Microbial Quality of Fresh and Frozen Fish from Markets of Lahore

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ABSTRACT: The present study aims at the microbiological analysis of market oriented fresh and frozen fish. Displayed portions of raw fish and frozen carried bacteria that can cause foodborne diseases clearly indicates the risk posed by poor sanitation and unhygienic handling, storage and transportation conditions of fish sold in the markets. Research was designed to compare the presence of indigenous and nonindigenous foodborne bacterial pathogens in displayed, prepacked and packed portions of fish in different markets of Lahore, Pakistan. A total 40 samples of fish were purchased from Super Store (Hyper star), Local Market (local carry shop Mughalpura), Retail shop (Data Darbar), and Fresh water (River Ravi) in Lahore city and analyzed for their microbial quality. All the samples were positive for Total plate count, coliform count, Staphylococcal count, Vibrio count. Among 10 fresh water fish samples mean total Plate Count was 3.8 x 10³ CFU/g (log 3.58 ± 0.03526 CFU/g). Among 10 super store fish samples mean total plate count was 4.9 x 10⁴ CFU/g (log 4.05 ± 0.22815 CFU/g). Among 10 retail store fish samples mean total plate count was 5.02 x 10⁴ CFU/g (4.19 ± 0.0343 CFU/g) and among 10 local market fish samples mean total plate count was 5.14 x 10⁴ CFU/g (4.212 ± 0.03793 CFU/g). In total, the plate counts range from minimum count log 3.16 to maximum count of 5.30 CFU/g. This study revealed that fish sold in Pakistan could be a source of foodborne bacterial pathogens. Improvements in handling and processing are needed to minimize the prevalence of pathogenic bacteria.

Key Words: Fish, microbiology, pathogenic bacteria, aquatic microbiology

INTRODUCTION

Pakistan has a domestic and an international market for fish, shrimps and fish products. At the domestic level the catch from marine fisheries or from local sources (river, canal) has been supplied to the local fish markets. Frozen or processed fish is marketed in few large departmental stores in some cities. Per capita consumption is only 1.6 kg/annum. On the international level Pakistan has a market for fish and fish products. About 30% of the total fish catch has been exported to 30 countries of the world. Pakistan earns more than 6% of its foreign exchange by exporting fish and fish products. Pakistan’s seafood exports have actually decreased during the past decade, with 1992 showing highest figures, i.e., US$ 181 million.
Pakistan’s domestic consumption is termed as one of the lowest in the world, at 1.6 kg per person per year (compared to world average of 16.2 kg per person per year. FBS, 2010). Microbes play an important role in the degradation of fish products, thus better knowledge of the microbiological conditions throughout the fish production chain may help to optimize product quality and resource utilization. This study presents the results of research project of the commercially most important fish species harvested and marketed in Pakistan. Fish samples from different markets of Lahore were collected. Totally 40 samples were assessed with respect to microbiological quality, hygiene and food safety. We introduce a quality and safety assessment scheme for Different fish samples originated from various markets depicting their storage, handling and quality characteristics. According to the scheme, in 25 of 40 samplings, sub-optimal conditions were found with respect to quality, whereas in 21 and 9 samplings, samples were not in compliance concerning hygiene and food safety, respectively. The present study revealed that the quality of marketed fish can be optimized by improving the hygiene conditions at some critical points at an early phase of the production chain. Thus, the proposed assessment scheme may provide a useful tool for the industry to optimize quality and maintain consumer safety of fish and fishery products.

Fish was a vertebrate which can be finfish, shell fish (molluscs and crustacean) and any other type of fresh water and marine water which can be used for domestic and animal consumption (Begum et al., 2010). Fish an extra relishing and nutritive source than the plant food. Fish meat was easily digested, generally it was preferred over meat and egg (Shingadia, 2011). Fish an important food item in the developing countries due to its high protein content and nutritional value (Sultana et al.). More than 30,000 species of fish are known, fish from the biggest group in animal kingdom that was used for the production of animal based foods. Nearly 700 of these species are commercially cultured and used for the food production (Olgunoglu, 2012). Unhygienic food causes many acute and chronic diseases that range from gastrointestinal diseases to various forms of cancer. The spoilage of fish was a complicated process which involves chemical and physical activity of microorganism. Fish products are very perishable, lack of appropriate facilities like exposure of the fish with high temperature and unhygienic condition during handling from the time of catching until it was processed into finished products contributes in major loss of fish quality.

Consumption of Seafood was becoming increasingly acceptable due to the ratio of high proteins, vitamins and poly-unsaturated fatty acids (Ge et al., 2012). Demand of fish and fish products are increasing rapidly around the world (Basti et al., 2006). Worldwide production of fish and fishery products has been doubled since 1970’s (Chakraborty et al., 2008). Fish was a very important sources of minerals, proteins, vitamins and omega 3 fatty acids (Goja,
2013). Present research aimed to highlight the risks posed by poor sanitation and unhygienic handling, storage and transportation conditions of fish sold in the market.

**MATERIALS AND METHODS**

**Sample Collection**

In this investigation the species of fish (*Labeo rohita*) was used, which were collected and randomly selected from the Fresh water, local market, retail market and super store of Lahore. Samples were labeled properly and shifted to Microbiology Laboratory, University of Veterinary and Animal Sciences Lahore.

**Preparation of Samples and Enumeration of Microorganisms**

Total bacterial count was calculated on the, MacConkey agar. For this purpose, MacConkey agar was weighed and dissolved in the distilled water. *Vibrio* count was calculated on the Thiosulfate Citrate Bile Salt Sucrose Agar (TCBS). For this purpose, Thiosulfate Citrate Bile Salt Sucrose Agar (TCBS) was weighed and dissolved in the distilled water according to the manufacturer instructions. Then it was autoclaved (120°C, 15lbs pressure for 15 minutes). Media was allowed to cool and poured in the sterilized Petri plates under sterilized conditions. These Plates were tested for sterility. 10 fold dilutions were made using Phosphate Buffered saline (PBS). Approximately 100ml Phosphate Buffered saline (PBS) was prepared and then added 9ml in each test tube and then it was autoclaved (120°C, 15lbs pressure for 15 minutes) and cooled down. One gram homogenized fish sample was taken in the test tube, containing 9ml of phosphate buffer saline solution and tenfold serially dilutions were made (Holt,1994).

**RESULTS AND DISCUSSION**

A total 40 sample of fish samples were purchased from Super Store, Local Market, Retail shop, and Fresh water in Lahore city and analyzed for their microbial Quality. All the samples were positive for Total plate count, coliform count, *Salmonella* count, *Vibrio* count. Among 10 fresh water fish samples mean total Plate Count was $3.8 \times 10^3$ CFU/g (log $3.58 \pm 0.03526$ CFU/g). The Counts range from minimum count log $3.48$ to maximum count of $3.71$ CFU/g. Among 10 super store fish samples means total plate count was $1.13 \times 10^4$ CFU/g (log $4.05 \pm 0.22815$CFU/g). The counts range from minimum count log $4.00$ to maximum count of log $4.10$ CFU/g. Among 10 retail store fish samples mean total plate count was $1.57 \times 10^4$ CFU/g (log $4.19 \pm 0.0343$ CFU/g). The counts range from minimum count log $4.15$ to maximum count of $4.23$ CFU/g. Among 10 local market fish samples mean total plate count was $1.63 \times 10^4$CFU/g (4.212 ± 0.03793 CFU/g). The counts range from minimum count log $3.16$ to maximum count of $4.30$ CFU/g. Among 10 fresh water fish samples mean coliform Count was $1.6 \times 10^5$ (4.20 ± 0.06822 CFU/g).The counts range from
minimum count log 4.14 to maximum count of 4.25 CFU/g. Among 10 super store fish samples mean coliform Count was 9.4 x 10^5 (4.97 ± 0.03108 CFU/g). The counts range from minimum count log 4.30 to maximum count of 5.07 CFU/g. Among 10 retail store fish samples mean coliform Count was 1.06 x 10^6 (5.28 ± 0.0275 CFU/g). Among 10 local market fish samples mean coliform Count was 1.40 x 10^6 (5.14 ± 0.04165CFU/g). Among 10 fresh water fish samples salmonella was detected in 10 percent. Among 10 super store fish samples Salmonella detected 60%. Among 10 retail market fish samples salmonella detected 80 %. Among 10 local market fish samples Salmonella was detected in 90% samples.

In current study total plate count was 3.8 x 10^3 CFU/g which was closely resembles to the values reported by (Ali et al., 1991). Another study in which reported results for TPC 4.5 x 10^3– 9.5 x 10^3CFU/g were different from my research due to conditional differences (Mailoa et al., 2013). Another study in which reported results for total plate count (8.81 ± 0.45 x 10^3 CFU / g) reassembled with the findings of (Mandal et al., 2009).

In present study the Staphylococcal count was 4.1 x 10^4 CFU/g which was higher than the values 2.50x 10^3CFU/g as compared to previous report earlier (Ayuba et al., 2013). Similar study revealed the values 1 x 10^4 CFU/g of Staphylococcal count, the variation might be due to the environmental conditions.

In present research the Vibrio Count was 3.12 x 10^2 which resembled with the values of 4 x 10^4 as reported by Enger et al. 1991. In another study the values of vibrio count was 7.76 x 10^4 CFU/g were high with my values reported by (Hasegawa et al., 1999).

According to my research finding the results were significant which depicts that the storage and handling conditions of some markets of Lahore. The results clearly showed that the microbial quality of fish sold in all the markets was contaminated with pathogens with non significant differences among different markets. Observational data showed pathetic hygienic conditions of the fish sold in local and retail markets while high bacterial load in superstore fish was alarming too. The results also showed that the bacterial load was comparatively lower in superstore fish than other markets. Lowest values of pathogens found in fresh fish indicated the poor handling, transportation and storage conditions. The results also directed that the hygienic conditions of different fish markets were also not appropriate and good. However the microbial quality of fresh water fish was comparatively good (Table 1; Fig. 1).
Table 1: Microbial Count in samples of fish from different sources

<table>
<thead>
<tr>
<th></th>
<th>TPC(CFU/g)</th>
<th>TCC(CFU/g)</th>
<th>SC(CFU/g)</th>
<th>TVC(CFU/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh Water</td>
<td>3.8 x 10^3</td>
<td>3.5 x 10^5</td>
<td>4.61 x 10^4</td>
<td>2.06 x 10^2</td>
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<td>Super Store</td>
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<td>4.05 x 10^5</td>
<td>4.76 x 10^4</td>
<td>2.62 x 10^3</td>
</tr>
<tr>
<td>Local Market</td>
<td>5.14 x 10^4</td>
<td>21 x 10^5</td>
<td>5.02 x 10^4</td>
<td>3.73 x 10^3</td>
</tr>
<tr>
<td>Retail Shop</td>
<td>5.02 x 10^4</td>
<td>4.19 x 10^5</td>
<td>4.12 x 10^4</td>
<td>3.59 x 10^3</td>
</tr>
</tbody>
</table>

** Total Plate Counts (TPC), Total Coliform Counts (TCC), Salmonella Counts (SC), Total VibrioCounts (TVC).

Fig. 1: Graphical representation of bacterial count in fish samples from different locations in Lahore
REFFERENCES


