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ICE STORAGE CHARACTERISTICS OF CULTURED SILVER CARP

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ABSTRACT

Cultured silver carp (*Hypopthalmichthys molitrix* 800-1000 g) was stored in ice (fish to ice ratio 1:1) in a plywood box insulated with one inch thick expanded poly styrene and subjected to detailed examination of quality by chemical, microbilogical and organoleptic evaluation at regular intervals to asses the storage life in good acceptable form. Alpha-amino nitrogen, non-protein nitrogen and pH values showed no positive correlation as spoilage index. Total volatile base nitrogen was not high at the end of the storage period although the fish became unacceptable during the period. There was steep decrease in total bacterial count during initial stages of storage and then increased steadily on further storage. Organoleptic evaluation of raw and cooked meat revealed that fish was in good acceptable form upto 14 days in ice.

The iced storage characteristies of many fresh water fishes in India have been studied (Nair *et al.,* 1971; and Bondopadhyay *et al.,* 1985; 1986; Durairaj and Krishnamurthi, 1986; Perigreen *et al.,* 1987; Joseph *et al.,* 1988; and Bhattacharyay and Chandhuri, 1990). The fresh water fish silver carp *(Hypophthalmichthys molitrix),* due to its very fast growth, has become one of the preferred fish under the composite fish culture system. But no data is available for its storage characteristics in ice. The present study reports the iced storage shelf life of cultured silver carp in ice.

Fishes were procured from a farm 20 km away from the laboratory. Immediately after catch, the fishes were iced and brought to the laboratory. In the laboratory, fishes (each weighing 800 to 1000 g) were washed thoroughly with cold water and stored in crushed ice layer by layer in a plywood box insulated with one inch thick expanded polystyrene slabs wrapped in 150 gague high density polythene sheets. The ratio of fish to ice was 1:1. Care was taken to put a layer of ice in the bottom and top of the stored fish. Reicing was done everyday. The fishes 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, protein, non-protein nitrogen and ash of the muscle of the

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fish were determined according to the methods of AOAC (1980). Alpha-amino nitrogen was determined by the method of Pope and Stevens (1939) and total volatile base nitrogen (TVBN) by the microdiffusion method of Conway (1947). pH was determined by blending the muscle with double volume of distilled water and immersing a combined electrode of the pH meter into it. Fat was estimated by Soxhlet-apparatus using petroleum either (B.P. 40-60°C) as solvent. Total aerobic bacterial plate count (TPC) of the muscle was determined using triptone-glucose beef extract agar (TGA) medium. The plates were incubated at R.T. (30± 1 °C) for 48 hrs and counts taken.

Visual and olfactory evaluation of the raw fish was done by examination of eyes, gills, odour, texture and colour of the fish. The fishes were cut into pieces and cooked in 2.5% brine for 10 minutes. The cooked samples were evaluated by a five member taste panel for flavour, texture, adour and overall acceptability on a 10 point hedonic scale following the method of Shewan *et al.* (1953), the score of 5 for any attribute was taken to be the borderline of acceptability.

The proximate composition of edible meat of silver carp is given in Table 1.

Table 1 : *Proximate composition of silver carp*

Moisture	-	78.10%
Protein	-	18.38%
Fat	-	2.30%
Ash	-	1.20%

Table 2 presents the changes in chemical parameters and bacterial count during ice storage of silver carp. The moisture content showed an increasing trend during ice storage. Almost similar trend was noticed in the case of other fresh water fishes (Bondopadhyay *et al.*, 1985; 1986; and Joseph *et al.*, 1988). This is due to uptake of water by fish muscle during the course of ice storage.

pH values gradually decreased initially and then increased, showing cyclic fluctuation. Similar cyclic fluctuations have been reported by Bondopadhyay *et al.*, (1985, 1986) in *Labeo rohita, Cirrhinus mrigala, Catla catla* and *Labeo fimbriatus*. So like other fishes, pH cannot be taken as an index of freshness for silver carp as well.

Alpha - amino - nitrogen showed a decreasing trend after slight initial increase, although the changes were not very sharp. Similar changes were observed by Perigreen *et al.*, 1987; Joseph *et al.*, 1988 and Perigreen and Gopakumar, 1991. Protein breakdown by bacterial attack was expected to increase the alpha - amino nitrogen values with storage time. But due to leaching of nitrogenous compounds by ice melt water the trend is reversed, rendering this parameter ineffective for assessment of freshness/spoilage.

Non-protein nitrogen values increased in the beginning and then showed a decreasing trend. Decreasing trend was also observed by Basu and Khasim (1985), Perigreen *et al.*, (1987) and Joseph *et al.* (1988) in *Chanos chanos, Labeo rohita* and *Channa striatus* respectively.

Table 2 : *Changes in biochemical parameters and bacterial count during ice storage of silver carp*

Days of storage	Moisture (%)	Alpha-amino nitrogen (mg/100g)	Total volatile basic nitrogen (mg/100g)	Non-protien nitrogen (mg/100g)	pH	Total bacteria (count/g)
0	78.10	41.07	12.1	374.0	6.58	$3.6x10^4$
2	78.30	42.00	16.3	437.5	6.53	$3.1x10^4$
4	78.86	44.80	17.3	512.0	6.35	$2.6x10^4$
6	79.28	31.73	18.2	525.0	6.17	$5.1x10^3$
8	79.34	33.60	14.7	587.5	6.28	$5.9x10^3$
10	79.64	27.07	16.9	450.4	6.14	$7.1x10^3$
12	79.78	23.80	15.8	400.0	6.13	$9.7x10^3$
14	79.88	24.97	16.2	312.5	6.10	$1.3x10^3$
15	80.09	28.00	18.6	351.5	-	$3.4x10^4$
16	80.20	42.47	14.5	412.5	6.26	$4.7x10^4$
17	80.30	38.50	16.0	425.7	-	$7.8x10^4$
18	80.32	33.84	16.5	350.7	6.48	$1.1x10^5$

TVBN values were higher at the end of the storage period than the initial value. Similar trend was noticed by Bondopadhyay *et al.* (1985,86), Perigreen *et al.* (1987), Bhattacharyay and Chaudhuri (1991), Nair *et al.* (1971). Connell and Shewan (1980) reported that TVBN increases slowly during the ice storage of most fresh water fishes, principally because of their low or negligible content of trimethyl amine oxide (TMAO). So TVBN values of fresh water fish cannot be taken as an index of spoilage. Leaching made this parameter more ineffective. In this study TVBN values did not correlate with organoleptic scores.

The total bacterial count of freshly caught silver carp was 3.6 x 10^4/g. During storage in ice, there was steep decrease in the counts initially and then the count increased during further storage. The reduction was due to the destruction of some bacteria (mesophiles) due to cold shock. After initial lag period, PSychrophiles originally present in fish started multiplying causing increase in the count in the subsequent period of storage. Similar trend was reported by many workers, (Garg and Stephan, 1982; Poulter and Nicolaids 1985; Basu and Khasim, 1985; Bondopadhyay *et al.*, 1985; 1986; Perigreen *et al.*, 1987).

Table 3 : *Changes in organoleptic scores of raw silver carp during ice storage.*

Days of storage	General appearance				Odour	Texture	Overall average score
	Eye	Gill	Skin	(Average)			
0	10.0 ± 0	10.0 ± 0	10.0 ± 0	10.0 ± 0	10.0 ± 0	10.0 ± 0	10.0 ± 0
1	9.4 ± 0.1	9.4 ± 0.2	10.0 ± 0	9.6 ± 0.1	10.0 ± 0	10.0 ± 0	9.8 ± 0.1
2	9.3 ± 0.4	9.3 ± 0.3	9.8 ± 0.2	9.5 ± 0.3	9.9 ± 0.1	10.0 ± 0	9.7 ± 0.2
3	9.2 ± 0.3	9.3 ± 0.4	9.5 ± 0.2	9.3 ± 0.3	9.4 ± 0.2	9.9 ± 0.1	9.5 ± 0.2
4	9.1 ± 0.4	9.2 ± 0.3	9.3 ± 0.2	9.2 ± 0.3	9.1 ± 0.2	9.8 ± 0.2	9.3 ± 0.3
5	8.9 ± 0.3	9.1 ± 0.4	9.2 ± 0.3	9.1 ± 0.3	8.9 ± 0.3	9.6 ± 0.3	9.1 ± 0.3
6	8.8 ± 0.4	9.0 ± 0.2	9.0 ± 0.3	8.9 ± 0.3	8.6 ± 0.2	9.4 ± 0.2	9.0 ± 0.3
7	8.4 ± 0.3	8.9 ± 0.4	8.9 ± 0.4	8.7 ± 0.4	8.1 ± 0.3	9.0 ± 0.3	8.7 ± 0.3
8	8.2 ± 0.5	8.8 ± 0.3	8.4 ± 0.4	8.5 ± 0.4	7.9 ± 0.3	8.5 ± 0.3	8.4 ± 0.4
9	7.8 ± 0.3	8.4 ± 0.4	8.1 ± 0.3	8.1 ± 0.3	7.4 ± 0.4	8.1 ± 0.2	8.1 ± 0.3
10	7.1 ± 0.5	7.7 ± 0.3	7.8 ± 0.2	7.5 ± 0.3	6.6 ± 0.2	7.2 ± 0.4	7.3 ± 0.3
11	6.9 ± 0.3	7.4 ± 0.3	7.2 ± 0.3	7.2 ± 0.3	6.4 ± 0.2	6.4 ± 0.2	7.0 ± 0.3
12	5.2 ± 0.4	6.5 ± 0.3	7.0 ± 0.2	6.2 ± 0.3	6.0 ± 0.3	6.1 ± 0.4	6.2 ± 0.3
13	4.9 ± 0.3	6.4 ± 0.3	6.6 ± 0.4	6.0 ± 0.3	5.6 ± 0.4	5.6 ± 0.2	5.8 ± 0.3
14	4.8 ± 0.5	6.2 ± 0.2	6.4 ± 0.2	5.8 ± 0.3	5.0 ± 0.2	4.5 ± 0.5	5.4 ± 0.3
15	4.4 ± 0.4	6.0 ± 0.3	6.0 ± 0.3	5.5 ± 0.3	4.6 ± 0.3	4.1 ± 0.3	5.1 ± 0.3
16	4.1 ± 0.5	5.1 ± 0.2	5.1 ± 0.4	4.8 ± 0.4	4.1 ± 0.4	4.0 ± 0.2	4.5 ± 0.3
17	3.7 ± 0.4	4.1 ± 0.5	4.9 ± 0.5	4.2 ± 0.4	3.5 ± 0.3	3.6 ± 3	3.9 ± 0.4
18	3.4 ± 0.3	3.6 ± 0.4	4.4 ± 0.4	3.8 ± 0.4	3.1 ± 0.3	3.1 ± 0.3	3.5 ± 0.9

Table 4 : *Changes in organoleptic scores of cooked silver carp during ice storage.*

Days of storage	Odour	Texture	Flavour	Overall average score
0	10.0 ± 0	10.0 ± 0	10.0 ± 0	10.0 ± 0
1	10.0 ± 0	10.0 ± 0	10.0 ± 0	10.0 ± 0
2	10.0 ± 0	9.9 ± 0.1	10.0 ± 0	10.0 ± 0
3	9.9 ± 0.1	9.8 ± 0.2	9.9 ± 0.1	9.9 ± 0.1
4	9.8 ± 0.2	9.6 ± 0.2	9.9 ± 0.1	9.8 ± 0.2
5	9.6 ± 0.2	9.5 ± 0.1	9.6 ± 0.3	9.6 ± 0.2
6	9.1 ± 0.3	9.1 ± 0.2	9.5 ± 0.1	9.2 ± 0.2
7	8.9 ± 0.2	9.0 ± 0.1	9.4 ± 0.2	9.1 ± 0.2
8	8.6 ± 0.2	8.2 ± 0.2	9.1 ± 0.1	8.6 ± 0.2
9	8.4 ± 0.2	7.9 ± 0.1	8.1 ± 0.2	8.1 ± 0.3
10	8.1 ± 0.2	7.6 ± 0.2	8.6 ± 0.2	8.1 ± 0.2
11	7.6 ± 0.3	7.4 ± 0.2	8.1 ± 0.2	7.7 ± 0.2
12	6.5 ± 0.4	6.6 ± 0.3	7.4 ± 0.3	6.8 ± 0.3
13	6.0 ± 0.3	6.0 ± 0.2	6.5 ± 0.4	6.2 ± 0.3
14	5.4 ± 0.3	5.4 ± 0.3	5.0 ± 0.2	5.3 ± 0.3
15	4.9 ± 0.2	4.9 ± 0.1	4.4 ± 0.3	4.7 ± 0.2
16	4.0 ± 0.2	4.2 ± 0.2	4.0 ± 0.3	4.1 ± 0.2
17	3.6 ± 0.3	3.8 ± 0.2	3.4 ± 0.3	3.6 ± 0.3
18	3.3 ± 0.4	3.4 ± 0.2	3.1 ± 0.3	3.3 ± 0.3

Changes in organoleptic quality of raw and cooked fish is presented in Tables 3 and 4. Organoleptic scores along with bacterial changes were found to be the best parameters for evaluation of quality of fish during ice storage. Joseph *et al.* (1988) suggested that detailed study of sensory parameters by a trained panel could only give a reliable result on the shelf life of iced fish. In the present study also, sesnsory parameters of raw and cooked fish gave the most reliable information regarding the quality of the fish in ice storage which was supported by the data on bacterial change, and thus it was concluded that fish was in good acceptable form upto 14 days.

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REFERENCES

AOAC. 1980. *Official Methods of Analysis* (Horwitz.W.Ed), 13th edn., Association of Official Analytical Chemists, Washington.

Basu, S and **Khasim, D.I.** 1985. Studies on the effect of leaching on the quality of ice stored fish. *Fish Technol.* **22** (2), 105-108.

Battacharyay, S.K. and **Chudhuri, D.R.** 1990. Studies on storage characteristics of *Clarius batrachus* at different temperatures. *Fish Technol.* **27** (2) : 127-129.

Bondopadhyay, J.K., Chattopadhyay, A.K. and **Bhattacharyay, S.K.** 1985. Studies on the ice storage characteristics of commercially important fresh water fishes. P.381. In : *Harvest and Post harvest Technology of Fish.* Society of Fisheries Technologists (India), Cochin-29.

Bondopadhyay, J.K., Chattopadhyay, A.K. and **Bhattacharyay, S.K.** 1986. Studies on the ice storage characteristics of *Catla catla* and *Lebeo fimbriatus.* Fish *Technol.* 23(2) : 140-142.

Connell, J.J. and **Shewan, J.M.** 1980. Sensory and non-sensory assessment of fish. P 56-65. In *Advances in Fish Science and Technology* (Ed. Connell, J.J.). Fishing News Books Ltd., London, England.

Conway, E.J. 1947. *Microdiffusion Analysis,* Revised Edn., d. Van Nostrant Co.Inc, New York.

Durairaj, S. and **Krishnamurthi, S.** 1986. The preservation of some Indian fresh water fish. *Fish Technol.* **23** : 115-119.

Garg, D.K. and **Stephen, J.** 1985. Ice storage of Ghol *(Pseudosciaena diacanthus)* fillets. Harvest and post harvest technology of fish. Society of Fisheries Technologists (India), Cochin-29. 377-378.

Joseph, J., Surendran, P.K. and **Perigreen, P.A.,** 1988. Studies on the iced storage characteristics of cultured rohu. *Fish Technol.* **25** (2): 105-109.

Nair, R.B., Taramani, P.K. and **Lahiry, N.L.** 1971. Studies on

chilled storage of fresh water fish. *J.Fd. Sci. Technol.* **8** : 53-56.

Perigreen, P.A., Joseph, J., Surendran, P.K. and **Gopakumar, K.** 1987. Studies on iced storage of common murrel *(Channa striatus). Fish Technol.* **24 (2)** : 99-102.

Perigreen, P.A. and **Gopakumar, K.** 1991. Handling and transportation of cultured fish. 731-736. In *Aquaculture Productivity* (Ed. Sinha, V.R.P. and Srivastava, H.C.). Oxford and IBH publishing Co. Pvt. Ltd. New Delhi.

Pope, C.G. and **Stevans, M.F.** 1939. *Biochem. J.* **33** : 1070.

Poulter, R.G. and **Nicolids, N.** 1985. Studies on the iced storage characteristics and composition of a variety of Bolivian fresh water fish. 1 Altiplano fish; 2. Parana and Amazon Basin fish. *J.Fd. Techno.* **20** (4) : 437-465.