American-Eurasian Journal of Scientific Research 4 (3): 191-194, 2009
ISSN 1818-6785

Biochemical Composition of Shell and Flesh of the Indian White Shrimp *Penaeus indicus* (*H.milne* Edwards 1837)

S. Ravichandran, G. Rameshkumar and A. Rosario Prince

Centre of Advanced Study in Marine Biology, Annamalai University, Parangipettai 608 502, India

Abstract: Shrimps are an extremely good source of protein, yet are very low in fat and calories, making them a very healthy choice of food. The present was investigated the variation between the proximate and mineral compositions of the shell and flesh of *Penaeus indicus*. Shrimps were collected from the Vellar estuarine environment Southeast coast of India. The results of proximate composition shows that the percentage of protein in the flesh was higher (41.3%) than that of shell protein (32.5%). Likewise the carbohydrate content of flesh was higher (2.4) than the shell (1.5%). The highest amount of lipid was found in shell, the value being 9.8% where as in the higher level of moisture content was noticed in 14.7 % in flesh. The higher value of 26.6% of ash was noticed in the shell than that of flesh 18.5%. The findings of minerals composition in the shell and flesh of *P.indicus* reported that mineral content was high in shell samples than flesh tissues. The results of the present study reported that *Penaeus indicus* is a good source of proteins and metabolically energy and average mineral supply.

Key words: *Penaeus indicus* · Shell · Flesh · Proximate composition · Mineral composition

INTRODUCTION

Shrimps are an extremely good source of protein, yet are very low in fat and calories, making them a very healthy choice of food. Although shrimps have high cholesterol content, they are low in saturated fat, which is the fat that raises cholesterol levels in the body. Minerals are essentials in shrimp nutrition. Aside from playing important role in osmotic regulation and moulting [1], minerals ions are also components of many biological compounds such as enzymes, hormones and high energy compounds. Nevertheless, dietary requirements of important mineral elements are known for selected species of shrimp such as *Penaeus japonicus* [2], *P.aztecus* [3,4] and *P.vannamei* [5].

There are many inorganic elements in the body of shrimp associated with the skeletal structure and biochemicals involved in vital physiological functions. Although shrimps are capable of extracting some of the elements from water, they do respond to dietary sources [2, 6, 7]. Since these micronutrients are essential, their absence in the diet may lead to deficiency disease. It is therefore necessary to understand their dietary requirement in formulating balanced feeds.

The economic importance of fish products to the community include source of food, provision of employment (for example over 400, 000 fishermen and members of their families are engaged), source of foreign exchange (shrimps fishery yield over 60,000 metric tonnes (shrimps annually), source of income, tool to rural development and source of raw materials to manufactures [8]. It is valuable in the diet, because apart from supply of good quality proteins and vitamins A & D, it also contains several dietary minerals such as Ca, Fe etc. which are beneficial to man and animals. This work was undertaken to determine the variation between the proximate and mineral composition of the shell and flesh of *Penaeus indicus* collected from the Vellar estuary.

MATERIALS AND METHODS

The shrimps (*Penaeus indicus*) were collected from the Vellar estuary environment Southeast coast of India (Lat 11 ° 29 'N; 79° 46' E). Samples were washed with de-ionized water to remove any adhering contamination, drained under folds of filter paper. Samples were then put in crushed ice in insulated containers and brought to the laboratory for preservation prior to analysis. The washed

Corresponding Author: S. Ravichandran, Centre of Advanced Study in Marine Biology, Annamalai University, Parangipettai 608 502. India

shrimps were wrapped in aluminum foil and frozen at -4°C for two days before samples were prepared for analysis. After defrosting, the shrimps were separated into the exoskeleton (head and the outer body shell) (*ie* shell) and the endoskeleton (*ie* flesh). The various parts were oven dried at 95-105°C until dried and ground into fine powder.

Determination of Proximate Composition: Estimation of moisture content by hot air oven method, lipid by [9], protein by [10], Carbohydrate [11] and minerals were analysed. [12].

RESULTS AND DISCUSSIONS

Proximate Composition: The proximate composition of the shell and flesh of *Penaeus indicus* is presented in (Table 1).The percentage of protein in the flesh was higher (41.3%) than that of shell protein (32.5%). Likewise the carbohydrate content of flesh was higher (2.4) than the shell (1.5%). The highest amount of lipid was found in shell, the value being 9.8% where as in the higher level of moisture content was noticed in 14.7 % in flesh. The higher value of 26.6% of ash was noticed in the shell than that of flesh 18.5%.

Comparison between the flesh and shell of *P.indicus* shows that high level of protein, carbohydrate and moisture content was reported in the flesh tissues. Likewise higher level of lipid, fibre and ash content was noticed in the shell part of the shrimp *P.indicus* (Table 1).

Mineral Composition: The mineral level of the *P. indicus* shell and flesh are shown in (Fig. A&B). The sodium content range from 29mg/100g (flesh) to 38.6mg/100g (shell). Potassium was found to be between 24.3 mg/100g (flesh) to 33.2 mg/100g (shell). Phosphorus was high and it ranged between 82.4 mg/100g to 91.5 mg/100g. High values were also recorded for calcium and magnesium. Very good ratios existed between calcium and phosphorus in both flesh and shell samples.

Prawn has great importance in food consumed by human and other organisms. It is valuable in the diet, because apart from supply of good quality proteins and vitamins, it also contains several dietary mineral such as calcium, Iron etc, which are beneficial to human and other organisms. Minerals that are required in relatively large amounts in the body are commonly grouped as major or macro elements. These minerals are essential components which are required in enzymatic biochemical activities in the body. The mineral ratios are very important in health at times they could pose as threat if their

Table 1: Biochemical composition of shell and flesh *of P. indicus* (% dry weight)

Parameter	Flesh	Shell
Crude protein	41.3±0.3	32.5±0.1
Crude carbohydrate	2.4±0.6	1.5±1.2
Crude lipid	7.6±0.7	9.8±0.7
Crude fibre	8.2±0.0	8.7±1.2
Moisture	14.7±0.7	12.3 ±0.1
Total ash	18.5±0.6	26.6 ±0.0

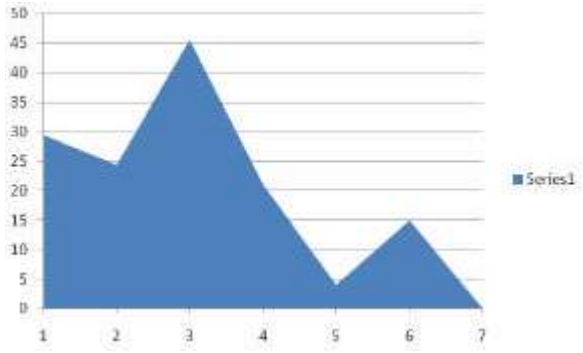

Fig. A: Mineral composition in the flesh of *P.indicus* 1.Na; 2.K; 3. Ca; 4. Mg; 5. Cu; 6. Fe; 7. Co; 8. Mn; 9. Cr; 10. P

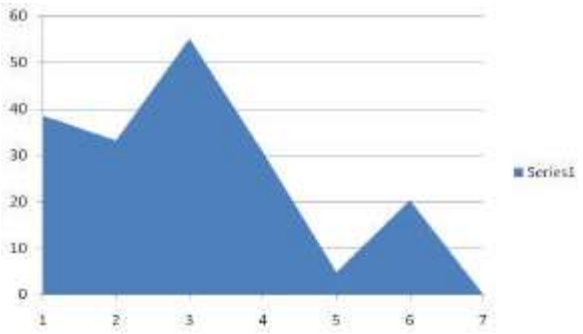

Fig. B: Mineral composition in the shell of *P.indicus* 1.Na; 2.K; 3. Ca; 4. Mg; 5. Cu; 6. Fe; 7. Co; 8. Mn; 9. Cr; 10. P

proportions are high. Ratios of 8.1 and 2.2 of Ca/P and K/ (Ca+Mg), respectively are capable of inducing metabolic disorder [13]. A value of 3 top 4 for Na/k is considered the most adequate for normal persecution of protein during growth [14].

In the present investigation comparison of proximate composition and minerals in the shell and flesh of *P.indicus* was studied. Both shell and flesh of *M. vollenhovenii*, *Palaemon* species and *P. notialis* were better concentrated in calcium, phosphorus, iron, cobalt, copper, sodium and potassium than in the shell and flesh of P. *notabilis* [15]. However, the levels of zinc, iron and

copper (except in *M. vollenhovenii*) in *P. notabilis* were higher than in the whole organisms of *M. vollenhovenii*, *Palaemon* species A, *P. notialis* and *P. kerathurus* [16] all found in Lagos lagoon. When *P. notabilis* was compared with other non-conventional sources of protein, it was found that its mineral levels were lower than what obtained in the various parts of male and female fresh water crabs [17] but better than the mineral levels in *Zonocerus variegatus* (variegated grasshopper) [18] and close to the levels obtained for winged termites (*Macrotermes bellicosus*) [19].

Proximate parameters in flesh were generally more concentrated than shell. The level of protein in the flesh was of good comparison with the shell of *P.monodon.* But the flesh contained low content of crude fibre then shell. Both the current and the literature references had low level of carbohydrate [15]. Some researchers found variation level of protein in shrimp waste, the level started from 39, 45 to 52, 70% [20-23]. The protein contain of shrimp waste from *Penaeus merguensis* is 24.03% in dry weight basis [24]. The shrimp waste is also well-known has high calcium contain [21-23] unfortunately; the shrimp waste protein digestibility is low and absorption in small amount by broiler because of chitin compound. The amount of shrimp waste inclusion broiler diet is controversial [25-28] measured 5-10, 15, 14, 25 and 9% respectively.

The results of the present investigation reported that the flesh and shell of *P.indicus* shows maximum level of protein, carbohydrate and moisture content was reported in the flesh tissues. Likewise higher level of lipid, fibre and ash content was noticed in the shell part of the shrimp *P.indicus*. The findings of minerals composition in the shell and flesh of *P.indicus* reported that mineral content was high in shell samples than flesh tissues. The results reported that *Penaeus indicus* is a good source of proteins and metabolically energy and average mineral supply.

ACKNOWLEDGEMENT

The authors are grateful to the Director of CAS in Marine Biology and authorities of Annamalai University for facilities provided.

REFERENCES

1. Vijayan, K. and A.D. Diwan, 1996. Fluctuations in Ca, Mg and P levels in the hemolymph, muscle, midgut gland and exoskeleton during moulting cycle of the Indian white prawn, *Penaeus indicus* (Decapod;: Penaeidae). Comp Biochem Physio, 114A: 91-97.
2. Deshimaru, O. and Y. Yone, 1978. Requirement of prawn for dietary minerals. Bull. Jap. Soc. Sci. Fish, 44: 907-910.
3. Hysmith, B.T., J.R. booth, H.L. Cook and W.l. Mies, 1972. Astudy of the effect of feeding synthetic diets to brown shrimp (*Penaus aztecus*). Proceedings of the World mariculture Society, 3: 365-388.
4. Sick, L.V., J.D. Andrews and D.B. White, 1972. Preliminary studies on selected environmental and nutritional requirements for the culture of penaeid shrimp. Fish Bull, 70: 101-109.
5. Davis, A. and Lawrence, 1993. Response of *Penaeus vannamei* to dietary calcium, phosphorus and calcium: phosphorus ratio. J. Wor. Agri. Soc., 24(4): 504-515.
6. Kanazawa, A., S. Teshima and M. Sasaki, 1984. Requirements of potassium, copper, manganeseand iron. Memoirs of Faculty of Fisheries Kagoshima University, 33: 63-71.
7. Davis, D.A., A.L. Lawrence and D.M. Gatlin III, 1992. Mineral requirement of *Penaeus vannamei:* A preliminary examination of the dietary essentiality for thirteen minerals.J Wor Agri Soc, 23: 8-11.
8. Akegbejo-Samson, Y., 1997. Introduction to aquaculture fishiness management in Nigeria Natural Resources Series 2. Good Educational Publishers, Nigeria. pp: 9-15.
9. Bligh, E.G. and W.J. Dyer, 1959. A rapid method of total lipid extraction and purification. Can. J. Biochem. Physiol., 37: 911-917.
10. Lowry, O.H., N.J. Rosebrough, A.L. Farr and R.J. Randall, 1951. Protein measurement with the Folin-Phenol reagents. J. Biol. Chem., 193: 265-275.
11. Morris, D.L., 1948. Quantitative determination of carbohydrates with Dreywood's anthrone reagent. Science, 107: 254-255.
12. A.O.A.C., 1990. Official methods of analysis 15 edition. Washington DC. pp: 222-245.
13. Abulude, F.O., L.O. lawal and Eshett, 2004. Physico-chemical properties and mineral composition of some edible oils in Ondo Stant Nigeria. J. Sust. Trop Agric. Res., 10: 76-78.
14. Tomori, W.B. and O.A. Obijole, 2000. Mineral composition of some less utilized vegetables in Nigeria. Afr. J. Sci. Tech., 1: 153-157.
15. Adeyeye, E.I. and H.O. Adubiaro, 2004. Chemical composition of shell and flesh of three prawn samples from Eagos lagoon. J. Sci. Food Agric., 8: 411-414.
16. Adeyeye, E.I., 2000. Bio-concentration of macro and trace minerals in four prawns living in Lagos lagoon. Pak J. Sci. Indus. Res., 43: 367-373.

17. Adeyeye, E.I., 2002. Determination of the chemical composition of the nutritionally valuable parts of male and female common West African fresh water crab *Sudananautes africanus africanus*. Int. J. Food Sci. Nutr., 53: 189-196.
18. Olaofe, O., L.A. Arogundade, E.I. Adeyeye and O.M. Falusi, 1998. Composition and food properties of the variegated grasshopper, *Zonocerus variegatus*. Trop. Sci., 38: 233-237.
19. Adeyeye, E.I., 2005. The composition of the winged termites, *Macrotermes bellicosus*. J Chem Soc. Nigeria, 30: 145-149.
20. Mirzah, 1990. Influence of shrimp waste meal processing and non processing level in ration for broiler performance. Thesis, Pajajaran University, Bandung, Indonesia.
21. Gernat, A.G., 2001. The effect of using different level of shrimp meal in laying hen diet. Res. Notes Poult Sci., 80: 633-636.
22. Fanimo, A.O., B.O. Oduguwa, O.O. Oduguwa, O.Y. Ajas and O. Jegede, 2004. Feeding Value of Shrimp Meal for Growing Pig.
23. Okoye, F.C., G.S. Ojewola and K. Njoku-Onu, 2005. Evaluation of shrimp waste meal as a probable animal protein source for broiler chicken. Int. J. Poult Sci., pp: 458-461.
24. Mahata, M.E., 2007. Repairing shrimp waste nutrient quality as poultry feed through chitosanase and chitinase hydrolysis from *Serratia marcescense* bacterium. Disertation andalas Uni., Padang, Indonesia.
25. Waskito, W.H.S., Zakaria and Suharjono, 1975. Kandungan Gizi dan Energi Metabolis Tepung Udang dan Pengaruhnya Terhadap Produksi Telur. Seminar Penelitian Peternakan. Pusat Penelitian Pengembangan Ternak Ciawi, Bogor.
26. Romziah, S., H. Setiono, M. Hayati, Y.M. Indrawani and K. dan Rochiman, 1981. Pengaruh Berbagai Tingkat Penggunaan Tepung Limbah Udang di Dalam Ransum Ayam Broiler Pedaging Terhadap Pertumbuhan dan Konsumsi Ransum. Direktorat P3M. FKH Unair, Surabaya.
27. Islam, M.A., M.D. Hossain, S.M. Baibul and M.A. Howlider, 1994. Unconventional feed for broilers. Ind. Vet. J., 74: 775-780.
28. Arellano, L.L., F. Carillo, Perez-Gill, E. Avila and F. Ramos, 1997. Shrimp head meal utilization in roiler feeding. Poult Sci., 76: 85.