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Original Research Article

Sanitary Condition of Battala Fish Market at Agartala, Tripura and its Public Health Significance

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A B S T R A C T

The sanitary condition of Battala Fish market located at Agartala, Tripura was examined on the basis of microbiological counts of the table tops where the fishes were kept to sold, water used for washing fish and iced used for preserving fish in the market. Twelve samples of each table top, water and ice were taken during six months period for the analysis and the results showed that the total plate count (TPC) of table tops was 10^{11} cfu gm^{-1}, 10^{10} cfu gm^{-1} in washing water and above 10^{9} cfu gm^{-1} in ice. The major public heath significant bacteria, *Staphylococcus sp* count was 10^{8} cfu gm^{-1} in table top, washing water and ice, *E. coli* count was 10^{6} cfu gm^{-1} in table top and 10^{5} cfu gm^{-1} in washing water and ice, *Salmonella sp* count was 10^{6} cfu gm^{-1} in table top and 10^{5} cfu gm^{-1} in washing water, *Salmonella* was not detected in ice. *Vibrio sp* was not detected in any of the sample.

Keywords

Fish market; Public health; Sanitation.

Introduction

Fish is the major source of diet for the peoples of Tripura where about 95% people consume fish. The per capita consumption of fish in Tripura is 13 kg which is much higher than all over India (9 kg) (Anonymous. 2008). Battala fish market is the major fish market of situated at Agartala, capital of Tripura. Fish produced locally in the state as well as brought from other state are principally marketed in Battala fish market. The sanitary condition of Battala fish market is grossly unhygienic. The facilities for preservation of fishes are not up to the mark. The floors of the fish market are filthy with no proper drainage system for water and there is no hygienic disposal system of waste. There are no proper facilities of washing fish, storage or chilling. In addition there is also no supply of clean water and ice. Fish quality deteriorates rapidly during storage and transportation (Vieira and Vieira 1989). Moreover, many of the local fish handlers are unaware of the basic rules needed to safeguard quality and safety of the

seafoods. Hence unsanitary practices are common in market place. The present work reports the unhygienic status in terms of microbiological quality of table tops where fish are kept for sold, water used for washing fish and ice use for preserving fish of Battala fish market.

Materials and Methods

Sampling plane

Fish storage surface i.e. table top, washing water and ice samples were collected from Battala fish market. Sampling was done fortnightly for six months period.

Sample preparation

Exactly 10cm^2 areas of table-tops, 10 ml of water and 25 g of ice were sampled. For table tops an area of 10cm^2 was swabbed with sterile swabs and taken into 90ml saline diluents (0.85% NaCl). For sampling of washing water, 10ml water was diluted into 90ml saline and mixed properly for making 10^{-1} dilution. Similarly ice samples of 25 g were diluted in 250ml saline water. The samples were serially diluted using 9ml sterile physiological saline and subjected to TPC, *E. coli*, *Staphylococcus* and *Salmonella* count.

Total plate count (TPC)

TPC of all the samples were done as per APHA (2001). Serial decimal dilution of 10^{-2} was prepared using 9ml sterile physiological saline and1ml homogenized sample and it was well mixed in cyclomixer. 0.1 ml of inoculums was spread plated on Trypticase Soya Agar (TSA) plates using a sterile glass spreader. The plates were incubated at 35°C for 24 h.

Pathogenic bacteria count

Staphylococcus count and *Escherichia coli* count were done by the method given by (Varma, 2002) and *Salmonella* spp. and *Vibrio* spp. count by the method given by (Manik, 1992). For staphylococcal count, 0.1 ml portion of various dilutions were spread on the surface of preset surface dried Baird–Parker agar plates supplemented with potassium tellurite and egg yolk emulsion. The plates were incubated at 37 °C for 36–48 h. Convex, black, shiny colonies with narrow white margin surrounded by clear zone were regarded as *S. aureus*. These colonies were confirmed by conducting gram staining, coagulase test, catalase test and anaerobic utilization of glucose and mannitol (USFDA, 2001). The colonies were purified onto Tryptose soya agar (TSA) plates and further subjected to coagulase test by slide technique for confirmation. For *E. coli*, 0.1 ml portions of various dilutions was spread on the surface of preset surface dried Tergitol-7 (T-7) agar plates Petri plates were incubated at 37°C for 48 h. The typical *E. coli* colonies on T-7 agar plates were counted which appeared as circular, non-mucoid, flat, and yellow with pinkish tinge. The colonies were purified onto Tryptose soya agar (TSA) plates and further subjected to Gram staining, Eijkman test, Indole test, Methyl red (MR), Voges Proskauer (VP) tests and citrate utilization test. For *Salmonella*, 0.1 ml aliquots of various dilutions were spread plated on the surface of preset surface dried Xylose lysine deoxycholate (XLD) agar plates, Bismuth sulphite agar (BSA) and Brilliant green agar (BGA) plates and plates were incubated at 35°C for 48h. The typical *Salmonella* colonies were counted which appeared pink or red with or without black centre on XLD plates, brown grey or black sometimes with metallic sheen on BSA plates and

colourless pink to fuchsia, translucent to opaque with surrounding medium pink to red On BGA plates. The isolates were further purified and subjected to plate agglutination test for further confirmation (Barsoum and Awad, 1972). For *Vibrio* count, 0.1 ml of aliquot was spread plated onto Thiosulphate citrate bile salt sucrose (TCBS) agar plates and incubated at 35°C for 48 h. The typical *Vibrio cholerae* colonies appearing as yellow on TCBS agar were counted. The isolates were further purified on a heart infusion agar (HIA) and subjected to screening test and slide agglutination test for further confirmation (CDC, 1994).

Statistical analysis

Statistical analysis was done by performing one way ANOVA (Post Hoc Duncan) to see the variation of means among the samples collected in different time (dependent variable) in SPSS-15.0 (2005).

Results and Discussion

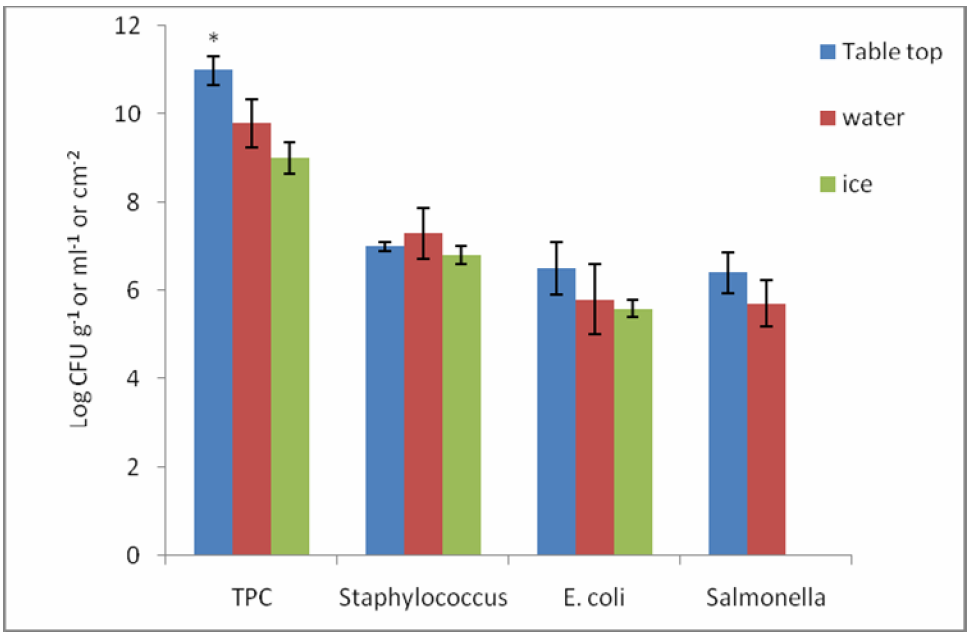
Total plate count

The TPC being more than 11 Log CFU cm^{-2} on table tops, 10 Log CFU ml^{-1} in washing water and 9 Log CFU g^{-1} ice samples (Fig 1), clearly indicated unhygienic status of the market. From these sources these bacteria may contaminate the fish and fishery product of the market. High count of TPC in table top may be due to use of wooden table top fish processing where the fish waste clogged and can not be properly washed and also the water used for washing table tops was not chlorinated. The vendors used unchlorinated water for washing fish and there was no running water facility they used the same water repeatedly for washing different lot of fish which was another reason for high count of TPC in washing water. The water used for was not chlorinated and also the ice were kept on the market floor which was filthy which may be the probable reasonfor high TPC count in ice samples which may contaminate fish.

Pathogenic bacteria count

Staphylococcus count and *E. coli* count were high for the table tops, water and ice. *Salmonella* count also was high in water and table-tops except ice where *Salmonella* was undetectable(Fig 1). The public health significant bacteria, *Staphylococcus* count was recorded near 8 Log CFU g^{-1} or cm^{-2} or ml^{-1} in all three sources. The natural habitat for *Staphylococcus*,spp. being the skin and mucus membranes of animals and men, it does not multiply in fish and its presence in fish indicates post harvest contamination (Huss, 1994). *S. aureus* is an indicator of hygiene and sanitary conditions the presence of this organism indicates the unhygienic condition during processing, storage etc and the contamination of fish could be the result of combination of improper handling, improper storage and cross contamination (Simon and Sanjeev, 2007). Through our overall observations, we could see that there were very little maintenance of proper personal hygiene, almost no use of chlorinated water for washing the table tops, containers, knives etc. and toilet facilities were poor. These observations supported the occurrence of high count of *Staphylococcus* spp. indicating very poor personal hygiene amongst the fish handlers. It is quite natural that such high count of *Staphylococcus* is grave concern of public health, leading to staphylococcal food poisoning among the consumers (Lilabati and Vishwanath, 1999). Staphylococcal food poisoning is one of the most prevalent causes of gastroenteritis

Fig.1 Total Plate Count and the occurrence of *Staphylococcus* spp., *E. coli* and *Salmonella* spp. in Table top (Log CFU cm-2), washing water (Log CFU ml-1) and ice (Log CFUg-1) (Bars with asterisks indicate significant difference (P<0.05), error bars show Mean ± S.E., n=36)



world wide, which is caused by the ingestion of food that contains preformed toxins (Jablonski and Bohach, 2001). Studies have shown that one of the most common types of food intoxication is caused by certain staphylococcus strains, mainly *Staphylococcus aureus* (Jablonski and Bohach, (2001) and Evenson et al. (1988).

E. coli showed a count near 6 Log CFU in table top, 5 Log CFU in washing water and ice. Natural habitat of *E. coli* is the gastrointestinal tract of warm blooded animals, the ICMSF, (1986) recommends testing for the presence of this organism as an indicator of post harvest contamination particularly from faecal origin and its limit is recommended as <100 *E. coli* g^{-1} fish. The abundance of *E. coli* has been shown to be more related to the sanitary risk than that of coliforms (16). The poor quality of water used for washing of fish, repeated use of same water for several lots of fish, unhygienic toilets and hand-wash facilities, accumulation of dirty wastes in the market premises etc. are clearly linked with high count of *E. coli.*

Salmonella count was 6 Log CFU cm^{-2} in table tops and 5 Log CFU ml^{-1} in washing water, *Salmonella* was not detected in ice samples. According to ICMSF, (1986) *Salmonella* should be absent in fish and fishery products. *Salmonella* and other bacteria may contaminate seafood during processing, and may cross-contaminate products during various stages of preparation (Amagliani et al. 2011). High count of *Salmonella* seems to be due to unhygienic handling, improper method of icing, exposure to outer environment such as soil, filthy water and surfaces etc.

Vibrio sp was not detected in any of the samples. Hence, it may be concluded that

recorded high bacteria count in table tops, water and ice may cross contaminate Fish. The results agree with the findings of (Subburaj, 1984) that the market premises and market floor and that water could be major sources of contamination of fish in the fish markets in Mangalore, India.

Suggestive management measures

Some of measures which could be urgently taken up are (1) Chlorination of water used for washing of fish at 5-10 ppm level and for premises table tops, surfaces of equipments at 10- 200 ppm level, use of potable water for ice making and proper storage of ice (2) Proper packaging of fish with recommended proportions of ice and fish 1:2 (fish to ice); (3) Construction of proper drainage systems in the auction centers and retail markets; (4) Organization of awareness camps amongst the fish handlers for maintaining good personal hygiene; (5) Government may impose strict rules and regulations for adopting sound measures for maintaining personal hygiene for the fish handlers; (6) Construction of proper infrastructure facilities in the fish market places such as concrete road and floor, covered drain, chlorinated water supply system, toilet and bathrooms, exhaust fan in the buildings, air curtains in the doors, foot dips before entering the fish markets.

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