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EFFECT OF PRESSING ON THE SHELF LIFE OF SUNDRIED WHITE SARDINE (*ESCUALOSA THORACATA*)

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ABSTRACT : In the present study, an attempt was made to investigate and explore a method for preparation of salted and dried white sardine which would have organoleptically sound attributes *viz.*, color, flavor, taste and texture. It could however be concluded from the results of present study that the sun dried pressed samples were in better condition than the unpressed sample.

Key Words: Dried, Pressed, Salted, Unpressed, White sardine.

INTRODUCTION

Preservation of fish by salting is one such process that yields a product rich in protein which is readily marketable and easy to handle without elaborate packaging (Del valle and Nickerson 1967). In India, about 17% of fish catch is utilized for curing (Lakshmanan 2002). Cured fish like dried anchovies are also exported from India, which brings in foreign exchange to a tune of 70 million USD. In more developed countries salting process is primarily used to produce specialty products to which the salting process imparts specific desirable flavors (Wheaton and Lawson 1985).

In pressing method, also known as Brazilian method, the fish is salted and subsequently pressed to reduce the moisture content to about 50% and without any recourse to sun drying. Natural drying by exposure to sun and wind is widespread and is possibly the first method used for preserving seafood. In the present investigation, the effect of pressing on the quality of sun dried white sardine (*Escualosa thoracata*) was carried out.

MATERIALS AND METHODS

White sardine (*Escualosa thoracata)* were obtained from commercial catches of the Digha

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fish landing centre, Purba Medinipur district in fresh condition and transported to the processing hall of Faculty of Fishery Sciences in iced condition using an insulated box. The fishes were washed in ice chilled water to remove adhering dirt, peritoneum membrane, blood and were subsequently brined in three different concentrations of 15%, 20% and 25% brine for 24 h in 1: 3 ratio (fish :salt). Ordinary commercial food grade salt and distilled water were used to prepare brine. Sensory evaluation was done along with microbiological tests for the quality analysis. Based on the results, 15% brine of the three brining concentrations found suitable was selected to study the effect of pressing on the quality of fish. The fishes were pressed using a screw press and dried under sun. The process of drying was done for 3 days until the moisture content became constant.

Moisture, protein, fat, ash and salt content of white sardine were determined by following the standard methods of AOAC (1975). Peroxide value (PV) and Free fatty acids (FFA) were estimated following the standard procedures of AOAC (1995). TMA and TVBN were determined by the method described by Convey (1962) and pH was determined following the method of Suzuki (1981). Total plate count was carried out following the method of APHA (1998).

Statistical analysis was performed as per the method of Snedecor and Cochran (1968). Correlation coefficient (r) was calculated for the chemical quality parameters of the raw material to observe their acceptance level. One way analysis of variance (ANOVA) followed by least significant test in the form of critical difference was performed to test the significant difference between samples and storage days in case of sun dried samples.

RESULTS AND DISCUSSION

The average total length, standard length and weight of white sardine used in the present study were 8.5 cm, 6.5 cm and 11.5 g respectively and the yield after dressing was 70.9%. The moisture, protein, fat, ash and salt content of white sardine was 74.81%, 24.01%, 0.82%, 0.30% and 0.23% respectively indicating that it was a low fat, high protein fish which was in agreement with the results of Ramaiyan *et al.* (1976). The TVB-N and TMA values of fresh white sardine were 6.12 and 3.78 mg% respectively which were within the acceptable limit of 20 mg% of muscle for TVB-N (Sen 2005) and 10-15 mg% of muscle for TMA (Lakshamanan 2000). pH of raw fish muscle of white sardine was 6.98 which indicated the fishes were in good quality which corroborates with the observations of Gopakumar (2000). In the present study, PV of white sardine was 0.53 milliequivalent of O_2 per kg of fat and the FFA value observed for white sardine was 1.58% of oleic acid which was within the acceptable limit (Lajolina *et al.* 1983, Reddy *et al.* 1992).

The recommended microbiological limit for fresh and frozen fish of aerobic plate count is 1.0×10^5 cfu/g of fish (I.C.M.S.F 1986). Aerobic plate count of white sardine was 2.6×10^4 cfu / g before washing, which is lower than that of recommended level. After washing, the microbial load came down to 1.08×10^4 cfu/g. The sensory evaluation of white sardine showed that the raw fishes were of very good quality with mean overall acceptability score close to the value of 8 (Basu and Chouksey 2001).

In the present study, after 24 h of brining, salt content and total bacterial load in white sardines were 9.83% and 3.65×10^3 cfu/g respectively. The total bacterial load in the

salted fish ranged from 10^4 to, 10^5cfu/g, while dried fish contain about 10^4cfu/g (Shakila *et al.* 2002). In the present study the total bacterial load for all samples of brining were well within the limit of 10^4 to 10^5 cfu/g.

The mean moisture content of pressed (P) and unpressed (C) white sardine samples increased from (21.59 ± 0.08) % to (22.78 ± 0.05) % and (27.85±0.11) % to (30.78 ±0.19) %, respectively. The relative humidity during the experimental period does not allow natural drying to proceed to satisfactory low moisture level (Curran and Trim 1982). The peroxide value of the pressed sample increased from (1.92±0.95) to (7.26± 0.15). This increase of PV is suggested to be derive from the preferential oxidation of phospholipids during the early stage of auto oxidation. In case of control (unpressed sample), PV increased gradually from (1.99±0.12) to (8.88±0.12)

Table 1: Raw material characteristics (± SD value)

Physical characteristics

Total length (cm) Standard Length(cm)	8.5 ± 0.02 6.5 ± 0.15
Total Weight(g)	11.5 ± 0.62
Dressing yield (%)	70.9 ± 1.92

Proximate composition

Moisture (%)	74.81 ± 0.75
Protein (%)	24.01 ± 0.37
Fat (%)	0.82 ± 0.52
Ash (%)	0.30 ± 0.01

Chemical characteristics

Peroxide value(milliequivalent of O_2/ Kg of fat)	0.53 ± 0.01
Free fatty acids (% of oleic acid)	1.58 ± 0.01
TVBN (mg %)	6.12 ± 0.97
TMA (mg %)	3.78 ± 1.08
APC (cfu/ g.)(Before washing)	2.6 ± 0.01 x 10^4
pH	6.98 ± 0.005
Salt(%)	0.23 ± 0.005

Table 2: Change in moisture level and chemical alterations during storage.

Parameter	0		15		30		45		60		75		90	
	P	C	P	C	P	C	P	C	P	C	P	C	P	C
Moisture	21.59±0.08	27.85±0.11	3.2X10^2	3.8X10^2	22.47±0.31	28.32±0.11	23.58±0.12	29.65±0.10	23.52±0.40	29.58±0.16	22.36±0.13	30.85±0.35	22.78 0.05	30.78±0.19
PV	1.92±0.95	1.99±0.12	2.20±0.99	2.42±0.14	3.48±0.85	3.76±0.18	3.96±0.89	4.03±0.12	3.98±0.26	5.12±0.14	4.77±0.15	7.013±0.16	7.26±0.15	8.88±0.12
FFA	1.58±0.95	1.96±0.99	4.18±0.56	4.98±0.12	7.37±0.12	8.06±0.15	10.45±0.45	11.45±0.19	12.68±0.12	14.45±0.56	14.25±0.52	16.37±0.25	16.49±0.16	18.92±0.13
TVBN	63.72±1.32	65.17±0.98	71.08±0.29	73.04±0.52	88.44±0.15	92.33±2.03	95.16±0.18	120.45±0.54	108.06±1.0	137.86±1.50	143.00±0.98	159.63±0.65	168.66±0.85	183.73±0.38
TPC	3.2X10^2	3.8X10^2	4.5X10^3	4.9X10^3	5.7X10^3	5.9X10^3	6.2X10^3	6.7X10^3	6.9X10^3	7.1X10^3	7.8X10^3	8.1X10^3	8.6X10^3	8.9X10^3
Mould	0.3X10^2	0.4X10^2	0.4X10^2	0.5X10^2	0.4X10^2	0.6X10^2	0.2X10^2	0.5X10^2	0.3X10^2	1.1X10^2	0.3X10^2	1.5X10^2	0.5X10^2	1.4X10^2

Table 3 : Correlation coefficients between every pair of measured variables under different situations.

	Pressed sample				Control sample		
	MOISTURE	PV	FFA		MOISTURE	PV	FFA
PV	0.31			PV	**0.90**		
FFA	**0.61**	**0.83**		FFA	**0.94**	**0.95**	
TVBN	0.35	**0.92**	**0.93**	TVBN	**0.95**	**0.98**	**0.99**

Table 4 : Situation wise ONE WAY ANOVA results.

		drying pressing		SUN YES			drying pressing		SUN NO		
Source	Variable	ss	df	mss	F	Sig.	ss	df	mss	F	Sig.
DAYS	MOISTURE	12.50	6	2.08	36.21	0.00	22.55	6	3.76	112.53	0.00
	PV	59.57	6	9.93	19.77	0.00	110.59	6	18.43	918.12	0.00
	FFA	533.69	6	88.95	359.42	0.00	690.54	6	115.09	557.11	0.00
	TVBN	26193.60	6	4365.60	6386.33	0.00	35759.29	6	5959.88	4931.23	0.00
Error	MOISTURE	0.81	14	0.06			0.47	14	0.03		
	PV	7.03	14	0.50			0.28	14	0.02		
	FFA	3.47	14	0.25		CD or at 1%	2.89	14	0.21		CD or at 1%
	TVBN	9.57	14	0.68			16.92	14	1.21		
Total	MOISTURE	13.30	20			0.58	23.02	20			0.44
	PV	66.60	20			1.72	110.88	20			0.34
	FFA	537.15	20			1.21	693.43	20			1.11
	TVBN	26203.18	20			2.01	35776.21	20			2.67

NS: P>0.05, Sig. if <0.01 i.e. ** or Significant at 1 %

during the storage period. The increase in peroxide value may be attributed to the oxidation of highly unsaturated fatty acids in fish lipids by the catalytic activity of common salt, iron impurities that are probably present in the crude salt, peroxide action of moisture and auto oxidation by atmospheric oxygen (Wheaton and Lawson 1985, Amano 1962). It is observed that during storage period, the TVB-N content increased gradually and it may be attributed to bacterial enzymatic action, particularly growth of halophilic bacteria (Venderzant *et al.* 1973). The increase in FFA with storage time in both the cases is related to hydrolysis of fats (Stansby and Lemon 1941). FFA content is positively correlated with storage days ($p<0.01$) The total bacterial load of 10^3 cfu/g is normal in salted and dried fishery products and the samples in the present study are found to be within the acceptable limit (Kalaimani *et al.* 1988). The TPC values of pressed and control samples were 8.6×10^3 cfu/g and 8.9×10^3 cfu/g respectively (Table 2) corroborating with similar observation by Shanmugam (1990).

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