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# FROZEN STORAGE CHARACTERISTICS OF RAW AND COOKED CRAB (*SCYLLA SERRATA*) SEGMENTS, BODY MEAT AND SHELL ON CLAWS*

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ABSTRACT

Changes in biochemical and organoleptic qualities during slow freezing and storage to —18° C in crab, raw and pre-cooked meat, segments and shell-on claws are discussed.

Cooking loss was worked out for whole crab, crab segments and claws and yield was found out for raw and pre-cooked crab and claw. Frozen storage studies indicated that in 40 weeks time the crab segments remained good to fair, whereas the cooked meat was graded fair to poor due to slight browning and flavour loss. In raw claw even though the pigment colour was changed from grey to black, the characteristic flavour was retained more than that of cooked claw.

## INTRODUCTION

THE QUALITY changes in quick frozen crab meat was reported earlier (Chinnamma, 1973). The effect of chemical glazes on keeping quality of crab meat and storage changes in cooked frozen crab meat having different pre-freezing ice storage life was also subjected to detailed investigations (Chinnamma, 1973 a; Chinnamma and Nair, 1976). Blackwood *et al.* (1969) used live crabs for processing and worked out the advantages compared to dead crabs. Varga *et al.* (1970) studied the quality loss in frozen and heat processed meat of crab (*Gergyon quinquidens*). Strasser *et al.* (1971) reported the effect of heat processing on crab meat. Paparella *et al.* (1971) studied the keeping qualities of blue crab claws.

The processing conditions for the preparation of cooked frozen crab meat and crab segments and shell on claw with a comparison to raw frozen material and its storage characteristics are reported in this paper.

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## MATERIALS AND METHODS

Live crabs *Scylla serrata* (about 120) of more or less uniform size (11-13) cm length caught from the fishing grounds off Cochin (the claws were cut off and kept separately) were brought to the laboratory. They were washed free of adhering slime and dirt. Whole lot was divided into four equal portions, one portion was cooked in boiling water for 15 minutes (Chinnamma and Nair, 1976); drained and cooled. Half of the claws was also cooked the same way, drained and cooled. Remaining three portions of crab were deshelled, cleaned properly free of gills and intestines and cut into half. One portion of crab segments was cooked as above.

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Meat was picked from one portion of raw crab and one portion of cooked crab. The material was packed in trays covered with 100 gauge polyethylene sheet as (1) raw crab segments (2) cooked crab segments (3) raw crab meat (4) cooked crab meat (5) raw crab claw and (6) cooked crab claw. All the samples were slow frozen with water glaze and stored at —18°C. At intervals of ten weeks samples were released and thawed. The frozen block was kept in a strainer over a steel tray at 0-4°C, the drip separated on thawing was simultaneously collected in the tray. The weight of the thawed material and the volume of the drip collected was determined and from the packed weight the percentage loss of weight of the frozen thawed material can be calculated. An aliquot of the drip was taken for estimating nitrogen according to Kjeldahl method.

Meat was picked from crab segments and claw of raw and cooked. All the six samples were minced well, then subjected to detailed analysis.

Moisture and protein were estimated according to the procedure of the Association of Official Analytical Chemists (AOAC) (1975). Salt extractable nitrogen (SEN) was estimated by the method of Dyer *et al.* (1950) and free alpha amino nitrogen by the method of Pope and Stevens (1939).

Organoleptic evaluation was made on the material after steaming in 2% sodium chloride solution for 10 minutes, according to the Official Methods of A.S.T.M. (1968). Samples graded below F-P were regarded as unacceptable.

## Results and Discussion

The cooking loss and meat yield obtained are represented in Table 1.

Table 1 a. *Cooking loss (%) in crab body and claw*

| | Loss of weight |
|---|---|
| Whole crab without claw .. | 10.07 |
| Crab segments .. | 16.28 |
| Crab claws .. | 22.50 |

Table 1 b. *Yield of meat from raw and cooked crab body and claw*

| | Whole weight (kg) | Meat weight (kg) | Yield (%) |
|---|---|---|---|
| Raw crab .. | 5.30 | 1.399 | 26.40 |
| Cooked crab .. | 7.45 | 1.470 | 19.72 |
| Raw claw .. | 9.39 | 4.850 | 51.60 |
| Cooked claw .. | 6.71 | 2.99 | 44.50 |

Note: Results represent to a typical series of experiment.

Appreciable change was not observed in moisture and protein contents, because of proper glazing and packaging of the product

The solubility of protein in Dyer's buffer was found to be less in pre-cooked samples, because of heat denaturation. Negligible change occurred in the soluble protein nitrogen values in cooked samples during storage, on the other hand in raw frozen samples the values showed considerable reduction during storage. According to the previous workers the protein actually involved in cold storage denaturation was actomyosin (Love, 1962; Connell, 1960, 1962; King, 1966; Awad *et al.*, 1969). According to Love and Ironside (1958) the change in salt concentration in liquid solution in the frozen fish was the agent causing changes in the solubility in Dyer's buffer and Love *et al.* (1965) suggested that changes in protein extractability were the consequence of binding together of structural protein molecules. According to Sayre and Briskey (1963), muscle protein solubility appeared to be one of the major factors affecting the juice retaining properties of the muscle.

TABLE 2. Frozen storage (−18°C) characteristics (Biochemical) of raw and cooked crab and claw

| Frozen storage weeks | | Moisture (g%) | Protein (g%) | SEN (mg%) | F.A.—$NH_2N$ (mg%) | Thawed yield (g%) | TN in drip (mg%) | Drip colour |
|---|---|---|---|---|---|---|---|---|
| | 1 | 82.50 | 15.50 | 2252 | 285.4 | 96.80 | 161 | Grey |
| | 2 | 80.98 | 17.30 | 650 | 138.5 | 92.51 | 280 | Cloudy white |
| | 3 | 81.50 | 16.16 | 2253 | 309.0 | 93.85 | 210 | Grey |
| 0 | 4 | 80.70 | 17.68 | 670 | 181.5 | 86.50 | 397 | Cloudy white |
| | 5 | 81.30 | 15.40 | 1726 | 286.4 | 96.80 | 38 | Grey |
| | 6 | 79.50 | 17.96 | 690 | 224.5 | 97.50 | 21 | Pink |
| | 1 | 83.05 | 15.05 | 2218 | 283.6 | 94.06 | 244 | Grey |
| | 2 | 80.78 | 17.24 | 546 | 136.6 | 90.93 | 392 | Cloudy white |
| | 3 | 80.56 | 16.36 | 2253 | 301.0 | 90.84 | 297 | Grey |
| 10 | 4 | 80.07 | 17.42 | 616 | 171.5 | 80.81 | 508 | Cloudy white |
| | 5 | 80.81 | 15.23 | 1526 | 276.6 | 93.20 | 41 | Grey |
| | 6 | 78.27 | 17.76 | 658 | 220.6 | 94.64 | 25 | Pink |
| | 1 | 82.28 | 15.05 | 1952 | 246.4 | 94.62 | 256 | Grey |
| | 2 | 81.28 | 16.27 | 854 | 120.4 | 90.20 | 323 | Cloudy white |
| | 3 | 80.95 | 15.75 | 1960 | 260.4 | 95.98 | 192.5 | Grey |
| 20 | 4 | 79.46 | 17.15 | 742 | 100.8 | 75.08 | 613 | Cloudy white |
| | 5 | 82.33 | 14.43 | 1232 | 212.8 | 87.54 | 132 | Black |
| | 6 | 78.72 | 18.46 | 686 | 198.8 | 95.01 | 25 | Pink |
| | 1 | 82.10 | 15.16 | 1652 | 244.1 | 93.65 | 270 | Grey |
| | 2 | 81.05 | 16.72 | 840 | 124.5 | 91.10 | 365 | Cloudy white |
| | 3 | 80.60 | 15.96 | 1700 | 259.0 | 90.00 | 230 | Grey |
| 30 | 4 | 78.80 | 17.85 | 792 | 102.0 | 76.80 | 670 | Cloudy white |
| | 5 | 81.80 | 15.10 | 1142 | 208.0 | 88.10 | 152 | Black |
| | 6 | 78.40 | 18.96 | 672 | 196.2 | 93.50 | 31 | Pink |
| | 1 | 81.80 | 15.76 | 1470 | 240.5 | 93.10 | 291 | Grey |
| | 2 | 80.70 | 17.05 | 810 | 116.5 | 90.08 | 404 | Cloudy white |
| | 3 | 80.50 | 16.10 | 1500 | 254.5 | 89.50 | 284 | Grey |
| 40 | 4 | 78.50 | 17.50 | 790 | 99.8 | 75.40 | 690 | Cloudy white |
| | 5 | 81.40 | 15.90 | 1100 | 206.5 | 87.00 | 171 | Black |
| | 6 | 78.60 | 18.70 | 650 | 198.5 | 93.10 | 51 | Pink |

NOTE :—Results represent average of 3 series of experiments.

1 : raw shell on crab ; 2 : cooked shell on crab ; 3 : raw crab meat ; 4 : cooked meat ; 5 : raw claw ; 6—cooked claw.

TABLE 3. *Organoleptic characteristics of frozen crab and claw* (Scylla Serrata) *both raw and cooked*

| Frozen storage weeks | | Colour | Texture | Flavour |
|---|---|---|---|---|
| | 1 | Good | Soft & firm | Good |
| | 2 | Good | Do. | G-F |
| | 3 | Good | Do. | Good |
| 0 | 4 | Good | Do. | Good |
| | 5 | Characteristics grey | Firm | Good |
| | 6 | Pinkish | Firm | Good |
| | 1 | Good | Soft & firm | Good |
| | 2 | Good | Do. | G-F slight loss of sweetnesss |
| | 3 | Good | Do. | G-F slight loss of characteristic sweet flavour |
| 10 | | | | |
| | 4 | Good | Firm | G-F characteristic flavour |
| | 5 | Good | Firm | F slight loss of characteristic flavour |
| | 6 | Good | Firm | Do. |
| | 1 | G-F | Soft & firm | G-F |
| | 2 | F | Slight hard | F |
| | 3 | F-white | Soft | G-F |
| 20 | 4 | Slight yellow | Fibrous | F |
| | 5 | Slight black | Firm | G-F |
| | 6 | Pinkish | Slight tough | G-F |
| | 1 | G-F | Soft & firm | G-F |
| | 2 | F | Slight hard | F |
| | 3 | F-white | Soft | G-F |
| 30 | 4 | Slight brownish | Fibrous | F |
| | 5 | Black | Granular | F |
| | 6 | Pink | Granular | F |
| | 1 | Fair | Soft | G-F |
| | 2 | F-P | Slight hard | F |
| | 3 | F | Soft | F |
| 40 | 4 | F-P slight brown | Fibrous | F-P |
| | 5 | Black | Granular | F |
| | 6 | Pink | Slight tough | F-P |

NOTE :—Sensory evaluation of a typical series of experiment.

1 : raw shell on crab ; 2 : cooked shell on crab ; 3 : raw crab meat ; 4 : cooked crab meat ; 5 : raw claw ; 6: cooked claw ; G-F=good to fair ; F=fair, F-P=Fair to poor.

Free alpha amino nitrogen values showed wide variation between raw and pre-cooked samples, the loss can be accounted for the loss due to cooking. During frozen storage in both raw and pre-cooked samples gradual reduction was found in amino nitrogen values, but the rate was more in pre-cooked samples. Nitrogen content in drip of all samples recorded a steady increase during storage. Drip loss was minimum in claw owing to the protection by the shell and maximum in pre-cooked crab meat. This finding is in agreement with that of Gangal and Magar (1963). The rate of decrease in thawed yield also was more in pre-cooked crab meat. In 20 weeks time the drip colour of raw claw was changed to black, in others much discolouration was not observed. The organoleptic characteristics (Table 3) showed that the raw frozen samples retained much of the flavour bearing constituents ; in raw claw the characteristic colour of the pigment was changed to slight black after 20 weeks storage, corresponding to the change in the drip colour. In 40 weeks time the shell on crab remained as good to fair, whereas the pre-cooked meat was graded as fair to poor. In raw claw, eventhough the pigment colour was changed from grey to black, the characteristic flavour was retained, more than that of cooked claw. In cooked crab meat slight browning was observed during storage probably due to sugar amino reactions. Tarr and Bisset (1954) and Jones (1962) reported about the possibility of sugar amino reactions in processed fishery products leading to unpleasant taste and smell.

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