Fishery Technology
2001, Vol. 38(1) pp : 48 - 50

Effect of Dietary Lipid Levels on Growth and Survival of Fingerlings of the Indian Major Carp *Cirrhinus mrigala*

K. Marimuthu and N. Sukumaran*
Centre for Aquaculture Research and Extension
St. Xavier's College, Palayankottai-627 002, India

Six isonitrogenous semi purified diets with graded levels of lipids (4.5, 6, 7.5, 9, 10.5 and 12%) were prepared in pelleted form and fed to the fingerlings of *Cirrhinus mrigala* for 60 days to evaluate the changes in growth and feed conversion. Absolute, relative and specific growth rates were found to be higher and FCR values better in fishes receiving a diet containing 7.5% lipid

Key words: Indian major carp, *Cirrhinus mrigala*, lipid requirement

In fish culture operations, the highest recurring cost is that of the feed (De Silva, 1988). Artificial feeding is an integral part of managed fish culture practices, where the focus is on maximum fish production with minimum feed cost (Jeyachandran & Raj, 1976). Although the technique of carp culture has been standardized to some extent in India, there is ample scope for further improvement through better management practices and optimization of quantity of nutrients to be given through artificial feeds. The traditional artificial diet of Indian major carps consisting of 1:1 mixture of oil cake and rice bran is not nutritionally balanced (Das & Ray, 1991). There is need to understand the basic nutritional requirements of each species in order to formulate cheap and nutritionally balanced diets. The reduction of protein level in the feed formulation and increase in the dietary lipid level to compensate the protein for energy requirement not only increases the fish growth but also reduces the feed cost from economic point of view (Phillip *et al.*, 1969). Dietary lipid is a major source of energy in fish feeds and it has protein sparing action (Sargent *et al.*, 1989; Ellis & Reigh, 1991). Dietary lipids supply energy and provide essential fatty acids needed for structural maintenance of membranes and proper functioning of many physiological processes. Lipids are almost completely digestible by fish and seem to be favoured over carbohydrate as an energy source (Ellis & Reigh, 1991). The present study was, therefore, designed to provide some information on the growth and feed conversion of fingerling of *Cirrhinus mrigala* at varying dietary lipid levels.

Materials and Methods

C. mrigala fingerlings were purchased from a private aquafarm near Ambasamudram, Tamil Nadu and acclimated to the laboratory condition. Six isonitrogenous diets containing 4, 5, 6, 7.5, 9, 10.5 and 12% of lipid (Table 1) were prepared in pelleted form using cod liver oil as the source of lipid. Fish from the acclimated lot were randomly allocated to experimental troughs (15 l capacity) containing 5 l of tap water, in triplicate groups of 6 fish for each diet. Thus, there were 6 treatments with 3 replicates for each lipid level. The feeding trial was conducted for 60 days. The fish were fed at 5% of body weight per day and the ration was divided into two doses (10 h and 16 h). Uneaten food

*Sri Parama Kalyani Centre for Environmental Sciences, M.S. University, Alwarkurichi-627 412

Table 1. Proximate composition of experimental diets of *C. mrigala*

	Feed					
	1	2	3	4	5	6
Crude protein,%	35.38	35.06	34.92	34.56	34.54	34.47
Crude lipid, %	4.67	6.13	7.57	8.97	10.36	11.91
Crude carbohydrate, %	23.24	22.35	22.23	21.51	21.40	20.37
Energy kcal/ 100 g* (Calculated)	318.22	340.25	352.09	359.89	371.98	381.48

* Gross energy was calculated based on ADCP (1983). Protein: 5.5 kcal.g^{-1}, Carbohydrate: 4.1 kcal.g^{-1}, Fat: 9.1 kcal.g^{-1}

was removed and weighed to calculate the amount of feed taken. Constant aeration was provided to the experimental fish along with 50% water exchange daily. The water quality parameters during the feeding trial were found to be temperature 29±1.5°C; pH 7.2 to 8.1 and dissolved oxygen 4.2 to 5.4mg.l^{-1}. Fortnightly weight gain was measured and absolute, relative and specific growth were calculated (Rangaswamy *et al.*, 1998). Proximate composition of diets was estimated (AOAC, 1984). Gross energy of the diets was calculated based on the values suggested by ADCP, (1983). Data were statistically analysed using Analysis of Variance test (Pillai & Sinha, 1968).

Results and Discussion

The effect of dietary lipid levels on the growth and survival of *C. mrigala* fingerlings for 60 days is presented in Table 2. It is clear from the data that absolute (0.602 g), relative (301%) and specific growth (2.31%) were higher and the FCR (1.25) better in fish which received a diet containing 7.5% of lipid. Hence it may be concluded that 7.5% of lipid in diet appears to be optimum for the maximum growth of C. mrigala fingerlings. The earlier reports on fish such as channel catfish *(Ictalurus punctatus)* (Dupree, 1969); rainbow trout *(Salmo gairdneri)* (Watanabe *et al.*, 1979) and red drum *(Sciaenops ocellatus)* (Williams & Robinson, 1988; Ellis & Reigh, 1991) indicated a dietary lipid requirement of 6-11%. The ability of fish to use lipid as a major source of energy has been investigated in many fish species (Watanabe, 1982; Sargent *et al.*, 1989; Sin, 1973; Singh, 1990 and Jafri *et al.*, 1995). It was found that the dietary lipid requirement of Indian major carp falls between 4 and 7% and that of tilapia between 4 and 9% (Singh, 1991; Hanley, 1991), whereas in the present study the dietary lipid requirement of *C. mrigala* was 7.5%. Growth of fish at different dietary lipid levels was significantly different ($p<0.01$). However, The growth at 9, 10.5 and 12% levels of lipid was comparable (Table 2) which suggested that incorporation of lipid in diets beyond 7.5% might not be advantageous in enhancing growth. Jafri *et al.* (1995) reported that feeding higher levels of lipid to *C. mrigala* resulted in reduced growth. Similar phenomenon was observed in catfish *Clarias batrachus* (Anwar & Jafri, 1994). Studies on channel catfish, striped bass and red drum suggested that feeding higher levels of lipid either reduced the growth or did not improve it (Dupree, 1969; Williams & Robinson, 1988; Patricia *et al.*, 1993).

Table 2. Growth performance of *C. mrigala* fed on varying levels of dietary lipids for 60 days

Lipid level (%)	Initial mean weight (g)	Final mean weight (g)	Absolute growth (g)	Relative growth (%)	SGR	FCR	Survival
4.5	0.2	0.631	0.431	215.5	1.91	2.99	83.3
6.0	0.2	0.645	0.445	222.5	1.95	2.32	100.0
7.5	0.2	0.802	0.602	301.0	2.31	1.25	100.0
9.0	0.2	0.738	0.538	269.0	2.17	1.65	100.0
10.5	0.2	0.687	0.487	243.5	2.04	1.98	100.0
12.0	0.2	0.621	0.421	210.5	1.88	2.16	83.3

The authors wish to thanks Mr. S. Vallinayagam, Junior Research Fellow, CBB, St. Xavier's College, Palayamkottai for his help.

References

ADCP (1983) *Fish Feeds and Feeding in Developing Countries.* FAO, Rome ADCP/REP/83/18

Anwar, M.F. & Jafri, A.K. (1994) *J. Appl. Aquaculture*, **47**, 87

AOAC (1984) *Official Methods of Analysis* 14th Edn., Association of Official Analytical Chemists, Arlington, Virginia

Das, I. & Ray, A.K. (1991) J. *Aqua. Trop.* **6**, 179

De Silva, (1988) in *Finfish Nutrition Research in Asia*, p.128, Heinemann publishers, Asis Pvt. Ltd., Singapore

Dupree, H.K. (1969) *U.S. Bur. Sport Fish Wild Tech.* Paper 27

Ellis, S.G. & Reigh, R.C. (1991) *Aquaculture*, **97**, 383

Hanley, F. (1991) *Aquaculture*, **99**, 323

Jafri, A.K., Anwar, M.F., Usmani, N., Sameed,R. & Albi, A.S. (1995) *J. Aqua. Trop.* **10**, 151

Jeyachandran, P. & Raj, S.P. (1976) *J. Inland Fish. Soc. India*, **8**, 33

Patricia, H.F., Woodie, P.W. & Theodore, I.J.S. (1993) *Aquaculture*, **116**, 171

Phillip, A.M., Linvingstone, D.L. & Poston, H.A. (1969) *Fish. Bull.* **29**, 6

Pillai, S.K. & Sinha, M.C. (1968) *Statistical Methods for Biological Workers*, Ram Prasad & Sons, Agra, India

Rangaswamy, C.P., Gopal, C. & Swamy, D.N. (1998) *Indian J. Fish.* **42**, 157

Sargent, J., Henderson, R.J. & Tocher, D.R. (1989) in *Fish Nutrition.* (Halver, J.E., Ed.), p.153, Academic Press Inc., New York

Sin, A.W. (1973) *Hong Kong Fish. Bull.*, **3**, 77

Sinh, B.N. (1991) *J. Inland Fish. Soc. India*, **23**, 99

Singh, B.N. (1990) *Fish Nutrition, Nutritional Requirements, Digestibility and Feed Formulation*, Symposium on Modern Trends in Fish Phyhsiology Research 17-20 January 1990, Bhayalpur

Watanabe, T., Takeuchi, T. & Ognio, C. (1979) *Finfish Nutrition and Fish Feed Technology*, (Halver, J.E. & Tiews, K., Eds.), p.113 Heanmann, Berlin, Germany,

Watanabe, T. (1982) *Comp. Biochem, Physiol.* **73**, 3

Williams, C.D. & Robinsion, E.H. (1988) *Aquaculture*, **70**, 107