Uttar Pradesh J. Zool. 27(3) : 357-360, 2007 ISSN 0256-971X

EFFECT OF IRON SUPPLEMENTED DIET ON THE GROWTH OF THE INDIAN MAJOR CARP, *CIRRHINUS MRIGALA*

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The fry of *Cirrhinus mrigala* were fed with fish meal based prepared diet supplemented with graded levels of ferric chloride 0,200,400 and 600 mg /kg of diet for a period of 40 days. A concentration of 200 mg ferric chloride per kg of feed is found optimum for growth enhancement in *C. mrigala*, while higher concentration of this mineral exhibited retarded growth as compared to control diet. The anabolic role of Fe^{+++} in *C. mrigala* is discussed.

Key words : Iron, diet, growth, *Cirrhinus mrigala.*

INTRODUCTION

A successful fish feed is a homogeneous pack of energy, growth promoters, health tonics, attractants and flavours presented in a most convenient and palatable form. Addition of certain substances to the feeds create acceptability and enhances food intake in fishes (Thandler *et al.*,1982; Johnson & Adam, 1986). But to stimulate growth faster than normal, selected growth promoting agents are incorporated in diets (Ahamed Ali, 1994; Archana, 1994; Jayaprakash & Sambhu,1994; Victor *et al.*, 2004). The dietary mineral requirement of aquatic organisms has been reviewed by FFI (1984) and Agrawal (1999). Chromium and Zinc have shown to improve growth in carp (Jain, 1994; Beena, 1997). In the present study, effect of incorporation of graded levels of ferric chloride to a formulated feed in the fry of Indian major carp, *Cirrhinus mrigala* is investigated.

MATERIALS AND METHODS

The fry of Indian major carp, *C. mrigala*, obtained from the Government hatchery, Malampuzha were acclimatized to the laboratory conditions by feeding control diet. Four practical experimental diets were formulated to provide graded levels of Fe^{+++} to the fish. The diets were prepared by the supplementation of graded levels of ferric chloride 0, 200, 400 and 600 mg/ kg of fish meal based prepared diet having 40% protein. Preparation of ingredients and the protein content of the diets are presented in Table I. The ingredients were dried, powdered and sieved through 100 μm mesh size sieve. The powdered ingredients were mixed with enough water to dough and cooked in a pressure cooker for 30 minutes. After cooling, vitamin mineral mix and vitamin C were added and mixed well. The dough was passed through a pelletiser and dried for 24 hours. The dried pellets were stored in air tight container.

Two sets of four plastic tubs of 10 litre capacity were cleaned, dried and filled with freshwater. After two days, groups of five fishes of almost uniform length and weight were released in to each of the tubs. Each tub was provided with continuous aeration. Temperature of water remained at 28-30^{0}C and dissolved Oxygen near saturation. The

fingerlings were fed with specified feeds once daily at the rate of 5 percent of the body weight for a period of 40 days. The unconsumed feed was collected 6 hours after feeding and the faecal matter accumulated at the bottom was collected before the next feeding by siphoning and filtering the water through a bolting silk.

Food intake was calculated on a daily basis and expressed as milligram of food eaten per gram weight of fish per day.

Assimilation of food A= C-F; where A is the assimilation, C= dry weight of consumed feed and F= weight of faeces.
Assimilation efficiency K= A/C (%)
Growth efficiency K1= P/C (%) where P= production.
Net growth efficiency K2= P/A (%).
Food conversion ratio FCR= Food intake (dry weight)/ weight gain (wet weight).
Specific growth rate SGR (%) = $[\log_e W_2 - \log_e W_1 / (t_2-t_1) \times 100]$ where W_2= final weight, W_1= initial weight, t_2 = final time, t_1= initial time.

Table I : Proportion of ingredients in the diets.

Ingredients	Diet D_1	Diet D_2	Diet D_3	Diet D_4
1. Fish meal	25 gm	25 gm	25 gm	25 gm
2. Rice bran	40 gm	40 gm	40 gm	40 gm
3. Tapioca flour	10 gm	10 gm	10 gm	10 gm
4. Ground nut oil cake	23 gm	23 gm	23 gm	23 gm
5. Vit. Mineral mix.	1 gm	1 gm	1 gm	1 gm
6. Vitamin C	1 gm	1 gm	1 gm	1 gm
7. Ferric chloride	-	20 mg	40 mg	60 mg

RESULTS AND DISCUSSION

The average length and weight of the *C.mrigala* fry after 20 and 40 days of the experiment are presented in Fig.1. Energy balance of *C. mrigala* fed with diets D_1 to D_4 are presented in Table II.

Fish fed with diet D_2 showed the highest weight gain followed by diet D_3, while that fed with diet D_4 exhibited retarded growth compared to the control diet D_1. Specific growth rate

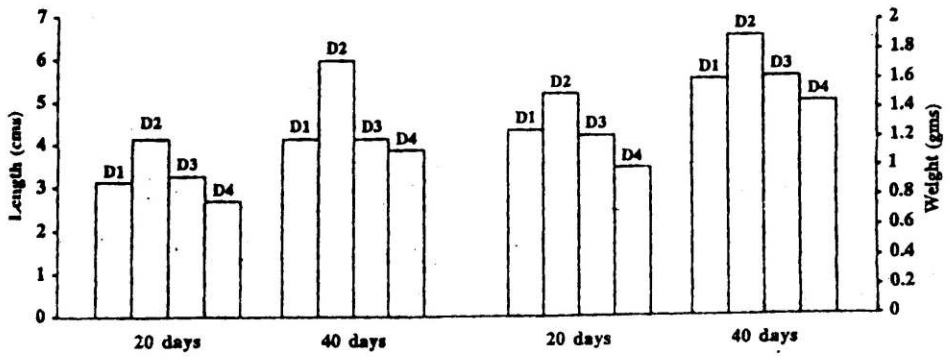

Fig. 1 : Effect of iron supplemented diet on the length and weight of *C. mrigala*.

Table II : Energy balance of *C. mrigala* fed with diets D1 to D4.

Feed	Days	W1 (g)	W2 (g)	P= (W2-W1) (g)	A= (C-G) (g)	K= P/C (%)	K1= P/A (%)	K2 = P/A (%)	FCR	SGR (%)
D1	20	0.620	1.24	0.62	0.74	92.7	86.9	83.4	1.16	
	40	1.24	1.61	0.37	0.72	92.5	46.3	51.3	1.24	4.7615
D2	20	0.61	1.45	0.84	0.95	95.1	83.2	87.6	1.05	
	40	1.45	1.86	0.41	0.83	95.7	43.6	49.1	1.14	4.5745
D3	20	0.63	1.22	0.59	0.66	93.3	85.0	89.1	1.06	
	40	1.22	1.64	0.42	0.88	93.0	46.2	47.3	1.26	4.7940
D4	20	0.61	1.03	0.42	0.53	91.1	81.0	82.4	1.28	
	40	1.03	1.45	0.42	0.93	90.9	49.3	45.1	1.83	4.3295

C = Food consumed; F = Faeces; FCR = Food intake (Dry wt.) / Weight gain (Wet weight).
Specific Growth Rate (SGR) (%) $= \log_e W2 - \log_e W_1 \times 100 / t_2 - t_1$; W_1 = Initial weight; W_2 = Final weight; t_2 = Final time; t_1 = Initial time.

also followed the same trend. Feed conversion ratio was better in D_2 than in D_1. The results of the present study clearly revealed the growth promoting potential of Fe^{+++} supplemented diet in *C. mrigala*. A concentration of 200 mg Fe^{+++} per kg of feed (Diet-D_2) is found to be the most suitable concentration in promoting maximum growth and better food conversion efficiency.

The Fe^{+++}, one of the stable oxidation state of this mineral has a significant role in protein metabolism. Iron present in the diet has been reported to be responsible for (channeling) aminoacids in to tissue protein thereby indicating the anabolic role for this mineral in aquaculture systems (Akiyama, 1991). The present observation of an increased growth rate with iron supplemented diet can be attributed to the anabolic role of this mineral.

The suitability of many chemical substances being tested as food additives and growth stimulants is doubtful as they may remain as residues in fish tissues and pose hazards to them and to the consumers. In the present study, the optimum level of Iron for attaining maximum growth rate was 200 mg/kg of feed, which is well above the level reported earlier (Agrawal, 1999), that could lead to tissue accumulation of the metal. However, no adverse effects on the growth and survival of the fish has been observed during the present study period of 40 days. The effect of the metal accumulation in tissues during prolonged use of this particular formulated feed needs further investigation.

The incorporation of ferric chloride at a concentration of 200 mg/kg of conventional feed has led to the increase in growth rate by stimulating protein metabolism and hence may be recommended in aquaculture practices.

ACKNOWLEDGEMENTS

The authors are thankful to the Principal, Sree Narayana College, Nattika for the facilities provided.

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