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RESEARCH ARTICLE

ANALYSIS OF THE NUTRITIVE COMPOSITION OF WILD AND FARMED TIGER SHRIMP PENAEUS MONODON FABRICIUS

M. MURALI MOHAN* and K. SRINIVASU**

1. Senior Research Fellow, Central Marine Fisheries Research Institute,

2. Research Scholar, Dept. of Anthropology, Andhra University, Visakhapatnam. Andhra Pradesh, India.

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Corresponding Author

M.MURALI MOHAN

Abstract

The present study was undertaken to estimate and compare the nutritive value (moisture, protein, fat, carbohydrate, calcium, phosphorus, iron) of peeled tails of wild and farmed shrimp *Penaeus monodon* as there is a misnomer that farmed shrimp has high fat/cholesterol content compare to wild shrimp and also wild shrimp is highly nutritious than farmed tiger shrimp. The percentage moisture content in the peeled tails of tiger shrimp specimens collected from coastal waters varied from 73% to 76.74% with an average of 74.83 %, protein content ranged between 19.5% and 21.0% with an average of 20.17%. The fat content varied from 3.2% to 5.0% with an average to 4.06%, carbohydrate content ranged between 0.07% and 1.09% with an average of to 0.64% and ash content varied between 0.43% and 0.55% with an average of 0.49 %. The phosphorus (as phosphate) content ranged from 923 to 1407 and averaged 1272 mg/l00g. The iron (ppm) concentration fluctuated between 79.61 and 93.19 and averaged to 89.04 ppm**.** From Brackish waters the percentage of moisture content ranged from 73.84 % to 76.14 % and averaged to 75.36%, percentage protein content varied from 18.1% to 20.1% and averaged to 19.05%. The percentage fat content varied from 3.09% to 5.44% and averaged to 4.06%, percentage carbohydrate content varied from 0.29% to 1.79% and averaged to 0.94% and ash content fluctuated from 0.45% to 2.74% and averaged to 1.01%. The phosphorus content ranged between 747 and 1025 and averaged to 888 mg/l00g and calcium content ranged between 186 and 501 and averaged to 375 mg/l00g. Iron concentration varied between 82.01 and 112.06 ppm and averaged to 100.45 mg/l00g.

INTRODUCTION

The firm, translucent flesh of raw shrimp is low in calories and saturated fat and is a wonderfully nutritious alternative to meat proteins. People have been enjoying shrimp as a food since times immemorial. Shrimp is found throughout almost the entire world. While many countries farm raises shrimp, much of the world's supply comes from India, United States, South and Central America, Japan, Thailand and Taiwan. Shrimp production has expanded specially in the past over one decade from 2.4 million mt in 1987 to 4.2 million mt in 2000 (FAO, 2004). The overall quality of the prawn is determined by its freshness and this is effected by the chemical composition namely, the relative concentrations of essential compounds such as proteins, lipids and carbohydrates.

Shrimp is also a very good source of vitamin D, vitamin B12, iron, phosphorous, niacin, zinc, copper and magnesium. In addition to this, it is also a good source of cardio protective omega 3 fatty acids noted for their anti inflammatory effects and ability to prevent the formation of blood clots. Shrimp provides 64.2% of the daily value for selenium in a 4-ounce serving. At present three candidate species are being reared under coastal aquaculture activity in A.P. viz shrimp, scampi and crab. Of these *P. monodon* dominates shrimp farming. There was also a lot

of improvement in the socioeconomic conditions of rural masses due to successful shrimp farming. Keeping all this in view, it is thought worthwhile to study the nutritive value of this species.

A study on the nutritive value of prawns was done by Shaikhmahmud and Magar 1956, Shaikhmahmud and Magar 1960; and Achuthankutty and Parulekar (1984). Wenjuan (1996) carried out a comparative study on fatty acid composition of wild and cultured specimens of *Penaeus chinensis* in Chinese waters. Variation in proteins, glucose and total lipids of *Penaeus notialis* during the moulting cycle in the Cuban waters, were investigated by Fernandez and Oliva (1997) Lipid composition and vitamin content of wild female *Litopenaeus vannamei* in different stages of sexual maturation were studied by Wouters *et al*. (2001).

Vedavyasarao *et al* (1982) studied the fluctuations in calcium level in the exoskeleton muscle and heamolymph of *Penaeus indicus* cultured in brackish water pond, Cochin. Concentration and distribution of heavy metals in tissues of wild and farmed shrimp *Penaeus vannamei* from the northwest coast of Mexico were investigated by Peaz-Osuna and Tron-Mayen (1996). Sunarya *et al.* (1996) studied the variation of fat content and fatty acid profile of *Penaeus monodon* from different habitats of Indonesia.

The present study was undertaken to estimate and compare the nutritive value (moisture, protein, fat, carbohydrate, calcium, phosphorous, iron) of peeled tails of wild and farmed shrimp *Penaeus monodon* as there is a misnomer that farmed shrimp has high fat/cholesterol content compared to wild shrimp and also wild shrimp highly nutritious than farmed shrimp.

MATERIAL AND METHODS

Random samples of tiger shrimp, *Peneaeus monodon* were collected from two sources: 1.commercial trawlers operating in the coastal waters of Visakhapatnam, north Andhra Pradesh, India and 2. Brackish water culture ponds of M/s Karuna Aqua farms, Vadachipurupalli for analysis of the nutritive composition during the period June 2005 to December 2006. Bi-monthly visits were made for brackish water culture ponds of M/s Karuna Aqua farms at Vadachipurupalli village and data related to growth performance parameters, stocking density as well as soil and water quality were collected during the study period. The data collected from the field were utilized for the assessment of performance parameters. Temperature and pH were recorded, salinity was measured by salinometer and dissolved oxygen was estimated by Winkler's method.

After ascertaining the species, the biochemical composition of peeled tails of tiger shrimp was estimated. Proximate analysis of muscle was carried out using standard AOAC (1984) methods. It must be mentioned here that water, protein, fat and ash content are represented as percentage of wet weight obtained by calculating the average percentage composition from the samples of each month. The average content of each chemical constituent was calculated from all the samples of each species.

Estimation of moisture content was done by drying method (Silas, 1981); protein content was estimated by slightly modifying Lowry's method (Lowry, 1951); estimation of fat content in the given sample was done by Soxhlet method; estimation of carbohydrate in the sample was done by the method of Dubois et al., (1956) and. Estimation of ash in the given sample was done by gravimetric method (Silas, 1981). Organic phosphorous was estimated by the method of Barnes (1959); calcium in the ash was obtained in the form of calcium oxalate precipitated by following the procedure of Mc Cruddin as described by Hawk (1954); iron was determined calorimetrically at 530nm.

RESULTS

Studies on the nutritive value of tiger shrimp specimens, i.e. moisture, protein, fat, carbohydrate and ash contents collected from coastal waters brackish water culture ponds are presented in Table 1. Distribution of phosphorus (as phosphate), calcium and iron in the peeled tails of tiger shrimp specimens collected from wild and grow out ponds are given in Table 2.

Total length (cm) of tiger shrimp specimens collected from coastal waters ranged from 15.7cm to 22.9 cm with body-weight (g) ranging from 39.3g to 109g (7.53±13.60) and weight of peeled tails ranging between 21.1g and 57.5 g (40.64±11.94). The total length of tiger shrimp specimens collected from grow out ponds of M/s. Karuna aqua farms, varied from 3.9 cm to 22.1 cm with body-weight ranging between 8.1g and 84.4g (44.95±26.84) and weight of peeled tails ranging from 4.2g to 45.2 g (22.7±15.58).

Proximate composition and mineral content of tiger shrimp collected from coastal waters of Visakhapatnam:

The percentage moisture content in the peeled tails of tiger shrimp specimens collected from coastal waters varied from 73% to 76.74% with an average of 74.83 %, protein content ranged between 19.5% and 21.0% with an

average of 20.17%. The fat content varied from 3.2% to 5.0% with an average of 4.06%, carbohydrate content ranged between 0.07% and 1.09% with an average of 0.64% and ash content varied between 0.43% and 0.55% with an average of 0.49 %. (Table 1). The phosphorus (as phosphate) content ranged from 923 to 1407 and averaged 1272 mg/l00g. The Iron (ppm) concentration fluctuated between 79.61 and 93.19 and averaged to 89.04 ppm (Table 2).

Proximate composition and mineral content of tiger shrimp collected from brackish water cultured ponds of M/s. Karuna aqua farms:

The percentage moisture content ranged from 73.84 % to 76.14 % and averaged to 75.36%, percentage protein content varied from 18.1% to 20.1% and averaged to 19.05%. The percentage fat content varied from 3.09% to 5.44% and averaged to 4.06%, percentage carbohydrate content varied from 0.29% to 1.79% and averaged to 0.94% and ash content fluctuated from 0.45% to 2.74% and averaged to 1.01% (Table 1). The phosphorus content ranged between 747 and 1025 and averaged to 888 mg/l00g and calcium content ranged between 186 and 501 and averaged to 375 mg/l00g. Iron concentration varied between 82.01 and 112.06 ppm and averaged to 100.45 mg/l00g. (Table 2).

In general, the moisture content, protein and ash contents in the muscle of shrimp collected from the two habitats is more or less same. The phosphorus (as phosphate) component in brackish water-cultured specimens exhibited low values. The coastal water specimens registered very high values of calcium where as brackish water-cultured shrimp showed relatively high iron concentrations.

Table-1. Proximate Composition of Peeled Tiles of Tiger Shrimp *Penaeus monodon* collected from Coastal waters and M/s Karuna Aqua Farms.

Area	No. of Specimens	Length range (mm)Min-Max	Body weight (gm)Min-Max	Weight of Peeled tail (gm) Min-Max	Moisture*	Protein* (%)	Fat* (%)	Carbohydrates* (%)	Ash (%)
Coastal Waters	20	15.7-22.9	39.3-109.0	21.1-57.5	73.0-76.74 (74.83 ± 1.16)	19.5-21.0 (20.17+0.40)	4.06-0.69 (2.82+5.00)	0.71-1.09 (0.64 + 0.34)	0.43-0.58 (0.49 + 0.05)
Cultured shrimp	45	3.9-22.1	8.1-84.4	4.2-45.2	74.9-76.14 (75.36 ± 0.86)	18.1-20.1 (19.05 ± 0.72)	3.09-5.44 (4.06 ± 1.22)	0.29-1.76 (0.94 ± 0.53)	0.51-2.74 (1.01 ± 0.77)

*Values are in wet weight basis. *Mean values given in parentheses.

Table-2. Mineral and Heavy Metal Composition of Peeled Tiles of Tiger Shrimp *Penaeus Monodon* collected from Coastal waters and M/s Karuna Aqua Farms.

Area	No. of Specimens	Length range (mm)	Body weight(gm)	Weight of Peeled tail	Phosphate (mg/100g)	Calcium (mg/100g)	Iron (ppm)
Coastal waters	20	15.7-22.9	39.3-109.0	21.1-57.5	923-1407 (1272 ± 163.18)	302-2088 (968 ± 441.72)	79.61-93.19 (89.04 ± 3.99)
Cultured Shrimp	45	3.9-22.1	8.1-84.4	4.2-45.2	747-1025 (888 ± 98.19)	186-501 (375 ± 122.99)	82.01-112.6 (100 ± 11.30)

*Values are in wet weight basis. *Mean values given in parentheses.

DISCUSSION

The proximate composition, mineral and iron contents of tiger shrimp specimens collected from coastal waters and brackish water ponds were estimated and compared. From the results we infer that the percentage moisture content of tiger shrimp specimens exhibited relatively minimal variations among coastal waters and brackish water cultures. This indicates that the moisture content of shrimp body is relatively constant (the present study about 73.9%), irrespective of the habitat. Achuthankutty and Paruleker (1984) recorded the absence of marked variation in the moisture content of shrimp body weight irrespective of the species and genus.

The protein content in the tiger shrimp collected from brackish water grow out ponds is less compared to those collected from coastal waters. Shaikhmahmud and Magar (1956) recorded that the protein content of different species of prawns does not vary with their age or seasons. Achuthankutty and Parulekhar (1984) record relatively high concentration (about 81 %) of protein in the four species of penaeid prawns. However, Pan *et al* (2001) reported an average concentration 21.2% protein in *Penaeus vannamei* cultured in the Chinese waters.

The percentage fat content is maximum and similar in the tiger shrimp collected from the coastal waters and grow out ponds of M/s.Karuna aqua farms. Achuthankutty and Parulekar (1984) reported similar values (4 to 5%) in the four species of penaeid prawns while Pan *et al* (2001) registered low values (about 1%) in the Chinese marine shrimps.

The percentage carbohydrate content did not show much variation in the specimens collected from coastal waters and brackish water grow out ponds. Ash content in the tiger shrimp specimens during the present study also did not show marked variation either with reference to habitat and similar observations are reported by Shaikhmahmud and Magar (1956) and Achuthankutty and Paruleker (1984). Phosphorus (as phosphate) (a mean of 1957 mg/100 g) distribution in the muscle of *Penaeus monodon* revealed minimal variation between natural waters and brackish water cultured shrimps. Penaeid shrimp grown in the natural waters registered a relatively a high concentration (966 mg / 100g) calcium in the muscle tissue. Low (375 mg/100g) calcium levels is observed in brackish water cultured shrimp. Vedavyasarao *et al* (1982) record relatively similar values (222 to 1236 mg/100g) of calcium in the muscle tissue of tiger shrimp in brackish water cultures of Cochin. The heavy metal Iron (ppm) distribution in the tiger shrimp registered variations with reference to habitat. Further the farmed shrimp also registered a high concentration of Iron (100 ppm) and similar observation is made by Paez - Osuna and Tron-Mayan (1996) in *Penaeus vannamei* from Mexican water. Guhatha-kurtha and Kaviraj (2000) reported concentrations of iron ranging from 5 to 495 ppm in the *Penaeus monodon* shrimp muscle tissue from mangrove culture pond groups of West Bengal.

CONCLUSION

The moisture content, protein and ash contents in the muscle of shrimp collected from two habitats are more or less same. The phosphorus (as phosphate) component in brackish water-cultured specimens exhibited low values. The coastal water specimens registered very high values of calcium where as brackish water-cultured shrimp showed relatively high iron concentrations.

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