SPOILAGE OF SPOTTED SEER *(SCOMBEROMOROUS GUTTATUS)* DURING ICE STORAGE

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Quality deterioration of seer held directly in contact with ice, in different forms, fillets and chunks, and of chunks held in ice but without direct contact, was studied for a period of 15 days. While the chunks held out of contact with ice were acceptable upto 13 days based on organoleptic evaluations, the chunks and fillets held in direct contact with ice were acceptable only upto 10 days. The order of preference of the samples at any interval of ice storage was chunks held out of contact with ice > chunks held directly in ice > fillets held directly in ice. The changes in the chemical quality of these samples were also in the same order, the deterioration being maximum in fillets and least in chunks kept out of contact with ice.

INTRODUCTION

Seer is one of the highly cherished food fishes of India and constitutes nearly 1.2% of the annual fish landings. Though some preliminary studies on preservation of this fish by freezing and glazing have been carried out (Jadav & Magar 1970) there appears to be no report in the literature concerning amenability of this fish to pre-process ice storage. Ice storage of fish probably constitutes the first important technological factor in its utilization for food. The quality of the fish prior to freezing will have a significant effect on the quality deterioration during subsequent frozen storage. The freshness of the fish being related to the period of ice storage prior to subsequent processing, will determine to a large extent the quality of the processed fish reaching the consumer.

This study was, therefore, designed to provide information on the type and pattern of spoilage of seer fish during storage in ice for longer periods. Spoilage was followed by chemical, bacterial and organoleptic tests. The chemical tests include changes in protein extractability and fat spoilage.

MATERIALS AND METHODS

Seer fish of average weight 5 Kg. caught by trawlers off Cochin were used in the experiments. They were brought to the laboratory within 5 hours of catch, eviscerated, beheaded and washed free of

blood and stored in ice. On the following day, the fish was cut into fillets and chunks, each fillet and chunk weighing approximately 350 gms. Half the chunks were kept out of contact with ice by wrapping them individually with polythene paper (c) the other half (C) and the fillets (F) being kept covered by ice, all in the same insulated box. Samples were drawn at regular intervals for assessing the changes in bacterial, biochemical and organoleptic characteristics.

The methods of estimation of total nitrogen (TN), total non protein nitrogen (TNPN), salt soluble nitrogen (SSN), Sarco plasmic protein nitrogen (SN), moisture (M), free α-amino nitrogen (α-NH_2-N), peroxide value (PV), and free fatty acids (FFA) were similar to those described in the earlier communication (Shenoy & Pillai 1971). The water extractable nitrogen (WEN) was estimated by kjeldahl method and the free amino acids by microbiological assay method after extracting the tissue with ethyl alcohol. The total bacterial count was determined by Pour Plate method; sea water, sea water agar and incubation of petridishes at 37°c for 48 hours, being the conditions used (ISI 1962).

The changes in the biochemical, bacterial and organoleptic characteristics of seer fish during ice storage are shown in table I, while table II depicts the changes in free amino acid pattern of chunks held out of contact with ice and chunks held directly in ice.

Results And Discussion.

The organoleptic rating show that the limit of acceptability of (F) and (C) is 10 days while that of (c) is more than 13 days. The order of preference of the samples at any interval during storage in ice was (c) > (C) > (F). The polythene wrapped chunks exhibited better appearance in the raw and cooked states. Rancid odour was detected in (C) and (F) after 10 days while it was not apparent in (c) even after 13 days of storage. The textural changes were more pronounced in samples held directly in ice, which became tough after 7 days where as no significant textural change was observed in samples stored out of contact with ice. The changes in texture of cooked muscle were more apparent in fillets than in the chunks held directly in ice.

Moisture content of all the samples (c), (C) and (F) showed gradual increase, the rate of increase being (F) > (C) > (c). TN decreased in all the samples, the rate of decrease being least in chunks wrapped in polythene. SSN showed a gradual decrease in all the samples with increasing periods of ice storage, to the extent of 6% in (c), 16% in (C) and 17% in (F). SN decreased by 3%, 11% and 12% respectively in (c), (C) and (F). WEN did not show any significant variation in (c), while in (C) and (F) there was considerable decrease (nearly 60%). TNPN showed gradual decrease in all the samples, the rate of decrease being (F) > (C) > (c). The free α -amino nitrogen increased in (c) gradually while an increase followed by a decrease was observed in (C) and (F).

PV and FFA showed a steady increase in all the samples. Though PV was higher in the samples directly held in ice, the FFA contents in all the sampes were comparable.

The total bacterial count did not show any significant increase in chunks stored out of contact with ice, even after 13 days of storage, while in the case of chunks held in contact with ice there was

TABLE I

No. of days of ice storage	Samples	Biochemical changes									Bacteriological changes	Organoleptic change		
		TN: %	TNPN: %	SSN: %TN	SN: %TN	SEN: %TN	M: %	α-NH_2N mg/100 gm.	PV: m moles/ 100 gm. fat	FFA: %Oleic acid	Total Plate counts count/gm.	Odour	Texture	Flavour
1	Fresh	3.50	0.4624	66.07	36.31	0.9183	69.98	51.67	10.90	1.53	3.1×10^2	G	G	G
	(c)	3.46	0.4819	68.16	36.06	0.7228	69.38	54.55	11.26	1.57	3.5×10^2	G—F	G—F	G—F
3	(C)	3.42	0.4246	63.97	32.73	0.6714	70.78	48.64	14.98	1.86	1.9×10^3	G—F	G—F	G—F
	(F)	3.40	0.3784	64.71	32.96	0.6266	70.18	31.92	13.42	1.57	2.1×10^3	F	G—F	G—F
	(c)	3.46	0.4764	65.16	36.14	0.6710	70.18	67.76	13.37	1.60	3.0×10^2	G—F	G—F	G—F
5	(C)	3.34	0.3864	59.43	32.89	0.4760	72.28	61.66	16.74	2.55	2.0×10^4	F	F	F
	(F)	3.26	0.3141	60.24	30.40	0.4989	71.30	44.76	18.84	2.50	1.0×10^4	F	F	F
	(c)	3.51	0.4498	63.28	34.15	0.7560	70.95	59.43	14.57	2.68	3.6×10^2	F	G—F	F
7	(C)	3.13	0.2716	68.97	30.97	0.4906	73.11	50.12	18.71	2.68	1.2×10^4	F	F—P	F>P
	(F)	3.12	0.3334	66.10	29.11	0.4493	72.44	50.12	23.39	2.88	1.1×10^5	F (Slightly hard)	F	F<P
	(c)	3.48	0.4560	62.37	33.88	0.7396	71.78	71.78	17.94	2.62	1.6×10^3	F	F	F
10	(C)	3.13	0.2661	54.08	27.57	0.4875	72.44	40.93	20.92	3.01	2.1×10^3	(Sl. rancid)	P	P
	(F)	3.09	0.3062	52.76	33.11	0.4315	73.28	63.39	29.85	3.61	1.3×10^4	,,	P (Hard)	P
	(c)	3.42	0.4395	60.81	33.34	0.7499	71.45	64.71	19.04	3.32	1.0×10^4	F	F	F
13	(C)	3.13	0.2213	50.10	25.94	0.3581	73.28	37.16	25.04	3.82	1.1×10^6	P	P	(granular)P
	(F)	2.98	0.1959	49.40	24.21	0.3581	73.96	33.81	35.73	4.00	3.5×10^6	P	P	P

(c) chunks stored out of contact with ice, (C) - Chunks held in ice, (F) - Fillets held in ice, G - Good, F - Fair, P - Poor.

TABLE II

Amino acids mg% in wet muscle	Initial	Free amino acid pattern of (c) No. of days of storage in ice					Free amino acid pattern of (C) No. of days of storage in ice				
		3	5	7	10	13	3	5	7	10	13
Histidine	65.81	31.14	33.48	31.14	23.48	19.83	48.02	31.71	19.96	17.77	9.47
Alanine	40.21	40.34	40.37	40.73	25.73	18.38	25.57	22.14	20.38	22.92	15.73
Glutamic acid	12.52	12.65	12.36	10.11	9.38	9.75	12.48	11.14	10.54	9.44	10.31
Glycine	8.65	3.38	2.17	Traces	Traces	Traces	0.83	Traces	Traces	Traces	Traces
Aspartic acid	7.25	4.51	3.18	2.01	1.12	1.09	3.74	2.81	1.98	1.49	1.13
Lysine	6.55	6.74	5.91	5.73	5.18	3.74	4.03	4.62	5.62	3.37	2.02
Leucine	5.63	3.53	3.96	3.51	2.49	2.11	2.07	1.92	1.84	2.06	0.98
Threonine	4.33	4.18	3.81	4.37	4.08	3.59	4.82	4.53	4.14	5.37	2.12
Proline	4.17	2.02	1.39	1.04	1.17	Traces	1.09	Traces	Traces	Traces	Traces
Methionine	3.61	3.18	3.01	3.09	2.91	2.14	2.87	2.91	2.14	2.07	1.08
Cystine	3.55	2.86	2.08	1.57	1.03	0.94	1.43	0.93	0.48	0.98	0.69
Tyrosine	3.53	3.47	3.72	3.49	3.75	3.41	3.51	3.22	3.12	3.68	2.17
Arginine	3.12	2.98	3.42	3.11	3.01	2.94	3.04	2.89	3.01	2 99	2.81
Serine	3.01	1.35	1.94	1.39	Traces	Traces	2.15	Traces	Traces	Traces	Traces
Isoleucine	2.57	1.83	1.94	1.33	1.54	1.31	1.67	1.41	1.29	0.91	0.69
Phenyl alanine	1.34	1.84	1.91	1.71	1.78	1.93	1.27	1.12	1.07	1.13	0.42
Tryphtophan	0.48	0.51	0.46	0.41	Traces	Traces	Traces	Traces	Traces	Traces	Traces

a sharp increase in the bacterial load. The bacterial count of the former was only 1.0×10^4 where as that of the latter was 1.10×10^6 on the 13th day of storage of the samples in ice (Table I). The organoleptic rating of the samples was closely related to the bacterial load and based on this it is quite evident that the storage life of chunks held out of contact with ice is more than that of the chunks held directly in ice.

The major components in the free amino acid pattern of seer fish muscle are histidine, alanine and glutamic acid. The higher histidine content appears to be the general characteristic nature of the fatty fishes (Shimizu *et. al* 1952, Shewan 1955, Hughes 1959). The quantity of free amino acids in both samples, in contact and out of contact with ice, indicated gradual decrease with increasing period of ice storage. The major amino acids which showed this decreasing trend were alanine, serine, glycine, proline, aspartic acid, lysine and histidine. In samples kept in contact with ice, serine, proline, glycine and cystine showed rapid fall within 3 days of storage. Histidine content decreased slowly upto 5 days and rapidly during further storage. The rapid fall in the case of histidine may be due to the production of histamine during spoilage. Geiger *et al* reported the production of histamine in mackeral muscle by bacterial decarboxylation. Hughes *op. cit.* obtained similar results on the postmortum spoilage of herring.

It is evident from the data that there does not exist a definite and close relationship in the changes of the free amino acids between the two samples. Also no corrulation was observed between the changes in the bacterial count and free amino acid pattern. This may be due to the nature of bacterial flora developing on the seer fish muscle during ice storage temperature which may vary the spoilage pattern of free amino acids, considerably. The gradual decrease in the free amino acids content may be due to leaching, during ice storage. The quantity of glycine, serine and proline which impart the sweet flavour to the fish muscle was found to be in low concentration in the seer fish samples that were studied which may be due to age and state of maturity of the fish.

Conclusions

Based on the study it can be concluded that seer fish stored in ice either as chunks or fillets keeps for 10 days in acceptable condition compared to just over 13 days for seer fish chunks stored out of contact with ice. The major changes taking place in the seer fish muscle during storage in ice are development of rancidity, toughening of the texture and loss in flavour. A closer examination of the protein extractable values in the chunks stored in contact and out of contact with ice reveal that the water extractable proteins are more or less intact in the later. The toughening of the texture in the former case may probably be due to the loss of water soluble proteins rather than due to the insolubility of myofibrillar proteins. The storage life of seer fish chunks and fillets may be extended by using a proper water proof wrapping materials.

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