SOME ASPECTS OF FREEZING AND FROZEN STORAGE OF POMFRETS

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It has been observed that a better frozen product can be obtained by freezing good quality pomfrets transported in insulated containers with sufficient quantity of ice. To enhance the keeping quality and to prevent dehydration and discolouration, a dip in B H A (0.005%) for 15 minutes and subsequent storage in polythene lined gunny bag at —15C to —18C can be recommended. The products treated in the above manner can be stored well over six months. Periodical glazing at an interval of 3 weeks will also prevent the dehydration to a greater extent.

INTRODUCTION

Among the different choice fishes transported from Gujarat coast to Bombay, white pomfrets *(Pampus argenteus)* form the major group. The fish are largely transported in country crafts and boats in insulated and non-insulated holds packed with ice. A detailed study on the quality of the fish transported to Bombay with its keeping quality at room temperature and in ice storage was done and the results were reported elsewhere. Part of the good quality fish are frozen and stored at low temperature for slack season. Sawant and Magar (1961) reported that the retention of amino acids were more and the dehydration was minimum during the five months storage of frozen pomfrets in gunny bags. Recently, Cyriac Mathen *et al.* (1966) reported that the protective coatings such as agar agar and dipping in hydroquinone solutions enhance the storage life of frozen oil sardines.

In the commercial freezing and storage, the fish on storage for 2 to 3 months gets yellow discolouration and dehydration and thereby reduces the market value. To prevent the dehydration and discolouration during storage of silver frozen pomfrets, a detailed investigation on the freezing and cold storage of silver pomfrets was done by the authors and the results are reported in this paper.

MATERIALS AND METHODS

The laboratory controlled samples were the freshly caught pomfrets packed

with ice in thermocole insulated boxes transported from Veraval to Bombay. The fish were thoroughly washed with water to remove blood and slime. The samples of high quality having the same physical characteristics were selected and quick frozen in 4 to 5 hours at —30C to —35C. Some of the fish samples were given a dip in a solution containing butylated hydroxy toluene (B. H. T) 0.005% and butylated hydroxy anisole (B. H. A) 0.005% with synergists like ascorbic acid and citric acid (1:1) 0.005%. The frozen samples were glazed periodically once in three weeks and stored at —15C to —18C. Along with these samples the commercially frozen samples were kept for the storage studies. The commercial samples were obtained from the trade with the same history.

The total volatile nitrogen and trimethyl amine nitrogen were determined by the method of Conway and Byrene (1933). Alpha amino nitrogen was determined by the Pope and Stevens method (1939) using trichloracetic acid extracts. The thiobarbituric acid number was determined by the distillation method of Tarladgis *et al.* (1960). The salt soluble nitrogen was extracted at below 4C by the method of Dyer *et al.* (1955) using 5% sodium chloride solution, and the proteins were estimated by the biuret method of Snow (1950). The lipids from the frozen fish were extracted using the chloroform methanol phase separation method of Folch *et al.* (1957). The free fatty acids were determined by dissolving the lipids in hot neutral alcohol and titrating against standard sodium hydroxide. Odour and flavour of the material were evaluated on the thawed sample after cooking. The thawed material was cut transversely and a portion was smeared with powdered salt to taste and was taken in a boilable type polythene bag, which was immersed in a boiling water bath. The sample was cooked until the internal temperature of the muscle reached 71C for about 15 to 20 mins. The average scores were taken on the samples as given in Table 6.

Results and Discussion.

The changes in total volatile nitrogen (TVN), trimethyl amine nitrogen (TMA N) and alpha amino nitrogen during the storage period of six months are given in table 1. The loss in moisture is less than 4% while the increase in the TMA N and TVN are not quite perceptible. Similar observations were recorded by Botalla *et al.* (1955) while working with frozen perch, mackerel and cod packed in polythene bags.

The results of denaturation of the proteins as determined by salt soluble nitrogen and the lipid hydrolytic changes as measured by the free fatty acids are given in table 2. The initial values of the salt soluble nitrogen were higher than those of Sawant and Magar (1961). The decrease in extractability of nitrogen with 5% sodium chloride is perceptible during the storage period of six months showing that considerable damage has been done to the texture of the muscle. Sawant and Magar (1961) recorded values as low as 26% for the frozen pomfrets stored for 4 months. Dyer *et al.* (1956) emphasized that a similarity exists in the rate of lipid hydrolysis and protein denaturation as measured by the loss in solubility in 5% sodium chloride solution. While working with frozen cod samples Olley *et al.* (1962) confirmed the observations of Dyer. In our studies also there is a similarity in the trends of protein denaturation along with the lipid hydrolysis. The free fatty acids have doubled during the storage period of six months.

In Table 3, percentage weight loss during storage of frozen pomfrets are

TABLE I NITROGENOUS CHANGES DURING STORAGE OF LABORATORY CONTROLLED FROZEN POMFRETS

Storage period	Moisture %	TVN	TMA	Alpha amino nitrogen
		.....	.....mg%	.....
Initial	75.69	12.6	2.80	15.80
3 months	76.40	18.1	4.10	20.66
4 months	76.71	19.1	3.96	22.33
5 months	73.24	19.5	4.20	21.46
6 months	72.00	20.8	.....	24.24

TABLE II PROTEIN EXTRACTABILITY AND LIPID HYDROLYTIC CHANGES DURING STORAGE OF LABORATORY CONTROLLED FROZEN POMFRETS

Storage period	Salt soluble nitrogen %	Free fatty acids %
Initial	77.38	7.65
2 months	68.11	9.71
4 months	58.32	11.73
6 months	53.02	14.14

TABLE III PERCENTAGE LOSS IN WEIGHT DURING STORAGE OF FROZEN POMFRETS

Storage period	Commercial samples	Laboratory controlled samples		
		Unglazed	Glazed	Glazed stored in poly thene lined gunny bag
		.....	% loss.	
1 month	3.2	0.9	...	0.00
2 months	5.9	1.7	0.3	0.00
3 months	8.1	2.8	1.1	0.00
4 months	8.7	4.6	2.2	0.00
4½ months	8.9	6.1	2.8	0.09
5 months	9.4	6.8	3.7	0.19
6 months	10.2	7.6	4.1	0.33
7 months	10.9	8.5	4.6	0.38

TABLE IV OXIDATIVE RANCIDITY DURING STORAGE OF LABORATORY CONTROLLED FROZEN SILVER POMFRETS

TBA number = mgs of malonadehyde / 1000 gms of sample

Storage Period	SKIN					MUSCLE				
	Control	Poly: lined gunny bag:		Waxed cartons.		Control	Poly: lined gunny bag		Waxed cartons	
		BHT	BHA	BHT	BHA		BHT	BHA	BHT	BHA
Initial	4.53	...	...	...	...	2.15	...	...	...	...
1 month	12.43	10.00	7.50	8.01	7.21	3.10	2.93	2.53	3.12	3.25
2 months	17.83	10.15	7.70	11.12	10.34	3.85	3.17	3.02	4.26	3.63
3 months	20.00	14.06	8.15	11.85	12.11	4.22	3.38	3.41	3.89	4.02
5 months	20.49	19.19	11.54	17.83	17.15	5.15	4.18	3.36	4.58	3.68
7 months	24.50	14.70	12.88	21.56	18.16	6.01	4.26	3.66	4.46	4.78

TABLE V OXIDATIVE RANCIDITY DURING STORAGE OF COMMERCIAL FROZEN POMFRETS

TBA number = mg of malonaldehyde/1000 g of SKIN

Storage period	Polythene lined gunny bag			Waxed caton		
	BHT	BHA	Control	BHT	BHA	Control
Initial	...	...	9.78	...	...	9.78
1 month	15.49	10.20	20.31	20.14	11.69	41.21
2 months	20.68	12.91	20.26	31.00	2I.12	38.46
3 months	26.12	14.46	25.89	35.19	28.46	43.17
5 months	28.68	15.49	28.75	43.80	26.42	.....
7 months	33.86	15.54	34.42	40.16	30.14	58.14

TABLE VI ORGANOLEPTIC SCORING OF LABORATORY CONTROLLED FROZEN POMFRETS

Storage period	Control	Poly: lined gunny bag		Waxed corton	
		BHT	BHA	BHT	BHA
Initial	5	5	5	5	5
1 month	4	5	5	4	4
2 months	3	4	5	3	4
3 months	2	3	4	2	3
5 months	1	2	4	2	3
7 months	1	2	3	1	2

Organoleptic scoring:

(a) Odour and flavour characteristics of freshly caught frozen pomfrets. 5

(b) Loss in part, odour and flavour characteristic of freshly caught frozen pomfrets, but not dtstinguished by new. } 4

(c) Moderate degree of change in flavour and odour but presence of sligt rancid odour. } 3

(d) Strong change in flavour and odour with more flat odours of rancidity. 2

(e) Extreme degree of change in flavour and odour with distinct flat odours of rancidity. } 1

TABLE VII ORGANOLEPTIC SCORING OF THE COMMERCIAL FROZEN POMFRETS

Storage period	Polythene lined gunny bag			Waxed cartons		
	BHT	BHA	Control	BHT	BHA	Control
Initial	...	...	5	...	...	5
1 month	4	4	3	3	4	2
2 months	2	3	2	2	3	1
3 months	1	2	1	1	1	1
5 months	1	2	1	1	1	1
7 months	1	2	1	1	1	1

given. During storage for 2 to 3 months in the commercial samples, where no glazing is usually done, there is a weight loss of 6 to 8%. This is reduced to minimum when the glazed samples were stored in polythene lined gunny bags. It has also been observed that with the increase of weight loss the yellow discolouration increases. During storage the discolouration appears on the head and lateral region.

The carbonyl compounds resulting from the fat oxidation,can enter into Maillard reaction to give compounds generally yellow or brown in colour. As the yellow discolouration is quite predominant over the skin, the thiobarbituric acid number for the skin and muscle was determined separately. It can be seen from Table 4 that the T B A value for the skin is very high when compared with the muscle. This is due to the high fat content of the skin. The fat content of the skin of the pomfrets varied from 32% to 45% (moisture free basis), while in the muscle the maximum value recorded was only 12% (moisture free basis). The increase in the value during 7 months storage is more than 5 times in the case of the control skin samples while it is only 3 times in muscle samples. It can be seen from Table 4,that B H A showed a little beneficial effect in retarding the oxidative rancidity in the frozen pomfrets during the 7 months storage.

An attempt to store the products in the waxed cartons did not yield any beneficial effect over the polythene lined gunny bag.

As the major changes in fat oxidation was taking place on the skin surface (vide Table 4), only skin samples were analysed when commercial frozen samples were handled. Results in Table 5 denote trends similar to those in Table 4, except that the values are of higher order. The samples were having a high T B A number even by 2 months storage period and the discolouration was quite perceptible in the control and BHT treated ones.

Organoleptic scoring of the cooked meat has been given in Tables 6 and 7. It is quite evident that the BHA treated samples are ranked high over the control and BHT treated ones. There is no perceptible rancid flavour in the samples upto 5 months storage in the polythene lined gunny bags. Even in the commercial samples, the BHA treatment proved beneficial in retrading the rancidity. However the commercial samples could not be stored for more than 7 months due to pronounced rancidity.

ACKNOWLEDGEMENTS

The authors express their sincere thanks to Mr. R. Venkataraman, Senior

Research Officer and also to Dr. A. N. Bose, Director of the Institute for valuable criticisms and suggestions.

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