REVIEW OF RESEARCH
IMPACT FACTOR : 5.7631(UIF) ISSN: 2249-894X
VOLUME - 1 | ISSUE - 2 | MARCH - 2019

EFFECT OF DIFFERENT DIETARY PROTEIN LEVELS ON THE BODY COMPOSITION OF JUVENILE CRAB SCYLLASERRATA (FORSKAL, 1775)

P.B.Markad, A.B.Patil, N.S.Deshpande, D.I.Pathan, A.S.Pawase, R.K.Pai, R.A.Pawar
College of Fisheries, Shirgaon, Ratnagiri – 415629.Maharashtra (India)
prashantmarkad5@gmail.com

ABSTRACT :

The crab juveniles were stocked at a rate of one crab in each circular HDPE tank of 0.24 m^2 area with a water level of 4-5 cm. Totally, five semi-purified pelleted diets containing variable protein levels: 38 (T_1), 40 (T_2), 42 (T_3), 44 (T_4) and 46% (T_5) but with a constant level lipid (8%) were prepared.Mud crab juveniles having initial length in the range of 4.05 ± 0.06 to 4.30 ± 0.04 cm and initial weight in the range 39 ± 0.67 to 42.50 ± 0.51 g were selected for experiment by using 10 – 6% feeding ration. At the end of experiment, the crabs belonging to T_3 recordedhigher values of protein (11.59 ± 0.20%) and lipid (3.6 ± 0.07%); lowest and best moisture; ash and fibervalues was recorded in T_3 (69.79 ± 0.28); (7.17 ± 0.07) and (1.42 ± 0.03) respectively, as compared to the crabs in other treatments ($P < 0.05$). Thus, considering body composition parameters, pelleted feed containing 42% crude protein and 8% lipid was found to be most suitable diet for better feed utilization for juvenile of Scylla serrata. The rearing experiment was conducted for a period of 90 days with four replicates for each protein level following CRD.

Keywords: Formulated feed, Body composition, Mud crab juveniles, *Scylla serrata,* etc.

INTRODUCTION

The mud crabs belonging to the genus *Scylla* represents a valuable components of small scale costal fisheries in many countries of tropical and subtropical Asia and African coasts. They are strongly associated to mangrove areas from their post larval stages, grow fast, attend maturity and form lucrative fishery in estuaries, backwaters and lagoons. With great demand for live, frozen and soft shelled crabs in global market along with increased price, the fishery and aquaculture of mud crabs have gained importance in India as well as in adjoining Asian countries. Over the last two decades, the exploitation of mud crab from natural habitats has been increased, posing a threat to natural biota. The history of mud crab aquaculture is of hundred years in China and for at least thirty years throughout Asia (Unnikrishnan and Paulraj, 2010).

Studies on the body composition of edible organisms are important from the nutritional point of view. That much published works are not available on the influence of feeds on the body composition of commercial crustaceans particular on the crabs Manivannan et al. (2010).

MATERIAL AND METHODS

Feed preparation:

A test diet was formulated consisting of marine and plant ingredients, such as fish meal, shrimp head meal, wheat gluten, squilla meal, *Acetes* spp. and sargassum. These were powdered in a grinder and passed through 0.25 mm sieve to obtain fine powder require for feed formulation. Five semi-purified pelleted diets were prepared by using locally available ingredients and containing variable protein level at 38, 40, 42, 44, and 46% all feed contained 8% lipid.

The different feed ingredients were weighed separately as per requirement and mixed thoroughly. Dough of mixed ingredients was prepared by addition of freshwater at the rate of 45 ml per 100 g of feed mixture. The dough was steam-cooked for 15 minutes and cooled at room temperature (30°C). The cooled dough was pressed through pellet machine to prepare pellets of 2.0 mm diameter. The pellets were spread uniformly on polythene sheet and kept at room temperature for drying. After 24 hours, pellets were separated out from the polythene sheet and oven-dried at 60 ± 50C for 2 hours. After cooling, the pellets were packed in plastic pouches and stored in dry place. The composition of the five experimental diets and their proximate composition are shown in Table 1.

Table 1. Ingredients and proximate compositions of the experimental diets

Ingredients (g/100 g^{-1})	Diets				
	T_1	T_2	T_3	T_4	T_5
Fish meal	16	15	14	14	14
Sargassum	12	16	16	15	12
Shrimp Head meal	10	11	11	11	11
Wheat gluten	12	10	10	13	16
Squilla meal	9	11	10	9	9
Acetes whole	10	10	11	11	11
Casein[a]	8	11	14	14	14
Cod liveroil	6	6	6	6	6
Gelatin[a]	6	3	2	2	2
Dextrin	4	2	1	1	1
Vit& min mix[b]	3	3	3	3	3
CMC[c]	4	2	2	1	1
Total	100	100	100	100	100
Proximate Composition (%)					
Moisture	8.82	8.5	8.01	8.4	8.6
Crude protein	37.82	40.37	42.07	43.77	46.32
Crude lipid	8.05	8.08	8.05	8.07	8.1
Crude ash	4.5	4.8	4	4.4	3.7
Crude fiber	2.01	2.2	1.9	2	2.5
NFE	38.80	36.05	35.97	33.36	30.78
Gross energy (MJ kg^{-1})[e]	19.0717	19.2091	19.5859	19.5443	19.7116

a. Obtained from Hi-media, India
b. Vitamin (100 g^{-1})- Vitamin B1- 200 IU, Vitamin B2- 200 IU, Vitamin B6- 150 IU, Calcium Pantothenate-700 IU, Inositol- 4000 IU, Biotin - 0.2 IU, Folicacid - 0.2 IU, PABA- 1000 IU, Cholinechloride- 6000 IU, Vitamin B12 - 0.01 IU, α – tocopherol - 40000 IU, Vitamin A - 30000 IU, Vitamin C – 20000 IU, Menadion- 40 IUMineral (100 g^{-1}) - $CaHPO_4$ - 200000, $K2SO_4$ - 100000, $MgSO_4$ - 90000, $FeSO_4$ $7H_2O$ -4000, $MnSO_4$ H_2O - 2000, Zn SO_4 H_2O - 1000, Cu SO_4 H_2O - 1000, Co C_{l2} $6H_2O$ - 200, KI - 100, Na SeO_3 - 1, Filler – 1690.
c. Carboxyl Methyl Cellulose
d. Nitrogen-free extract (Nitrogen free extracts including crude fiber = 100 – (Crude Protein + Crude Lipid + Crude Ash + Crude Fibre).
e. Gross energy, calculated based on 23.9, 39.8 and 17.6 MJ kg^{-1} for protein, lipid and NFE, respectively (Schulz et al., 2007).

Feeding trials

Juvenile of crabs were collected from a wild and were acclimatized for a week to the laboratory conditions in high density polyethylene (HDPE) circular tanks of 125 L capacity. During acclimatization, the

crabs were reared in 25 ppt salinity and were fed formulated diet for about 15 – 20 days. The pelleted feed was provided twice at 10:00 and 17:00 hrs everyday. About 20 to 30% water exchange was carried out daily. Uneaten feed and faecal matter was removed by siphoning out water regularly. At inception of research work, initial length and weight of crabs were recorded. The stocking density maintained was 1 crab tank 1.

Experimental procedure

Each tank was cleaned properly and filled with seawater up to 4-5 cm level, for the experimental use. Mangalore tile were placed as shelters in each tank. The juvenile with initial length ranging from 4.1 ± 0.2 cm and weight 40 ± 2 g were stocked at the rate of 1 crab tank $^{-1}$. Crabs were fed on a daily ration equal to 10 - 6% of body weight. Feeding was done twice daily in equally divided doses, at 10.00 hrs and 17.00 hrs.The experiment was conducted for a period of 90 days with four replicates for each protein level following Completely Randomized Design. During the experiment, the water temperature, salinity, pH, dissolved oxygen, total alkalinity, free carbon dioxidewas measured by standard methods given by Boyd (1981).

Analysis of samples

The proximate composition of the ingredients, experimental diets and samples of pooled whole crabs was analyzed as per the standard methods given by AOAC (2005).

Statistical analysis

The experimental data were analyzed by One-way ANOVA. Significant differences were indicated as $P< 0.05$, among the treatments means (Zar, 2010).

RESULT

The proximate composition of experimental animals (Table 2) revealed that there was significantly ($P<0.05$) increase in moisture, crude protein, lipid and ash in crabs fed with formulated diet compared to the initial crabs respectively, (Table2).

Table 2. Proximate composition of test animals fed on formulated feed with different protein levels

Particulars	Dietary protein levels (%)					
	Initial	38	40	42	44	46
Moisture (%)	63.2 ± 0.67	71.62 ± 0.34	71.35 ± 0.41	69.79 ± 0.28	70.59 ± 0.28	72.28 ± 0.27
Protein (%)	9.11 ± 0.01	10.10 ± 0.23	10.48 ± 0.21	11.59 ± 0.20	10.70 ± 0.11	10.43 ± 0.19
Lipid (%)	1.72 ± 0.01	2.68 ± 0.02	3.18 ± 0.01	3.60 ± 0.07	2.93 ± 0.09	2.53 ± 0.09
Ash (%)	6.32 ± 0.12	7.71 ± 0.03	7.91 ± 0.03	7.17 ± 0.07	7.61 ± 0.07	8.03 ± 0.07
Fiber (%)	1.29 ± 0.04	1.52 ± 0.02	1.63 ± 0.03	1.42 ± 0.03	1.58 ± 0.04	1.64 ± 0.04
NFE (%)	16.34 ± 0.10	15.20 ± 0.30	15.34 ± 0.13	15.30 ± 0.29	15.31 ± 0.12	15.24 ± 0.14

Water parameter

Water quality parameters such as temperature (°C), pH, salinity (ppt), dissolved oxygen (mg L^{-1}), total alkalinity (mg L^{-1}), and free carbon dioxide (mg L^{-1}) were observed in the range of 23 – 28°C, 6.5 – 8, 23 – 27 ppt., 5.2 – 6.4 mg L^{-1},70 – 80 mg L^{-1}, 0.9 – 3.5 mg L^{-1} during experiment period of 90 days.

DISCUSSION

Appropriate protein sources and its appropriate proportion also play a vital role in the economics of the culture of candidate species. In the mud crab culture practices, a protein percentage of 30 to 55% has been used by (Mu et al., 1998; Hutabarat, 1999; Catacutam, 2002; Ali et al., 2008; Unnikrishnan and Paulraj, 2010; Luo et al., 2011; Shelley and Lovatelli, 2011; Li et al., 2012; Jin et al., 2013; Huo et al., 2014; Nguyen et al., 2014). In the present experiments, protein levels of 38, 40, 42, 44 and 46% have been used. In order to find out the influence of added protein to the crab diets, composition of the carbs before and after the experiments was assessed. The results of the present study showed positive influence of protein in the diet which reflected in the growth of crab juveniles. During the experimental duration, the crabs were fed with pelleted feed with the protein percentage of 38 to 46%. At end of the experiment protein percentage showed increase in protein composition. Similar results have been observed by Anil and Suseelan (2001), Ali et al. (2008), Unnikrishnan and Paulraj (2010), Jin et al. (2013), Nguyen et al. (2014).

REFERENCES

1. Ali, S.A., Dayal, J.S., Ambasankar, K., Kathirvel, M., Pandian, S.K., Balasubramanian, C.P., Venugopal, G., Muralimohan, K., Reddy, P.R., 2008. Farming of mud crabs. Fishing Chimes 28(1), 143 – 145.
2. Anil, M.K., Suseelan, C., 2001. Experiment fattening of the green mud crab Scylla oceanica (Dana). Journal Marine Biological Association of India, Cochin. pp. 95-110.
3. AOAC, 2005. Official methods of analysis, In: Horwitz, W., Latimer, G. W., (Eds.), Association of Official Analytical Chemists, fifteenth Edition, Washington, DC, USA.
4. Baliao, D.D., Santos, M.D.L., Franco, N.M., 1999. Mud crab, Scylla spp, production in brackishwater ponds, Southeast Asian Fisheries Development Center, Tigbauan, Iloilo, Philippines. Aquaculture Extension Manual No. 28, 1-13.
5. Boyd, C.E., 1981. Water quality in warm water fish ponds. Auburn University, Alabama, USA.
6. Catacutan, M.R., 2002. Growth and body composition of juvenile mud crab, Scylla serrata, fed different dietary protein and lipid levels and protein to energy ratios. Aquaculture 208, 113-123.
7. Catacutan, M.R., Eusebio, P.S., Teshina, S.S., 2003. Apparent digestibility of selected feedstuffs by mud crab, Scylla serrata. Aquaculture 216 (1-4):253-261.
8. Christensen, S.M., Macintosh, D.J., Phuong, N.T., 2004. Pond production of the mud crabs Scylla paramamosain (Estampador) and S. olivacea (Herbst) in the Mekong delta, Vietnam, using two different supplementary diets. Aquaculture Research 35, 1013-1024.
9. Das, S., Nayak, L., 2012. Pen culture of mud crab (Scylla serrata) in Chilika lagoon, Orissa, east coast of India. DCSI 7, 109-116.
10. De Silva, S.S., Anderson, T.A., 1995. Fish nutrition in aquaculture. Chapman and Hall, London SE1 8HN, UK. pp. 284.
11. Erdogan, F., Olmez, M., 2009. Effects of enzyme supplementation in diets on growth and feed utilization in Angel Fish, Pterophyllumscalare. Journal of Animal and Veterinary Advances 8 (9), 1740-1745.
12. FAO, 2014. The State of World Fisheries and Aquaculture. Rome.
13. Huo Y.W., Jin, M., Zhou, P.P., Li, M., Mai, K.S., Zhou, Q.C., 2014. Effects of dietary protein and lipid levels on growth, feed utilization and body composition of juvenile swimming crab, Portunustrituberculatus. Aquaculture 434, 151–158.
14. Hutabarat, J., 1999. Diet development for mud crab (Scylla serrata) aquaculture using local material available in central java. Journal of Coastal Development 2(2), 363-375.
15. Jin, M., Zhou, Q.C., Zhang, W., Xie, F.J., Shen, J.K., Huang, X.L., 2013. Dietary protein requirements of the juvenile swimming crab, Portunustrituberculatus. Aquaculture 414–415, 303–308.
16. Kathirvel, M., Srinivasagam, S., Ghosh, P.K., Balasubramanian, C.P., 1997. Mud crab culture. CIBA. Bull. No. 10, 1-14.

17. Keenan, C.P., 1999. Aquaculture of the mud crab, genus Scylla- past, present, future. In: Keenan, C.P., Blackshaw, A. (Eds.), Mud Crab Aquaculture and Biology. ACIAR Proceedings, Canberra, Australia. pp. 9–13.
18. Li, X., Luo, L., Ye, Y., 2012. Growth, precocity, enzyme activity and chemical composition of juvenile Chinese mitten crab, Erocheirsinensis, fed different dietary protein-to-energy ratio diets. Aquaculture Research 43, 1719–1728.
19. Luo, Z., Li, X.D., Wang, W.M., Tan, X.Y., Liu, X., 2011. Partial replacement of fish meal by a mixture of soybean meal and rapeseed meal in practical diets for juvenile Chinese mitten crab, Erocheirsinensis: effect on growth performance and in vivo digestibility. Aquaculture Research 42(11), 1650-1622.
20. Manivannan, K., Sudhakar, M., Murugesan, R., Soundarapandian, P., 2010. Effect of feed on the biochemical composition of commercially important mud crab Scylla tranquebarica (Fabricius, 1798). International Journal of Animal and Advances 2(1), 16-20.
21. Margaret, A.M.R., Kandasami D., Kizhakudan J.K., Gandhi A.D., Leslie V.A., 2007. Efficacy of a formulated pellet feed for grow-out of the blue swimming crab Portunuspelagicus (Linnaeus, 1758) Madras Research Centre of CMFRI, Chennai, Technical and Extension Series, No. 193, 4-5.
22. Marichamy, R., Rajapackiam, S., 2001. The aquaculture of Scylla species in India. Asian Fisheries Science 14, 231-238.
23. Mia, M.Y., Shah, M.M.R., Alam, M.J., Begum, M., 2007. Optimization of stocking density of mud crab, Scylla serrata culture in Brackishwater earthen pond in Bangladesh, Sindh University Research Journals (Sci. Ser.) 39(1), 25-32.
24. Mu, Y.Y., Shim, K.F., Guo, J.Y., 1998. Effects of protein level in iso-caloric diets on growth performance of the juvenile Chinese hairy crab, Erocheirsinensis. Aquaculture 165, 139-148.
25. Nguyen, N.T.B., Chim, L., Lemaire, P., Wantiez, L., 2014. Feed intake, molt frequency, tissue growth, feed efficiency and energy budget during a molt cycle of mud crab juveniles, Scylla serrata (Forskal, 1775), fed on different practical diets with graded levels of soy protein concentrate as main source of protein. Aquaculture 434, 499–509.
26. Patil, D. W., Singh, H., 2014. Effect of papain supplemented diet on growth and survival of post larvae of Macrobrachiumrosenbergii. International Journal of Fisheries and Aquatic Studies 1(6), 176-179.
27. Pillai, S.L., Rajapackiam, S., Sunderarajan, D., 2002. Mud crab Scylla tranquebarica culture in earthen pond at Tuticorin. Journal of Marine Biological Association of India 44 (1&2), 245-248.
28. Quinitio, E.T., Cruz, J.J., Eguia, M.R., Estepa. D.P., Pates, G., Lavilla, C.R., 2011. Demonstration of the mud crab Scylla serrata. Aquaculture International 19, 237-250.
29. Sheen, S.S., 2000. Dietary cholesterol requirement of juvenile mud crab Scylla serrata. Aquaculture 189, 277-285.
30. Silas, E.G., 2013. Research and technology development in mud crab fisheries and aquaculture aimed at sustainability and environmental compatibility, keynote address presented at the inaugural function of the international seminar workshop on mud crab aquaculture and fisheries management held at RGCA, 10-12th April 2013. Sirkazhi, Tamilnadu, India. 1-7.
31. Shelley, C., Lovaelli, A., 2011. Mud crab aquaculture A practical manual. FAO Rome, Italy, Technical Paper No. 567, pp. 43-61.
32. Suseelan, C., 1996. Crab culture and crab farming. Bull. Cent. Mar. Fish. Res. Int. 48, 99-102.
33. Trino, A.T., Millamena, O.M., Keenan, C.P., 2001. Pond culture of mud crab Scylla serrata (Forskal) fed formulated diet with or without vitamin and minerals supplement. Asian Fisheries Science 14, 191-200.
34. Unnikrishnan, U., Paulraj, R., 2010. Dietary protein requirement of giant mud crab Scylla serrata juveniles fed iso-energetic formulated diets having graded protein levels. Aquaculture Research 41, 278-294.
35. Wang, C., Li, S., Li, C., Zhao, J., 2001. Observation and analysis on appearing difference of precocious crab of Yangtze population and Liaohe population cultured in ponds. Journal of Lake Science 13, 57–62 (in Chinese with English abstract).

36. Wang, D., Xia, D., 1998. Study on the reasons and prevention methods of precocity of Eriocheirsinensis. Fisheries Science 17, 17–20.
37. Zar, J.H., 2010. Biostatistical analysis. Fifth Edition, Pearson Education. Singapore Pvt. Ltd.