INVESTIGATION OF NUTRITIVE VALUE OF CRABS ALONG KERALA COAST

Final Report of Minor Research Project

By

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Dr.Dhanya Viswam

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Chapter - 1

INTRODUCTION

Crabs are the most interesting groups among decapod crustaceans . They are distributed in seas, backwaters, estuatries, lakes and freshwaters. They have a broad carapace and a bend short abdomen. The eyes are stalked. The structure of carapace, the arrangement of spines on the body colouration etc. all have got striking taxonomical importance.

The important edible varieties of crabs belong to the family protunidae. They are Scylla Secrrata (Forskal), Portunus Pelagicus(Linnaelus), Portunus Sanguinolentus (Herbst), Charybdis cruciata(Herbst) Charybdis Feriata, Scylla Olivacea (orange mud crab)

1. COMMERCIALLY IMPORTANT CRABS OF KERALA

The major commercially important crabs of kerala are scylla serrata (mud crab), Portunus pelagicus, Portunus sanguinolentus and Charybdis cruciata.

1.1. SCYLLA SERRATA

This appear to be the largest known crab species from the near shore and brackish water habitats of India. They grows to a size of 150-200mm in carapace width. One distinguishing feature of this species is the presence of nine sharp acuminate teeth of equal size on each side of the antero-lateral borders. The carapace is dark green in colour, unsmooth and anteriorly porjected. They have 'H' shaped deep furrow on carapace. The posterior border of the carapace is broad and less convex. Ventral side of the carapace are white or cream coloured. Last pair of walking legs with numerous mosaic like yellow or white patches. Chelate legs are green with yellow tinge in the lower margin. Two stout spines are present in the outer angle of the carpus. The adbomen of the fully mature females has numerous yellow or white patches. The chelipeds are very large with powerful chelae, the second to the fourth pairs of legs are normal and the fifth pair of legs are paddle-like and adapted for swimming.

1.2. PORTUNUS PELAGICUS

It is a marine form, grow up to 178mm in carapace width. This species exhibit sexual dimorphism. Males being larger than females with larger chelae. Carapace in both sex is ash grey coloured with irregular mosaic like white patches. The carapace is much broader than its length. Its antero-lateral border bears nine spines of which the posterior most is the largest . The frontal lobe consist of six teeth, of which the middle two are pointed spines. Three spines at inner angles of merus and one at the external at the rear end of the merus . Carpus consist of three spines along the dorsal margin. One spine is present at the rear end of the propodus.

1.3. PORTUNUS SANGUINOLENTUS

It is a marine form growing to a size of 145mm carapace width. But specimens of 90-100mm are very common. This species can be easily identified by the three distinct red spots located dorsally on carapace, of which one is median and two lateral, each spot encircled by a whitish ring. There is no spines on the meru. Behind the chelipeds, the three pairs of legs are normal, and the last pair is oar-like for swimming. The anterior pair of abdominal appendages is slender and straight with marginal spines at the tip.

1.4. CHARYBDIS CRUCIATA

This inhabits the off-shore waters at depths of 15-40mm of the seas and grows to a fair size of 150mm across the carapace. The length of the carapace is much less than its width. The antero-lateral teeth of the carapace are six, of which the anterior most one is truncated and the rest acuminate. The sixth abdominal segment is broad. The anterior abdominal appendage in the male is almost stright with a blunt tip and hairs on the outer margin. The colour of the carapace is markings, of which is a cross. The appendages are purplish brown in colour.

CHARYBDIS
LUCIFERA

Habitat

Sandy or muddy bottom.

Distribution

India, Sri Lanka, East Asian Countries, Australia and Japan.

Description

The carapace is very much broader, its length being much less than two-thirds its breadth. A sharply dentiform lobule at the outer end of the lower border of the orbit. The chelipeds in the male are not very much more than twice the length of the carapace.The posterior border of the propodite of the last pair of legs are serrated throughout. The sixth male abdominal segment has its sides parallel or even slightly divergent in atleast two-thirds of its extent. In the anterior male abdominal appendages, there is no bend near the fringe of hairs on the distal part of the outer margin also. The fingers of the larger cheliped are shorter than the palm.

Remarks

Colour yellowish brown with large white spots on either branchial region, chelipeds scariet pink, the tips light brown, extreme tips whitish.

SCYLLA OLIVACEA

Carpus of spines low (mean height c. 0.03 times frontal width measured between medical orbital sututes), rounded with shallow interspaces. Antero-lateral carapace spinces broad, with outer convex. Carpus of chelipeds usually with one small blunt prominence (may be spinous in juveniles) ventro-medically on outer margin; reduced second spine may be present dorso-distally in juveniles and young adults. Palmof cheliped usually with a pair of blunt prominences on dorsal margin behind insertion of the dactyl, inner larger than outer; may be spinous in juveniles and young adults. Chelipeds, legs and abdomen all without obvious polygonal patterning for both sexes. Colour varies from red through brown to brownish/black depending on habitat. (Keenan et al., 1998)

CHARYBDIS FERIATIA

This large and colourful species of swimming crab is wide ranging in the tropical Indo-West Pacific from East Africa the Persian Gulf through to Indonesia and Japan, and throughout most of Australia. The crucifix crab lives in shallow sandy or rocky areas. In parts of its range, such as India, the crucifix crab forms a substantial commercial and recreational fishery but in Australia this species is quite rare and isn't caught in large numbers

Crabs are also good source of Phosphorous , Calcium etc. They also have higher proportions of amino acids such as glycine, lysine, serine and tyrosine. The sweet flavour of the meat of scylla serrata is due to the presence of aminoacid glycine in it. In addition to this crabs are also rich in proteins, carbohydrates, Vitamin A, B , C etc. From the nutritional point of view crab meat has a significant role.

Crabs are also said to have many theraputic properties .Crab meal can cure asthma. Crab soup is given to patients just after recovery from malaria and typhoid. It can cure dysentry and also is a postnatal nutrient for women.

In our country crabs are generally considered as cheap food, consumed mostly by the coastal inhabitants and do not fetch high prices as other edible crustaceans and fishes.

Due to population explosion in the present century, there is scarcity for nutritious food which is essential for health and survival. In this scenario economically backward people of coastal area, located nearby our college should be made aware of nutritious value of crab which is easily available in this region.

A study is therefore initiated on the nutritive value of crabs along Kerala coast.

CHAPTER 2

REVIEW OF LITERATURE

Crabs are highly nutritious and healthy owing to its content proteins, essential amino acids, unsaturated fatty acids and minerals.

Many studies examined the proximate composition of different species of crab in various parts of the world. (Akbar etal 1988; Adeyeye 2002; Skonberg and Perkins 2002, Nackzk etal 2004, Musaiger and Al-Ruaidh, 2005, Chen-etal , 2007, Adeyeye 2008)

Nutritional quality of warty crab (Erihia Verrucosa Forskal) of Turkey was determined by Yalcin etal Turkey and found that warty crab is a valued food due to high quality protein (2009)

Nutritive value of hard and soft shell crabs of portunus sanguinolentus (Herbst) was compared by M.Sudhakar etal of Annamalai University (2009) and found that hard shell crabs are superior to soft shell crabs. Their study also pointed out that there is no need to discard soft shell crabs because they also have appreciable nutritional value.

Chemical composition of carapace meat from adult male and female blue crabs caught in the Mersenbay was studied by Deviz Ayas- University of Mersin Turkey. The results of the analysis showed that female blue crab had higher protein content than male (2011)

Approximate mineral composition of crab speicies callinects Pallidus and Cardisoma HArmatum of Badagry Greek of Nigeria was studied by Elegeda etal and found that they can meet the protein need of the nation.(2013)

Nutritional status of fresh water crab spiralothelphusha hydrodroma(Herbst) from Parangepettai, South East Coast of India was carried out by Varadharajan D etal of Annamalai University . Their study showed that this aruatre animal resource from rice fields provide enough nutrients to the villagers.

Compositional characteristics of green crab (carcinus maenas) of Canada was carried out by (Marian Naczk) etal(2014). Moisture content , protein content, carotenoids fatty acid distribution and amino acid composition was analyzed. The study showed that green crab provides a nutritious source of meat and useful by products for commercial explodation.

Blue crab (Callenectes sapidus) and swim crab (Portunus Pelagicus) caught of the Gulf of Antalya were investigated by Nalan Gokolu etal of University of Akdeniz, Turkey. Due to lack of knowledge of the nutritional value of this species they were not consumed by Turkish people. This study showed that Crabs caught from Gulf of Antalya had high protein content and were rich in terms of mineral content especially Na, K, Ca and P. The results shows that these crabs are ideal dietetic foods to prevent nutrition defeciencies in the future(2003). Bio chemical composition of deep water brachyuran crab charybedies Smithi was determined by C.P.Balasubramanian and C.Suseelan CMFRI Cochin . Their study showed that nutritine value of charybdis Smithi is similar to other commercially exploted crabs.

The nutritional status of different size groups of crab Podophthalmus vigil(Fabricus) was evaluated by C.K.Radhakrishnan and R.Natarajan , Centre of Advanced study in Marine Biology. The studies showed that protein and moisture values were more in small crabs, but carbohydrate and fat were less. But in bigger

size groups proteins and moisture content were less, but values of fat and carbohydrate were found to be higher.

The study of nutritive value of crabs available in various coastal regions abroad and in India has been carried out by various groups. So the present study was carried out to determine the nutritive value of crabs available in the coastal regions of Cherthala, Alappuzha and Neendakara.

Chapter 3

MATERIALS AND METHODS

3.1 Availability and location of available crabs and collection of the sample

A preliminary investigation on different species of crabs available along the kerala coast was done.Coastal regions of Neendakara,Alappuzha and Cherthala were encoded for the study.Subsequently bulk quantities of different species were bought from Neendakkara harbour and from local fishermen of Arthungal and Kanichukulangara region of Cherthala and from Alappuzha.They were brought to the laboratory and stored in deep freezer.The particular species of different samples were identified.The samples were dried at 60^0c in an oven and used for biochemical analysis.The protein carbohydrate and lipid contents were estimated.

3.2 Biochemical Analysis

3.2.1 Determination of Protein content

Total protein content was determined colourimetrically by the method of Lowry et.al. 10 mg of the dried sample was taken in a test tube, 5 ml of IN NaOH was added and allowed to stand for 24 hrs at room temperature. 0.5 ml of freshly prepared alkaline copper tartrate reagent was added followed by 0.5 ml of IN Folin-Ciocalteu phenol reagent. The contents were mixed thoroughly and allowed to stand for 20 min for colour development. The absorbance was then read at 750 mm against a reagent blank using spectronic Genesys 10.

3.2.2 Determination of carbohydrate content

Total carbohydrate content was determined colourimetrically by phenol-H_2SO_4 method (Dubois etal). To 5 mg of the sample taken in a test tube, 10 ml of 5% trichloroacetic acid was added and heated in a water bath at 80-90^{0}C for 3 hrs. After cooling to room temperature, the volume was made upto 10 ml with mill-Q water,0.2 ml of the extract was pipetted into a separate test tube and 1 ml of 5% phenol was added followed by rapid addition of 5 ml of con. H_2SO_4. Afetr cooling the contents of the tube, absorbance was measured at 490 nm against a reagent blank using UV-Visible spectrophotometer. Glucose was used as the standard and the results were expressed.

3.2.3 Determination of total lipd content

Total lipid contents were determined colourimetrically by sulphophosphovanillin method after its extraction into 2:1 $CHCl_3$:CH_3OH solvent mixture. To 50 mg of powder taken in screw capped test tube, 10 ml of 2:1 $CHCl_3$;CH_3OH solvent mixture was added . The tube was loosely capped and heated in a water bath at 60^{0}C for 30 min. After cooling the solution, the volume was made upto 10 ml with the solvent mixture 0.4 ml of the extract was pipette in separate test tube, allowed to dry completely and digested with 0.4ml of conc.H_2SO_4 by boiling in a water bath for 10 min. After cooling the tube 5 ml of phosphovanillin reagent was added and allowed to stand for 30min, for colour development. The absorbance was then measured at 520 mm against a reagent blank using UV-Visible spectrometer. Cholestrol was used as standard.

Chapter 4

RESULTS AND DISCUSSION

The samples collected from coastal areas of Neendakara, cherthala and Alappuzha were subjected to species identification and seven different species were identified.The identified species were

1.Charybdis Lucifera (Fabricus,1758)

2.Scylla Serrata (Forskal)

3.Portunus Pelagicus (Linnaeus)

4.Scylla Olivacea –Orange mud crab (Herbst 1796)

5.Charybdis Feriata Linnaeus 1758

6.Portunus Sanguinolentus (Herbst)

7.Charybdis Cruciata (Herbst)

Quantitative analysis of protein content of seven different species of crab were carried out based on the method of Lowry etal.The results showed that among the seven different species identified Scylla Serrata (Forskal) had the highest protein content (5.91mg/g).Biochemical studies on crab Scylla Serrrata by Chinnamma George and K.Gopakumar of Central Institute of Fisheries Technology Cochin also shows that Scylla Serrata is rich in protein content.Scylla Olivacea had a protein content of 3.85 mg/g whereas Charybdis Creuciata had a nearby value of 3.08mg/g. Charybdis Lucifera had a protein content value of 2.04mg/g.The protein content of Portunus Sanguinolentus was only 1.87mg/g and

that of Charybdis Feriata was 1.73mg/g.Among the seven different species Portunus Pelagicus showed the lowest value of 1.61mg/g.

Table 1: Protein content in different species of crabs

Sl.No	Sample	Protein content (mg/g)
1	Charybdis Lucifera	2.04
2	Scylla Serrata	5.91
3.	Portunus Pelagicus	1.61
4.	Scylla Olivacea	3.85
5.	Charybdis Feriata	1.73
6	Portunus sanguinolentus	1.87
7	Chaydbis Creuciata	3.08

Graph -1 Protein content in different species of crabs

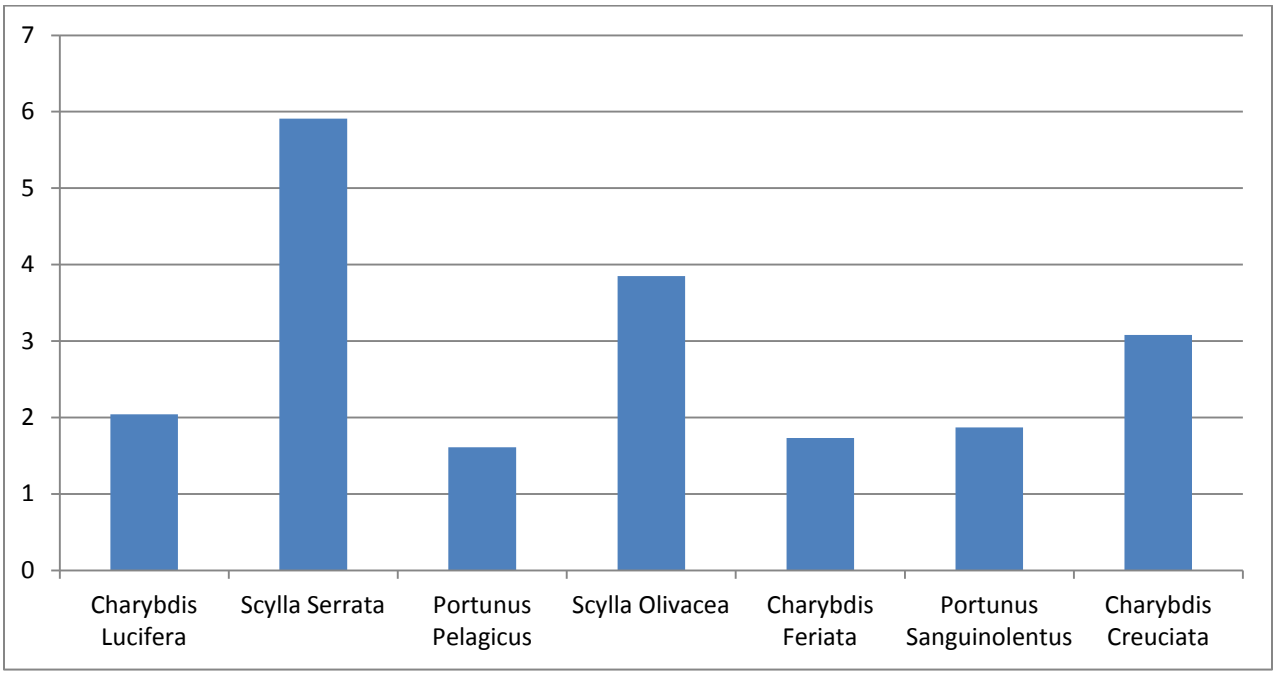
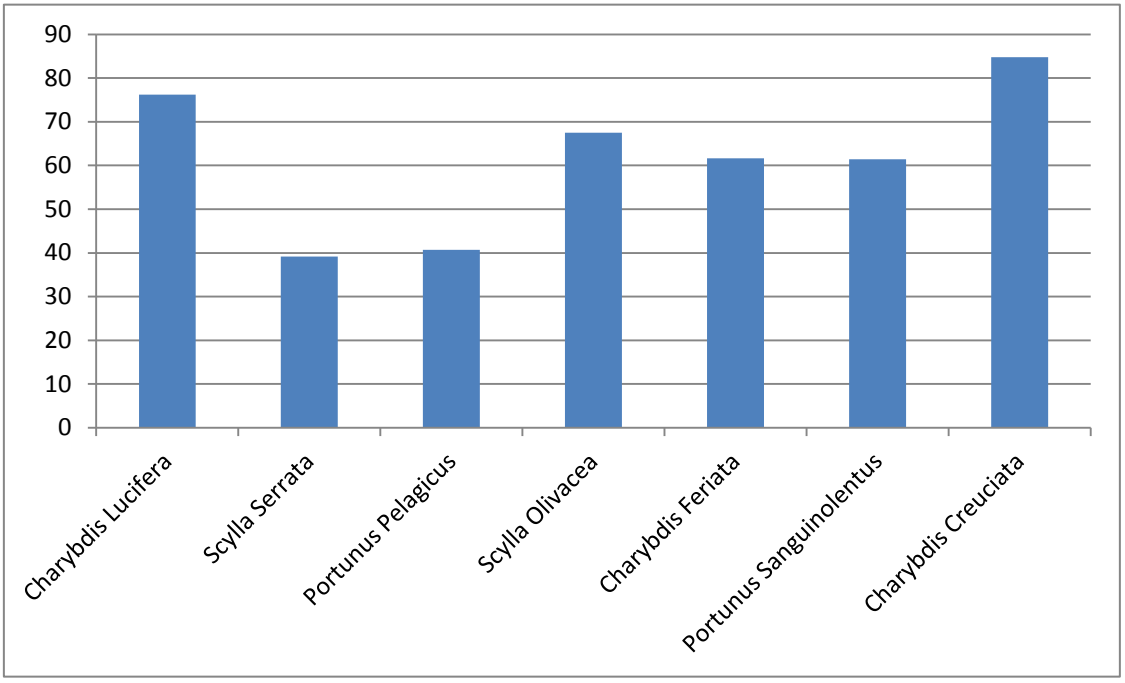


Table 2: Carbohydrate content in different species of crab

Sl.No	Sample(species of crab)	Carbohydrate content (mg/g)
1	Charybdis Lucifera	76.18
2	Scylla Scerrata	39.14
3.	Portunus Pelagicus	40.70
4.	Scylla Olivacea	67.50
5.	Charybdis Feriata	61.61

6	Portunus sanguinolentus	61.41
7	Charybdis Creuciata	84.75

Graph-2 carbohydrate content in different species of crab

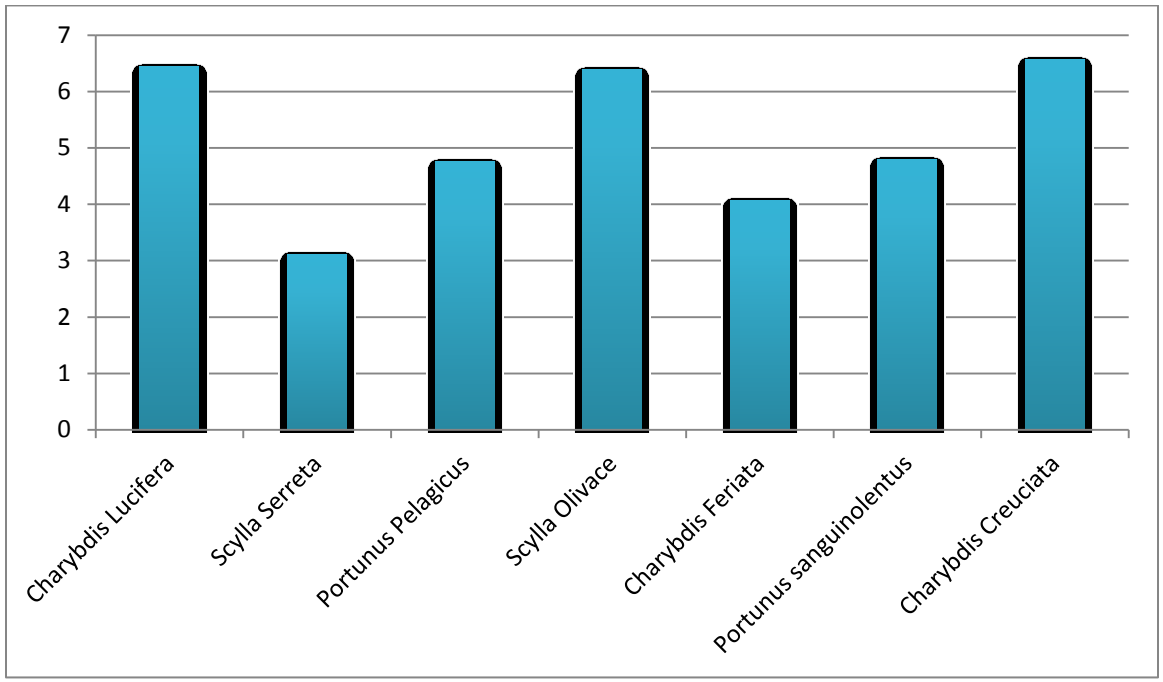


Quantitative analysis of carbohydrate content (Dubois etal 1956) of seven different samples showed that Charybdis Creuciata had the highest value of 84.75mg/g.Charybdis Lucifera had a high value of 76.18mg/g.The carbohydrate content of Scylla Olivacea was found to be 67.50mg/g.Charybdis Feriata and Portunus sanguinolentus had almost closer value of 61.61mg/g and 61.41mg/g respectively.Scylla Serrata which recorded the highest protein content was found to have the least carbohydrate content ie 39.14mg/g.

Table: 3 Total Lipid content in different species of crab

Sl.No	Sample(species of crab)	Lipid content (mg/g)
1	Charybdis Lucifera	6.44
2	Scylla Scerrata	3.10
3.	Portunus Pelagicus	4.75
4.	Scylla Olivacea	6.39
5.	Charybdis Feriata	4.07
6	Portunus sanguinolentus	4.79
7	Charydbis Creuciata	6.57

Graph 3: Total lipid content in different species of crab



Quantitative analysis of toal lipid content of seven different species by sulphophosphovanillin method showed that Charybdis Creuciata recorded the highest value of 6.57mg/g.Charybdis Lucifera and Scylla Olivacea had almost same value of 6.44mg/g and 6.39mg/g.Similarly Portunus Sanguinolentus and Portunus Pelagicus had a very close value of 4.79mg/g and 4.75mg/g.The toal lipid content of Scylla Serrata was comparatively low ie only 3.10mg/g.Chinnamma George and Gopakumar in their work also has reported that eventhough Scylla Serrata is high in protein content it has a low carbohydrate content and total lipid content.The present findings also support this observation.

Biochemical studies are very important from the nutritional point of view.Protein is essential for the sustenance of life.It exists as a largest quantity of all nutrients as a component of the human body (Okuzumi and Fujii).Due to increase in population there is an increasing demand for good quality animal protein.For this aquatic resources are extensively being exploited.Crab due to its high protein content is valuable in compensating protein malnutrition especially in children.The species Scylla Serrata which is available in this coastal area is thus proved to be a good protein diet to economically backward people of this coastal region.

Carbohydrates in fishery products mainly consists of glycogen.They also contain traces of glucose,fructose,sucrose and other monosaccharides and disaccharides (Okuzumi and Fujii 2000).The present study shows that consumption of Charybdis Creuciata is good to meet the demand for carbohydrate.

Lipids are highly efficient sources of energy and they contain more than twice the energy of carbohydrates and proteins (Okuzumi and Fujii,2000).In the present study Charybdis Creuciata was found to have high lipid value.Lipids act as a major food reserve along with protein.

Chapter 5

CONCLUSION

Ocean constitutes about 70% of the world's surface, and hence species diversity is likely to be found in ocean.Due to population explosion there is an increasing demand for good quality animal protein and other substances of nutritive value.To meet this need presently aquatic resources are being extensively exploited.

Among the decapod crustaceans crabs are an interesting group due to it's nutritional richness and being delicious.Being cheap compared to other edible crustaceans and fishes they are also affordable to economically backward coastal inhabitants of developing countries.It is very valuable in combating protein malnutrition especially in children.

Crabs are also good source of elements such as phosphours,calcium,zinc etc.They are also rich in carbohydrates,lipids,fatty acids,aminoacids etc.Certain species of crabs are also rich in Vitamin A,B,C etc.Many of these species has also therapeutic properties.

Due to the nutritional richness, nutritional value of crabs are being assessed extensively in the coastal regions of Japan,spain Canada and other foreign countries. Studies are also going on in this area in various coastal regions of India such as Marthwada region and Parangipettai region of Tamilnadu.So there is the

need for the study of nutritive value of crabs along the coastal regions of our locality.

In the present study different varieties of edible crabs were collcted from the coastal regions of Cherthala,Alappuzha and Neendakara.Identification of species showed seven different varieties.

1.Charybdis Lucifera (Fabricus,1758)

2.Scylla Serrata (Forskal)

3.Portunus Pelagicus (Linnaeus)

4.Scylla Olivacea –Orange mud crab (Herbst 1796)

5.Charybdis Feriata Linnaeus 1758

6.Portunus Sanguinolentus (Herbst)

7.Charybdis Cruciata (Herbst)

Biochemical composition of the species were studied by estimating the protein.cabohydrate and lipid contents by adopting the standard methods of Lowry etal (1951) Dubios etal (1956) and sulphophosphovanillin method (Barnes and Blackstock 1973) respectively.Quantitative analysis showed that protein content of the different species ranged from 5.91mg/g to1.61mg/g.The highest value was recorded for Scylla Seretta and lowest for Portunus Pelagicus.Quantitative analysis of carbohydrate showed that the value ranged from 84.75mg/g to 39.14mg/g.Charybdis Creuciata had the highest carbohydrate content and Scylla Seretta the lowest.Quantitative analysis of the total lipid content showed that the value ranged from 6.57mg/g to 3.10 mg/g.Charybdis Creuciata was found to have

the highest lipid content and Scylla Seretta the lowest.This study showed that among the seven different species studied Scylla Seretta is the best for meeting the protein requirement where as Charybdis Creuciata can supply much of carbohydrate and lipid.

REFERENCES

George,C and K.Gopakumar,1987,Biochemical studies on crab Scylla Serrata.Fish.Tech,24:57-61

Balasubramanian C.P.and C.Suseelan,2001,Biochemical composition of the deep water crab Charybdis smithi.Indian J.Fish.,48(3):333-335

M.Sudhakar,K.Manivannan and P.Soundrapandian,2009,Nutritive Value of Hard and Soft Shell Crabs of Portunus sanguinolentus (Herbst).International J.of Animal and Veterinary Advances,1(2): 44-48

Khan,P.A.,1992.Biochemical composition,mineral and chitin content of two portunid crabs Scylla Serrata Forskal and Portunus pelagicus available in and around the coastal regions of Bangladesh.M.Sc thesis,Institute of Marine Sciences,Chittagong University.pp:112

C.K.Radhakrishnan and R.Natarajan,1979,Nutritive value of the Crab Podothalmus vigil(Fabricus).Fish Technol,16,37-38

De-Wei Chen,Min Zhang,Sundar Shrestha,2007,Compositional Characteristics and nutritional quality of Chinese Mitten Crab (Eriocher sinensis).Food Chemistry,103,1343-1349

Ackman R.G.and C Mc Leod,1988,Total lipids and nutritionally important fatty acids of some Nova Scotia fish and shellfish food products.Can.Innst.Food Sci Technol.J.21(4): 390-398

Adeyeye E.I.,2002,Determination of the chemical composition of the nutritionally valuable parts of male and female common west African fresh water crab .Int.J.Food.Sci.Nut,53,189-196

Deniz Ayas,Yesim Ozogul,2011,The chemical composition of carapace meat of sexually mature blue crab(Callinectes sapidus) in the Mersin bay.J.of Fisheries Sciences,com,5(3):262-269

Elegbede IO and Fashina-Bombata HA,2013,Proximate and mineral composition of common crab species of Badagry Creek Nigeria.Poult Fish Wild Sci Research article2:1

Varadharajan D and Soundrapandian P,2014,Proximate composition and mineral contents of fresh water crab Spiralothelphusa hydrodroma(Herbst 1794) from Paragipettai south east coast of India.J Aquac Res Development Research Article 5:2

Nalan Gokoolu and Pynar Yerlikaya,2003,Determination of proximate composition and mineral contents of blue crab and swim crab caught off the gulf of Antalya.Food Chemistry,80,495-498