

Development of Ready-to-fry Crab Products

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Crabs are one of the major components of seafood industry in the world. This study contains the development of two important ready to fry products from crab meat viz., crab sticks and crab cutlets. The suitable recipes for these products are standardized and their chemical analysis recorded.

Key word : Ready-to-fry, crab sticks, crab cutlets

Among shellfish, crab ranks second only to shrimps in the rupee value of harvested products. Like other seafoods crab meat is also highly perishable. The development of ready-to-fry/serve products with long shelf life is therefore of congenit necessity. Hence, a study was initiated to standardize and develop recipes for ready-to-fry and serve products from crab meat. This paper reports results of the study.

Materials and Methods

Fresh crabs (*Portunus pelagicus* L.), a by-catch of shrimp trawlers, available in considerable quantities along Mangalore coast, were brought to the laboratory in iced condition, washed thoroughly in chlorinated, chilled water (20 ppm) and stored in chilled condition (0 - 5 °C) until further use. Shell, viscera and gill were removed, followed by a thorough wash in fresh water and blanched in boiling water with 2% salt for 10 min. Blanched carcass was cooled in chilled water for 5 min and the meat was picked manually under hygienic conditions. Similarly, shrimps (*Metapenaeus dobsoni*) were blanched in boiling water for 10 min and were cut into small pieces.

Potatoes were washed thoroughly with water, boiled for 15 min, cooled, peeled and mashed into a fine paste. Onions were cut into small pieces of 2 cm after the removal of their external cover and fried in double refined groundnut oil to a golden brown colour. Egg were broken, egg white was separated for use in recipe. Powdered bread crumbs were used as coating material.

The basic formula of fish cutlets (Maruthi, 1989) and fish fingers (Reddy, 1982) was used. Suitable changes in the starting recipe were worked out by varying the levels of different ingredients. A total of five recipes were formulated for both crab sticks and crab cutlets (Table 1). The preparation steps are presented in Fig. 1. Mixing and breading was done manually. The products were then fried at 140 - 150 °C for 4 minutes to develop a golden brown colour.

The products were presented to fifteen trained panelists and the evaluation was done on a 9-point Hedonic scale. These data were analysed using analysis of variance (anova) and the differences between the products

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determined by Duncan's multiple range test (Duncan, 1955).

Moisture, protein, crude fat and total ash were estimated by standard methods (AOAC, 1984). Peroxide value (PV) (Tarr, 1947) and free fatty acid (FFA) content (AOAC, 1975) were also determined.

The microbiological characteristics namely, total plate count (TPC) and most probable number (MPN) of indicator organisms (coliforms) were also determined (APHA, 1976).

Results and Discussion

The five different recipes worked out for crab sticks and crab cutlets are delineated in Table 1. The results of sensory analysis of these are depicted in Table 2. Different recipes of crab sticks (I - V) obtained an overall acceptability score of 7.0, 6.3, 7.3, 6.3 and 7.2 while that of crab cutlets (I - V) scored 6.4, 7.0, 7.0, 6.7 and 7.1 in the same order.

Based on the sensory analysis and the comments of the panelists, recipe no. III in case of crab sticks and Recipe No.

Table 1. Composition* of various recipes for crab sticks and crab cutlets

Recipe ingredients	Crab sticks					Crab cutlets				
	I	II	III	IV	V	I	II	III	IV	V
Crab meat	56.0	60.0	50.0	45.0	65.0	56.0	60.0	60.0	40.0	66.0
Prawn**	12.0	10.0	15.0	17.0	3.0	10.0	5.0	15.0	15.0	6.0
Potato+	14.0	10.0	5.0	12.0	6.0	10.0	9.5	5.0	10.0	5.0
Wheat flour	-	-	3.0	2.0	5.0	-	-	3.0	-	-
Oil	3.0	6.0	8.0	10.0	4.0	3.0	5.5	8.0	10.0	7.0
Salt	1.2	1.5	1.5	2.0	1.0	1.7	1.5	1.5	1.0	1.5
M.S.G.	-	0.3	0.2	0.6	0.4	-	0.3	0.4	0.6	0.2
Onion++	1.0	-	5.0	4.0	6.0	6.0	8.0	5.0	10.0	5.0
Baking powder	0.5	0.5	0.5	0.3	0.5	0.5	0.2	0.5	0.5	0.5
Egg White	5.2	5.5	4.0	2.0	1.8	5.6	3.9	4.0	3.6	2.0
Bread Crumbs	6.0	4.0	5.0	2.0	3.0	6.0	4.0	5.0	3.1	2.8
Spice Mixture										
Chilly Powder	0.7	0.8	0.6	0.5	0.8	0.7	1.0	0.6	1.2	0.9
Ginger	0.3	0.5	0.2	0.3	0.4	0.3	0.4	0.2	0.4	0.3
Pepper	0.1	0.4	0.3	0.2	0.3	0.1	0.1	0.3	0.3	0.2
Clove	-	-	0.2	0.1	0.3	-	0.2	0.2	0.1	0.1
Garam Masala	-	0.5	1.5	2.0	2.5	-	-	1.3	3.5	2.0
Cumin	-	-	-	-	-	-	0.2	-	0.2	0.2
Coriander	-	-	-	-	-	-	0.2	-	0.5	0.3
Turmeric	-	-	-	-	-	0.1	-	-	-	-

* All the values are expressed as percentage of final products. ** Blanched in boiling water for 10 min, cut into pieces and mixed. + Boiled, peeled and made into a paste. ++ Fried to brown colour in double refined ground nut oil.

Blanched crab meat

Mixing with boiled and peeled potato paste along with salt, chilly powder, ginger, pepper, powder monosodium glutamate, baking powder wheat flour and refined ground nut oil



Mixing with blanched prawn-cut pieces



Moulding into rectangular shape



Dipping in beaten egg white



Breading



CRAB STICKS

Mixing with boiled and peeled potatoes paste along with salt, baking soda, chilly powder, pepper powder, cumin, garam masala, clove and coriander powder



Mixing with fried onion and ginger



Mixing with blanched and cut prawn pieces



Add the double refined ground nut oil and mix the ingredients thoroughly.



25 g of material was shaped into balls and flattened to 1 cm thickness



Dipping in beaten egg white



Breading



CRAB CUTLETS

If desired can be frozen and stored at $-20 \pm 2^{\circ}\text{C}$



Thawing



Fry and Serve

Fig. 1. Schematic representation of process of preparation of Crab sticks and crab cutlets

Table 2. Mean organoleptic scores* of different recipes of crab sticks and crab cutlets used in standardization.

Recipe Attributes	Crab sticks					Crab cutlets				
	I	II	III	IV	V	I	II	III	IV	IV
Colour	7.0	7.1	7.5	5.8	7.0	6.5	6.9	7.4	6.3	7.4
Texture	7.0	6.2	7.3	6.1	7.2	7.3	6.9	6.8	7.1	7.4
Flavour	7.1	6.3	7.3	5.8	7.0	7.1	6.2	6.6	6.5	7.9
Appearance	7.0	7.0	7.3	6.0	6.9	6.9	6.5	6.6	6.3	7.8
Taste	7.0	6.5	7.2	6.5	7.0	7.6	6.8	7.0	6.9	7.2
Odour	7.0	6.3	7.2	6.5	6.8	6.8	6.7	6.0	6.0	6.9
Overall accept ability	7.0	6.3	7.3	6.3	7.2	6.4	7.0	7.0	6.7	7.1

* Based on 9 point Hedonic scale employing a group of 15 trained panelists.

V (Table 2) in case of crab cutlets were adjudged to be the best. Eventhough there is no significant difference ($p < 0.05$) between the recipes III, I and V of crab sticks, the recipe III was selected because it had relatively higher overall acceptability score.

The physical, chemical and microbiological characteristics of raw material along with the chemical and microbiological characteristics of the final products, using the standardised recipe are tabulated in Table 3. The average length and width of crab (*Portunus pelagicus*) used in the study were 12 cm and 8.7 cm respectively while the yield of crab meat was 15.4%. The water content observed in *P. pelagicus* was 77.25%. This is more or less in conformity with Srinivasan (1979). However, higher values of moisture (82

- 84%) have also been reported in the case of the same species (Chinnamma *et al.*, 1971). The protein content observed in the raw crab was 18.64% and this corroborates well with that reported by Radhakrishnan & Natarajan (1979). However, large variation ranging from 13.97 (Chinnamma *et al.*, 1971) to 16.99% (Srinivasan, 1979) have also been documented. The fat content of 0.64% to 0.92% has been reported in *P. pelagicus* (Chinnamma *et al.*, 1971).

The lower PV and FFA in the raw material indicates the prime freshness of the material (Connell, 1970). A large variation from 21.9% (Chinnamma & Gopakumar, 1987a & b) to 35% (Radhakrishnan & Samuel, 1980) exists in the reports related to the yield of crab meat. This contrasting variations may be due to the effect of lunar phases and

Table 3. Various characters of the raw material and the prepared products

Type of Material	Yield %	Protein %	Moisture %	Fat %	Ash %	PV (mM of O ₂ / kg oil)	FFA(%) of oleic acid	TPC g ⁻¹	Total coliform 100 g ⁻¹	Faecal coliform 100 g ⁻¹	E.coli 100 g ⁻¹
Raw Material	15.40	18.64	77.25	0.75	2.45	8.65	1.35	1.4x10 ⁶	2.8x10 ²	1.4x10 ²	1.2x10 ²
Crab Sticks	NA	17.64	68.82	8.62	4.05	12.25	1.07	3.4x10 ⁴	8.1x10 ⁴	1.2	NIL
Crab cutlets	NA	17.07	67.72	8.36	4.00	12.26	1.123	3.6x10 ⁴	6.8	1.1	NIL

reported by Radhakrishnan & Samuel (1980). The initial high TPC, total coliforms, faecal coliforms and *E. coli* may be due to the fact that crabs are bottom dwellers (Bal & Rao, 1990) and the fact that these were recorded in the raw material before washing in chlorinated water. Further, reductions in all these parameters in the products may be due to washing with chlorinated water and blanching.

It is evident from Table 3, that the final product prepared by selecting the best recipe had high amount of protein and fat. The increase in PV and FFA with in safe limit in the final product as compared to the raw material may be due to frying. This indicates that the product is safe to be consumed and no health hazard can set in. Also, the product is devoid of bones, shells and fishy smell, which is an added advantage.

The development of diversified crab products calls for the standardization of new recipes. The present study is a begining in this line. The major raw materials empolyed in the present study are available locally in good quantities and the products being ready-to-serve (after frying) and devoid of fishy smell/ bones, it is hoped that the method if commercialised will fetch good returns to the fishermen/entrepreneur.

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