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Iced and Frozen Storage Characteristics of Cultured *Chanos Chanos* (FORSKAL)

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Freshly harvested milk fish *(Chanos chanos)* were stored in crushed ice and their storage life estimated by following biochemical, bacteriological and organoleptic changes occurring during storage. Samples of the fish were withdrawn at various intervals of storage, quick frozen, glazed and held in frozen storage at-18°C. Shelf-life in frozen storage was determined in relation to period of ice storage prior to freezing by determining biochemical and organoleptic characteristics upto 30 weeks.

Milk fish, *Chanos chanos* (Forskal) occur throughout the Indo-Pacific area. The adult fish generally live and spawn in the open sea. But their fry, fingerlings and even juveniles are found in the brackish water regions. Even though milk fish do not form a significant marine fishery, they constitute a good estuarine fishery. They are also one of the most suitable species for brackish water fish culture because of their vast adaptive powers to wide variations in the living medium, abundant occurrence and fast growth. They are widely spread in peninsular India from Orissa and Andhra coasts in the east to Karnataka coast in the west and around Andaman and Lakshadweep.

Out of the nearly 2 million hectares of brackish waters available in India, 2.6 lakhs hectares could be converted into salt water fish ponds, even though at present only a very insignificant area is being utilized as well-organised fish ponds. It is estimated that 800 million *Chanos* fry can be successfully reared in a year if all the culturable area mentioned above is utilized (Tampi, 1973). This works out to a potential yield of 4 lakh tonnes of chanos per annum, assuming that the fish grows to an average weight of 500 g.

Such increases in the resources of the fish call for development of proper post-harvest technology so that the fish is put to maximum economic utility. Frozen storage studies of fresh water fishes like *Labeo rohita, Catla catla, Cirrhina mrigala, Labeo calbasu, Mystus seenghala* and *Wallago attu* have been reported by Devadasan *et al.* (1978). Factors affecting keeping quality of *Barbus carnaticus, Barbus dubius, Labeo sp., Ophiocephalus* and *Wallago attu* (Lahiri *et al.*, 1963), *C. mrigala* (Nair *et al.*, 1971) and *C. catla, L. rohita, C. mrigala, L. calbasu* and *B. carnaticus* (Nair *et al.*, 1974) during chilled storage have also been studied. But so far no research has been carried out on the preservation of our major brackish water fishes. Hence it was thought of interest to study the proximate composition, iced and frozen storage characteristics of *Chanos chanos* (Forskal), a variety widely cultured in all brackish water fish farms as well as occurring in large quantities in the back-waters, estuaries and brackish water lakes of the country.

Materials and Methods

Chanos chanos, freshly harvested from the Narakkal brackish water fish farm of the Central Marine Fisheries Research Institute, Cochin, were iced immediately and brought to the laboratory within four hours of removal from water. The fish weighed 809 g on an average and were used in these studies after cleaning in tap water. The muscle was analysed in the fresh condition for moisture, crude proteins, fat, ash, acid insolubles and non-protein nitrogen (NPN) by the methods of AOAC (1955). Sarcoplasmic and myofibrillar proteins were determined by the method of King (1966), prolamine by the method of Green & Hughes (1962), stroma proteins by the method of Sayre (1968), sodium, potassium and calcium by flame photometry

(Vogel, 1961), alpha amino nitrogen by the method of Pope & Stevens (1939), ribose by Mejbam's method (1939), fructose by method of Rae (1934), glycogen by method of Kleiy (1951) and phosphorus by the method of Fiske &Subba Row (1925).

The whole fish were stored in an insulated box in crushed ice in 1:1 proportion with replenishment of ice. Samples were drawn at intervals of 0, 4, 7, 10, 14 and 18 days and analysed for moisture, total nitrogen (TN), NPN, peroxide value (PV), salt soluble nitrogen (SSN), standard plate count (SPC) and overall organoleptic quality. On each day of sampling, representative samples were quick frozen, glazed, packed in polythene sheets and stored at-18°C. Samples from frozen storage were drawn and analysed at intervals of 2, 11, 20 and 30 weeks for moisture, TN, NPN, SSN, PV and organoleptic quality.

Table 1. *Proximate composition and protein fractionation of the fresh muscle*

Moisture %		:	71.69
Crude protein (TN x 6.25) %		:	24.06
Proteins % (TN-NPN)x 6.25		:	20.47
Sarcoplasmic proteins (% of proteins)		:	34.52
Myofibrillar proteins (% of proteins)		:	52.36
Prolamines (% of proteins)		:	1.96
Stroma protein %		:	0.71
Non-protein nitrogen mg/100 g		:	560
Free alpha amino nitrogen mg/100 g		:	140
Ether extractables %	(O.W.B.)	:	3.510
Ash %	(O.W.B.)	:	1.460
Acid insolubles %	(O.W.B.)	:	0.046
Potassium mg/100 g	(O.W.B.)	:	307
Sodium mg/100g	(O.W.B.)	:	61
Calcium mg/100 g	(O.W.B.)	:	190
Ribose mg/100g	(O.W.B.)	:	559
Fructose mg/100 g	(O.W.B.)	:	12
Glycogen mg/100 g	(O.W.B.)	:	117
Phosphorus mg/100 g	(O.W.B.)	:	202

Results and Discussion

Results of analyses of the fresh fish muscle are presented in Table 1. Changes occurring in the fish muscle during ice storage are shown in Table 2. Moisture content gradually increased from 71.69 to 73.64% in the course of 18 days. TN showed a gradual decrease from 3.726 to 3.418%. This is in full agreement with the trend observed in all the references cited earlier. Organoleptically the fish were in excellent to good condition for 4 days and in fair condition for 10 to 14 days in ice, after which the eating quality deteriorated considerbly. Toughening of texture and loss of juiciness and characteristic flavour were the main symptoms of deterioration. Of course, the fish were on the border line of acceptability for about another week, though definitely much inferior in quality and hence not at all comparable with those stored in ice for less than two weeks.

Changes in moisture contents of the muscle during frozen storage are shown in Table 3. The trend is the same as observed in the case of the other fishes studied earlier, that is, a gradual decrease along with increase in storage period. The changes in TN during frozen storage (Table 4) are not significant. Changes in NPN (Table 5) during frozen storage show some interesting trend. In general, an increase is observed upto 11 weeks of storage with a drastic fall when analysed in the 20th week. This fall may be attributed to the drip loss while thawing due to prolonged frozen storage, which invariably occurs in such cases. Changes in SSN during frozen storage are presented in Table 6. Gradual fall in these values are observed along with storage period due to denaturation of proteins. Table 7 indicates the changes in PV during frozen storage. As is to be expected, a gradual increase in the values is observed during frozen storage due to oxidation of the fat. Organoleptic changes occurring in the fish muscle during frozen storage are presented in Table 8. The broad observations are that the frozen storage life of the freshly frozen fish is 30 weeks, that of fish stored in ice for 4 days prior to freezing is 20 weeks, that of fish held in ice for 7 days and then frozen is 11 weeks, that of fish stored in ice for 10 days before freezing is 2 week and that of

Table 2. *Changes in muscle during storage in ice*

Storage period days	Moisture %	TN %	NPN %	PV ml N/500 thio/g fat	SSN % of TN	SPC/g	Overall quality
0	71.69	3.726	0.560	0	67.57	764	Excellent
4	72.01	3.616	0.532	10.86	65.47	11,330	Good
7	72.45	3.584	0.504	12.32	64.62	97,970	Fair to good
10	72.21	3.506	0.560	12.14	61.94	252,300	Fair
14	72.68	3.520	0.588	23.88	60.64	55,630	Fair
18	73.64	3.418	0.560	22.12	58.16	—	Fair to poor

Table 3. *Changes in percentage moisture contents during frozen storage*

No. of days in ice before freezing	Initial value (before freezing)	Period of frozen storage in weeks			
		2	11	20	30
0	71.69	71.30	71.23	70.92	70.82
4	72.01	71.10	70.18	70.01	70.23
7	72.45	71.89	70.94	71.21	70.89
10	72.21	71.17	71.16	70.85	71.08
14	72.68	72.23	71.52	70.12	—
18	73.64	—	—	—	—

Table 4. *Percentage change in total nitrogen contents during frozen storage*

No. of days in ice before freezing	Initial value (before freezing)	Period of frozen storage in weeks			
		2	11	20	30
0	3.726	3.780	3.612	3.706	3.672
4	3.616	3.790	3.558	3.631	3.605
7	3.584	3.504	3.536	3.712	3.482
10	3.506	3.613	3.436	3.501	3.382
14	3.520	3.413	3.591	3.602	3.435
18	3.418	3.502	3.282	3.481	3.372

Table 5. *Percentage changes in non-protein nitrogen contents during frozen storage*

No. of days in ice before freezing	Initial value (before freezing)	Period of frozen storage in weeks			
		2	11	20	30
0	0.560	0.610	0.752	0.488	0.5282
4	0.532	0.506	0.821	0.392	0.4106
7	0.504	0.701	0.662	0.336	0.3914
10	0.560	0.656	0.608	0.426	0.4118
14	0.588	0.412	0.524	0.492	0.4804
18	0.560	—	—	—	—

Table 6. *Percentage changes in salt soluble nitrogen (% of total nitrogen) contents during frozen storage*

No. of days in ice before freezing	Initial value (before freezing)	Period of frozen storage in weeks			
		2	11	20	30
0	67.57	64.27	63.39	61.40	50.34
4	65.48	58.15	62.79	58.16	47.37
7	64.62	62.22	57.91	49.56	46.35
10	61.94	59.56	56.22	53.64	—
14	60.44	52.81	48.16	—	—
18	58.16	—	—	—	—

Table 7. *Changes in peroxide value (ml N/500 thiosulphate/g of fat) in muscle during frozen storage*

No. of days in ice before freezing	Initial value (before freezing)	Period of frozen storage in weeks			
		2	11	20	30
0	0	12.82	17.18	18.12	26.28
4	10.86	15.78	21.52	...	24.12
7	12.32	18.24	33.19	26.15	23.82
10	12.14	16.80	26.15	31.15	22.11
14	23.88	20.50	56.38	...	...
18	22.12	38.16	...	...	...

Table 8. *Changes in organoleptic characteristics during frozen storage*

No. of days in ice before freezing	Initial quality	Period of frozen storage in weeks			
		2	11	20	30
0	Excellent	Good	Good	Fair	Fair to poor, acceptable, less juicy
4	Good	Good	Good	Fair	Poor
7	Fair to good	Fair to good	Fair	Poor	Poor
10	Fair	Fair	Poor	...	...
14	Fair	Fair to poor, acceptable	Poor, not juicy, rancid	...	...
18	Fair to poor	poor	...	...	...

fish held in ice for 14 days prior to freezing is less than 2 weeks. Border lines of acceptability are reached after these time intervals in frozen storage. Though the fish do not become totally unacceptable after these periods, eating qualities are adversely affected. Thus *Chanos chanos,* freshly harvested from fish farms could be held in edible condition in crushed ice for 12 to 14 days. The fish held in ice for different periods ranging from 0 to 14 days and then frozen, showed shelf lives of less than 2 to 30 weeks at-18°C in an inverse relation to the period of storage of the fresh fish in ice.

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