

Studies on the Utilization of Indian Oil Sardine (*Sardinella longiceps*) for the Preparation of Fish Sausages: 2. Effect of Sodium Bicarbonate Treatment on Meat Characteristics and Sausage Quality

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Studies on the utilization of Indian oil sardine (*Sardinella longiceps* Valenciennes) for the preparation of minced meat and fish sausages were made. Picked meat was treated with various concentrations of sodium bicarbonate, of which washing the meat with 0.5% was found to be most effective in improving the colour and quality characteristics of the meat and the sausages.

Many efforts are being made to utilize fatty fishes for the production of minced meat. Washing minced Indian oil sardine with chilled water has been found to improve its quality. But ordinary water washing does not properly remove fat and water soluble proteins (WSP). There have been a number of reports regarding the effectiveness of sodium bicarbonate wash for the removal of fat, water soluble protein and hence improvement of jelly strength of the meat (Suzuki, 1981; Okada, 1980, Park *et al.*, 1985; Lee *et al.*, 1985).

The effect of washing mince from oil sardine with sodium bicarbonate solution and then in water to improve its quality as also its suitability for the preparation of sausage are discussed in this paper.

Materials and Methods

Fresh Indian oil sardine (*Sardinella longiceps* Valenciennes) were procured from local fish landing centre under iced condition. The time lag between capture and collection of fish was about 2 to 3 h. Immediately after bringing the fish to the laboratory, they were washed thoroughly, dressed and washed again and the meat was separated using a meat picking machine. The picked meat was divided into five batches and were separately suspended

in sodium bicarbonate solutions of varying concentrations (0.25, 0.5, 0.75, 1.0 and 1.5%) for 15 min at the ratio of 1:5 (meat to solution) in chilled condition (15°C). After decanting the solution, the meat samples were washed five times in chilled water for 15 min duration each. After the final wash, the meat was pressed in a cloth to remove excess water. Sausages were prepared from the meat after each wash and analysed for the changes in quality.

The methods for the determination of various parameters like proximate composition, non-protein nitrogen (NPN), water soluble protein (WSP), salt soluble nitrogen (SSN), alpha amino nitrogen, peroxide value (PV), free fatty acid (FFA), thiobarbituric acid value (TBA), trimethyl amine (TMA), volatile base nitrogen (VBN), total bacterial plate counts (TPC), expressible water, jelly strength, folding test, organoleptic evaluation and method of preparation of sausage are similar to those described by Ravishankar *et al.*, (this volume).

Results and Discussion

Different concentrations of sodium bicarbonate ranging from 0.25% to 1.5% were tried along with chilled water washes and their effect on pH (Table 1), proximate

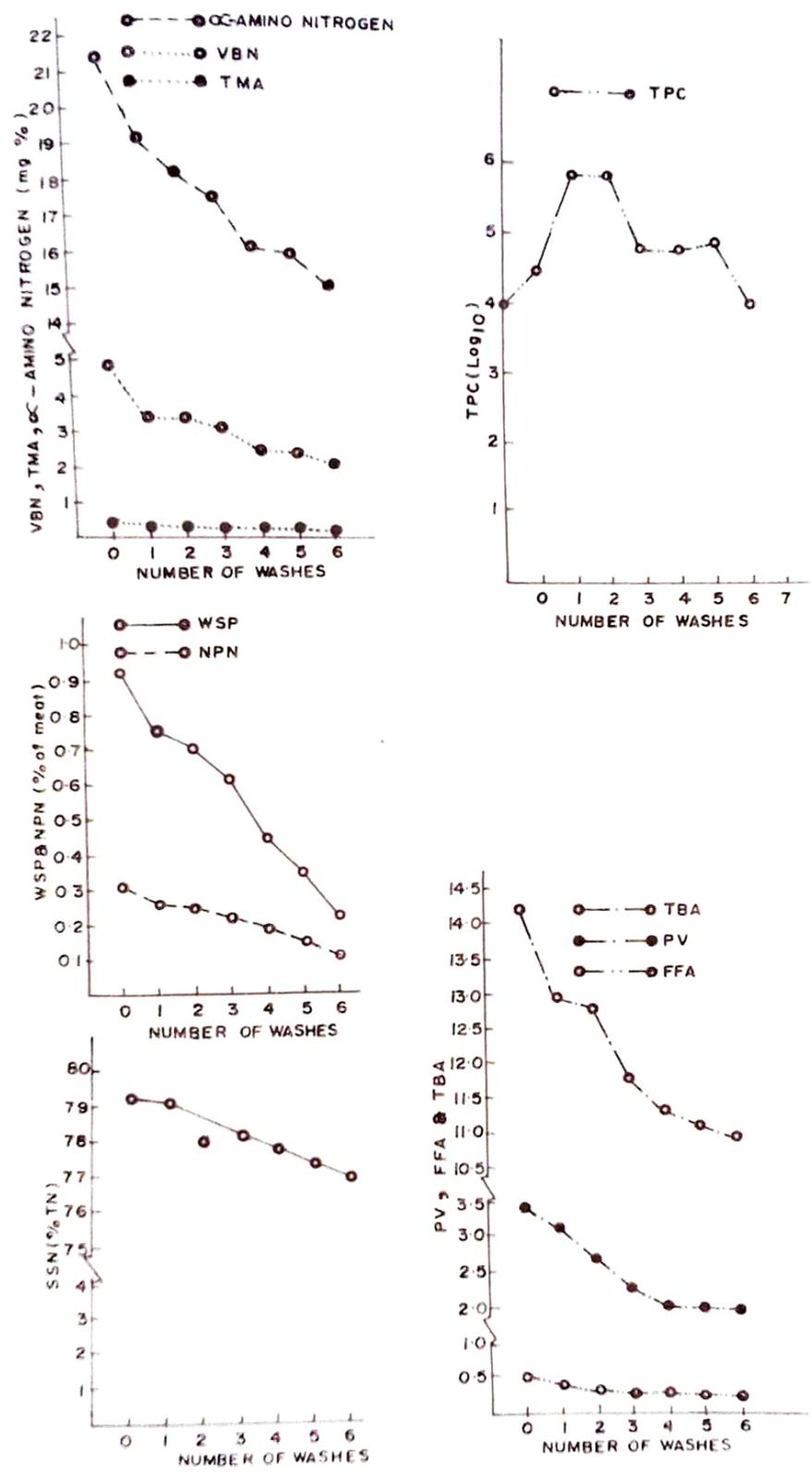


Fig. 1 Effect of washing minced sardine with 0.5% sodium bicarbonate on their chemical and microbiological parameters.

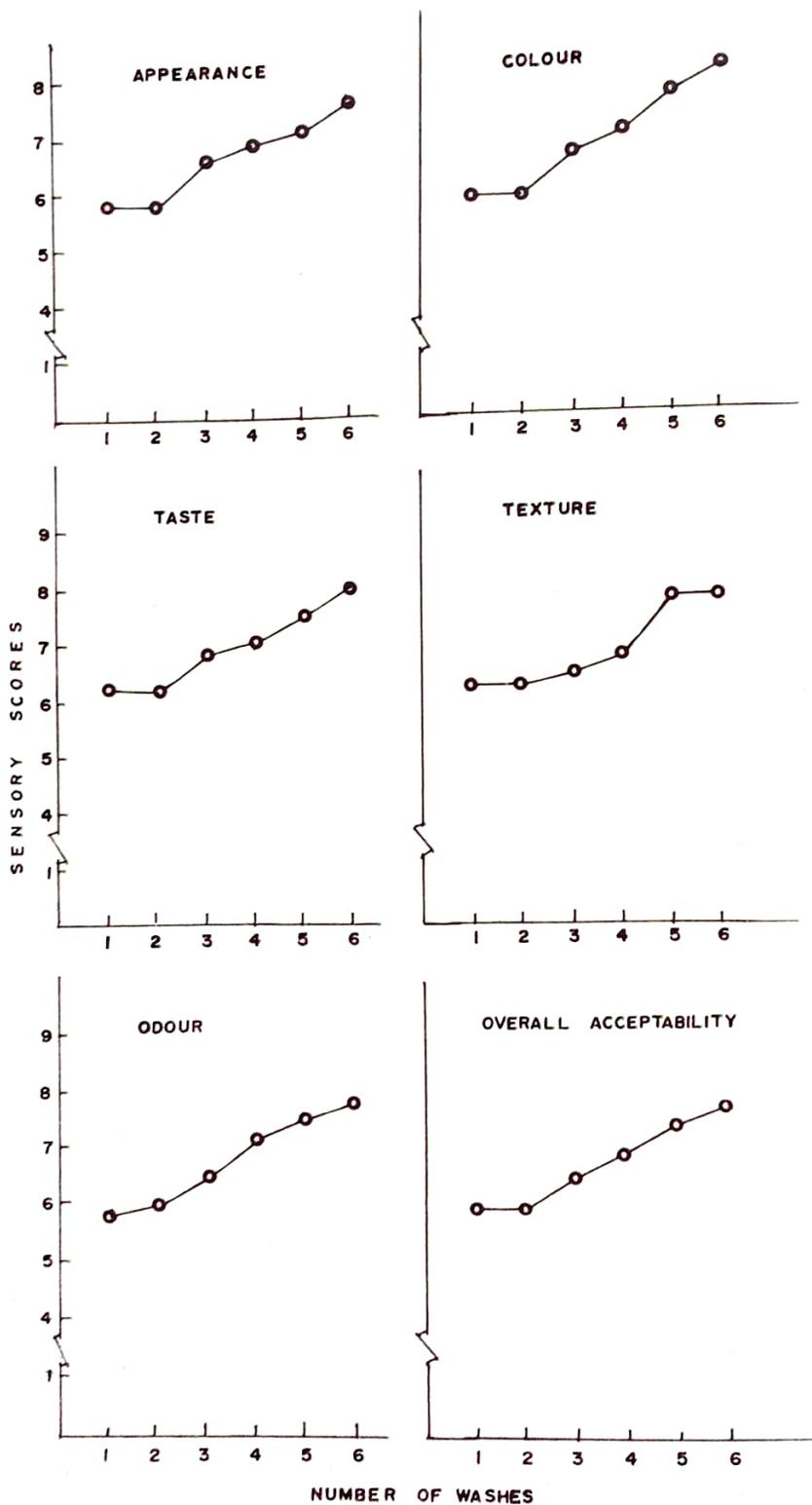


Fig. 2. Effect of washing minced sardine with 0.5% sodium bicarbonate on the organoleptic characteristics of sausages prepared out of them.

Table 1. Changes in pH of the meat during washing with varying concentrations of sodium bicarbonate (NaHCO₃) solutions

pH of NaHCO ₃ solution	Concentration of NaHCO ₃ , %				
	0.25	0.50	0.75	1.0	1.5
7.0	7.5	9.5	10.0	10.5	
Number of wash					
1 (in NaHCO ₃ solution)	6.8	7.5	8.0	9.0	9.5
2 (in water)	6.6	7.0	8.0	9.0	9.0
3 (")	6.5	6.8	7.8	8.6	8.7
4 (")	6.5	6.7	7.5	8.0	8.5
5 (")	6.5	6.5	7.2	7.8	8.2
6 (")	6.5	6.5	7.0	7.5	8.0

pH of the picked meat before washing = 6.5

composition and colour (Table 2) were studied. The results indicated that washing the meat with 0.5% sodium bicarbonate for 15 min followed by five chilled water washes was optimum compared to other concentrations. Higher concentrations did not improve the removal of fat further but resulted in elevation of meat pH. So, 0.5% concentration was selected for further ex-

Table 2. Effect of concentration of sodium bicarbonate on proximate composition and colour of the meat (Sample after 6th wash)

Proximate composition, (%)	Picked meat	Concentration of NaHCO ₃ solution, %				
		0.25	0.5	0.75	1.0	1.5
Moisture	69.21	77.92	80.41	80.52	80.81	80.93
Protein	19.76	16.75	16.01	15.99	15.98	15.97
Fat	9.87	4.27	2.92	2.92	2.90	2.90
Ash	1.43	1.13	0.84	0.84	0.84	0.84
Colour of the meat*	7+	6+	4+	4+	4+	4+

*The units given for the colour of the meat are on an arbitrary scale, giving 7+ units to the original picked meat.

periments. Treatment with 0.5% sodium bicarbonate solution followed by chilled water washes reduced the fat by 70.41% as compared to 63.37% fat removal accomplished by chilled water washing alone (Ravishankar *et al.*, this volume). Roussel & Cheftel (1988) could achieve 80.85% fat removal in European sardines. Washing with sodium bicarbonate could not improve the colour of the meat over and above that of chilled water washed meat.

The effect of sodium bicarbonate on chemical and microbiological parameters of the meat was studied and the results are presented in Fig.1. The results indicated that there was only a marginal improvement in the percentage removal of WSP (76.08), NPN (64.51) VBN (54.93) and PV (42.35) and slight improvement in the retention of SSN as compared to corresponding values obtained for chilled water washed meat (Ravishankar *et al.*, this volume). However, there was a substantial removal of TMA, FFA and alpha amino nitrogen from the meat.

Sausages were prepared from the meat treated with 0.5% sodium bicarbonate followed by chilled water washing. The values obtained for various chemical and microbiological parameters of sausages prepared after each wash (Table 3) were almost similar to the corresponding values

Table 3. *Effect of washing with 0.5% sodium bicarbonate on quality of sausages: chemical and microbiological parameters*

Number of wash	TMA mg%	VBN mg%	PV, mmol of O ₂ /kg fat	TBA, moles of malonaldehyde/kg fat	TPC count/g
1 (NaHCO ₃)	0.38	4.08	3.30	13.12	4.2x10 ³
2 (water)	0.34	3.78	3.08	12.69	2.1x10 ³
3 (")	0.30	3.61	2.99	11.62	1.8x10 ³
4 (")	0.29	3.03	2.72	11.08	3.1x10 ³
5 (")	0.25	2.98	2.39	10.98	1.1x10 ³
6 (")	0.24	2.67	2.02	10.72	8.9x10 ²

Table 4. *Effect of washing with 0.5% sodium bicarbonate on quality of sausages: physical parameters*

No. of wash	Jelly strength gm/cm. ²	Expressible water, %	Folding test grades	pH
1 (NaHCO ₃)	191.38	9.43	B	6.7
2 (water)	207.90	10.20	B	6.6
3 (")	225.32	9.12	B	6.5
4 (")	227.52	8.54	A	6.5
5 (")	237.11	7.98	AA	6.5
6 (")	279.53	7.12	AA	6.5

obtained for sausages prepared from sardine meat after each wash with chilled water (Ravishankar *et al.*, this volume). However, with respect to physical parameters (Table 4) sodium bicarbonate treatment showed further improvement. The difference could be noticed from the first wash onwards as compared to the sausages prepared after each wash with chilled water alone. After the final wash, the jelly strength was 279.53 g/cm² in sausages. Similar trend was observed with respect to expressible water and folding test grades in sausages prepared after each wash.

The organoleptic evaluation of sausages prepared from sodium bicarbonate treated meat showed gradual improvement with each wash in the mean panel scores obtained for various attributes as well as overall acceptability (Fig.2). Compared to the scores obtained for sausages prepared from chilled water washed meat (Ravishankar *et al.*, this volume), the sausages prepared

from sodium bicarbonate treated meat of the present study fared better.

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