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Frozen Storage Characteristics of *Oratosquilla nepa*

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The stomatopod, *Oratosquilla nepa* was quick frozen as whole and as meat at -40°C and stored at -18°C. The shelf life was evaluated by following biochemical, physical and organoleptic changes that occurred during storage. Total bacterial count was found to show a progressive fall for 3 months. Trimethyl amine values were found to decrease after 6 months of storage. Highest values for total volatile nitrogen were observed after 6 months of storage. Organoleptic quality was acceptable up to 5 months. Frozen squilla stored for 5 months can be used for further processing into value added products.

Key words: ***Oratosquilla nepa*, frozen storage, shelf life.**

Squilla (*Oratosquilla nepa*) is available as a bycatch of shrimp trawlers. The quantity available is substantial, but most of it is discarded at sea because there is very little use for this species. Utilization of this stomatopod for human consumption has not yet begun to any significant extent. The limited meat content of squilla is a major disadvantage in its proper utilization.

Madhavan & Nair (1975) have developed a method for production of chitosan from squilla. Garg *et al.* (1977) had adopted a simple procedure for the preparation of protein from squilla without the addition of chemicals. Moorjani *et al.* (1978) have reported the importance of chitosan having high viscosity as a valuable by-product from squilla. Ahamad & Mohammed (1985) compounded feeds for the culture of penaeid prawns from prawn waste and squilla. Lekshmy *et al.* (1985) studied the nutrional quality of squilla.

Because of the low economic importance of the species very little work has been done on its storage characteristics. The new emerging trends indicate that *O. nepa* may gain more importance in the coming years. In this context, data on the shelf life and storage characteristics of this species under different conditions are useful. The present paper reports the quality changes in frozen-stored *O. nepa* and assesses its shelf life.

Materials and Methods

Fresh samples of *O. nepa* were obtained from the trawlers operating in Cochin waters. The samples were kept in ice from the time of catch till they were used for the experiment, the duration not exceeding 4 h. They were brought to the laboratory and washed thoroughly with chlorinated potable water and graded. Mature specimens (7-12 cm size, Rajeswari, 1996) were packed in polythene bags and block frozen with glaze in plate freezer at -40°C and then stored. Initial samples were taken from the landed squilla without washing.

For estimating the yield of meat, washed fresh squilla was kept in ice for 18 h. The extraction of meat after this temporary storage in ice was found to be easier and more efficient (Rajeswary, 1996). Meat was extracted by cutting with a pair of scissors on the side from the abdominal region upto the 5th thoracic region. This was adopted as the best method for manual extraction of the meat because a higher yield was obtained through this method. In the case of frozen-stored samples, thaw drip was estimated by thawing the samples at room temperature and recording the weight loss. Whole squilla as well as the meat were analysed for proximate composition (moisture, protein, crude fat and ash) by standard methods (AOAC, 1975). Sodium and potassium were estimated by the method of AOAC (1970) using flame photometer (Elico model 26 D). Carbohydrate was estimated by the phenol sulphuric acid method (Dubois *et al.* 1956). Trimethyl amine (TMA) and total volatile nitrogen (TVN) of squilla meat were determined as per the method of Conway (1947).

Whole squilla was used for microbiological analysis. Total bacterial count was determined by standard plate count method using tryptone glucose beef extract agar and incubation at 37°C for 48 h. *Escherishia coli* was determined using tergitol 7 agar and coagulase positive staphylococci with Baird Parker agar. Salmonella was determined as per the method recommended by AOAC (1975). Organoleptic characteristics of *O. nepa*, cooked in 1% NaCl for 10 min was assessed by a 10 member trained panel and the scoring was done using a 10 point hedonic scale, 10 being very good; 1, being bad; and 4, just acceptable. In addition, an examination of the uncooked samples was conducted by the panel (Anon, 1986) to study the extent of changes.

Results and Discussion

The yield of squilla meat from whole squilla was 20%. The proximate compositions of whole squilla and squilla meat are given in Table 1. As in other crustacea, carbohydrate level was high in squilla.

Table 1. Proximate composition of *Oratosquilla nepa*

	Whole	Flesh
Moisture (%)	78.22	82.75
Protein (% DWB)	44.57	68.31
Fat (% DWB)	2.86	3.12
Ash (% DWB)	27.61	11.88
Carbohydrate (% DWB)	2.29	2.55
Sodium (mg%)	54.33	98.4
Potassium (mg%)	65.39	88.18

DWB: Dry weight basis

Fig. 1 shows the variations in the yield of thawed material during frozen storage. In the initial stages, the loss in yield was comparatively low. After frozen storage for two months, the loss increased. Mathen & Thomas (1987) reported that loss during thawing of prawns was 0-6%

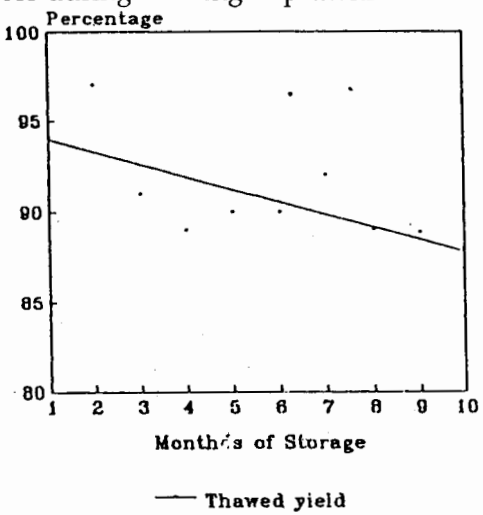

Fig. 1. Yield of thawed meat from *Oratosquilla nepa* during frozen storage.

initially which increased to 18.2% after 6 months of frozen storage. George *et al.* (1990) have reported that weight loss during thawing of frozen *Scylla serrata* increased progressively with increase in storage time. The trend observed in *O. nepa* was similar to the above observations for other crustaceans.

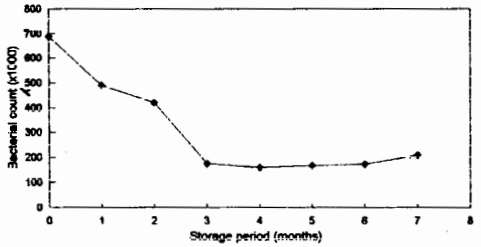

Fig. 2. Changes in the Toal Bacterial Count of *Oratosquilla nepa* during frozen storage.

Changes in the total bacterial count of *O. nepa* are given in Fig. 2. High total bacterial count was noticed in fresh squilla before washing. This may be due to its burrowing nature in the mud at the sea bottom and the likelyhood of high bacterial load on the body surface. There was a progressive fall in the bacterial count during the first three months of storage. But after 4 months it increased slowly. Shaikhmahamad & Magar (1965) noticed a slow and steady increase of total bacterial count in frozen prawns after 5 months of frozen storage. Though *E. coli* was present in the initial sample, it was absent in the samples analysed after freezing. Staphylococcus and salmonella were not present in the beginning or during the course of the study.

The extent of change in the levels of TMA and TVN of *O. nepa* is presented in Fig. 3. TMA was not present in the fresh sample and a gradual increase in the TMA values was observed in *O. nepa* during six months of frozen storage. The values were found to decrease from then till the end of the study. TVN was found

Table 2. Changes in the organoleptic score of *Oratosquilla nepa* during frozen storage

	Storage period (months)										
Raw samples	0	1	2	3	4	5	6	7	8	9	10
Appearance	7	7	7	7	7	6	4	3	3	3	3
Odour	7	7	7	7	7	6	4	3	3	3	3
No. of dehydrated pieces	-	-	-	-	-	-	-	-	-	3	5	8
No. of discoloured pieces	-	-	-	2	1	-	1	2	5	9	9
No. of deteriorated pieces	-	-	-	-	-	-	2	3	6	7	7
Pieces with black spot	-	-	-	-	-	3	3	2	5	8	7
Overall score	7	7	6	6	5	5	4	3	2	1	1
Cooked samples											
Texture and appearance	7	7	6	6	5	5	4	3	2	2	1
Odour and flavour	7	7	6	5	5	5	3	2	1	1	1
Overall score	7	7	6	6	5	4	3	2	1	1	

to reach highest level by six months and after that the values came down.

Table 2 shows the changes in the organoleptic qualities of *O. nepa* during frozen storage. The raw samples maintained fresh appearance and odour for 5 months. Texture was moderately tough as in fresh squilla till the 6th month of frozen storage and thereafter the meat became softer. Off odour developed after the 5th month of storage. Dehydration was observed by the 8th month and discoloured pieces were noticeable by the 3rd month. The main type of discolouration noticed was the darkening of the shell in patches, at the dorsal region. Probably these patches can be the initial stages of the black spot formation. Pieces with black spots were

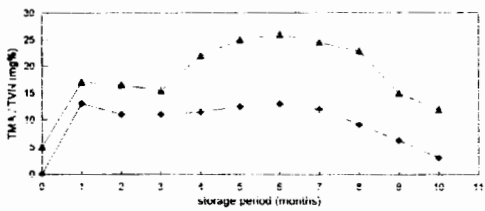

Fig. 3. Changes in trimethylamine and total volatile nitrogen during frozen storage of *Oratosquilla nepa*.

noticeable from the 5th month onwards. The cooked samples were acceptable to the panel upto 5 months. The cooked meat of squilla has a moderately rigid texture, slightly inferior to cooked prawns. Odour, flavour and sweetish taste of cooked squilla were similar to those of prawns. Slight deterioration in the physical characteristics of the cooked meat was noticeable after 5 months, especially the odour and flavour. This indicated a shorter shelf life for squilla when compared with prawns under frozen conditions (Pillai *et al.*, 1961; Lekshmy & Govindan 1962).

The present investigation show that freshly frozen *O. nepa* remains in good condition for about 5 months. This stored material can be utilised for the development of value added products. The reasonably long shelf life is an advantage in the better utilization of this resource.

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