Biological Forum — An International Journal, **4**(1): 79-81(2012)

ISSN No. (Print) : 0975-1130
ISSN No. (Online) : 2249-3239

Protein Efficiency Ratio (PER) of *Ctenopharengedon idella* Fed on Soyabean Formualted Feed

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(Recieved 28 March 2012 Accepted 15 April 2012)

ABSTRACT : Aquaculture is a dynamic industry that continues to provide consumers with a reasonably priced, high quality protein. The impact that any aquaculture system has on the environment, is today, and will continue to be, in the forefront when environmental issues are discussed. A better understanding of the dietary nutrient requirements of cultured fish species and a continual search for accessible, highly digestible proteins to replace expensive fishmeal is essential. This approach coupled with applying the ideal protein concept in the formulation of fish feeds can greatly ameliorate nitrogen pollution arising from fish production systems and increase profitability. Taking into account this consideration, the present investigation is carried out to evaluate protein efficiency ratio in freshwater fish *Ctenopharengedon idella* fed on different combinations of feeds formulated from readily available protein sources like soyabean and deoiled groundnut cake. The fishes fed on 100% formulated feed had highest PER values than other feeds.

Keywords : Formulated feed, Ctenopharengedon idella, PER.

INTRODUCTION

Sustainable fish culture is a formulated feed-based industry. Fish feeds constitute the major fraction of the operational cost in both intensive and semi-intensive culture systems globally. Protein is the major item of formulated feeds. It is required in large quantity by many cultivable fishes. Protein requirement of fishes is uniformly high irrespective of their food habits and ranging from 35 to 70% dry weight of the feed. Growth in cultivable fishes is primarily influenced by quality (amino acid composition) and quantity of proteins in the formulated feeds, compared to other farmed animals. Conventional fish meal continues to be a primary protein source in formulated feeds. But its rising cost, uncertain unreliable qualities have led to the scientific search for alternative sources. The utility of plant protein sources (PPS) to completely or partly replace the fish-meal is being researched meticulously. The high protein level required by fish for maximum growth has been established. Growth of fishes and utilization of feed are reported to be optimal with proteins of animal origin, mainly fish meal characterized by being of high nutritive value (Dabrowska and Wojno, 1977). The high price of fish meal and shortage on the world markets have made it necessary to look for substitutes (Tacon and Jackson 1985; Webster et al. 1992). Unfortunately, attempts to replace the fish meal component of practical fish feeds with alternative protein sources have resulted in only variable success and have generally led to reduced feed efficiency and growth (Tacon and Jackson, 1985). Regardless of the limited success, the formulation of feeds containing high levels of plant proteins has become an important objective in fish nutrition research.

MATERIALS AND METHODS

Choice of ingredients to be used in feed formulation should be based on their qualities such as protein content, energy level, types of amino acids etc. Since fish feeds contain high protein levels, protein sources are key ingredients. Proteins are made of amino acids and these are what the fish truly requires. Protein is the main constituent of the fish body soyabean is higher in proteins than any other plant sources; hence rich protein plant source soyabean is selected as basic ingredient in feed formulation. The other ingredients such as milk powder, corn flour, eggs, cod liver oil, vitamin mixture containing vitamin B Complex and E, agar powder, garlic paste, pepper powder, and cumin powder were used.

Preparation of Feed. Soyabean meal (80 gm) was taken in powder form as principal ingredients. Other ingredients like milk powder (60 gm), corn flour (20 gm), and eggs (70 gm) were added and mixed well. Agar powder (4 gm) was added as binding agent; turmeric (0.5 gm) and garlic (1 gm) as antibiotics. The said mixture was boiled, cooled at room temperature. After cooling cod liver oil (3.5 ml), vitamin mixture of vitamin B complex (1gm) and vitamin E (1 gm) were added. It was kept under refrigeration for 12 hrs. After 12 hrs it was squeezed over polythene sheet and dried at room temperature for 48 hrs. The dried nodules are crushed into small pellets then pellets are sun dried to avoid fungal infection, weighted and stored in the bottle. Following the above procedure all the feeds were formulated in the percentage composition of 25% (soyabean meal 25% + groundnut oil cake 75%), 50% (soyabean meal 50% + groundnut oil cake 50%), 75% (soyabean meal 75% + groundnut oil cake 25%), 100% formulated (totally of

soyabean meal)and 100% conventional (totally of groundnut oil cake).

EXPERIMENTAL SET UP

The fingerlings of freshwater fishes *Ctenopharengedon idella* were brought to the laboratory and acclimatized for two weeks in glass aquaria. During acclimation adequate aeration, pH and temperature was maintained from 280C to 300C. The fingerlings were randomly distributed at the rate of 20 fishes per aquaria. All the five aquaria were labeled i.e.100% formulated, 75% formulated, 50% formulated, 25% formulated and 100% conventional as per the feeding. The fishes from each tank were weighted and recorded as initial weight before starting the experiment. The average initial weight in each tank was 3.82 gms, 4.05 gms, 3.10 gms, 2.78 gms and 2.96 gms respectively. Feeding was carried out at the rate of 5% of total body weight and the fishes were fed once in a day. The weights of fishes were recorded at predetermined time intervals from each aquarium. The PER values were obtained by taking into account the recorded weights and introduced in given formula.

Protein Efficiency Ratio (PER) is based on the weight gain of a test subject divided by its intake of a particular food protein during the test period. PER is a widely used for evaluating the quality of protein in feed. The feed industry has been using PER as the standard for evaluating the protein quality of feed. Nutritional value of protein is used as guide to the effectiveness of protein source in requirements. PER is one of the most popular methods for quantifying the nutritional value of protein. It is an expression which relates the gram of weight gained to the gram of crude protein fed.

$$\text{Protein Efficiency Ratio (PER)} = \frac{\text{Total we-weight gain (g)}}{\text{Dry weight of protein fed (g)}}$$

RESULTS AND DISCUSSION

(For all experimental fishes at each time interval the values shows, $P \leq 0.0001$)

Dietary protein is used by fish for growth, energy and maintenance (Kaushik and Medale, 1994). Protein requirement for maximum growth of any species is a logical step to the development of a cost-effective feed for the fish, and entails determining the minimum amount required to produce maximum growth and not be used for energy (Sang-Min and Tae-Jun, 2005). Thus, any reduction in dietary protein level without affecting fish growth can substantially reduce the cost of feed. The need for protein and other nutrients in supplemental diets depends upon the levels supplied by the natural food for a targeted production level. Thus, the incorporation of these nutrients in supplemental diets must increase to meet the requirement of increasing fish biomass (Sumagaysay and Borlongan, 1995).Protein, essential for tissue growth and maintenance, is an expensive component of formulated diets. When insufficient energy is available in a diet from non-protein sources, protein may be catabolized to meet the energy requirements at the cost of nutrient supply (Capuzzo & Lancaster 1979; Sedgwick 1979).

Table 1: Protein analysis in formulated feeds.

Parameters	Conventional feed 100%	Formulated feed			
		100%	75%	50%	25%
Analytical values of protein in fish feed (%)	24.495	32.92	32.92	32.70	25.99

Table 2: The values Protein Efficiency Ratio (PER) of experimental fishes fed on different combinations of feeds were as follows.

Days	Conventional feed 100%	Formulated feed			
		100%	75%	50%	25%
30	0.0142	0.0207	0.0283	0.0066	0.007045
45	0.0222	0.0313	0.0280	0.0061	0.011160
60	0.0306	0.0308	0.0329	0.0127	0.012175
75	0.0323	0.0445	0.0340	0.0177	0.0130
90	0.0299	0.0381	0.0312	0.0506	0.0115

Graphical presentation of Protein Efficiency Ratio (PER) values in experimental fishes fed on formulated feed:

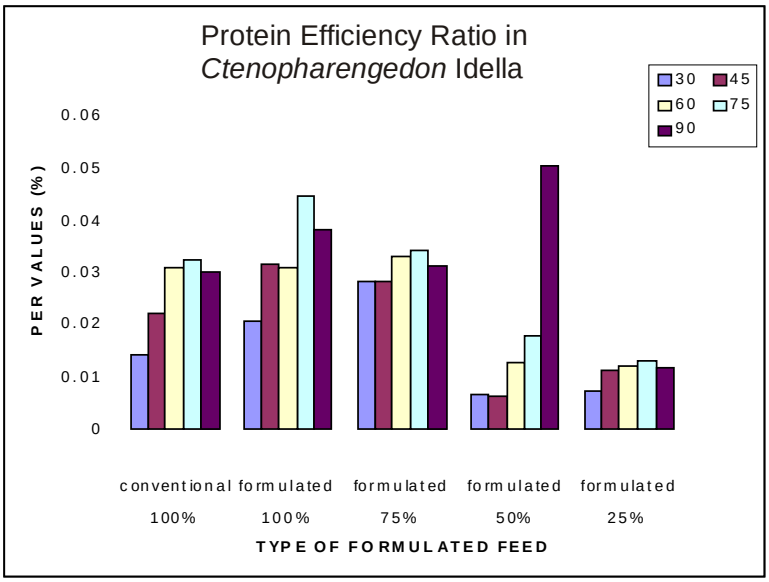

Table 3: Mean and Standard Deviation values for PER results.

Type of feed	30 days	45 days	60 days	75 days	90 days
Conventional feed 100%	0.0143±0.000167	0.0224±0.000158	0.0307±0.000158	0.0325±0.000158	0.0297±0.000158
*Formulated feed 1*00%	0.2058±0.00013	0.0314±0.00158	0.0307±0.000187	0.0447±0.000148	0.0385±0.000023
Formulated feed 75%	0.0285±0.000158	0.0282±0.000207	0.0327±0.000084	0.0343±0.000303	0.0313±0.000207
Formulated feed 50%	0.0068±0.000158	0.0063±0.00023	0.0126±0.000114	0.0177±0.000114	0.0506±0.000114
Formulated feed 25%	0.0071±0.00027	0.0113±0.0027	0.0123±0.000187	0.0138±0.000192	0.0115±0.000152

In the present experiment, results of PER values were high in 100% formulated feed (0.0445 g), while the fishes fed on 100% conventional feed shows 0.0323 g, which is the low value as compared to other formulated feeds. The values of Protein Efficiency Ratio of experimental fishes are statistically highly significant ($P \leq 0.0001$).

ACKNOWLEDGEMENT

Authors are thankful to Head, Department of Zoology, Shivaji University, Kolhapur for providing laboratory and other infrastructure facilities towards completion of said work.

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