Quality Changes of Fish Sausage Incorporated with Potato Starch Powder at Room Temperature

Ganapati Hegde, T.C.Chandrasekhar and K.C. Dora

College of Fisheries, Mangalore-575001

Fish sausages were prepared from the minced meat of croaker (*Johnius* spp.)by mixing with 7% potato starch dried powder. Control samples without potato starch dried powder were also prepared and both samples were stored at room temperature (28 ± 2°C). The studies showed that the control samples remained in acceptable condition for 3 days, where as the potato starch powder added samples were in acceptable condition for 2 days only. The total plate count of control samples were lower than that of the potato starch added samples.

In 1987, the world production of minced meat from a variety of fish species has crossed 400,000 tonnes and most of this is produced by Japan for the preparation of diversified fish paste products such as kamaboko, fish sausage and others. In India,technology of fish sausage was introduced by Japanese workers in 1963 and some work has been carried out (Yermal *et al.*, 1972; Prabhu *et al.*, 1988)on the development of acceptable fish sausages and other paste products suited to Indian conditions. The main objective of the present investigation is to study the suitability of potato starch powder on the quality and shelf life of product stored at room temperature.

Materials and Methods

Fresh croaker (*Johnius* spp.) collected from Mangalore fish landing centre and stored in cold storage (-20°C) was used for the studies. The synthetic casing 'Krehelon' (Co-Polymer of Polyvinylidine chloride and Vinyl chloride) of size 50 mm x 280 mm, manufactured by the Kureha Chemical Industry Co.Ltd., Japan was used as the packaging material. Plate count agar was purchased from Himedia Laboratory Pvt. Ltd., Bombay. The peeling and drying of potato were carried out according to the method described by Girdhari *et al.* (1967). Preliminary experiments were conducted by incorporating 3, 5, 7, 9 and 11% of potato in sausage for standardising the potato starch level. 7% of potato starch was added for further experiments (PSAS). The method described by Prabhu *et al* . (1988) was followed to prepare fish sausage, heat processed in water at 88 ± 2°C for 60 min and stored at room temperature (28 ± 2°C). Control sample (CL) was prepared without potato starch.

Jelly strength was estimated by Okada gelometer (Tanikawa,1965). Folding test and expresssible water were carried out according to the methods described by Iwata *et al.* (1971). The proximate composition of raw material and final product was estimated as per AOAC methods (1975). Horiba M.5pH meter was used to determine pH. Trimethylamine and volatile base nitrogen were estimated according to the methods described by Beatty & Gibbons (1937). Peroxide values were determined by the method of Lea (1957). FFA values were determined iodometrically (AOAC, 1975). Total plate count of the raw material and the product was carried out according to APHA (1966). Subjective evaluation of product acceptability and quality was carried out by taste panels using a 5 point hedonic scale (5 = excellent; 4 = very good; 3 = good; 2 = like and 1 = dislike). Statistical analysis was done using analysis of variance technique (ANOVA).

Results and Discussion

The proximate composition of croaker (*Johnius* sp.) used for the preparation of fish sausage was 18.02% protein, 2.58% fat, 78.26% moisture and 1.12% ash, and the final product contain 16.98, 4.96, 69.75 and 2.23% protein, fat, moisture and ash respectively.

The changes in physical parameters of fish sausages during storage at 28 ± 2°C are presented in Table 1. The gradual reduction in jelly strength could be attributed to the acidic nature of glucano-delta lactone. The expressible water content of the control sample increased from 4.22% to 8.74% on the 3rd day, while that of PSAS increased from 4.22% to 8.622% on the 2nd day before they were spoiled due to discolouration. The reduction in jelly strength and proportionate increase of the expressible water of sausage in the present study agreed with the results of Matsuda (1983) and Cross & Chandrasekhar (1986).

The changes in pH,VBN and TMAN are given in Table 2. pH of the control sample decreased to 6.6 on 3rd day, while for PSAS decreased to 6.5 on 2nd day. According to Okada & Takesu (1965), Cross & Chandrasekhar (1986), mild acidity although reduced the jelly strength gradually, it would be favourable to paste products for extending their shelf life, and also to prevent the growth of spoilage bacteria. The VBN content of the control increased from 6.16 to 12.24 mg% on 3rd day and from 6.78 to 11.76 mg% in PSAS on 2nd day. Suzuki (1981) reported increase in values of VBN on similar products. The TMAN content of the control sample increased from 2.90 to 5.03 mg% on the 3rd day and in potato starch added samples from 3.42 to 4.84 mg% on the 2nd day.

The changes in PV, FFA and total plate count are given in Table 3. The peroxide value of control samples increased from 12.20 to 28 millimoles on 3rd day and of PSAS from 13.98 to 32.41 millimoles on

Table 1. *Changes in the physical parameters of fish sausage stored at room temperature* (28± 2°C)

Days	0		1		2		3	
Parameter	CL	PSAS	CL	PSAS	CL	PSAS	CL	PSAS
Jelly strength g.cm	253	266	212	217	194	170	168	-
Expressible water,%	4.22	4.17	5.81	5.70	7.40	82	8.74	-
Folding test, grades	A	A	A	A	B	C	C	-

CL -control,without starch; PSAS - potato starch added sample;

A - when the sausage slice is intact without breakage; B - when there is crack at folded edge;

Table 2 *Changes in pH, VBN and TMAN content of fish sausages stored at room temperature (28 ± 2°C)*

	pH		VBN, mg%		TMAN, mg%	
Days	CL	PSAS	CL	PSAS	CL	PSAS
0	6.9	6.8	6.16	6.78	2.90	3.42
1	6.9	6.7	7.80	8.21	3.27	3.85
2	6.8	6.5	9.15	11.76	3.73	4.84
3	6.6	-	12.24	-	5.03	-

Table 3 *Changes in PV,FFA and TPC of fish sausage stored at room temperature* (28 ± 2°C)

Days	PV, millimoles/ kg fat		FFA, as % of Oleic acid in total fat		Total plate count, g^{-1}	
	CL	PSAS	CL	PSAS	CL	PSAS
0	12.20	13.98	2.20	3.45	7.0×10^1	1.4×10^2
1	15.65	18.21	5.75	5.26	4.2×10^2	9.1×10^2
2	23.70	32.41	6.91	9.01	8.3×10^2	6.2×10^3
3	28.00	-	8.10	-	5.0×10^3	-

Table 4 *Organoleptic evaluation of fish sausage stored at room temperature*(28 ± 2°C)

Days	CL				PSAS			
	Colour	Texture	Flavour	Appearance	Colour	Texture	Flavour	Appearance
0	4.0	3.7	3.7	4.0	3.9	3.8	4.0	4.1
1	4.0	3.0	2.9	3.0	4.0	3.9	3.8	3.0
2	3.8	3.3	3.0	3.0	3.6	3.7	3.5	3.0
3	3.6	3.4	3.1	2.8	Product spoiled due to gas formation and slight discolouration			
4	Spoiled due to discolouration							

second day. However, the products were not rancid. The PSAS showed slightly higher bacterial load compared to CL and the bacterial load was around 10^3 on 2nd day in PSAS and 3rd day in CL.

The results of the taste panel tests are recorded in Table 4. The average panel score of PSAS was higher than CL. The product with potato starch spoiled on 3rd day due to gas formation and discolouration. The control samples spoiled on 4th day due to discolouration.

The results of the statistical analysis on the overall acceptability of the products are

Table 5 *Analysis of variance on the mean panel scores of various samples of fish sausage stored at room temperature*(28 ± 2°C)

Source of variation	Degrees of freedom	Sum of squares	Mean sum squares	F-ratio	F-table value
Between attributes	4	1.99	0.4975	24.875*	3.84
Between samples	1	0.50	0.50	25.0*	5.32
Between storage days	2	2.97	1.485	74.25*	4.46
Interaction between attributes and samples	4	0.48	0.12	6.0*	3.84
Interaction between attributes and storage days	8	1.55	0.1938	9.69*	3.44
Interaction between samples and storage days	2	0.22	0.11	5.5*	4.46
Error	8	0.16	0.02	-	-
Total	29	7.87	-	-	-

* Significant at 5% level

presented in Table 5. The F ratios showed that the various treatments and the storage period had significant effect on the overall acceptability of the products. Moreover there was an interaction effect between attributes and samples, attributes and storage days and samples and storage days on the overall acceptability of the products.

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References

AOAC (1975) *Official Methods of Analysis.* 12th edn., Association of Official Analytical Chemists, Washington, D.C.

APHA (1966) *Recommended Methods for the Microbiological Examination of Foods.* American Publ. Health Association Inc., New York

Beatty, S.A. & Gibbons,M.A. (1937) *J. Fish. Res. Bd Can.* **3**,77

Cross, V.R.M. & Chandrasekhar,T.C. (1986) *Fish. Technol.* **23**, 146

Girdhari, L., Siddappa, G.S. & Tandon, G.L. (1967) in *Preservation of Fruits and Vegetables.* Indian Council of Agricultural Research, New Delhi, pp.254

Iwata, R., Kanna, K. & Okada, M. (1971) *Bull. Jap. Soc. Sci. Fish.* **43**,237

Lea, C.H. (1957) *J. Sci. Food Agric.* **8**,1

Matsuda, Y. (1983) *Bull. Jap. Soc. Sci. Fish.* **49**, 1293

Okada, M. & Takesu, M. (1965) *Bull. Jap. Soc. Sci. Fish.* **31**,628

Prabhu, R.M., Shamsunder, B.A., Krishnamurthy, B.V & Chandrasekhar, T.C. (1988) in *The First Indian Fisheries Forum Proceedings* (Joseph, M.M., Ed.) p.426. Asian Fisheries Society,Indian Branch, Mangalore

Suzuki,T.(1981) *Fish and Krill Protein Processing Technology.* Applied Science Publishers Ltd., London, p.62

Tanikawa, E. (1965) in *Marine Products in Japan*, p.521

Yermal, J.R., Desai, T.S.M., Chandrasekhar, T.C. & Shenoy, M.G. (1972) *Sea Food Export J.*, **4**, 1