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Development of Fish ham from Red meat of Tuna (*Euthynnus affinis*)

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A method was developed for the preparation of "fish ham" from the red meat of tuna (*Euthynnus affinis*). Preparation of fish ham involves two steps. In the first step, meat of croaker (*Jhonius sp.*) and pink perch (*Nemipterus japonicus*) was separated, mixed and ground into a paste with required additives. In the second step, red meat of tuna was filleted, cut into cubes and its colour was fixed by curing in 0.01% sodium nitrite, 0.05% ascorbic acid, 0.01% sodium tripolyphosphate, 2% salt and 1.5% sugar mixture and stored in anaerobic condition at 2°C for 48 h. Finally, fish paste and cured red meat cubes of tuna were mixed in the ratio of 60:40 and packed into krehalon casing, sealed and inserted into the metallic box type retainers and heat processed at 88-90°C for 105 min and cooled at 10°C for 20 min. Acceptability of fish ham was studied by chemical, microbiological and organoleptic tests. The product had excellent appearance, taste and texture. At ambient conditions the product had a shelf life of 6 days and at refrigerated condition 42 days.

Key words: Fish ham, red meat of tuna, processing time standardization mixing ratio

Fish ham is one of the important and popular fish paste products, produced on commercial scale in many countries especially Japan because of its special taste and flavour (Chandrasekhar, 1970). Tanikawa, (1971) and Chandrasekhar and Desai (1972) have described methods for manufacturing different types of ham products using land animal meat and tuna meat. Work on the development of fish ham using red meat of tuna has not been carried out so far. Hence, the present study was undertaken.

Material and Methods

Freshly landed croaker (*Jhonius Sp.*) and pink perch (*Nemipterus japonicus*) and frozen tuna (*Euthynnus affinis*) formed the raw material. The meat from croaker and pink perch was separated by a reciprocatory type of meat separator. The picked meat of croaker and pink perch were mixed in the ratio of 1:1, minced and then ground into a fine paste together with other ingredients as shown is Table 1, in silent cutter for 15 min. at 12 ± 2°C. Frozen tuna was skinned in semi-thawed condition, washed in chilled water and was cut into slices and later into cubes of 1 cm^3 size. The tuna cubes were mixed with curing mixture containing sodium nitrite (0.01% w/w), salt (2.0%w/w), sugar (1.5%w/w), sodium tripolyphosphate (0.01%w/w) and ascorbic acid (0.05%w/w) and kept at + 2°C in anaerobic condition for 48 h for colour fixation.

The fish paste and cured tuna meat were mixed in different ratios (50:50; 60:40; 70:30; 80:20; 90:10 and 100:00) and stuffed into coloured Krehalon synthetic casing (size: 220 mm x 320 mm), sealed (net weight about 300 g), inserted into metallic box type retainers and heat processed in hot water at 88-90°C for 105 min and cooled at 10°C for 20 min, to arrive at the optimum mixing ratio. Using the standardised mixing ratio (60:40- fish paste: cured tuna meat), ham was prepared and heat processed at 88-90°C for various periods (60 min, 75 min, 90 min, 105 min and 120 min) to obtain the standard heat

Table 1. Percentage composition of various ingredients in the fish paste

Ingredients	Quantity (%)
Fish meat (minced)	70
Salt	2
Sugar	1.5
Starch	10
Fat	5
Spice mixture*	1.7
Monosodium glutamate	0.2
Sodium tripolyphosphate	0.2
5% colour solution**	0.13
Crushed ice	9.27

* Spice mixture: Pepper powder (0.2%w/w), ginger (0.3%w/w), garlic (0.2%w/w), coriander powder (0.4%w/w), chilly powder (0.6%w/w).

** Colour solution: Ponceau-4R (3%), Carmosine (2%)

processing time. Fish ham was prepared, as described in the flow chart, adopting the optimum ratio of mixing and standard heat processing time and tested for quality. The organoleptic quality of the product was judged by a group of 8 panelists for various attributes. pH of the sample was determined using a pH meter after homogenizing 10 g of ham piece in 50 ml distilled water. Proximate composition was determined according to AOAC (1984) method. Trimethylamine nitrogen (TMAN) and volatile base nitrogen (VBN) were estimated according to Beatty and Gibbons (1937). Total Plate Count (TPC) and spore counts were determined as per APHA (1976)

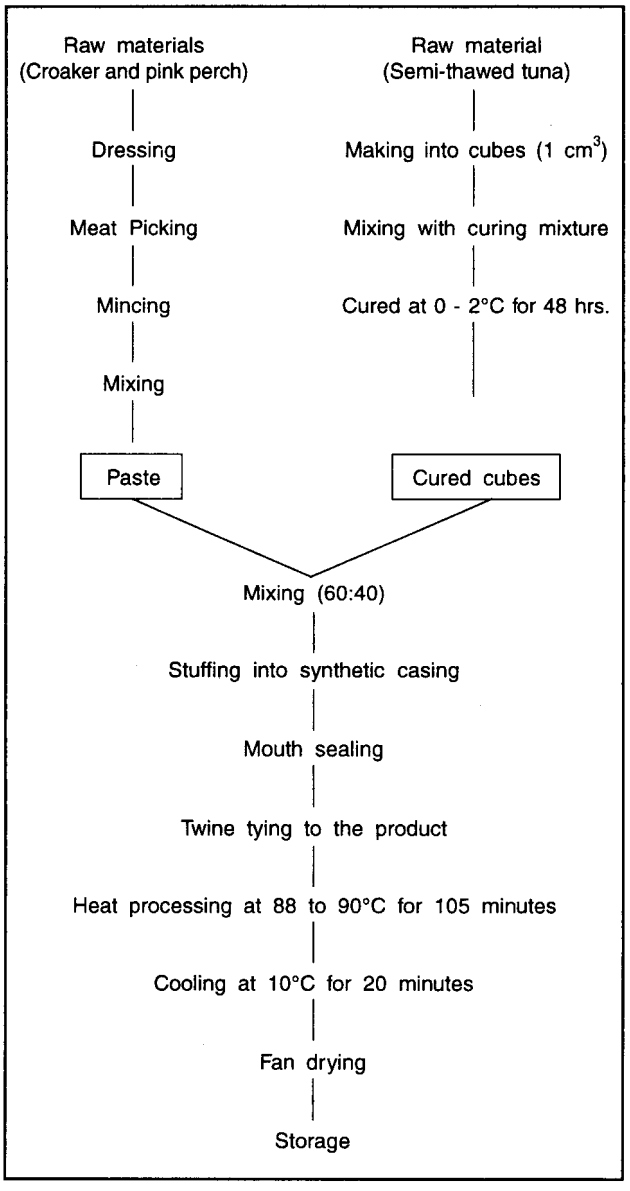

Fig. 1. Flow diagram for the preparation of fish ham

Table 2. Standardization of mixing ratio of fish paste and cured tuna meat

Attributes	Fish paste: Cured tuna meat 50:50	60:40	70:30	80:20	90:10	100:00 (Control)
Colour	2.25	3.25	3.12	2.87	2.62	3.75
Appearance	2.50	3.25	2.37	2.62	2.87	3.00
Texture	2.87	3.37	3.30	3.00	3.00	3.12
Flavour	2.62	3.37	3.30	3.35	3.35	3.30
Taste	3.25	3.87	3.37	3.37	3.25	3.12
Binding of ham pieces and paste	2.87	3.75	3.37	3.62	2.62	—

Organoleptic evaluation rating scale: Excellent=5; Very good =4; Good = 3; Acceptable = 2, Neither acceptable nor rejected 1; Rejected 0

Table. 3. Standardisation of Processing time* of fish ham by organoleptic evaluation

Processing time (min.)	Attributes: Appearance	Flavour	Taste	Texture	Binding of ham pieces	Remarks
60	6.37	6.75	6.38	5.87	6.25	Improper cooking; binding of cubes with paste was not good
75	6.38	7.12	6.62	6.00	6.62	-do-
90	6.50	7.12	6.75	6.25	6.87	Not cooked at the centre
105	8.10	8.00	7.62	7.87	7.75	Properly cooked, good flavour, taste and texture, overall quality was very good
120	6.30	7.25	7.80	6.50	6.75	Over cooked, softened texture

*The products were processed at 88 - 90°C and cooled at 10°C for 20 min.
Organoleptic evaluation rating scale: Extremely good=9; Very good=8; Good=7; Very fair to good=6; Very fair=5; Fair=4; Poor=3; Very poor=2; Extremely poor=1.

Results and Discussion

In the present experiment fish ham was made from cured red meat of tuna. Method of curing followed is in accordance with Desai and Chandrasekhar (1972). In Japan, fish ham is prepared by mixing cured cubes of red meat of tuna and whale meat with pork fat and adhesive binding meat (Tanikawa, 1971). According to Chandrasekhar and Desai (1972) adhesive binding meat is prepared by grinding fish meat having high elasticity and good binding capacity with the cured red meat, preservatives, seasoning materials, colouring material, and smoke flavour in a grinder for 15-20 min to get a fine paste of high viscosity.

Table 4. Overall quality of fish ham

Chemical characteristics	
Protein	17.9%
Fat	04.88%
Moisture	70.11%
Ash	2.15%
PH	6.80
TMAN	02.68 mg%
VBN	21.80 mg%
Microbiological counts:	
Total Plate Count/gm	$2.1x10^1$
Spore Count/gm	Not detected

Rating: Extremely good=9; Very good=8; Good=7; Very fair to good=6; Very fair=5; Fair=4; Poor=3; Very poor=2; Extremely poor=1.

The results of different mixing ratios of fish paste/adhesive binding meat and tuna meat are depicted in Table 2. Out of five different ratios experimented the product with 60:40 (fish paste: cured tuna meat) ratio showed better overall quality in respect of colour, appearance, texture, flavour, taste and binding of tuna meat to the paste. This product exhibited mosaic pattern, when cut into slices and the taste was superior compared to fish paste.

A heat process for 105 minutes at 88-90°C resulted in a product with very good organoleptic characteristics (Table 3). The products processed for 60 and 75 min were found to be improperly cooked, gave fishy smell and binding was not proper. In the 90 minute process, the product was not cooked at the centre, whereas 120 min process resulted in over cooking and soft texture of the product. Comparative organoleptic evaluation of the products processed at different periods indicated high scores for the sample

processed for 105 min (Table 3). Organoleptic quality of the product was good with proper binding of cured tuna cubes in the paste. Chemical quality attributes show that the TMAN, VBN are low and microbiological quality parameters like TPC and spore counts were within limits, indicating superior overall quality of the product. The shelf stability of fish ham at ambient temperature was found to be 6 days. Refrigerated temperature extended the storage life to 42 days. Detailed results of investigations on the storage characteristics of fish ham at different storage conditions are being presented elsewhere.

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