REPLACEMENT OF FISH MEAL PROTEIN BY SOY BEAN AND CORN GLUTEN MEAL PROTEINS IN THE DIET OF MUD CRAB, *Scylla paramamosain*

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ABSTRACT

Mud crab culture relies heavily on trash fish as the main source of feed ingredients. Artificial diets have been developed for mud crab and most of them have high content of fish meal. The increasing cost and demand of fish meal has encouraged feed manufacture to search for cheaper alternative protein sources such as plant protein. There is an urgent need to find suitable alternative protein sources to reduce the dependence of fish meal in mud crab diet. The objective of this study was to develop compounded feeds for juvenile of mud crab with reduced fish meal content, and as an alternative of trash fish feeding. For that reason, the experiment was done. Experimental diets were fish meal, 20% of soy bean (20% SBP), 40% of soy bean (40% SBP), 20% of corn gluten (20% CGP), and 40% of corn gluten meal protein (40% CGP). Average initial mud crab body weight of 0.65 ± 0.03 g was fed experimental diets for 56 days. The result showed that dietary fish meal protein can be replaced by 20% of soy bean and 20%–40% of corn gluten proteins for mud crab (*Scylla paramamosain*) diet. Thus, it can arguably be concluded that soy bean and corn gluten proteins are the alternative protein sources to partially replaced fish meal.

KEYWORDS: artificial diets, trash fish, mud crab

INTRODUCTION

Mud crab culture relies heavily on trash fish to feed cultured fish. Artificial diets have been developed for mud crab (Chin *et al*., 1992). These diets have high content of fish meal, the most common protein source in aquafeeds. With the increasing population and increased fishing pressure, the global production of fish meal has been in a state of decline whilst the demand for aquaculture has been steadily increasing (Tacon, 1996).

Fish meal is readily recognized as the best source of dietary protein and n-3 fatty acid eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), which are the essential dietary requirement of tropical marine species (King, 2004). Fish meal is also one of the most expensive and demanded ingredients and has become the main and most critical ingredient in aquafeed production. The increasing cost and demand of fish meal has encouraged feed manufacturer to search for cheaper alternative protein sources such as plant protein. Fish nutritionists have tried to use less expensive plant proteins to partially or totally replace fish meal. Substitution with other ingredients, especially from plant origin, is likely to compromise nutrient balance. Considering the increasing cost of fish meal

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and doubt concerning its long term availability, many researches have been carried out to find alternative protein sources as fish meal substitutes. Williams *et al.* (2003) reported that in order aquaculture to make a net contribution to human supplies, the present use of fish meal in aquaculture diets must be substantially reduced.

From market availability and nutritional value, the prime candidates for replacing fish meal in mud crab diet are soy bean meal and corn gluten although the protein content of soy bean meal is less than that of fish meal.

Until present, artificial feed for mud crab has not available yet. In mud crab feed development, it is an urgent issue to find a suitable alternative to reduce fish meal portion in mud crab diet. The objective of this study was to develop compounded feeds for juveniles of mud crab with reduced fish meal content, and serve as alternative feed ingredients to trash fish feeding.

MATERIALS AND METHODS

Mud crab juveniles (crablet) were produced in an oval tank of 5-m^3 volume, after which 120 of mud crab juveniles with the average initial body weight of 0.65 ± 0.03 g were transferred and reared individually using PVC compartments in several 30 L tanks equipped with flow through system and aeration. Eight juveniles of mud crab were reared in each tank. The experiment was arranged in complete randomized design (CRD) with 5 treatments and 3 replications.

Experimental diets were fish meal, 20% of soy bean (20% SBP), 40% of soy bean (40% SBP), 20% of corn gluten (20% CGP), and 40% of corn gluten meal protein (40% CGP). All diets were dried with freeze dryer. The composition of the experimental diets is shown in Table 1.

Crabs were fed with 5%–10% of body weight twice a day for 9 weeks. All crabs were individually measured body weight every week. All data were analyzed using one-way ANOVA and the differences between means treatment were considered significant at $P<0.05$ (Steel & Torrie, 1980).

RESULT AND DISCUSSION

The response of mud crab juveniles, in term of average body weight, toward different levels of soy bean and corn gluten proteins contained in the experimental diets is presentented in Figure 1. The best trend of growth after 2 weeks was shown by crab juveniles fed with the experimental diet of 40% SBP.

The initial average body weight of mud crab was 0.6 gram and gaining weight of 3.52 to

Table 1. Composition of experimental diets

Ingredients	Diets				
	Fish meal	20% SBP	40% SBP	20% CGP	40% CGP
Fish meal	52.7	42.2	31.6	42.2	31.6
Soy bean meal[1]	-	14.8	29.8	-	-
Corn gluten meal[2]	-	-	-	16	31
Vitamin mix	2.5	2.5	2.5	2.5	2.5
Mineral mix	2	2	2	2	2
Fish oil	2.7	2.7	2.7	2.7	2.7
Dextrin	24.5	24.5	24.5	24.5	24.5
Squid liver meal	5	5	5	5	5
Lecithin	2	2	2	2	2
Wheat flour meal	6	6	6	6	6
CMC	2	2	2	2	2
Fuller earth	0.6	1	0	0	0

Protein digestibility of soy bean and corn gluten meal were 96.05%[1] and 78.81%[2]

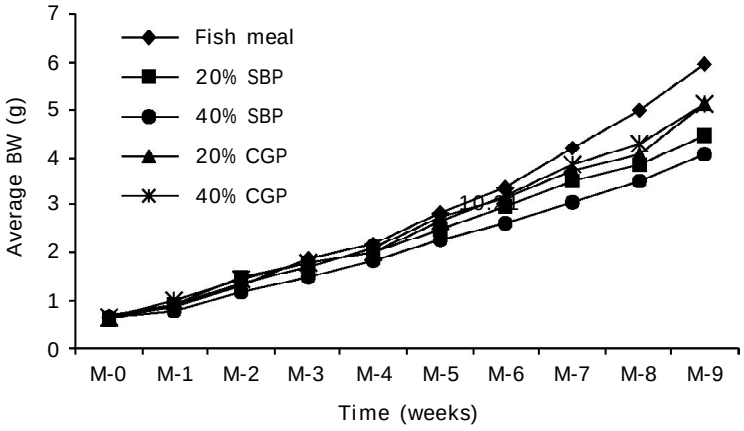

Figure 1. Rate of body weight gain of mud crab juveniles

4.98 gram after 56 days. Analysis variance showed that the average weight gain and final body weight were significantly affected by the levels of soy bean and corn gluten proteins in the diets ($P<0.05$) (Table 2). The increasing level of soy bean protein in the diet reduced weight gain. Mud crab fed on diet of 40% of soy bean protein (40% SBP) had significant lower weight gain than those fed on diet containing fish meal. This result indicates that replacement of fish meal protein by soy bean protein for better growth of mud crab should be less than 40% percent.

Mud crab fed on diet with the replacement of fish meal protein by 20% of soy bean protein (20% SBP), 20% of corn gluten (20%CGP), and 40% of corn gluten protein (40% CGP) had not shown significant different weight gain ($P<0.05$).

Marasigan *et al*. (1999) reported that mud crab, *Scylla serrata* and *Scylla transquebarica* fed on mussel meat had better growth than those fed on moist or dry shrimp diet and squid. On other hand, mud crab (*Scylla serrata*) fed on trash fish and mussel meat had not significant difference on growth.

This result indicates that source of protein affected the growth of mud crab. Dietary fish meal protein can be replaced by 20% of soy bean and 20%–40% corn gluten protein in the diet of mud crab (*Scylla paramamosain*). Thus, it can possibly state that soy bean and corn gluten protein can serve as alternative protein sources to partially subtitute fish meal.

The result of this experiment was supported by analysis of feeding habit of mud crab itself. The mud crab belongs to omnivore group, which feeds on detritus (35.7%), fish (23.6%), and crustacean (18.3%) (Prasad & Neelakantan, 1988). In other word, mud crab has the ability to use protein from plant sources such as soy bean and corn gluten protein.

Table 2. Initial, final weight, and weight gain of mud crab fed on experimental diets after 56 days

Diets	Initial body weight (g)	Final body weight (g)	Weight gain (%)	Survival rate (%)
Fish meal	0.66 ± 0.03	5.95 ± 0.18	801.1 ± 54.48^{b}	96 ± 7.2
20% SBP	0.63 ± 0.02	4.46 ± 0.57	607.8 ± 109.17^{ab}	91 ± 7.8
40% SBP	0.64 ± 0.03	4.05 ± 0.23	531.9 ± 51.27^{a}	100 ± 0.0
20% CGP	0.66 ± 0.22	5.13 ± 0.40	680.2 ± 57.37^{ab}	92 ± 14.4
40% CGP	0.65 ± 0.03	5.14 ± 0.36	687.7 ± 68.70^{ab}	95 ± 8.2

Values in the column with the same letter are not significantly different ($p>0.05$)

CONCLUSSION

Dietary fish meal protein can be replaced by 20% of soy bean and 20%–40% of corn gluten proteins for mud crab (*Scylla paramamosain*) diet. This leads to the conclusion that soy bean and corn gluten proteins might serve as potential alternative protein sources to partially or fully subtitute fish meal content in the diet of mud crab.

ACKNOWLEDGEMENTS

Financial assistance was provided through Assessing the Potential for Low Cost Formulated Diets for Mud Crab Aquaculture in Australia, Indonesia & Vietnam (Project No. FIS/2000/065) from ACIAR for which we are most greatfull.

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