

Research Article

Evaluation of the nutritional quality of selected dietary ingredients for mud crab *Scylla serrata* of Suarashtra region in Gujarat, India

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Abstract

Mud crabs, or mangrove crabs, are one of the most valuable groups of crab species in the world. Several studies have been conducted to describe the nutrient requirements of mud crabs. Only preliminary studies have been conducted to define the nutritional ingredients requirements for growing out diets. Results of the analysis revealed the major components of seaweeds (*Ulva reticulata* and *Sargassum cinctum*) poultry waste, earth worms and fish meal with carbohydrate 57.18 % (*Ulva reticulata*) and 55.86 % (*Sargassum cinctum*), 31.07 %, 21.83 % and 2.89 %, followed by ash content of 21.3 % (*U. reticulata*) and 14.1 % (*S. cinctum*), 8.4 %, 12.0 % and 8.40 %, respectively. The crude protein component of fishmeal, soyabean meal, earthworms and seaweeds were obtained in little amount with 61.20 %, 48.3%, 36.2 % and 13.41 % (*U. reticulata*) and 10.67% (*S. cinctum*) and followed by crude lipid component of poultry waste 25.0%, seaweeds 13.41 % (*U. reticulata*) and 10.67 % (*S. cinctum*), earthworms 9.52% and fishmeal 9.20% respectively. These results of nutritional composition indicated that poultry waste, earthworms and seaweeds have potential as a source of feed supplement and human nutrition.

Keywords: Ingredient, Mud crab, Poultry waste, *Sargassum cinctum* and *Ulva reticulata*

INTRODUCTION

Mud crabs, or mangrove crabs, are one of the most valuable groups of crab species in the world. Mud crab, genus *Scylla* aquaculture is expected to continue to grow in the future (Azra and Ikhwanuddin, 2016). Production of mud crabs in 2015 was around 226,390 metric tons (Anonymous, 2015) with a farm-gate value of US\$1.06 billion. Commercial markets are primarily driven by live or frozen soft-shell crab sales (Quinitio and Lwin, 2009). Traditionally, mud crabs were viewed as carnivores with preferences in their natural diet for molluscs, crustaceans and fishes that have relatively high protein content (Hill, 1979). Several studies have been conducted to describe the nutrient requirements of mud crabs, and only preliminary studies have been conducted to define the nutritional ingredients requirements for growing out diets.

The raw ingredients that will be selected for feed production must be sustainable, cost-effective and

with steady availability. However, the availability of these ingredients is becoming more restricted and the prices are increasing accordingly. Therefore, these ingredients must be spared and replaced by meals from sustainable sources. The alternative sources may include fish meal, poultry waste, earthworms, spirulina, moringa leaf, seaweeds and other dietary feed ingredients. Fish meal, Poultry waste, Earthworms, Spirulina, Moringa leaf, Seaweeds and other dietary feed ingredients are rich in proteins, vitamins, carbohydrates, fibre, lipids, and minerals and are easy to obtain. Some species of algae may contain more protein, carbohydrates, and fat than the ingredients traditionally used in trash fish diets in crab (Catacutan, 2002). The find out of best suitable ingredients for mud crab feed can give new direction in the development of fattening feeds in commercial direction for soft shell mud crab grower. A cost-effective replacement of ingredients is needed to ensure the benefits gained to date are not lost. Therefore, the present study was

undertaken for evaluation of the nutritional quality of selected dietary ingredients (viz. poultry waste, earthworms, fishmeal, *Ulva reticulata* and *Sargassum cinctum*) in the pelleted feed of *Scylla serrata*.

MATERIALS AND METHODS

Site of experiment: The experimental analysis was carried out at the Department of Aquaculture, College of Fisheries Science, Junagadh Agricultural University, Veraval (Gujarat), India.

Sample collection: Poultry waste used consisted of wastes including viscera, heads, legs and feather. This poultry waste was collected from local chicken slaughter and was washed thoroughly with tap water in order to remove unwanted parts of chicken was made by exposing to 150-200°C with 2.5 bar (atmospheric pressure) for 5 hrs. Both poultry wastes and fish meal were tested for nutritional composition for the diet formulation. Fresh marine seaweeds *Ulva reticulata* and *Sargassum cinctum* were accumulated from the rocky seashore region of Veraval coast, Saurashtra region of Gujarat. The accumulated seaweeds were washed thoroughly with fresh water in order to remove epiphytes as well as other marine organisms, and then seaweeds fixed on herbarium sheet for the making of voucher specimen and then identified with the help of the standard literature. After that identified seaweeds were dried under shade at room temperature and samples of dried seaweeds were ground well by using a mixer grinder and sieved by a nylon sieve in order to remove seaweed fibre. Fish meal was procured from the fish meal plant at Porbandar. The moringa leaves, earthworms, bloodworms, spirulina, soybean meal and remains all feed ingredients were purchase from Veraval market.

Composition of ingredient analysis: Compositions of samples were analyzed by standard methods of AOAC (Anon., 2000). Crude protein content was analyzed using the Kjeldahl method. Crude lipid was examined with the Soxhlet apparatus. Moisture and ash content were analyzed with the help of the incubator and muffle furnace, respectively.

Crude protein (CP): The protein content of the samples was determined as total nitrogen using micro Kjeldahl method after acid digestion. The nitrogen content of the sample was determined constitutively by using semi-automatic micro-kjeldahl digestion and distillation apparatus (Gerhardt, Germany). Protein percentage was calculated by multiplying the nitrogen percentage found with a factor of 6.25.

Crude protein (%) = N₂ (nitrogen%) X 6.25Eq.1

Crude lipid: Crude lipid was estimated by the ether extraction by using Soxhlets apparatus with petroleum ether (Boiling point 40-60°C) as the solvent. The con-

tents of crude lipids were determined gravimetrically after oven-drying (80°C) the extract overnight.

$$\text{Crude lipid (\%)} = \frac{\text{Weight of the ether extract}}{\text{Sample Weight}} \times 100 \quad \dots \text{Eq. 2}$$

Moisture: Moisture content was estimated by taking a known weight of samples in petri-dish for oven-drying at 100-105°C till a constant weight was achieved. After the process, weight loss in samples was calculated as moisture content, which was calculated by using the following formula.

$$\text{Moisture (\%)} = \frac{\text{Wet weight of sample} - \text{Dried weight of sample}}{\text{Wet weight of sample}} \times 100 \quad \dots \text{Eq. 3}$$

Ash: Ash content was determined by taking a known weight of sample in silica crucible and placing it in a muffle furnace at 600°C for 6 hrs. The calculation was done as follows:

$$\text{Ash (\%)} = \frac{\text{Weight of Ash}}{\text{Sample Weight}} \times 100 \quad \dots \text{Eq. 4}$$

Total carbohydrate: Total carbohydrate was estimated by the difference method given by the formula:

$$\text{Total carbohydrate} = 100 - (\text{CP} + \text{CL} + \text{Moisture} + \text{Ash}) \quad \dots \text{Eq. 5}$$

Analysis of data: Compositions of ingredients were analyzed using standard methods of AOAC (Anon., 2000) and the data obtained in the present investigation were subjected to analysis using Microsoft Excel.

RESULTS AND DISCUSSION

The proximate composition of selected major ingredients viz. poultry waste, earthworms, fishmeal, seaweeds species *U. reticulata* and *S. cinctum* meal, as well as other diet ingredient soybean meal, moringa leaf, tubifex worms, fermented silage and blood worms, are shown in Table 1.

Results of the analysis revealed that the major components of seaweeds, poultry waste, earth worms and fish meal were the carbohydrate 57.18 % (*U. reticulata*) and 55.86 % (*Sargassum cinctum*), 31.07 %, 21.83 % and 2.89 %, followed by ash content of 21.3 % (*U. reticulata*) and 14.1 % (*Sargassum cinctum*), 8.4 %, 12.0 % and 8.40 %, respectively. Crude protein component of fishmeal, soyabean meal, earthworms and seaweeds were obtained in amount with 61.20 %, 48.3%, 36.2 % and 13.41 % (*U. reticulata*) and 10.67% (*Sargassum cinctum*) and followed by crude lipid component of poultry waste 25.0%, seaweeds 13.41 % (*U. reticulata*) and 10.67 % (*Sargassum cinctum*), earthworms 9.52% and fishmeal 9.20% respectively. Several studies showed that crabs were able to digest many different ingredients, in particular protein from plants (Catacutanet *et al.*, 2003; Truong *et al.*, 2009; Nguyen *et al.*, 2014). Based studies on

Table 1. Composition of ingredients for mud crab diet.

Ingredients (%)	Moisture	Crude Protein	Crude Lipid	Ash	Carbohydrate
Poultry waste	4.91	18.00	25.00	8.40	31.07
Earth worms	9.20	36.2	9.52	12.0	21.83
Fish meal	6.80	61.20	9.20	8.40	2.89
<i>Ulva reticulata</i>	7.03	13.41	13.10	14.1	57.18
<i>Sargassum cinctum</i>	7.19	10.67	11.0	14.1	55.86
Soybean meal	6.12	48.3	7.90	21.3	27.39
Moringa Leaf	5.90	24.55	2.48	6.52	10.03
Fermented Silage	6.03	28.3	8.73	14.1	10.9
Tubifex worms	5.18	52.0	8.01	3.10	13.21
Blood worms	5.70	52.6	7.90	2.89	12.40

protein and lipid (energy) levels and ratios for different levels of shrimp farming provide a guide for crab farming (Alava *et al.*, 2007; Ali *et al.*, 2011; Catacutan *et al.*, 2003; Sheen, 2000).

In the present study, protein and lipid were found to have wide ranges in ingredients which were exhibited in a similar requirement for mud crab formulation diets. Moisture level of earthworms, seaweeds, fish meal and soyabean meal was 9.20%, 7.19% (*S. cinctum*) and 7.03% (*U. reticulata*), 6.80% and 6.12%. The other component of blood worms, tubifex worms, fermented silage and moringa leaf, were crude protein with 52.6%, 52.0%, 28.3% and 24.5% respectively. In soybean meal levels of carbohydrate (27.39%), crude lipid (7.90 %), ash (21.3 %) and moisture (6.12 %) were exhibited while in the fish meal; ash (8.40%), crude lipid (9.20%), moisture (6.90 %) and little amount of carbohydrate (2.89 %) were exhibited. Researchers in the Philippines, Vietnam and Australia reported that crabs have protein requirements of 35-55% based on their age and size (Catacutan *et al.*, 2002; Tuan *et al.*, 2006; Truong, 2008; Truong *et al.*, 2009; Anderson *et al.*, 2004; Holme *et al.*, 2006). In general, crabs are viewed as carnivores on the basis of gut analyses and feeding observations that contained relatively high protein content (Hill, 1979). Dietary protein supply is one of the major factors that influence the productivity of mud crab species (Davis *et al.*, 2004). The present study showed the per cent level of crude protein and crude lipid found in fishmeal, soyabean meal, poultry waste, earthworms, blood worms, tubifex worms, moringa leaf and seaweeds (*U. reticulata* and *S. cinctum*) that might be used as ingredients in a formulated crab diet. The availability and quality of these ingredients are good, and they are suitable for the aqua-feed industry. These are also widely used ingredients in aquaculture diets as they have good nutrient profiles, are readily digested by crustacean and are cost-effective when compared other ingredients. Therefore, results indicated that selected ingredients could be considered as an

alternative source for feed supplement and animal nutrition.

Conclusion

In the present investigation, the ingredients like poultry waste, earthworms, and seaweeds contained relatively little amount of protein and lipid compared to that in fishmeal but in optimum range than those found in other seaweed species. The results of the present study demonstrated that mud crabs would accept formulated feeds using targeting ingredients in laboratory process or commercial extrusion. Hence, the development of selected ingredients diets for crabs is technically possible.

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