Influence of Fish Chilling Methods on the Quality of White Sardine

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The bacteriological, biochemical and organoleptic characteristics of white sardine *(Kowala coval)* kept in ice as well as in chilled seawater immediately after capture and in ice after keeping 6 h at ambient temperature (28±2°C) were studied. It was found that delayed iced white sardines, became unacceptable after 6 days of storage. The samples stored in ice and chilled seawater immediately after capture were acceptable for 9 and 11 days respectively.

Fresh fish is susceptible to rapid spoilage at the ambient temperature of the tropics. Keeping fish in chilled seawater or ice considerably reduces the spoilage. Iced storage changes in most of the commercially important marine fishes in India have been studied (Govindan, 1971; Shenoy & James, 1974; Banik. *et al.*, 1976; Surendran & Iyer 1976; Joseph *et al.*, 1980). Since pelagic fishes are landed in large quantities and a good portion of them is used for reduction, proper care is not taken in their handling, chilling and transportation. So the processor or consumer gets these fishes in poor condition. It is necessary to have a good knowledge of the various changes taking place in fish during handling and chill storage to improve the quality of fish when it reaches the consumer. Hence, the present work is an attempt to analyse the influence of fish handling/chilling methods on the quality of the small pelagic fish, white sardine.

Materials and Methods

White sardine obtained from a commercial fishing boat were divided into three lots. One lot was kept at ambient temperature of 28±2°C for about six hour and thereafter held in crushed ice (DI). Another lot was mixed with crushed ice in the ratio 1:1 immediately after catch (II). The third lot was kept in chilled seawater with fish:ice:water ratio of 9:3:1 as soon as caught (CSW). All these three samples were held in a chill room at 0 to 5°C.

Changes in the quality of fish were assessed by physical, organoleptic, microbiological and biochemical tests at intervals of two or three days. Organoleptic tests were conducted on cooked fish and presented to a panel of 8 to 10 judges for evaluating sensory attributes of appearance, colour, texture, odour and taste, on a numerical scoring system (9-10; excellent; 7-9: good, 5-7: acceptable; 3-5: poor and 1-3: very poor).

The total plate counts (TPC) were determined by the method of APHA (1976). pH of fish muscle was measured by a combined electrode pH meter. The salt soluble protein (SSP) was analysed by the modified method of Gornall *et al.*, (1949), total volatile base nitrogen (TVBN) and trimethylamine nitrogen (TMAN) as per the procedure of Beatty & Gibbons (1937), peroxide value (PV) by the method of Hills & Thiel (1946) and thiobarbituric acid (TBA) value by the method of Yu & Sinnhumber (1957). Proximate composition and salt content of fish were

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determined according to the methods of AOAC (1975).

Results and Discussion

The results of physical examination of raw fish and organoleptic evalution of cooked fish are presented in Table. 1. The changes in total plate count are given in Table 2. It can be seen that most of the major changes indicating loss of freshness and onset of spoilage occur in DI, II and CSW samples after 4, 6 and 9 days of storage respectively. During this period, organoleptic scores for all attributes were over six and total viable counts below one million per g. The fish were acceptable upto 6, 9 and 11 days in the case of DI, II and CSW respectively.

During storage the moisture content increased and protein content decreased in all the three samples (Table 3). The increase in moisture content may be due to the absorption of moisture from the surrounding ice or chilled seawater and loss of protein due to leaching of soluble protein components.

Table 4 shows that SSP content of fish gradually decreased, the DI sample showing a faster rate than II and CSW samples. The SSP content influenced the quality attributes like texture, flavour and taste of fish. Thus DI samples were found to be quickest and CSW samples slowest in losing the original texture and flavour of fresh fish (Table 1).

TVBN and TMAN increased during storage in all the three samples. The TVBN values reached between 15 and 17 mg% for all the three samples when it was just acceptable. These values are lower than the acceptability limit of 20 mg% suggested by Tanikawa *et al.* (1952). TMAN values reached about 3 mg% at the acceptability limit. PV and TBA values increased during chilled storage. The DI samples exhibited a faster

Table 1. *Effect of handling and chilling methods on the physical and organoleptic characteristics of white sardines*

Parameters	Holding period required to show quality changes, days		
	DI	II	CSW
Fish skin			
Loss of gloss	4	6	6
Appearance of discolouration	6	9	9
Scales detaching easily	6	6	9
Eyes			
Bright and transparent cornea	4	4	4
Cornea opaque	6	11	11
Gills			
Turning brown	4	9	11
Formation of slime layer	6	13	13
Texture			
Fish body retaining finger impression	4	9	9
Odour			
Fresh fish odour	2	4	4
Loss of fresh fish odour	4	6	6
Overall quality			
Judged as excellent or good	2	4	4
Judged as acceptable	6	9	11
Sensory scores for cooked fish			
For all attributes over 6	4	6	9
For one or more attributes below 6	6	9	11

Table 2. *Changes in total plate count of delayed iced (DI) immediately iced (II) and chilled seawater (CSW) stored white sardine*

Holding period (days)	Total plate count/g		
	DI	II	CSW
0	$4.40x10^3$	$4.15x10^3$	$3.90x10^3$
2	$3.98x10^4$	$5.30x10^3$	$4.15x10^3$
4	$5.80x10^5$	$2.12x10^4$	$1.89x10^4$
6	$2.59x10^4$	$2.74x10^5$	$2.32x10^5$
9	-	$2.73x10^6$	$2.94x10^5$
11	-	$2.96x10^6$	$1.99x10^6$

Table 3. *Changes in proximate composition of delayed iced, immediately iced and CSW stored white sardine*

Storage period, days	Moisture %	Protein %	Fat %	Ash %
DI				
0	74.49	23.19	0.39	1.36
6	76.84	19.26	0.67	2.60
9	-	-	-	-
II				
0	74.49	23.19	0.73	1.36
6	76.20	21.43	0.73	1.69
9	77.09	20.16	0.69	1.93
CSW				
0	74.49	23.49	0.73	1.36
6	76.18	21.87	0.73	1.40
9	77.17	20.83	0.72	1.88

Table4. *Influence of handling and chilling methods on Salt Soluble Protein (SSP), total Volatile base nitrogen (TVB) and trimethylamine nitrogen (TMA - N) content of white sardine*

storage period,days	SSP%		
	DI	II	CSW
0	15.90	16.00	16.00
2	14.20	14.90	14.80
4	13.30	14.50	14.60
6	12.10	13.90	14.00
9	-	13.50	13.80
11	-	12.90	13.50
	TVB - mg%		
	DI	II	CSW
0	1.19	0.60	0.60
2	5.95	4.76	3.57
4	11.90	8.33	9.52
6	15.45	13.09	14.28
9	-	16.66	15.47
11	-	19.04	16.66
	TMA -N mg%		
	DI	II	CSW
0	0.60	0	0
2	1.90	1.19	1.19
4	2.40	1.19	1.79
6	3.75	2.38	2.38
9	-	2.98	2.98
11	-	3.57	2.99

Table 5. *Effect of handling and chilling methods on peroxide value (PV) and thiobarbituric acid value (TBA) of white sardine lipids*

Holding period (days)	PV m.moles 0_2			TBA mg per kg fat		
	DI	II	CSW	DI	II	CSW
0	2.92	1.39	0.28	6.71	3.47	2.67
2	4.52	2.74	1.88	11.71	8.85	7.65
4	8.71	4.95	3.89	17.96	13.90	11.66
6	16.31	9.42	8.90	23.63	17.32	16.96
9	-	17.59	13.74	-	37.14	25.62
11	-	21.82	16.48	-	49.23	33.68

rate of change than the other two (Table 5) pointing out the impact of initial delay in chilling on peroxidation of lipids.

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