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Effect of Isocaloric Diets with Varying Protein Level on Growth and Survival of Post-larvae of *Macrobrachium rosenbergii*

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Post-larvae of *Macrobrachium rosenbergii* (de man) were fed on an isocaloric diet (3100 K.cal DE/Kg) having different levels of protein (27.56, 34.12 and 41.12%) with protein: energy ratio of 88.16, 109.18 and 130.58 mg CP/K. cal respectively. The animals were reared for a period of six weeks under a temperature regime of 13-22°C. The highest weight gain, specific growth rate and the best feed conversion ratio recorded were 165.61 mg, 3.35 and 1.69 respectively. The survival rates in ranged between 77.8 and 84%.

Key words : Isocaloric diet, *Macrobrachium rosenbergii*, protein FCR, PER, survival.

The giant freshwater prawn, *Macrobrachium rosenbergii* is a fast growing prawn among the palaemonids and has proved to be an excellent shell fish for warm water aquaculture (Ling, 1969). The present trend in aquaculture is the development of semi-intensive culture system where feed is the most critical and expensive item. So, development of a nutritionally balanced feed is of paramount importance.

Protein and energy content of the feed are of prime importance for regulating growth and feed intake of the animal, which directly affect the economy. Protein is an essential but expensive component in a diet. This expensive protein fraction should be optimally utilized for growth rather than for maintenance of the prawns. Knowledge of the optimal level of protein and protein sparing effect of non-protein nutrients (carbohydrates and lipids) are effective in reducing feed cost.

Similarly feed intake of the animal is regulated according to energy concentration of the feed (Jobing & Wandsnik, 1983) and dietary protein has no significant influence on dietary feed intake (Dela *et al.*, 1989).

Since protein and energy relationship (P/E) is basic to define other nutritional requirements, and information related to this for *M. rosenbergii* is scarcely available, this work was undertaken to study the effect of different P/E ratios on post larval diets of *M. rosenbergii* on growth and survival.

Materials and Methods

Two hundred and twenty five, 20 days old post larvae of *M. rosenbergii* (average wt., 51.3 mg) were stocked in 50 l capacity plastic basins at the backyard of Aquaculture Division of Central Institute of Fisheries Education, Mumbai at densities of 15 post larvae in 30 l water (500 Pl/m^2) and fed three iso-caloric diets (3100 K.cal DE/Kg) having different levels of proteins 27.56%, 34.12% and 41.12% with protein energy ratio of 88.16 (D_1), 109.18 (D_2) and 130.58 (D_3) mg of CP/ Kcal of DE, for 42 days. Each treatment was replicated in 5 plastic basins. The feed were similar to those fed commercially, composed of acetes, prawn head meals, groundnut oil cake, soybean cake, sesame oil cake, rice bran, wheat flour, cod liver oil, soybean oil and vitamin and mineral supplements. The physical and chemical composition are given in Table 1. DE values were estimated as per

NRC, 1983. The different ingredients were mixed according to the formulation to make iso-energetics. Diets were processed into 2 mm diameter sinking pellets by a hand pelletizer. Dry matter, protein, lipid, crude fiber, nitrogen free extract and ash percentages in the diets were estimated by the methods prescribed by AOAC (1980) whereas the water quality parameter like pH, DO, total alkalinity and water temperature were measured as per APHA (1985). Round the clock aeration was done to maintain the DO level of each experimental basin.

Table 1. Ingredients proportion and proximate composition of the experimental diets

Ingredients (%)	Diets (DM basis) Diets D_1	D_2	D_3
Acetes	20	30	40
Prawn head meal	8	8	10
GNOC	8	12	12
Soybean meal	8	10	12
Sesame oil cake	5	5	5
Rice bran	34	20	7
Wheat	10	10	10
Cod liver oil	3	2	1
Soybean oil	3	2	2
Vitamin & Mineral	1	1	1
Proximate composition of the diets:			
Crude protein (CP)	27.56	34.12	41.12
Ether Extract (EE)	9.33	10.66	7.66
Crude Fiber	3.82	4.63	5.38
Nitrogen Free Extract (NFE)	46.41	37.17	31.12
Ash	11.85	11.42	14.28
Calculated Energy (Kcal De/Kg)	3126	3125	3149
Protein: Energy Ratio	88.16	109.18	130.5

The length and weight of the animals were taken just before starting of the experiment followed by ten days interval till the end of the experiment. Accordingly the growth parameter like gain in length and weight, percent increase in length and weight, per day increment, specific growth rate, feed conversion ratio and efficiency ratio was calculated (Halver, 1957). The total number of PL in each basin were determined at the end of the experiments and survival percentage in treatment was calculated.

Data for the mean percent gain in length and weight, specific growth rate, feed conversion ratio and feed efficiency ratio were compared by analysis of variance (Snedecor & Cochran, 1980) to determine, if significant difference occurred among treatments. Differences were considered significant at $P = 0.05$.

Results and Discussion

The physico-chemical parameters like DO, pH, total alkalinity ranged from 7.8 – 9 mg^{-1}, 7.0-8.2 and 174-230 mg L^{-1}, respectively, which were in agreement with the optimum range for *M.rosenbergii* (New & Singholka, 1982; Subramanyam, 1987 and Sandifer & Smith, 1985). However, the water temperature varied from 13–22°C throughout the experimental period.

The growth parameter like gain in weight and length, percent gain in length and weight, per day increment, specific growth rate (SGR) are in Table 2. The weight gain, length gain and SGR increased as the protein in the diet increased to 34.12% of 109.18 mg of CP/K cal of DE. A maximum weight and length of 218.51 mg and 28.46 mm, respectively were recorded by D_2 group (34.12% protein content of the diet or, 109.18 mg of CP/K cal of DE) followed by D_1

Table 2. Mean and percent gain in length and weight, SGR and per day increment of prawns fed different experimental diets.

Parameters	Groups D_1	D_2	D_3
Initial body weight (mg)	54.45±5.37	52.90±0.9	48.65±3.38
Final body weight (mg)	193.85±20	218.51±16.59	160±15.34
Body weight gain (mg)	139.40	165.61	111.35
Daily weight gain (mg)	3.31	3.94	2.65
Percent weight gain	342.02	413.68	337.65
Initial length (mm)	19.13±0.55	18.64±0.19	18.11±0.31
Final length (mm)	28.03±1.12	28.46±0.54	25.5±0.61
Length gain (mm)	8.90	9.82	7.39
Daily length gain (mm)	0.21	0.23	0.17
Percent length gain	146.54	152.54	140.87
Specific growth rate	3.02	3.35	2.81

(27.56% protein content of the diet or 88.16 mg CP/K cal of DE) and D_3 (41.12% protein content of the diet or, 130.58 mg of CP/K cal of DE). Similarly gain in weight (165.61 mg), length (9.82 mm), percent weight gain (413.68%), percent length gain (152.55%) and specific growth rate (3.35) were also highest for D_2 group which were not significantly different than the other groups. The present trend of increased growth rate upto 34.12 % protein content of the diet, or, 109.18 mg CP/K cal of DE followed by decreased growth rate beyond this level of protein is supported by many workers (Deshimaru & Yone, 1978; Ahmed Ali, 1988). It suggests that protein may be spared by carbohydrates or lipids as long as caloric requirements are met, thus permitting more efficient utilization of protein. The effective protein level of 34.12% found in this experiment is consistent with the results obtained by Sahadevan (1992). The less growth rate in D_3 group having highest protein level (41.12%) indicated inadequate energy content of the feed for which protein was utilized for energy purpose rather than growth.

Table 3. Mean feed conversion ration (FCR), Feed Efficiency ratio (FER) Protein Efficiency ratio (PER) and Survival

Experimental groups	FCR	FER	PER	Survival
D_1	2.04±0.15	0.49±0.04	1.81±0.15	77.33
D_2	1.69±0.12	0.59±0.04	1.75±0.11	80.00
D_3	2.29±0.32	0.48±0.08	1.15±0.21	84.00

* ($p \leq 0.05$)

No significant difference was observed in FCR and FER values, as protein level increased from 34.1 to 41.12% (Table 3). The high FCR in D_1 group may be due to less protein (27.56%) and high level of carbohydrate in the diet which has a negative effect on feed conversion efficiency as reported by Shimeno *et al.* (1979). However, the higher FCR in D_3 group having highest protein level (41.12%) may be due to reduced growth of this group.

Protein efficiency ratio (PER) in D_1 and D_2 group were significantly different than D_3 group ($P<0.05$). The lowest PER values obtained by D_3 group containing highest protein (41.12%) suggest that more protein is diverted into energy production if the caloric requirement in the diets are not satisfied. Cowey & Sargent (1972) also stated that if the diet is insignificant in energy, protein is used for energy rather than for growth.

Present study did not show any definite relationship between survival percentage and dietary treatments. However, higher survival of 84% was recorded by D_3 group followed by D_2 (80%) and D_1 group (77%). In the present situation it is difficult to draw any conclusion regarding survival, as the mortality occurred due to some external infection during the last part of the experiment. Besides this the low temperature and handling stress during the experiment also caused mortality.

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