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Proximate composition, amino acid, fatty acid, vitamins and mineral analysis of Crab *Portunus gladiator* (Fabricius, 1798) from Parangipettai Coastal area.

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Abstract

Marine foodstuffs are unique in having easily digestible proteins and essential Poly unsaturated fatty acids in its nutritional compositions. The protein, carbohydrate, fat, ash and moisture content of *P. gladiator* were found to be 42.59, 25.09, 89.02, 4.57 and 70.19mg/100g respectively. Totally 11 essential amino acids, 10 non essential amino acids, six fatty acids and seven minerals were observed on *P. gladiator*. This crab species is characterized as a very good delicacy throughout the coastal regions of India. In spite of its delicacy and preference among the consumers there is no clear documentation about the nutritional quality of this species.

INTRODUCTION

The utilization of sea food by human resources has augmented swiftly in world-wide. As a whole, marine food products, including crustacean, molluscs have been much-admired for their health promoting characteristics. The marine organisms are nutritionally valuable sources of various minerals and high quality of protein content to human being [1, 2]. In worldwide, crustaceans are highly valued and are considered sumptuousness seafood products. Although their regular utilization is not advisable in general, either due to their allergenic reactions or the supposedly high cholesterol content, there are a many number of researches promoting crustacean consumptions [3, 4, 5, 6, 7, 8, 9]. Crabs are a large group of invertebrates and, due to the high palatability of their meat; they are a focus of commercial fisheries. The composition of proteins,

amino acids, total lipids and fatty acids of the most commercially significant crabs can be found in earlier publications [10]. Seafood is unique in having easily digestible proteins and essential PUFAs in its composition [11].

Nutrients play a vital role on the physical growth, maintenance, organ development, physical activity and quality of health. Nutrition, a basic prerequisite to sustain life must be obtained through a judicious choice and combination of a variety of foods.

Carbohydrates, fat and proteins are the macronutrients which are needed in large amounts. Vitamins and minerals which constitute the micronutrients are necessary for physiological and biochemical processes through which the human body acquires, assimilate and utilize food to maintain proper health. Nutrition not only promotes proper physical growth and development, but also ensures adequate immune competence and cognitive developments. Balanced diet is the one containing all essential macro and micro nutrients in adequate proportions. The quantity of food necessary to meet the nutrient requirements varies with age, gender, physical activity and physiological status [12].

The objective of the work was planned to study the proximate composition of *P. gladiator* Crab through estimating their major biochemical components such as total protein, carbohydrate, lipid, amino acids, fatty acid profile and mineral content on their appendages and body parts.

Material and Method:

The crab *P. gladiator* was collected lively at Mudasal odai landing center, Parangipettai (Lat.11°29'N; Long.79°46'E) and transported immediately to the laboratory for the analysis. The crab was separated into two parts, which is body (Shell and Muscles) and appendages (Walking legs Claws). The digestive system was removed edible portions were taken separately and the tissues samples were kept in an electric oven at 75°C (30 Min.) for proper drying. The dried samples were powdered and stored for below mentioned estimations.

Estimation of Protein

The Folin-Ciocalteu Phenol method of Lowry *et al.*, (1951) was used for the estimation of total protein in the crab [13].

Estimation of Lipid

The total lipid content was estimated gravimetrically by following Folch *et al.*, (1957) [14].

Estimation of Carbohydrate

The total carbohydrate was estimated by phenol- sulphuric acid method of Dubois *et al.*, (1956) [15].

Estimation of Amino Acids

The experimental samples were finely ground for estimating the amino acids in the HPLC (Merck Hitachi L-7400) following the method of Baker *et al.*, (1994) [16].

Fatty Acid Analysis

For fatty acid analysis, the samples were homogenized with chloroform: methanol (2:1 v/v) mixture and they were extracted

using the method of Bligh *et al.*(1959). After the fat was extracted, they were esterifies with 1% H_2So_4 and fatty acid methyl esters were prepared by following the procedure of AOAC,(1995). The identification and quantification of fatty acids were done using Gas Chromatography (Hewlett Packard 5890 model) [17, 18].

Estimation of Minerals

The minerals were estimated by following the method of Guzman and Jimenez (1992) [19].

Figure 1: *P. gladiator* (Fabricius, 1798)

Table 1: Proximate composition of *P. gladiator* crab appendages (Claws & legs) meat and body meat (Including Shell and abdomen) for mg/100 gm.

S.No		Appendages	Body	Total
1	Protein	11.14	31.45	42.59
2	Carbohydrate	9.64	15.45	25.09
3	Fat	27.11	61.91	89.02
4	Ash	1.59	2.98	4.57
5	Moisture	21.21	48.98	70.19

Table 2: Essential amino acid composition of *P. gladiator* crabs appendages meat and body meat. Mg/100gm

S.N	Essential Amino acids	Appendages	Body	Total
1	Threonine	0.115	0.594	0.709
2	Arginine	0.226	0.494	0.720
3	Histidine	0.482	0.813	0.1295
4	Valine	0.171	0.413	0.584
5	Methionine	0.231	0.553	0.784
6	Iso Leucine	0.214	0.445	0.659
7	Phenylanine	0.126	0.393	0.519
8	Leucine	0.184	0.625	0.809
9	Lysine	0.425	0.934	0.1359
10	Tryptophan	0.186	0.493	0.679
11	Taurine	0.151	0.343	0.494

Table3: Non essential amino acid composition of *P. gladiator* crab on appendages and body meat mg/100gm

S.N	Non essential Amino Acids	Appendages	Body	Total
1	Aspartic Acid	0.213	0.656	0.869
2	Glutamic Acid	0.022	1.093	1.115
3	Asparagine	0.049	0.314	0.363
4	Serine	0.115	0.645	0.760
5	Glutamine	0.126	0.534	0.66
6	Glycine	0.116	0.414	0.530
7	Alanine	0.197	0.543	0.740
8	Cysteine	0.335	0.933	1.268
9	Tyrosine	0.396	0.934	1.33
10	Proline	0.213	0.566	0.779

Table 4: The fatty acid composition of *P. gladiator* crabs appendages meat and Body meat Mg/100gm.

No	Fatty Acids	Appendages	Body	Total
1	Palmitic Acid	3.93	8.24	12.17
2	Stearic Acid 18:0	2.39	9.45	11.84
3	Oleic Acid 18:1	1.24	5.36	6.6
4	Linolenic Acids	1.16	4.98	6.14
5	Alpha Linolenic Acid	4.06	9.04	13.1
6	Moroctic Acid 18:4	0.21	1.35	1.56

Results:

Proximate composition

In this present study the protein, carbohydrate, fat, ash and moisture content of *P. gladiator* were found to be 42.59, 25.09, 89.02, 4.57 and 70.19mg/100g respectively. Among the proximate compositions, the fat and protein content were recorded in higher concentrations (Table 1).

Estimation of Amino acid

Essential amino acids

In this study totally 11 essential amino acids were observed on *P. gladiator.* Among the essential amino acids Histidine (0.482 and 0.813), Lysine (0.425 and 0.934 mg/100g), Arginine (0.226 and 0.494) and Iso leucine (0.214 and 0.445 mg/100g) were observed at superior concentrations and other amino acids were observed in trace quantities (Table 2).

Non essential amino acids

Totally, 10 non essential amino acids were recorded in an investigated crab appendages and body tissue sample. Among the non essential amino acids, Tyrosine (0.396 and 934 mg/100g), Cysteine (0.335 and 0.933 mg/100g) and aspartic acid (0.213 and 0.656 mg/100g) were noticed as predominant Non essential amino acids (Table 3).

Determination of Fatty acid composition

The fatty acid analysis of *P. gladiator* crab showed significant values of various fatty acids. Totally 6 fatty acids were recorded, in this composition Alpha Linolenic Acid (4.06-9.04 mg/100g), Palmitic Acid (3.93-8.24 mg/100g) and Stearic (2.39 mg/100g) Acid levels are showed in higher level and others are shown in trace (Table 4).

Mineral composition

The mineral composition analysis of study animal showed higher and moderates levels of various minerals. The superior concentration of Calcium (215.2 to 434.6 100mg/g), Sodium (268.2 mg/100g), Potassium (76.2 mg/100g) and Magnesium (52.3 to 78.8 mg/100g) were recorded in the tissue of *P. gladiator* (Table 5).

Discussion:

In this present investigation, the protein concentration varied between 11.14 gm and 31.45 mg/100 g in appendages and body parts of studied *P. gladiator* crab. Results were showed in Table 1. The proximate chemical composition of edible tissues generally reflects their physiological functions, metabolic needs and available diet [20, 21]. Much more researches were registered on this crustacean sub phylum. Although, crab *Callinectes sapidus, Maja brachydactyla, Carcinus mediterraneus* and *Fenneropenaeus indicus* were gave similar results. (C¸elik *et al*., 2004; Bodin *et al*., 2007; Cherif *et al*., 2008 and Vasquez-Boucard *et al*., 2004) [22, 23, 24, 25]. Emmanuel *et al*. (2010) were analyzed protein content on *Sudananautes africanus,* in this species protein level was recorded as 22.1mg and 18.6mg in both male and female crab species, [26]. Udo and Vivian (2012) are measured the protein content on shell (5.23%) and flesh (20.12%) of *Callinectes amnicola.* The protein levels in-between studied crab and above revealed studies were averaged significantly increased. These kind of dissimilarities might be geographical location of water bodies and population of species as mention by Udo and Vivian (2012) [27]. Moronkola *et al*., (2011) were estimated protein contents on crunchy chest (19.8%), walking legs (19.2%) and tissue samples (28%) of *C. amnicola* [28]. In Chinese mitten crab 7.02 % and 5.80% of protein in female and male Chinese mitten crab (Ke chen, 2013). In these results showing, protein level was significantly more than other crab species [29].

The essential and non essential amino acids were differed from appendages and body part of investigated crab *P. gladiator* species. It shows 2.51 gm & 1.78 of total EAA and NEAA of appendages and 6.1g & 6.632g on body part. In general, the quality of protein was assessed by utilization of essential amino acids (Chen *et al*., 2007) [5]. FAO/WHO were referred amino acid obligation for two to five year old children (FAO/WHO/ UNU, 2005), in case the EAA above 100; this will meet the necessities of human. If not this amino acid will be considered as limiting amino acid in food for our utilization [30]. The amino acid composition of the meat of various crab species appears similar, including the blue swimmer crab, the swimming crab (Su *et al*., 1996) the Chinese mitten crab (Chen *et al*., 2007) and the green crab (Naczk *et al*., 2004). Manivannan *et al*.(2010) were recorded nine EAA and 10 NEAA on crab *Scylla tranquebarica* [31, 5, 32, 33] . In this species, Arginin (11.473%) and Liucin (9.266) were recorded as the highest level of amino acids. This kind of difference might be most probably linked to the size of the crab studied for the separate studies or seasonal conditions at the time of study conducted (Beth Fulton and Elizabeth Fairchild, 2013) [34].

The fatty acids are rich in *P. gladiator;* in this species have 12.78 g in appendages and 6.632 g in body part of the investigated species. Ayas and Ozogul (2011) were observed fatty acid on *Portunus pelagicus;* in this crab species, the Oliec acid is diverse between 14.66%-14.75% on all male and female *Callinectes sapidus* [35]. Kuley *et al*. (2008) registered the quantity of oleic acid and palmitoleic acid content on blue crab of *C. sapidus;* it has 3.4%-17.1% and 3.0%-3.3% male and female crab species [36]. This variation might be almost certainly connected to the size of the species investigated for the separate studies or seasonal conditions at the time of study conducted (Kathirvel *et al*., 2014) [37]. In present study, significant levels of minerals were recorded and it has 447.49 mg & 895.8 mg/g in appendages and body part of the investigated species. Many researches were revealed that the

crab species having many differences on the chemical proportion were recorded between tissues. Crab species each tissue between sexes, while tiny differences were recorded due to the location of fishing ground. Similar studies were conducted in some other crab species. Udo Paul and Vivian (2012) were examined mineral level on *Callinectes amnicola* [27]. It has 718 mg/100gm of Ca is the predominant source on *UCA tangeri* species and Cu 7 mg was detected as lower level on *C. amnicola*. Soundarapandian *et al*.(2014) were studied mineral analysis on *Podophthalmus vigil* and it contained 14.58 mg of Ca on female crab species [38]. Fe has fairly presented a lot of imperative functions in the human body. In general, the Iron deficiency was occurred when the demand for iron content is too high, in this current investigation the iron level is high in body then appendages.

Conclusion:

In general, the *P. gladiator* crab is economically cheaper and it is available frequently in Parangipettai coast. This study revealed that this *P. gladiator* species are able to compete with more commercially consumed species in terms of nutritional values, and they can definitely also compete when it comes to taste.

Reference:

1. Skonberg D.I and B.L. Perkins, Nutrient composition of green crab (*Carcinus maenus*) leg meat and claw meat. Food Chemistry, 72, 2002, 401–404.
2. USDA (2003). National Nutrient Database for Standard Reference, Release 16. Nutrient Data Laboratory.
3. Rosa, R., Nunes, M.L., 2003a. Nutritional quality of red shrimp, *Aristeus antennatus* (Risso), pink shrimp, *Parapenaeus longirostris* (Lucas), and Norway lobster, Nephrops norvegicus (Linnaeus). Journal of the Science of Food and Agriculture 84, 89–94.
4. Ku¨ c¸u¨kgu¨ lmez, A., C¸elik, M., Yanar, Y., Ersoy, B., C¸ikrikc¸i, M., 2006. Proximate composition and mineral contents of the blue crab (*Callinectes sapidus*) breast meat, claw meat and hepatopancreas. Journal of Food Science and Technology 41, 1023–1026.
5. Chen, D., Zhang, M., Shrestha, S., 2007. Compositional characteristics and nutritional quality of Chinese mitten crab (Eriocheir sinensis). Food Chemistry 103 (4), 1343–1349.
6. Teixeira, B., Barrento, S., Carvalho, M.L., Nunes, M.L., Marques, A., 2008. Macro and trace elements in edible tissues of *Carcinus maenas* and *Necora puber.* Journal of the Science of Food and Agriculture 88, 2451–2459.
7. Barrento, S., Marques, A., Teixeira, B., Vaz-Pires, P., Carvalho, M.L., Nunes, M.L., 2008a. Essential elements and contaminants in edible tissues of European and American lobsters. Food Chemistry 111 (4), 862–867.
8. Barrento, S., Marques, A., Teixeira, B., Carvalho, M.L., Vaz-Pires, P., Nunes, M.L., 2009a. Accumulation of elements (S, As, Br, Sr, Cd, Hg, Pb) in two populations of Cancer pagurus: ecological implications to human consumption. Food and Chemical Toxicology 47 (1), 150–156.
9. Barrento, S., Marques, A., Teixeira, B., Vaz-Pires, P., Nunes, M.L., 2009b. Nutritional quality of the edible tissues of European lobster *Homarus gammarus* and American lobster *Homarus americanus*. Journal of Agricultural and Food Chemistry 57 (9), 3645–3652.
10. Gates, K. W., & Parker, A. H. (1992). Characterization of minced meat extracted from Blue crab picking plant by-products. Journal of Food Science, 57(2), 267–270.
11. Guddings, G. G and Hill, L. H. (1975). Processing effects on the lipid fractions and principal fatty acids of blue crab (*C. sapidus*) muscle. Journal of Food Science, 40, 1127–1129.
12. Ramakrishnan, S. and S. Venkat Rao, 1995. *Nutritional Biochemistry.* T.R. Publication, Chennai, India, 97pp.
13. Lowry O.H, N.J Rosebrough, A.L Farr, R.J Randall, Protein measurement with the folin phenol reagent. J Biol Chem 193: 265-273. (1951).
14. Folch. J, M. Lees, G.H. Sloane Stanley, A simple method for the isolation and purification of total lipids from animal tissues. J Biol Chem 226: 497-509. (1957).
15. Dubois .M, K.A. Gilles, J.K. Hamilton, P.A Rebers, F. Smith (1956) Colorimetric method for determination of sugar and related substances. Annal Chem 28: 350.
16. Baker D.H and Y. Han (1994) Ideal amino acid profile for chicks during the first three weeks posthatching. Poult Sci 73: 1441-1447.
17. Bligh E.G and W.J. Dyer A rapid method of total lipid extraction and purification. Can J Biochem Physiol 37: 911-917. (1959).
18. AOAC, Official methods of analysis of AOAC International, 16th edn. AOAC International. Arlington, Va. (1995)
19. Guzman H.M and C.E. Jimenez Concentration of coral reefs by heavy metals along the carribean cost of central Africa (costarica and panama). Mar Pollut Bull 24: 554-561. (1992)
20. Rosa, R., Nunes, M.L., 2003b. Biochemical composition of deep-sea decapod crustaceans with two different benthic life strategies off the Portuguese south coast. Deep-Sea Research I 50, 119–130.
21. Vinagre, A.S., Amaral, A.P.N., Ribarcki, F.P., Silveira, E.F., Pe´ rico, E., 2007. Seasonal variation of energy metabolism in ghost crab *Ocypode quadrata at Siriu´* Beach (Brazil). Comparative Biochemistry and Physiology A 146, 514–519.
22. C¸elik, M., Tu¨ reli, C., C¸elik, M., Yanar, Y., Erdem,U¨ ., Ku c¸u¨kgu¨ lmez, A., 2004. Fatty acid composition of the blue crab (*Callinectes sapidus* Rathbun, 1896) in the north eastern Mediterranean. Food Chemistry 88, 271–273.
23. Bodin, N., Le Loc'h, F., Hily, C., 2007. Effect of lipid removal on carbon and nitrogen stable isotope ratios in crustacean tissues. Journal of Experimental Marine Biology and Ecology 341, 168–175.
24. Cherif, S., Frikha, F., Gargouri, Y., Miled, N., 2008. Fatty acid composition of green crab (*Carcinus mediterraneus*) from the Tunisian mediterranean coasts. Food Chemistry 111, 930–933.
25. Vasquez-Boucard, C.G., Patroisb, P., Ceccaldi, H.J., 2004. Exhaustion of lipid reserves in the hepatopancreas of *Fenneropenaeus indicus* broodstock in relation to successive spawnings. Aquaculture 236, 523–537.
26. Emmanuel Adeyeye. I, O. John Olanlokun, O. Tosin Falodun, Proximate and mineral

composition of whole body, flesh and exoskeleton of male and female common west african fresh water crab *sudananautes africanus* africanus. Pol. J. Food Nutr. Sci.2010, 60, No. 3, pp. 213-216.
27. Udo Paul Jimmy and Vivian Nneka Arazu, The Proximate and Mineral Composition of Two Edible Crabs *Callinectes amnicola* and *Uca tangeri* (Crustecea: Decapoda) of The Cross River, Nigeria. Pakistan Journal of Nutrition, 2012, 11 (1): 78-82.
28. Moronkola B.A, R.A. Olowu, O.O. Tovide and O.O. Ayejuyo, Determination OF Proximate and mineral contents of crab (*Callinectes amnicola*) Living on the shore of Ojo river, Lagos, Nigeria. Sci. Revs. Chem. Commun. 2011: 1(1), 1-6.
29. Ke Chen, Erchao Li, Na Yu, Zhenyu Du, Liqiao Chen (2013). Biochemical composition and nutritional value analysis of Chinese mitten crab, *Eriocheir sinensis*, grown in pond. Global Advanced Research Journal of Agricultural Science, 2013, 2(6), 164-173.
30. FAO (United Nations Food and Agriculture Organization), Nutritional elements of fish FAO, Rome. 2005.
31. Su, X.R., Li, T.W., Oyang, F., Li, P., 1996. Study on the nutritive compositions of *Portunus trituberculatus*. Acta Nutrimenta Sinica 18 (3), 342–346.
32. Naczk, M.,Williams, J., Brennan, K., Liyanapathirana, C., Shahidi, F., 2004. Compositional characteristics of green crab (*Carcinus maenas*). Food Chemistry, 88, 429–434.
33. K Manivannan, M. Sudhakar, R.Murugesan and P. Soundarapandian Effect of Feed on the Biochemical Composition of Commercially Important Mud Crab *Scylla tranquebarica* (Fabricius 1798). International Journal of Animal and Veterinary Advances, 2010 2(1): 16-20.
34. A Beth Fulton and A. Elizabeth Fairchild. Nutritional Analysis of Whole Green Crab, *Carcinus maenas*, for Application as a Forage Fish Replacement in Agrifeeds, Canadian Center of Science and Education. Sustainable Agriculture Research, 2(3); 2013.
35. Ayas. D., and Y. Ozogul, The chemical composition of sexually mature blue swimmer crab (*Portunus pelagicus*, Linnaeus 1758) in the Mersin bay. Journal of fisheries science. 2011, 5(4): 308-316.
36. Kuley .E, F. Ozogul, Y. Ozogul, A.I. Olgunoglu, Comparison of fatty acid and proximate compositions of the body and claw of male and female blue crabs (*Callinectes sapidus*) from different regions of the Mediterranean coast. Int J Food Sci Nutr. 2008, 59(7-8):573-80.
37. Kathirvel. K, A.Eswar, T.Manikandarajan, K.Ramamoorthy and G.Sankar, R.Anbarasu. Proximate composition, Amino acid, Fatty acid and mineral analysis of box crab, *Calappa lophus* (Herbst, 1782) from Parangipettai, Southeast Coast of India. Toxicology and Food Technology, 2014, 8(5), PP 50-57.
38. P Soundarapandian, D. Varadharajan, S. Ravichandran. Mineral composition of edible crab *Podophthalmus vigil Fabricius* (Crustacea: Decapoda). Arthropods, 2014, 3(1): 20-26.