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EFFECT OF VARYING DIETARY PROTEIN LEVELS ON THE GROWTH OF *ETROPLUS SURATENSIS*

Lekshmi, S*. and Prasad, G.
Laboratory of Conservation Biology, Department of Zoology, University of Kerala, Kariavattom, Thiruvananthapuram- 695581, Kerala, India.
**Email: luxmisanker@gmail.com*

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Abstract: The *Etroplus suratensis* (Cichlidae), The State Fish of Kerala, is an important edible and highly priced fish. This thrives well in both freshwater and brackish water. Considerable attention has been given in recent years to research and development programmes relating to the culture of this species. Protein is the most important and expensive nutrient in fish feed. Determination of appropriate levels of protein in fish feed in relation to the digestive capacity of the organism is essential in order to make the feed cost effective as well as to minimize the nitrogenous waste excretion. Dietary nutrient requirements in fish are usually estimated empirically by feeding graded levels of a specific nutrient (dose), in a basal diet containing a different level of that nutrient, and then measuring growth, feed intake, body nutrient stores or other variables (response). The main objective of this study is to estimate the optimum dietary protein requirement of pearl spot fingerlings. Fishes weighing 1 ± 0.12g were used for the study. They were collected from a local fish farm at Thiruvananthapuram and were acclimatized in the laboratory for one week. The fishes were divided into six groups, each group containing 7 fishes. After grouping, weight and length of each fish was recorded and quantity of feed needed for each group has been determined. The experiments were done in triplicates. They were fed a formulated feed of varying protein levels of 20%, 25%, 30%, 35%, 40% and 45%, for 60days. The fishes were fed twice daily at 3% of their body weight. Every fortnightly all the fishes were weighted and redefine the feed ration. After 60 days the fishes were sacrificed, recorded weight and length and used for biochemical assay. Protein was analyzed using Lowry *et al.* (1951) method. Percentage weight gain, specific growth rate (SGR), food conversion ratio (FCR) and protein energy ratio (PER) were calculated using standard methods (De Silva and Anderson, 1995). The data were subjected to one way ANOVA and compared the differences between diet treatment means ($P<0.05$). The result of the present study shows that growth response and feed utilization of fishes fed the experimental diets were influenced by the levels of protein in the diets. The highest growth performances and feed utilization were found in fishes fed 30% protein diet (D3). In the present study maximum SGR and Percentage weight gain were attained in fishes fed on diet 3. SGR and Percentage weight gain increased with increase in dietary protein level up to 30% and there after both the parameters decreased at higher protein levels. Fishes fed diet 3 (protein 30%) had the highest Percentage weight gain and SGR. In the present investigation the best FCR and PER values were obtained in fishes fed on diet 3, containing 30% protein. PER and FCR were significantly ($P<0.05$) different among the experimental diets. The PER and FCR clearly depends on the protein content of the diet. So the result of this study can be concluded as 30% of dietary protein was estimated to be optimum for the economic rearing of *E. suratensis* fingerlings.

Key words: Pearl spot, FCR, SGR, Percentage weight gain, PE

INTRODUCTION

The primary source of metabolic energy in fish is protein and lipid rather than lipid and carbohydrate in other animals (Pandian, 1988). Protein is a major fish feed component not only provides essential aminoacids, but is also used for tissue repair and growth (De Silva *et al*., 1989). Protein acts both as a structural component and as an energy source (Brett and Groves, 1979). But higher levels of protein in the fish diet not only increases the cost but also harmful to fish due to excessive excretion of ammonia (Prather and Lovell, 1973).

Protein being the most important and expensive nutrient in fish feed. Determination of appropriate levels of protein in fish feed in relation to the digestive capacity of the organism is essential in order to make the feed cost effective as well as to minimise the nitrogenous waste excretion. According to Cowey (1978) unless sufficient dietary energy is provided, the quality and quantity of dietary protein cannot fully contribute to protein synthesis. At the same time, excess energy also results in the production of more fatty fish. Hence, optimum

protein to energy (P/E) ratio in fish diet is very important to maintain flesh quality and to reduce the dietary cost.

Protein requirements, as a proportion of the diet, are known to decrease as the fish grows (NRC, 1993).Dietary nutrient requirements in fish are usually estimated empirically by feeding graded levels of a specific nutrient (dose), in a basal diet containing a different level of that nutrient, and then measuring growth, feed intake, body nutrient stores or other variables (response). The experiment is usually conducted for a sufficient period of time to produce differences in response variable. The dose response relationship is then examined using one or more methods, and the nutrient requirement is estimated from the level that produces the maximum response. The general design of these experiments has remained relatively unchanged since the early days of fish nutrition research (Wilson, 1994).

Dietary protein requirements of the fishes vary from species to species. Delong, Halver and Mertz (1958) reported 40 to 55 % as optimum protein requirement for Chinook salmon. Works of Nail (1962), Simco and Cross (1966) and Deyoe and Tiemeier (1973) showed that dietary protein requirement for the optimum growth is 25 % and above in the channel catfish. Dupree and Sneed (1966) obtained optimum growth rate in channel catfish as 40 % protein content in a dry diet. Ogino and Saito (1970) reported 35% as optimum protein level requirement for the young carp. Sumitra vijayaraghavan et al; 1978 reported 60 to 87 % protein level is optimum for *Etroplus suratensis* for higher food conversion efficiency.

MATERIALS AND METHODS

Fishes weighing 1 ± 0.12g were collected from the same farm, for knowing the optimum protein level needed for *E. suratensis*. They were acclimatized for one week at the laboratory. The fishes were divided into six groups, each group containing 7 fishes. After grouping, weight and length of each fish was recorded and quantity of feed needed for each group has been determined. The experiments were done in triplicates. They were fed a formulated feed of varying protein levels of 20%, 25%, 30%, 35%, 40% and 45%, for 60days.the fishes were fed twice daily at 3% of their body weight.

Every fortnightly all the fishes were weighted and redefine the feed ration. After 60 days the fishes were sacrificed, recorded weight and length and used for biochemical assay. Protein was analyzed using Lowry *et al.* (1951) method.

Percentage weight gain =

$$\frac{\text{Final body weight - Initial body weight}}{\text{Initial body weight}} \text{ x } 100$$

Specific growth rate (SGR, %day) =

$$\frac{\text{In final weight - In initial weight}}{\text{Final weight - Initial weight}} \text{ x } 100$$

Food conversion ratio (FCR) =

$$\frac{\text{In Mass of food consumed (dry)}}{\text{Increase in mass of animal produced (wet)}} \text{ x } 100$$

Protein energy ratio (PER) =

$$\frac{\text{Increase in mass of animal produced (wet)}}{\text{Mass of protien in feed (dry weight)}} \text{ x } 100$$

Percentage weight gain, specific growth rate (SGR), food conversion ratio (FCR) and protein energy ratio (PER) were calculated (De Silva and Anderson, 1995) as:

The data were subjected to one way ANOVA and compared the differences between diet treatment means ($P<0.05$).

RESULTS

Growth response and feed utilization of fish fed the experimental diets were influenced by the levels of protein [Table 1]. The highest growth performances and feed utilization were found by fishes fed 30% protein diet (D3). PER and FCR were significantly ($P<0.05$) different among the experimental diets. Fishes fed diet 3 (protein 30%) had the highest Percentage weight gain and SGR (Table 2).

DISCUSSION

The result of the present study shows that the dietary protein requirement of *E. suratensis* fingerlings was estimated to be 30% of protein. This value is higher when compared with the dietary protein requirement reported by

Table 2. Proximate composition of feed ingredients

No.	ingredients	Dry matter	Crude protein	Ether extract	Crude fibre	Ash
1	Fish meal	89.4	14.4	8.7	30	16.5
2	Soybean meal	90	46.0	0.9	7.3	0.6
3	Wheat flour	87.4	14.5	3.7	2.7	2.3
4	Tapioca powder	92	1.8	1.3	1.8	0.2

Table 2. Various parameters of the fishes fed on the experimental diets

No	feed	1	2	3	4	5	6
1	Protein	20%	25%	30%	35%	40%	45%
2	Initial weight	1.1	1.08	1.06	1.06	1.08	1.08
3	Final weight	2.17^{f}	2.78^{cde}	3.08^{b}	2.67^{be}	2.5^{df}	2.3^{ae}
4	Percentage weight gain	90.9^{f}	156.03^{ce}	189.18^{bd}	150.43^{cef}	131.32^{bdf}	113.24^{ade}
5	SGR	1.08^{f}	1.57^{ce}	1.77^{bd}	1.52^{cef}	1.39^{bdf}	1.26^{ade}
6	PER	1.32^{c}	1.35	1.2^{a}	0.95	0.78	0.65
7	FCR	3.79^{f}	2.95^{ce}	2.75^{bd}	3^{cef}	3.17^{bdf}	3.4^{ade}

Values on the same row with different supercripts differ significantly (P<0.05).

Palavesam *et al*. (2008), 25% protein diet had given higher growth rate than in 30% protein diet or higher protein concentration. This was due to the L-lysine supplementation in that particular diet. When L-lysine was supplied with 30% protein diet, in their study also shows higher growth performances.

Percentage weight gain of *E. suratensis* in the present study increased almost linearly with increasing dietary protein content up to 30% of protein. Beyond 30% the value showed gradual decrease. A similar decrease in growth rate was observed in E. *suratensis studied* by *Palavesam* et al (2008). Pillai and Ali (1997) reported that 31.5% protein was optimum for E. *surtensis*. This observation supports the result of the present study. Anikutty et al (1994) recommended an azolla feed of 36.93% protein for the optimum growth of E. *suratensis*. Findings of Anikutty et al (1994) show a marked increase in optimum protein requirement for E. *suratensis,* when compared to the present study and other previous studies on optimum protein for E. *suratensis* (Palavesam *et al*. (2008), Pillai and Ali (1997). The differences reported may be due to different protein used, varied components, formulation method, different environmental conditions, level of dietary intake and experimental duration.

In the present study maximum SGR was attained at diet 3 and SGR increased with increment of dietary protein level up to 30% and there after decreased at higher protein levels. This decrease in SGR at protein levels above the optimum may be the result of reduction in the dietary energy available for growth due to the energy required to deaminate and excrete excess of absorbed amino acids (Ufodike and Matty, 1983; Cho *et al*., 1985). According to Jauncey (1982), slight decrease in SGR at protein levels above the optimum may be due to the reduction in dietary energy available for growth since more energy is required to deaminate and excrete excess absorbed amino acids.

The percentage weight gain was maximum obtained in diet 3 (30% protein). Percentage

weight gain also shows a similar increase up to optimum protein level (30%) and there after it also showed a marked decrease. The FCR value was lowest in diet 3 and thereafter it increases and remains almost same value. According to De Silva and Anderson (1995) FCR (for which a lower value indicates an improved outcome) as low as 1 have been reported in fish, although generally they range between 1.2 and 1.5 for animals fed carefully prepared diets.

The PER and FCR clearly depends on the protein content of the diet. In the present investigation the best FCR and PER values were obtained in the diet 3, containing30% protein. The dietary protein content (not the initial status of fish) determines the final body protein composition (Ogunji and Wirth, 2000). This could be interpreted as the use of carbon skeleton from excess amino acids to produce reserve fat and subsequent reduction in energy available for lipid synthesis due to excess energy required for deamination, for protein levels in diets above the optimum requirement and further increments (Ufodike and Matty, 1983; Vergara *et al*., 1996). This study suggests an optimal protein level of 30% could be effectively utilized with no adverse effect by the fish.

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