

Utilization of Low Value Fish - 1. Preparation of Fish Fingers from Croaker and Perches

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A method for the preparation of fish fingers from croaker and pink perch meat has been developed. The recipe, ingredients for the paste, batter and the breading mix have been standardised through taste panel studies. An extrusion technique has been used to make fish fingers to the required size and shape rather than sawing of the frozen meatblocks generally followed.

Mechanised trawlers, fishing mainly for shrimp, bring large quantities of low value fish, which goes for reduction into fish meal or fish menure and fetch a very low price to the fishermen. The need to use these fish for human consumption, through diversified fish products has long been pointed out by several scientist all over the world and considerable progress has been made in India in this direction. This paper presents the developments and standardisation of fish fingers from the minced meat of croaker (mixed species of sciaenids) and perches (*Nemipterus japonicus*).

Materials and Methods

Fresh croaker (mixture of fish, belonging to sciaenids) and pink perch (*Nemipterus japonicus*) were obtained from the landing centre at Mangalore. The fishes were brought uniced to the landing centre with a time lag of 5-6 h. At the landing centre these were iced, brought to the laboratory and used for the preparation of fish fingers.

The dressed and washed fish were fed into meat picking machine (Japanese make) and the picked meat was passed through a mincer, 2-3 times, using sieves of different size. The minced meat was then transferred to a silent cutter (Japanese make) and the various additives shown in Table 1 were added and mixed into a homogeneous paste. A nozzle to fit into a sausage stuffer having a cross section of 1.5 x 1 cm at the extruding tip was made and used for preparing fish fingers. The moulded paste was sliced into pieces of 6 cm length and the

fingers are then dipped in the batter solution and rolled in the breading mix, packed in polythene bags and stored at -20°C.

The composition of ingredients (Table 1.) standardised using a trained taste panel by considering the appearance, texture and flavour of the final product. The fish fingers were presented to the taste panel after frying in refined groundnut oil (180-200°C) for 2 min. to a golden brown colour.

The yield percentages of dressed fish and picked meat were recorded. The average weight of fish fingers before breading, after breading and after frying were also recorded.

Duplicate samples were used for the determination of proximate composition. All the values are expressed, on wet weight basis, as percentage of raw materials. The proximate composition analysis for moisture, protein, fat and ash was done according to the method recommended by AOAC (1975).

Trimethylamine nitrogen (TMAN) and total volatile base nitrogen (TVBN) were estimated according to Beatty & Gibbons (1937). The lipids were extracted according to the procedure of Bligh & Dyer (1959) and the peroxide value (PV) of the extracted oil was determined by the method described by Hills & Thiel (1946). 2- Thiobarbituric acid (TBA) value was determined by the method of Koning & Silk (1963). Free fatty acids (FFA) were determined by titrating with standard alkali (Olley & Lovern, 1960) and expressed as oleic acid percentage.

The samples were analysed for aerobes and for the presence of enteropathogenic *E. coli*, *Salmonella*, *Vibrio* and *Staphylococcus aureus* according to the standard methods recommended by Speck (1976).

Results and Discussion

Fish fingers were prepared from frozen blocks of fish fillets, buy cutting or sawing into suitable size, battering, breading and deep frying in fat. Since the advent of deboning machines, use of frozen blocks of minced meat came into use for the preparation of fish fingers (Steinburg, 1980). During sawing of frozen minced fish blocks substantial quantities of meat particles are lost. In the present study, this loss was eliminated using an extrusion nozzle. The fish fingers prepared by extrusion were of uniform shape, size and weight and had smooth surface. This facilitated a uniform batter coating on the surface of fish fingers.

Table 1. *Ingredients used in the formulation of paste, batter and breading mix*

Ingredient	%
For the paste	
Meat	74.50
Onion*	1.00
Sugar	1.50
Garlic**	0.10
Chilli powder	0.50
Pepper powder	0.15
Coriander powder	0.25
Refined groundnut oil	4.50
Refined wheat flour (Maida)	6.00
Ice water	9.00
Salt	2.50
For batter solution	
Bengalgram flour	27.50
Water	69.00
Baking soda	0.40
Chilli powder	1.40
Salt	2.10
For breading mix	
Bread toast powder	98.00
Salt	2.00

* Blanched in boiling water for 1 min and mixed with fish meat while mincing itself.

** Equivalent quantity of oleoresin was used.

Generally, the ingredients are added to the batter and breading mixtures during fish fingers production. In the present study, the ingredients (Table 1.) were added to the minced meat and mixed in a silent cutter into a homogeneous mass. The spices were added, both to the meat and the batter solution, in order to give an oriental taste to fish fingers.

Among the major ingredients used in the recipe, the effect of different levels of refined wheat flour (maida) on the product characteristics were studied. Of the three levels of wheat flour tried (4,6 and 9 percent), 6% incorporation gave the best results with respect to overall acceptability of the product. Similarly, addition of refined groundnut oil at 4.5% level and ice water at 9% level gave the best results with respect to overall acceptability of the product.

The yield of picked meat was 30% in case of croaker and 37% in pink perch (Table 2). Revankar *et al.* (1981) obtained a yield range of 25-40% for croaker and 30-43% for pink perch.

Table 2. *Yield of picked meat, average weights of fish fingers and percentage increase in weight*

Stage	Croaker	Pink Perch
Yield of dressed fish, %	62	58
Yield of picked meat, %	30	37
Average weights of fish fingers		
Before battering and breading, g	9.3	9.7
After battering and breading, g	11.4	11.7
After frying, g	10.2	10.1
Percentage pick up of batter breading mix	23.2	20.8
Percentage overall increase in weight from the raw fingers to fried fingers	10.3	4.6

The size of the fish fingers was standardised to 1.5 x 1 x 6 cm. Uniform frying was difficult with bigger sized fish fingers. The average

weight of fish fingers prepared from croaker and pink perch were 9.3 g and 9.7 g respectively (Table 2). The proximate composition of samples during different stages of production is given in Table 3.

Table 3. *Proximate composition of the products during different stages of processing*

Sample	Moisture %	Protein %	Fat %	Ash %
Croaker				
Meat	78.9	17.3	2.1	1.4
Paste	71.6	13.1	5.8	3.4
Fingers	70.8	13.0	5.6	3.3
Fingers (after frying)	52.4	20.3	18.4	3.9
Pink perch Meat	77.6	18.1	1.9	1.6
Paste	72.5	12.2	5.9	3.5
Fingers	72.0	11.9	5.5	3.4
Fingers (after frying)	51.4	22.4	16.7	3.9

Due to the addition of refined wheat flour (maida) the moisture content was reduced to the extent of 5-7% in the paste and fish fingers.

Table 4. *Some of the chemical quality characteristics of line samples*

Sample	TMAN	TVBN	PV (Milli- moles oxygen per 1000 g extracted oil)	TBA number (mg malonal- dehyde per 1000g extracted oil)	FFA (as% oleic acid)
Croaker					
Meat (immediately after picking)	1.96	7.7	1.20	3.26	0.34
Paste (immediately after mixing the ingredients)	1.96	8.4	1.43	4.02	0.39
Fingers (after battering and breading)	2.24	8.4	2.43	6.28	0.43
Pink perch Meat (immediately after picking)	1.82	7.0	0.48	4.17	0.29
Paste (immediately after mixing the ingredients)	2.10	10.5	1.13	5.63	0.39
Fingers (after battering and breading)	2.10	9.8	2.97	7.80	0.41

The higher values obtained for liquid and ash contents in the paste and fish fingers were due to the added fat and salt respectively. The protein content of the meat decreased significantly after the additives were added, further decrease after battering and breading was however, insignificant. During frying the fish fingers lose moisture and absorbed oil considerably. Similar changes as observed in the present study, have been recorded by Dyer *et. al.*, (1977), Rudia Setty *et. al.*, (1975), Shenoy *et. al.*, (1975) and Marangal (1979).

Some of the chemical characteristics like TMAN, TVBN, PV, TBA and FFA were studied to assess the quality of fish meat, paste, and fish fingers and the values are presented in Table 4. The TMAN and TVBN values obtained for croaker and pink perch meats indicated that the raw material was quite fresh. During the different processes in the preparation of fish fingers, the TMAN and TVBN values increased slightly. Also the mincing process accelerates the reduction of TMAO (Babbitt *et. al.*, 1972).

There was a gradual increase in PV, TBA and FFA values during processing (Table 4). Anand (1976) observed that peroxides were ab-

sent in very fresh pink perch, where as Deng *et. al.* (1977) have reported a PV of 2 milli equivalents per 1000 g of extracted oil of fresh mullet (*Mugil cephalus*). The slightly higher values of PV noticed in the present study may be due to icing of fish 5-6 h after catch and the mincing process.

Table 5. *Aerobic plate count at various stages of fish finger preparation*

Sample	Aerobic plate count (number per g)
Croaker	
Meat	1.68×10^6
Paste	2.88×10^6
Fingers (before frying)	3.00×10^6
Fingers (after frying)	Nil
Pink perch	
Meat	1.64×10^5
Paste	2.28×10^5
Fingers (before frying)	2.16×10^5
Fingers (after frying)	Nil

Table 6. *Aerobic plate count and mesophilic spore count of some of the ingredients used and of the final product*

Material	Aerobic plate count/g	Mesophilic spore count/g
Picked meat-croaker	1.68×10^6	400*
Picked meat - pink perch	1.64×10^5	350*
Sugar	N.d.	100*
Chilli powder	1.59×10^5	1.78×10^4
Pepper powder	2.38×10^5	1.90×10^4
Coriander powder	0.31×10^4	750*
Wheat flour	2.4×10^5	700*
Salt	N.d.	1600*
Bengal gram flour	1.56×10^4	0.525×10^4
Baking Soda	0.94×10^4	2200*
Bread powder	0.47×10^4	500*
Fingers (croaker base)	3.00×10^6	0.33×10^4
Fingers (pink perch base)	2.16×10^5	0.32×10^4

* Estimated; N.d. = not determined

Slightly higher counts ie. 1.68×10^6 /g and 1.64×10^6 /g for croaker and pink perch respectively noticed in the present study (Table 5 and 6) are presumably due to delayed icing of fish after catch and deboning both of which increase the microbial load. There was a slight increase in the bacterial load of paste and fingers which might be due to the addition of various ingredients, as they carried their own load of bacteria and due to the time lost in the preparation of product from minced meat. Similar observation have been made by Maragal (1979) during the preparation of fish sausages and Chandrasekhar *et. al.* (1977) working on fried fish cakes and fish balls.

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References

- Anand, C.P. (1976) *Studies on the Effect of Preservatives on the Growth of Psychrophilic Bacteria Isolated from Marine Fish and on the Preservation of Fish in Cooler Storage*. Master's Thesis, University of Agricultural Sciences, Bangalore.
- AOAC (1975) *Official Methods of Analysis*, 12th edn. Association of Official Analytical Chemists, Washington, D.C.
- Babbitt, J. K., Crawford, D. L. & Law, D. K. (1972) *J. Agric. Food Chem.* **20**, 1052.
- Beatty, S.A. & Gibbons, N. E (1937) *J. Biol. Bd Can.* **3**, 77.
- Bligh E. G. & Dyer, W. J., (1959) *Can. J. Biochem. Physiol.* **37**, 911.
- Chandrashekar, T. C., Yermal, J. R., Desai, T. S. M. & Bhandary, M. H. (1977) *Curr. Res.* **6**, 145.
- Deng, J. C., Matheus, R. F. & Watson, C. M. (1977) *J. Food Sci.* **42**, 344.
- Dyer, W. J. Hiltz, D. F., Hayes E. R. & Munro, V. G. (1977) *J. Inst. Can. Sci. Technol. Aliment.* **10**, 185.

- Hills, L. G. & Thiel, C. C. (1946) *J. Dairy Res.*, **14**, 340.
- Koning, D. A. & Silk, M. H. (1963) *J. Am. Oil. Chem. Soc.* **40**, 165.
- Maragal, M. G. (1979) *Preparation and Preservation of Fish Sausage in Natural Casing at Refrigerated Temperature with Chemical Preservatives and by Smoking*. Master's Thesis, University of Agricultural Sciences, Bangalore.
- Olley, J. & Lovern, J.A. (1960) *J. Sci. Fd. Agric.* **11**, 644.
- Revanker, G. D., Keshava, N., Naidu, A. K. & Baliga, B. L. (1981) *Indian Food Packer* **35**, 20.
- Rudra Setty, T. M., Muddanna, V., Nagaraj, A. S., Chandrashekar, T. C. & Shetty, H. P. C. (1975) in Proc. Symp. Fish Processing Industry in India. 13-14 Feb. 1975, Mysore, Association of Food Scientists and Technologists (India) 1976, p. 55.
- Shenoy, M. G., Desai, T. S. M. & Bhandary, M. H. (1975) *Mysore J. Agric. Sci.* **9**, 150.
- Speck, M. L. (1976) *Compendium of Methods for the Microbiological Examination of Foods*. American Publish Health Association. Washington. D. C.
- Steinberg, A. M. (1980) in *Advances in Fish Science and Technology* (Cornell, J.J., Ed.), Fishing News (Books) Ltd., England p. 34.