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COMPARISON OF GROWTH AND CONVERSION EFFICIENCY OF THE FRESHWATER PRAWN *MACROBRACHIUM MALCOLMSONII* (H. MILNE EDWARDS) JUVENILES FED WITH FORMULATED AND COMMERCIAL FEEDS

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ABSTRACT

A nutritional study was carried out to know the feasibility of formulated and commercial feeds on the growth of juveniles of the freshwater prawn *Macrobrachium malcolmsonii*. Best relative growth rate was observed for feed 1 followed by feeds 2 and 3. Animals fed with feed I showed higher production than the other feeds. Higher assimilation efficiency was noticed in the animals provided with feeds 5 and 4. Higher gross and net growth efficiencies were observed in the animals offered feed 1. Among the commercial feeds feed 3 may considered to be suitable alternative to feed 1.

Keywords : Conversion efficiency, commercial & formulated feeds

INTRODUCTION

Of the total 74. 393 tonnes shrimp exported from India in 1992-93, freshwater prawns accounted for only about 1,300 tonnes (15%), though we have 7.5 lakh ha of pond/tanks, 15.5 lakh ha of reservoirs, 1.81 lakh ha of oxbow lake belts, besides 45,000 km of long rivers. Most of these freshwater resources are suitable atleast for extensive prawn farming (Jayaraman, 1994). However, freshwater prawns have been a neglected resource in India as far as aquaculture is concerned (Tripathi, 1992). This may be due to non-availability of proper feeds (John Samuel, *et al.,* 1994). Most recently, the problems faced by the brackish water shrimp farmers along the southeast coast of India due to disease out break and pollution related social problems have made them to think of switching over to freshwater prawn farming. Since suitable feeds for scampi culture are not available exclusively a study on the feasibility of commercial penaeid feeds for freshwater prawns was felt essential and hence the present investigation was carried out in *Macrobrachium malcolmsonii.*

MATERIAL AND METHODS

Four commercially available shrimp feeds (crumble form) were procured from shrimp farms and two feeds were prepared in the laboratory for comparison. The feed preparation procedure followed in this study has been described by John Samuel (1991). The details are given in Table I & II. Juveniles of *M. malcolmsonii* were collected from lower Anaicut. Kumbakonam (Anakarai) and brought to the laboratory

Table I : Details showing the different feeds fed to *M.malcolmsonii* juveniles

Feeds	Trade Name	Company
1	Prepared feed	---
2	Prepared feed	---
3	Aquaster feed	Trouw International, SE Asia, Bangkok, Thailand
4	Lux feed	The waterbase Ltd., Nellore, Andhra Pradesh
5	C. P. feed	C. P. Group (Chareeon Pokphand), Bangkok, Thailand
6	Higashi feed	Higashimaru feeds (India) Ltd., Cochin

Table II : Percentage of ingredients for prepared feed 1 and 2

Feed 1	percentage	Feed 2	Percentage
Squid meal	40	Fish meal	25
Tapioca	25	Chicken waste	15
Soya flour	10	Wheat flour	15.5
Groundnut oilcake	10	Rice bran	14
Fish meal	5	Coconut oil	8
Prawn head waste	5	Tapioca	10
Fish oil	2	Starch	5.5
Soya lecithin	1	Soya flour	5
Guargum	1	Vitamins & minerals	1.5
Vitamins & minerals	0.6	Triple active* growth promotor	0.5

* Cattle feed supplement.

Table III : Proximate composition of feeds

Feeds	Carbohydrate (%)	Protein (%)	Lipid (%)	Moisture	Ash	*Energy Kcal/g
1	25.0	41.0	7.5	8.0	15	3.53
2	26.0	41.2	6.0	10.5	17	3.53
3	20.0	41.6	7.0	9.0	14	3.30
4	21.8	43.0	5.0	10.0	13	3.24
5	24.2	42.0	5.0	11.0	14	3.30
6	22.0	42.0	6.0	11.0	16	3.30

* Based on the following values - 4.18 Kcal/g carbohydrate. 4.32 Kcal/g protein, 9.46 Kcal/g lipid (Bages and Sloane, 1981)

in oxygenated bags. They were acclimated to laboratory conditions similar to John Samuel *et al.*, (In press). Before start of the experiment, the animals were starved for 24 hrs to ensure evacuation of gut and weighed individually. They were introduced into the experimental plastic troughs (size 25 cm x 34 cm) separately 5 animals per trough having filtered fresh water. Triplicate was maintained for each feed. No aeration was provided and the experiment was continued for 45 days. Every morning the animals were fed with the prepared and commercial feeds at the rate of 10% of body weight. Fifty percent of water was changed every morning after collecting the moult, if any. The unconsumed feed and faecal matter were collected and dried at 60°C and weighed. At the end of the experiment, prawns in each trough were starved again for one day to ensure complete evacuation of gut, then weighed and dried at 60°C for biochemical analysis. The energy budget was calculated by the method of Crisp (1971).

RESULTS

Table III shows the proximate composition of feeds used in the present study. Protein level in the commercial feeds (feeds 3-6) ranged between 41.6% and 43%. However, in the prepared feeds (feeds 1&2), protein level was almost same (41% & 41.2%). Carbohydrate content was higher in feed 2 (26%) and lower in feed 3 (20%). Among the six feeds, the lipid content ranged from 5%-7.5%. Ash content was higher (17%) in feed 2 than the other feeds.

Energy budget of *M. malcolmsonii* fed on different feeds are presented in Table IV. Best relative growth rate (0.021mg/day) was observed with feed 1, followed by feed 2 (0.014mg/day) and feed 3(0.013mg/day). Comparatively higher production was observed in feed 1. Feed 5 showed higher assimilation efficiency followed by feed 4 which contain higher protein levels 42% and 43%, respectively. Higher gross growth efficiency K_1(45.64%) and net growth efficiency K_2(54.81%) was observed in feed 1 and lower gross growth efficiency (22.53%) and net growth efficiency (25.73%) in feed 4.

From Table V it is evident that the consumption rate and protein intake rate ranged between 37.69 mg g^{-1} day^{-1} to 44.15 mg g^{-1} day^{-1} and 15.55 mg g^{-1} day^{-1} to 18.50 mg g^{-1} day^{-1}, respectively. Protein efficiency ratio was higher in the feed 1 (0.0011) followed by feed 2 (0.0009).

Biochemical composition of *M. malcolmsonii* fed with test diets is given in Table IV. Initial protein (59%.), lipid (8.8%) and energy level (3.54 kcal/g) of the test animals were increased to 61.5%. 9.6% and 3.71 kcal/g by feed 6. In feed 1, 0.73% increase in carbohydrate level and 1% increase in protein level at the end of the study was observed with 0.8% decrease in lipid. The energy level increased from 3.54 kcal/g at the beginning of the experiment to 3.95 kcal/g in feed 2 at the end of the experiment.

DISCUSSION

The ingredients and the dietary level of protein have received much attention of nutritionists because of the nutritional

Table IV : Energy budget of *M.malcolmsonii* juvenils fed on formulated and commercial feeds

Feeds	Initial Weight W_1 (mg)	Final Weight W_2 (mg)	Production $P = W_2 - W_1$	Food Consumed C (mg)	Faercal output F (mg)	Rel. Growth rate P/W_1/45 days	Assimilation $A = C - F$	Metabolism $R = A - P$	Assimilation efficiency A/C%	Gross growth efficiency $K_1 = P/C\%$	Net growth efficiency $K_2 = P/A\%$	Food conversion ratio (FCR)
1	0.463±0.081	0.876±0.165	0.412±0.070	0.903±0.054	0.150±0.005	0.021±0.007	0.752±0.058	0.340±0.070	83.26±1.272	45.64±7.003	54.81±8.63	2.22±0.313
2	0510±0.48	0.826±0.062	0.316±0.059	0.866±0.058	0.156±0.007	0.014±0.004	0.710±0.053	0.394±0.091	82.0±0.0869	36.71±8.03	44.84±10.28	2.81±0.570
3	0.608±0.79	0.980±0.150	0.372±0.075	1.051±0.097	0.174±0.004	0.013±0.002	0.877±0.065	0.505±0.014	83.5±1.433	35.19±3.70	42.17±5.75	2.86±0.29
4	0.560±0.062	0.777±0.082	0.217±0.064	0.960±0.128	0.117±0.010	0.008±0.003	0843±0.120	0.726±0.184	87.82±0.900	22.53±8.95	25.73±10.37	4.42±2.64
5	0.534±0.116	0.827±0.118	0.292±0.033	0.996±0.185	0.109±0.016	0.012±0.003	0.888±0.170	0.595±0.170	89.03±0.875	29.94±5.67	33.64±6.414	3.30±0.69
6	0.499±0.082	0.744±0.115	0.245±0.056	0.928±0.107	0.153±0.013	0.011±0.003	0.775±0.094	0.530±0.144	83.51±0.46	26.40±8.52	31.61±10.35	3.79±1.52

importance of protein. Many authors concluded that the average weight gain is directly related to the level of protein in the diet (Ali. 1982b; Sambasivam, *et al.,* 1982). Though the feeds 1,2 and 3 contain more or less same protein levels, best growth was observed in feed 1 with 41% protein followed by feed 2 and 3. This was supported by the observations of Balazs and Ross (1976) for *M. rosenbergii* (above 35% protein) and John Samuel *et al.,* (1994) for *M. malcolmsonii* (40% protein). Though the protein content in feed 3 (Aquaster feed) is more or less similar to feed 1 and 2 (prepared feeds), the lower relative growth rate in feed 3 may be attributed to the lesser carbohydrate level, since a large quantum of energy required for the metabolic activity is partly supplied by increasing carbohydrate level (Ali, 1982 a). Hajra *et al.,* (1986) reported the optimum protein requirement to be 43% for growth of *P. indicus* with an energy value of 4.72 kcal/g. However, in the present study, *M. malcolmsonii* required 3.5 kcal/g of energy at 41% protein level for optimum growth. Reduced growth rates in commercial feed 3, 4, 5 and 6 may be attributed to the higher protein content than the optimum level in the prepared feeds. Ali (1982 b) and Sambasivam *et al.* (1982) noticed that the growth rate increase with an increase in protein content upto certain level. Further increase in the protein reduces the growth rate. Next to the prepared feeds, feed 3 (Aquaster feed) showed good relative growth rate (0.013 g) in *M. malcolmsonii* compared with other commercial feeds.

Not only protein, but also growth promoters, chemoattractants and easily assimilable ingredients included in the diet enhance growth (Heinen, 1980; Meyers, 1980; Meyers and Hagood, 1984). Deshimaru and Shigueno (1972) and Kittaka (1976) obtained good results by the addition of squid meal as a protein source in the prawn diets.

Not only prawn head waste seems to be a good source of fatty acids and pigments for *M. malcolmsonii* (John Samuel *et al.,* 1994) but also it acts as a chemoattractant (John Samuel *et al.* In Press) Teshim *et al.,* (1982) and Kanazawa (1985) stressed the importance of soya lecithin in the shell fish diets for better growth. Similarly, Krishnamoorthy and Subramanian (1995) observed a growth increment of *M. lamarrei* fed with soya mixed diets. The above mentioned ingredients used in feed 1 in the present study may be another reason for better growth. Lack of this ingredients may be the reason for comparatively lower growth in feed 2 than feed in 1 (Table II).

Higher gross and net growth efficiency and lower food conversion ratio leading to enhanced growth in animals fed with feed 1 followed by feed 2 and 3 indicate higher efficiency of food utilization. Similar type of inverse relationship between the gross growth efficiency and food conversion ratio was reported by Godfred *et al.* (1990). Lower K1 and K2 values obtained in feed 4 reflect poor food utilization.

The lower FCR obtained in feed 1 having optimum dietary protein level may be compared to the observations of Mathew and Jayaprakas (1990) and Godfred *et al.* (1990). The FCR values in the commercial feeds as reported in the company feeding chart (1 to 2.5) may not only be attributed to the relative brevity of the study period,

but also the poor utility of the feed by *M.malcolmsonii.*

Higher protein efficiency ratio (0.0011) in feed 1 containing high energy (3.53 kcal/g) indicates that the metabolisable energy from carbohydrate did exert a transient protein sparing action similar to the observation of Hajra et al. (1988) in *P. monodon*. So it is possible to suggest that the optimum protein level (40%) for *M. malcolmsonii* may be reduced to a lower level to reduce the cost of protein in the diet by increasing the carbohydrate level in the diet.

In conclusion, feed 1 which comprised the optimum protein level with chemo-attractant, growth promotors and easily assimilable ingredients showed the lowest food conversion ratio. Among the commercial penaeid feeds, feed 3 (Aquastar feed) may be a suitable alternative for feed 1, which showed the FCR values close to feed 1. So it may be recommended for the culture of freshwater prawn *M. malcolmsonii.*

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