

Sanitation in Fish Curing Yards of Tuticorin, Tamil Nadu

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The method of preparation of cured fish and the sanitary conditions prevailing in the fish curing yards of Tuticorin region were studied. The water used for washing and brine preparation did not conform to the BIS standards and had high counts of viable bacteria, coliforms and fungi. Relatively high counts of viable organisms, coliforms and fungi in worker's hand, soil and curing tanks resulted in poor microbial quality of the cured fish. A lack of awareness of the importance of hygiene and sanitation among the processors and workers was observed during the survey.

Key words : Fish curing yards, hygiene, Tuticorin

Utilization of fish by traditional methods of curing such as salting, drying, etc. play an important role in the socio-economic system of small scale fisherfolk. These cured fishery products have good internal market and also are exported in sizable quantities to countries like Sri Lanka, Hong Kong and Singapore. During the past few years there has been a decline in the exports of Indian cured fishery products. A survey by Bay of Bengal Programme revealed that poor quality of Indian dried products and competition posed by quality products from Thailand contributed to the decline in the export of dried anchovies to Sri Lanka by India (Anon., 1991). In order to assess the quality of cured fishery products along the maritime states, surveys have been conducted by several research workers from time to time (Srinivasan & Joseph, 1966; Joseph *et al.*, 1986; Kalaimani *et al.*, 1988; Prasad *et al.*, 1994). However, little or no attention has been paid to assess the sanitation during processing. This paper presents the results of the microbiological survey conducted at fish curing yards of Tuticorin.

Four fish curing yards located in the Tuticorin region were covered under this survey between September and December 1990. Samples of water used for brine preparation and washing, brine used for curing, swab (64.5 cm²) from curing tank, soil from dressing area, swab (13.9 cm²) from worker's hand, curing fishes, cured fishes and commercial salt were collected aseptically for microbiological analysis from each fish curing yard. Microorganisms were enumerated from duplicate samples by standard pour plate technique as described by Speck (1976). Total viable counts and fungal counts were enumerated on salt (1.0% sodium chloride) supplemented plate count agar and potato dextrose agar, respectively. Coliforms were determined by the three tube MPN method using Lauryl sulphate tryptose broth. Basic data such as the species used for curing, curing practices followed and methods of disposal of final product were also collected.

The methods of preparation of cured fish in the curing yards visited are detailed in Table 1. The methods followed were

Table 1. The methods of preparation of cured fish in Tuticorin region

Fish	Preparation of fish for curing	Salt ratio	Curing Tank size, m	Curing period	Drying period	Drying method	Method of packing/packing material
Small varieties such as <i>Sardinella</i> spp.	Whole fish washed in seawater and immersed in brine	1:5 (Salt: water)	2x1.5x1	16-24 h	2-3 days	Spreading on sand coir mat or occasionally on cement platform	Packing in gunny bags
Bigger varieties such as rays and sharks	Fish cut into pieces of 1.0 to 2.0 kg and with several deep scoring on the ventral side; Salt rubbed into scored areas and cured	1:3 (Salt: Fish)	2x1.5x1	4-6 days	No drying	-	Packing in palmyrah leaf basket with the addition of salt @ 2-5%

observed to be almost similar in all the yards.

The results of the counts of total viable bacteria, most probable number of coliforms and fungi are presented in Table 2. The water used for brine

preparation and washing did not conform to the BIS standards (BIS, 1967) and was found to be contaminated by indicator organisms and fungal spores. The water used was drawn from open wells and/or sea and stored in cement tanks without any treatment in all curing yards. The brine

Table 2. Microbial load in samples collected from four fish curing yards of Tuticorin region (in log cfu)

Samples	Total viable count		Total fungal count		MPN Total coliforms	
	Range	Mean	Range	Mean	Range	Mean
Water, ml ⁻¹	3.30 - 4.00	3.75	< 1.00 - 1.30	0.94	0.48 - 3.00	2.56
Curing tank - empty, cm ²	0.65 - 0.77	0.73	< 0.16 - 0.36	0.27	0.07 - 0.34	0.25
Curing tank with fish, cm ²	0.62 - 0.82	0.78	< 0.16 - 0.31	0.23	0.07	0.07
Brine, ml ⁻¹	4.23 - 4.81	4.52	1.18 - 3.48	2.90	0.48 - 3.38	2.80
Soil, g ⁻¹	4.37 - 5.81	5.50	0.70 - 3.47	2.99	0.95 - 3.63	3.08
Worker's hand cm ²	0.55 - 1.13	1.04	0.16 - 0.26	0.18	0.07 - 0.37	0.28
Curing fish, g ⁻¹						
Sardine (<i>Sardinella</i> spp.)	3.79 - 6.15	5.57	< 1.00 - 1.54	1.21	1.30 - 2.66	2.28
Ray (<i>Trygon sephen</i>)	4.48 - 7.32	6.72	1.18 - 1.78	1.56	0.48 - 1.36	0.98
Cured fish, g ⁻¹						
<i>Sardinella</i> spp	4.0 - 5.76	5.20	0.70 - 2.20	1.67	0.48 - 1.63	1.24
<i>Trygon sephen</i>	4.18 - 5.43	5.03	-	-	-	-

used for curing had higher mean counts of viable bacteria, coliforms and fungi than water. It was observed, that most of the time, the fishes were not washed properly to remove the adhering sand and dirt. The rays (*Trygon sephen*) were split open by placing them on sand and transferred to the curing tank without proper washing. The soil was found to carry highest counts of total coliforms and fungi followed by brine. From these results it appears that the fungi enter the fish or brine mainly through soil.

Other important factors were the personnel who handle the products and the curing tanks that were improperly cleaned (Table 2). The washed empty curing tanks were found to harbour high counts of microbes due to improper cleaning or poor quality of water used for cleaning. Moreover, the tanks were not adequately dried after every batch of curing. The high microbial load in some curing fishes appeared to be because of multiplication of bacteria in fish flesh at the early stages of the salting process (VanKleveran & Legendre, 1965). Nevertheless, the viable counts of finished products in this study conform to observation of Joseph *et al.* (1986). In certain cases, comparatively higher counts of viable bacteria and fungi were observed in cured fish than curing fish. This may be attributed to cross contamination of products at the time of drying, handling, and/or packing.

The results of the present study indicate the lack of awareness on the importance of hygiene and sanitation among the processors and workers. This calls for the need for better hygienic conditions in the curing yards to improve the quality of the product.

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