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Macrobrachium lar and analysis of its physical and chemical characteristics

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Abstract

Macrobrachium lar a fresh water prawn being a natural breeder available in almost all freshwater bodies of North and Middle Andaman enables the farmers to collect and rear them under controlled conditions, preventing the organisms from foraging on natural feed which demands providing them with an alternative source of nutrient. The present study thus defines the various steps of feed formulation and evaluates the physical and chemical properties of the feed thus prepared with 45% protein and 8% lipid. The feed was formulated based on the nutrient requirements of the organism to support its growth and survival. Proximate composition analysis such as moisture content (12.842±0.142), total ash (8.471±0.154), crude protein (43.027±2.77), crude fibre (5.37±1.7), lipid content (7.193±1.577) and nitrogen free extract (23.097±0.695) have shown promising results. Physical property such as water stability and sinking rate plays a vital role in defining the quality of the feed, which can be enhanced by using different binders. Thus the water stability and buoyancy of feed bound with three different binding agents such as cod liver oil, combination of tapioca flour with cod liver oil and the combination of corn flour and cod liver oil were also tested which revealed that the combination of corn flour with cod liver oil showed the best water stability and combination of tapioca flour with cod liver oil expressed the maximum floatation.

Key words: *Macrobrachium lar,* artificial feed, proximate composition, fresh water prawn

Introduction

The decapod crustaceans, *Macrobrachium* are the genus of freshwater prawns belonging to the family Palaeomonidae. These natural breeders are found in almost all inland water bodies such as rivers, lakes, canals (New, 2002) which may facilitate farmers for collection and rearing of *Macrobrachium lar* (Fabricius, 1798) seeds under controlled condition. They have been reported as the native species of Andaman and Nicobar Islands (Costa, 1979; Sarangi *et al.*, 2001). When aquatic organisms are reared in confined cage culture systems, where they cannot freely forage on natural feed, their nutritional requirements completely depends upon the formulated feed. Thus a complete diet must contain all the necessary nutrients in proper proportion for supporting the growth of cultured animals (Craig, 2009). They can be cultured along with carps as a polyculture practice. In case of semi intensive or intensive culture, feed plays an important role and approximately 60-70% of the operational cost of the culture system is expended on feed. Shrimp head meal, fish meal, squids and cuttle fish, soybean meal, krills and scallop are being considered as a prominent source of protein for shrimp feed (New, 1976; Venero *et al.* 2008). Irregular feeding often leads to differential growth that may result in cannibalism which can be prevented by providing nutritionally sound diet and proper feed management practices. Pellets can be prepared in various sizes depending upon the mouth size of the organism but size of the pellet plays a major role as giving too large pellet to a small organism can result in decreased feed intake and can even cause choking. Sinking rate of a feed depends upon its bulk density and in order to sink the pellets must weigh over 600-640g/ litre (Rokey, 2004; Kearns, 2008). Sinking rate plays a major role as all the organism dwell and feed at different layer of the water. Floating feeds are necessary for surface feeders whereas, shrimps and prawns feeds off the substrate thus they require sinking pellets. Coating of the pellets is done to increase its water stability and to reduce the rate at which it sinks. Oil coating is often done after pelletizing in order to prevent the loss of lipid content due

to the heat generated during autoclaving and pelletizing. Since, no attempt has been made to culture this species in captive condition even though having lot of scope in Andaman and Nicobar Islands. With this background, we have initiated to formulate the diet for *Macrobrachium lar* and evaluated its physical and chemical properties.

Materials and Methods

Preparation of feed

The ingredients required for feed preparation namely, groundnut oil cake (GNOC), coconut oil cake (COC), rice bran, broken rice & tapioca flour were procured from the local vendors and were properly milled & sieved. Marine fishes, shrimp heads, squids & cuttle fish were also procured from the local fish market, boiled and made into a paste. The ingredients were taken in necessary proportion required to formulate a diet with 45% crude protein and 8% of lipid (Table 1). As *M. lar* is omnivorous the formulation was prepared using both animal and plant protein sources, of which major part was contributed as animal source and minor portion was of plant protein.

Pelleting started with thorough hand mixing of dry ingredients, to which the wet ingredients were added and mixed to obtain homogenous dough which was autoclaved. After autoclaving vitamin and mineral premix was added to the dough and mixed thoroughly. Feed pellets of 1.2 mm size were generated using a pelletizer. The pellets were collected in trays and shade dried to attain a moisture level below 12%. The dried pellets were stored in air tight pouches.

Table 1: Composition of ingredients for feed formulation

S.No	Ingredients	Protein % (Ingredient)	Dose used (%)	Required(g)	Protein in Feed	Lipid in Feed
1	Fishmeal	60	20	500	12	2
2	SHM	75	15	375	11.25	1.05
3	Squid or Cuttle fish meal	80	10	250	8	1.2
4	GNOC	48	20	500	9.6	1.4
5	COC	22	5	125	1.1	0.2
6	Rice bran	12	10	250	1.2	1.2
7	Broken rice	14	15	375	2.1	0.6
8	Tapioca flour	4.5	3	75	0.135	0.03
9	Vit & Min premix	-	2	50	-	-
	Total		**100**	**2500**	**45.385**	**7.68**

Analysis of physical parameters

Water stability test was conducted in triplicates. Approximately, 1 g of feed was taken and immersed in a beaker containing tap water and allowed to lose physical shape of the pellets after which the pellets were transferred into pre weighed petri plates and dried. Further, weight of the petri plates with the dry sample was taken and water stability was calculated based on the difference between the weights of the retained pellet against the actual weight of the pellet.

Sinking rate of the feed was assessed in triplicates. Around 5-10 pellets of same size were dropped one at a time in a beaker containing water up to 10 cm, timed by a stop watch to note the time taken for the pellet to reach the bottom of the beaker. The dried pellets were coated with different materials and oil and were used to detect changes in sinking rate and water stability. The different coatings used are: i) Cod Liver oil ii) Cod liver oil plus corn flour iii) Cod liver oil plus tapioca flour (Figure 1).

Figure 1: Feed coated with different coating materials

Proximate composition analysis of formulated feed

Proximate composition is the method of quantifying the macronutrients present in the feed, developed by Henneberg and Stohmann in Germany, 1860. Proximate composition is an analysis that divides the components present in the feed into nutrient and non-nutrient based on their chemical properties. It divides and estimates the components present into the following six categories: such as moisture, crude protein, lipid, total ash, crude fibre and nitrogen free extract (digestible carbohydrates). These components were estimated using the method of Association of Official Analytical Chemists (AOAC, 1995). Nitrogen content was determined by Micro-Kjeldahl method, followed by converting the nitrogen content to crude protein content by multiplying the value with a constant 6.25. Nitrogen free extract refers to the soluble carbohydrate present in the feed which can be determined by difference. The study for each parameter was conducted in triplicate and results obtained were tested by one-way analysis of variance (ANOVA) and the comparison among the parameters were done by Duncans' multiple range test by SPSS 16.0.

Results and Discussion

The size of the formulated feed was maintained as 1.2 mm in order to feed PL20 stage of *M. lar*. Large pellets are economically not ideal, as it often results in wastage which leads to accumulation of ammonia in the culture system resulting in poor water quality and promoting retarded growth. On the contrary, very small sized pellet results in ineffective feeding as the organisms have to spend large part of energy in searching the feed (Craig, 2009). Water stability defines the duration for which the pellet can remain in the water without undergoing disintegration, which may result in loss of nutrients and incomplete utilization (Soloman *et al*. 2011). The water stability of the formulated feed was recorded as 2 hours±12 minutes with a leaching rate of 23.28%. Normally slow feeders like prawn and shrimps require a minimum 1.5 to 2 hrs of water stability. The average time taken for *M. lar* feed pellets to reach the bottom was 12.87±0.5 secs.

Fig 2: Water stability of the pellets

Fig 3: Sinking rate of pellet

The result thus presented in the Table 2 and Fig. 4 revealed that the formulated feed contained 43.027±2.77% of protein, 7.193±1.577% of lipid which fulfils the requirements structured for the formulation of the feed. Fibre content of the feed was observed as 5.37±1.7% which is under the acceptable limit thus it also aids the water stability of the feed. However, the total ash content is higher than the acceptable limit (8.471±0.154%) making the feed quite uneconomical for the farmers. This increase in total ash may result in reduced digestibility and indicates the presence of sand and silica which can be avoided by selecting the quality ingredients without contamination.

Table 2: Proximate composition of formulated feed

S.No.	Parameter	Percentage (%)
1.	Moisture	12.842± 0.142
2.	Crude Protein	43.027 ±2.77
3.	Crude Lipid	7.193± 1.577
4.	Total Ash	8.471±0.154
5.	Crude Fibre	5.37±1.7
6.	Nitrogen Free Extract	23.097±0.695

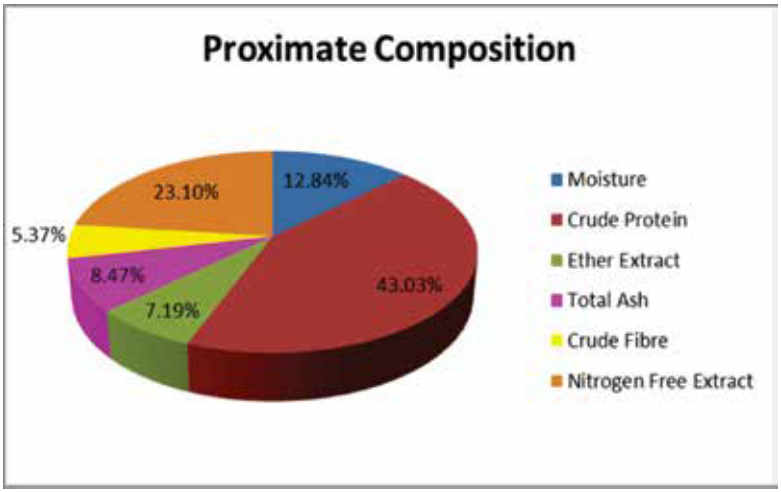

Fig 4: Proximate composition of ***M. lar*** feed

Outer coating with cod liver oil helps in increasing the water stability of the feed as it delays the rate at which water molecules enters the intermolecular spaces of the pellets (Lim and Cuzon, 1994; Kearns, 2008). This property has been clearly observed in the prepared feed upon coating with oil and other materials, an increase in the water stability was observed in the coated feed. A maximum of 2 hours ± 35 minutes of water stability was shown by corn flour coated pellets. Though, much difference in the duration of stability was not observed upon coating but major changes were recorded in the leaching rate of the pellets. Among the three different materials used, the combination of corn flour and cod liver oil showed the best result with a low leaching rate of 12.2% followed by tapioca flour with cod liver oil (17.2%) and the maximum leaching was observed in pellets which were coated only with cod liver oil (20.6%). This proves that the loss of nutrients can be minimised on coating with a combination of corn flour and cod liver oil. Sinking rate of the pellets was significantly increased based on the types of coating materials used. It was observed that sinking rate was mainly affected

by tapioca flour (18 minutes and 04 seconds) while corn flour (11 minutes and 06 seconds) and oil (10 minutes and 04 seconds) expressed almost similar results. From this present study, it can be concluded that tapioca flour in combination with cod liver oil can be used to obtain feed pellets that can float for 18 minutes of exposure to water, while a combination of corn flour and cod liver oil can be used to get feed pellets which are durable in water for more than 2.5 hours.

References

Costa, H. H. & Wanninayake, T. B., (1986). Food, feeding of the giant freshwater prawn *Macrobrachium rosenbergii* from natural habitat in Sri Lanka. In: Maclean, J. L., Dizon, L. B. and Hostillos, L. V. (Eds.), *Proceedings of the first Asian fisheries forum,* Asian Fisheries Society, Manila, Philippines, 555-558.

Craig, S., (2009). Understanding Fish nutrition, Feeds and Feeding. Department of Fisheries and Wildlife Science; Virginia Tech; 256-420. (www.pubs.ext.vt.edu/420/420-256/420-256.html).

Kearns, J., (2008). Technical advancements in extruded shrimp feed. Aquaculture Process Engineering Manager Wenger Manufacturing, Inc. Sabetha, Kansas. Prepared For Aquafeed Horizon Asia, pp. 6.

Lim, C., & Cuzon, G., (1994). Water Stability of Shrimp Pellet; A Review. *Asian Fisheries Science*, **7**: 115-127.

New, M. B., (2002). Farming freshwater prawns: A manual for the culture of the giant river prawn *(Macrobrachium rosenbergii). FAO Fish. Tech. Paper,* **428**: 212.

New, M. B., (1976). A Review of Dietary Studies with shrimps and Prawns. *Aquaculture*, **9**: 101-144.

Rokey, G. J., (2004). Modern Extrusion System for Shrimp Feed Production. Aqua feeds: Formulation and Beyond, **2**: 21-24.

Sarangi, N., Soundararajan, R., Dam Roy, S., Beroi, P., & Tripathy, S. K., (2001). Distribution of wild freshwater prawn species *Macrobrachium lar* in streams of Andaman- a glimpse of its culture possibility *vis-à-vis* exploiting resource potential. *Proceedings of the national symposium on Biodiversity vis-à-vis resource exploitation; introspection"* Andaman Science Association, CARI, Port Blair, Andaman and Nicobar Islands, India, pp. 65-66.

Sethi, S. N., Nagesh Ram & Venkatesan V., (2013). Food and feeding habits of *Macrobrachium lar* (Decapoda, Palaemonidae) from Andaman and Nicobar Islands, India. *Indian J. Fish.,* **60** (4): 131-135.

Venero, J. A., Davis., & Lim, C. E., (2008). Use of Plant Protein Sources in Crustacean Diets. In: C.E. Lim, C.D. Webster and C.S. Lee; eds. Alternative protein sources in aquaculture diets, New York, Haworth Press, 163-203.