

Nutritional Studies on Marine Crabs (Decapoda: Portunidae: Galenidae) from the Coromandel Coast of Tamil Nadu

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Abstract: This study evaluates the nutritive value of edible marine crabs collected from the Coromandel Coast of the Cuddalore District, Tamil Nadu, India. Biochemical composition, including protein, carbohydrate, lipid and moisture content, was analyzed in both body and claw meat. Among the species studied, *Portunus sanguinolentus* exhibited the highest protein content ($32.12 \pm 0.586\%$), *Scylla serrata* showed the highest carbohydrate level ($4.61 \pm 0.558\%$) and *Podophthalmus vigil* recorded the highest lipid ($3.75 \pm 0.060\%$) and moisture content ($79 \pm 0.060\%$). Overall, hard-shelled crabs demonstrated higher nutritional values compared to soft-shelled crabs.

KEYWORDS: Marine crabs, nutritive value, protein, carbohydrates, lipids

INTRODUCTION

Crabs are essential components of aquatic ecosystems and represent some of the most evolutionarily advanced members of the phylum Arthropoda. Among crustaceans, brachyuran crabs form a significant part of the macro benthic fauna and play a vital ecological role (Shukla *et al.*, 2013). They occupy multiple trophic levels, acting both as predators-feeding on fish, mollusks, crustaceans, annelids and aquatic vegetation and as prey for birds, mammals and fishes, thereby contributing significantly to estuarine food webs (Hall *et al.*, 2006).

In addition to their ecological importance, crabs are widely consumed as seafood across the world, particularly marine species. They hold substantial economic value in countries such as China, Japan, Indonesia, the Philippines, Spain, Thailand, the United States and India. Decapod crustaceans exhibit complex life cycles involving planktonic larval and benthic adult stages, during which significant biochemical changes occur (Anger, 1998).

Crab meat is highly valued for its rich nutritional profile. It serves as an excellent source of high-quality protein and contains essential vitamins such as A, C and B-complex (including B6, thiamine, riboflavin, niacin and pantothenic acid), along with trace amounts of foliate and vitamin B12. It also provides important minerals such as calcium, iron, zinc, copper, phosphorus and potassium (Udo and Arazu, 2012). Variations in biochemical composition among crab species have been reported across different geographical regions (Naczek *et al.*, 2004). According to WHO (2003), seafood plays a crucial role in maintaining a balanced and nutritious diet due to its high-quality protein, essential fatty acids and low saturated fat content (Nesheim and Yaktine, 2008).

Globally, crabs are not only consumed as food but are also utilized in value-added products such as feed additives and fertilizers derived from processing residues (Gulle, 2005). The demand for crab meat continues to grow in both domestic and international markets, making it an economically important fishery resource. Nutritionally, crab protein compares favorably with that of other animal meats such as mutton, chicken, duck and fish. Annual marine landings exceed 1.5 million tones, highlighting the commercial importance of crab fisheries (Dineshbabu, 2011).

Along the Indian coastline, particularly the east coast, members of the family Portunidae dominate the marine crab population and contribute significantly to fisheries (Radhakrishnan, 2000; Johnsamuel *et al.*, 2004). Several studies have documented variations in biochemical composition among crab species. For instance, protein content has been reported in *Charybdis*



smithii (Balasubramanian and Suseelan, 2001), while moisture and lipid variations have been observed in *Portunus vigil* and related species (Vasconcelos and Braz, 2001). Lipids are recognized as vital energy sources and structural components in marine organisms (Arts *et al.*, 2001) and seafood products are increasingly preferred due to their health benefits (Skonberg and Perkins, 2002).

Previous studies have also highlighted the nutritional and biochemical diversity of crabs, including variations in protein, lipid and carbohydrate content among species and environmental conditions (Murugesan *et al.*, 2008; Sudhakar *et al.*, 2009). Furthermore, crabs are considered excellent sources of essential amino acids, unsaturated fatty acids and minerals necessary for human health (Adeyeye, 2008). Differences in biochemical composition, including haemolymph protein levels, have been reported among brachyuran species (Ravichandran *et al.*, 2009), while dietary influences on nutrient composition have been studied in commercially important species such as *Scylla tranquebarica* (Manivannan *et al.*, 2010). Additionally, species like *Callinectes amnicola* have been recognized for their contribution to mineral intake, particularly calcium and iron, which are important for bone development (Mornakola *et al.*, 2011). The findings establish freshwater crabs as excellent sources of affordable animal protein (providing 30% of daily value) with low cholesterol, supporting their traditional use as food and medicine among indigenous communities. Conservation of rice-based aquatic ecosystems is essential for sustaining this valuable nutritional resource (Kalaimagal *et al.*, 2026).

MATERIALS AND METHODS

The present study was conducted to evaluate the nutritive value of marine brachyuran crabs collected from the Coromandel Coast (east coast) of the Cuddalore District, Tamil Nadu, India. Specimens were collected from the Cuddalore landing center (Lat. 11°43' N; Long. 79°49' E) over a one-year period from August 2024 to July 2025. The collected crabs were transported to the laboratory in ice boxes to maintain freshness.

Species identification was carried out using standard taxonomic keys based on morphological characteristics, photographs and descriptions, following Ng *et al.* (2008). Identification was further verified using the Marine Species Identification Portal. Prior to analysis, samples were thoroughly washed with freshwater to remove adhering impurities, drained using filter paper and preserved in crushed ice during transport to the laboratory.

Sex identification was performed based on abdominal morphology. Typically, brachyuran crabs possess seven abdominal segments; males exhibit a narrow, triangular to T-shaped abdomen, whereas females have a broader, semicircular abdomen covering a larger portion of the ventral surface.

For analysis, the samples were thawed and subjected to morph metric examination. Crabs were dissected to separate the exoskeleton and edible tissues (endoskeleton). Body and claw meat were carefully removed, pooled for each species and dried in a hot air oven at a constant temperature of 60°C until complete moisture removal. The dried samples were then homogenized into a fine powder using a mortar and pestle and stored for further biochemical analysis.

Proximate composition (%) of the samples, including protein, carbohydrate, lipid and moisture content, was determined using standard methods. Protein content was estimated following the method of Lowry *et al.* (1951), carbohydrate by Dubois *et al.* (1956), lipid by Folch *et al.* (1957) and moisture content by Rajendran (1973).

RESULTS

The present study evaluated the nutritive value of brachyuran crabs collected from the Cuddalore landing center during the study period. A total of ten species belonging to two families and four genera were identified.

Comparative proximate analysis of the selected crab species was carried out and the results are presented in the corresponding tables. The proximate composition, including protein (mg/g), carbohydrate (mg/g), lipid (%) and moisture (%), is illustrated in Figures 1–4.

The analyzed species include *Scylla serrata*, *Portunus sanguinolentus*, *Portunus pelagicus*, *Portunus gracillimanus*, *Charybdis natator*, *Charybdis feriata*, *Charybdis lucifera*, *Charybdis affinis*, *Podophthalmus vigil* and *Galene bispinosa*. These figures depict variations in biochemical composition among the studied crab species.

Table: 1. Nutritive Value of Brachyuran Marine Crabs

Species	Protein	Carbohydrate	Lipid	Moisture
<i>Scylla serrata</i>	30.54±1.688	4.61±0.558	1.19±0.030	79.45±0.426
<i>Portunus sanguinolentus</i>	32.12±0.586	4.22±0.060	1.53±0.032	76.11±0.011
<i>P. pelagicus</i>	27.16±0.541	3.98±0.448	1.23±0.036	78.29±0.050
<i>P. gracilimanus</i>	17.66±0.990	2.57±0.041	1.43±0.040	72.48±0.025
<i>Charybdis natator</i>	20.40±0.902	2.91±0.052	1.06±0.041	75.66±0.395
<i>C. feriata</i>	22.98±0.015	3.65±0.015	2.79±0.015	78.34±0.077
<i>C. acutifrons</i>	18.14±0.141	1.13±0.023	1.56±0.066	64.76±0.065
<i>C. lucifera</i>	27.19±0.185	2.49±0.109	2.75±0.041	78.54±0.105
<i>Podophthalmus vigil</i>	27.13±0.238	1.98±0.310	3.75±0.060	79±0.060
<i>Galena bispinosa</i>	21.47±0.443	1.65±0.190	2.08±0.079	76.14±0.085

PROTEIN

The present study was carried out proximate composition (Protein, Carbohydrate, Lipid and Moisture) of Brachyuran crabs. The protein content (mg/ g) was varied from (Fig. 1). The maximum protein content was observed in *Portunus sanguinolentus* (32.12 ± 0.586) and minimum was observed in *P. gracilimanus* (17.66±0.990).

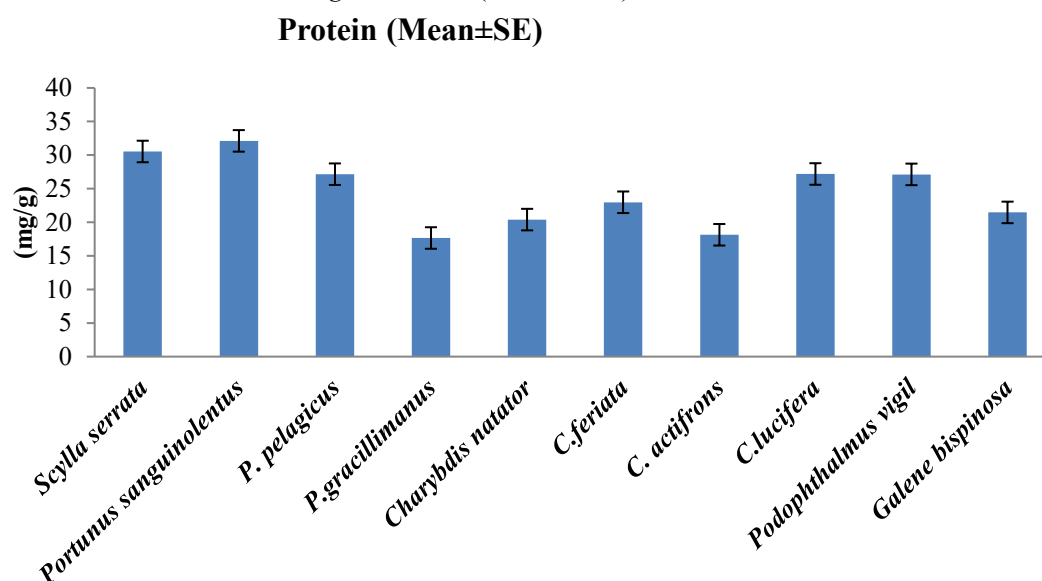


Fig. 1. Protein content between the species

CARBOHYDRATE

The maximum carbohydrate content as shown Fig. 2 was observed in *Scylla serrata* (4.61±0.558) and minimum was observed in *Charybdis acutifrons* (1.13±0.023).

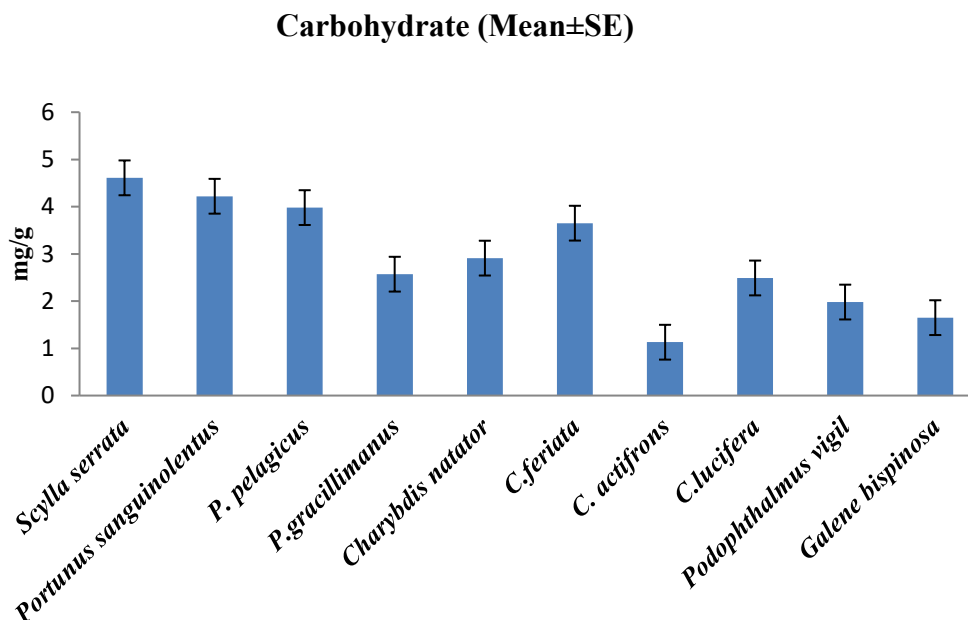


Fig. 2. Carbohydrate content between the species

LIPID

The maximum lipid content as shown Fig. 3 was observed in *Podophthalmus vigil* (3.75±0.060) and minimum was observed in *P. pelagicus* (1.23±0.036).

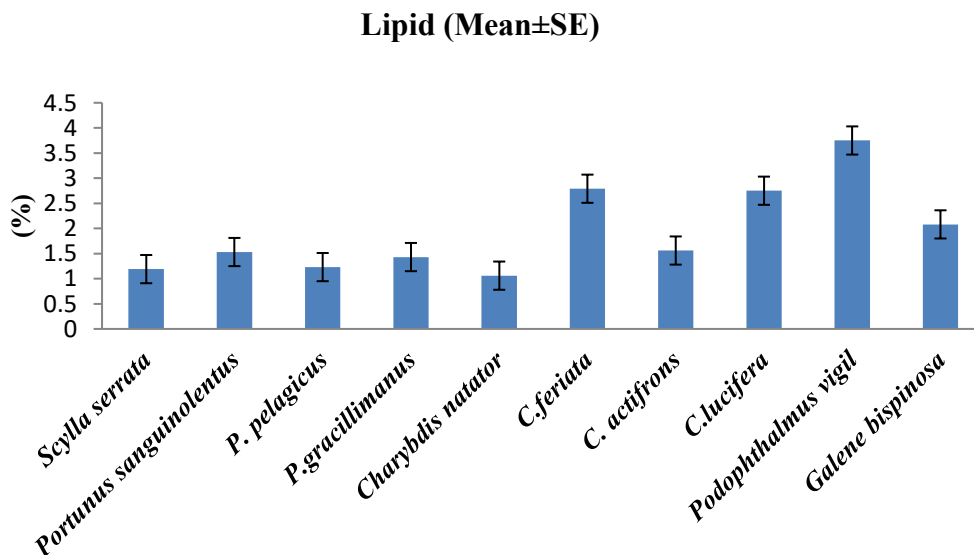


Fig. 3. Lipid content between the species

MOISTURE

The maximum moisture as shown Fig. 4 was observed in *Podophthalmus vigil* (79±0.060) and minimum was observed in *Charybdis acitfrons* (64.76±0.065).

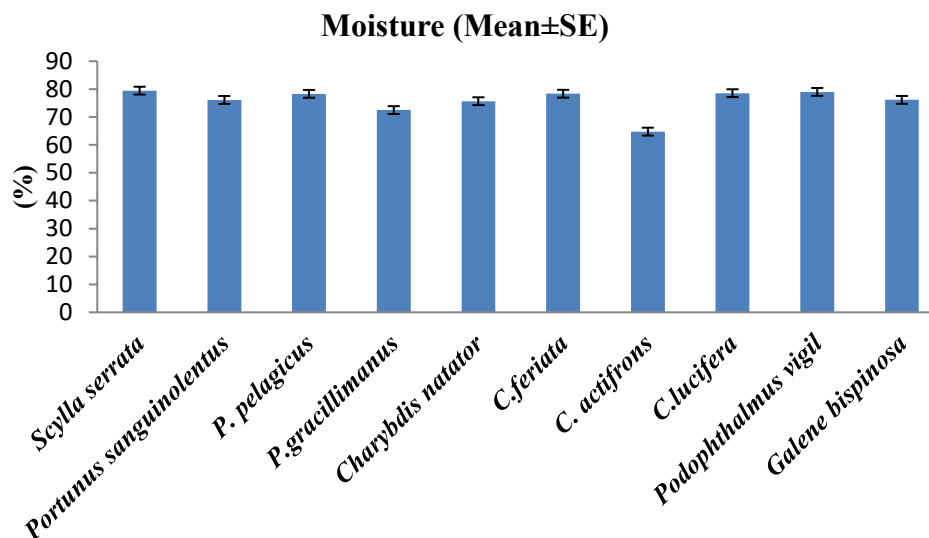


Fig. 4. Moisture content between the species

DISCUSSION

The crab fishery in India is rapidly developing, with significant potential due to the high demand for crab meat, valued for its delicacy and nutritional richness. In recent years, crab meat has gained global acceptance and is extensively harvested and marketed across maritime states of India as well as internationally (Rao *et al.*, 1973). Crabs serve as an important food source not only for marine organisms but also for humans, particularly as a rich source of high-quality protein (Khan 1992).

Crab meat is considered highly nutritious due to its composition of proteins, unsaturated fatty acids, carbohydrates and essential minerals. The health benefits associated with crab consumption are largely attributed to these nutrients, including vitamins and essential fatty acids. Species such as *Callinectes amnicola* are known to be good sources of important minerals. Calcium (Ca) and iron (Fe), for instance, play vital roles in human health—calcium is essential for bone development, blood clotting, muscle contraction and nerve transmission, while iron is crucial for oxygen transport in blood and proper physiological functioning. Additionally, zinc is an important component of various enzymes and is involved in metabolic processes, nucleic acid stability, wound healing, growth and reproductive functions (Mornakola *et al.*, 2011).

In the present study, a total of ten crab species belonging to four genera and two families were recorded from the Coromandel Coast of the Cuddalore coastal waters. The identified species include *Scylla serrata*, *Portunus sanguinolentus*, *Portunus pelagicus*, *Portunus gracillimanus*, *Charybdis natator*, *Charybdis feriata*, *Charybdis acutifrons*, *Charybdis lucifera*, *Podophthalmus vigil* and *Galene bispinosa*. Among these, members of the families Portunidae and Galenidae were predominant in the study area.

Biochemical composition plays a crucial role in determining the nutritional quality of marine organisms. It is well established that biochemical constituents in crustaceans vary depending on factors such as season, size, maturity stage, environmental temperature and food availability (Sudhakar *et al.*, 2009). The findings of the present study indicate significant interspecific variation in the proximate composition of brachyuran crabs, highlighting differences in their nutritional profiles.

PROTEIN

Protein is an essential nutrient for the maintenance and sustenance of life and constitutes the largest proportion of nutrients in the human body (Okuzumi and Fujii, 2000). The increasing demand for high-quality animal protein to support a growing population has led to intensified utilization of aquatic resources. Crab meat, due to its high acceptability and easy digestibility, serves as an excellent dietary source to combat protein malnutrition, particularly in children. Moreover, crab protein possesses high biological value and significant growth-promoting potential.



The present study revealed that the highest protein content was recorded in *Portunus sanguinolentus* (32.12 ± 0.586), while the lowest was observed in *Portunus gracillimanus* (17.66 ± 0.990). Similar findings have been reported by Zafar *et al.* (2004), who documented protein values of 17.69% and 19.39% in male and female *Scylla serrata*, respectively. Likewise, Tureli *et al.* (2000) reported protein contents of $18.83 \pm 0.23\%$ in males and $17.55 \pm 0.23\%$ in females of *Portunus pelagicus*. These results highlight the significance of marine crabs as a valuable source of dietary protein for human consumption. Furthermore, Thirunavukkarasu (2005) reported higher protein levels in different body parts of *Scylla tranquebarica*, with values ranging from 65.48 to 72.24% in body meat, 69.50 to 80.29% in claw meat and 69.47 to 74.70% in leg meat.

CARBOHYDRATE

Carbohydrates are an important group of organic compounds, including sugars and glycogen, that serve as a primary energy source for living organisms. In fishery products, carbohydrates are generally present in low quantities and occur mainly in the form of glycogen, with trace amounts of simple sugars such as glucose, fructose and sucrose (Okuzumi and Fujii, 2000).

The present investigation revealed that carbohydrate content varied among the studied crab species. The highest carbohydrate level was observed in *Scylla serrata* (4.61 ± 0.558), while the lowest was recorded in *Charybdis acutifrons* (1.13 ± 0.023). These variations may be attributed to differences in species, feeding habits, metabolic activity and environmental conditions.

LIPID

Lipids are highly efficient energy sources, providing more than twice the energy of carbohydrates or proteins (Okuzumi and Fujii, 2000). In addition to energy, lipids play important roles as structural components of cell membranes and in metabolic processes.

The present study revealed variation in lipid content among the examined crab species. The highest lipid level was observed in *Podophthalmus vigil* (3.75 ± 0.060), while the lowest was recorded in *Portunus pelagicus* (1.23 ± 0.036). These values are consistent with earlier reports by Sudhakar *et al.* (2009), although slight regional differences in lipid content were noted, likely influenced by factors such as species, habitat, diet and seasonal variations.

MOISTURE

Moisture serves as a crucial medium for the dissolved nutrients in living tissues and most cellular biochemical reactions occur in an aqueous environment. In the present study, moisture content varied significantly among the crab species. The highest moisture level was observed in *Podophthalmus vigil* ($79 \pm 0.060\%$), while the lowest was recorded in *Charybdis acutifrons* ($64.76 \pm 0.065\%$). These findings are consistent with earlier reports by Sudhakar *et al.* (2009), although slight regional variations in moisture content were noted, likely influenced by species, habitat and environmental conditions.

SUMMARY AND CONCLUSION

Fish and shellfish meat are highly nutritious due to their rich content of essential amino acids and high-quality proteins. Knowledge of the amino acid and fatty acid composition of edible organisms is crucial, as their nutritive value is directly reflected in these biochemical constituents, which play vital roles in growth, development and the maintenance of normal physiological functions. Crabs, in particular, are an excellent source of protein and are widely consumed in traditional diets across many countries. They offer superior nutritional quality compared to other meats, providing a balanced composition of proteins, fats and amino acids, which are indicators of good physiological and biochemical health.

The findings of the present study on the proximate composition and nutritive value of brachyuran crabs suggest that these species can serve as a valuable component of a nutritious diet. Furthermore, their nutritional potential can be enhanced through sustainable aquaculture practices under controlled conditions, supporting both human health and commercial seafood production.

ECONOMIC IMPORTANCE

Crab meat is not only palatable but also highly nutritious. In traditional practices, crab preparations are associated with medicinal benefits. For example, crab curry is reputed to provide relief from asthma, while soups prepared from swimming crabs such as *Portunus sanguinolentus* and *Portunus pelagicus* are commonly consumed by individuals recovering from malaria and



typhoid. *Scylla serrata* is traditionally used to alleviate diarrhea and dysentery and the crushed carapace of *Uca* species is applied as a paste to relieve hyperacidity.

In addition to their therapeutic uses, edible crab meats are rich in vitamins and are considered beneficial in managing respiratory conditions, colds and immune-related disorders. They are also traditionally believed to have neuro-stimulatory effects, supporting cognitive functions and general well-being.

ACKNOWLEDGEMENT

Authors are grateful to our esteemed Institute, Thiru Kolanjiappar Government Arts College (Grade-I), Vriddhachalam-606001, Cuddalore District, Tamil Nadu, India, for providing the work space.

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Cite this Article: Kalaimagal, P., Senthil Kumar, G., Muthalagi, S. (2026). Nutritional Studies on Marine Crabs (Decapoda: Portunidae: Galenidae) from the Coromandel Coast of Tamil Nadu. *International Journal of Current Science Research and Review*, 9(4), pp. 2049-2056. DOI: <https://doi.org/10.47191/ijcsrr/V9-i4-34>