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# Effect of 10% Concentrations of Salt, Garlic and Coriander on the Quality of Smoked Hilsa Fish (*Tenualosa ilisha*)

[1]Maruf Hossain, [1]Ripon Kumar Adhikary, [2]Khandaker Rayhan Mahbub, [3]Mohajira Begum and [1]Md. Rakeb Ul Islam

[1]Department of Fisheries and Marine Science, Noakhali Science and Technology University, Sonapur, Noakhali-3814, Bangladesh

[2]Industrial Microbiology Section, [3]Fish Technology Research Section, Institute of Food Science and Technology, Bangladesh Council of Scientific and Industrial Research, Dhaka, Bangladesh

*Corresponding Author: Mohajira Begum, Fish Technology Research Section, Institute of Food Science and Technology, Bangladesh Council of Scientific and Industrial Research, Dhaka, Bangladesh*

## ABSTRACT

The present study was conducted to evaluate the quality of smoked Hilsa fish (*Tenualosa ilisha*). The fishes were grouped into three parts. One part contains 10% salt, 10% garlic and 10% coriander and treated as Treatment 1 (T-1). Another named was Treatment 2 (T-2) and contained 10% salt and 10% garlic. The other parts contained 10% salt only and treated as Treatment 3 (T-3) to evaluate the quality of the smoked Hilsa with these ingredients for preparing a ready food item. All three treatments were found microbiologically acceptable since indicator organisms and *Salmonella* were not detected. However, from the results of overall acceptability, taste, colour and texture of the products, Treatment 2 had the best acceptance and significantly different when compared to the other treatments and selected the item as a quick but ready food item in laboratory condition. The moisture content, protein content, fat content, ash content, total volatile nitrogen and salt content of treatment 2 were found 39.65±0.19, 25.65±0.17, 24.85±0.17, 3.50±0.30, 2.55±0.22 and 16.20±0.14, respectively. All three treatments were found microbiologically acceptable since indicator organisms and *Salmonella* were not detected. However, from the results of overall acceptability, taste, colour and texture of the products, Treatment 2 had the best acceptance and significantly different when compared to the other treatment and selected the item as a quick but ready food item in laboratory condition.

**Key words:** Smoking, proximate composition, total volatile nitrogen, microbial assessment, Hilsa fish

## INTRODUCTION

Fish is the primary source of animal protein in the diet of the most people in our country. Fish and dried fish is a very popular food item. Fish contribute about 9% of the total protein composition and 63% of the per capital animal protein intake in the daily diet of the people. According to the Fisheries Statistical Yearbook, 2006-2007 per capita animal fish take was 16.62 kg. Per capita annual fish needed was 25.50 metric tons. Annual total fish demand 2.3 million metric ton and contribution to animal protein supply is 63% (Department of Fisheries, 2007).

Fish protein is said to be healthier and cholesterol free. Fish proteins that contains all of the EAA in right proportion and is called complete protein needed for the proper growth and development of the animal body. Fish tissue is being characterized in being rich in protein substance but low in carbohydrate resulting in high post mortem pH (<6). Further the pelagic fatty fishes have a high content in lipid consisting mainly of triglycerides with long chain fatty acid which are highly unsaturated. Also the phospholipids are highly unsaturated and these circumstances have important consequence for spoilage process under aerobic storage condition. Fish have rich source of essential nutrients required for supplementing both infant and adult diets (Abdullahi *et al*., 2001).

Fish lives in water. There are millions of very small micro organisms, called bacteria, in the water that can come in direct contact with fish. Water pass through the gills and mouths during respiration. Marine fish drinks water, so these bacteria may enter the stomach. Thus the whole body of fish (skin, mouth, gills, eyes, stomach) is exposed to bacteria. Most of these bacteria are harmless: some of these are use to fish, some breakdown vegetation to the soil to release nutrients to the water, but some cause disease in fish and some also spoil fish (Clucas and Ward, 1996). The spoilage bacteria, however, cannot spoil the muscle when the fish alive. After death, spoilage bacteria enter the muscle from the skin and gills, disintegrate the muscle cells and take necessary energy to grow. As soon as the fish dies the supply of energy ceases. The fish muscles gradually harden and the entire body becomes stiff with a few hours of death. This hardening remains for a couple of hours depending on the species, temperature and other conditions of death (Nowsad, 2007).

Smoking is a method of preserving fish which involves some processes of (1) Cooking, (2) Drying and (3) Preservative value of the smoke (Clucas and Ward, 1996).

Smoking is a method of preservation that combines six important effects in fish and shrimp muscle. Fire producing smoke can generate heat and dry the fish and thus reduce the water activity so that the micro organisms cannot survive. Hot smoking cooks the flesh and thus destroys enzymes and kills the bacteria. Wood smoke contains compound like phenol and kill bacteria. Wood smoke contain compound that acts as anti oxidant. Smoking imparts on the product highly acceptable bright brown and reddish color. Wood smoking imparts effects of highly relished characteristics smoke flavor (Horner, 1992).

Ilish is the national fish of Bangladesh. As it is anadromous in nature (an uncommon phenomenon in tropical waters), the Ilish lives in the sea for most of its life, but migrates up to 1,200 km inland through rivers in the Indian sub-continent for spawning. Distances of 50-100 km are usually normal in the Bangladesh Rivers.

In Bangladesh a lot of works were carried on drying (Ahmed *et al*., 1979; Morshed, 2005), salting and freezing (Rabbane, 2006; Sarmin, 2008) but few scientific works on smoke curing. On the other hand smoke curing method is the method which is not affected by climatic condition as well as the smoke cured product has a special taste and color. It also has worldwide acceptability as processed fish.

The purpose of the present research activities was to investigate the effectiveness of smoking with salt, garlic and coriander treatment to make the fish as a quick but a ready food item that will contain the essential amount of nutrients but in a good quality that will ensure it is not deteriorated in the quality.

## MATERIALS AND METHODS

**Collection of fish and smoking procedure:** The experimental fish were collected from Hatirpul Bazar, Dhaka during very early in the morning. The study was carried out from month of 4 September (2011) to 4 October (2011). The fish samples were transported to the laboratory in sterile polythene bags to avoid any type of microbial contamination. After cleaning and cutting, the fishes were dipped in the solution for about two hours and make ready for smoking. Seven hundred and fifty grams fishes were taken for three treatment and they were soaked in 300 mL of distilled water with the associated ingredients. Temperature and RH inside and outside of the drying box have been recorded carefully by means of thermometer and Hare Hygrometer, respectively. Smoke curing is the final hurdle before tasting that anxiously awaited fish treat. The fishes are to be arranged on rods or rack. Fish may be hanged on S shape. Hooks, strung through gills by rods, split and nailed to rods or simply laid on rock. Regular nails 8 or 10 gauge steel wires, S shaped iron hooks or round wooden sticks are used during curing fish. Build the fire on level ground with non resinous (hickory, oak, maple, apple etc.) wood chip or saw dust to produce fire, constant volume of smoke. Soft (Resinous) wood gives an acrid flavor and odor to fish. Center smoke house over smoldering fire and close flaps. Danger of fire was minimized if ventilation is controlled to promote smoke rather than flames. Alternative method is fire may be built in covered pit or trench outside the chamber. Smoke is conducted into the bottom of smoking chamber via tile on stove pipe.

**Preparation of the samples for test:** The sample was cut into very small pieces for sample to test various examinations. Determination of moisture content of the raw as well as smoke cured fish was conducted by AOAC method (AOAC, 1975). The crude protein of the fish was determined by micro-Kjeldahl method (Pearson, 1999). The estimation of fat content of experimental raw fish, smoke cured fish samples had been accomplished by Bligh and Dryer method. The fresh raw, smoke fish sample (2/3 g) were minced, weighed and ignited in the crucible. Then it was transferred in the muffle furnace held at dark red at a rate of 550-600°C for 6-8 h until the residue was white. Finally the percentage of ash content was calculated. TVN value was determined by the modified Micro Diffusion technique (Conway and Byrne, 1933). The volatile bases produced during post mortem changes in fish and their increase in concentrations indicates fish spoilage. This value was used as a parameter to estimate the microbiological and enzymatic deterioration of fish. For microbiological quality assessment the standard plate count was obtained by pour plate method (ICMSF, 1988).

## RESULTS AND DISCUSSION

The comparative studies between the qualities of the three treatments were performed by several parameters, such as biochemical composition, TVN, amount of iron, calcium and phosphorus.

From the Table 1 it is observed that T-1 has the least moisture, protein, fat amount but the highest amount of ash in percentage. T-2 contains more value in moisture, protein, fat but less than T-3. T-3 has the highest value of moisture and fat but less value of protein than T-2. T-3 has the least amount of ash.

The moisture content is medium in T-2 than T-1 and T-3 indicates that it is resistant to enzymatic and microbial activities and qualities may have lengthened the shelf life. According to BSTI (1982), the increased moisture content of dried fishes above 15% favors the growth of mould and insect infestations which in turn accelerate the spoilage of fish product. According to Waterman (1976), bacterial action stops at 25% water content and mould action ceased at 15% water content.

Table 1: Biochemical composition of treated smoked Hilsa fish

| Treatment | Moisture (%) | Fat (%) | Protein (%) | Ash (%) | Calcium (g) | Salt (%) | TVN |
|---|---|---|---|---|---|---|---|
| T-1 | 39.40 | 24.51 | 24.26 | 3.54 | 1.29 | 22.53 | 3.47 |
| T-2 | 39.65 | 24.85 | 25.65 | 3.50 | 2.78 | 23.67 | 2.58 |
| T-3 | 40.60 | 26.14 | 24.78 | 3.42 | 3.42 | 16.20 | 3.12 |

TVN: Total volatile nitrogen

Table 2: Microbiological status of treated Hilsa fish

| | Treatments | | |
|---|---|---|---|
| Parameters | T-1 | T-2 | T-3 |
| Total viable count (CFU $g^{-1}$) | $2.0\times10^4$ | $2.1\times10^3$ | $2.2\times10^3$ |
| Total coliform ( MPN $g^{-1}$) | <3 | <3 | <3 |
| *E. coli* (MPN $g^{-1}$) | <3 | <3 | <3 |
| *Salmonella*/25 g | Absent | Absent | Absent |

The moisture content is the highest in treatment 3 but lowest in treatment 1. It seems that as there was highest value in the moisture content it is more likely to be attacked by the microbes. In case of protein percentage also T-3 is the highest but T-1 is the lowest. But in case of fat T-2 is the highest but T-1 is lowest. In case of mineral T-2 contains more in value than T-3.

The TVN value which helps to measure the level of fish spoilage is used widely to explore the shelf life of fishes. Rahamatullah (1980) observed a high TVN value varied from 219-512 mg/1000 g in dried pomfret and reported it unacceptable. At last as the food will be used by a ready food item the microbial content was also determined. The result of microbiological examination is given in Table 2.

Total bacterial count was found to range from $2.1\times10^3$ to $2.0\times10^4$ in the treatments and the treatment 2 showed the lowest count. The total bacterial counts are similar with the findings of Shewan (1977) and Gillespie and Macrae (1975). Indicator organisms coliform and *E. coli* were absent in all treatments and the pathogenic bacteria *Salmonella* was also absent in experimental treatments. These results are acceptable according to ICMSF (1988).

## CONCLUSION

The present research revealed that the application of salt and garlic gave the best result comparing with the other treatment as it retained the more beneficial nutrient property, lower moisture and TVN score, higher Fat and Ca, protein and salt score. The salt used to remove water from the fish body and thus to help the fish through smoking where as the other two Treatment are used not only to remove water from the fish body but also added some nutrients that prevent the growth of moulds and bacteria due to the formation of an unfavorable growth medium but with a good taste. So Treatment 2 may be recommended for table use as a good quality ready food item after some more field trials.

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