

Nutritional composition, yield and consumer response to a semi-fermented fish product prepared from underutilized fish species of the Bangladesh coastline

M A Mansur & M N Islam

Department of Fisheries Technology, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh
and

A K M A Bhuiyan & M Enamul Hoq

Bangladesh Fisheries Research Institute, Mymensingh-2201, Bangladesh

Reviewed 20 October 1998; revised 25 November 1999

Nutritional composition, yield and consumers' acceptability of a ground semi-fermented fish product prepared from the underutilized fish species of the Bay of Bengal have been studied. The product was prepared by a traditional semi-fermentation method, identical for the preparation of "Sheedal shutki", and was subsequently dried in oven, ground, packed in polyethylene bags and stored in ambient condition. Quality in terms of nutritional composition was found comparable to other fish products of Bangladesh. Comparative study on the acceptability of the new product, traditional Sheedal shutki from both *Puntius* sp. and miscellaneous sea fish species show that the new product is equally acceptable. The taste and flavour of the product was judged to be identical with those of the traditional Sheedal shutki from *Puntius* sp. and superior to the Sheedal shutki from underutilized sea fish species. Yield study indicated that commercial production can be attempted if the raw fish is available at a cheap price. Overall results of the study show that the product can be easy to handle, transport and store, and can easily be incorporated with the cereal based diet.

Development of ready to use fishery product from the under utilized sea fish species has been attempted by some of the investigators in this part (Indian sub-continent) of the world. Attempts have also been made to produce some novel products from less utilized sea fish species^{1,2}. Such attempts were necessary to find out a means for the direct utilization of those fish species which are usually discarded at sea during trawling operation³. It has been estimated that about 40,000 mt of the white fish are being discarded in the sea by the shrimp trawlers of Bangladesh annually due to their low commercial value⁴. With the objective to develop a food product of low cost and which is easy to transport, store and can be used as protein rich relief food material during natural calamities in Bangladesh Bhuiyan *et al.*² and Mansur *et al.*⁵ produced a ground semi-fermented fish product. This product was reported to have flavour and taste identical with that of the locally known Sheedal shutki or Chapa shutki. Laboratory experiments proved this product to be superior to the Sheedal shutki with respect to biochemical and microbiological evaluation. The product's keeping quality and consumers' acceptability were also found to be promising. But before recommendation of this process development technology for commercial use further study was necessary on a wider scale,

particularly due to uncertainty whether the nutritional quality of the final product will be same or at least in acceptable condition with the variation of raw material utilized. The objectives of the present study were to assess the consumers' acceptability of the new product, to study the yield, nutritional quality and shelf life of the product.

Materials and Methods

Raw fish samples were collected from fish at Chittagong. Fish samples were kept in iced condition in the fish hold of the trawler. Immediately after collection the raw fish were again iced with new crushed ice in wooden box. The box was then transported to the laboratory which required about 12 hour journey. After arrival at the laboratory specimens of each species were preserved in 10% formalin solution for identification and the bulk of the samples were subjected to processing operation for the preparation of the product. Species identification was performed on the basis of morphometric and meristic characters according to Hussain⁷ and Day⁸.

The fish were gutted, beheaded for a few species and washed with fresh water. Gutting was avoided in the case of very small species. All of the samples were then subjected to sundrying on bamboo mats for a period of 10 days.

During this time earthen vats were prepared to use in the semi-fermentation process. It was done by repeated soaking of inner and outer surface of the vat with fish oil until saturation. This treatment is necessary to prevent further absorption of fish oil from the dried fish during subsequent ripening in these vats and also to close the pores of the vat. The dried fish were sprinkled with water and kept overnight. On the next day vats were filled up to the rim with these fish in such a way that no space left for air inside the vat. The vat was closed successively with polyethylene sheet and a heavy layer of clay to create anaerobic condition. The vats so treated were kept underground for a period of 5 months. The product prepared in this way is locally known as "Sheedal shutki". The Sheedal shutki was then dried in electric oven at 80°C until dried enough for easy grinding. Grinding of the dried Sheedal was carried out in Warring blender. The ground product was sieved to reduce particle size and to remove scales, bones of large size etc. The product was immediately packaged in small polyethylene bags each containing 250 g and sealed without leaving space for excess air. The polyethylene bags containing ground product was stored at ambient condition. A small portion of the whole Sheedal shutki (not dried or ground) was kept in the original vats and stored under same condition for comparative study on consumers acceptance.

Proximate composition (crude protein, lipid, ash and moisture) of the raw fish and the final product was carried out according to the methods of AOAC⁹. Bacteriological study for the detection of *Salmonella* was carried out according to the methods of Collins & Patricia¹⁰. For amino acid determination, a sample specimen of about 0.5 mg was hydrolyzed in 6N HCl at 110°C for 24 h in evacuated hydrolysis ampoules. After hydrolysis, samples were partially neutralized with 5.25 M NaOH and then diluted with 0.01 N HCl. Amino acid composition of the proteins of the final product was carried out on high performance liquid chromatography (HPLC) apparatus (Hitachi model 638-39).

Two tests (acceptance test and hedonic test) were performed to study consumers' response to the ground powdered semi-fermented product. The new product (ground/ powdered Sheedal shutki) designated A, whole Sheedal shutki (not ground) from the underutilized sea fish as B and Sheedal shutki from freshwater puti (*Puntius* sp.) as C were included in the test. The third one was collected from local fish market and this is the common Sheedal shutki liked

by the people in many areas of Bangladesh. Three product varieties were supplied to 35 panelists irrespective of profession, age, sex and religion in and around the Bangladesh Agricultural University (BAU) campus. The Panelists were included in the study /test having been confirmed that they eat Sheedal shutki every now and then, they are able to identify the taste of Sheedal shutki and any other similar semi-fermented fish product. Reasonable quantity of the products and a scoring sheet (9 scale for hedonic test) was supplied to the panelists who were asked to cite their opinion independently. All other conditions of the experiment were explained to them. Analyses of the data on acceptance test and hedonic test were performed according to the statistical analysis proposed by Watts *et al.*¹¹

Results and Discussion

Species identified

Fifteen fish species were identified from the collected samples (Table 1). Among these species three were small sized commercial fish. These three species were also classified as underutilized by the trawler crews because of their uncommon size. Proximate composition of these fish been reported by Mansur *et al.*¹² which indicated nearly the same composition in all of the species. The results also indicated the composition of these species are comparable with those of commercial fish species with few exceptions.

Nutritional composition and microbiology

Composition and *Salmonella* count of the final product during 90-day storage time at ambient condition have been shown in Table 2. Proximate composition provides with a clear idea about the nutritive value of a food. The results of the present study indicate that the ground semi-fermented fish product contains a high nutritional value if protein content is taken as the most important criterion. The amino acid composition and content in the protein of the product is also encouraging compared to exportable dried fishery products of the country⁵ (Table 3). Fair quantity of lysine, good quantity of glutamic acid and all of the essential amino acids are present in appreciable quantities. Sum of the amino acids was about 61.0 g/100 g sample which is almost equal to the amount of crude protein in the product, which means that the product contained very little amount of NPN. This can partially contribute to overcome malnutrition problem in Bangladesh where

Table 1—Species composition of the raw fish

Local name	Scientific name	Local name	Scientific name
Chouk	<i>Ilisha filigera</i>	Fatra	<i>Raconda russelliana</i>
Rupa poa	<i>Otolithes argenteus</i>	Rita	<i>Rita rita</i>
Lal poa	<i>Johnius argenteus</i>	Tailla	<i>Eleutheronema</i>
Taka chanda	<i>Leiognathus</i> sp.		<i>tetradactylum</i>
Olua	<i>Coilia dussumieri</i>	Chhoto lambu	<i>Otolithoides microdon</i>
Chhuri	<i>Trichiurus haumela</i>	Shada machh	<i>Lactarius lactarius</i>
Phasa	<i>Setipinna taty</i>	Hali chanda	<i>Parastromateus niger</i>
Barguni	<i>Therapon theraps</i>	Kukur	<i>Cynoglossus bengalensis</i>

Table 2—Nutritional composition and *Salmonella* count of the final product during storage at ambient condition

Parameters studied	Storage period			
	0 day	30 day	60 day	90 day
Moisture (%)	10	9	10	13
Ash (%)	17	18	18	14
Crude lipid (%)	7	8	8	7
Crude protein (%)	62	61	61	62
NPN (%)	1	1	1	1
<i>Salmonella</i> /50g	nil	nil	nil	nil

nearly 80% of the total population suffer from protein deficiency. It can serve as a protein rich food item during the frequent natural calamities in this country. The popular misconception in the urban section of our people that Sheedal shutki or similar other fermented fish cause "Salmonellosis" was found invalid since no *Salmonella* could be detected in the product even after a long storage period (Table 2). Lower percentage of moisture (10%) usually does not permit the growth of pathogenic organism. The product is safe from Salmonellosis point of view also.

Yield study

Yield is an important factor to be considered before commercial production. For the assessment of yield it should be mentioned that the great major portion of moisture is evaporated during the processing operation, first by sundrying and then in electric oven. Drying in oven continued until the Sheedal shutki was ready for easy grinding. That means the mass reduction was necessary to have the final form of the product. Apparently the yield seems to be slightly lower than expected level (Table 4) but on the basis of nutritional component per unit mass the yield is undoubtedly promising. Yield of the final product can easily be raised by increasing the mesh in the sieve. The waste i.e. the scales, bones and other residual materials can be used as fertilizer or as fish feed. Since the raw fish are obtainable at very low or no price such yield is expected to be profitable for commercial production.

Table 3—Content of amino acid residues of the final product

Amino acid	Content (g/100g dry sample)
Threonine	2.50
Valine	3.00
Methionine	1.90
Isoleucine	2.89
Leucine	4.85
Phenylalanine	2.61
Histidine	1.14
Lysine	4.43
Tryptophan	—
Arginine	3.41
Taurine	0.79
Aspartic acid	5.88
Serine	2.03
Glutamic acid	10.72
Proline	3.13
Glycine	4.49
Alanine	4.68
Tyrosine	2.44
Total	60.89

Table 4—Yield of the final product

Wt. of raw fish (guttled) (kg)	Wt. of sheedal shutki (kg)	Wt. of final product (kg)	Yield (%)
50	26.3	8.96	17.92

Consumers' response test

According to statistical analysis¹¹, the tabulated critical value at $p=0.05$, for 35 panelists and three samples is 20. The difference between pairs of rank totals (1 to 14) is less than the tabulated critical values. Thus, the taste of the cooked Sheedal shutki varieties is not significantly different. The panelists found the variety-C (puti sheedal) most acceptable over A (powdered sheedal from marine underutilized fish) and B (marine sheedal) on the basis of taste. However, the difference in taste was not significant.

Sensory attributes, mainly taste and flavour, are most important for a food to be accepted and liked by the consumers. Results on the consumers' response study reveals that the new product of the present study is quite acceptable to them and there is no significant

Table 5—ANOVA table for the Hedonic test

Sources of variation	d.f	SS	MS	F test	
				Calculated	Tabulated
Total (T)	104	232	—	—	—
Treatment (Tr)	2	0.2285	0.1142	0.0694	3.0718
Panelists (P)	34	120	3.5294	2.1473	1.4052
Error (E)	68	111.7715	1.6436	—	—

difference in taste and flavour between the new product and the traditional Sheedal shutki.

Since the calculated treatment F ratio of 0.0694 did not exceed the tabulated F ratio of 3.0718, it may be concluded that there was no significant ($P < 0.05$) difference among the mean hedonic scores¹¹ for the three Sheedal shutki varieties (Table 5). That means there was no significant difference in taste among the three Sheedal shutki varieties.

Tabulated category scores for the acceptance and hedonic tests show that there was some difference among three different product varieties but that difference was not statistically significant. The difference found in the study may be because of the preference of the panelists to puti Sheedal shutki. Because the puti Sheedal shutki, a semi-fermented product, available in Bangladesh prepared from only *Puntius* sp. The new product was assessed by the panelists taking puti sheedal as reference.

The whole study i.e. nutritional composition, yield and consumer acceptability show that the product (ground, semi-fermented fish product from underutilized sea fish) is a protein rich, safe, economically feasible and acceptable food to the consumers. Since the raw fish are available at a very low price it is expected that the final product will be a cheaper one. In addition it is easy to store, handle and transport at ambient condition. The possibility of commercial production of such food product from underutilized sea fish species is promising and encouraging. If the raw fish are available on large scale at the current price (i.e. very low) the commercial production of such food can be attempted on experimental basis.

Acknowledgement

This study was carried out by the financial support of Science and Technology Division, Ministry of Education. The authors are grateful to Dr. Takao Itakura, Faculty of Fisheries, Kagoshima University, Japan for his generous help in the determination of amino acid content.

References

- 1 Chhaya N D, Dabhi R G, Trivedi Y A, Nimavat D M. & Khatri C N, in *Harvest and post-harvest technology of fish*, edited by: (Society of Fisheries Technologists in India, Cochin) 1985, 646.
- 2 Bhuiyan A K M A, Gheyasuddin S & Mansur M A, *Bangladesh J. Fish*, 12 (1989) 21.
- 3 Disney J, *Prospect for fish silage in Malaysia, Sri-Lanka, Bangladesh and the Philippines*, IPFC Occ Pap 1979/1 (FAO, Bangkok) 1979, pp. 20.
- 4 Khan M G, in *Sustainable development of marine fisheries resources in Bangladesh*, edited by M A Mazid, V R P Sinha & M Kamal, (Fisheries Research Institute, Mymensingh, Bangladesh) 1995, 30.
- 5 Khan M N A, Hossain M A, Kamal, M & Islam, M N, *Bangladesh J. Fish Res*, 1 (1997) 83.
- 6 Mansur M A, Gheyasuddin S & Bhuiyan A K M A, *Bangladesh J. Fish*, 12 (1989) 27.
- 7 Hussain M, *The commercial fishes of the Bay of Bengal*, UNDP Project PAK 22 (Fisheries Development Corporation of Pakistan, Dacca) 1971, pp. 60.
- 8 Day F, *The fishes of India*, (Williams Dawson & Sons Ltd, London) 1958.
- 9 AOAC, *Official methods of analysis*, (Association of Official Agricultural Chemists, Washington DC) 1975, pp. 1094.
- 10 Collins C H & Patricia ML, in *Microbiological methods*, (Butterworth and Co Publishers Ltd., London) 1976, 349.
- 11 Watts B M, Ylimaki G L, Jeffery L E & Elias L G, *Basic sensory methods for food evaluation*, (International Development Research Centre, Ottawa) 1989, pp. 63.
- 12 Mansur M A, Islam M N, Bhuiyan A K M A & Hoq M E, *Prog. Agril*, 1 (1990) 93.