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Food Ration for Rearing the Fry of the Mullet *Liza parsia*

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Abstract

The objective of this study was to determine the optimum feeding level for rearing the fry of a euryhaline mullet, *Liza parsia*. Six feeding levels, (4, 8, 12, 16, 20 and 24% of the body weight) were selected for experimental trial. Three groups, each with twelve fish fry (0.650 ± 0.025 g,) were fed on semi-moist purified diet at each of the above feeding levels, once a day for 5 weeks. Data on growth, food intake and food conversion were obtained. Food intake did not increase significantly beyond 8% feeding level. The growth increased linearly upto a feeding level of about 8%. Further increase in feeding level did not proportionately increase growth. The food conversion efficiency was better at the lower feeding levels, the best being at 4%.

Introduction

The influence of rate of feeding on growth rate, conversion efficiency, body composition and metabolism has been extensively studied by Gerking (1955, 1971) on *Lepomis macrochirus;* Pandian (1967) on *Megalops cyprinoides* and *Ophiocephalus striatus;* Brett *et al.* (1969) on *Oncorhynchus nerka;* Andrews and Stickney (1972) on *Ictalurus punctatus;* Pandian and Raghuraman (1972) on *Tilapia mossambica;* Reddy and Katre (1979) on *Heteropneustes fossilis;* Teshima *et al.* (1984) on *Chanos chanos* and Singh and Srivastava (1985) on *Heteropneustes fossilis.* Karmakar and Ghosh (1984) attempted to determine the optimum rates of feeding in *Liza parsia* using rice polish as the lone feed source. This feed is nutritionally inadequate especially because of its low protein and high fibre contents. That study thus remained empirical as the authors failed to consider important aspects like nutrient composition of the diet, food intake and conversion rate. The present work was therefore carried out using a. standard reference diet of known composition to determine ration levels for nursery rearing, as well as for laboratory based studies with the fry of *L. parsia.*

Material and Methods

Fry of the mullet *L. parsia,* (size 3.6±0.2 cm and mean weight 0.625 g) were obtained from the fish farm of Kerala Agricultural University, Vypeen Island, Cochin. They were acclimatised to the laboratory conditions and artificial diets for ten days. Twelve animals were introduced into each of the eighteen circular plastic tubs holding about 40l of sea water. The fish were fed on a modified, Halvers H 440 purified test diet (Table 1) in semi-moist (moisture content about 35%) form. The selected feeding levels were 4, 8, 12, 16, 20 and 24%) (designated as F_4 F_8 F_{12} F_{16} F_{20} and F_{24}) of the live body weight of the fishes. Each of the ration was fed to three groups of fry and thus a total of 36 fish fry were maintained in each ration. The amount of feed consumed by the fish was determined after collecting the food left over, if any. Individual weights were recorded in the initial and final stages of the experiment. However, group weights were measured every week. Salinity was maintained at 15±1 ppt; temperature ranged between 30.3 and 32.2°C and pH varied between 8.03-8.32 during the experimental period.

Results and Discussion

Growth (Fig. 2) observed in the fish depended on the amount of food offered, the maximum (64.67%) being for the fish fed 24% of their body weight and the least (28.57%) for fish fed 4%. The weight increment in the 4% fed group was significantly less ($P<0.001$) than those of groups F_8 to F_{24}. The percent gain in weight at the higher feeding levels (F_8-F_{24}) was not significantly ($P>0.01$) different from each other Table 2). The correlation pattern of growth over the experimental duration in the different group is indicated in Fig. 1. The data on the weekly growth increment revealed that gains were greater during the initial weeks of the experiment. The overall growth exhibited by the fish in the present study gave a non-linear exponential relation when plotted against daily ration provided (Fig. 2).

The food consumption at the F_8 level was significantly ($P<0.001$) higher than at F_4. At higher feed levels the increase in consumption was not statistically significant ($P>0.001$). Maximum amount of left-over food was collected from the F_{24} groups. Fig. 2 also shows that feed offered above 8% body weight is wasted. The gross conversion efficiency showed an inverse relation with ration level (Table 2, Fig. 3). The Food conversion ratio ranged between 4.73 (F_4) and 5.97 (F_{16}). The protein efficiency ratio was higher at the lower feed levels and the maximum was 0.48 at F_4 (Fig. 3). No significant difference in mortality rate was found between fish groups fed at different levels.

Consumption is the quantity of food eaten (as % body weight) by an animal in unit time of 24 hours (Fischer, 1979). The growth of fish is dependent on the quality and quantity of food offered. Under the present conditions, the growth of fish did not proportionately increase when fed in excess of 8% of the body weight. From Fig. 2 it is evident that the fry of *L. parsia* can consume a maximum of about 80 mg of feed/g live fish day^{-1}. This is comparable to the figure for an euryhaline fish *Tilapia mossambica:* 65 mg/g day^{-1} (Pandian and Raghuraman, 1972) and that of an airbreathing fish *Ophiocephalus striatus:* 70 mg/g day^{-1} (Pandian, 1967). The values obtained for other fishes were higher: *Gasterosteus aculeatus,* 120 mg/g day^{-1} (Beukema, 1968); *Mystus vittatus,* 157.6 mg/g day^{-1} (Arunachalam, 1978) and *Heteropneustes fossils,* 127.26 mg/g day^{-1} (Reddy and Katre, 1979). Karmakar and Ghosh (1984) had concluded that 12% body weight ration was ideal for the *L. parsia* fry having a mean weight of 142 mg using rice polish as the feed. The increased intake can be attributed to the small size of the fish, or to the nutritional imbalance of the rice polish. The percent food consumption (Fig. 2) in the fry of *L. parsia* did not increase much beyond the feed level of 8%, indicating that the maximum acceptable, ration for the fry is about 8% of its body weight. Food satiety is probably reached around this level, thereby mechanisms inhibitory to feeding reflexes are induced resulting in no further increase in food consumption. This accounts for the increasing amounts of left-over food (Fig. 2) at higher feeding levels.

Fig. 1 indicates strong correlation between weight gain and time found in all treatments. The 'b' values also showed an increase with ration levels. From the growth-ration curve (Fig. 2) we can deduce a linear increase up to a level of 8%, beyond which the growth slowed down to a non-linear pattern. The drop in growth increment beyond the feeding level of F_8 was such there was no significant difference amongst the values. Brett *et al.* (1969), Edward *et al.* (1972), Allen and Wootton (1982) and Singh and Srivastava (1985) have described such a relationship. In the present study the grwoth rate at the different feeding levels are 7.13 mg/g day^{-1} (at 4%), 12.72 mg/g day^{-1} (at 8%), 13.13 mg/g day^{-1} (at 12%), 13.26 mg/g day^{-1} (at 16%), 13.49 mg/g day^{-1} (at 20%) and 13.96 mg/g day^{-1} (at 24%). In the catfish, *Heteropneustes fossilis,* Reddy and Katre (1979) reported a growth of 8.6 mg/g day^{-1} at feed level of 4%. Since a limit has been noted in the maximum food ingested, the effective utilization for growth seems to be poorer at the higher levels of feeding.

Conversion efficiency decreased with increase in the level of food offered. The reduction in conversion efficiency may be attributed to the decrease in the efficiency of assimilation and digestion at higher rations (Werner and Blaxter, 1980). Increased SDA also may have contributed in lowering the conversion values.

The survival rates in the experiment were not affected by the feeding rates eventhough 8% mortality was observed at F_4. This is in contrast to the observations made by Karmaker and Ghosh (1984) wherein there was great variations in survival (31 to 88%), which the authors attribute to the high stocking density (3/1) of the fish. The superior survival rates obtained in this study clearly indicates that the feed supplied was nutritionally adequate.

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Table 1. Composition of experimental diet.

Ingredient	(g)
Casein	38
Dextrin	25
Gelatin	10
Starch	5
Cornoil	6
Codliver oil	4
Vitamin mix*	1
Mineral mix**	4
Cellulose	7

* Vitamins (g): Choline chloride 0.500; Inositol 0.200; L-Ascorbic acid 0.100; Nicotinic acid 0.075; Calcium pantothenate 0.050; Riboflavin 0.020; Thiamine hydrochloride 0.005) Pyridoxine hydrochloride 0.005; Menadione 0.004; Folic acid 0.0015; Cyanocobalamin 0.0011; Biotin 0.0005; L-Tocopherol acetate 0.040.

** Minerals (for 100g): Calcium biphosphate 13.58; Calcium lactate 32.70; Ferric citrate 2.97; Magnesium sulphate 13.20; Potassium phosphate dibasic 23.98; Sodium biphosphate 8.72; Sodium chloride 4.35; Zinc sulphate 0.300; Manganesesulphate 0.080; Cobalt chloride 0.100; Aluminium chloride 0.015; Potassium iodide 0.015; Cuprous chloride 0.010.

Table 2. Growth, food consumption and gross conversion efficiency of *Liza parsia* fry.

Daily ration % bodyweight F	Initial mean weight (g) W_o	Final mean weight (g) W_t	Total weight increment (%)	Daily rate of growth (%) G_d	Total food consumed (mg) FC	Gross conversion efficiency E
4	0.676 ±.014	0.869 ±.022	28.57*[a] ±1.07	0.713 ±.023	912.33*[a] ± ±27.80	23.13 ± .47
8	0.671 ±.029	1.056 ±.036	57.30[b] ± 1.35	1.272 ±.024	1844.33[b] ±30.07	20.83 ± .12
12	0.630 ±.020	1.006 ±.040	59.67[b] ±1.31	1.313 ±.022	2008.67[b] ±79.46	18.70 ± .50
16	0.662 ±.008	1.062 ±.014	60.43[b] ±1.03	1.326 ±.018	2389.33[b] ±37.50	16.77 ± .15
20	0.641 ±.040	1.037 ±.067	61.80[b] ±1.08	1.349 ±.018	2357.00[b] ±91.43	16.80 ± .56
24	0.634 ±.011	1.044 ±.015	64.67[b] ±1.26	1.396 ±.021	2417.66[b] ±22.19	16.97 ± .32

t = duration of experiment = 35 days

$$G_d = \frac{W_t - W_o}{t/2(W_o + W_t)}.100$$

$$E = \frac{W_t - W_o}{FC}.100$$

* Means not sharing a common superscript letter are significantly different (P< 0.001)

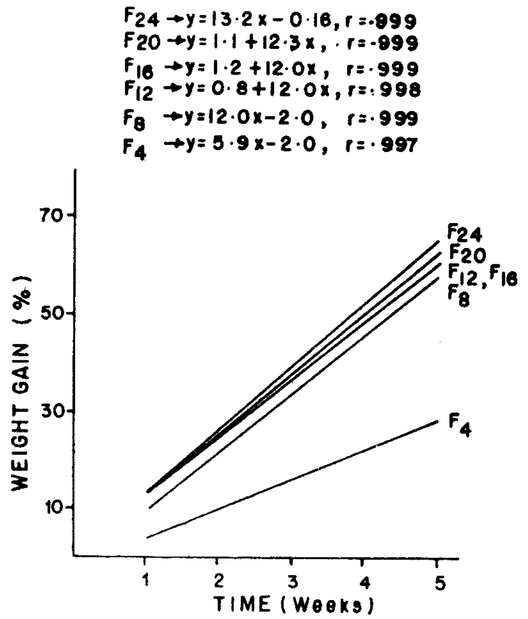

Fig. 1. Pattern of weight gain over time in the different groups.

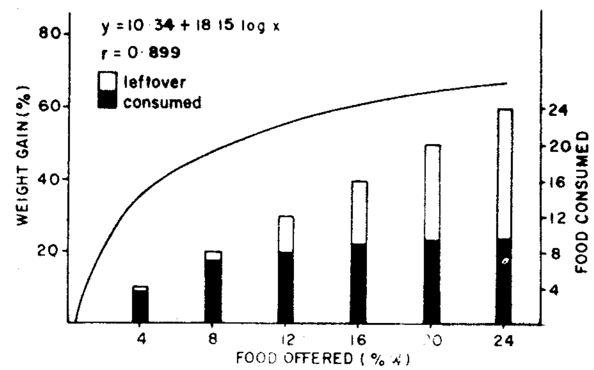

Fig. 2. Weight gain and food consumption in relation to feeding levels.

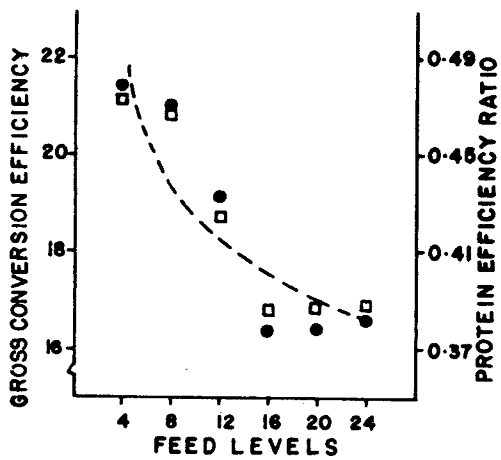

Fig. 3. Gross conversion efficiency (□) and Protein efficiency ratio (•) in relation to feeding levels.