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A STUDY ON THE EFFECT OF CHROMIUM (Cr^{3+}) SUPPLEMENTATION ON THE GROWTH OF THE INDIAN MAJOR CARP, *CIRRHINUS MRIGALA*

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A feeding trial was conducted on the fry of the Indian major carp, *Cirhinus mrigala* to evaluate the effect of graded levels of Chromium chloride, 0, 50, 100 & 200 mg/kg. of conventional diet for a period of 40 days. All levels of Chromium resulted in an appreciable effect on the growth of *C. mrigala.* The fish fed with diet D3 (100 mg.Cr^{3+}/kg of feed) exhibited significantly superior growth reaching a net weight of 1.36 gram in 40 days. The mean specific growth rate in fishes fed with Diet D2, D3 and D4 (1.69) was higher than that observed in the control fish (1.50) with maximum in diet D3 (1.92) showing that Cr^{3+} promoted the growth of *C. mrigala.* The results of the present study clearly revealed the growth promoting potential of Cr^{3+} incorporated diet in *C. mrigala.* The level of 100 mg.Cr^{3+} along with 600 mg. vitamin C per kilogram of prepared feed was found to be the most suitable concentration in promoting maximum growth. The anabolic role of Cr^{3+} in *C. mrigala* is discussed.

Key words : *Cirrhinus mrigala*, diet, Chromium (III), growth rate.

INTRODUCTION

India has a great potential to increase cultured fish production. Some of the main factors governing fish culture activities at a substantial level are those relating to use of balanced high quality feed and other inputs apart from proper management. Use of environment friendly and economically viable artificial feed of good and growth promoting quality is of utmost priority. The criteria of a good feed is that it should be economical, acceptable to fishes and stimulate rapid growth with good survival. Such a feed can be achieved by mixing more than one material in a balanced way. The formulated feed so obtained promotes normal growth of recipient animals. But to promote growth faster than normal, selected growth promoting agents are incorporated in diets (Rajkumar, 2002; Kour *et al.*, 2004). Dietary mineral requirement of aquatic organisms have been reviewed by Agrawal (1999). Iron and Zinc have shown to improve growth in carp (Shibu & Sindhu Josy, 2007; Shibu, 2008). The present work is an attempt to evaluate the effect of incorporation of graded level of Cr^{3+} to a formulated feed in the fry of the Indian major carp, *Cirrhinus mrigala.*

MATERIALS AND METHODS

Four practical experimental diets were formulated to provide graded levels of Cr^{3+} to the fish. The diets were prepared by the supplementation of graded levels of Chromium chloride, 0, 50, 100 & 200 mg/kg of fish meal based prepared diet having 40% protein.

Preparation of the ingredients and protein content of the diets are presented in Table I. The ingredients were dried, powdered and sieved through 100µm. 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 containers.

The fry of *Cirrhinus mrigala* were procured locally and maintained in the laboratory on a pelleted fish meal based diet having 40% protein. 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°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 (75μ mesh size). Fishes were weighed by batch in every week end and subsequently feeding was readjusted. Care was taken to keep the water level in the aquarium constant throughout the span of the experiment. Growth parameters such as Specific growth rate (SGR) and Food conversion ratio (FCR) were found out following Olvera-Novoa *et al.* (1990).

RESULTS AND DISCUSSION

The weight gain, food conversion ratio (FCR) and specific growth rate (SGR) are presented in Table II. The fish accepted the formulated feed well and there was no mortality. The data summarized in Table II indicates that all levels of Chromium resulted in an appreciable effect on the growth of *C. mrigala.* The fish fed with diet D3 (100 mg.Cr^{3+}/kg of feed) exhibited significantly superior growth reaching a net weight of 1.36 gram in 40 days. The mean specific growth rate in fishes fed with Diet D2, D3 and D4 (1.69) was higher than that observed in the control fish (1.50) with maximum in diet D3 (1.92) showing that Cr^{3+} promoted the growth of *C. mrigala.* The results of the present study clearly revealed the growth promoting potential of Cr^{3+} incorporated diet in *C. mrigala.* The level of 100 mg.Cr^{3+} along with 600 mg. vitamin C per kilogram of prepared feed was found to be the most suitable concentration in promoting maximum growth and better feed conversion efficiency. Feed conversion ratio was better in D3 than in D1.

Some research data indicate that Cr^{3+} is an essential nutrient for food producing and laboratory animals. Improvement in the growth rate of swine as a result of supplementation of diet with 0.50 mg-5.0 mg Cr^{3+}/kg were reported (NRC, 1997). Roginski & Mertz (1969) reported that Cr^{3+} supplementation increased amino acid uptake

Table I : Proportion of ingredients in the diets (weight in grams).

S. No.	Ingredients	Diets			
		D1	D2	D3	D4
1.	Fish meal	25	25	25	25
2.	Rice bran	40	40	40	40
3.	Tapioca flour	10	10	10	10
4.	Ground nut oil cake	24	24	24	24
5.	Vitamin mineral mixture	0.06	0.06	0.06	0.06
6.	Chromium chloride	-	0.005	0.01	0.02

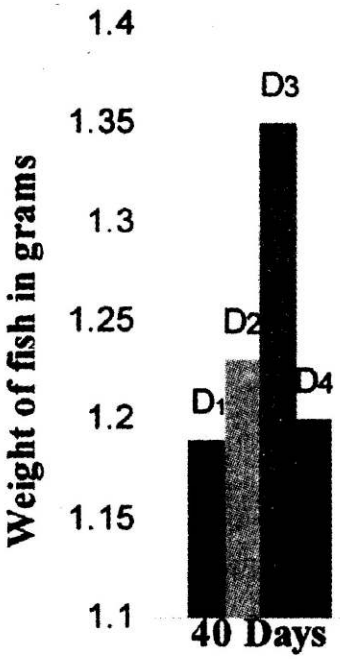

Fig. : Effect of Chromium supplemented diet on the weight of *C. mrigala.*

in to the tissues of rat. In the present study the increased growth rate in fishes fed with diet D3 could be attributed to the role of Cr^{3+} in the channeling of amino acids in to tissue proteins. It indicates the anabolic role of this mineral in aquaculture systems. A correlation of the Cr^{3+} supplementation in diet with the growth of fish showed that the fish utilized more protein from the diet in the presence of an optimum level of the metal (100 mg/kg). At concentrations above the optimum level, no inhibitory effect on growth was observed in comparison to the control. It is worthwhile to mention the report of Archana & Sinha (1994) regarding the growth promoting effect of vitamin C supplemented diet in *Catla catla.* They recommended an optimum level of 600 mg vitamin C/kg of feed as a growth promoter in aquaculture. In the present study though the vitamin C level in the four diets was kept constant, the growth rate was maximum in diet 3 that contained 100 mg Cr^{3+}/kg of feed.

Table II : Results of feeding trial with diets D1 to D4 on *C. mrigala.*

S. No.	Parameters	Diets			
		D1	D2	D3	D4
1.	Initial weight (gm)	0.59	0.58	0.58	0.59
2.	Final weight (gm)	1.19	1.23	1.35	1.20
3.	Net weight gain (gm)	0.60	0.65	0.77	0.61
4.	Weight gain (%)	101.60	112.07	132.75	103.34
5.	SGR	1.50	1.62	1.92	1.52
6.	FCR	3.30	3.07	2.59	3.28

One of the disadvantages of using chemicals as food additives and growth stimulants is that they may remain as residues in fish tissues and pose hazards to them and for the consumers. Our study revealed that the optimum level of Cr^{3+} for attaining maximum growth was 100 mg/kg of feed, which is well above the level reported by Chakraborthy &

Mishra (1982) that could lead to tissue accumulation of the metal. The incorporation of vitamin C might have a stimulatory effect on the metabolism of Cr3+ in the living tissues and thereby a reduction in the rate of Cr^{3+} accumulation may be expected. This view is supported by the report of Abdel-Tawwab *et al.* (2001) that high levels of vitamin C are efficient in reducing the toxicity of heavy metals preventing disease and enhancing fish tolerance to environmental stress.

The incorporation of Cr^{3+} and vitamin C at a level of 100 and 600 mg respectively per kg of conventional feed has led to the increase in growth rate. Thus Cr^{3+} may help fish rearing by increasing the growth rate and may be recommended in aquaculture practices.

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