CASE STUDY: PREVALENCE OF STAPHYLOCOCCUS AUREUS IN FISHERY PRODUCTS

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Abstract: A case study accidentally found the incidence of Pathogenic Staphylococcus aureus in ready to eat / ready to cook fishery products. Coagulase positive S aureus was detected in fish pickles. Methicillin Resistant S aureus was detected in 24% of fishery products. Hence the isolation of potentially pathogenic S aureus isolates from fishery products indicates risk to consumers; screening of prevalence, pathogenicity potential and antibiotic resistance is essential to implement control measures. This is a serious public health risk and highlights the need to implement good hygienic practices. These findings emphasize the need to presence of S aureus strains and Staphylococcal enterotoxin production in foods.

Index Terms - Staphylococcus aureus (S aureus), Coagulase positive Staphylococcus aureus (CPS).

I. INTRODUCTION

Staphylococcus aureus is a common pathogen associated with serious community and Hospital acquired diseases and has for long been considered as a major problem of Public Health (Pesavento et al., 2007). Seafood’s are rich in protein and their breakdown in low molecular weight peptides and amino acids support the growth of S. aureus. The foods involved in outbreaks are canned, smoked and salted products, frozen fishery products, boiled fish paste and fish sausages which inhibit the growth of competing organisms (Bryan, 1980; Nakano et al., 2004; Sanjeev, Iyer, Rao, & James, 1986). Freshly caught seafood’s are free from S. aureus and contamination takes place during handling (Bryan, 1980; Shewan, 1962). Staphylococcal food poisoning is one of the most prevalent causes of gastroenteritis worldwide, which is caused by the ingestion of food that contains preformed toxins (Jablonski and Bohach, 2001). Some strains of this organism can cause food-poisoning by production of enterotoxins (SEs) when growing in foods; SEs have been divided into different serological types initially SEA through SEE and later the existence of new types of SEs have also been reported (Monday and Bohach, 1999; Omoe et al., 2005; Chiang et al., 2006; Chiang et al., 2008). Biological tests and immunoassays may be used to detect SEs (Dolman and Wilson, 1940; Casman, 1965; Celano et al., 1999; Normanno et al., 2001). Molecular biology methods, such as Polymerase Chain Reaction, are able to detect the genes encoding for the SEs (Johnson et al., 1991; Beker et al., 1998; Mehrotra et al., 2000). Immunoassays are both very sensitive and specific and reverse passive latex agglutination is acknowledged to be a sensitive, rapid and simple method for the detection of SEs (Rose et al., 1989; Brett, 1998; Soriano et al., 2002). Detection of SEs is paramount to food safety and protection of the food supply. S. aureus isolates from intensive care units across the country and from blood culture isolates worldwide are increasingly resistant to a greater number of antimicrobial agents. Inevitably this has left fewer effective bactericidal antibiotics to treat these often life-threatening infections. As rapidly as new antibiotics are introduced, staphylococci have developed efficient mechanisms to neutralize them. Recent reports of S. aureus isolates with intermediate or complete resistance to vancomycin portend a chemotherapeutic era in which effective bactericidal antibiotics against this organism may no longer be readily available. Most of the nosocomial S. aureus infections are caused by methicillin-resistant S. aureus (MRSA) strains and have become a widely recognized cause of morbidity and mortality throughout the world (Ardic et al., 2006; Pesavento et al., 2007; Ho et al., 2008). In addition, MRSA strains resistant to quinolones or multiresistant to other antibiotics have been emerging, leaving a limited choice for their control (Mee-Marquet et al., 2004; Nejma et al., 2006; Pesavento et al., 2007). Hence this study emphasizes the prevalence of S aureus in fishery products and to characterize its antibiotic susceptibility.
Samples analyzed in the study

II. MICROBIOLOGICAL ANALYSIS OF FISHERY PRODUCTS

About 76 RTC/RTE Samples were collected from various supermarkets, hypermarkets in and around Kochi, Trissur, and Kollam. Microbiological procedures were carried out to detect the presence of *S. aureus* and following results were obtained:

**2.1** 23.68% of the total samples was contaminated with Staphylococcus sp among which 2.68% were coagulase positive *S. aureus*. Moreover, 35% of the products shows antimicrobial count of above 5 Log (cfu/g) which exceeds standard APC limit of 5 log (cfu/g).

Microbial load of RTC/RTE fishery products from different markets of Kerala

<table>
<thead>
<tr>
<th>Sl. no</th>
<th>Sample</th>
<th>No of samples</th>
<th>APC (log cfu/g) (Range)</th>
<th>Coagulase positive staphylococci (log cfu/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dried fish products</td>
<td>13</td>
<td>3-6.18</td>
<td>ND</td>
</tr>
<tr>
<td>2</td>
<td>Fish Pickles</td>
<td>13</td>
<td>1-4.25</td>
<td>1-2.66</td>
</tr>
<tr>
<td>3</td>
<td>Prawn Pickles</td>
<td>11</td>
<td>1-3.9</td>
<td>ND</td>
</tr>
<tr>
<td>4</td>
<td>Fish cutlet</td>
<td>1</td>
<td>3.81</td>
<td>ND</td>
</tr>
<tr>
<td>5</td>
<td>Fish fillets</td>
<td>1</td>
<td>5.85</td>
<td>ND</td>
</tr>
<tr>
<td>6</td>
<td>Fish fingers</td>
<td>1</td>
<td>6.05</td>
<td>ND</td>
</tr>
<tr>
<td>7</td>
<td>Canned tuna products</td>
<td>10</td>
<td>0-3.39</td>
<td>ND</td>
</tr>
<tr>
<td>8</td>
<td>Canned sardine</td>
<td>1</td>
<td>2.30</td>
<td>ND</td>
</tr>
<tr>
<td>9</td>
<td>Dried prawn</td>
<td>5</td>
<td>3.8-5.25</td>
<td>ND</td>
</tr>
<tr>
<td>10</td>
<td>Prawn chutney powder</td>
<td>10</td>
<td>4.05-5.95</td>
<td>ND</td>
</tr>
<tr>
<td>11</td>
<td>Fried Prawn</td>
<td>1</td>
<td>5.69</td>
<td>ND</td>
</tr>
<tr>
<td>12</td>
<td>Prawn roast</td>
<td>1</td>
<td>4.47</td>
<td>ND</td>
</tr>
<tr>
<td>13</td>
<td>Shrimp cocktail</td>
<td>1</td>
<td>3.94</td>
<td>ND</td>
</tr>
<tr>
<td>14</td>
<td>Mussel Pickle</td>
<td>1</td>
<td>1.00</td>
<td>ND</td>
</tr>
<tr>
<td>15</td>
<td>Fish samosa</td>
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<td>4.27</td>
<td>ND</td>
</tr>
<tr>
<td>16</td>
<td>Clam pickle</td>
<td>4</td>
<td>1-2.4</td>
<td>ND</td>
</tr>
<tr>
<td>17</td>
<td>Squid Pickle</td>
<td>1</td>
<td>1.77</td>
<td>ND</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>76</td>
</tr>
</tbody>
</table>

Coagulase positive *S. aureus* were isolated in Baird Parker agar plates from RTC/RTE products. Total 76 samples were used for the present study. About 50 *S. aureus* isolates were obtained out of these 17 isolates obtained from two samples were coagulase positive. CPS were present in 2.63% of the total samples. The isolated then subjected to biochemical confirmation.
Characteristics colonies of *S. aureus* on Baird-Parker agar plate. Colonies appear as small, black, convex round colonies with clear zone.

2.2. Biochemical test was performed with 50 isolates out of which 17 were coagulase positive, catalase positive, Mannitol salt agar positive, and DNase test positive. In our study prevalence of coagulase positive *S. aureus* was detected only in fish pickles. The contamination could be the result of a combination of improper and unsanitary handling, improper storage and cross contamination (Huang, Weng, and Chiou, 2001; Ng and Tay, 1993; Synder and Poland, 1991; Tranter, 1990). Other products viz. dried fish products, frozen fish products, mussel pickle and value-added products did not show the presence of Coagulase Positive *S. aureus*. This low level of incidence could be attributed to the improvements in the handling and sanitary procedures and adaptation of good manufacturing practices (GMP) and hazard analysis and critical control points (HACCP) in the processing units.

2.3. Enterotoxigenic strains were not detected in any of the isolates.

2.4. Antibiotic sensitive test was performed with isolates and obtained that 24% of isolates were resistant to methicillin, 6% showed multidrug resistance to methicillin, ampicillin, oxacillin, and erythromycin, while 80-100% were sensitive to ampicillin, trimethoprim, tetracycline, erythromycin, clindamycin, gentamycin, chloramphenicol, cephalothin, and oxacillin. However, the prevalence of MRSA in our study (24%) which was higher than that (0.6%) of the study by Wang et al. (2014). Contamination of food with antimicrobial-resistant bacteria is a threat to public health.

2.5. Test to detect the presence of virulence factors was performed on blood agar. β-hemolysis was exhibited by 52.9% and 47.1% exhibits δ-hemolysis.

### III. INFERENCE

*S. aureus* is an indicator of hygiene and sanitary conditions hence the presence of this organism indicates the unhygienic condition during processing, storage etc. (Synder & Poland, 1991). In conclusion, these findings highlight the high potential risk for consumers in the absence of strict hygienic and preventative measures to avoid the presence of *S. aureus* isolates and SEs production in foods, emphasising the need for improved hygiene practices during food processing and also during the distribution and consumption of the final food products. It is important to identify the origin of food-related MRSA and to evaluate the potential pathogenicity of these MRSA isolates. However, the findings of our study are even more serious in terms of public health because RTE foods are consumed without further cooking, which would eliminate or reduce the microbial load. Consequently, the incidence of *S. aureus* and MRSA in RTE foods, along with the spread of antibiotic resistant strains, represents a potential health hazard to humans.
REFERENCES


