

STUDIES ON COLOMBO-CURING OF MACKEREL (*RATRELLIGER KANAGURTA*)

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Results of investigations carried out to improve the process of 'Colombo-curing' of mackerel are presented in this paper. Optimum composition of salt and goruka puli (malabar tamarind, *Garcinia cambogea*) to be used in the pickle mixture to give a product of good organoleptic and chemical characteristics have been worked out. Sodium benzoate is used as a preservative against the attack of molds, 'red' etc.

INTRODUCTION

Pickling is one of the earliest known methods of preservation of fish. Preservative action of salt coupled with the acidity of vinegar has been accounted for as a very effective principle in maintaining the quality of preserved fish. Though the method of preservation of fish by pickling has not been extensively practised in commercial scale as in certain European and Scandinavian countries, it has been in vogue and practised on a fairly large scale along the west coast of India. Since large quantities of mackerel and sardine are landed along this coast and the fishery is seasonal and since they turn rancid and discoloured on salting and drying due to the high fat content, pickling preservation will find an edge over the other methods.

The industry is located mainly on the Malabar South Kanara coast and the products sealed in barrels used to be mostly exported to Ceylon. The method consisted in rendering the brine acidic by rubbing into the gutted and washed fish along with salt dried pots of "goruka puli" (malabar tamarind - *Garcinia cambogea*). These heavily salted fish are left in large cement tanks for some weeks and later packed in air tight barrels under brine for export (Nicholson, 1930). It has also been reported that several curers all along this coast preserve bulk catches of fish under saturated brine in cement tanks with or without the addition of goruka puli (Rao & Valsan, 1962).

However, this method of preservation using goruka puli does not yield a palatable

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TABLE I
Particulars of treatment of fish

Sample No.	Ratio of salt to fish	Content of sodium benzoate in salt (%)	Proportion of goruka puli (g./kg. of fish)
1 (control)	1:3	Nil	50
2	1:4	0.25	50
3	1:4.5	0.50	50
4	1:5	0.50	45
5	1:5	0.50	40

product owing to the very high salt content resulting in tough and fibrous texture and sour taste of the product often resulting from the high proportion of the goruka puli used. There are some attempts made to modify this process. Vasavan and Varma (1959) reported their experiments on pickling fish with vinegar and malabar tamarind. Rao, Valsan and Nair (1958) studied the use of tamarind (*Tamarindus indica*) as a substitute for goruka puli. Valsan, Nair and Rao (1961), and Rao and Valsan (1962) showed that the storage life of pickled fish could be extended considerably by giving them a predip treatment in propionic acid. Rao and Valsan (1962) in their attempt to further modify the process showed that mackerel after heavy salting could be effectively preserved in saturated brine containing 0.25% or 0.5% propionic acid. They have reported while comparing the quality of pickled fish made by different methods that the intensity of mold growth and reddening was found to be less in the goruka puli treated samples in the initial stages.

The use of goruka puli as a preservative in place of propionic acid offer the advantage that it is more easily available in villages whereas propionic acid is an imported commodity, and that the natural flavour of goruka puli can do away with the bitter taste of propionic acid. However, the use of very high proportion of salt and goruka puli as practised in industry will add to the processing cost of the product. Nicholson (1930) has reported the use of 82 lbs. of salt to 290-330 lbs. of gutted fish and 20 lbs. of goruka puli. In general practice the ratio of salt to fish employed is around 1:3. Therefore, it was found worthwhile to study in detail and work out the optimum proportions of salt and gouka puli to give a product having good organoleptic characteristics and reasonably high storage life at a minimum of processing cost. The present paper reports the results of the experiments carried out on 'Colombo-curing' of mackerel with the above aims in view.

MATERIAL AND METHODS

Freshly landed mackerel (*Rastrelliger kanagurta*) (size 20-22 cms) were gutted, dorsoventrally split, washed and smeared on the outside and inside with a well-blended mixture of refined salt and sodium benzoate. Small amounts of goruka puli were inserted into the belly cavity of each fish. A control sample was prepared without adding sodium benzoate. Particulars of treatment are as in Table I.

Fish as treated above were packed in glass jars. Samples were tested at regular intervals for the chemical indices of spoilage, organoleptic rating and visual observation for the presence or absence of molds, fungus, insects, "red", putrid smell etc.

TABLE II
Initial Analysis of the Experimental Samples

Samples	Moisture	TMAN mg %	TVN mg %	Salt % on D.W.B.	Fat on D.W.B.	Organoleptic rating			
						Score	Taste	Tex- ture	Flavour
Fresh fish	76.24	—	—	0.26	9.1	—	—	—	—
Sample 1	50.20	1.36	19.2	22.1	8.9	1.0	*	Very hard	Poor
2	49.10	1.86	18.6	19.5	8.9	1.5	**	„	„
3	53.1	1.48	20.8	16.89	9.0	2.0	***	Hard	Slightly better
4	51.5	1.44	19.1	15.84	8.9	4.0	†	Soft	Good
5	52.5	1.52	22.4	15.12	8.8	4.5	‡	„	Very Good

* prominently sour; highly saltish

** prominently sour; highly saltish

*** prominently sour; salt content slightly above normal

† good taste; salt content normal

‡ better taste; salt content normal

Moisture, fat and sodium chloride were estimated by the A. O. A. C. (1955) method; trimethylamine nitrogen (TMAN) and total volatile nitrogen (TVN) were estimated on a trichloroacetic acid extract (Beatty and Gibbons, (1957) by the microdiffusion method of Conway (1947). The organoleptic rating was carried out by an experienced panel on the cooked product, and given numerical scores according to the quality.

RESULTS AND DISCUSSION

The results of the chemical analysis of the fresh fish and the initial analysis of the experimental samples are presented in Table II.

Samples 1 and 2 contain a fairly higher content of salt and the organoleptic ratings are proportionately lower. In

addition to the higher salt content and bitter sour taste, the texture also appeared to be very hard. Sample 3, although less salty, had the sour taste predominating. The other samples were better with regard to their taste and texture.

Similar observations on the samples on progressive storage is given in Table III.

Spoilage due to "red" and fungus have been found to be very common in commercial mass pickling of fish and investigations have revealed that incorporation of 0.25% to 0.5% of sodium benzoate into the pickle is an effective remedy (Valsan, 1967, unpublished communication). However, in the present study from a consideration of overall quality and shelf life of the product it was observed that 0.25% of sodium benzoate is not sufficient to effectively control the above phenomena,

TABLE III

Results of analysis of the processed and stored fish

Sample No.	Time of storage in weeks											
	4				8				12			
	Moisture %	TMAN mg. %	TVN mg. %	NaCl %	Moisture %	TMAN mg. %	TVN mg. %	Nacl %	Moisture %	TMAN mg. %	TVN mg. %	Nacl %
1	49.21	1.74	22.28	21.28	48.42	2.05	24.42	21.81	47.23	2.76	25.01	19.92
2	48.94	2.76	20.17	19.44	47.04	3.26	22.25	17.88	47.23	2.84	23.78	18.89
3	51.12	1.54	22.14	17.52	51.01	2.12	23.64	18.24	49.61	2.71	26.82	18.41
4	49.41	1.48	22.06	16.02	48.91	2.04	20.01	17.16	47.94	2.68	24.14	17.68
5	52.02	2.15	34.15	16.28	51.42	3.02	45.47	17.44	49.22	3.94	52.62	17.50
	16				20				24			
1	48.11	3.11	28.42	19.19	49.14	3.24	31.52	19.52	50.02	3.36	35.77	21.95
2	48.45	4.21	26.13	18.24	47.78	4.51	29.44	18.78	45.40	4.96	33.87	18.91
3	49.14	3.18	29.10	18.80	52.13	3.22	31.51	18.46	55.12	3.42	35.60	17.82
4	47.51	2.96	26.76	17.61	49.04	3.02	29.20	17.60	51.44	3.24	34.40	16.82
5	47.12	4.42	60.82	17.44	48.89	4.72	65.04	17.24	51.13	5.81	67.21	16.70

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TABLE IV
Observation on the organoleptic condition of Colombo-cured mackerel
Time of onset of spoilage factors in number of days

Sample No	Molds	Red halophiles	Maggots	Putrid odour
1.	36	64	82	89
2.	110	124	106	130
3.	172	134	92	156
4.	196	136	104	—
5.	96	108	126	91

and therefore, 0.5% of the preservative was used. Mold growth was observed in the control sample in as little as 36 days of storage, as it contained no benzoate. As judged by the physical, chemical and organoleptic characteristics, sample No. 4, viz. the sample which has been treated with salt in the ratio 1:5 and goruka puli at the rate of 45 g./kg. of fish and sodium benzoate at 0.5% in the pickle gave a product having very good storage life and better organoleptic characteristics than others. The flavour and taste are not masked to that extent as in other samples studied. The product with proportion of 40g. gorukapuli per kg. of fish, though gave a still better taste with less sour taste, was inferior in its keeping quality. (Table III).

It has been suggested that the preservative action of goruka puli is mainly due to the lowering of pH (Sreenivasan and Venkataraman, 1957). Rao and Valsan (1962) have reported pH values of 5.0 with propionic acid, 5.4 with goruka puli and 4.8 with tamarind. In the present stu-

dies the pH values were 5.6, 5.2, 5.2, 5.2 and 5.4 with respect to the samples 1 to 5. Whereas goruka puli alone could not extend the storage life very near to that of propionic acid, the present investigations have shown that Colombo-cured product with the preservative action of goruka puli in conjunction with sodium benzoate shows good storage life comparable to that produced by propionic acid and having good organoleptic characteristics. Further, while propionic acid is an imported commodity, goruka puli is a cheap produce indigenously available in large quantities adds to the advantages of the process.

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