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ABSTRACT

The aim of the present study is to investigate the incidental occurrence of pathogenic bacterial strains namely Escherichia coli, Staphylococcus aureus, Salmonella sp. and Vibrio parahaemolyticus from the seafood samples collected from Therespuram, Inigo Nagar and Tharavaikulam in Tuticorin.

INTRODUCTION

India has 8129 km long coastline and is the third largest fish producing nation with an annual production of 5.36 million tones. Indian seafood occupies an eminent position in world food trade. India has grown as a major exporting country of fishery products among more than 60 countries including the European Union, Japan and USA. Fresh fish is a highly perishable food product. It can be kept for only a short time. In many countries fresh fish are filleted and displayed for sale on a bed of crushed ice or refrigerated. Fresh fish is most commonly found near bodies of water, but the advent of refrigerated train and truck transportation has made fresh fish more widely available in land. Long term preservation of fish is accomplished in a variety of ways. The oldest and still most widely used techniques are drying and salting. Desiccation (complete drying) is commonly used to preserve fish. Partial drying and salting is also popular for the preservation of fish. Seafood is consumed all over the world. It provides the world’s prime source of high-quality animal protein (14-16%).

Bacterial domination in the spoilage of fish was shown by Anderson (1907) and subsequently it was established that the bacteria involved are those that are normally present on fresh fish. The study of bacteriology of fish and spoiling of fish has been on the logarithmic phase. It has also been demonstrated that the normal flora of the fresh and spoiling fish is predominated by psychrophilic Gram-negative rods (Shewan, 1977). The pathogenic bacteria like Escherichia coli, Staphylococcus sp., Salmonella sp. and Vibrio sp. are distributed geographically all over the world, but principally occurring in the gut of man and animals and in environments polluted with human or animal excreta. Survival in water depends on many parameters such as biological and physical factors like temperature (Rhodes and Kator, 1988).

Staphylococcus is a Gram-positive bacterium. Most of them are completely harmless and reside normally on the skin. Staphylococcus aureus can infect wounds. It is a bacterium characteristic in its appearance when grown out on agar plates. It appears as large, round, golden-yellow colonies with beta haemolysis of blood agar. It is a facultative anaerobe. Staphylococcus can produce diseases by its ability to multiply and invade tissues and also through the production of extracellular enzymes and toxins. It causes lysis of red blood cells. It can be demonstrated on blood agar (Doctor Lounge). Escherichia coli is Gram-negative rod. It is commonly seen as colobacillar form and rarely as a filamentous form. It has 4-8 peritrichate flagella and it is sluggishly motile. It does not form spore. They do not form any spore. It is a facultative anaerobe. It...
develops circular, raised and smooth colonies emitting a faecal odour (Annie Rodalankis et al., 1973). *Salmonella* is small Gram-negative bacillus. It is usually motile and possesses polysaccharide capsule. It has specific O antigens. *Salmonella* sp. are relatively resistant to bile acids. It is usually motile and possesses polysaccharide capsule. It has specific O antigens. *Salmonella* sp. are relatively resistant to bile acids. It contains over 2,000 species and is one of the most important pathogens in the family Enterobacteriaceae. Exposure to the O and H antigens stimulates the production of specific antiboides (David and Joseph, 2000).

*Vibrio parahaemolyticus* is a Gram-negative bacterium. It is typically found in warm estuarine sea water area to its halophilic (salt-requiring) characteristics. It is the number one leading cause for seafood associated bacterial gastroenteritis in the United States. *Vibrio parahaemolyticus* causes diarrhoea upon ingestion. Majority of people acquire infection by eating raw or undercooked seafood, particularly shellfish and oyster. An open wound exposed to warm seawater can facilitate *Vibrio parahaemolyticus* infection (Daniel, N.A., B.Ray et al., 2000).

**MATERIALS AND METHODS**

**Collection of samples**

Fish samples were collected from Thrasepuram (Station I), Inigo Nagar (Station II) and Tharavaikulam (Station III) (PLATES IV and V). Samples were collected at random from these three stations. The fishes were collected individually in pre-sterilized polythene bags and transported to laboratory in an icebox. Processing of samples and bacteriological analysis were completed within 2-4 hours of collection. Aseptic procedures were strictly followed during collection, transportation and analysis. The fishes were identified using standard reference manuals (Whitehead, 1972).

**Bacteriological Methods**

The enumeration of pathogenic bacteria namely *Escherichia coli*, *Staphylococcus aureus*, *Salmonella* sp. and *Vibrio parahaemolyticus* was made using the streak plate method.

<table>
<thead>
<tr>
<th>S. No</th>
<th>Species</th>
<th>Station I Thrasepuram</th>
<th>Station II Inigo Nagar</th>
<th>Station III Tharavaikulam</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Charybdis variegata</td>
<td>40</td>
<td>40</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>Loligo duvauceli</td>
<td>5</td>
<td>3</td>
<td>44</td>
</tr>
<tr>
<td>3</td>
<td>Anguilla anguilla</td>
<td>30</td>
<td>60</td>
<td>23</td>
</tr>
<tr>
<td>4</td>
<td>Sardinella longiceps</td>
<td>5</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Octopus vulgaris</td>
<td>3</td>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td>6</td>
<td>Stolephorus commersonii</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>Mesoprion malabaricus</td>
<td>10</td>
<td>7</td>
<td>6</td>
</tr>
</tbody>
</table>

**Showing the occurrence of the bacterial pathogens in the different species collected at different stations**

![Graph showing the occurrence of bacterial pathogens in different stations](image-url)
on EMB (Eosin Methylene Blue agar), Mac-Conkey agar and Deoxycholate citrate agar plates, TCBS (Himedia, Mumbai, India).

RESULTS AND DISCUSSION

The present investigation was carried to study the incidental occurrence of pathogenic bacteria like Escherichia coli, Staphylococcus aureus, Salmonella sp. and Vibrio parahaemolyticus from the seafood samples collected from three different stations Threaspuram, Inigo Nagar and Tharavaikutum in Thoothukudi. Totally 60 samples were collected, which include 33 fin fishes and 27 shell fishes. Totally 11 fin fishes and 9 shell fishes were found to be contaminated. All the 21 samples were contaminated with Escherichia coli, Staphylococcus aureus, Salmonella sp. and Vibrio parahaemolyticus. The presence of Escherichia coli, Staphylococcus aureus, Salmonella sp. and Vibrio parahaemolyticus were recorded in seven different species of fishes and molluscs. The Vibrio parahaemolyticus was recorded in almost all samples collected from all stations. The highest was recorded in station I (Threaspuram). Similarly the high incidence of Vibrio load was reported in Mesopriion malabaricus species. Vibrio is found in aquatic habitats with a wide range of salinities. It is very common in marine and estuarine environments and on the surfaces and in the intestinal contents of marine animals. Three species Vibrio cholerae, V. parahaemolyticus and V. vulnificus are well documented human pathogens (Holt et al., 1994). Vibrio species account for a significant proportion of human infections from the consumption of raw or under worked shellfish (Kaysner and Depaola, 2004) reported that both Vibrio parahaemolyticus and V. cholerae were found exclusively in The presence of Escherichia coli, Staphylococcus aureus, Salmonella sp. and Vibrio parahaemolyticus were recorded in seven different species of fishes and molluscs. The Vibrio parahaemolyticus was recorded in almost all samples collected from all stations. The highest was recorded in station I (Threaspuram). Similarly the high incidence of Vibrio load was reported in Mesopriion malabaricus species. Vibrio is found in aquatic habitats with a wide range of salinities. It is very common in marine and estuarine environments and on the surfaces and in the intestinal contents of marine animals. Three species Vibrio cholerae, V. parahaemolyticus and V. vulnificus are well documented human pathogens (Holt et al., 1994). Vibrio species account for a significant proportion of human infections from the consumption of raw or under worked shellfish (Kaysner and Depaola, 2004). Eleftheriadou et al. (2002) reported that both Vibrio parahaemolyticus and V. cholerae were found exclusively in imported raw frozen prawns and shrimps and fishes in the Republic of Cyprus. When ingested Vibrio parahaemolyticus causes watery diarrhoea often with abdominal cramping, nausea, vomiting, fever and chills. V. parahaemolyticus can also cause skin infection when an open wound is exposed to warm seawater.

The Escherichia coli. was noted in station I (Charybdis variegata, Threaspuram) and lowest in station I (Stolephorus commersonii, Threaspuram). Sugumar et al. (2008) reported that Escherichia coli showed greater variation among samples during different seasons and highest count was recorded in water samples of Threaspuram landing centre. Swarnakumar (2008) reported that there was no significant relationship in the THB and other pathogenic load (when an ANOVA was done) recorded at different stations. The same was reported in the present study. Kumar et al. (2005) reported that estuaries and coastal water bodies which are the major sources of seafood in India are often contaminated by human activities and are associated with the widespread occurrence of Escherichia coli in seafood. Sewage contamination of fish harvesting areas is the major reason for the presence of Escherichia coli, but contamination can occur through the use of non potable water or ice in the landing centers or fish markets (Karunasagan et al., 2005). reported that Escherichia coli number was lesser in sand compared to water samples of south Landing centre.

The Staphylococcus aureus was highest in Station I (Threaspuram) in Anguilla anguilla. The minimum was noted in Octopus vulgaris. There was significant variation in the concentration in Anguilla anguilla, Loligo duvauceli and Sardinella longiceps between stations II and III. The maximum population density of Salmonella was recorded in Charybdis variegata and minimum from Sardinella longiceps in Station I (Threaspuram). Incidences of Salmonella in seafoods from India have been reported by a number of investigators. Hatha and Lakshmana Perumalsamy (1997) reported 14.25 % of the fish samples and 17.39 % of crustacean samples were contaminated with Salmonella. The percentage prevalence reported varied among the different products: frozen peeled and deveined shrimps accounted for 7.46 %, peeled and deveined shrimps for 12 %, headless shell–on shrimps for 10 %, peeled and undeveined shrimps for 14 %. Salmonella infections of humans mostly account for food poisoning caused by nontyphoidal Salmonella such as S. typhimium, S. enteriditis, S. choleraeus and S. Hader.

This shows that all three stations were equally polluted and the load was high in all species. This proves that although all the stations were almost equally polluted the bacterial load accumulated on each species varied due to various reasons. Seafood is a highly perishable product. Its quality deteriorate more rapidly than other protein sources such as chicken and red meat. It is inevitable to eliminate foodborne pathogens and ensure food safety. Improving food safety along the western standards is more expensive. Therefore, affordable food safety norms should be introduced. Improvement of the hygiene of raw seafood at the local sale location level is recommended. It can be achieved by awareness programmes to both seafood handlers and consumers. Routine inspection programmes can reveal microbial status of the retail products and this would help to keep the unsafe seafood off the market and encourage high quality products for domestic customers.

References


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