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Quality attributes of salted Hilsa (*Hilsa ilisha*)

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ABSTRACT

Present study was conducted to improve the food quality of traditional salted Hilsa (*Hilsa ilisha*) products of Bangladesh, and updating the knowledge of the older processes and highlighting important new areas of work. It was found that traditional salted Hilsa processed with poor quality crude solar salt under poor hygienic condition. It was also found that they do not maintain fish: salt ratio in most cases. Trading of salted Hilsa products is considered as a profitable business by all concerned. Salted Hilsa collected from retail market was organoleptically graded as good (Type-1), moderate (Type-2) and poor (Type-3) in overall quality respectively. Moisture, crude protein, lipid, ash, and salt content of collected market salted Hilsa samples were 40.03- 43.09 %, 23.58- 21.91 %, 21.21 - 17.39 %, 16.15- 17.55 % and 17.25-19.22 % respectively. Per-oxide (P.O) value, TVBN value and bacterial load of collected market salted Hilsa samples were 97.64-107.39 meq/kg, 30.29–35.94 mg/100g and 1.83×10^{6}– 2.61×10^{6} CFU/g respectively. Organoleptically all the salted Hilsa products have got deteriorated in overall quality in storage condition. Presence of unwanted chemicals in fish sample have been detected which included Arsenic- 0.16µg/g, Cadmium- 0.04 µg/g, and Lead-0.13 µg/g.

INTRODUCTION

Fish salting is practiced world-wide, both to preserve and to extent the variety of products available. An alternative to lowering the water activity of fish flesh by merely extracting the water, as simple dehydration, is to increase the concentration of solutes in lowering water activity in the flesh. Common salt is more effective than safe, common and cheap food solutes, like sugar, even when present in relatively small concentrations. However, long-term cured product stability is only approached when the concentration of salt in the flesh reaches saturation concentrations (Hall, 1994).

Millions of people are suffering from serious nutritional problem owing to acute shortage of animal protein in their diet. Over 5% of the pregnant women, lactating mothers and children suffer from nutritional disease in Bangladesh (Ahmed et al., 2008).

Fish alone contributes about 63% of animal protein to the diet of the people of this country (DOF, 2009). Approximately 12.5 million people are directly engaged in fishing, 11 million in part time fishing, another 3 million in aquaculture activities. Fisheries sector contributes 5% of the Gross Domestic Product (GDP) and 4.04% of the foreign exchange earnings (DOF, 2009). Bangladesh earned 3720 corer taka by exporting fish and fishery products in 2006-2007 (DOF, 2009).

Fishery industries of Bangladesh are processing high value items such as frozen shrimp, fish and dried products. The fish is caught more or less round the year, but catch of Hilsa is very high during the moonson (June to October). The main landing centres are located at Chandpur, Cox's Bazar, Chittagong, Barisal and Khulna. Landing centres are widely scattered in the southern part of the country. As a result, the problem of making freshly caught fish available to the consumer is formidable and render it more difficult because of the inherent problem of transportation, storage and market facilities. The market- value of the fish becomes high with the increase of consumer's demand. Generally in our

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country, fishes are preserved by the methods of freezing, drying, salting etc. Drying is not suitable for fatty fish like Hilsa due to oxidation and rancidity. Fatty fishes are comparatively less suitable for long term freezing, because most pelagic fatty fish species like Hilsa contain large proportion of dark muscle that lead to muscle protein deterioration more quickly than lean fishes in freezing (Hultin, 1988).

Considering the suitability and acceptability, salting is the most suitable and the oldest method of fish preservation in Bangladesh. It is a simple and cheaper method, salt hinders the growth and multiplication of spoilage microorganisms, keeps the fish in edible form for a longer period. Salted fish has a universal appeal to the consumer for its excellent flavour and colour. Transportation and storage of salted fish is also very easy.

Proper handling of the raw material, improved hygiene and sanitation in the process and improved packaging and storage can significantly improve the keeping quality and shelf-life of the traditional products (Nair, 2002).

Considering all the circumstances, this study was undertaken with the following objectives to evaluate the nutritional and food qualities of salted Hilsa products, to improve the existing methods of traditional salted Hilsa products, to detect presence of unwanted substances (unwanted chemicals like- Pb, Cd, and As) in salted Hilsa, to assess proximate composition, Peroxide value and microbiological load.

MATERIALS AND METHODS

Collection of salted Hilsa products

Traditional salted Hilsa fish were collected from the local market of survey area of Mymensingh region and brought to the Processing Laboratory of Fisheries Technology Department, Bangladesh Agricultural University, Mymensingh for preparation of samples.

Organoleptic characteristics of market (salted Hilsa*)* sample

The organoleptic characteristics of traditional salted Hilsa fish collected from retail market have been presented in Table 1. Organoleptic parameters such as color, texture, flavor and overall quality of traditional salted Hilsa were examined and recorded as Type-1 is good, Type-2 is moderate and Type-3 is poor.

Table 1
Organoleptic characteristics of traditional salted Hilsa fish collected from retail market of Mymensingh region.

Types of the products	Organoleptic characteristics	Overall quality
Type-1	Slightly reddish appearance, semi-elastic texture with characteristics of dominant salty flavor.	Good
Type-2	Yellowish appearance, comparatively tough texture with characteristics of dominant salty flavor and sands, filth present.	Moderate
Type-3	Slightly brown appearance, slightly tough texture with characteristics of dominant salty flavor and bad smell, harder muscles, molds present.	Poor

Biochemical analysis

The analytical methods for proximate analysis were: Moisture, fat and ash contents of the fish were determined by AOAC method (1980). The crude protein of the fish was determined by Micro-Kjeldal method (Pearson 1999). TVB-N was determined by Conway modified micro-diffusion technique (Conway, 1993). pH was used to measure quality deterioration of salted Hilsa fish using pH was used to measure quality deterioration of salted Hilsa fish using pH paper strips and necessary adjustments were made where necessary.

Per-oxide value was determined according to the procedure described by Egan et al., (1981) and adopted from Wood and Aurand (1977).

NaCl was determined by using potassium dichromate (5% solution in water) as indicator against 0.1N $AgNO_3$ solution.

For bacterial count Plate count agar (Hi-Media) was used for total aerobic plate count Aerobic plate count (APC) expressed as colony forming units per gram (CFU/g) of fish sample on different days of storage were determined by consecutive decimal dilution techniques using spread plates as described by Seely and Vandemark (1972).

For determining the unwanted chemicals present in fish only Type-2 samples were used as having limitaionof the existing facilities. The fish was collected from the Mechhua Bazar, Mymensingh. The samples were subjected to analysis by Atomic Absorption Spectrophotometer (HG-AAS, PG-990, PG Instruments Ltd. UK) at "Professor Mohammad Hossain Central Laboratory", BAU, Mymensingh, according to the method of Clesceri et al., (1989). The wave length of As, and Cd were 193.7 nm and 217 nm respectively.

RESULTS AND DISCUSSION

Biochemical analysis

Moisture content of Type-1, Type-2 and Tyep-3 samples were 40.03%, 42.37% and 43.09% respectively; crude protein content were 23.58%, 22.55% and 21.91% respectively. On the other hand, lipid and ash content of the samples were 21.21 %, 19.65 %, 17.39 % and 16.15 %, 16.43% and 17.55% respectively.

Table 2
Proximate composition and salt content of traditional salted Hilsa fish collected from retail market of Mymensingh region.

Type of the Product	Moisture (%)	Crude Protein (%)	Lipid (%)	Ash (%)	Salt content (%)
Type-1	40.03±1.04	23.58±0.63 (39.32)	21.21±0.74 (35.37)	16.15±1.22 (26.93)	17.25±0.33
Type-2	42.37±1.03	22.55±1.06 (39.13)	19.65±0.64 (34.1)	16.43±0.48 (28.51)	18.62±0.83
Type-3	43.09±1.70	21.91±0.62 (38.51)	17.39±0.83 (30.56)	17.55±1.13 (30.82)	19.22±0.54

*Figure in the parentheses indicates values on dry matter basis.
*Mean value ± standard deviation

Table 3
Per-oxide value (P.O), TVBN value and bacterial load (CFU/g) of traditional salted Hilsa fish collected from retail market as Type-1, Type-2 and Tyep-3 of Mymensingh region.

Type of the Product	Per-oxide value (meq/kg)	TVBN value (mg/100g)	Bacterial load CFU/g
Type-1	97.64	30.29	1.83×10^6
Type-2	101.55	33.52	2.34×10^6
Tyep-3	107.39	35.94	2.61×10^6

Per-oxide value and TVBN value of Type-1, Type-2 and Type-3 samples were 97.64 meq/kg, 101.55 meq/kg, 107.39 meq/kg and 30.29 mg/100g, 33.52 mg/100g and 35.94 mg/100g respectively (Table 3). The per-oxide value of all the samples was very high. The possible reason may be direct exposure to air, sunlight, higher lipid content of Hilsa, as well as higher storage temperature. TVBN value gradually increased from 30.29 mg/100g to 35.94 mg/100g from Type-

1 to Type-3. The bacterial load of Type-1, Type-2 and Type-3 sample were 1.83×10^6 CFU/g, 2.34×10^6 CFU/g and 2.61×10^6 CFU/g respectively. Bacterial load also gradually increased from 1.83×10^6 CFU/g to 2.61×10^6 CFU/g on the way from Type-1 to Type-3.

Table 4
Detection of unwanted chemicals concentrations in salted Hilsa (*Hilsa ilisha*) fish (Type-2).

Unwanted chemicals	Concentration level (µg/g)
Arsenic	0.16±0.03
Cadmium	0.04±0.01
Lead	0.13±0.02

Mean value ± standard deviation of 3 individual measurements

According to the result moisture contents of traditional salted Hilsa gradually increased from 40.03% to 43.09% on the way from Type-1 to Type-3. On the other hand, crude protein and lipid contents gradually decreased from 23.58% to 21.91% and 21.21% to 17.39% respectively, but ash content remains unchanged. The variation of moisture, crude protein and lipid content of traditional salted Hilsa among the Type-1, Type-2 and Tyep-3 are believed to be due to longer storage time, rough handling, rancidity of lipids, bacterial spoilage etc. Salt content of Type-1, Type-2 and Tyep-3 samples were 17.25%, 18.62% and 19.22% respectively.

Kamruzzaman (1998) and Rahman(1976) studied the proximate composition and salt contents of salted Hilsa during storage time and reported more or less similar results. Rahman (1996) reported the similar per-oxide value of dry salted Hilsa during a 3 weeks study. The TVBN values of all the samples were found to be lower than the recommended acceptable value (100–200 mg/100g) for variety of salted and dried products (Connell, 1980).

Chakraborty et al., (1997) reported the bacterial load of 2.4×10^5 CFU/g, 2.6×10^6 CFU/g, and 2.2×10^5 CFU/g respectively for dry salted, wet salted and sun dry salted Hilsa fish during a 16 days observation.

From the qualitative point of view, traditional salted Hilsa collected from local market as Type-1 was better than those from Type-2 and Tyep-3.

Frazier (1958) recorded that solar salt contained a wide number of halophiles such as *Holobacterium*, *Salinarium*, *Bacillus*, *Micrococcus*, *Sarcina* and *Serrata*. It is assume that fishes became contaminated with the bacteria from solar salt during salting process in addition to their normal flora. Brain et al., (1958) identified that halophilic bacteria are frequently derived from contaminated solar salt. Though salt prevents the growth and multiplication of spoilage bacteria, other microbs, such as high tolerant and *halophiles* are not affected by the presence of salt

Arsenic concentration was 0.16µg/g, which was within the acceptable level for human consumption. Cadmium concentration was 0.04µg/g, which was within the acceptable level for human consumption. Lead concentration was 0.13µg/g, which was within the acceptable level for human consumption (Table 4).

According to the result Arsenic contents of traditional salted Hilsa is 0.16µg/g (average). On the other hand, Cadmium 0.04 µg/g and Lead 0.13 µg/g. The variation of Arsenic, Cadmium, and Lead content of traditional salted Hilsa among the Type-2 are believed to be due to water pollution with different ways like fertilizer industry's wastes, Pharmaceuticals industry's wastes, Battery industry's wastes etc.

CONCLUSION

There is no well established marketing chain for salted Hilsa products in Bangladesh and the marketing durations varies from place to place and season to season. As a business salted Hilsa products processing and trading is a profitable one but the traders are not conscious about the product quality. Low quality solar salt makes the salted product unattractive physically. Traditional salted Hilsa products available in the wholesale and retail markets are mostly contaminated with sand, dirt, filth, dust and presence of insects around the products are very common. Packaging and storage are not appropriate and hygienic. The people involved with salted Hilsa business are not much

aware about the quality management systems of salted Hilsa products. Poor quality salt helps to grow some halophilic microorganisms (*Pseudomonas spp., Stephlyococcus aureus)*. As marine species Hilsa contains low concentration on unwanted chemicals which might have human health risk.

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