

Process Development for Canning of White Sardine (*Kowala coval*)

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The suitability of canning white sardine (*Kowala coval*) was studied. The canning procedures of white sardines in natural pack, oil and brine were standardised. Blanching the product in saturated brine at room temperature for 6 min, precooking the product for 45 min in steam at 100°C and sterilisation at 115.6°C for 75 min yielded a canned product with good organoleptic quality. The results of heat penetration studies are discussed. High temperature and prolonged cooking resulted in a product with broken meat. Oil packed fish was organoleptically better than natural or brine packed product.

Small pelagic fishes comprising of anchovies, herrings, pilchards, sprats and sardines occupy a unique position in the marine fisheries of the world, often regulating the total fish landings of many countries. In India, this group is represented by sardines, anchovies, white bait, rainbow sardine and white sardine. A high proportion of these fishes is used for reduction. Since these fishes are as nutritious as other fishes but less expensive, it is worthwhile to investigate their suitability for processing and preservation. With this objective, the present work is undertaken to standardise the canning method of white sardine.

Materials and Methods

Fresh white sardines (*Kowala coval*) was obtained from commercial catches of Mangalore coast and brought to the laboratory in ice. Total length, standard length and total weight of the fish were measured and then dressed manually. The dressed and canned yields were also found out. The fish muscle was analysed for moisture, crude protein, total ash and salt by the AOAC (1975) methods. Total lipids were determined following the method of Bligh & Dyer (1959).

The dressed fish was cut into 54 mm

length and dipped in saturated brine solution at room temperature (28°C) for 4, 6, 8 and 10 min. Round open top sanitary cans (301 x 203) with SR lacquer coating were used as containers. The fish was packed in the cans vertically, adjusting the pack weight to give a final drained weight of around 65 -70% of the water holding capacity of the can. The cans were then precooked in steam at 100°C for 15, 30, 45 and 60 min. The precooked cans were drained and filled with hot oil or hot 2% brine and seamed in a vacuum double seamer.

Thermal processes were standardised for three different packs of white sardine, namely, the natural pack (WSN), brine pack (WSL) and oil pack (WS3). Heat penetration studies of the three lots were conducted by noting the temperature at the centre of the can at intervals of 5 min during autoclaving at 115.6°C, using an assembly of thermocouples and selfcompensated digital thermometer with a reading accuracy of 0.1°C, supplied by M/s ELLAB INSTRUMENTS, Copenhagen, Denmark. Finally the thermal process values for the three different packs were calculated from the heat penetration test, according to the method of Patashnik (1953).

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A general appraisal of quality of the canned products was made by 'can opening' tests. The products were judged by a panel of 8-10 experienced technologists for their sensory characteristics, which were rated on a five point scale. (Prabhu *et al.*, 1984).

Results and Discussion

White sardine used in the studies had average total length 103 mm, standard length 82 mm and total weight 11.4 g. The average moisture, protein, fat and ash contents of the fish were 74.49, 23.19, 0.73 and 1.36% respectively. The white sardine is a low fat-high protein fish. The dressing and overall canning yield of 71 and 70% respectively of the round fish weight are much higher than the corresponding values for other marine fishes, such as oil sardine, mackerel, tuna, seer and pomfrets (Saralaya and Parashuram, 1971). The overall canning yield was calculated after canning of fish. Blanching in saturated brine for 6 min at room temperature ($28 \pm 2^\circ\text{C}$) resulted in optimum saltiness in the canned product.

The white sardines showed much less weight loss than the European Sardines (Meesemecker & Sohler, 1959) for similar precook treatments. The results of exudate in oil packs were found to be higher than the limit set by ISI for tuna, mackerel and sardine canned in oil. This is mainly due to the fact that the precooking was not done under pressure in the present study. Even though the quantity of exudate was more it was found not to affect the product quality, because the original fat content of the fish was low. High temperature and prolonged cooking resulted the separation of fish meat from its backbone giving the product an undesirable appearance. Under these circumstances, for white sardines packed in 301 x 203 cans, pre-cooking for about 45-60 min at 100°C may be considered

as adequate.

The results of heat penetration test are presented in Table 1 and the heat penetration data in Table 2. It is seen that the rate of heat penetration in white sardines canned as 'natural' and in brine are almost equal and much faster than the oil pack.

Table 1. Results of heat penetration test on canned white sardines in 301 x 203 cans (net weight 175-190 g)

Particulars	White sardine Natural pack	White sardine in brine	White sardine groundnut oil
Initial temperature at can centre ($^\circ\text{C}$)	27.8	51.9	46.8
f_h value (slope of the semilog heating curve in min)	24.0	23.5	31.0
Retorting time, min	Equivalent lethality at 250°F , min		
30	2.5	4.9	1.6
45	6.1	8.8	4.6
60	9.9	12.8	8.3
75	14.1	16.8	12.3

Based on the heat resistance of *Clostridium botulinum* spores, usually F values equal to 2.7 min (Esty & Meyer, 1922) are considered as adequate for low acid-foods like fish from the public health point of view, but processes with 5 to 6 times this value ($F_{121.1} = 15-18$ min) may be necessary when spoilage organisms of greater heat resistance are likely to be encountered (Hersom & Hulland, 1980) or when bone softness in the canned fish is the required criterion. In the present study, retorting for

Table 3. *Quality characteristics of white sardines canned as 'natural pack', in brine and in groundnut oil*

Particulars	Natural pack	Brine pack	Oil pack
A. Cut-out characteristics			
Net weight (g)	175	190	190
Drained weight of solids (g)	126	126	125
Vacuum (mm of Hg at 28°C)	158	170	180
Gross headspace (mm)	7.0	6.0	5.0
Number of pieces/can	22	21	21
Turbidity of liquid	Slight	Nil	Nil
Meat adhesion to can	+	-	-
pH of meat	6.5	7.0	6.5
Exudate (% of total liquid)	-	-	24.2
B. Organoleptic attributes			
Appearance	G	E	E
Colour	G	G	E
Odour	G	G	G
Taste	G	G	G
Texture	G	G	G
Overall acceptability	G	G	E
Average of six determinations.			
E = Excellent, G = Good			

75 min at 115.6°C was found to achieve both complete sterility and the desired bone softness and therefore, this process can be considered suitable for all the packs of white sardine.

Table 2. *Heat penetration pattern in canned white sardines packed in 301 x 203 cans*

Time (min)	Cans centre temperature (°C)			Retort temperature (°C)
	WSN	WSL	WS3	
20	62.9	88.6	66.7	112.4
25	78.2	102.5	80.9	115.7
30	92.0	108.9	92.8	115.6
35	101.1	111.7	100.0	115.6
40	107.0	113.0	105.0	115.6
45	110.5	113.9	108.5	115.6
50	113.0	114.9	111.0	115.6
55	114.1	114.9	112.5	115.6
60	114.7	115.1	113.4	115.6
65	115.0	115.3	114.1	115.7
70	115.3	115.3	114.5	115.6
0	27.8	51.9	46.8	32.2
5	29.7	50.6	46.1	60.9
10	35.4	53.0	48.1	81.5
15	46.8	66.1	54.4	100.0

Time (min)	Cans centre tempe- (°C) rature			Retort tempe- rature (°C)
	WSN	WSL	WS3	
75	115.3	115.3	114.9	115.6
80	115.4	115.3	115.1	115.7
85	115.4	115.4	115.2	115.7
90	115.5	115.4	115.3	115.6
95	115.5	115.4	115.4	115.6
100	115.5	115.4	115.4	115.6
105	110.0	111.0	104.0	33.1
110	98.6	98.7	75.4	30.8
115	91.8	86.8	58.6	30.7

The quality characteristics of white sardines canned in three different styles are summarised in Table 3. Net weight, drained weight of solids, headspace, vacuum and pH values were in the desirable range. Only the oil pack had higher exudate than similar packs of other marine fishes. The sensory evaluation showed that the products were rated 'good' or 'excellent' with respect to the organoleptic attributes tested. Oil packed fish generally scored higher than the other two packs.

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