

Changes in the Muscle of Three Indian Major Carps During Frozen Storage

R. CHAKRABARTI

Kakinada Research Centre of Central Institute of Fisheries Technology, Kakinada - 533 002

Chunks of *Labeo rohita*, *Cirrhinus mrigala* and *Catla catla* wrapped in polythene film were stored at -8 to -10°C in the freezer cabinet of the refrigerator. It was found that *L. rohita* and *C. mrigala* were acceptable upto 33 days and *C. catla* upto 35 days. Total volatile base nitrogen, free fatty acids and degree of sponginess of the samples showed increasing trend during frozen storage.

With the increase in the use of refrigeration appliances in domestic use there is a need to provide information in detail about the storage life of different food products in refrigerators. *Catla catla*, *Labeo rohita* and *Cirrhinus mrigala* are commercially important freshwater fishes. This study was conducted to find out the storage life of these fishes in the form of chunks, which is the usual form preferred by users for regular or casual use, when stored in the freezer cabinet (-8 to -10°C) of refrigerator.

Material and Methods

Fishes weighing 0.5 to 0.75 kg each were procured from local markets at Kakinada, immediately after arrival from nearby ponds/tanks. They were washed and cut into chunks (average thickness 2 cm). The chunks were washed and wrapped in polythene film of 200 g per pack and stored in the inner cabinet (-8 to 10°C) of refrigerator.

Moisture, fat, total nitrogen and non-protein nitrogen (using trichloroacetic acid extract) were estimated by AOAC (1960). Total volatile base nitrogen content was estimated by Conway microdiffusion method (1947) and alpha amino nitrogen content was estimated by Block & Bolling (1951), free fatty acid by the method of Dyer & Morton (1956). Total plate count was determined by IS: 2237 (1971) procedure. Organoleptic tests were carried out immediately after thawing and also after cooking the thawed material in 2% sodium chloride solution for 10 min.

Results and Discussion

Tables 1, 2 and 3 show the changes in the chemical composition, bacterial count and organoleptic qualities of chunks of *C. catla*, *L. rohita* and *C. mrigala* respectively, during storage at -8 to -10°C. Frozen chunks were thawed to room temperature and then the above parameters were studied.

Moisture, non-protein nitrogen and alpha amino nitrogen decreased during frozen storage. This trend was noticed because of drip loss during thawing. Total volatile base nitrogen content, free fatty acid content and the degree of sponginess of the thawed fish increased in all cases during storage. Similar trend was reported by Kamasastri *et al.* (1967), Shenoy (1976) and Garg *et al.* (1982) during frozen storage of fish and fish fillets. There was an initial fall in total bacterial count and then no significant change in TBC was observed in all cases, during the remaining period of storage. Taking all the parameters into consideration it was found that *L. rohita* and *C. mrigala* were acceptable upto 33 days and that of *C. catla* upto 35 days during storage at -8 to -10°C. In comparison with the usual frozen fish products (frozen at -40°C and stored at -18°C), the fish products kept in the inner cabinet (-8 to -10°C) of refrigerator have short span of storage life because of slow freezing and high storage temperature (-8 to 10°C) which cause fast changes in biochemical and organoleptic characteristics.

Table 1. *Changes in chunks of C. catla stored at -8 to -10°C*

	Initial	Days of storage						
		7	14	21	28	33	35	28
Moisture, %	80.2	79.9	79.6	79.2	78.6	78.4	78.2	78.1
Total nitrogen, %	2.8	2.75	2.7	2.63	2.55	2.5	2.48	2.47
Non-protein nitrogen, %	0.378	0.328	0.33	0.289	0.285	0.282	0.28	0.275
Total volatile base nitrogen, mg/100g	7.5	11.7	14.7	15.9	18.7	19.1	19.5	20.2
Alpha amino nitrogen, mg/100g	44.6	36.8	33.7	26.2	23.7	22.8	21.6	20.8
Free fatty acid, % oleic acid	1.05	1.55	1.85	2.31	2.44	2.86	3.45	4.72
Total bacterial count	20 x 10 ⁴	5 x 10 ⁴	3 x 10 ⁴	3 x 10 ⁴	2 x 10 ⁴	3 x 10 ⁴	4 x 10 ⁴	4 x 10 ⁴
Thawed fish texture	firm	firm	firm	firm	firm	Slightly spongy	Slightly spongy	Spongy
Overall quality	Very good	good	good	good	fair	fair, little off flavour	fair, little off flavour	poor, off flavour
Cooked fish, overall quality	"	"	"	"	"	fair, little loss of fresh flavour	fair, with little off flavour	poor, with rancid flavour

Table 2. *Changes in chunks of L. rohita during storage at -8° to -10°C*

	Initial	Storage in days					
		7	14	21	28	33	35
Moisture, %	80.81	80.2	80.02	79.63	79.4	79.04	78.9
Total nitrogen, %	2.88	2.84	2.82	2.79	2.78	2.76	2.74
Non-protein nitrogen, %	0.34	0.315	0.304	0.295	0.285	0.27	0.268
Total volatile base nitrogen, mg/100g	7.99	8.14	11.98	12.02	16.28	20.00	20.8
Alpha amino nitrogen, mg/100g	54.45	50.55	49.75	48.5	47.5	45.26	44.9
Free fatty acid, % oleic acid	1.12	1.86	2.15	2.43	2.84	3.16	4.24
Total bacterial count/g	19 x 10 ⁴	6 x 10 ⁴	4 x 10 ⁴	4 x 10 ⁴	3 x 10 ⁴	3 x 10 ⁴	4 x 10 ⁴
Thawed fish texture	firm	firm	firm	firm	slightly spongy	slightly spongy	spongy
Overall quality	very good	good	good	good	fair	fair, little off flavour	poor, off flavour
Cooked fish, overall quality	"	"	"	"	fair	fair, little off flavour	poor rancid flavour

Table 3. Changes in chunks of *C. mrigala* during storage at -8 - to -10°C

	Storage period in days						
	Initial	7	14	21	28	33	35
Moisture, %	80.0	79.4	78.9	78.1	78.1	77.6	77.2
Total nitrogen, %	2.87	2.84	2.81	2.79	2.77	2.73	2.71
Non-protein nitrogen, %	0.325	0.333	0.331	0.315	0.304	0.291	0.289
Total volatile base nitrogen, mg/100g	8.2	12.6	14.7	15.5	17.8	19.7	20.5
Alpha amino nitrogen, mg/100g	50.2	42.5	30.25	23.5	21.5	20.75	19.5
Free fatty acid, % oleic acid	0.8	1.15	1.41	1.52	1.81	2.11	3.38
Total bacterial count/g	22 x 10 ⁴	7 x 10 ⁴	5 x 10 ⁴	3 x 10 ⁴	3 x 10 ⁴	3 x 10 ⁴	5 x 10 ⁴
Thawed fish texture	firm	firm	firm	firm	Slightly spongy	Slightly spongy	spongy
Overall quality	very good	good	good	fair	fair, little loss of fresh odour	fair, loss of fresh odour	poor, off flavour
Cooked fish overall quality	..	..	..	good	fair	fair, little off flavour	poor, perceptible rancid flavour

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