COMPARATIVE STUDIES ON THE CANNING PROPERTIES OF POMFRETS AND HILSA

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Fresh silver pomfret, black pomfret and hilsa were canned at absolutely fresh and iced conditions and the qualities of the final products were studied comparatively in relation to the initial quality of the raw materials. Under identical conditions a maximum quantity of cook-drip and nitrogen contents were found to be lost in black pomfret and minimum in hilsa. Silver pomfret and black pomfret iced for 3 days gave fairly good products on canning while hilsa came out only as a satisfactory product on canning after the same ice storage period of the raw material.

INTRODUCTION

About 25,000 tonnes of pomfrets and 10,000 tonnes of hilsa are landed every year in India. It is practically impossible to can the whole bulk of raw material on the same day of catch during the season when there are bumper catches. On such occasions the fresh fish are preserved in ice. During storage in ice gradual changes in physical and biochemical characteristics take place by the action of bacteria, enzymes and other constituent chemical compounds which have a direct impact on the quality of the processed product. Therefore it was felt very essential to study the effect of ice storage of raw materials on various factors like loss of nitrogenous matters, cook-drip, texture and over-all quality of the canned pomfrets and hilsa. The aim of this paper is to present such data collected by systematic investigations on the problem and also to suggest a maximum permissible limit of ice storage period for raw pomfrets and hilsa intended for canning.

MATERIALS AND METHODS

Raw materials:

Absolutely fresh silver pomfrets *(Pampus argenteus)*, black pomfrets *(Parastromateus niger)* and hilsa *(Hilsa toli)*, procured from the fishing ground in the iced condition were used for the experiments. All the species were taken from single gill-net haul, iced immediately and stored in insulated boxes, fabricated at this

Sub-station and brought to the laboratory. The fish was stored in the same insulated container without any disturbance, replenishing the ice periodically, taking care to see that the muscle temperature remained at or near 0°C. Representative samples from each species were canned under identical conditions at fresh stage and also after 3 days, 5 days and 7 days of icing after which the study was discontinued. Canning was carried out as per the procedure given below.

Filleting:

Fish after dressing and proper washing were filleted into suitable sizes. In the case of hilsa, due to its bony nature, the size of the fillets had to be slightly bigger, compared to silver and black pomfrets.

Brining:

20% brine prepared from refined salt was used for brining. Brining was effected for 30 mts with a ratio of 1 kg of fillets in 500 cc brine.

Filling in cans:

A known weight (about 340 gms) of the brined fillets after draining was filled in SR lacquered (301 x 309) open top cans. In the case of silver and black pomfrets six pieces were filled whereas in the case of hilsa four pieces were filled in each can.

Pre Cooking:

The filled materials were pre-cooked in an autoclave at 0.49 kg/cm^2 steam pressure for 15 minutes. The cooked samples were drained for 10 mts and the pre-cook drip was collected individually.

Filling with oil:

The cans were filled with deodourised double refined ground nut oil at 80°C leaving a head space of about 5-8 mm.

Exhausting and seaming:

The filled cans were exhausted by steam for 10 mts and immediately double-seamed.

Processing:

The seamed cans were processed for 45 mts at 1.05 kg/cm^2 steam pressure.

Cooling and cleaning:

The processed cans were suddenly cooled in ice cold water. After cooling the cans were removed and cleaned with alkaline water to remove oil and other dirt particles adhering to the can surface, which were then properly wiped to remove water. The cans were stored for some days in a cool dry place.

Analysis:

The raw materials were analysed at all the stages of canning. The cannned samples prepared from fresh and iced materials were also analysed. Moisture and salt were estimated by the methods of A O A C (1960). The total volatile nitrogen (TVN) and trimethylamine (TMA) contents were determined by Conway (1947) Micro Diffusion method. For non-protein nitrogen (NPN) 20% trichloracetic acid extract was used. NPN, water soluble nitrogen (WSN) and total nitrogen (T N) contents were estimated by micro Kjeldahl method. Pope and Steven's (1939) method was followed for determining α-amino nitrogen. The nitrogen contents in brine (after brining of fillets), pre-cook drip and final cook drip (after processing) were also estimated.

Results and discussions

Table I shows the physical changes occurring in pomfrets and hilsa during icing. It was found that silver pomfret remained in absolutely fresh condition for 5 days after which the freshness was lost even though off odors did not develop. In black pomfret and hilsa absolute freshness was retained only for 3 days. In all the species no signs of spoilage were

TABLE I PHYSICAL OBSERVATION OF ICED POMFRETS AND HILSA

Ice storage period in days	Species	Colour of the skin	Colour of the flesh	Appearance of eyes	Colour of gills	Odour of gills	Texture of muscle	Overall quality
	Silver pomfrret	Bright white with silvery scales	Characteristic fresh white	Convex shining black	Bright red	Fresh sea-weedy	Firm	Excellent
Fresh	Black pomfret	Bright, brown or black	Fresh, slightly brown	Bright, slightly convex	-do-	-do-	-do-	-do-
	hilsa	Bright with silvery scale	Fresh reddish	Bright convex	-do-	-do-	-do-	-do-
	Silver pomfret	White	White	Convex black foggy	Red and covered with pale yellow mucus	Fresh	firm	good
3	Black pomfret	Brown or black covered with thin layer of slime	Slightly brown	Foggy	-do-	fresh odour lost	slight soft	-do-
	Hilsa	-do-	Dull reddish	-do-	-do-	-do-	-do-	Fair
	Silver pomfret	Covered with pale yellow slime	Dull white	Cloudy	Covered with yellow mucus	Slightly fishy	Slightly soft	-do-
5	Black pomfret	-do-	Dull brown	-do-	Brownish covered with thick yellow mucus	Fishy	Soft	Satisfactory
	Hilsa	-do-	Dull red	-do-	-do-	-do-	-do-	-do-
	Silver pomfret	Covered with pale yellow patches	Slightly discoloured	Clondy	Completely covered with yellow mucus	Fishy	Soft	Satisfactory
7	Black pomfret	Covered with thick slime	Brown	-do-	-do-	Slightly stale	-do-	Poor
	Hilsa	Covered with slime	Dull red	-do-	-do-	stale	-do-	-do-

TABLE IV PHYSICAL OBSERVATION OF CANNED POMFRETS AND HILSA

Ice storage period of raw material in days	Species	Appearance of flesh	Appearance of drip	Appearance of oil	Texture of flesh	Odor of flesh	Flavour	Vacuum cm	Head space mm	Overall quality
Fresh	S. P.	Characteristic fresh	Clear, slight brown	Clear, pale yellow	Firm	Good	Characteristic flesh	18–20	4–5	Good
	B. P.	,,	Clear moderately brown	Clear, pale brown	,,	,,	,,	15–18	–do–	,,
	H.	,,	,,	,,	,,	,,	,,	–do–	5–6	,,
3	S. P.	,,	Clear, slight brown	Clear, pale yellow	Moderately firm	Fresh odor lost	Fresh flavour lost	12–15	4–5	Fair
	B. P.	,,	,,	,,	,,	,,	,,	,,	3–4	,,
	H.	slightly discolored	,,	,,	Slightly soft	very slight penetrating odor	,,	,,	4–5	Satisfactory
5	S. P.	Slightly dull discolored	Slight brown clear	Clear, pale yellow	,,	Stale	Satisfactory	7–10	4–5	,,
	B. P.	,,	,,	,,	,,	Tainted	Off flavour	5–8	4–5	Poor
	H.	,,	,,	,,	,,	,,	,,	,,	3–4	,,
7	S. P.	Dull	,,	Clear yellowish	,,	,,	Considerable off flavour	,,	4–5	,,
	B. P.	More discoloration	,,	,,	,,	,,	Off flavour & biting taste	negligible	4–5	Very Poor
	H.	,,	Slight brown	,,	,,	,,	,,	,,	5–6	,,

S. P. = Silver pomfret B. P. = Black pomfret H. = Hilsa

TABLE II ANALYSIS OF FRESH AND

Species	Fresh				3days iced			
	Moist %	TVN mg %	TMA mg %	SPC	Moist %	TVN mg %	TMA mg %	SPC
Silver pomfret	71.88	10.42	2.935	3.3×10^5	71.94	12.00	3.456	—
Black pomfret	73.02	11.03	2.636	2.6×10^5	74.92	14.95	3.018	—
Hilsa	73.40	9.35	3.394	2.4×10^5	74.80	14.00	3.945	—

TABLE III ANALYSIS OF FRESH AND

Sample	Fresh				3 days iced			
	∝-amino nitrogen mg%	NPN mg %	WSN mg %	TN %	∝-A. N. mg %	NPN mg %	WSN mg %	TN %
Silver pomfret	12.139	445.5	488.4	2.959	16.35	396.7	450.8	2.890
Black pomfret	16.346	484.9	503.4	3.251	25.19	465.5	493.2	3.148
Hilsa	15.609	501.7	607.1	3.448	25.11	489.6	602.2	3.409

TABLE V ANALYSIS OF CANNED

Species	Fresh canned					3 days iced & canned				
	Moist %	Salt %	NPN mg%	WSN mg%	T.N. %	Moist %	Salt %	NPN mg%	WSN mg%	T.N. %
S. P.	63.62	1.43	193.4	352.3	3.325	64.57	0.92	126.6	498.1	3.272
B.P.	66.85	0.79	288.9	342.2	3.519	65.28	0.90	193.8	549 4	3.550
Hilsa	65.86	0.85	342 3	325.0	3.961	65 97	1.321	142.5	674.2	3.699

S. P. = Silver pomfret B. P. = Black pomfret

noticed upto 7 days of ice storage even though the freshness was lost within five days. The firm texture of fresh fish gradually disappeared by 7 days of ice storage and all the species became considerably soft after 5 days.

Tables II & III show the analytical data of fresh and iced fish. A slight increase was noted in moisture contents. Even though TVN and TMA contents (Table II) gradually increased with ice storage period the change is not rapid, which shows the satisfactory conditions of all the species. NPN, WSN and TN contents were found to decrease which may partly be due to the leaching of soluble materials along with ice melt water. Apart from this leaching, Choudhury and Bose (1960) have suggested that either the initial bacterial attack or the activity of deaminating enzymes might reduce the nitrogen contents in the fish. The rate of bacterial multiplication during ice storage was maximum in silver pomfret and minimum in hilsa.

ICED POMFRETS AND HILSA

5 days iced				7 days iced			
Moist %	TVN mg %	TMA mg %	SPC	Moist %	TVN mg %	TMA mg %	SPC
72.40	17.98	6.294	17.2×10^5	73.55	24.03	8.650	99.3×10^5
75.32	20.90	6.094	3.0×10^5	76.43	21.51	6.293	14.0×10^5
75.40	18.19	4.197	4.7×10^5	77.00	23.26	6.487	8.3×10^5

ICED POMFRETS AND HILSA

5 days iced				7 days iced			
∝-A. N. mg %	NPN mg %	WSN mg %	TN %	∝-A N. mg %	NPN mg %	WSN mg %	TN %
20.15	388.6	447.4	2.847	23.84	360.0	380.0	2.767
31.94	400.8	469.8	3.656	35.80	385.7	400.7	2.985
31.90	467.0	580.1	3.348	39.26	454.0	531.1	3.251

POMFRETS AND HILSA

5 days iced & canned					7 days iced & canned				
Moist %	Salt %	NPN mg%	WSN mg%	T.N. %	Moist %	Salt %	NPN mg%	WSN mg%	T.N %
65.98	0.853	104.6	565.9	3.113	65.40	0.817	128.9	371.5	3.118
66.57	1.267	166.5	495.8	3.419	65.98	1.490	132 8	293.1	3.318
65,02	1.814	206.0	357.3	3.760	64.39	1.612	183.4	278.3	3 815

Table IV shows the quality of canned pomfrets and hilsa prepared from fresh and iced raw materials. It was found that cans prepared from three days iced silver and black pomfret were as good as fresh canned products while similarly iced hilsa gave only a satisfactory canned product.

On five days icing silver pomfret gave a satisfactory canned product while that from black pomfret was poor. This indicates the superior quality of silver pomfret over black pomfret and hilsa. This also agrees with the view of Venkataraman *et al* (1966) who reported a fairly longer storage life for silver pomfret compared to black pomfret in ice. Analytical data show the inferior quality of iced hilsa in canning compared to iced silver and black pomfrets under identical conditions. However the quality of the canned products from iced raw materials was found to have some relationship with the percentage of red muscle in the fish. It is to be noted that hilsa has got a very high percentage of red muscle followed by black pomfret

while silver pomfret has very little red muscle.

In Table V, could be noted a sharp fall in NPN in all the species of canned products as a result of pre-icing of the raw materials. No appreciable change in moisture content was noted in canned black pomfret and hilsa on icing. However a slight increase was noted in the case of silver pomfret. The total nitrogen was found to have reduced in all the species of canned products almost proportionally to the ice storage period of raw materials.

The protein contents (T N x 6.25) of fresh silver pomfret, black pomfret and hilsa were found to be 65.8%, 75.3% and 81% (D. W. B.) respectively.

Table VI indicates the protein losses (calculated from total nitrogen given in Table V) in canned fish. It is generally noted that about 9.7%, 12.5% and 8.2% (DWB) of protein were lost during canning of fresh silver pomfret, black pomfret and hilsa respectively. This loss was found to increase upto 12.2%, 15.4% and 13.6% in the above order when the raw materials were iced for 7 days. Among the fresh canned products the maximum loss of protein was observed in black pomfret and minimum in hilsa. However, the rate of loss was higher in hilsa compared to other species as a result of icing the raw materials. This coincides with the higher rate of spoilage observed in the canned product from iced hilsa. The texture and firmness of the muscle vary considerably from species to species and this has a direct bearing on the drip formation and loss of protein.

Regarding loss of nitrogenous matter during initial brining of the fresh fillets, pre-cooking and final processing (Table VII) it was noted that the prior ice storage of raw material effected a slight increase in loss during brining and significant

TABLE VI PERCENTAGE LOSS OF PROTEIN IN CANNED POMFRETS AND HILSA

Species	fresh canned	3 days iced & canned	5 days iced & canned	7 days iced & canned
Silver pomfret	9.70	9.88	10.76	12.23
Black pomfret	12.45	12.78	12.01	15.35
Hilsa	8.185	12.73	12.50	13.57

increase during precooking while a propotional decrease during final processing just in correlation with the quantity of cook drip formed. This coincides with the general impression that a higher loss of drip causes a higher loss of soluble nitrogen. A significantly higher loss of nitrogen in black pomfret was observed compared to that of silver pomfret which closely moves with the nitrogen value of hilsa.

Figure I shows the quantities of cook-drip formed during the pre-cooking and further processing of the brined fillets prepared from fresh and iced materials. It indicates that quantity of pre-cook drip formed is proportional to the prior storage of the raw materials in ice. It is observed that the quantity of processing drip decreases with the increase of ice storage period of the raw materials. Regarding the total quantity of drip formed during pre-cooking and processing a gradual increase was observed as the result of pre-icing. Under identical conditions of processing it was found that the maximum loss of drip was formed in black pomfret while the minimum was in hilsa.

On the basis of the analytical data presented here a definite answer cannot be given for these variations of protein contents and drip formations in different products under study. A thorough investigation on the chemical constituents of these species and their variation in several

TABLE VII NITROGEN LOSSES IN BRINING AND IN COOK DRIPS

(Values expressed in mg N/100 g muscle)

Stage at which analysed	Silver pomfret				Black pomfret				Hilsa			
	Days of storage in ice				Days of storage in ice				Days of storage in ice			
	0	3	5	7	0	3	5	7	0	3	5	7
Initial brining	20.8	22.77	29.14	33.31	24.8	27.27	32.5	44.92	28.4	30.32	32.50	35.33
Pre-cooking	121.9	157.87	173.69	202.98	140.5	178.0	214.1	233.0	105.8	136.60	192.70	200.08
Processing	125.8	102.13	79.11	69.52	201.9	185.8	150.0	126.0	130.1	109.55	65.59	53.32

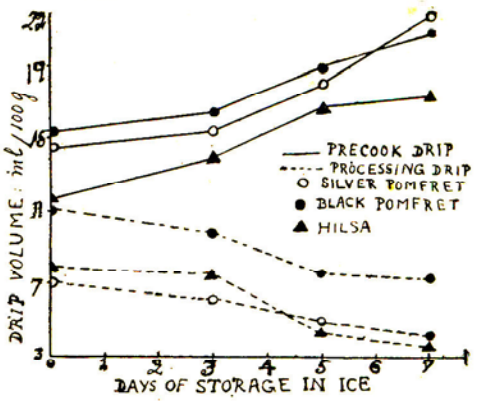

Fig 1. Precook drip and processing drip.

seasons has to be conducted to explain the physical and chemical characteristics of canned products prepared from fresh and iced raw materials. Such type of study has already been taken up by this Sub-station.

SUMMARY

A comparative study was carried out on the properties of canned silver and black pomfrets and hilsa prepared from fresh and iced raw materials. It was found that silver pomfret retained its fresh odour and appearance for 5 days while the freshness of black pomfret and hilsa disappeared after 3 days. All the species were in satisfactory condition upto the 7th day which was the maximum limit allowed during this study. The loss of nitrogenous matter during icing was almost proportional to the storage period. The rate of bacterial multiplication was maximum in silver pomfret and minimum in hilsa. It was found that a maximum period of 5 days ice storage could be permissible in the case of silver pomfret and 3 days in black pomfret and hilsa intended for canning. 9.7,% 12.5% and 8.2% of proteins (DWB) were lost during canning of fresh silver pomfret, black pomfret and hilsa respectively. This loss increased upto 12.2%, 15.4% and 13.6% in the above order

due to the prior ice storage of the raw materials upto 7 days.

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