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Effect of Feed on the Growth and Survival of Long Eyed Swimming Crab *Podophthalmus vigil* Fabricius (Crustacea: Decapoda)

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Abstract

Food is considered to be the most potent factor affecting growth. Attempts to develop diets for culture of crabs have resulted in a variety of feeds. The absence of suitable feed either pellet or live food which can promote growth and survival is considered to be the most important lacuna in cultivation of crabs. So searching of economically viable feed to optimize the growth and survival in crabs are very much essential. In the present study the weight gain was higher in the crabs offered with *Acetes sp*. (86 g) followed by clam meat fed animals (47 g). The crabs fed with minimum amount of *Acetes sp*. (152 g) and maximum of clam meat (182 g). The FCR value was better in *Acetes sp*. (1.8) fed animal rather than clam meat fed animals (3.8). The survival rate was higher in *Acetes sp*. fed animals (92%) and lowest survival (72%) was observed in animals fed with clam meat. The survival was reasonable for both the feeds. But higher survival rate was reported in the animals fed with *Acetes sp*. than that of clam meat.

Keywords: *Acetes sp*; Clam meat fed animals; Survival; Growth, *P. vigil*

Introduction

The increasing cost of operations in the aquaculture practices has necessitated and development of new and more economically viable methods of cultivating the fin and shellfishes. A nutritious and cheap feed is a prerequisite for profitable aquaculture [1,2]. Though, use of commercial pellet and live feeds is in practice in many countries for shrimp and prawns [3]. Such feeds are very much lacking for crabs [4,5]. Therefore, nutritionally well balanced artificial and live feeds are essential to get optimum growth and survival. So in the present study an attempt has been made to study the effect of two feeds on the growth of commercially important crab, *P. vigil*.

Materials and Methods

Animal collection

The crabs were collected from the Annankoil landing center (Lat.11°29' N; Long. 79°46' E) of Parangipettai coast. They were examined to ensure uniform size, good health and disease free crabs. The weight of the collected crabs was ranging between 100-120g. After reaching the laboratory, the crabs were immersed in 5ppm formalin (prophylactic dip) for 15 minutes and acclimatized to the laboratory conditions.

Stocking

After acclimatization, the crabs were stocked at a density of 5 crabs/tank (Length - 44cm, width -37cm and depth -30cm) for each feed.

Feeding

The crabs were fed with 2 different diets viz., *Acetes sp*. and fresh clam meat (*Meretrix Meretrix*). They were fed with 3% and 5% of their body weight for *Acetes sp*. and clam meat respectively. Feeding was done twice a day at 8.30 am and 5.00 pm.

Water exchange

The water was exchanged daily in the morning hours and left over feed and fecal matter was removed while water exchange. The experiments were terminated after measuring the weight of the crabs. The total duration of the experiment was 120 days. Triplicate was maintained for each feed.

Environmental parameters

The optimum environmental parameters were maintained during the experimental period. Salinity was (29-35ppt) estimated by using refractometer and dissolved oxygen was estimated by Do meter (4.2-5.8ml/litre). The temperature of the water (28-30°C) was noted by thermometer and the pH (7.5-8.3) was measured by using digital pH pen.

Feed preparation

Healthy *Acetes sp*. was collected from Vellar estuary. The live *Acetes sp*. was not used as a feed directly to the experimental crabs since they are moving animal. So the experimental animals are very difficult to catch. The dried *Acetes sp*. was tried but unfortunately it was floating in the water column. Hence, the *Acetes sp*. was prepared as a pellet feed with minimum ingredients. The *Acetes sp*. was washed with fresh water subsequently dried in sun light. It was then powdered using an electric mixer and maida flour was used as a binder. The dough was extruded in a hand pelletizer using 3mm diameter size, the wet pellets were collected in a tray and dried in an oven at 60°C for 12 hours. The dried pellets were broken into pieces of 15-20mm in length and stored in new polyethylene air tight bags for further use. The fresh clams were collected from the Vellar estuary opposite to the Marine Biology station by hand picking. The collected clam meat was freshly fed to the experimental animals.

Biochemical analysis of the experimental feeds

The proximate composition of the experimental feeds was determined by using standard methods; viz., protein, carbohydrate,

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lipid, ash and moisture [5-8]. The gross energy of the feed was calculated from the biochemical constituents by using the conversion factors i.e. 4.18kcal/g for carbohydrate, 9.46kcal/g for lipid and 4.32kcal/g for protein [9].

Results

The proximate composition of clam meat and *Acetes sp*. are given in Table 1. It is observed that the percentage of protein was very high for both the feeds followed by that of lipid and carbohydrate. The protein content of the *Acetes sp*. and clam meat was recorded as 57.55% and 47.61% respectively. The carbohydrate content of *Acetes sp*. and clam meat was found to be 7.94% and 4.53% respectively. The lipid content of *Acetes sp*. was highest (7.56%) followed by clam meat (5.04%). The ash content of the *Acetes sp*. was maximum (22.32%) and minimum (18.66%) was in clam meat. The moisture content of the clam meat was found to be 68.4% and *Acetes sp*. was 8.98%.The gross energy of *Acetes sp*. and clam meat was found to be 3.36 kcal/g and 2.44kcal/g respectively.

Weight gain, feed consumption, FCR and survival rate of the experimental crabs offered with different feeds are given in Table 2. A remarkable difference can be observed among these two experimental feeds. Weight gain was higher in the crabs offered with *Acetes sp*. (86 g) followed by clam meat fed animals (47 g). The crabs fed with minimum amount of *Acetes sp*. (152 g) and maximum of clam meat (182 g). The FCR value was better in *Acetes sp*. (1.8) fed animal rather than clam meat fed animals (3.8). The survival rate was higher in *Acetes sp*. fed animals (92%) and lowest survival (72%) was observed in animals fed with clam meat.

Discussion

In the present study demonstrated that diets had accelerated the growth of crab, *P. vigil*. In most of the growth studies, the internmoult period and tissue growth was mainly dependent on the nutritional quality of feeds [10]. In the present study, two types of feeds were given to the experimental crabs for comparison. *Acetes sp*. is partly pellet feed and partly detritus in nature and clam meat is a live feed. The average weight gain of *P. vigil* noticed in the present study was directly related to the level of protein in the diet. Variations in growth rate and survival of crabs were found to be associated with difference in chemical composition of diets. It is known from the previous studies that the optimum requirement of dietary protein for crustaceans was in a range of 20 to 60% [11]. The dietary protein content in the present study was 57.55% in *Acetes sp*. and 47.61% of clam meat. Likewise, the animals fed with *Acetes sp*. showed the highest weight gain (86g), while the lowest weight gain (47g) was observed in the animals fed with clam meat. Similar results were obtained in various size groups of *S. serrata* fed with dry pelleted feed containing 35% and 40% dietary protein [12]. More or less similar growth rate was obtained in *S. tranquebarica* fed with *Acetes sp*. pellet feed and clam meat respectively [4]. Growth did not show significant difference in crabs fed with diets containing 5.3-13.8% lipid with a basal protein level of 48% [13]. Maximum growth was achieved in the diets containing approximately 50% of total crude protein [13]. In general, the protein requirement is affected by many factors such as size or age, temperature and digestibility of the diet. [14] reported that the fresh diets of short neck clam (*Tapes philippinarum*) gave superior growth compared to the compounded diets for *P. japonicus*. Similar results were obtained from [15] for *P. serratus*. Frequent moulting was observed during feeding experiment with fresh clam meat [16]. The flashes of molluscs and crustaceans have been found to be the most acceptable and producing the best growth for *M. rosenbergii* [17] and *M. malcolmsonii* [18]. Marine sources included fish meal, *Acetes sp*. and squid was used as a feed because it is known to be highly digestible for some crustaceans as in the present study [4,19,20]. Several workers have directed preliminary efforts on developing artificial diets capable of sustaining good growth in shrimp feed [21-24] and prawn feed [18]. In the recent past several scientists tried to develop artificial diets for crabs too [4,25-27].

The carbohydrate content of *Acetes sp*. was found to be 7.94% and clam meat was 4.53%. Lipid content of both the diets of the present study was also followed similar trend as carbohydrates. As a result of various experiments in crustaceans, dietary lipid of 2-10% was found to be optimum [9,18,28]. In the present study also, both the feeds used had more or less same optimum range of lipid (4.53% - 7.94%). [29,30] noted that crustaceans are not able to tolerate more than 10% of lipid in their diet and its inefficient utilization causes reduced growth. Several investigations suggested that optimum protein levels are dependent upon the proper balancing of lipid levels and carbohydrate sources. Diaz and Nakagawa H [31] stated that the difference in weight gain cannot be ascribed to dietary energetic content, but probably to the nutritive value of the carbohydrate source. Clifford HC and Brick RW [32] reported that the levels of dietary protein for juvenile *M. rosenbergii* influenced by the magnitude of specific dynamic action (SDA) in the 15-25% dietary protein range. When protein levels exceeded 25%, the major non-group component of protein remained constant. At 25% levels of protein, the protein sparing effect of a non-protein energy source was maximized at 1:4 of lipid and carbohydrates ratio. So in general, even the protein content is lower than required in the feed, the animals might have utilized the carbohydrate and lipid from the diet [18]. The ash, moisture content and gross energy of the present investigation was agreement with the findings of [18]. The animals fed with *Acetes sp*. showed best FCR followed by clam meat. The FCR of the present study was similar to that obtained by [4,15,16,18,33].

In the present study, good survival was (93%) obtained when *Acetes sp*. fed with experimental crabs followed by clam meat fed animals (72%). Similar result was already reported by Manivannan K et al. [4] in *S. tranquebarica* fed with *Acetes* sp and clam meat. According to Clifford HC and Brick RW [32], a survival of more than 80% is usually

Feed	Protein (%)	Carbohydrate (%)	Lipid (%)	Ash (%)	Moiture(%)	Gross energy (Kcal/g)
Acetes sp	57.55	7.94	7.56	22.32	68.04	3.36
Clam meat	47.61	4.53	5.03	18.66	8.98	2.44

Table 1: Proximate composition of test diets.

Feed	Weight gain (%)	Feed consumption (%)	FCR	Survival rate (%)	Moiture(%)	Gross energy (Kcal/g)
Acetes sp.	86 ± 1.02	152 ± 2.21	1.8 ± 0.12	93 ± 1.28	68.04	3.36
Clam meat	47 ± 2.12	182 ± 1.38	3.8 ± 0.15	72 ± 2.13	8.98	2.44

Different superscripts in a rows are significantly different (P<0.05)

Table 2: Weight gain, feed consumption, FCR and survival rate of *P. vigil* fed with test diet. (Values are mean of three values ± SE).

considered as good for crustacean culture. The lower stocking density in crabs leads to higher survival [30]. An increase in survival rate with lower stocking density may have been due to reduced cannibalism among the stock [34-37]. In the present investigation, five animals were stocked in each tank. So the survival was reasonable for both the feeds. But higher survival rate was reported in the animals fed with *Acetes sp*. than that of clam meat. This clearly shows that not only stocking density but also feed is prime factor which control the survival, since the experimental animals are exposed similar environmental conditions for both the feeds.

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