Water Imbibition and Thawing Losses from Frozen Prawn Meat

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Prawn meat which was never in contact with ice or water prior to freezing was frozen at –30°C and was studied upto six months of storage at –23°C for thawing losses and cooked characteristics of the thawed material. Thawing loss was nil in unwashed samples after three days of storage and it gradually increased to 6.6% after 6 months compared to 6.0 and 18.2% in the washed samples during the same periods. It is inferred that the high thawing losses observed in commercial frozen prawn meat immediately after freezing may be mainly an after effect of the water imbibed during the prefreezing stages. During frozen storage, the changes in texture observed by sensory methods on the cooked product were more in the washed sample indicating that the imbibed water or constituents washed out of the tissue play an important role in textural changes in prawn meat during frozen storage.

Thawing loss from commercial frozen prawn meat is heavy and its prevention by treatment with phosphates was studied by Mathen (1968, 1970a, 1970b) and Mathen & Pillai (1970). It is generally observed that frozen prawn meat of commerce suffers extensive thawing loss, averaging 10%, even within short frozen storage periods. It has also been shown that the raw as well as frozen prawn meat available in the industry has low dry matter content(Mathen,1983;Mathen *et al.*, 1986). Thus it was assumed that the water imbibed by prawn meat during the prefreezing stages might be an important factor determining the extent of thawing loss. To verify this, unwashed and uniced prawn meat was frozen and thawing losses were studied during frozen storage in comparison with washed prawn meat and the results are presented in this communication.

Materials and Methods

Prawns *(Penaeus indicus)* caught by country crafts off Cochin and landed uniced were used. In the laboratory, they were washed, drained and hand peeled. The meat was divided into two lots of 1100 g each. One lot was washed in running potable water at room temperature (28–30°C) and drained. From each lot one by eleven part by weight was used for determination of dry matter content by drying to constant weight at 103±2°C. The rest of the material from each lot was divided into five equal portions by weight. Each portion was packed in a polythene bag and was frozen at -30°C. At the time of freezing the prawns were in post rigor stage and 300 pieces made up a kg. The frozen prawns were stored at-23°C and one bag each from each lot was withdrawn after 3, 10, 60, 120 and 180 days of storage. Each bag was placed at room temperature till thawed. The thawed prawns were drained in a glass funnel placed over a measuring cylinder. When no more drop of drip tickled in 2 min, the volume of drip was noted and the prawns were weighed. One half quantity of the thawed meat was cooked in boiling 3% sodium chloride solution for 3 min, drained and weighed. The sensory characteritstics, especially texture, colour and flavour were assessed by a panel of three experienced members. The other half of the meat was used for dry matter determination.

Results and Discussion

The washed and drained lot weighed 1125 g, increase in weight being 2.2% over the original. The dry matter contents of the two

Table 1. *Changes in the characteristics of washed and unwashed frozen prawn meat during storage at -23°C*

Storage time (days)	Thawing loss[1] (1)	(2)	Drip volume[2] (1)	(2)	Dry matter[3] (1)	(2)	Cooking loss[3] (1)	(2)	Sensory characteristics of the cooked material
3	0.0	6.0	0.0	5.0	23.4	19.6	25.0	33.0	(1) Just like cooked fresh prawns
10	0.0	6.5	0.0	6.5	23.2	19.6	25.0	33.0	(2) Less sweet, slight tough
60	2.0	16.5	1.0	16.0	24.1	21.5	26.8	21.7	(1) Just like, previous colour deeper. (2) Texture more tough, less sweet
120	4.0	16.0	2.0	15.5	24.8	21.7	22.2	22.0	(1) Almost like cooked fresh prawn in texture, difference in flavour slight, very deep colour
180	6.0	18.2	3.5	17.5	25.1	22.7	15.2	26.0	(2) Texture more tough, very less sweet.

1 = as % of material frozen
2 = as ml/100g material frozen
3 = as % of thawed material
(1) = unwashed
(2) = washed

lots were 23.4 and 19.0% after treatments. The apparent loss in dry matter by washing was 4.4% and the actual 4.0%.

The results of the analysis of the samples during frozen storage are presented in Table 1. These results show that thawing loss from unwashed prawn meat is lower at all intervals. Initially the thawing losses are 0.0 and 6.0% which increase to 6.6 and 18.2% after six months of frozen storage. Changes in the volume of drip also follow the same trend. The minimum changes in texture is in the unwashed sample whereas the washed one shows gradually increasing toughness. The negative score for the unwashed sample is for colour. Cooking loss is lower in the unwashed sample and it remains almost constant upto 60 days and decreases thereafter. The dry matter is also higher in the unwashed one. The levels of dry matter show an apparent increase with storage time. The decreasing cooking loss and increasing dry matter contents are the result of incresing thawing losses with storage time. Considering the prefreezing treatment given, the results show that the water imbibed or the components washed out prior to freezing causes the thawing loss and textural changes during freezing and frozen storage.

Washing or icing of prawn meat causes the removal of outer slime, dissolution of sarcoplasmic proteins, other nitrogenous constituents and removal of some of the inorganic materials like phosphates. Any one or all of these may contribute to thawing losses in varying degrees. But water content is the largest component in quantity. The increased water level due to absorption may cause imbalance of the solids/protein: water ratio in the tissue and may contribute to the denaturation of the myofibrillar proteins and resultant thawing loss and increasing toughness during frozen storage.

Previous studies on thawing loss from prawn meat have shown that it increases with smaller size, longer prefreezing ice storage period and removal of shell(Mathen & Pillai, 1970). Shenouda (1980) has reviewed the studies on shelf stability of frozen fish. It is shown that protein in lean fish (less than 1% lipids) denature more rapidly than that of fatty species (10% lipids) and it was shown that moderate levels of intact fish lipids pro tect protein against denaturation. It is also shown that moderate levels of intact lipids enhance denaturation when the pressure exerted by the ice crystals cause breakdown of tissue structure allowing for interactions between different proteins and lipids