

## Comparison of Live Adult *Artemia* and Squid Meat on the Growth of Penaeid Shrimp *Metapenaeus dobsoni* (Miers)

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An experiment lasting 14 weeks was conducted to compare the efficiency of live adult *Artemia* with fresh squid meat on growth of penaeid shrimp *Metapenaeus dobsoni* (Miers). The shrimps were found actively feeding on live *Artemia* and grew 84% more than those fed with squids. The intermoult period significantly differed between the diets. It is suggested that the presently unutilised rich source of adult *Artemia* in salt pans and salt lakes could be used as an important ingredient in the preparation of quality shrimp feeds.

**Key Words:** Growth, Live *Artemia*, Squid, Diets, Penaeid Shrimps

### Introduction

The main thrust in fish and crustacean nutrition research at present is aimed at ascertaining the nutritional requirements and the effect of these on the health, stress, function and development of the instance. Applied nutrition is directed toward designing feeds and feeding strategies to maximise profitability under various culture conditions (Lovell 1992). Studies on shrimp nutrition (New 1976, 1980 for review) have become important with the commercial shrimp culture gaining momentum. Although many shrimp feeds are available in the market, the quest world over is on to produce the best and less expensive ones. Squids are an important dietary component (Chamberlain et al. 1981, Achuthankutty et al. 1993, and formulated diets containing squid meat give a better growth to penaeid shrimps (Cruz-Suarez et al. 1992). Adult *Artemia* present in large quantities in salt producing areas and certain salt lakes are presently not utilised though they are a rich source of protein. India also has

large areas under salt production and her natural sources of adult *Artemia* are quite high (Royan 1980). Therefore we conducted an experiment to compare the growth efficiency of juveniles of *Metapenaeus dobsoni* fed exclusively on live adult *Artemia* and those fed exclusively on fresh squid meat. *M. dobsoni* was selected as the experimental animal because it is the most common and abundant species in traditional shrimp culture practices of India.

### Materials and Methods

Juveniles of *M. dobsoni* were collected from the Mandovi estuary (Goa) using a cast net, and acclimated to laboratory conditions (salinity  $29 \pm 1$  ppt; temperature  $28 \pm 1^\circ\text{C}$ ) for 5 days before experiment.

The duration of the experiment was 14 weeks. Twenty four shrimps (wet weight range, 0.18-0.22g) were selected at random and kept individually in round bottom fibreglass tanks (diam. 0.5m, height 0.4m) containing filtered seawater (30 L). The tanks were cont-

inuously aerated. Every morning water temperature, dissolved oxygen and pH were measured using a Hydrolab Model 4041, Hydrolab Corporation, Texas). Seawater in experimental tanks was changed once a week.

Twelve shrimps were fed live adult *Artemia* and the rest with squid meat. They were fed 30% of their body weight once in the morning. Fresh squid meat was cut into small pieces weighed and fed. Live *Artemia* were rinsed in distilled water to remove salt, weighed after blot drying a fed. Uneaten food was collected the following morning and weighed to calculate daily consumption rates. No supplementary feed was given to both sets of experimental animals.

Wet weights (nearest mg) of animals were taken once a week after carefully blotting excess water. Moults were also removed and weighed similarly. Moulting frequency and moult weight were recorded for individual shrimp. No mortality occurred during the period of experiment. All shrimps used in this study were females.

#### *Artemia* Culture

Cysts of San Francisco Bay strain (Ref. No: ARC. 1090) were hatched (Sorgeloos et al. 1986) and nauplii inoculated into three 300 litre tanks. Salinity was maintained at  $50 \pm 2$  ppt and the temperature at  $30 \pm 2^\circ\text{C}$ . Rice bran suspension was given as food *ad libitum*. The nauplii grew to adults within 12 days and started reproducing ovoviviparously. The required quantity of adult *Artemia* for feeding was harvested daily using a hand net.

## Results

### Growth

Average weekly progression in absolute growth is given in figure 1. At the end of the experiment, shrimps fed on adult *Artemia* grew 84% more than those fed on squids—the faster growth rate being registered right from the 1st week and this trend continued.

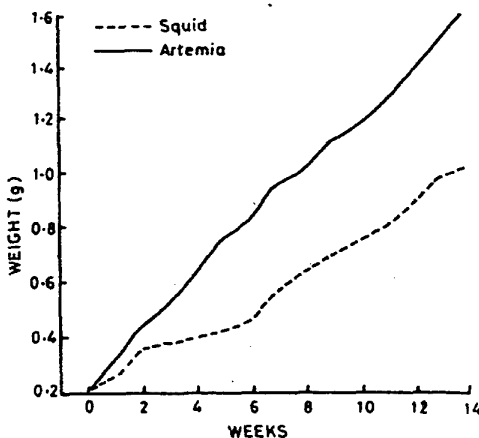


Figure 1 Progression of absolute growth of juveniles of *M. dobsoni* fed *Artemia* and squid

Statistical tests (*t* test) indicated significant difference in growth between diets ( $P < 0.01$ ).

### Moult

Intermoult period, was 4 to 6 days for shrimps on *Artemia* diet and 5-10 days for those on squid diet (table 1)—showing significant difference between diets ( $p < 0.05$ ).

### Food Consumption and Faecal Production

Shrimps were observed actively feeding on live adult *Artemia* holding several at a time. Food consumption generally increased with increase in size (table 1). Although consumption of squid was relatively less, there was no significant difference ( $P > 0.05$ ) between the consumption of the two diets.

## Discussion

Application of on-grown and adult *Artemia* for growth of penaeid shrimp is limited (Millamena et al. 1985, Bombeo 1987, Yashiro 1985). However, as compared with freshly hatched nauplii the nutritional value of on-grown and adult *Artemia* is superior: protein content increased from an average of 47% in nauplii to 60% in adults on dry weight basis

**Table 1** Average intermoult period (days) and food consumption ( $g \pm SD$  in parenthesis) of *M. dobsoni*

Weeks	Intermoult period		Food consumption	
	Artemia	Squid	Artemia	Squid
1	5	8	0.366 (0.09)	0.362 (0.08)
2	4	5	0.230 (0.02)	0.202 (0.01)
3	5	5	0.160 (0.01)	0.218 (0.02)
4	4	9	0.171 (0.06)	0.198 (0.02)
5	4	7	0.268 (0.04)	0.212 (0.11)
6	5	8	0.212 (0.07)	0.214 (0.02)
7	6	5	0.324 (0.09)	0.234 (0.08)
8	6	6	0.394 (0.07)	0.208 (0.02)
9	6	7	0.262 (0.04)	0.240 (0.001)
10	6	8	0.268 (0.09)	0.361 (0.05)
11	6	9	0.346 (0.04)	0.280 (0.01)
12	6	9	0.522 (0.08)	0.318 (0.04)
13	6	10	0.474 (0.09)	0.345 (0.03)
14	6	9	0.477 (0.08)	0.361 (0.01)

(Leger et al. 1986). The exoskeleton of adult *Artemia* is extremely thin which facilitates digestion of the whole animal. The better growth of juvenile shrimps on live adult *Artemia* could be attributed to more frequent mo-

ultings as evidenced by moult data analyses. As there was no significant difference in food consumption between the two groups of experimental shrimps, it is felt that adult *Artemia* has a better conversion efficiency than squid meat.

It is known that some n-3 highly unsaturated fatty acids (HUFA) particularly 20:5 n-3 (ecosapentaenoic acid) and 22:6 n-3 (docosahexaenoic acid) are essential dietary components for many marine organisms (Koven et al. 1992) and for marine shrimps these are considered to be growth stimulants (Kanazawa et al. 1977, Bottino et al. 1980). The proportion of these fatty acids in adult *Artemia* is primarily determined by the food ingested (Sakamoto et al. 1982, Millamena et al. 1985, Yashiro 1987). Since the *Artemia* used in this experiment were fed only with rice bran suspension which is reported to be lacking in the above fatty acids (Leger et al. 1986), these fatty acids may not be responsible for the accelerated growth observed. It is suggested that the rich source of protein and the improved protein quality due to the presence of essential amino acids in greater quantities in *Artemia* (Leger et al. 1986) are probably helping shrimps to attain faster growth. The results of the present study are of major significance because the unutilised rich source of adult *Artemia* in salt pans and salt lakes in India can be harvested and used as an important ingredient in the preparation of high quality shrimp feeds.

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