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Comparative Study on Growth, Feed Consumption and Survival of Spiral babylon *Babylonia spirata* Linnaeus, 1758 (Mollusca: Gastropoda) Fed with Formulated Diets

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A growth trial was conducted to determine the effects of the dietary protein level on growth, feed utilization and survival of *Babylonia spirata*. Triplicate groups of 50 animals (with an initial average weight of 49.24 ± 0.8 g) were stocked in 50-l tanks and fed to apparent satiation twice daily for three months with two experimental diets of 30% and 40% protein content and control diet of fresh meat clam. Growth of snails that were fed with natural food was not significantly ($P<0.05$) higher than those fed with the experimental diets. There was no significant difference ($P>0.05$) in growth and Feed Conversion Ratio between snails that were fed with experimental diets. Present study infers that a diet containing 30% and 40% of protein content may be recommended for the growth of *B. spirata.*

Key words: *Babylonia spirata*, Formulated feed, Clam, Growth performance]

Introduction

The phylum Mollusca comprises the largest and diverse class Gastropoda with approximately 75,000 existing species and about 15,000 fossil forms according to the back of cambium. Spiral Babylon snail *Babylonia spirata* (Linnaeus, 1758) is a commercial gastropod that is in high demand in China, Japan, Taiwan and India[1,2]. This gastropod is a good prospect for commercial aquaculture due to its resistance to the environment. It is important to develop a cost-effective and nutritionally balance feed formulation for this species in the future[3,4]. Establishment of a successful aquaculture industry based on this species will require optimization of their diet for fast growth and survival, while maintaining a good proximate composition in the flesh. It commands a high price and has a relatively simple culture technique in comparison with other gastropods[5,6,7]. Market demand for this gastropod is rapidly increasing due to the sharp decline in natural stock due to overfishing. Therefore, the culture of spiral Babylon snail is important to meet the market demand and for the development of natural wild stock. The artificial diets allow mechanized production[8], result in increased survival rates[9] and generally produce better growth in weight and length than natural food. The slow growth and poor survival of spiral Babylon's resulting from inappropriate or inadequate food supply during the growing-out period will prolong holding time and increase hatchery expenditure. Nowadays, the lack of research and development on appropriate feeds to culturing spiral Babylon is a major constraint for malacological studies. The artificial feed formulation and preparation is to provide for optimal nutrition for *B. spirata* at the lowest possible cost. In reality, however the diet development is normally a compromise between this ideal situation and practical considerations, such as the cost of ingredients, pellet ability, and diet acceptability, water stability of the feed and handling requirement[10].

Materials and Methods

Two experimental diets were formulated to contain protein level of 30% and 40%. The formulations of the experimental diets and their proximate composition are shown in (Table 1). Fishmeal and fish oil were used as the protein and lipid sources and

Tapioca was used as the carbohydrate source and wheat starch was used as the binder, respectively. Procedures for food preparation were modified[11]. The feed ingredients were homogenized thoroughly in a food mixer. After adding water to the mixed ingredients, a paste was made using a hand mixer. Paste was shaped into 0.5 mm thick sheets, cut into 2 cm^2 flakes, sealed in a plastic bag and stored at –20℃ until use. The dry feed samples were analysed for proximate composition following the standard[12].

Babylonia spirata (Buccinidae) were collected at the Therispuram coastal area (80 48′N; 78^0 94′E), Tamilnadu, Southeast coast of India (Figure 1). They were reared in rectangular tanks of 1.5 x 0.5 x 0.5 m (L: W: H), supplied with flow-through natural, aerated ambient seawater. Bottom of the rearing tanks was covered with a 3 cm layer of coarse sand (250 to 500 micron mean grain size) as substrate. After removing the snails from the culture tanks, sand was then cleaned using a water jet flushing then sun dried for 6 hours at 30-day intervals to remove accumulated waste materials. Temperature and salinity ranged from 28 to 30°C and 28 to 29 ppt, respectively. These parameters were examined by using SYSTRONICS water analyser 371.

Feeding treatments were randomly allocated to each tank (three replicates per treatment).The initial mean total weight and shell length of snails was 49.24 ± 0.8 g and 5.40 ± 0.1cm respectively. Initial stocking density was 50 snails per tank. The experimental groups were fed with formulated diet and control group were fed with fresh clam twice daily at 09:00 am and 04:00 pm. Amount of feed consumed by the snails in each tank was recorded daily. The total experiment was conducted for 90 days. Twenty randomly selected snails per tank from each treatment were measured for their total weight and shell length every 30 days and returned to the tank. The mean monthly growth rates (g) were calculated from average increments in shell size and weight according to the formula.

Growth performance and nutrient utilization were expressed in terms of weight measurements, weight gain (**WG**), specific growth rate (**SGR**), survival rate and feed conversion ratio (**FCR**), as follows:

Total weight = final weight - Initial weight.

Total length = final length - Initial length.

Weight gain = W2 – W1 (W2 = mean final weight, W1 = mean initial weight)

Feed Conversion Ratio = Feed Consumed / Live Weight Gain

Specfic Growth Rate = (ln W2 – ln W1 /T) × 100

(W2 = final weight, W1 = initial weight, T = experimental period (day))

Survival (%) = F2 / F1 × 100

(F1 = number of snail at the beginning of experiment, F2= umber of snail at the end of the experiment).

All calculations were based on the triplicate tank treatment.

Fig. 1- Map showing the study area

Statistical analysis

Data analysis was performed by one-way analysis of variance (**ANOVA**) using **SPSS** version 12.0. The data were subjected to an analysis of variance and Duncan multiple-range test and was used to evaluate specific differences between treatments test at 5% probability level. Differences were considered significant at $p<0.05$.

Results

Growth of snails fed with natural food was not significantly ($P<0.05$) higher than those snails fed with the experimental diets. Besides, no significant difference ($P>0.05$) in growth was found between the snails fed with experiment diets of 30% and 40% protein contents. The weight gain of snails was 2.21 g, 2.38 g and 3.92 g for snails fed with experimental diets of 30% and 40% protein contents and natural food, respectively. The specific growth rate (SGR) of snails was 1.11 g, 1.31 g and 1.73 g for experimental diets of 30% and 40% and control, respectively. No

significant difference (P>0.05) was observed in feed conversion ratio (FCR) between the feeding treatments (Table 2). Over the period of experimenthe survival exceeded 95% for all treatments and did not appear to be affected by dietary protein.

Discussion

The present study showed that differences in the growth and feed conversion ratio of *B. spirata* fed with experimental diets of 30% and 40% protein contents and natural food are relatively small. Survival was 100% for feeding diet treatments, based on the present data. The *B. spirata* fed on the formulated diets produced good results in growth of weight gain, length increment, FCR and survival, which are similar to those fed with the natural diet

Similarly the other authors have reported the higher growth and low FCR with increasing protein content of formulated diet for abalones[13,14]. This study suggests that the formulated diet is considered to be suitable for growing out of *B. spirata* over a period of 90 days due to its ready for acceptance of formulated feeds with a relatively rapid

Artificial diets may be much better than plant diets to increase growth in cultured snails. The artificial diet associated with plants resulted in great grown and earlier sexual maturity than artificial food without plants or plants alone in *Achatina fulica*[16,17]. However, no information on the nutritional requirements of *spiral Babylon* under controlled conditions has been reported. The present study indicates that artificial diets are accepted for the culture system of *spiral Babylon* and suitable candidate for mariculture due to its ready acceptance of formulated feeds that promote a relatively rapid growth rate, low FCR and high survival.

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Table 1- Composition of the basal diet

S.No	Ingredients	Control	30%(Diet 1)	40% (Diet 2)
1	Fish meal	-	30	45
2	*GOC	-	35	35
3	Tapioca flour	-	18	10
4	Maida	-	15	8
5	Fish oil	-	1	1
6	Vitamine&Mineral Tablet premix	-	1	1
	Proximate composition (%)			
	Protein	71.76	30.56	40.72
	Carbohydrate	25.54	22.89	19.43
	Lipid	3.89	2.11	2.89

*Ground nut oilcake

Table 2 Average growth parameters of *B. spirata* fed with experimental diets.

Parameters	Initial weight (g)	Final weight (g)	Initial length (cm)	initial Length (cm)	Weight Gain (g)	FCR	SGR (g)	Survival (%)
Control	52.20±0.91[a]	56.12± 0.23[a]	5.76±1.04[a]	6.13±0.12[b]	3.92±0.07[a]	1.06±0.11 a	1.73±0.08[b]	100
Diet 1	50.12±0.23[b]	52.24±0.19[a]	5.40±0.53[a]	5.51±0.11[b]	2.12±0.09[c]	1.37±0.14 a	1.11±0.14[a]	94
Diet2	51.51±1.08[c]	53.89±1.07[a]	5.40±1.09[b]	5.69±0.19[b]	2.38±0.13[a]	1.39±0.01 a	1.33±0.05[a]	96

[a,b]All values are means of three replicates ± SD for triplicate feeding groups and values in the same row with different superscripts are significantly different ($p<0.05$)

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