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Consumers' Acceptance and Market Test of Fish Sausage and Fish Ball Prepared from Sea Catfish, *Tachysurus thalassinus*

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Abstract: Non-conventional seafood products, fish sausage and fish ball were developed from underutilized sea catfish and consumer's acceptance and market test of the new products were conducted in inland rural and coastal fishing communities. Sea catfish, *achysurus thalassinus* was collected from Chittagong in an insulated box. The cost of production and profit of the products were assessed in the laboratory of the Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh, Bangladesh. From a 1000 g catfish, 500 g washed mince could be recovered. From 500 g washed mince, a total of 1000 g dough could be produced and from this dough 17 pieces of fish sausage and 40 pieces of fish ball were produced. The total production cost of the products from 1000 g dough including raw materials, ingredients, wage, transportation, storage and marketing was Tk. 75. Pilot market-testing were done in 10 villages of Mymensingh and six coastal villages of Chittagong. Finally, an analysis of the cost and profit of production was done on the basis of the price of product set by the people, the price of raw material in the market, tentative cost of productions and cost of transportation and storage. As per the average selling price obtained from the market tests, products of 1000 g can be sold at Tk. 136/- for sausage (Tk. 8/- each) and Tk. 160/- for fish ball (Tk. 4/- each) in the rural market of Bangladesh. Therefore, a net profit of Tk. 61 from fish sausage and Tk.85 from fish ball could be realized, from a manufacture of 1000 g whole sea catfish. Consumer's acceptance and market tests revealed that fish ball was best chosen between the two products.

Key words: *Tachysurus thalassinus*, fish sausage, fish ball

INTRODUCTION

Sea cat fish, *Tachysurus thalassinus* is a dominant underutilized species, contributes considerably in the annual landing of Bangladesh, ranging from 22,000 to 25,000 metric tons per year (Nowsad *et al.*, 1998). It is characterized by a large hard shield (cranium) over the head, three strong serrated spines and naked grayish, odd-looking skin. The species is less preferred for consumption as raw fish due to its muddy texture and blunt taste (Nowsad, 1994). So, that the fish remains underutilized and the price in the market has been very low (Tk. 15.00 - 20.00 per kg during peak fishing season). Sea catfish is intermediate in the gel forming ability (Nowsad *et al.*, 2000).

Many Southeast Asian fish-ball industries depend largely on low cost, easily available species and the mixed mince of by catch species (Sribhibhadh, 1985) High-priced, high quality fish balls are made from wolf herring, coral fish, Spanish mackerel and conger eel. Low-cost species used in lower quality fish balls include threadfin bream, big-eye snapper, lizard fish, barracuda and croaker (Sribhibhadh, 1985). In Bangladesh, the GFA and value-added products making ability of few by-catch species and some freshwater fishes have been searched (Nowsad *et al.*, 1998, 1999). Considering the constrains related to production and marketing of the value-added products suffered by BFDC in late 80s, various measures in this research for production and marketing of value-added products have been taken. To make the sea fishing

moreprofitable and to give the underutilized and by-catch species an acceptable food grade structure and mostly, to protect the sea against serious pollution due to bulk discard, the production of value-added products is only the choice.

Fish ball and fish sausage are very popular seafood items in South-east Asia. The product has not yet been introduced in Bangladesh, probably due to some marketing constrains, although the consumers preference for the products seems to be encouraging (Nowsad *et al.*, 2000).

Marketing is an essential part of any production and if the product is new in a country, it has to be given special emphasis. The mince-based products like fish sausage and fish ball are new in Bangladesh. It is therefore, very important to go into insight of the peoples preference and marketability of the products. With such considerations the present study was undertaken. It is expected that successful manufacture and marketing of fish ball and fish sausage from underutilized sea catfish, will create a useful situation for proper utilization of the fish and raise the price of the harvest. Production in household level will generate additional income for poor fisherman family. Therefore, present study was under taken to achieve consumer's preference of the fish sausage and fish ball in two representative areas of the country ; one is coastal fishing community and the other is inland rural poor community.

MATERIALS AND METHODS

This study was conducted from January 2002 to June 2002 in inland rural area of Mymensingh district and coastal fishing communities of Chittagong district. The cost of production and profit of the products were assessed in the laboratory of the Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh. Sea catfish, *Tachysurus thalassinus* (Ruppell) was selected for the manufacture of fish ball and fish sausage for consumer's acceptance and market test. It was purchased from Feringi Bazar Fish Landing Centre in Chittagong. The fishes were in iced condition during purchase. Immediately after purchase the fish were adequately iced again with new crushed ice in an insulated box (Cosmos Ltd., Seoul, Korea 20 l). The box was brought to the laboratory of the Fisheries Faculty, Bangladesh Agricultural University (BAU), Mymensingh, Bangladesh. The average size of sea cat fish was 45.0 ± 3.74 cm and 2.6 ± 0.59 kg. After brought to the laboratory, the fish was washed with chilled fresh water and preserved in deep freezer (-20°C) after wrapping with polythene bag.

Preparation of the products

Preparation of fish mince from sea catfish: For the preparation of fish mince from sea catfish, the fish was cleaned with water, deheaded, eviscerated and minced by a mechanical mincer through a 1 mm orifice diameter so that all bones were removed from the muscle. One part of the mince was washed with cold (4°C) washing solutions for either one or two times to remove lipid, enzymes, sarcoplasmic proteins and other gel inhibitory substances. Washing solutions included tap water, variable levels of NaCl (0, 0.05, 0.1, 0.15%) and CaCl_2 (0, 0.5, 1.0 and 1.5 M). For washing, the mince was stirred in 4 volumes of the washing solution for 3, 5 and 7 min for agitation and 4 min for settling each time before draining. The meat was drained in a nylon bag after leaching and excess water was removed by pressing (15 kg cm^{-2} for 15 min. each time). The washed mince obtained by the above procedures were mixed with 4% sucrose, 4% sorbitol and 0.2% Na-tripolyphosphate to produce surimi or washed mince block. Mixing was done manually with greater care so that all the ingredients were mixed homogeneously. After mixing the dough was packed in polyethylene bag, made block of 2 kg and kept frozen at -25°C until analysis. The fish sausage and fish ball were prepared from the washed mince for consumer's acceptance and market test.

Preparation of fish sausage: For the preparation of fish sausage from sea cat fish, either fresh fish or frozen mince block was used. Frozen mince block was thawed at 4°C overnight. Fresh or frozen minces were ground with 2.5% NaCl, 1.6% sugar, 0.1% monosodium glutamate (MSG), 1-1.5% spices, 2% vegetable oil and variable levels of potato starch, mashed potato and boiled rice paste. Grinding was done for a total period of 20 min. At first, mince was ground with salt for 7 min, then starch, MSG and various spice-mix were added and ground for 8 min. Finally, ground again for another 5 min after incorporating vegetable oil. During this time various chemicals (0.1% sodium nitrite, ascorbic acid, etc.) and natural colorants were tested to develop a suitable colour of the sausage. Asthaxanthin, a natural colour, was incorporated at required amount. The ground paste was stuffed into a sausage casing (Krehalon casing, 2.8 cm diameter, 8 cm long, Kureha Chemical Co., Tokyo, Japan) by a mechanical stuffer, sealed the both ends with cotton twine and heated into water bath. Heating was done in a two-step process, first at peak setting temperature for sea cat fish at 55°C for 1 h and then 95°C for 30 min. Before selecting the optimum heating temperature, a series of heating experiments were conducted. Process was standardized with the mince for the preparation of sausage depending on the nature of myofibrillar proteins and their gelation in each species.

Preparation of fish ball: For the preparation of fish ball, either fresh fish or frozen mince block was used. Frozen mince block was thawed at 4°C overnight. The minces were ground with NaCl (2.0%), sugar (1.6%) spices (1.0-1.5%- ginger, garlic, onion and chilly powder), 0.1% MSG, variable levels (0, 10, 15 and 20%) of potato starch, mashed potato, boiled rice and the required amount of water in a mortar at 4°C. Grinding was done for a total period of 16 min. At first, mince was ground with salt for 5 min, then sugar and spices were added and ground for 4 min. Finally, ground again for another 7 min after incorporating starches. The ground paste was shaped into ball and dip-fried in oil. Prepared fish ball was kept at room temperature for 2 h before any quality analysis.

The cooked products were cooled down at room temperature and packaged in double layers of polythene bag. Two sizes (7×6 and 14×8 inch) of polythene bags were used for packaging. Smaller one contained 8 pieces and the larger one contained 16 pieces of the sausage and ball. The polythene packages were sealed by wrapping several times with cotton thread. The packaged products kept in master carton were stored in the refrigerator (4°C) overnight. The refrigerated products were kept in the ice box with sufficient ice around and transported by DFID vehicle to the remote villages for consumer's acceptance and market test. Ice was changed if necessary, in the ice box to ensure the optimum chilling of the products.

Consumer's acceptance and marketability tests were done in two localities- inland rural area and coastal fishing village. Two local NGOs, viz., GRAMAUS, working in Mymensingh region and CODEC, operating in Chittagong region were involved in such data generation process. The market-testing program was planned, designed and finalized with the assistance of these 2 NGOs well ahead of the test conducted. The tests were conducted in 3 ways: using Participatory Rapid Appraisal (PRA), through interview schedule and in combination of both PRA and interview schedule. For this purpose, a very simple questionnaire, easily understandable by the village people was developed. One hundred people from 10 villages of Mymensingh and 100 families from six villages of Chittagong were fed with the products and their responses in respect of taste, texture, mouth-feel, flavour, colour, acceptance, price, buying ability, buying options, market characteristics, etc. were recorded.

The data obtained from the market test were analysed through Analysis of Variance (ANOVA) and Duncan's New Multiple Range Test by a Statistical Package MSTAT-C.

Table 1: Proximate composition of the products

	Moisture	Protein	Lipid	Ash
Fish sausage WM	80.10±2.01	13.44±0.85	4.32±0.54	2.37±0.04
Fish ball WM	79.04±2.19	15.40±0.76	1.02±0.33	4.57±0.01

Mean±SE of 2 individual measurements, WM = Washed Mince

RESULTS AND DISCUSSION

A very good quality fish sausage and fish ball were prepared using the standard process. The proximate composition of the products are given in Table 1.

The consumer's acceptance and marketability tests of fish sausage and fish ball were conducted on 100 rural people from 10 villages of Mymensingh and 100 families from the coastal fishing community of 6 villages of Chittagong. The tests were conducted in 3 ways: using Participatory Rapid Appraisal (PRA), through interview schedule and in combination of both PRA and interview schedule.

The participatory rapid appraisal is a very effective tool to generate data from the rural people, who are mostly illiterate and always afraid of seeing something in written and published form. Among various tools of PRA, Focus Group Discussion (FGD) is one of the most effective and very much adaptive techniques that directly deals with the data generator (people) and makes a cross-bridge between the data generator and conductor or facilitator. In this study, fish sausage and ball were supplied to the rural and coastal people to eat or swallow and asked them directly to score on the score sheet. Before that the team discussed about the products and its preparation, its alternative income generating opportunities and its nutritional, economic and social benefits. The test people were encouraged to comment on it and allowed to enter in depth of the problem that should be answered. In most of the cases, their answers were spontaneous and self-explanatory. They thoroughly thought and discussed about the problems themselves and reset the answers. In that way, more accurate and near to expecting data came out.

In both Fulpur and coastal Chittagong area, people liked both the products much. In case of fish sausage, percent response of people in respect of taste, flavour, colour and overall acceptability were slightly lower compared to fish ball (Table 2). A 38.93-50.53% people told it as "good" and 7.5-20.1% people told it as "very good". No consumer scored any product as "very bad". Although 13.65- 26.89% people scored sausage as "bad", that implies the negative habituation of aged people towards new taste. Scores "average", "good" and "very good" combinedly comprises more than 80% of peoples response.

Table 2: Consumer's response (%) toward fish ball and sausage

Product	TS ¹	Taste	Flavour	Colour	OA
Ball	1	-	-	-	-
	2	3.75±2.62 ^c	9.05±3.40 ^f	4.68±2.66 ^b	4.67±1.42 ^d
	3	29.75±2.4 ^b	31.07±3.95 ^b	25.46±2.83 ^b	22.93±2.4 ^b
	4	58.25±2.88 ^a	45.75±1.03 ^a	55.46±4.09 ^a	60.25±0.50 ^a
	5	8.50±2.24 ^f	14.10±3.67 ^e	14.40±10.55 ^b	12.60±2.50 ^e
Sausage	1	-	-	-	-
	2	18.65±2.10 ^b	21.72±1.50 ^b	13.65±1.4 ^b	26.89±1.50 ^{ab}
	3	28.40±1.10 ^a	31.85±6.30 ^a	15.62±3.10 ^b	19.44±2.10 ^{ab}
	4	42.75±3.70 ^a	38.93±4.5 ^a	50.53±3.90 ^a	41.27±3.20 ^a
	5	10.35±0.70 ^b	7.50±5.10 ^f	20.10±5.80 ^b	12.40±1.52 ^b

Mean sensory scores of same parameter for a particular product bearing different superscript(s) differ significantly (p<0.05). '-' Means no consumer scored; TS¹ = Test Score: 1 = Very bad; 2 = Bad; 3 = Average; 4 = Good; 5 = Very good; OA = Overall Acceptability

Table 3: Consumer's response (%) towards the taste of fish ball and sausage in relation to occupation

Product	TS	Occupation						
		FM	HW	Td	St	SH	AgF	AgF + Td
Ball	1	-	-	-	-	-	-	-
	2	4.80±0.90 ^f	6.13±4.1 ^b	7.7±1.2 ^e	8.0±0.6 ^f	7.4±0.5 ^e	11.2±0.4 ^f	1.0±0.8 ^f
	3	22.80±2.0 ^b	80.5±1.2 ^a	24.8±1.5 ^b	16.6±.4 ^b	10.5±0.5 ^e	52.8±15 ^a	64.8±3 ^a
	4	65.1±2.0 ^a	5.07±0.1 ^b	58.5±0.4 ^a	63.2±0.4 ^a	64.9±1.8 ^a	34.3±22 ^b	32.6±1.3 ^b
	5	7.3±0.60 ^f	8.3±1.2 ^b	8.9±0.4 ^f	12.3±0.7 ^e	17.2±0.8 ^b	1.7±0.7 ^e	1.6±0.4 ^f
Sausage	1	-	-	-	-	-	-	-
	2	12.0±0.5 ^d	15.5±1.1 ^b	8.6±0.62 ^b	1.3±0.8 ^f	15.8±1.2 ^b	9.2±0.82 ^e	31.8±1.6 ^b
	3	37.5±0.8 ^a	72.5±0.7 ^a	40.6±40 ^a	60.3±1.2 ^a	10.8±0.41 ^{bc}	10.2±0.9 ^f	63.6±2.4 ^a
	4	37.8±0.9 ^a	8.5±0.6 ^b	34.0±0.8 ^a	37.3±1.4 ^b	62.5±1.4 ^a	50.1±1.1 ^a	2.7 ±1.29 ^f
	5	12.7±0.5 ^d	4.0±0.5 ^{bc}	16.6±1 ^b	1.2±1.31 ^c	10.9±0.9 ^{bc}	30.5±0.6 ^b	1.9±0.82 ^e

Mean sensory scores of same parameter for a particular product bearing different superscript(s) differ significantly (p<0.05). '-' Means no consumer scored; TS = Test Score: 1 = Very bad; 2 = Bad; 3 = Average; 4 = Good; 5 = Very good; FM = Fishermen; HW = House Wife; Td = Traders; st = Students; SH = Service Holder; AgF = Agricultural Farmers; AgF+Td = Agricultural farmer cum trader

Table 4: Consumer's response (%) towards flavour of fish ball and sausage in relation to occupation

Product	TS	Occupation						
		FM	HW	Td	St	SH	AgF	AgF + Td
Ball	1	-	-	-	-	-	-	-
	2	7.4±0.36 ^e	18.3±0.78 ^b	3.4±0.1 ^c	10.2±0.9 ^b	1.0±0.82 ^d	5.3±37.1 ^c	5.3±0.8 ^f
	3	32.0±0.40 ^b	62.3±0.8 ^a	8.0±0.25 ^e	11.5±0.9 ^b	48.5±1.2 ^a	25.7±0.5 ^b	32.5±0.6 ^b
	4	58.9±3.3 ^a	18.4±0.8 ^b	70.6±0.25 ^a	76.7±1.4 ^a	32.5±0.7 ^b	65.0±4.3 ^a	62.2±0.8 ^a
	5	1.98±0.40 ^e	1.0±0.81 ^f	18.0±0.25 ^b	1.65±1.6 ^f	18.0±0.92 ^e	4.0±4.08 ^f	-
Sausage	1	-	-	-	-	-	-	-
	2	14.9±0.70 ^f	17.8±1.2 ^b	2.7±0.5 ^e	1.0±1.44 ^e	2.4±1.2 ^d	1.1±0.8 ^f	65.4±1.2 ^a
	3	25.8±0.4 ^b	56.1±0.8 ^a	41.2 ±1.2 ^a	56.0±1.3 ^a	32.2±1.2 ^b	45.1±0.9 ^b	31.6±1.3 ^b
	4	49.8±0.4 ^a	26.1±0.9 ^b	40.5±1.3 ^a	22.2±1.2 ^b	48.7±1.9 ^a	53.0±0.6 ^a	2.0±0.80 ^f
	5	9.5±0.9 ^d	-	15.6±1.2 ^b	21.0±1 ^b	16.7±1.7 ^e	1.0±0.8 ^d	1.0±0.80 ^f

Mean sensory scores of same parameter for a particular product bearing different superscript(s) differ significantly (p<0.05). '-' Means no consumer scored; TS = Test Score: 1 = Very bad; 2 = Bad; 3 = Average; 4 = Good; 5 = Very good FM = Fishermen; HW = House Wife; Td = Traders; st = Students; SH = Service Holder; AgF = Agricultural Farmers; AgF+Td = Agricultural farmer cum trader

The scenario is quite opposite in case of fish ball which was greatly liked by every section of people, irrespective of age, sex and occupation as was shown (Table 2). The taste, overall acceptability, colour and flavour were very much liked by about 70% of the people. However, a few people scored its flavour 'bad' but significant percent told it 'very very good'. Among the two products under consumer's acceptance test, fish ball was most chosen by the rural and coastal people (Table 2).

Consumer's response towards the taste, flavour and colour of fish ball and fish sausage in relation to occupation have been presented (Table 3, 4 and 5,

respectively). During consumer's acceptance and market test, 100 test families were selected in such a way that they could represent different occupations and age-groups. Major occupations identified were fishermen, house-wife, small-traders, low-income service holder, agricultural farmer and agricultural farmer cum small trader. Response towards the taste, flavour or colour of the fish ball and fish sausage varied with different occupation of consumer. Majority of the fishermen, small traders, students and service holder scored 'good' taste for fish ball. The majority of house wives, agricultural farmers and agricultural farmers cum traders opinioned it 'average' in taste (Table 3).

Table 5: Consumer's response (%) towards colour of fish ball and sausage in relation to occupation

Product	TS	Occupation						
		FM	HW	Td	St	SH	AgF	AgF+Td
Ball	1	-	-	-	-	-	-	-
	2	-	2.0±0 ^e	1.0±0 ^d	3.1±0.9 ^{bc}	2.25±0.5 ^d	1.0±0 ^e	1.0±0 ^e
	3	24.0±1.5 ^b	18.0±0.6 ^b	41.0±1.4 ^a	10.5±1.3 ^b	14.9±1.2 ^c	32.1±0.9 ^b	31.5±1.4 ^b
	4	74.5±0.9 ^a	54.0±0.8 ^a	33.0±1.8 ^b	76.2±1.1 ^a	49.5±1.2 ^a	65.3±1.9 ^a	65.4±1.1 ^a
	5	1.0±0.0 ^e	26.0±0.8 ^b	25.0±0.8 ^c	10.2±0.5 ^b	33.1±1.6 ^b	1.7±0.9 ^e	2.0±0.8 ^e
Sausage	1	-	-	-	-	-	-	-
	2	12.8±1.3 ^c	7.0±1.7 ^b	5.8±4.4 ^b	3.9±6.2 ^c	56.6±8.1 ^a	24.8±9.6 ^b	22.7±0.8 ^b
	3	25.5±1.6 ^b	30.2±8.3 ^a	14.4±8.5 ^b	37.5±8.7 ^a	6.4±6.3 ^c	64.0±9.4 ^a	10.5±5.0 ^c
	4	53.3±1.5 ^a	37.3±11 ^a	43.0±14.7 ^a	37.8±11 ^a	31.4±5.7 ^b	5.6±2.3 ^c	45.5±12 ^a
	5	8.4±3.3 ^c	25.5±8 ^{ab}	36.8±10 ^a	20.8±7.7 ^b	5.6±6.3 ^c	5.6±6.6 ^c	21.3±16 ^b

Mean sensory scores of same parameter for a particular product bearing different superscript(s) differ significantly ($p < 0.05$). '-' means no consumer scored; TS = Test Score: 1 = Very bad; 2 = Bad; 3 = Average; 4 = Good; 5 = Very good FM = Fishermen; HW = House Wife; Td = Traders; st = Students; SH = Service Holder; AgF = Agricultural Farmers; AgF+Td = Agricultural farmer cum trader

Table 6: Consumer's response (%) towards the taste of fish ball and sausage in relation to age group

Product	TS	Age group				
		15-25	26-35	36-45	46+	
Ball	1	-	-	-	-	-
	2	3.98±2.16 ^d	6.80±0.6 ^e	5.25±3.7 ^e	7.25±0.3 ^b	
	3	15.34±1.8 ^c	29.3±22.1 ^b	30.30±1.02 ^b	41.46±1.6 ^b	
	4	53.45±2.71 ^a	56.22±13.2 ^a	55.00±1.2 ^a	49.37±0.6 ^c	
	5	27.23±1.31 ^b	7.69±0.40 ^e	9.24±1.6 ^e	-	
Sausage	1	-	-	-	-	
	2	1.79±10.3 ^d	17.88±1.6 ^b	14.50±1.3 ^b	23.62±0.5 ^b	
	3	10.15±3.6 ^e	34.02±1.1 ^a	39.28±1.1 ^a	24.87±1.3 ^b	
	4	62.50±1.5 ^a	36.2±11.5 ^a	44.97±3.6 ^b	51.56±1.4 ^a	
	5	25.76±2.8 ^b	11.97±1.7 ^b	1.25±0.6 ^e	-	

Mean sensory scores of same age-group for a particular product bearing different superscript(s) differ significantly ($p < 0.05$). '-' means no consumer scored; TS = Test Score: 1 = Very bad; 2 = Bad; 3 = Average; 4 = Good; 5 = Very good

Table 7: Correlation between different age group and response (%) towards the flavour of fish ball and sausage

Product	TS	Age group				
		15-25	26-35	36-45	46+	
Ball	1	-	-	-	-	
	2	1.4±0.4 ^d	16.1±2.2 ^b	10.6±0.4 ^e	29.7±1.7 ^a	
	3	32.1±3.5 ^b	34.3±1.8 ^a	51.2±1.1 ^a	33.7±1.8 ^b	
	4	47.929.8 ^a	44.3±1.2 ^a	30.8±1.7 ^b	36.9±1.5 ^a	
	5	18.6±1.8 ^c	5.3±0.5 ^{bc}	7.6±1.1 ^e	1.5±0.06 ^b	
Sausage	1	-	-	-	-	
	2	11.7±0.1 ^b	20.6±1.5 ^b	21.8±1.3 ^b	29.3±1.6 ^a	
	3	18.2±0.1 ^b	30.5±2.1 ^{ab}	29.2±1.9 ^{ab}	30.7±2.3 ^a	
	4	51.8±2.5 ^a	45.5±1.1 ^a	40.7±1.2 ^a	39.0±0.9 ^a	
	5	17.3±1.1 ^b	3.4±0.1 ^c	8.3±0.80 ^e	1.0±0.02 ^b	

Mean sensory scores of same age-group for a particular product bearing different superscript(s) differ significantly ($p < 0.05$). '-' means no consumer scored; TS = Test Score: 1 = Very bad; 2 = Bad; 3 = Average; 4 = Good; 5 = Very good

Table 8: Correlation between different age group and response (%) towards the colour of fish ball and sausage

Product	TS	Age group				
		15-25	26-35	36-45	46+	
Ball	1	-	-	-	-	
	2	8.58±1.50 ^b	9.75±10.1 ^c	7.12±0.2 ^e	-	
	3	31.63±2.20 ^a	45.12±5.3 ^a	20.21±0.6 ^b	52.15±1.92 ^a	
	4	43.91±1.80 ^a	36.62±7.7 ^b	59.03±4.3 ^a	47.07±1.5 ^a	
	5	15.88±1.10 ^b	8.53±3.70 ^e	13.64±0.6 ^e	1.05±1.50 ^b	
Sausage	1	-	-	-	-	
	2	1.98±1.40 ^e	9.22±1.10 ^{bc}	2.25±0.02 ^e	3.25±0.04 ^e	
	3	27.75±2.10 ^b	16.08±1.9 ^b	4.61±3.10 ^e	40.0±2.80 ^b	
	4	53.07±1.3 ^a	56.47±2.3 ^a	70.85±2.9 ^a	55.00±2.7 ^a	
	5	17.28±0.80 ^{bc}	18.31±2.4 ^b	22.29±1.5 ^b	2.50±0.01 ^e	

Mean sensory scores of same age-group for a particular product bearing different superscript(s) differ significantly ($p < 0.05$). '-' means no consumer scored; TS = Test Score: 1 = Very bad; 2 = Bad; 3 = Average; 4 = Good; 5 = Very good

In case of sausage, majority of fishermen, service holder and agricultural farmer liked it very much. A considerable portion (31%) of agricultural farmers scored the test 'very good' for sausage. Again the housewives opinioned sausage 'average' in taste. This result indicated that women were very careful to accept change. This may be due to the social structure and the nature of job the women perform that they are always home-bound, have limited scope to go outside, see the new things and taste new foods. The picture was more or less similar in case of the response towards flavour of fish ball and sausage (Table 4). But they equally liked the colour of the products like other occupational groups (Table 5).

The consumer's response towards the products in relation to different age-groups were calculated. Teste people were categorized into four age-groups: age between 15 - 25, 26-35, 36-45 and above 45. The results of responses towards tastes, flavour and colour of the products are presented in Table 6, 7 and 8.

A distinct correlation between the age-group and acceptance of new products were observed. Very young people (age 15-25) predominantly scored the tastes of fish ball and sausage as "good" or "very good". With older age, this tendency was reduced. The middle aged or aged people (age 36-45 and 46) increasingly scored the taste of the products "average" and contrarily, number of people scoring "very good" was tremendously decreased in this case. Similar correlation was found between the flavour of the products and age group. But response towards colour did not follow any specific rules (Table 8).

People's top preference towards these two products in relation to age group was also investigated (Table 9). Irrespective to age, majority of the people liked fish ball much compared to fish sausage.

The market of fish sausage and fish ball was thoroughly analysed. Peoples were asked if they buy it in the market if available in reasonable and affordable price. Almost 100% people responded positively. They were asked whether they will produce the products at home and sell in the market if the technology is taught.

Everybody answered, 'yes'. They were further asked to set prices for each product what they can afford and think reasonable. They were asked to set three prices: I. what should be minimum price for a product; ii. what should be an average or middle price and iii. what should be maximum price? Very interesting results have come out. Aged people were very rigid to spent money for the products. The youngsters were justifiable for the prices. Middle-aged people were moderate in spending money. However, the prices they set for the fish ball and fish sausage (Table 10) and the mean price: Tk. 4.3 for a fish ball and Tk. 8.5 for a sausage, were much higher than the production cost.

The cost of production and profit of the products were assessed. An analysis on the basis of price of product taken from the market tests, the price of raw material in the market, tentative cost of productions, cost of transportation and storage and on other presumptions has been made. In fishing season in Chittagong and Cox's Bazar, the price per kg of sea catfish is Tk. 20. In non-fishing season, however, the price of sea catfish increases up to Tk. 35. From a 1 kg catfish, 500 g of washed mince could be recovered. From 500 g washed mince, a total of 1000 g sausage dough could be produced (20% water = 130 g, 20% starch = 130 g, 4% sugar = 26 g, oil = 45 g and other ingredients = 20 g). From 1000 g dough, 17 pieces of fish sausage (60 g each) and 40 pieces of fish ball (25 g each) could be produced. The total production cost of the products from 1000 g dough (raw material: Tk. 20, ingredients: Tk. 10, wage: Tk. 10, transportation and storage: Tk. 25 and marketing: Tk. 10) was Tk. 75/-. On the other hand, as per the average selling price obtained from

Table 9: People's preference (%) of fish ball and sausage in relation to different age group

Age group	Fish ball	Fish sausage
15-25	65.02±4.11 ^{ab}	34.97±4.18 ^b
26-35	76.24±3.24 ^a	24.50±3.57 ^c
36-45	53.00±4.13 ^b	40.92±4.13 ^a
46+	73.00±2.10 ^a	27.09±2.15 ^c

Mean values in a same column bearing different superscript (s) differ significantly (p<0.05)

Table 10: Price of fish ball and sausage set by the people of different age group

Product	Age group	Price level (in Taka)			
		Minimum price set	Middle price set	Mean	Maximum price set
Ball	15-25	4.19±2.5	5.53±1.7	4.3	6.87±1.8
	26-35	3.17±1.9	4.32±1.1		5.47±1.5
	36-45	3.58±1.2	4.02±1.0		5.45±2.4
	46+	2.78±1.3	3.59±0.8		4.42±1.2
Sausage	15-25	8.84±1.24	10.9±1.0	8.5	13.4±2.9
	26-35	7.09±2	9.03±0.9		10.58±2.0
	36-45	6.72±2.4	8.00±1.5		9.24±2.4
	46+	5.93±1.6	6.25±1.2		7.28±1.1

the market tests, products of 1000 g dough can be sold at Tk. 136/- for sausage (Tk. 8/- each) and Tk. 160/- for fish ball (Tk. 4/- each) in the rural market in Bangladesh. Therefore, a net profit of Tk.61 from fish sausage and Tk. 85 from fish ball could be realized. Since, however, the production cost varies depending on the availability of fish due to seasonal or spatial variations, the high margin of profit (80% in sausage) and (110% in fish ball) in long term equilibrium, will compensate every ill-marketing behaviour due to adverse situation. On the other hand, the actual production cost would be lesser if the fish is purchased from the whole sale market and the products are produced commercially.

From the present findings, it is understood that an economically viable value-added fish product industry can be operated in rural and coastal areas. Coastal fishing communities are living in extreme poverty conditions. To generate alternative income in fisher's family, the poor fishermen and wives of fishers can be trained up in production and marketing activities of such seafood products.

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