Fishery Technology
1999, Vol. 36(1) pp : 52 - 55

Effect of Varying Levels of Dietary Protein on the Growth and Body Composition of the Grey Mullet *Liza macrolepis* Fingerlings

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Casein-gelatin based isocaloric purified diets with graded levels of protein (10-60%) were fed to the fingerlings of *Liza macrolepis* for 60 days to evaluate the growth, feed conversion and carcass composition. Relative growth, specific growth, normalized biomass index and survival rate were higher and feed conversion ratio, lower in fish which received 40% dietary protein. Carcass composition of the fish indicated that protein, lipid, carbohydrate and moisture were significantly different while ash content was not significantly different from the initial values. The studies showed that dietary protein at a level of 40% was optimal for the species.

Key words: *Liza macrolepis*, growth, carcass composition, protein requirement

Protein is the most important component in formulated feeds from the view point of cost and growth performance. It acts both as a structural component and an energy source in fish (Brett & Groves, 1979). An excess dietary protein may not only cost more but also increase the energy cost of assimilation by hiking the specific dynamic action (Le Grow & Beamish, 1986; Pandian, 1989). Hence protein levels should be optimized in feeds. *Liza macrolepis* (Smith) is a species with high market value and is suitable for brackishwater aquaculture. Data on the quantitative and qualitative feed requirements of this species is essential to work out the economics of its production through aquaculture. While a great deal of information is available on the nutrient requirements of fresh water fish (Cowey, 1979; N.R.C., 1983; Pandian, 1989; Mukhopadhyay, 1997), not much information is on hand on the nutritional requirement of brackishwater fin fish. Hence the present study was undertaken to evaluate the effect of varying levels of dietary protein on the growth, feed conversion and carcass composition of *L. macrolepis* and thus determine the optimal dietary protein requirement of this species.

Materials and Methods

L. macrolepis fingerlings (1.8±0.7 g) collected from backwaters were acclimated to the laboratory conditions. Fish from the acclimated lot were randomly allocated to experimental concrete tanks containing 100 l of fresh filtered sea water in triplicate of 15 fish per treatment. Isocaloric diets with casein-gelatin as protein source were formulated (Gopal & Paulraj, 1990; Rangaswamy *et al.*, 1998) containing varying levels of protein ranging from 10 to 60% (Table 1).

The feeding trial was conducted for 60 days. Fish were fed at 10% of body weight per day, divided into two rations (at 10 AM and 4 PM). Unconsumed feed was collected and weighed to estimate the amount of food consumed. Water was changed daily and aerated. The water quality parameters

Table 1. Proportion of ingredients, proximate composition and energy content of experimental diets for *Liza macrolepis* fingerlings

	Protein levels %					
	10	20	30	40	50	60
Ingredients g/100 g						
Casein (lipid free)	12	20	28	36	44	52
Gelatin	3	5	7	9	11	13
Dextrin	62.6	51.4	40.1	28.9	17.6	6.4
Fish oil	4	4	4	4	4	4
Sun flower oil	2	2	2	2	2	2
Lecithin	2	2	2	2	2	2
Mineral mix[1]	4	4	4	4	4	4
Vitamin mix[2]	3	3	3	3	3	3
Carboxy methyl cellulose	2	2	2	2	2	2
Cellulose	5.4	6.6	7.0	9.1	10.4	11.6
Proximate composition						
Crude protein (%)	10.34	19.74	33.06	39.00	51.53	60.74
Crude lipid (%)	8.42	8.68	8.62	8.59	8.42	8.85
Gross energy (Kcal/100g)[3]	368	363	370	349	352	348

1,2 Rangaswamy *et al.*, (1998); 3 Gross energy (Kcal/100g) was calculated according to Phillips 1969

during the feeding trials were recorded. Proximate composition of the diets and carcass (initial and final) were determined (AOAC, 1984). Gain in weight, relative growth rate (RGR), specific growth rate (SGR), normalized biomass index (NBI) and feed conversion ratio (FCR) were estimated. Data were subjected to Analysis of Variance test (Snedecor & Cochran, 1973).

Results and Discussion

The water quality parameters during the experiment were: temperature, 30.0-32.2°C; salinity, 28±1 ppt; dissolved oxygen, 3.0±4.5

Table 2. Growth performance of *Liza macrolepis* fed on varying levels of dietary protein for 60 days

Protein level (%)	Average Initial weight (g)	Average Final weight (g)	Gain in weight (g)	Survival Rate (S.R.) (%)	R.G.R. (%)	S.G.R. (%)	N.B.I.	F.C.R.
10	1.464	2.574	1.110a,b	77.74	75.81	0.94	0.080	3.01
20	1.951	3.503	1.552b,c	84.44	79.54	0.97	0.150	2.79
30	1.840	3.273	1.433a,b,c	84.44	77.88	0.95	0.138	2.97
40	1.872	4.110	2.49d	88.88	133.01	1.41	0.300	2.36
50	2.571	4.889	2.31d	86.66	90.15	1.07	0.249	2.81
60	1.550	2.889	1.330a,b	84.44	85.31	1.03	0.131	3.03

Values with the same superscripts are not different significantly ($P<0.05$)

R.G.R. = $100(W-W_0)/W_0$

S.G.R. = Loge W-log $W_0/t \times 100$

F.C.R. = Feed intake (g)/Fish wt gain (g)

N.B.I. $(W \times N) - (W_0 \times N_0)/100$

N_0 = Mean number at beginning; N = Mean number at end; W_0 = Mean body weight (g) at beginning; W = Mean body weight (g) at end; t = Time in days

ppm and pH, 8.3±0.1. The effect of dietary protein on RGR, SGR, NBI, survival rate (SR) and FCR of the fish for 60 days are presented in Table 2. Growth of fish at 15 days interval is depicted in Fig.1. It is clear from the data that RGR (133.01%), SGR (1.41%), NBI (0.30) and SR (88.88%) were higher and FCR (2.36) better in fish which received 40% protein in the diet. Therefore it is evident that 40% protein in the diet is optimum for the growth of *L. macrolepis* fingerlings.

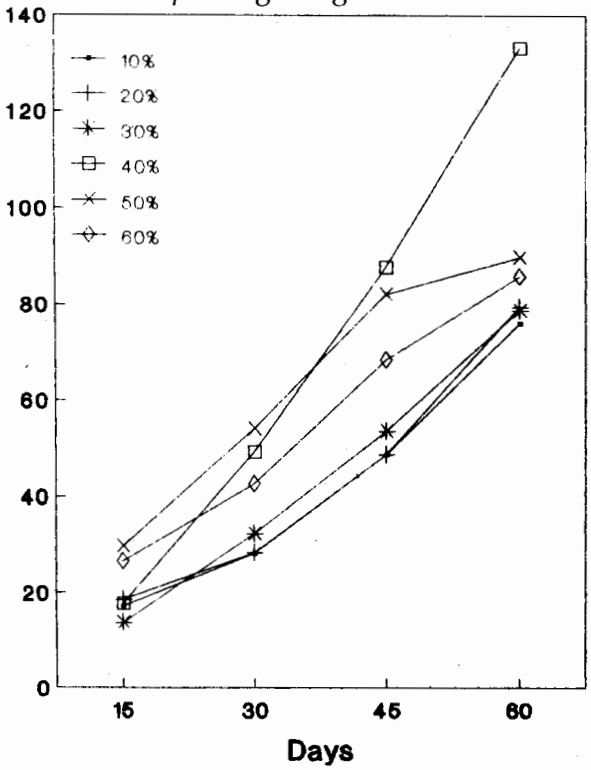

Fig. 1. Effect of varying levels of dietary protein on growth of *Liza macrolepis*.

The present findings of protein requirement for *L. macrolepis* are in broad agreement with the earlier observations on *Chanos chanos* (Lim *et al.*, 1979), *Liza haematocheila* (Yoshimatsu *et al.*, 1992) and *L. parsia* (Kiron, 1993). Studies on fresh water fish such as *Cyprinus carpio* (Ogino & Saito,1970), *Ictalurus punctatus* (Garling & Wilson, 1976) and *Tilapia mossambica* (Jauncey, 1982) also indicated that the optimal dietary protein requirement ranged from 31-40% for the above species.

Growth of fish at different dietary protein levels was significantly different ($p<0.05$). At 50 and 60% dietary protein levels the SGR, RGR and NBI exhibited a decreasing trend (Table 2). The apparent growth depressing effect of high protein diets had been reported for carps (Ogino & Saito, 1970) and tilapia also (Jauncey, 1982). This suggested that incorporation of protein beyond 40% level in diet may not be advantageous in terms of weight gain. Earlier studies on red lipped mullet indicated that higher growth was recorded with a diet having energy content of 3.56 Kcal/g and protein content of 40% (Yoshimatsu *et al.*, 1992). In the present study also the maximum growth of the fish was recorded with 40% dietary protein and 3.49 Kcal/g energy.

Significant differences in the proportions of protein, ($p<0.01$); lipid, ($p<0.01$) and

Table 3. Carcass composition of *Liza macrolepis* fed on varying levels of dietary protein for 60 days

		Dietary protein levels %					
	Initial	10	20	30	40	50	60
Protein (% DWB)	56.6^{a}	55.7	56.3^{a}	56.8^{a}	56.8^{a}	55.9^{a}	52.5
Lipid (% DWB)	$15.2^{a,b}$	$15.3^{a,b,c}$	14.8^{a}	$15.8^{b,c}$	$16.4^{c,d}$	17.1^{d}	19.7
Carbohydrate (% DWB)	2.7	4.4^{b}	5.4^{c}	5.1^{c}	3.0^{a}	3.1^{a}	4.2^{b}
Ash (% DWB))	21.6	21.2	20.6	19.0	20.3	21.1	19.7
Moisture (%)	67.0	66.8	66.7	66.6	67.2	67.6	66.8

DWB - Dry weight basis;
Values in each row with the same superscripts are not significantly different.
Protein ($p<0.01$); Lipid ($p<0.01$); Carbohydrate ($p<0.05$); Ash ($p<0.05$)

carbohydrate, ($p<0.05$) in the carcass of the fish were evident (Table 3). However, the ash content was not significantly different ($p>0.05$). Similar observations were made in tilapia also (Jauncey, 1982). Lipid accumulation and protein depletion at higher dietary protein levels may be due to the deamination of surplus protein.

The authors are grateful to Dr. K.Alagarswami, former Director and Dr. G.R.M.Rao, Director, C.I.B.A., Chennai for providing the necessary facilities. Thanks are also due to Dr. M. Natarajan, Senior Scientist for help.

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