

Technological feasibility of incorporating collagen in specialized fish products

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Abstract

The functional property of surimi varies with fish species and it is necessary to improve the quality of low-grade surimi using additives or modified processing schedules. Surimi, a refined form of comminuted fish flesh, has great potential as a functional protein ingredient and can be substituted for a variety of traditional animal and vegetable proteins. 10 % collagen when added to surimi will enhance consumer acceptability and will provide good texture to the product. In the present study, three specialty products were prepared with common carp surimi with 10 % collagen of the total protein percentage and with shark surimi without collagen. The collagen prepared from the airbladder of surimi was used for modifying the texture of the products. A comparative study of sensory characteristics of the products prepared with these two types of surimi was also done. The results showed that the overall acceptability of products developed from shark surimi was slightly less than those from common carp surimi with 10 % collagen of the total protein.

Keywords: Collagen, Fish products

1. Introduction

Consequent to urbanization, the preference of people shifted from raw fish to ready to eat fishery products. Consumer acceptance of these products is largely based on their appearance, sensory qualities and economic value. Surimi, a refined form of comminuted fish flesh, has great potential as a functional protein ingredient which can be substituted for a variety of traditional animal and vegetable proteins (Lanier, 1986; Spencer *et al.* 1992). The effect of starch on the strength of cooked fish gels has been investigated by several Japanese workers (Okada and Yamazaki, 1959 and Wu *et al.* 1985). In USA, surimi technology led to the development of commercially acceptable shellfish analogues, which were not successful when soy protein was used. The functional quality of surimi varies with fish species and it is necessary to improve the quality of low-grade surimi using additives or modified processing schedules.

Nature of surimi products are affected by the functional properties of surimi, ingredients used and temperature-time relationship during

Sustain Fish (2006) B.M. Kurup & K. Ravindran (Eds.), School of Industrial Fisheries, Cochin University of Science & Technology, Cochin-682016, India

heat setting (Okada, 1963; Wu *et al.*, 1985; Kim and Lee 1987). By the incorporation of gel forming polymers into products and mechanical texturisation processes, a variety of seafood analogue products have been developed (Okada, 1963; Akahane *et al.*, 1984; Kim and Lee, 1987, Chung and Lee, 1990). Fabricated foods are made by structuring, shaping or blending various ingredients into finished food products. The ingredients used must be readily available, economical, safe and must serve a useful function. In 1983 Codex Alimentarius Commission, proposed hydrocolloids such as carrageenan, pectin and alginates as additives for minced fish. Meullenet *et al.*, (1994) studied the textural properties of chicken frankfurters with added collagen fibres. A variety of seafood analogues were prepared by Jayasekharan and Shetty (1992), incorporating non-fish protein to comminuted meat.

The functional property of surimi varies with fish species and it is necessary to improve the quality of low-grade surimi using additives or modified processing schedules. Hassan and Mathew (1996) estimated collagen content in the white muscle of commercially important tropical fishes and classified fishes accordingly and reported 3.25 % of total collagen in Common carp and 13.11 % in shark meat. Hassan and Mathew (1999) found that 10 % collagen when incorporated to surimi prepared from common carp, will enhance the physical and rheological properties. In the present study, three-speciality products with 10 % collagen of the total protein percentage were prepared with common carp surimi and with shark surimi without collagen. A comparative study of sensory characteristics of the products prepared with these two types of surimi products was also done.

2. Materials and Methods

2.1 Materials

2.1.1 Base Material

- (A) Surimi prepared from a low collagen fish, common carp (*Cyprinus carpio*) incorporated with collagen at 10 % level of the total protein.
- (B) Surimi from a high collagen species, Shark (*Scoliodon sorrakowah*)
- (C) Preparation of collagen from the air bladder.

Collagen was prepared and purified from the air bladder of common carp as described by Gallop and Seifter (1963). The collagen prepared was dried in oven at 30-35 °C and stored in a refrigerator. As and when needed this dried collagen was soaked overnight in water at 4°C and ground to get a homogenate with resultant moisture content comparable to that of surimi.

2.1.2 Ingredients

The ingredients are given along with recipe (2.2) of each product.

2.1.3 Mould

To get an attractive appearance moulds were prepared. These moulds were cast in brass for hygienic handling of the product.

2.2 Methods

The method of preparation along with recipe of each product is given below. The total weight of the ingredients added to each of the products prepared weighed 10 kg.

2.2.1 Savoury mince fingers

The thawed product can be mixed in breadcrumbs or batter and then fried in vegetable oil at 200 °C or grilled. The ingredients used include

Ingredients	Weight (kg)
Fish Surimi	5.80
Tomato sauce	1.80
Milk	1.70
Rusk	0.60
Salt	0.06
Pepper	0.04
Total weight	10.00

Surimi with the ingredients were mixed in a food mixer into a pulp form. The pulp was then shaped in a mould and the moulded product was frozen at -40 °C and cold stored at -20 °C. In this condition the product will remain in good condition for more than six months.

2.2.2 Fish mince cake

The product must be cooked before consumption. It can be fried, steam cooked or grilled. The ingredients required are

Ingredients	Weight (kg)
Fish Surimi	4.85
Cheese	3.00
Rusk	1.00
Water	1.00
Coriander	0.02
Pepper	0.01
Salt	0.12
Total weight	10.00

Surimi was mixed with other ingredients in the chopper for four minutes and thirty seconds. The mixture was filled in the mould. The perishable product retrieved from the mould can be kept chilled or frozen. It will keep in good condition for four days at 4 °C; when deep frozen it will keep for more than six months at -20 °C.

2.2.3 Fish mince crisp

The product has to be fried for ten seconds in vegetable oil at 200 °C before serving. The ingredients required are

Ingredients	Weight (kg)
Fish Surimi	4.40
Starch	4.30
Water	1.00
Salt	0.30
Total weight	10.00

Surimi is mixed with other ingredients for fifteen minutes in a dough mixer, until the mixture is firmly bound and comes away cleanly from the side of the bowl. The mixture was spread to a thickness of 2 mm in a stainless steel container and pressure cooked at 15 lbs for 30 minutes. The cooked mass was cut into different shapes as desired and then dried in a current of warm air at 35-40 °C, until they are hard and brittle. It was then packed in airtight containers. This will keep in good condition for six months at room temperature.

3. Results and Discussion

Surimi is a good protein source with unique gelation characteristics and visco-elastic properties. In the present study surimi was used as base material. Being the source of protein, when incorporated as an ingredient for making product, the nutritive value shoots up. The products were prepared by blending and shaping or structuring various ingredients. Here the ingredients used are readily available, economical and safe. The speciality products prepared were found to have good consumer acceptability regardless of species difference. Since the products are meant for human consumption, sensory evaluation of the product is very important. The sensory evaluation is the oldest and still the most widespread means for evaluating the acceptability and edibility of fish and fishery products.

Plate: 1 shows the different products prepared from surimi

The enjoyment value of food is very difficult to assess because this must take into account all those properties of food such as, appearance (visual appeal), odour, texture, taste *etc.* The overall

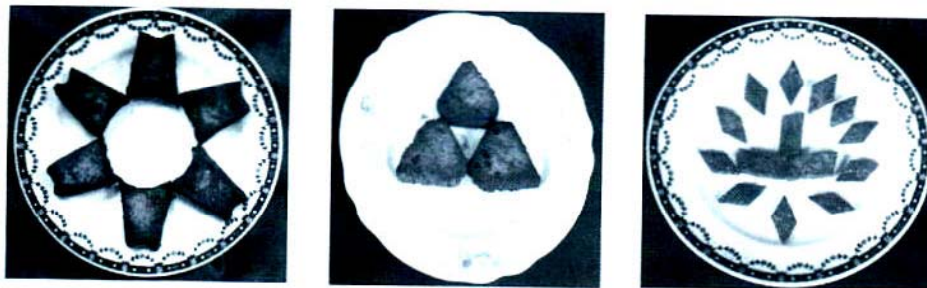


Plate 1a

Plate 1b

Plate 1c

acceptability of food depends upon all these parameters. The organoleptic evaluation of all products were done by a panel of ten judges, the samples were coded and presented to the judges, who were instructed to evaluate the products by giving scores for different attributes like appearance, colour, odour, taste, texture and overall acceptability. The quality of samples were evaluated for appearance and colour by visual feel, odour by olfaction, taste by tongue and texture by biting. Sensory feel ratings were recorded in a score sheet and these ratings were based on previously assigned scores. The score is on 1-5 scale with 5-excellent, 4-Very good, 3-Good, 2- Fair, 1- Bad.

Mean Sensory evaluation Score (\pm SD) for different products is given in Table 1

Table 1. Mean Sensory evaluation Score (\pm SD) for different products (Average of 10 x 3 readings)

Attributes	Savoury		Fish mince cake		Fish mince crisps	
	CCS	SS	CCS	SS	CCS	SS
Appearance	4.7 \pm 0.12	4.7 \pm 0.11	4.8 \pm 0.27	4.8 \pm 0.25	4.9 \pm 0.18	4.9 \pm 0.17
Colour	4.6 \pm 0.11	4.6 \pm 0.15	4.7 \pm 0.09	4.8 \pm 0.22	4.8 \pm 0.16	4.8 \pm 0.15
Odour	4.7 \pm 0.22	4.2 \pm 0.14	4.7 \pm 0.16	4.5 \pm 0.26	4.7 \pm 0.18	4.5 \pm 0.14
Taste	4.6 \pm 0.18	4.2 \pm 0.17	4.8 \pm 0.26	4.3 \pm 0.21	4.7 \pm 0.19	4.7 \pm 0.11
Texture	4.5 \pm 0.32	4.3 \pm 0.15	4.6 \pm 0.23	4.2 \pm 0.27	4.7 \pm 0.18	4.7 \pm 0.16
Overall	4.6 \pm 0.13	4.0 \pm 0.34	4.5 \pm 0.30	4.0 \pm 0.31	4.7 \pm 0.23	4.7 \pm 0.09
Acceptability						

CCS: -Common carp surimi with 10 % collagen

SS: - Shark surimi

The consumer acceptability of the products evaluated by sensory evaluation was excellent. One of the reasons for this may be, the acceptable odour and taste of the product. Due to repeated washing while preparing surimi, most of the odouriferous compounds were removed and the resultant surimi was almost free of fish odour.

The good texture of these products may be due to the heat denaturation of collagen and its consequent conversion to gelatin. The ability to undergo thermal transition and dispersion of ingredients are responsible for the difference in texture modifying effect.

From the results of sensory evaluation it was also noticed that shark surimi, even though had good consumer acceptability, its overall acceptability was less compared to the products prepared from common carp with 10 % collagen. The probable reason for this is the presence of high amount of non-protein nitrogenous matter, particularly urea in shark meat. If some method can be incorporated to remove this non-protein nitrogenous matter from the meat without affecting the functional properties, the acceptability of the product can be increased which in turn will simplify the preparation as it reduces the task of incorporating collagen in the surimi.

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