

Optimum Ration size and Feeding Frequency for Rearing of *Penaeus monodon* Fabricius

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Optimum ration for *Penaeus monodon* juveniles with an average size of 3.3 cm (0.209 g) has been determined after conducting feeding trials with rations at 0, 3, 6, 9, 12, 15, 18 and 21 percent of the body weight on a clam meal based diet. The results of the study indicated that 6% was the optimum ration while the maintenance ration and maximum ration were found to be 1.8% and 15%, respectively. The optimum feeding frequency was found out by feeding the juveniles with the selected ration at different frequencies. The highest weight gain was recorded in the case of prawns fed thrice daily.

Key words : Ration size, feeding frequency, prawn culture, *Penaeus monodon*

The black tiger prawn *Penaeus monodon* is the most extensively cultured species in the countries of South-East Asia, owing to its fast growth rate, capacity to adapt to various culture systems and efficient response to compounded feed. In intensive monoculture farming systems of shrimp and other crustaceans in controlled tanks, application of optimum ration and feeding frequency have much significance both for reducing unit cost of production as well as improving the yield. The ration size and the frequency with which animals consume feeds have been shown to have substantial effects on their metabolism (Cohen *et al.*, 1963). It is a common practice in hatcheries to vary the feeding regimes to improve the growth and survival rates of the larvae (Ishiwata 1969, Kono & Nose, 1971). The quantity of feed offered to an animal is generally based on the body weight and ranges from 5-100% of wet body weight in dry feed depending on the size of the animal (Subramanyam & Oppenheimer, 1970; Venkataramiah *et al.*, 1972). Feeding animals in divided doses twice or thrice a day was found to contribute towards better growth and

conversion efficiencies than feeding the entire quantity once in a day (Primavera *et al.*, 1979; Chua & Teng, 1982; Cuzon *et al.*, 1982). According to Sick & Baptist (1973) factors such as age and size of test animal, environmental parameters such as salinity, oxygen, temperature and pH of the water are also known to influence food consumption. In the present paper an attempt has been made to find out the optimum food ration and meal frequency for *P. monodon* juveniles fed on a clam meal based diet.

Materials and Methods

Post larvae of *Penaeus monodon* belonging to the same broodstock were obtained from the Regional Shrimp hatchery at Azhikode, Kerala, India. The post larvae were introduced into cement cisterns of 350 l capacity at the rate of 100-150 animals per tank. The water in the cisterns were maintained at 20‰ salinity. The post larvae were fed with compounded pellet diets to obtain desired early juveniles for the present experiment. Experiments were carried out in 50 l plastic tanks of 60x40x40 cm size in which aeration was provided with the help of an air compressor using air

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stones. One third of the water was replaced daily by water of the same salinity while complete water in the tanks was replaced once a week. Fifteen numbers of juveniles of *P. monodon* (average length 3.3 ± 0.01 cm; average weight 0.21 ± 0.06 g) were introduced into each experimental tank. Rations at 0, 3, 6, 9, 12, 15, 18 and 21 percentage of the body weight were given to the prawns. The feed provided was based on powdered clam meal maintaining 40 percent protein level. The proportion of the different ingredients in the diet was clam meal 62%, groundnut oil cake 15%, rice bran 10%, tapioca powder 11%, sardine oil 1% and mineral mix 1%. Each treatment had three replications. The specific growth rate, survival (%) and food consumption rate were determined at the end of 6 weeks. In order to study the optimum feeding frequency 15 nos. of *P. monodon* juveniles (average length 3.2 ± 0.02 cm; average weight 0.21 ± 0.02 g) were introduced into each tank. The prawns were fed on the selected diet at the rate of 5% of the body weight at different frequencies viz., (I) Once a day at (a) 08:00 h or (b)

20:00 h; (II) Twice a day at (c) day and night (08:00 h and 20:00 h) or (d) 08:00 and 14:00 h or (e) 14:00 and 20:00 h; (III) Thrice a day at (f) 08:00, 14:00 and 20:00 h (IV) Four times a day at (g) 08:00, 11:00, 14:00 and 20:00 h. At the end of 6 weeks the specific growth rate, food consumption and survival rates were worked out.

Results and Discussion

Temperature in the experimental tanks ranged between 25.5 - 28.5°C. The pH in the tanks was found to be alkaline throughout, in the range of 7.97 - 8.49. The salinity of the water was maintained at 20‰. The average value of oxygen in the different treatments varied from 5.27 - 7.01 ppm. The highest live weight gain, specific growth rate and survival percentage were obtained when feeding was done at 15% of the body weight. Table 1 presents the data on the effect of ration size on food consumption and growth of *P. monodon* juveniles. The analysis of variance of the data showed that different rations significantly influenced ($p < 0.01$) the growth rate of the test animals.

Table 1. Effect of ration size on food consumption and growth of *Penaeus monodon* juveniles*

	Ration size (% body weight)							
	0	3	6	9	12	15	18	21
Mean initial weight, g	0.236	0.213	0.201	0.208	0.188	0.208	0.205	0.220
Mean weight after 3 weeks, g	0.141	0.277	0.391	0.539	0.543	0.632	0.627	0.579
Mean live weight gain, g	-0.095	0.064	0.190	0.331	0.355	0.424	0.422	0.359
Total food consumption per animal, g	Nil	0.141	0.389	0.745	0.905	1.230	1.413	1.400
Food conversion ratio	Nil	2.200	2.050	2.250	2.550	2.900	3.350	3.900
Survival, %	32	56	80	82	86	92	90	86

* Average of three values

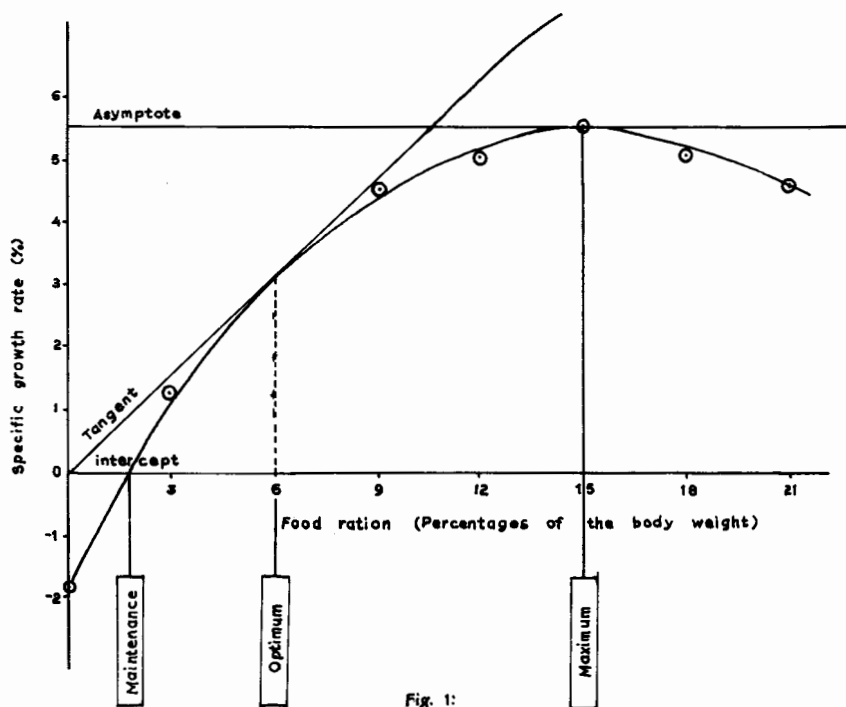


Fig. 1:

Fig. 1. Relationship between ration size and specific growth rate for *Penaeus monodon*

In shrimp farming systems, determination of optimum food ration is of great significance for reducing the cost of operation, as well as for maintaining the environmental hygiene. Sick *et al.* (1973) observed that consumption rates in prawn were directly proportional to the animal size and length of exposure to any particular feed. Apud (1988) reported that the optimum ration for *P. monodon* having an average weight of 1.7 g is 6% of the body weight and maximum ration as 13% of the body weight. Sedgwick (1979) found that the optimum ration for *P. merguensis* juveniles was 6% of the body weight while the maintenance and maximum rations were 2% and 16% of the body weight, respectively. In the present study, the optimum ration for prawns with an average size of 3.3 cm/0.21 g for the clam meal based diet was found to be 6% of the body weight, while maintenance ration and

maximum ration were found to be 1.8% and 15% respectively (Fig. 1). Gain in weight and survival rates increased with increase in ration, until it reached 15% of the body weight, after which the gain in weight decreased. The food intake was also low beyond 15% ration.

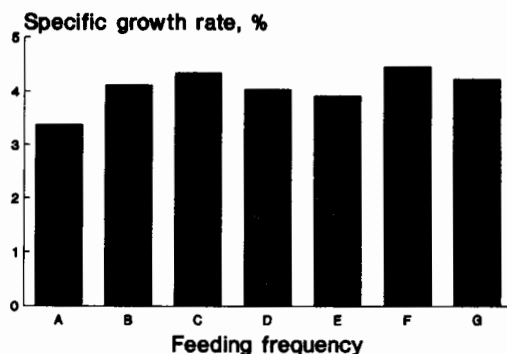


Fig. 2. Growth response of *Penaeus monodon* to different feeding frequencies. See text for explanation of frequency codes

Table 2. Effect of feeding frequency on food consumption, growth and survival of *Penaeus monodon* juveniles*

	Once a day		Feeding frequency Twice a day			Thrice a day	Four times a day
	08:00 h	20:00 h	08:00 & 20:00 h	08:00 & 14:00 h	14:00 & 20:00 h	08:00; 14:00 & 20:00 h	08:00 14:00 & 17:00 & 20:00 h
	A	B	C	D	E	F	G
Mean initial weight, g	0.240	0.201	0.198	0.216	0.224	0.202	0.220
Mean weight after four weeks	0.617	0.636	0.667	0.668	0.670	0.702	0.718
Mean live weight gain, g	0.377	0.435	0.469	0.452	0.456	0.494	0.498
Total food consumption animal ⁻¹ , g	1.206	1.465	1.680	1.600	1.620	1.884	1.733
Survival, %	82	86	88	86	89	92	90

* Average of three values

The effect of feeding frequency on food consumption, growth and survival in juveniles of *P. monodon* are given in Table 2. The water temperature range in this experiment was between 25.5 - 29.8°C, the salinity 19.5 - 21.2‰, pH 7.6 - 8.37 and dissolved oxygen 4.8 - 6.45 ppm. Food consumption, growth and survival increased as the feeding frequency was raised. However, food consumption and growth increased only up to an increase of 3 meals day⁻¹ and thereafter these parameters showed a declining trend (Fig. 2). There was an increase of 46% and 31% in food consumption and gain in weight as the feeding frequency was raised from once a day to thrice a day respectively. Analysis of variance of the data showed that frequency of feeding significantly influenced ($p < 0.01$) the growth of test animals. The highest live weight gain was recorded in the case prawns, which were fed thrice daily (4.45%) and lowest in those fed once a day (3.37%). In the case of prawns fed once daily, feeding time was seen to influence food consumption, growth and survival. Thus the prawns fed during night

20:00 h showed a better growth than those fed during day time. Again, in twice a day meal frequency, higher growth was obtained when meal was offered during morning-night hours, instead of morning midday or midday-night hours (Table 2).

Increasing the frequency of feeding has been reported to have an important role in improving overall yield and reducing the cost of operations in intensive shrimp farming systems. Sedgwick (1979) reported that better growth and feed efficiency can be achieved by increasing the feeding frequency from once a day to four times daily in *P. merguensis*. Better growth and survival in *P. monodon* was observed by Apud et al. (1980) by manipulating the feeding frequencies during different months of the rearing period. Sampath & Sridhar (1987) reported that in *P. monodon*, rate of feeding absorption and production increased as the frequency of feeding was raised from once in five days to twice a day with maximum ration. In the present study too, food consumption, growth and survival of *P. monodon* juveniles increased as

the feeding frequency was raised from once a day to thrice daily.

Primavera *et al.* (1979) have observed that compared to morning and afternoon hours, feeding was more intense during dusk hours (18:00 hrs). According to Pascual (1988) the best feeding time for *P. monodon* is late afternoon and evening hours, since they are more active during this time. In the present study too, the *P. monodon* juveniles fed during night hours registered better growth probably due to more intense feeding during this time. Hence it may be surmised that evening and night feeding schedules are better suited for *P. monodon* during their early rearing period.

The results of the study will be helpful for better farming operations of tiger prawn through judicious feeding strategies, leading to higher growth and production.

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References

- Apud, F.D., Deatras, N. & Gonzales, K.G. (1980) *Q. Res. Rep. SEAFDEC Aquacult. Dept.* 4 (3), 19
- Apud, F.D. (1988) in *Biology and Culture of Penaeus monodon* p. 118 SEAFDEC, Philippines
- Chua, T. & Teng, S. (1982) *Aquaculture* 27, 273
- Cohen, C., Joseph, D., Bell, L. & Oler, A., (1963) *Amer. J. Physiol.* 205, 71
- Cuzon, G., Hew, M., Coegine, D. & Soletehnik, P. (1982) *Aquaculture*, 29, 33
- Ishiwata, N. (1969) *Bull. Jap. Soc. Sci. Fish.* 35, 985
- Kono, H. & Nose, Y. (1971) *Bull. Jap. Soc. Sci. Fish.* 37, 169
- Pascual, F.P. (1988) in *Biology and Culture of Penaeus monodon* SEAFDEC p. 310, Philippines
- Primvera, J.H., Lim, C., & Boulongan, E. (1979) *Q. Res. Rep. SEAFDEC* 3(1), 12
- Sampath, K. & Sridhar, R.T. (1987) *J. Ag. Trop.* 2, 127
- Sedgwick, R.W. (1979) *Aquaculture* 16, 279
- Sick, K.V. & Baptist, G. (1973) *J. Elisha Mitchell, Sci. Soc.* 89, 161
- Sick, L.V., White, D.B. & Baptist, G.J. (1973) *Prog. Fish. Cult.* 35, 22
- Subramanyam, C.B. & Oppenheimer, C.H. (1970) *Proc. World. Maricul. Soc.* 1, 91
- Venkataramiah, A., Lakshmi, G.J. & Gunter, G. (1972) *Proc. World Maricult. Soc.* 3, 267