EFFECTS OF FEEDING FROGMEAT ON THE GROWTH AND SURVIVAL OF THE POSTLARVAE OF THE TIGER PRAWN, Penaeus monodon

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Introduction

The giant tiger prawn, *Penaeus monodon* or "sugpo" is the biggest and is among the aquaculture species which command high market prices. Among the characteristics which make it an ideal aquaculture species are high survival rates in grow-out ponds and fast growth rates with sizes of up to 100 grams after four to five months at low density culture (Apud et al., 1983).

Prawn and shrimp farming is carried out in various parts of Asia, but has been highly developed in Japan (Barnes, 1980; Sarian, 1987) and Taiwan (Guerrero, 1987; Sarian, 1987) where shrimps are reared from eggs to marketable size. PCARRD (1985) indicated that the scientific farming of shrimps as main crop in earthen ponds in the Philippines is still in its infancy due to traditional methods applied. But the increased fry production from commercial hatcheries has contributed to more than 50% of seedstock for pond culture. However, Guerrero (1987) reported the identified problems of low survival rates of prawn larvae due to bacterial infection, poor quality control of fry, and high cost of inputs such as hatchery feeds. While the capability to produce planktonic live feeds such as *Skeletonema* and *Chaetoceros* for the zoea and mysis stage has already been established in most hatcheries, the dependence on imported brine shrimp or *Artemia* for the mysis and postlarval stages is still the rule. This dependence on *Artemia* has contributed to the high cost of fry production.

The demand for economical and nutritional diet has exerted pressure on the shrimp farming industry for the past several years. Extensive studies on feed formulation have been conducted and a wide variety of food sources had been utilized. Varied results were obtained.

Yashiro (1972) revealed that *P. monodon* postlarvae fed with cooked mussel meat had lower weight gain but had high survival rates than those fed with *Artemia*. Studies of Motah (1978) showed that larvae fed with kitchen vegetable trash exhibited late stage development and were smaller compared with those fed with culture diatoms. Millamena and Ojero (1978) compared the survival of the larvae fed with different species of preserved algae. Both *Chaetoceros calcitrans* and *Tetraselmis chuii* were found to be able to support survival at zoea stage while larvae fed with dried *Isochyris* sp. had low survival.

Chaiyakam (1977) revealed that commercial fish pellets were superior to brown mussel meat. Destajo (1979) further pointed out that a mixture of fish meal and shrimp meal was a better source of animal protein than a pure fish meal diet or shrimp head diet. Apud et al., (1981) also found out that *P. monodon* prefer dried tilapia to fresh or fermented ones.

The semi-intensive culture of prawns requires food supplements, 50-80% of the total food. Animal proteins must be supplied adequately because prawns are highly carnivorous. Highest weight gains of *P. monodon* were observed among those given diets containing 40-45% proteins (Alava, 1979); both W^3 (Catacutan, 1985) and W^6 (Maguire, 1980) fatty acids; and sufficient calcium and phosphorous (Maguire, 1980).

Natural food is supplied by aquatic plants like "digmaan", "lumut", and "kusay-kusay". The choice of supplemental feed depends on what is economical and readily available in the locality. Feeds commonly used are shelled mussel meat, snails, tilapia, trash fish, chicken entrails, hides from slaughter houses, and toads. Commercial prawn feeds (e.g., Vitarich, B-meg pellets) are also available (PCARRD, 1984).

Based on this survey of literature then, no studies have been conducted to investigate the use of frogmeat as feed for the postlarvae of *P. monodon*. Hence, the author is prompted to investigate and determine:

(a) The effects of frogmeat as food on the growth and survival rates of *P. monodon* postlarvae grown under controlled conditions; and

(b) The feasibility of using the meat of *Rana catesbiana* for the growing of *P. monodon* postlarvae under controlled conditions based on its effect on the growth and survival rates of the organism.

Materials and Methods

Experimental Set-up

There were two feeding treatments tested: tunameat and frogmeat, each with three replicates. Plastic containers (17-li) were filled with 15 li. of brackish water and provided with aeration.

The postlarvae (PL_7) from GAIC Hatchery, Lugait, Misamis Oriental were used in this study. Prior to stocking, postlarvae were counted (150 individuals/container) and weighed (ave. wt. = 2.66mg). These were then stocked at a rate of 10 individuals per liter and were reared for a period of 15 days.

The animals were taken from the nursery tanks of GAIC hatchery and placed in their assigned containers. They were already exposed to *Artemia* sp. feeding before the feeding experiment was initiated.

Feed Preparation

Live *Rana catesbiana* were obtained from nearby ponds, rice paddies and rivers. The frogs were skinned and meat from the thigh portion was removed mostly from the femur bone using a sharp knife. Tunameat was bought from the local market. Each meat was blended separately into a fine mass and given to the postlarvae with the corresponding treatment.

Physical Parameters

Selected physical parameters of the culture media were monitored at every water change. The pH of the media was determined by the use of a pH paper, while temperature was determined by the use of an ordinary thermometer. Both temperature and pH measurements revealed no drastic fluctuations. Salinity was measured by using a refractometer-salinometer (ATAGO model). Initial salinity was measured at 27 ppt while final salinity was 15 ppt. The salinity of the water was gradually lowered to acclimate the animals to lower salinity in grow-out ponds.

Management

The postlarvae were fed with the experimental feeds at no less than 10% of the initial body weight. The feed was divided equally into four parts and administered every six hours.

Water change was done every two days to flush out waste products in the culture medium. When changing water, 13-14 liters of water in the container were drained and replenished.

Measurement of Growth Increment and Survival

The postlarvae in each of the treatments were weighed at the end of the experiment. The weight of a container (small plastic bowl) which was filled to the brim with water from one of the basins was determined initially using a sensitive balance. The water from the container was then poured out. The empty container was used to scoop the postlarvae from each of the basins, also seeing to it that it was filled to the brim with the medium. The container containing the postlarvae and water was once more weighed. The difference between the container plus water plus larvae and the weight of the container plus water was noted. The same procedure was repeated until all the postlarvae in each basin were weighed. The average weight of each larva (AW_1) was obtained using the formula:

$$AW_1 = \frac{D_1 + D_2 + \ldots\ldots D_i}{\text{number of larvae per basin}}$$

Survival rate at the end of the experiment was determined by dividing the number of live postlarvae by the initial number per basin multiplied by 100%.

Chemical Analysis

Analysis of the protein content of the frogmeat and tunameat was done at MSU-IFRD, Naawan, Misamis Oriental by the Laboratory Technician at the Chemistry Section.

Results and Discussion

Growth

In most cases, growth is associated with increase in height. Balinsky (1971) stressed that from a biological viewpoint, growth is an increase of the mass of the living substance, therefore, only weight can be considered as an index of growth.

The growth increment of the *P. monodon* postlarvae is presented in Table 1. The frogmeat feeding resulted in a relatively higher weight gain for *P. monodon* postlarvae. Results of the ANOVA (Table 2) of the given data indicated a significant difference at 0.10 level but no significant difference at 0.05 level of significance. Further analysis using the chi-square method (Table 3) gave a significant difference at 0.05 level of significance.

Table 1

Growth increment per shrimp of *P. monodon* postlarvae fed with the experimental diets.

REPLICATES	TREATMENTS	
	FROGMEAT (mg)	TUNAMEAT (mg)
1	114.91	32.05
2	52.74	41.77
3	60.23	23.26
AVERAGE	75.76	32.36

Table 2.

Analysis of variance (ANOVA) of growth increment per shrimp of *P. monodon* postlarvae fed with the experimental diets.

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Squares	Computed F	Tabular F
Treatment	1	2860.167	2860.167	4.64	7.71*
Error	4	2465.897	616.474	4.06**	
TOTAL	5	5326.064			

Table 3.

Chi-square analysis of the growth increment per shrimp of *P. monodon* postlarvae fed with the experimental diets.

REPLICATES	TREATMENTS (mg)		TOTAL	DEGREES OF FREEDOM	CHI-SQUARE VALUE
	Frogmeat	Tunameat			
1	114.91	32.05	146.96	2	13.881[a]
2	52.94	41.77	94.71		5.991[b]
3	60.23	23.26	83.49		
BLOCK TOTAL	228.08	97.08	325.16		

a Computed chi-square value
b Tabular chi-square value at 0.05 level of significance

The significant difference obtained in this study indicated that frogmeat is a better diet than tunameat. This difference may be due to the higher crude protein content of the frogmeat (72.48%). Tunameat contained only 64.80% of crude protein. Proteins are vital structural elements in all living cells. They are essential for the growth and repair of the body tissue and play an important part in the hormone and enzyme systems (Sebrell, 1973).

Survival

Survival rates of the postlarvae from each replicate ranged from 41.33 to 60.67% (Table 4). Average survival was higher in treatment receiving frogmeat (50.44%) than the treatment receiving tunameat (47.78%). The ANOVA and chi-square tests gave no significant differences between the two treatments (Table 5 and 6). The results of the study imply that *P. monodon* postlarvae can take up any of the diets depending on which is available. However, it was not determined if the postlarvae would exhibit a definite choice of feed if exposed to the frogmeat and tunameat in one setting.

Table 4.

Survival rate of *P. monodon* postlarvae fed with the experimental diets.

REPLICATES	TREATMENTS	
	FROGMEAT (%)	TUNAMEAT (%)
1	60.67	48.00
2	49.33	41.33
3	41.33	54.00
AVERAGE	50.44	47.78

Table 5.

Analysis of variance (ANOVA) of survival rate of *P. monodon* postlarvae fed with the experimental diets.

Source of Variation	Degree of Freedom	Sum of Squares	Mean Squares	Computed F	Tabular F
Treatment	1	10.666	10.666	0.0029	7.7100*
Error	4	14739.968	3684.992		
TOTAL	5	14750.634			

Table 6.

Chi-square analysis of the survival rate of *P. monodon* postlarvae fed with the experimental diets.

REPLICATES	TREATMENTS		TOTAL	DEGREES OF FREEDOM	CHI-SQUARE VALUE
	Frogmeat	Tunameat			
1	60.67	48.00	108.67	2	3.632
2	49.33	41.33	90.66		5.991
3	41.33	54.00	95.33		
BLOCK TOTAL	151.33	143.33	294.66		

a Computed chi-square value
b Tabular chi-square value at 0.05 level of significance

Although there is no significant difference between the two treatments in terms of survival, the income that would be generated based on the survival rates of the postlarvae is as follows: for every 1,000,000 fry reared per cropping, 504,400 postlarvae fed with frogmeat are produced while tunameat feeding produces 477,800 postlarvae. At a selling price of P0.35 per fry, the income that would be generated using frogmeat feed is P176,540 and P167,230 for tunameat or a difference of P9,310.

Thus, results indicate that frogmeat and tunameat have an equal potential as feed in terms of survival. However, frogmeat is a better diet for growth and thus, more efficient as food source than tunameat. Since frogs can be caught in the farms, ponds, or canals, they cost less or nothing at all when used as food for *P. monodon*.

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