Staphylococcal Food Poisoning from Infected Snoek

B. A. PRIOR, D. P. THERON, J. S. HENNING, E. FOUCHE

SUMMARY

Snoek was implicated in the food poisoning of 2 people in Bloemfontein. The patients' symptoms and culture of snoek samples suggested Staphylococcus aureus as the causative agent. Enumeration of S. aureus by selective procedures gave counts of 200 000 per gram in snoek obtained from the patients and from the butchery supplying the snoek. Investigations indicated that the snoek was heavily contaminated with S. aureus before arrival at the butchery and that the organisms grew as a result of mishandling after processing.


The frequency of staphylococcal food poisoning in South Africa has not yet been established, as outbreaks are not centrally recorded. Food poisoning by staphylococci is usually the most frequent type of food-borne disease reported in the USA, and the situation may be similar in South Africa.

Foods implicated in staphylococcal food poisoning have usually been processed and have subsequently been mishandled during storage. Meats are usually associated with food poisoning, but fish has only occasionally been implicated. Salt-preserved codfish contaminated with staphylococci affected 539 persons in an outbreak in the USA. Fish contaminated with Clostridium botulinum, Vibrio parahaemolyticus and Salmonella have also been implicated in various outbreaks.

To our knowledge this is the first instance where smoked snoek has been reported as a vehicle for staphylococcal food poisoning. Smoked snoek is prepared by salting the fish, freezing it and from a wholesaler in Bloemfontein. The fish from the wholesaler was not the same brand as the other samples and was used as a control. All samples were immediately frozen upon receipt in the laboratory.

TEST METHODS: Ten grams of snoek were placed in a Waring blender (MSE Atomix) with 90 ml of sterile 0.1% peptone water and homogenized for 30 seconds at 6000 rpm followed by 60 seconds at 12 000 rpm. Further decimal dilutions were made in 0.1% peptone water.

The aerobic plate count was determined by placing 1 ml of the appropriate dilutions into duplicate Petri dishes and mixing with tempered plate count agar (Difco). Plates were incubated at 30°C for 48 hours. Duplicate plates containing 30-300 colonies were counted and the average calculated.

Escherichia coli were enumerated by the three-tube 'most probable number' (MPN) technique. One-millilitre aliquots of decimal dilutions between 10\(^{-4}\) and 10\(^{4}\) were transferred into triplicate tubes of MacConkey broth (Merck) and incubated at 37°C for 48 hours. Further 1-ml aliquots from tubes positive for gas and acid were transferred to fresh MacConkey broth and tryptone water and incubated at 44°C for 48 hours. Tubes positive for gas, acid and indole were presumed to contain E. coli.

S. aureus were enumerated according to the technique of the US Department of Agriculture using Vogel-Johnson agar. Diagnostic sensitivity test (DST) agar (Oxoid) with blood was used to isolate staphylococci from the nasal swabs of the food handlers. Plates were incubated at 37°C.

The DNase reaction of isolates was determined by the method of Vera and Dumont. A psychrometric method was used to determine water activity (a_s).

Direct microscopical observations on smears made from the subcutaneous fat and the flesh of the fish sample...
obtained from the patients and the butchery, showed numerous Gram-positive cocci. No organisms were observed in similar smears made from the control snoek.

The aerobic plate count of the samples of snoek from the patients and the butchery showed counts of 1 000 million per gram or greater (Table I). The control snoek sample had significantly fewer organisms present. S. aureus counts of 200 000 per gram were found in the snoek samples from the patients and butchery while S. aureus could not be isolated from the control sample. None of the samples were positive for E. coli.

The a of the snoek samples from the patients and the butchery was significantly higher than that of the control snoek (Table I).

**TABLE I. INCIDENCE OF MICRO-ORGANISMS IN SNOEK SAMPLES**

<table>
<thead>
<tr>
<th>Counts per gram snoek</th>
<th>Snoek from patient</th>
<th>Snoek from butchery</th>
<th>Control snoek</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerobic plate count</td>
<td>1.62 × 10⁶</td>
<td>1.00 × 10⁷</td>
<td>1.36 × 10⁷</td>
</tr>
<tr>
<td>Escherichia coli</td>
<td>&lt;3</td>
<td>&lt;3</td>
<td>&lt;3</td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>2 × 10⁴</td>
<td>2 × 10⁴</td>
<td>&lt;3</td>
</tr>
<tr>
<td>Water activity</td>
<td>0.9348</td>
<td>0.9315</td>
<td>0.7015</td>
</tr>
</tbody>
</table>

Investigation of Food Handlers

Haemolytic staphylococci were isolated from nasal swabs taken from all the food handlers in the butchery. All staphylococci isolated from the DST agar were coagulase-negative and DNase-negative, indicating that the source of S. aureus in the snoek was not from the food handlers.

**DISCUSSION**

The symptoms reported by the patients and examination of samples of the suspected snoek suggested food poisoning by S. aureus. Laboratory investigations showed a large number of S. aureus in the patients’ snoek sample (Table I). Hobbs (quoted by Jay) suggested that at least 500 000 staphylococci per gram of food must be present to induce food poisoning symptoms in man. While a lower count of S. aureus (200 000/g) was found in our investigations, the patients evidently ate sufficient snoek to cause food poisoning. The fact that no other food was consumed at the time may have increased the degree of poisoning. The number of S. aureus in the food is not always a reliable indicator of the cause of food poisoning. Assays for toxin in the food are a more definite indication of food poisoning by S. aureus. However, a large amount of sample is necessary for the assay and insufficient material was available to carry out the test in this laboratory.

The S. aureus count in the sample of snoek from the butchery indicated that the toxin was already in the food at the time of purchase by the patient. Investigation at the butchery showed that the snoek was always stored frozen or held in a display cabinet at a temperature that would not allow the growth of staphylococci. This evidence as well as the absence of coagulase-positive staphylococci from the food handlers in the butchery, suggest that the growth of staphylococci occurred before the snoek arrived at the butchery. Unfortunately, the contaminated batch of snoek was no longer available from the wholesaler and the origin of the staphylococci could not be investigated further.

The high aerobic plate count in the snoek from the butchery suggests that at some stage between processing and arrival at the butchery, the snoek was held at a temperature that allowed rapid proliferation of microorganisms. Snoek after smoking normally has a low count of micro-organisms as revealed by examination of the control snoek sample.

**REFERENCES**