

Studies on the Utilization of Indian Oil Sardine (*Sardinella longiceps*) for the Preparation of Fish Sausages: 1. Effect of Washing in Water on Meat Characteristics and Sausage Quality

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Effect of washing the mince from Indian oil sardine (*Sardinella longiceps*) with chilled water on the quality of sausages prepared from it was studied. Samples of meat were drawn at the end of each washing cycle for the analysis of physical, chemical, microbiological and organoleptic characteristics. The sausages prepared from the meat samples after each wash were also analysed for the quality. Washing of meat for six times, with a suspension time of 15 min was found to be optimum in improving the meat characteristics and the sausage quality.

Minced fish offers a new field in the utilization of underutilized species, since minced fish can be used as the base material for production of many fish products like fish sausages, fish balls, fish fingers etc. While the technique for the preparation of fish sausage from several low fat white fleshed fishes has been developed, investigations are going on for the use of fatty fish species for this purpose. Fatty fishes like oil sardine contain more dark meat which lower the gel forming ability. Also, these fatty fishes are susceptible to rancidity.

In order to remove the water soluble proteins, fat and pigments, many efforts were made. Water washing of minced fish removes depot fat, meat pigments, blood, microorganisms and water soluble proteins (Suzuki, 1981). This improves the jelly strength (Shyamasunder *et al.*, 1988; Hastings, 1989; Suzuki, 1981; Iso *et al.*, 1985), reduces the fat content (Sato *et al.*, 1978; Adu *et al.*, 1983) and lightens the colour (Tableros & Young, 1981).

The present study was undertaken to standardise the number of washing cycles of the mince from Indian oil sardine for the preparation of sausage.

Materials and Methods

Fresh Indian oil sardine (*Sardinella longiceps* Valenciennes) was procured from the local fish landing centre (Mangalore, Karnataka) under iced condition and processed immediately in the laboratory. The time lag between the capture and collection of fish was approximately 2 to 3 h. It was washed thoroughly, dressed, washed again and meat was separated using a meat picking machine. This picked meat was repeatedly washed in cold water (15°C) upto six times at the ratio of 1:5, (meat to water) with a suspension time of 15 min each. The water was decanted after each wash. After the final wash, the meat was pressed in a cloth manually to remove excess water. After each wash, the samples were collected and analysed for changes in proximate composition and other parameters.

Sausages were prepared from the meat after each wash and analysed for their quality. For the preparation of sausage, the minced meat was mixed with additives (Table 1) in a silent cutter. The time taken for mixing was 15 min and the temperature was maintained below 10°C. The paste was stuffed in to krehelon casings, sealed and

Table 1. *Ingredients used for the preparation of fish sausage*

Materials	Weight %
Fish meat	70.0
Salt	2.0
Sugar	1.5
Polyphosphate	0.2
Spices :	
Chilli powder	0.4
Coriander power	0.3
Pepper powder	0.2
Garlic	0.05
Ginger	0.05
Monsodium glutamate	0.2
Colour solution (Ponaceau 4R,3% & Cormosine, 2%)	0.15
Starch	9.0
Fat	5.0
Water	11.0

washed. Stuffed sausages were boiled at 88 to 90°C for 60 min, cooled in water at 15°C for 15 min and then were reboiled at 100°C for 30 sec. The sausages thus prepared were fan dried.

Moisture, total protein, crude fat, crude ash, non-protein nitrogen (NPN) and water soluble protein (WSP) were determined by the method described in AOAC (1975), salt soluble nitrogen (SSN) by the method of Dyer *et al.*, (1950), alpha amino nitrogen in accordance with the procedure of Pope & Stevens (1939), peroxide value(PV) according to the method of AOAC (1975), free fatty acids (FFA) by the method described by Olley & Lovern (1960), thiobarbituric acid value (TBA) according to the method of Yu & Sinhuber (1957) and trimethylamine (TMA) and volatile base nitrogen (VBN) by the method of Beatty & Gibbons (1937). Total bacterial plate counts (TPC) were estimated according to the method given in APHA (1976). The physical quality parameters of sausages like expressible water and jelly strength were analysed by the method described by Okada (1959) and the folding test according to Suzuki (1981). The organoleptic evaluation of sausages were done on the basis of 9-point hedonic scale in which panel scores of ≤ 5 were taken as spoiled.

Results and Discussion

In order to standardise the total number of washes and suspension time for each wash, the picked meat was washed with chilled water with varying time for each wash and also number of washes. After each wash the samples were taken and analysed for changes in proximate composition and also for the reduction in dark colour. Based on these trials, six washes of 15 min duration each was found to be optimum for colour improvement and fat reduction.

The results of each chilled water washing, of 15 min duration, on changes

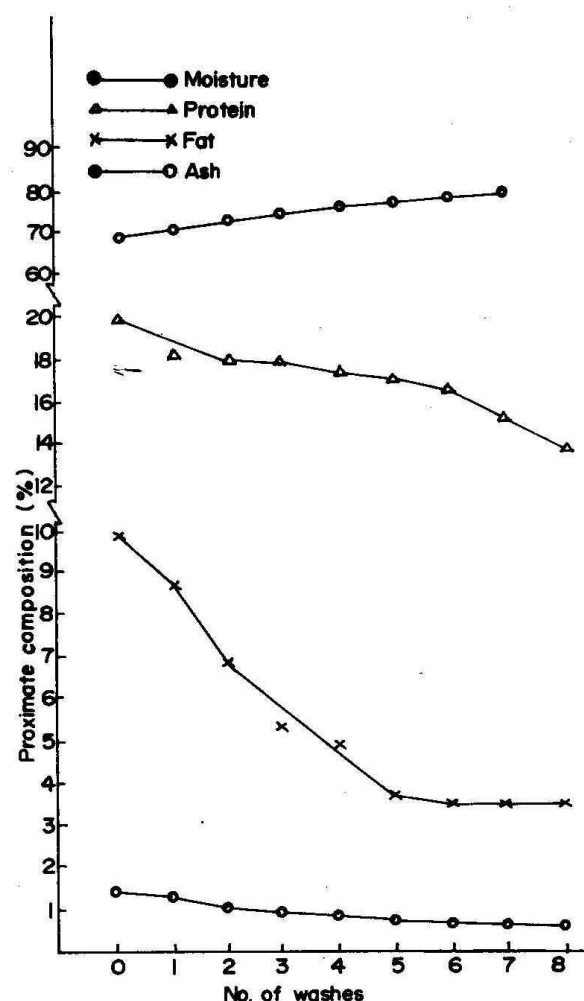


Fig. 1 Effect of washing in chilled water on the proximate composition of mince from sardine

Table 2. *Effect of chilled water washing on the quality of sausages : Chemical parameters and total plate counts.*

Number of wash	TMA mg %	VBN mg %	PV mmol of O ₂ /kg fat	TBA moles of malonaldehyde /kg fat	TPC counts/g
1	0.37	3.75	3.20	13.27	3.2×10^3
2	0.35	3.62	3.01	12.18	2.1×10^3
3	0.32	3.45	2.97	11.72	4.9×10^3
4	0.29	3.02	2.99	11.23	1.2×10^3
5	0.27	2.98	2.65	11.08	7.9×10^3
6	0.25	2.72	2.45	10.98	2.9×10^3

Table 3. *Effect of chilled water washing on the quality of sausages physical parameters*

Number of wash	Jelly Strength g/cm ²	Expressible water, %	Folding test grades	pH
Before washing	—	—	—	6.6
1	182.78	9.70	C	6.0
2	179.23	9.08	B	6.2
3	213.89	8.23	A	6.5
4	237.43	8.54	A	6.5
5	248.34	7.28	AA	6.5
6	268.42	7.43	AA	6.5

in proximate composition of meat is shown in Fig.1 and on other chemical and microbiological parameters in Fig.2. The loss of protein due to water washing was 14.22% and fat content was reduced by 63.32%. Considerable reduction in WSP (73.91%), NPN (61.29%), TMA (47.61%), VBN (50.20%), FFA (58.0%), PV (36.76%), alpha amino nitrogen (32.71%) and TBA (22.46%) and slight reduction in SSN (2.9%) were observed. Removal of WSN and fat helps in improving the gel strength of the meat, which is required for products like Kamaboko and sausages. Also, reduction in PV, TBA, TMA, VBN, FFA etc. is highly beneficial for improving the shelf life of minced meat in frozen storage.

The sausages were prepared from the meat after each wash and the results of

chemical and microbiological analysis are shown in Table 2. In general these values were similar to the corresponding values obtained for sardine meat after each wash except slightly higher values for TMA, VBN and PV in sausage samples. The results of the analysis of sausages for physical parameters like jelly strength, expressible water, folding test and pH are shown in Table 3. The results indicated a highly significant improvement in jelly strength and the folding test grades and gradual decrease in expressible water percentage in the sausages prepared after each wash. These improvements are due to the considerable reduction in fat and WSP by washing (Suzuki, 1981; Shyamsundar *et al.*, 1988; Prabhu *et al.*, 1988). The organoleptic evaluation of sausages (Fig.3) prepared after each wash also showed a gradual im-

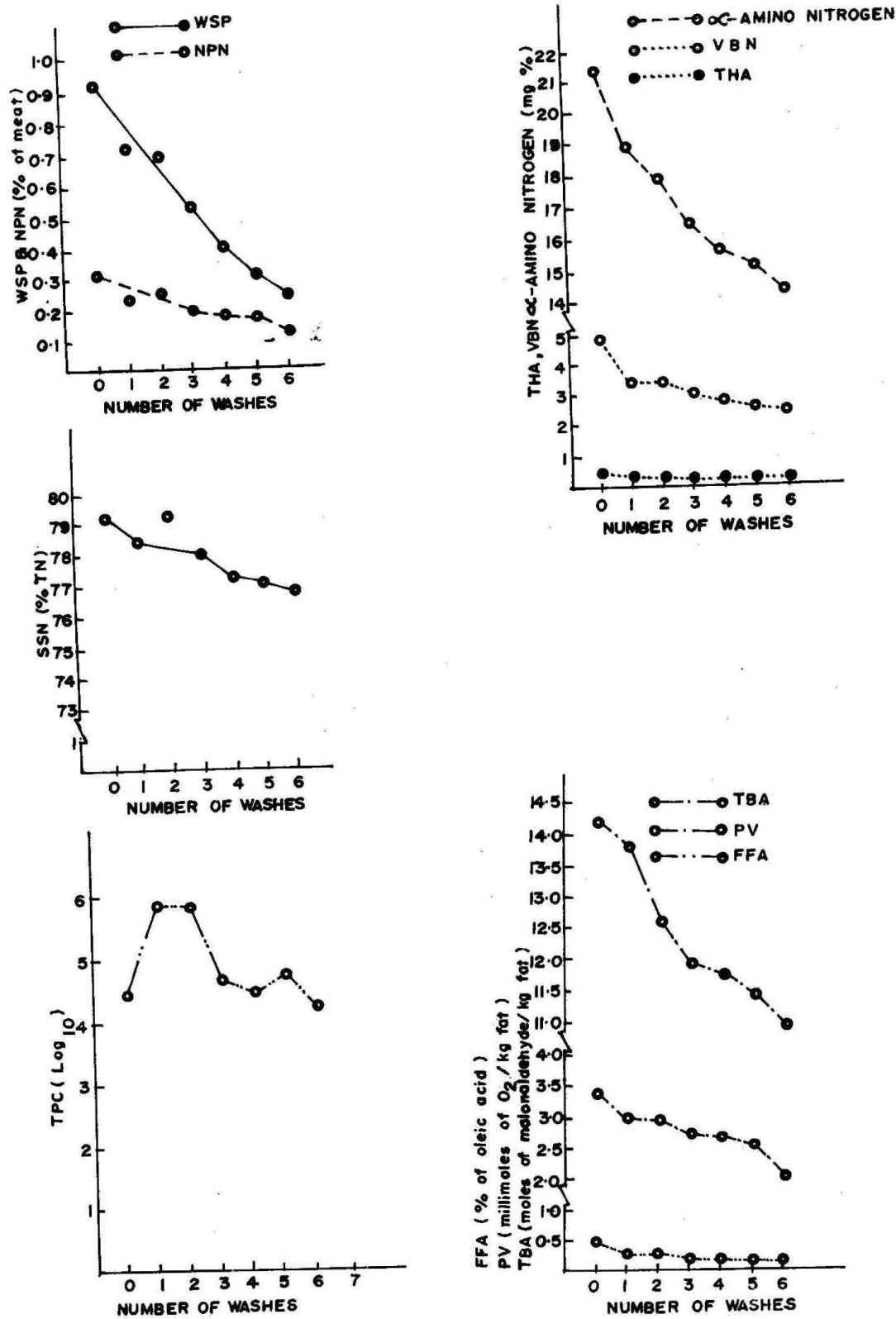


Fig. 2 Effect of washing in chilled water on the chemical and microbiological parameters of mince from sardine

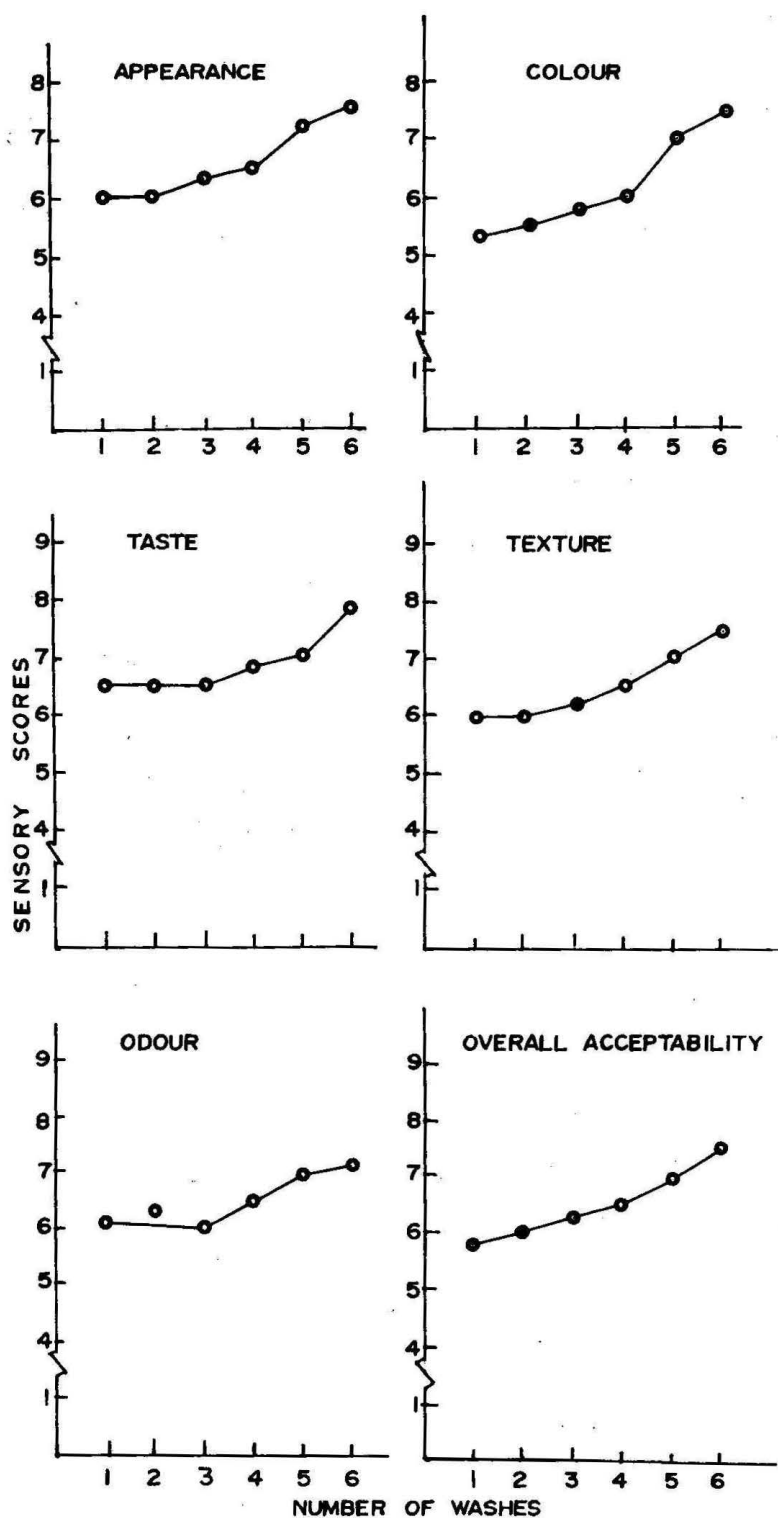


Fig. 3 Effect of washing in chilled water of the mince from sardine on the organoleptic quality of sausages prepared from it.

provement in the mean panel scores for all attributes and overall acceptability.

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References

Adu, G.A., Babbit, J.K. & Crawford, D.L. (1983). *J. Fd Sci.* 48,1053

AOAC (1975) *Official methods of analysis*, 12th edn., Association of Official Analytical Chemists, Washington

APHA (1976) *Compendium of Methods for the Microbiological Examination of Foods* (Speck, M.L., Ed), American Public Health Association, Inc. New York

Beatty, S.A. & Gibbons, N.E. (1937) *J. Biol. Bd. Can.* 3, 77

Dyer, W.J., French, H.V. & Snow, J.H. (1950) *J. Fish. Res. Bd. Can.* 7, 585

Hastings, R.J. (1989) *Int. J. Fd Sci. Technol.* 24, 93

Iso, N., Mizuno, H. & Saito, T. (1985) *Bull. Jap. Soc. Sci. Fish.* 51, 1495

Okada, M. (1959) *Bull. Tokai Reg. Res. Lab.* 24, 67

Olley, J. & Lovern, J.A. (1960) *J. Sci. Food Agric.* 11, 644

Pope, C.G. & Stevens, M.F. (1939) *Biochem. J.* 33, 1070

Prabhu, R.M., Shyamasundar, B.A., Krishnamurthy, B.V. & Chandrasekhar, T.C. (1988) in *Proceedings of the First Indian Fisheries Forum* (Mohan Joseph, M., Ed.), Asian Fisheries Society, Indian Branch, Mangalore, 431

Sato, B., Saskai, Y. & Abe, S. (1978) *Fisheries Agency, Japan*, 105

Shyamasundar, B.A., Krishnamurthy, B.V., Prabhu, R.M. & Chandrasekhar, T.C. (1988) in *Proceedings of the First Indian Fisheries Forum* (Mohan Joseph, M., Ed.) Asian Fisheries Society, Indian Branch, Mangalore, 425

Suzuki, T. (1981) *Fish and Krill Protein - Processing Technology*, Applied Science, Publications, London

Tableros, M.A. & Young, R.H. (1981) *J. Fd Technol.* 16, 199

Yu, J.C. & Sinhuber, R.O. (1957) *Fd Technol.* 11, 104