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## **Survival and Growth of the Freshwater Prawn *Macrobrachium rosenbergii* in Relation to Different Nutrients Composition**

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### **ABSTRACT**

The objective of this study is to assess the effect of different nutrients composition on growth rate of *Macrobrachium rosenbergii* and its Survival and growth during the preparation of diet. The experiment was set up with 5 dietary treatments with change in their composition. The study was conducted in 5 aquariums with stocking density of 30 prawns. The investigation was conducted for 6 month. Generally, the maximum survival rate (40) was recorded at the diet III including protein 45%, while lowest survival rate (13.33) was observed at the diet V including highest protein. Significantly higher growth for final body weight (35.5 g), specific growth rate (2.04) and improving in normalized biomass index (3.99) were observed in groups of prawn fed diets III (including protein 45%) In addition the growth significantly declined at the diet V including highest protein (75%). The most suitable diet in supplemented feed for rearing *M. rosenbergii* should be supplemented with protein level ranged from 30-45%.

**Key words:** *Macrobrachium rosenberger*, treatment, survival rate, weight, protein, specific growth rate

### **INTRODUCTION**

Freshwater prawn farming is expanding fast all over the world and therefore concerted efforts are being made to increase the seed production (Soundarapandian, 2008). More *Macrobrachium rosenbergii* is found extensively in the tropical and subtropical fresh waters of India, Sri Lanka, Thailand, Malaysia, Philippines. It is generally found in freshwater, in ponds, rivers, lakes, ditches, canals, depressions, low-lying floodplains and river mouths. Most of the species spend their early life in brackish water that is connected directly or indirectly with the sea. Some species complete their life cycles in freshwater but these are not of commercial importance. *Macrobrachium rosenbergii* is most suitable for culture due to its large size and its less aggressive nature under culture conditions. There are 150 species of *Macrobrachium* in the world, of which 49 are commercial. Twenty-seven of the commercial species are found in Asia and the Pacific. Most live in freshwater. Tayamen (2001) of which about 25 species are found in India (Soundarapandian and Kannan, 2008).

The farming of the giant freshwater prawn *Macrobrachium rosenbergii* popularly known as 'scampi' has been expanding in India recent years (Mitra *et al.*, 2005). The freshwater prawns (*Macrobrachium rosenbergii*) have been the focus of research in India because of the success achieved in its commercial farming in southern states (Jain *et al.*, 2008).

India with its aquaculture production of 3.12 million tones is placed second only after China in the year 2006 (FAO, 2009). Freshwater crustaceans including prawns though produced in meager quantities (around 953 198 tones) have gained significance as high value commodity by standing

as fifth highest valued species group. Farming of giant freshwater prawn *Macrobrachium rosenbergii* popularly known as scampi is spreading fast to all Indian states due to its large size attainment, tolerance to water quality changes, ability to cope with handling stress and ability to feed on unconventional feeds (Yathavamoorthi *et al.*, 2010).

The global annual production of freshwater prawns (excluding crayfish and crabs) in 2003 was about 280,000 tons, of which China produced some 180,000 tons, followed by India and Thailand with some 35,000 tons each. Additionally, China produced about 370,000 tons of Chinese river crab (FAO, 2003). The prawn is one of the high value aquaculture products emerging from Asia. At present feed is the largest single cost item, as it constitutes 40-60% of operational cost in prawn production.

Water quality influences the level of growth that can be achieved with freshwater prawns. Dissolved oxygen is particularly important and a good oxygen-monitoring program is necessary because prawns live on the bottom, levels of dissolved oxygen should be routinely monitored within the bottom 0.3 m (1 ft) depth of water. Oxygen levels at the surface can potentially be lower than those at the bottom (MSUC Cares/CommercialPrawnProduction).

A high pH can cause mortality either directly by means of creating a pH imbalance relative to the prawn tissue or indirectly by causing a larger proportion of ammonia to exist in the toxic un-ionized form (Costa-Pierce *et al.*, 1984).

Water temperature is probably the most important environmental variables in prawn cultures, because it directly affects metabolism, oxygen consumption, growth, molting and survival (Soundarapandian *et al.*, 2008). *Macrobrachium rosenbergii* do best in water of 26 to 30 degrees C. (79 to 86 F). They can survive from 22 to 32 degrees C. (71 to 90 degrees F.) but growth and activity becomes at best sluggish at the ends of their range (Costa-Pierce *et al.*, 1984).

## MATERIALS AND METHODS

**Experimental conditions:** The experiment has started on the first of August 2009. The study was carried out in laboratory aquariums to find out *Macrobrachium rosenbergii* food habits and its survival and growth with different food items which are easily available. The rearing of *Macrobrachium rosenbergii* was done in 5 aquariums (each of 60×40×30 cm size) were filled with water and were continuously aerated by means of an electric compressor. Polyvinyl Chloride (PVC) tubes and some stones were put on the bottom of each aquarium as sheltering place for *Rosenbergii juveniles*.

**Feeds and feeding rate:** Feeding content was adjusted based on daily observations of feed intake of the *rosenbergii* juveniles. Total feed rotation was divided into two parts; about 1/3 of the total feed was given at 10 a.m. and the remaining amount at 10 p.m. At the end of the experiment, all *rosenbergii* (in bulk) from each tub were weighed. Five different types of feed with change in their composition were tested. There were 5 dietary treatments. Ingredient compositions of the test diets were similar as in Table 1.

**Sample collection:** Prawns were measured for weight every fifteen days and water sample collection for analyzing of physic-chemical were carried at 10 a.m and usually from 5-10 cm depth from the water surface, once a week for pH and Do and every day for temperature.

Table 1: Composition of test diets

Ingredient	Diet I (%)	Diet II (%)	Diet III (%)	Diet IV (%)	Diet V (%)
Powder meat	5	10	15	20	25
Moll scan meat	5	10	15	20	25
Cornmeal	20	20	15	10	5
Wheat flour	20	20	15	15	5
Multivitamin	5	5	5	5	5
Soya flour	5	10	15	20	25
Groundnut oil	20	10	10	5	5
Rice and bean	20	15	10	5	5

**Growth measurements:** Body weights (g), of prawns were measured biweekly and Weight Gain (WG) %, Specific Growth Rate (SGR), Normalized Biomass Index (NBI), as follow:

$$\text{Weightgain (WG)} = \text{Final b.wt.(g)} - \text{Intial b.wt.(g)}$$

$$\text{Weightgain (WG)\%} = [\text{Final b.wt.(g)} - \text{Intial b.wt.(g)}] \times 100$$

$$\text{Specificgrowthrate (SGR)} = \left[ \frac{\text{Ln}(\text{Final b.wt.(g)}) - \text{Ln}(\text{Intial b.wt.(g)})}{t} \right] \times 100$$

$$\text{NBI} = \frac{\text{Final Wt. x Prawn No.} - \text{Intial Wt. x No.}}{100}$$

$$\text{Survivalrate} = \frac{\text{Final No. of prawn}}{\text{Intial No. of prawn}} \times 100$$

**Water quality parameters:** Temperature, pH, dissolved oxygen were measured using Standards Methods for the Examination of Water and Waste Water (APHA, AWWA and WPCF, 1995).

**Statistical analysis:** Data were statistically processed for one analysis of variance (ANOVA) with Duncan's Multiple Range Test (DMRT) according to Snedecor and Cochran (1961). To find out the significant differences among the treatment groups for growth studies at different comparison of test diets.

## RESULTS

**Growth of prawn analysis:** Growth parameters of *M. rosenbergii* in relation to different composition of test diets are shown in Table 2. During the period of the study conducted using different feeds in *M. rosenbergii* showed significantly greater growth in terms of Weight Gain % (34.6 g), specific growth rate (2.04) and improving in normalized biomass index (3.99) were observed at the diet III including protein 45% during 6 month. While the minimum WG , SGR and NBI, measured for the *Rosenbergii* fed treatment -V containing 75% dietary protein and showed lowest significantly values until the end of experiment.

Analysis of feeding experiments carried out with the weight gain of freshwater prawn *Macrobrachium rosenbergii* in order to determine the requirement of different dietary supplements on growth rate of *Macrobrachium rosenbergii* especially in term of survival rate is shown in Table 3. This shows significantly higher survival rate (40) was measured for the *rosenbergii* fed

Table 2: Growth parameters of the freshwater prawn fed different composition at the end of 6 months

Parameters treatment	Initial weight (g)	Final b.wt. (g)	Weight gain (WG) (%)	Specific growth rate	Normalized biomass index
Diet I	1.00	28.06	27.06	1.85	1.94
Diet II	1.03	32.02	30.99	1.91	3.21
Diet III	0.90	35.50	34.60	2.04	3.99
Diet IV	0.94	25.05	24.11	1.83	1.22
Diet V	0.97	22.00	21.03	1.73	0.60

Table 3: Survival rate performance of the freshwater prawn fed different composition at the end of 6 months

Treatment	Initial No.	Final No.	Survival rate
Diet I	30	8	26.66
Diet II	30	11	36.66
Diet III	30	12	40.00
Diet IV	30	6	20.00
Diet V	30	4	13.33

Table 4: Fluctuation in (Mean±SD) pH of water samples at during 6 month

Month treatment	Aug.	Sep.	Oct.	Nov.	Des.	Jan.
Diet I	8.38±0.026	8.30±0.035	8.00±0.17	7.90±0.17	7.70±0.15	7.5±0.17
Diet II	8.26±0.026	8.23±0.036	8.00±0.17	7.85±0.15	7.60±0.17	7.5±0.15
Diet III	8.30±0.026	8.27±0.060	8.20±0.28	8.00±0.17	7.80±0.17	7.9±0.15
Diet IV	8.27±0.060	8.21±0.070	8.00±0.10	8.00±0.16	7.83±0.17	7.7±0.17
Diet V	8.30±0.230	8.29±0.032	8.15±0.20	8.00±0.17	7.73±0.16	7.4±0.17

\*\*Fluctuation in (Mean±SD) pH of water by the different diet are not significantly different

Table 5: Fluctuation in (Mean±SD) DO of water samples at during 6 month

Month treatment	Aug.	Sep.	Oct.	Nov.	Des.	Jan.
Diet I	6.8±0.17	6.5±0.17	6.5±0.17	6.1±0.17	5.7±0.17	5.2±0.17
Diet II	7.0±0.17	6.8±0.17	6.7±0.17	6.2±0.17	5.7±0.17	5.5±1.08
Diet III	6.9±0.17	6.5±0.17	6.2±0.17	6.2±0.17	5.7±0.17	5.0±0.21
Diet IV	7.0±0.17	6.7±0.17	6.5±0.17	6.0±0.36	5.9±0.10	5.5±1.08
Diet V	6.7±0.17	6.5±0.17	6.3±0.17	6.0±0.36	5.4±0.10	5.1±0.10

treatment -III with 45% dietary protein and survival rate obtained for the prawns fed with diet II was 36.66 and this tank had higher survival rate than tank No. 1 with the prawns fed with diet I and tank No. 4 with the prawns fed with diet IV ( 26.66 and 20 ). While the minimum survival rate was measured for the *rosenbergii* fed treatment-V with 75% dietary protein showed significantly lowest survival rate (13.33).

**Physico-chemical analysis parameters of water:** Fluctuation the means values±SD of water sample quality parameters such as like pH, Temperature, DO in the investigation period that are important water quality parameters in grow *M. rosenbergii* juveniles have been depicted in Table 4 and 5.

The fluctuations in the values of pH in relation to different composition of test diets are represented in Table 4. According to Table 4, the maximum value of pH (8.38±0.026) was recorded for the fed treatment-I on the August month and the minimum pH value (7.4±0.17) was for diet-V on the January.

The Fluctuation in the level of Dissolved Oxygen (DO) for each treatment are represented in Table 5. The maximum concentration of Dissolved Oxygen (DO) was  $7\pm 0.17$  mg L<sup>-1</sup> recorded for Diet-II and minimum obtained value ( $5\pm 0.21$  mg L<sup>-1</sup>) was recorded for fed treatment-III.

Generally all the parameters quality were optimum for the growth of the prawn and were within the acceptable range for freshwater prawn, *Macrobrachium rosenbergii*.

## DISCUSSION

The study carried out with the feeding experiments showed that the giant freshwater *Macrobrachium rosenbergii* require dietary protein for weight gain, specific growth rate and survival rate Gomez *et al.* (1988). Studied on the effect of dietary Protein and energy level on growth of the giant freshwater *Macrobrachium rosenbergii* and they have concluded that the dietary energy levels improved growth and feed efficiency.

This study brought out that fresh water prawn required dietary supplements with protein level ranging from 30-45% and best growth was seen in these protein level tank II, III and confirmed the best result in terms of growth weight gain %- specific rate growth and survival rate. However Habashy (2009) studied on the growth of juvenile freshwater prawn, *Macrobrachium rosenbergii*, he had concluded that freshwater prawn required dietary protein level ranged from 25-35%.

In the present study the highest weight gain (30.99, 34.60), survival rate (36.66, 40) and specific growth rate (1.91, 2.04) were recorded in aquarium number fed with diet II and III including 30 and 45% dietary protein level but Habashy (2009) has given the protein requirement for the best prawns growth ranged from 25-35%. Weight gain and feed efficiency increased as the energy level increased.

This study showed increasing the dietary protein levels does not improve growth. Protein levels tested in this study did not affect the growth terms in range 60-75% but Gomez *et al.* (1988) have told increasing the dietary energy level improved growth and feed efficiency.

The results of the present study showed that the 45% protein diet was recommended to achieve the optimum growth rate of freshwater *M. rosenbergii* but a study by Chowdhury *et al.* (2008) has shown that 35% protein diet shows the optimum growth indices of freshwater prawn *M. rosenbergii*.

## CONCLUSION

Based on this study the suitability of the used feed ingredients could be clarified. Thus the present study indicated that the prawns fed with diet III (45% protein) displayed highest growth measurements While the minimum gain terms were measured for the fed treatment V with 75% dietary protein. In summary, the results suggest that the most suitable diet in supplemented feed for rearing *M. rosenbergii* should be supplements with protein level ranged from 30-45%.

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