODUCTION

Common carp is one of the most widely cultured freshwater fish species in the world (Hasan *et al*, 2007; FIGIS, 2011). Even in India from warm-water to coldwater and from planes to mid hills culture of this fish is widely spread and it is currently being used as integral constituent of four or six species composite fish culture in the country. This fish is omnivorous in feeding habit and considered one of the fastest-growing species in all terrains. It is highly suitable for culture in fresh water including upland lakes and reservoirs along with other Indian major carps. Hence, culture of common carp is plays an important role in total production of inland aquaculture.

Aquatic animals are more sensitive to feed quality than terrestrial animals. Artificial feeding is an essential practice in aquaculture operation accounting for over 60 percent in total input cost, representing over half of the total operating expenses of a fish farm. Feed cost plays a vital role in determining the economic feasibility of fish culture practice. This implies that closer attention must be given while formulating aqua-feeds. Diet formulation provides for a balanced mixture of ingredients which support all biological functions such as maintenance, growth, reproduction and health at an acceptable cost (Chiba, 2009). However, majority of fish farmers use only supplementary feed which results in comparison to application of organic manures, alone or in combination with fertilizers. Supplementation of monobasic phosphate to FM-based diets resulted in an increase in growth response of common carp (Takeuchi *et al*, 2002). Feed additives such as minerals, vitamins and probiotics are seldom used.

Minerals are one of the most essential components of a balanced feed for fish. Although all the minerals are required in optimum quantity for normal metabolism and reproduction of fish, certain trace elements like copper, cobalt and zinc have a specific role in fish eggs suggesting the need

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Table 1: Details of stocking and weight gain during investigation period.

Details	Control Tank	T_1	T_2
Number of fish stocked	40	40	40
Number of fish harvested	37	36	35
Survival (%)	92.5	90.0	87.5
Initial average weight (g)	6.45	6.25	6.60
Final average weight (g)	23.20	26.94	25.35
Total weight stocked (g)	775.2	765.6	789.6
Total weight harvested (g)	2375.4	2781.0	2556.7
Net production in experimental tanks (g)	1600.2	2015.4	1767.1
Specific Growth Rate	1.33	1.55	1.45
Condition Factor	3.04	3.10	3.03

of these elements in the brood stock diet (Nandi *et al*, 1998). Zaheri *et al* (2018) reported, probiotic supplementary diets can improve growing rates. The minerals required by fish are calcium, chlorine, magnesium, phosphorus, sodium and potassium along with a number of trace elements such as cobalt, copper, iodine, iron, manganese, selenium, zinc, aluminum, chromium and vanadium. Calcium and phosphorus are closely related in metabolism. Prabhu *et al* (2016) have reported that minerals have structural as well as functional roles as essential nutrients. Hence, the investigation on effect of mineral mixture-based diet may help to evaluate its proximity and importance in culture practice of common carp.

MATERIALS AND METHODS

The present investigation was undertaken for 90 days to study the effect of mineral mixture-based diet on growth and survival of common carp fingerlings. The study was carried out in three outdoor FRP circular tanks of diameter 1.0 m having water holding capacity of 1000 Liter. A uniform water depth of 0.5m was maintained throughout the duration of study. Oxygenated ground water was used for rearing fingerlings in the circular tanks. The feed was formulated having fish meal (10%), rice bran (40%), mustard oil cake (25%), and soybean oil cake (25%) was provided. The experiment was designed under control (Formulated feed) and two treatments (T_1= formulated feed fortified with 0.5% mineral mixture and T_2= formulated feed added with 1% mineral mixture). Each tank was stocked with 40 fingerlings. Initial length (6.4±0.2cm) and weight (6.38± 0.25g) of fingerlings were recorded prior to release into the tanks. Temperature was observed daily and other important water quality parameters *viz.,* dissolved oxygen (DO), free carbon-dioxide, pH and total alkalinity were recorded weekly and fish growth in terms of length and weight were recorded fortnightly.

RESULTS AND DISCUSSION

Growth performance and Survival rate

At the time of harvesting there was significant difference in the average final weights of fish from different tanks. The fish under T1 treatment, registered the highest growth rate (26.94) followed by T2 (25.35g) and control tank (23.20g). Final length at the time of harvesting was recorded in the range of 8.7-8.9 cm, 9.3-9.5 cm and 9.1-9.2 cm in control tank, T1 and T2 tanks, respectively. Percent survival rate of fishes recorded after 90d of experimental period was highest in control tank (92.5%) followed by T2 (90%) and T1 (87.5%) tanks. Zhanhg *et a*l 2008, reported the similar results in a study done with Japanese seabass, *Lateolabrax*

Table 2: Matrix of length-weight relationship of different experimental tanks during investigation period

Sampling period	Control Tank	T_1	T_2
0 d	Log W = -0.60 ± 0.84Log L (r = 0.989)	Log W = -0.59 ± 0.24Log L (r =0.999)	Log W = -0.67 ± 0.79Log L (r =0.995)
15 d	Log W = -1.73 ± 0.45Log L (r = 0.956)	Log W = -1.89 ± 0.84Log L (r =0.999)	Log W = -2.29 ± 0.83Log L (r =0.827)
30 d	Log W = -2.34 ± 0.41Log L (r =0.904)	Log W = -2.60 ± 0.89Log L (r = 0.996)	Log W = -2.49 ± 0.87Log L (r =0.960)
45 d	Log W = -2.11 ± 0.64Log L (r =0.834)	Log W = -3.17 ± 0.83Log L (r = 0.935)	Log W = -2.89± 0.74Log L (r =0.997)
60 d	Log W = -1.97 ± 0.49Log L (r = 0.993)	Log W = -2.90 ± 0.54Log L (r = 0.999)	Log W = -2.79 ± 0.24Log L (r = 0.999)
75 d	Log W = -3.19 ± 0.17Log L (r = 0.997)	Log W = -3.31 ± 0.19Log L (r =0.898)	Log W = -3.01 ± 0.19Log L (r =0.999)
90 d	Log W = -2.23 ± 0.24Log L (r =0.693)	Log W = -2.55 ± 0.71Log L (r =0.993)	Log W = -2.49 ± 0.56Log L (r =0.995)

japonicus, showed that survival rates were not significantly influenced by different levels of dietary mineral premix. The specific growth rate was calculated highest 1.55 in Treatment T1 followed by 1.45 in T2 and 1.33 in Control treatment. The value of K (condition factor) recorded in the present investigation was maximum for the fishes from T1 tank 3.10, while value of K (condition factor) was recorded 3.04 for fishes from T2 tank and 3.03 in control tank respectively. However, there was no significant difference in percent survival rate among different treatments (Table 1).

Length-weight relationship

The final length and weight of the fishes in different tanks were significantly different at analysis of variance (Tables 2). The fish from T1 tank, registered highest growth rate followed by T2 and control tank. The length-weight data of different test groups was statistically analyzed and found to be significantly different. Sarkar *et al* (1998) recorded the values of 'b' from 2.53 to 3.41 and stated that if the exponent was less than 3, the species becomes lighter for its length as it grows larger and if greater than 3, the species becomes heavier for its length as it grow longer. In the present study, these values were less than 3 in all the experimental tanks indicating no isometric pattern of growth meaning common carp weight increases faster than its length. In the present investigation, the values of correlation coefficient 'r' ranged from 0.693-0.989 in control tank, 0.898-0.999 in T1, and 0.827-0.999 in T2 tank. The fishes from experimental T1 performed better in terms of growth and survival than the two tanks. The values of correlation coefficient 'r' of all experimental tanks ranged between 0.693-0.999. If the value of correlation coefficient 'r' is more than 0.99 then it deviated from cube law of length-weight relationship. The values of correlation coefficient

'r' indicated that fishes of all experimental tanks followed the cube-law equation.

Water quality

The physico-chemical parameters of all the tanks fluctuated within the optimum range. The temperature of water ranged from 23.5-26.5ºC, while value of Dissolved Oxygen fluctuated between 8.1-8.8 mg/l in the different tanks. The free carbon-dioxide values varied from 0.3 to 0.7 mg/l and pH ranged from 6.7 to 7.0 during the experimental period. The total alkalinity varied between 168-183 mg/l. Thus, the values of water quality parameters were not affected by addition of mineral mixture in the diet.

CONCLUSION

The above observations indicated that experimental feed fortified with mineral mixture was much effective than the normal formulated feed as far as growth (in terms of length and weight) is concerned. Therefore, the results of the experiment clearly indicated the usefulness of mineral mixture in enhancing fish growth and finally fish production. Thus, use of mineral mixture brought feed input cost down in aquaculture through efficient utilization of food. Minerals played an important role in improving fish growth and add significant values in formulated feed. Hence, mineral mixture-based feed would be a low input aquaculture practice, relevant for small and marginal farmers.

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