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EFFECT OF NEW FORMULATED DIETS ON GROWTH AND BIOCHEMICAL PARAMETERS OF *Babylonia spirata* (LIN, 1758), GULF OF MANNAR

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ABSTRACT: A feeding experiment of three dietary protein levels (30%, 35% and 40%) with three replicates was conducted to determine the proper protein level for the growth and survival of the *Babylonia spirata* under laboratory conditions. Snail with initial body weight ranged from 50.95 ± 0.33g to 51.05 ± 0.21g and initial length ranged from 5.96 ± 0.62 cm to 6.91 ± 0.70 cm were fed the experimental diet for 3 months. Mean weight gain, survival rate, biochemical parameters of snail fed the 40 % protein diets was significantly (P<0.05) different from that snail fed the 30% and 35%. The results of the study indicate that a diet containing 40 % dietary protein was recommended for snail growth under our laboratory conditions.

Keywords: Formulated diet, Growth, Biochemical parameters, *Babylonia spirata*

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INTRODUCTION

Generally, meats of molluscs especially gastropods were highly nutritious, owing to its contents of proteins, rich vitamins and minerals (Thanonkaew et al., 2006). Therefore, the biochemical composition of marine gastropod persists as an excellent nutritional assurance for millions of malnourished peoples. The gastropod meat has been considered to be free of cholesterol but contains high nutritive substances substances (Asadatun Abdullah et al., 2016).

The use of prepared feed formulation would helps to manipulate in a proper way and obtain an optimum nutritional value. Further, it could be properly prepared and stored for a longer duration according, to their demands (Nyameasem and Borketey-La, 2014). The usages of such as formulated feeds in spotted Babylon farming have made a significant contribution to their production in Thailand (Chaitanawisuti et al., 2010). By adaptation this strategy in *Babylonia areolata* may have been observed to increase within growth high protein content of 27% and 45%.

The artificial feed formulation and preparation can be done with optimal nutrition for *B. spirata* at the lowest possible cost. The diet development is involved certain factors such as the cost of ingredients, pellet ability and diet acceptability, water stability of the feed and handling requirements (Chaitanawisuti et al., 2010). In recent days, the increasing demand of the meat, operculum and shells of the gastropod have led to the development of active fishery in different parts of India (Periyasamy et al., 2011). The heavy fishing may result in the depletion of natural stocks to a large extent. Several bivalves are produced through aquaculture, but gastropods are not produced

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through aquaculture and they can also be cultured for commercial production. Only a few studies were done in India on breeding, larval rearing and sea ranching of gastropods (Mohanraj et al., 2010). The present study deals with the work, influence of formulated diets on growth and biochemical parameters of *B. spirata.*

Materials and Methods

The samples of *B. spirata* with their initial weight ranged from50.68g to 52.52g and initial length ranged from 5.53cm to 5.82cmwere collected at the Therespuram coastal area (80^0 48'N; 78^0 94' E), Tuticorin, Southeast coast of India. Collected samples were made to acclimatize in 7 days in by using aerated plastic holding tanks (1.5m×2m×0.5m L: W: H) in the Marine Gastropod Hatchery Research Laboratory, Kamaraj College, Tuticorin, Tamil Nadu, India. During this study period, the snails were fed with natural live clam meat. Then they were randomly distributed into triplicate FRP tank containing 200L at 40 snail /tank and three experimental groups were maintained. The tanks were regularly cleaned, disinfected and allowed to dry for 24h after which they were filled with dechlorinated ambient seawater to 2/3 sizes of the tanks. The bottom of the rearing tanks was covered with 3 cm layer of coarse sand (500 to 1000 micron mean grain size) as substrate. After removing the snails from culture tanks, sand was cleaned using a water jet flushing and sundried at 30days intervals in order to remove the accumulated waste materials. During this period the snails were fed with formulated (30%, 35% and 40 % crude protein) at once day. The total experiment was conducted for 90 days.

Experimental diet

The procedures for feed preparation were modified by Hardy (1980). The feed ingredients were homogenized thoroughly in a food mixer. After adding distilled water to the mixed ingredients, a paste was made using a hand mixer. The paste was shaped into 0.5 mm thick sheets and they were cut into 2 cm^2 flakes, sealed in a plastic bag and stored at -20^0C. The experimental diets were formulated with the composition protein of 30%, 35% and 40%. The fish meal and groundnut oil cake serves the protein source, fish oil as serves lipid source, tapioca powder serves as the carbohydrate source, wheat flour serves as a binder and vitamin and mineral mixtures were also added (Table 1).

Table 1 - Composition of basal diet

Ingredients	30%	35%	40%
Fish Meal	26	32	38
Groundnut oil cake	26	32	38
Tapioca	23	17	11
Maida	23	17	11
Cod liver oil	1	1	1
Vitamin and Minerals mix	1	1	1
Proximate Composition	**30%**	**35%**	**40%**
Moisture	74.26 ± 0.26^a	74.96 ± 0.78^b	75.12 ± 0.15^a
Protein	30.45 ± 0.47^b	34.63 ± 0.19^b	39.17 ± 0.31^a
Carbohydrate	10.87 ± 0.96^c	10.96 ± 0.46^{ac}	11.05 ± 0.24^c
Fat	2.16 ± 0.44^d	2.20 ± 0.63^b	2.54 ± 0.10^c
Ash	8.11 ± 0.78^e	8.13 ± 0.75^{bc}	8.23 ± 0.84^c

^{abc} (Mean±SD) the same letter in the same row is not significantly different at P<0.05.

Water quality

The seawater quality parameter was analyzed weekly for its purity. It includes parameters like, temperature (^{0}C), salinity (ppt), pH and dissolved oxygen (mg/L) were examined by using SYSTRONICS water analyzer 371.

Growth parameters

The growth performance and biochemical profile were expressed in terms of weight measurements like weight gain (g) and survival (%) were monitored according following formula of Chaitananawisuti et al. (2011).

Weight gain (g) - Final weight –Initial weight

Survival (%) - $\frac{F_2}{F_1} \times 100$

F_1 - Number of snail at the being of experiment

F2 -Number of snail at the end of the experiment

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Estimation of Biochemical profile

The Folin- Ciocallteu phenol method of Lowry et al. (1951) was adopted for the estimation of total protein in the tissue. Total carbohydrate content method was followed by Dubois et al. (1956). The lipid content was estimated gravimetrically by following the method of Floch et al. (1956). The moisture and ash content was followed by AOAC (1990).

Statistical analysis

All experimental data obtained were analyzed using one-way analysis of variance (ANOVA) followed by Duncan's multiple range test $P < 0.05$ was considered for describing the significant level (SPSS Version 20).

Results and Discussion

The aquaculture of molluscs seems to be seriously affected worldwide by bacterial pathogens and predators' that cause high losses in hatcheries as well as in natural beds. The main responsible for the mortality outbreaks is a number of *Vibrio*sp and *Aeromonas* species that are considered important pathogens in aquaculture (Chen et al., 2005). The pathologies caused by *Vibrio* in bivalves and gastropods have been described since the 1960s; however, over recent years successive episodes of high mortality have been recorded due to these microorganisms. The average shell length and weight and survival rate of *B.spirata* fed with formulated diet for three month are shown in Table 2. The growth expressed as body weight, shell length and survival rate were significantly not different $p<0.05$ among the experiment diets. Among the average body weight gain, the highest was observed at 40% level of protein diet (2.14 ± 0.84g) and the lowest was observed at 30% level of protein diet (1.01 ± 0.36g). In average final shell length, the highest was observed at 40% diet (6.91± 0.70cm) and the lowest was observed at 30% diet (5.96 ± 0.62cm). The average survival rate, the highest was observed at 40% of protein diet (91 ± 1.04%) and the lowest was observed at 30% diet (89 ± 1.06%). The maximum growth and survival rate were observed in 40% protein diet.

Table 2 - Average length, weight and survival rate of *B. spirata* fed with (30%, 35% and 40%) different formulated diet for 3 month

Diets	Initial weight (g)	Final weight (g)	Weight gain (g)	Initial length (cm)	Final length (cm)	Survival (%)
30%	50.95 ± 0.33^{a}	51.96 ± 0.32^{ba}	1.01 ± 0.36^{ca}	5.56 ± 0.63^{a}	$5.96 \pm 0.62^{b,a}$	89 ± 1.06^{ca}
35%	50.16 ± 0.12^{ab}	51.63 ± 0.15^{b}	1.47 ± 0.55^{c}	5.79 ± 0.45^{ab}	6.59 ± 0.45^{b}	90 ± 1.23^{cb}
40%	51.05 ± 0.21^{a}	53.45 ± 0.24^{b}	2.14 ± 0.84^{cab}	5.81 ± 0.41^{a}	6.91 ± 0.70^{ba}	$91 \pm 1.04^{c,a}$

Table 3 - Proximate composition of formulated deitof *B. spirata*

Proximate composition (%)	30%	35%	40%
Moisture	74.53 ± 0.06^{bac}	74.31 ± 0.19^{c}	80.17 ± 0.19^{a}
Protein	46.12 ± 0.57^{bca}	37.68 ± 0.55^{c}	50.61 ± 0.61^{a}
Carbohydrate	13.22 ± 0.74^{bac}	11.92 ± 0.17^{c}	15.41 ± 0.84^{ac}
lipid	4.02 ± 0.03^{bac}	3.80 ± 0.02^{c}	4.09 ± 0.03^{ac}
Ash	16.33 ± 1.15^{bac}	13.33 ± 1.52^{cac}	15.66 ± 0.57^{a}

^{abc} (Mean±SD) the same letter in the same row is not significantly different at $P<0.05$.

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Table 3 - Average water quality parameters observed during experimental period of (12 weeks) in *B. spirata* at 30%, 35% and 40% of basal diet.

30%				
Weeks	**Temperature (°C)**	**Salinity (ppt)**	**pH**	**DO mg/L**
1	26.32±0.74^{a}	33.04±0.25^{b}	7.21±0.39^{ab}	5.30±0.12^{d}
2	26.90±0.98^{ab}	32.66±0.58^{b}	7.15±0.14^{c}	5.13±0.38^{d}
3	27.12 ±0.30^{a}	33.19±0.21^{a}	7.13±0.21^{c}	5.06±0.16^{a}
4	27.00 ±0.94^{a}	33.92±0.77^{ba}	7.06 ±0.11^{a}	5.16±0.24^{a}
5	27.96±0.73^{abc}	32.53±0.51^{b}	7.61±0.78^{c}	5.05±0.16^{dbc}
6	26.85±0.86^{a}	33.13±0.48^{b}	7.56±0.11^{cab}	6.02±0.51^{d}
7	27.12±0.81^{a}	32.16±0.19^{b}	7.10±0.51^{cab}	5.26±0.17^{dab}
8	26.08±0.37^{a}	33.26±0.14^{ba}	7.86±0.95^{c}	5.96±0.63^{da}
9	27.03±0.44^{ac}	33.62±0.37^{bc}	7.45±0.61^{c}	5.02±0.37^{d}
10	26.97±0.42^{a}	33.07±0.43^{ba}	7.26±0.07^{ca}	6.30±0.12^{d}
11	27.06±0.83^{a}	33.52±0.31^{b}	8.03±0.73^{ab}	6.55±0.47^{d}
12	26.05±0.50^{a}	32.20±0.39^{b}	7.60±0.46^{c}	6.77±0.61^{da}
35%				
Weeks	**Temperature (°C)**	**Salinity (ppt)**	**pH**	**DO mg/L**
1	26.55±0.17^{a}	32.60±0.16^{ba}	7.16±0.36^{ca}	5.11±0.13^{d}
2	27.80±0.12^{a}	33.26±0.62^{b}	7.63±0.24^{cab}	5.33±0.48^{d}
3	26.18±0.29^{a}	32.66± 0.63^{ba}	7.27±0.23^{cad}	5.41±0.26^{d}
4	26.25±0.52^{a}	32.92±0.54^{b}	7.66±0.19^{c}	5.08±0.24^{d}
5	27.49±0.69^{a}	32.63±0.63^{ba}	7.28±0.45^{ca}	5.65±0.66^{d}
6	28.15±0.19^{a}	33.83±0.19^{b}	7.16±0.36^{ca}	5.33±0.71^{d}
7	26.92±0.29^{a}	33.16±0.26^{ba}	7.33±0.24^{ca}	5.11±0.67^{da}
8	27.18±0.29^{ab}	33.90±0.46^{b}	7.60±0.63^{cb}	5.16±0.43^{db}
9	27.03±0.64^{ac}	33.62±0.54^{bc}	7.31±0.45^{c}	6.05±0.27^{d}
10	27.67±0.62^{ac}	32.77±0.29^{bc}	7.13±0.64^{c}	5.93±0.12^{dc}
11	27.11±0.43^{a}	32.50±0.26^{b}	7.23±0.27^{cad}	6.21±0.67^{d}
12	26.85± 0.63^{a}	33.08±0.39^{ba}	7.20±0.23^{c}	6.07±0.03^{d}
40%				
Weeks	Temperature (oC)	Salinity (ppt)	pH	DO mg/L
1	26.66±0.57a	33.00±0.55ba	7.82±0.39ca	5.41±0.43d
2	27.30±0.98a	33.06±0.58b	7.83±0.54cab	5.53±0.38d
3	27.68±0.30a	33.96±1.01ba	7.83±0.49ca	5.41±0.36da
4	27.45±0.94a	33.92±0.77b	7.71±0.51cab	5.78±0.34d
5	27.49±0.74a	33.53±0.56b	7.63±0.74ca	5.45±0.46da
6	27.55±0.26a	32.93±0.48b	7.36±0.41c	5.93±0.51da
7	27.42±1.01a	32.46±0.81ba	7.70±0.61ca	5.61±0.37d
8	26.78±0.37a	32.90±0.54b	7.80±0.55ca	5.66±0.43da
9	26.93±0.44a	33.12±0.37b	7.81±0.41ca	5.45±0.37d
10	27.67±0.72a	32.77±0.43b	7.83±0.37c	5.93±0.42da
11	26.81±0.43a	32.60±0.41b	7.63±0.43ca	6.21±0.47da
12	26.85±0.70a	32.88±0.39b	7.60±0.46c	6.07±0.43da

^{abcd} (Mean±SD) the same letter in the same row is not significantly different at P<0.05.

According to Nilnaj Chaitanawisutia (2010) have reported *B.areolata* is one of the most important cultivable species with significant commercial value. Currently, the most common practice in spotted babylon culture in Thailand. Similarly, Chaitanawisuti and Kristanapantu (2000) have reported that average growth rate of juvenile spotted babylon of *B.areolata* was 3.86 mm mo^{-1} in length and 1.47 mo^{-1} in weight after 8 months when cultured at a density of 300 snails/m^2 in flow through system and 3.21 mm mo^{-1} and 1.10g mo^{-1} when held in a recirculation system. Temperature and salinity are considered to be the most important physical factors influencing marine organisms and the biological effects of these factors are complex and wide ranging. Secondly, temperature affects the hatch rate, incubation period, the size of the newly hatched larvae, larval yolk absorption and utilization, larval feeding behavior, larval survival and larval growth (Shi *et al*., 2010). The temperature, salinity, diet and rearing density are exogenous factors affecting larval growth, settlement and metamorphosis Crisp (1974). Theaverage water quality parameters observed during the experimental period for twelve weeks are shown in Table. 3. These

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parameters were significantly P<0.05 different including the temperature which ranged between 26.66 ± 0.57 ^{0}C and 27.68 ± 0.30 ^{0}C, the salinity between 32.12 ± 0.37 ppt and 33.92 ± 0.77 ppt, the pH from 7.60 ± 0.46 to 7.83 ± 0.49 and the dissolved oxygen from 5.41 ± 0.36 mg/L to 6.21 ± 0.47 mg/L. These values are suitable for rearing of *B. spirata.* Similarly, Kritsanapuntu et al. (2006) observed the higher body weight gain and shell length increments were observed in *B. areolata* held in recalculating seawater system at water exchange of 15 day intervals. The proximate compositions of *B. spirata* tissues fed with different formulated diet are shown in the Table.3. The maximum moisture content (80.17 ± 0.19%), Protein (50.61±0.61), Carbohydrate (15.41±0.84), Lipids (4.09±0.03), Ash (15.66± 0.57) was recorded in 40% of protein deit and minimum in 30% protein det. All the above proximate values are (p<0.05) not significantly different. Palapandi *et al*. (2010) have reported the proximate composition of *Cymbiummelo*. Among proximate composition, protein ranged from 20.78% to 30.19%, carbohydrate 5.14% to 2.59%, lipid 3.39% to 2.76 % and moisture content 83.69% to 76.59%. Similalry, Periyasamy *et al*., (2011) has reported that *B.spirata* meat is a valuable food with high quality protein and well balanced diet.Nutritional contents of protein (53.86%), carbohydrate (16.85%) lipid (9.30%). SiniMargt *et al*. (2013) have also observed the biochemical composition of four important gastropods from Kanyakumar coast. The maximum protein content was observed in *B.spirata* (39.8%) and *B. zeylancia* (35.8%). In conclusion, the results of our study reported that 40% of protein diet better growth performance and biochemical variables in *Babylonia spirata*.

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Conflict of interest

There is no conflict of interest to be declared by the author

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