Biochemical and Nutritional Evaluation of Crab Meat

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Different species of sea crabs, *Portunus pelagicus, P. sanguinolentus, Charybdis cruciata,* and *C. lucifera* were analysed for moisture, protein, lipids, non-protein nitrogen, α amino nitrogen, carbohydrate, glycogen, fructose, ribose and minerals. The meat had high content of α amino nitrogen, ribose, phosphorus, and sodium whereas lipids, glycogen, fructose, potassium and calcium were low. Stroma protein was low in all species. Biochemical composition did not show much variation. Protein efficiency ratios except that of *P. sanguinolentus* were better than that of casein.

Key words: Crab, biochemical characteristics, nutritional characteristics

Biochemical and nutritional characteristics of many species of crabs have been studied. Seasonal variations in the biochemical composition of the meat (Chinnamma *et. al.,* 1970; Chinnamma and James, 1971) and, the biochemical differences and flavour constituents in body and claw meats of crab *Scylla serrata* have been reported (Chinnamma and Gopkumar, 1987). Heath (1970) observed variations in biochemical composition of crab *Carcinus maenas* during moult cycle. Radhakrishnan and Natarajan (1979) reported the nutritive value of the meat of *Podophthalmus vigil* and Mukundan *et. al.,* (1981) compared the nutritive and calorific value of *Scylla serrata* with those of fish and shrimp. Biochemical and nutritional qualities of four species of crabs from Indian waters are presented in this paper.

Materials and Methods

Portunus pelagicus, P. sanguinolentus, Charybdis cruciata and *C. lucifera,* were collected from the trawl catches off Cochin and brought live in seawater to the laboratory. The size groups were; *P. pelagicus* 7.0 - 14.0 cm, *P. sanguinolentus* 9.2 - 13.7 cm, *C. cruciata* 7.8 - 13 cm and *C. lucifera* 7.1 - 10.2 cm. The bigger sized animals were used in the studies. Live crabs were killed by immersing in ice-water slurry for 30 min. After thorough washing to remove adhering slime and dirt on the outer shells and legs, the claws and the carapace were removed. The carcasses were cleaned free of gut, hepatopancreas and other intestinal organs. Meat was picked from the body cavity, claws and legs was collected in a glass container kept in ice. After removing the shell particles and cartilage the meat was homogenised in a mechanical grinder and used for analysis.

Moisture, total nitrogen, non-protein nitrogen, lipids and ash were estimated by the methods of AOAC (1990). Protein fractionation was carried out by the preferential

solubility techniques, using potassium phosphate and sodium phosphate buffer of μ M 0.05 and pH 7.45 for sarcoplasmic proteins and KCl - KH_2PO_4 and Na_2HPO_4 buffer of μ M 0.5 and pH 7.5 for myofibrillar proteins at 0 - 4°C (King, 1966; Paul *et. al.,* 1966). Denatured protein was extracted using 0.1N NaOH solution at room temperature. Residue after these extractions was directly digested to estimate stroma or connective tissue nitrogen. Total salt soluble protein was determined by the method of Dyer *et. al.* (1950). α-amino nitrogen was estimated by the method of Pope and Stevens (1939), carbohydrate by anthrone method (Hassid and Abraham,1957), glycogen according to Van de Kleiy (1951), pentose by the method of Mejbaum (1939), fructose by the method of Roe (1934), and total and inorganic phosphorus by the method of Fiske and Subbarow (1925). Sodium, potassium and calcium were estimated using flame photometry.

Protein efficiency ratio (PER) was estimated by feeding albino rats by the method of Chapman *et. al.,* (1959). Casein (Sisco Laboratories, Mumbai) was used as control. Composition of control diet containing protein at 10% levels is casein 12.6, refined groundnut oil 10, vitamin mixture 1.0, salt mixture 4.0, corn starch 66.90, cellulose 5.0 and methionine 0.5%. The experimental diets were prepared by replacing casein with the corresponding quantity of dry crabmeat powder. Five male weaning albino rats with similar mean weights, housed individually were assigned to each diet. Feed and water were supplied *ad libitum.* The daily feed intake and weekly increase in body weight were recorded for 28 days.

Results and Discussion

Chemical composition of meat of different species of crabs is given in Table 1. Moisture content was in the range 80.74 - 83.33 %, total nitrogen 2.151- 2.970 %, non-protein nitrogen 0.500 - 0.680 %, α-amino nitrogen 143 - 235 mg/100g and lipids (DWB) 0.67 - 1.12 %. Carbohydrate was very low and ranged from 160 to 462.6, glycogen 59.5 to 155.3, fructose 9.1 to 25.7 and ribose 67 to 73.7 mg/100g. It is evident that crabmeat is a high protein low fat food with high content of free amino acids and minerals. Carbohydrate reserve is less compared to molluscan shellfishes

Table 1. Chemical composition of crab meat

Parameters	*P. pelagicus*	*P. sanguinolentus*	*C. cruciata*	*C. lucifera*
Moisture, %	81.570	80.850	80.740	83.330
Total nitrogen, %	2.873	2.787	2.970	2.151
Crude protein, %	17.950	17.410	18.560	13.440
Nonprotein nitrogen, %	0.580	0.680	0.500	0.550
α amino nitrogen, %	0.235	0.231	0.205	0.143
Lipids (DWB), %	0.930	0.670	0.830	1.120
Ash (DWB), %	3.060	1.590	4.250	3.720
Carbohydrate, mg %	275.800	0.166	150.000	462.600
Glycogen, mg %	109.400	65.600	59.500	155.300
Fructose, mg %	25.700	12.900	9.100	18.600
Ribose, mg %	68.100	73.700	72.700	67.000

(Chinnamma *et. al.*, 1970). Compared to other species, *C. lucifera* had higher contents of water and lipid and lower protein. Protein in the crabs studied is comparable with that of mud crab *Scylla serrata* (Chinnamma and Gopakumar, 1987). Reay *et. al.* (1943) had reported 73.6% water and 22.4% protein for crab *Cancer pagurus* and higher non-protein nitrogen.

Table 2 presents the protein fractions of crab meat. Extractability of proteins was lower in *C. lucifera* than the other three. Sarcoplasmic protein was maximum in *P. pelagicus* and minimum in *C. lucifera.* Same trend was noticed in myofibrillar fraction also. The highest level of denatured protein (15.77%) was noted in *C. lucifera* and the lowest (7.55%) in *P. pelagicus.* Stroma protein content ranged from 0.72 to 3.6% and the lowest value was in *P. sanguinolentus.*

Table 2. Protein fractions (as % of total protein) in crab meat

Protein fractions	*P. pelagicus*	*P. sanguinolentus*	*C. cruciata*	C. lucifera
Salt soluble protein	89.05	85.76	86.23	79.38
Sarcoplasmic protein	33.24	32.20	32.63	28.74
Myofibrillar protein	55.89	53.46	53.60	50.64
Denatured protein	7.55	11.23	11.38	15.77
Stroma protein	2.40	0.72	1.20	3.60

Table 3 presents the mineral contents of the crab meat. Crab meat is rich in phosphorus. Phosphorus was more in *Portunus* sp. than *Charybdis* sp. Not much variation was observed in calcium and potassium but appreciable variation was noticed in sodium. Sodium was highest in *C. cruciata* and lowest in *C. Lucifera.*

Table 3. Mineral composition of crab meat (mg/100g, DWB)

Parameters	*P. pelagicus*	*P. sanguinolentus*	*C. cruciata*	*C. lucifera*
Total phosphorus	206.6	185.0	148.7	115.0
Inorganic phosphorus	134.0	132.2	80.7	64.0
Calcium	129.0	176.2	115.5	116.6
Sodium	387.0	584.9	616.3	350.0
Potassium	184.4	258.0	157.9	166.7

PER of casein and crab proteins from three experimental species and mud crab *Scylla serrata* was evaluated. Highest PER of 3.69 was obtained for *S. serrata,* followed by *C. cruciata* (3.18), *P. pelagicus* (3.05) and *P. sanguinolentus* (2.13). PER of casein was 2.71.

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