Studies on Iced Storage of Common Murrel *(Channa striatus)*

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The iced storage characteristics of common murrel *(Channa striatus)* have been studied. The non-protein nitrogen and alpha amino nitrogen in the muscle of the fish decreased during iced storage and the total volatile base nitrogen at the end of iced storage was not high even though the fish became unacceptable during the period. There was steep decrease in total bacterial count during initial storages of storage and then increased steadily on further storage. The fish remained in acceptable condition for 8 to 9 days in ice.

Fresh fish is susceptible to rapid spoilage in the high ambient temperature of the tropics. It has been reported that tropical fish when held under ice have varying shelf-life depending upon the species (Poulter & Linda, 1985; Carol *et al.*, 1980, 1981a, 1981b; Disney, 1976; Disney *et al.*, 1971 and Nair *et al.*, 1971). Disney *et al.* (1971) have suggested that many tropical fish have longer shelf–life when stored in ice compared to fish from temperate waters. Recently Bandyopadhyay *et al.* (1985) observed iced storage shelf life of 13–24 days for 5 species of freshwater fishes from Orissa. This work reports the iced storage shelf-life of common freshwater murrel *(Channa striatus)*.

Materials and Methods

Live murrels were collected from the freshwater fish ponds at Narakkal, near Cochin in July, 1983 (batch I) and in March, 1984 (batch II). The fish samples weighed from 125 to 250 g. In the laboratory, the fish were killed by giving a blow on the head. The murrels were then washed well in potable water and stored in crushed ice (1:1) in thermocole insulated boxes with replenishment of ice daily. The fish were subjected to detailed examination of quality by chemical, microbiological and organoleptic methods before storage in ice and at definite intervals during iced storage. Moisture, total nitrogen (TN), non–protein nitrogen (NPN) and ash of the muscle of the fish were determined according to the methods of AOAC (1975). Salt soluble nitrogen (SSN) was determined as per the method of Dyer et al. (1950), alpha amino nitrogen by the method of Pope & Stevens (1939) and total volatile base nitrogen (TVBN) by the microdiffusion method of Conway (1947). The peroxide value (PV) and free fatty acids (FFA) were estimated by the methods of Lea (1952) and AOCS (1946) respectively.

Total aerobic bacterial plate count (TPC) of the muscle was determined using tryptone glucose beef extract agar (TGA). The plates were incubated at $28 \pm 2°C$ (RT) for 48 h and counts taken. Total coliforms were determined using desoxycholate lactose agar and *Escherichia coli* by standard method (FDA, 1973). Faecal streptococci was estimated using KF agar and coagulase positive staphylococci using Baird Parker agar (Difco, 1971). Salmonella was detected and identified by the method of Galton *et al.* (1968). The physical and olfactory changes in the raw fish were also followed. The organoleptic quality of the meat was determined by a trained taste panel. Fish cooked in 2% NaCl for 15 min was served to the panel for assessing the sensory quality on a 10 point hedonic scale, 10 being very good, 0 being bad and 4 being just unacceptable, taking into consideration the changes in odour, texture and flavour of the cooked meat.

Results and Discussion

The proximate compositions of *Channa striatus* of the two size grades studied are

Table 1. *Proximate composition of murrel*

Sample	Average length cm	Average weight g	Moisture %	Protein %	Fat %	Ash %
Batch I	24.0	125	79.61	18.87	0.36	0.96
Batch II	29.5	250	80.25	18.62	1.06	1.29

Table 2. *Changes in biochemical parameters and organoleptic scores of murrels during storage in ice*

	Storage period days	Moisture	SSN % of TN	NPN mg/100g	Alpha-amino nitrogen mg/100g	TVBN mg/100g	PV m mol/kg fat	FFA % oleic acid	Average organoleptic score
	0	79.61	48.60	313	44	9.6	Nil	3.8	9.4
	3	79.40	72.09	255	33	10.4	Nil	7.0	7.6
Batch I	6	82.66	68.49	238	36	13.6	10.8	10.6	5.3
	8	81.20	65.87	183	40	15.7	23.8	7.1	4.2
	10	81.86	64.36	190	25	17.0	58.2	14.9	3.6
	0	80.25	52.35	238	34	7.4	Nil	3.4	9.5
	3	81.35	74.00	210	28	11.6	12.1	2.9	8.2
Batch II	6	80.36	68.52	208	24	9.8	17.2	6.7	6.0
	9	82.23	68.64	168	15	14.1	35.9	11.4	4.5
	13	81.50	48.18	163	13	16.2	70.6	10.8	3.5

given in Table 1. The fat content of the fish was found to be very low.

The moisture contents of the samples increased during iced storage due to the uptake of water. The NPN and alpha amino nitrogen values showed a decreasing trend during iced storage (Table 2). In batch I, the NPN decreased from 313 to 190 mg/100g during 10 days iced storage and in batch 11 samples the decrease was from 238 mg/100g to 163 mg/100g muscle. Similar observations have been made by Shenoy 1972) and Basu & Khasim (1985) in *Tilapia mossambica* and *Chanos chanos* respectively. The rate of increase in TVBN during iced storage of *C. striatus* was slow and it reached maximum values of 17 mg/100g in 10 days in batch I and 16.2 mg/100g muscle in 13 days in batch II samples (Table 2). The TVBN values at the end of iced storage were not high although the samples became unacceptable during the period. This may be due to the leaching of volatile bases formed during iced storage.

It has been reported by several workers (Nair, *et al.*, 1971; Connell &Shewan, 1980; Bandhyopadhyay *et al.*, 1985) that TVBN values in freshwater fish cannot be taken as an index of spoilage on account of its low values developed during iced storage compared to tropical marine fish. This study also showed that TVBN values did not correlate with organoleptic scores.

Initially, the percentage of SSN was low (48 and 52) in both the samples and on the third day it increased to 72 and 74% respectively in samples I and II and then decreased (Table 2). The initial low value of SSN may be due to the effect of rigor mortis on the extractability of proteins. Nikkila & Linka (1954) have shown that the amount of protein that can be extracted from Baltic herring *(Clupea herengus)* falls of as much as 50% when the fish enters rigor. Dyer (1951) also observed a similar phenomenon when pollack in pre-rigor was stored in ice. In the case of *C. striatus* also the fish in pre-rigor condition was used as the starting material for study.

As expected the PV and FFA values increased during storage at 0°C (Table 2) in both the samples. But rancid flavour and odour could not be detected by the taste panel members during storage of the fish.

Table 3. *Changes in physical and olfactory characteristics of murrel stored in ice for batch I samples**

Days of storage	Physical and olfactory characteristics
0	Pre-rigor state, eyes convex, bright red gills, slime on the surface
3	Later stage of rigor, eyes convex, red gills, slime on the surface, no off odour, muscle slightly soft
6	Rigor resolved, eyes slightly sunken, gills red with some mucus, neutral odour, muscle soft
8	No slime on the skin, muscle soft, eyes sunken, discolouration of gills and mucus on the gills; no odour
10	Dull appearance, eyes sunken, mucus on gills and bleached slightly, flesh soft, slight decayed odour

*similar results have been obtained in the case of batch II samples

Table 4. *Changes in bacterial count of murrel during iced storage*

	Days of storage	TPC/g	Total presumptive coliforms/g	*E. coli*/g	Faecal streptococci/g	*Salmonella*/g
Batch I	0	1.1×10^6	8.4×10^4	7.2×10^3	2.36×10^3	Nil
	3	1.4×10^4	Nil	Nil	2.1×10^3	Nil
	6	1.3×10^6	Nil	Nil	1.08×10^2	Nil
	8	1.07×10^8	Nil	Nil	2.6×10^2	Nil
Batch II	0	9.2×10^6	5.2×10^5	4.44×10^4	1.22×10^4	Nil
	3	4.04×10^4	2.81×10^8	1.02×10^2	1.1×10^4	Nil
	6	1.9×10^6	Nil	Nil	1.44×10^3	Nil
	9	3.36×10^6	Nil	Nil	6.3×10^2	Nil
	13	6×10^7	Nil	Nil	2.6×10^2	Nil

Similar observations has been made by Bandhyopadhyay *et al.* (1985) in the case of freshwater fishes from Hirakud reservoir.

The physical and olfactory changes in *C. striatus* during iced storage are given in Table 3 and the average organoleptic scores of the cooked fish in Table 2. Organoleptically the fishes were acceptable for 8 and 9 days for batches I and II respectively. The difference in the iced storage life may be due to the difference in the size of the fish. Bandhyopadhyay *et al.* (1985) have also reported that bigger size fish have better iced storage life compared to smaller ones. After 3 days storage in ice the flesh of the fish became slightly soft and the softness increased on further storage. During 6–8 days in ice the juiciness of the meat was lost to a great extent and the flavour decreased; but there was no development of off odour.

The changes in the bacterial counts of the fish muscle with skin are presented in Table 4. The total aerobic bacterial counts (TPC) of the freshly caught fish were 1.1×10^6/g and 9.2×10^6/g for the batch I and batch II respectively. During storage in ice, there was steep decrease in the counts initially, and thence the bacterial counts increased steadily during further storage. The common murrel harboured a very large population of faecal bacteria, particularly *E. coli* and faecal streptococci. But it may be noted that the coliform bacteria including *E. coli* rapidly decreased during iced storage and almost vanished by 3 to

6 days of iced storage. The steep decrease noted in the total bacterial population of the fish during initial stages of iced storage might be due to the rapid death of the coliforms including *E. coli* due to cold shock during iced storage. However, it is interesting to note that the faecal streptococci showed only a very small rate of decrease during iced storage of the fish and even after 8 to 13 days of iced storage, detectable numbers of faecal streptococci still survived.

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