Listeria Monocytogenes – 1988

Listeria monocytogenes was once considered a pathogen of principal concern to veterinarians who recognized the organism as a cause of encephalitis in ruminants (circling disease). Since human disease has become associated with Listeria, the species has commanded a much greater respect by the food industry and regulatory agencies. It is probably accurate to say there have been more research papers published on Listeria monocytogenes in food products in the past 12 months than from all sources in the previous 12 years.

The primary driving force has been Listerial outbreaks and the attendant deaths associated with dairy products, but the spillover of potential threat has caught the attention of the balance of the food industry, particularly the meat industry.

I will start this update by accounting for the most recent outbreak. This was reported in Switzerland in 1987 and was attributable to a brand of soft cheese (Vacherin Mont d’Or). Over a period of three years, 122 cases of Listerialis were diagnosed and 33 deaths were recorded.

The details of the outbreak were presented at the WHO Listeria Conference in Geneva on February 15-19, 1988. Meat industry experience relative to incidence and control of Listeria was shared with the Conference by Dr. Paul Hopper of General Foods, Chairman of the International Life Sciences Institute-Nutrition Foundation (ILSI-NF). The principal recommendations of the Conference for the industry were: (1) promote the HACCP approach and motivate management and employees at all levels regarding a safe food supply; (2) investigate natural and synthetic inhibitors; (3) improve the hygienic design of equipment; (4) develop codes of hygienic practice for the different sectors of food production; (5) devise model food microbiological curricula, and (6) develop new technologies for products which are not heat treated. For the public health authorities, the Conference recommended that “decisions to withdraw product from the market should be based on the best available scientific information and made only after careful risk analysis, with the goal of maintaining consumer confidence in the food supply which cannot be made totally Listeria-free.”

Research activities on Listeria can be classified broadly into three categories: (1) understanding of virulence and pathogenicity; (2) methods; and (3) factors influencing the growth, survival and control in foods.

In an attempt to further characterize Listeria found in meat products, positive samples found in an American Meat Institute (AMI) monitoring program, described later, are being serotyped at the Centers for Disease Control and tested for pathogenicity at the National Food Processors Laboratory (Silliker, 1988). Broome, (1986) has reported the distribution of human isolates as follows: 1/2 a, 27%; 1/2 b, 31%; 3 a, 1%; 3 b, 3%; and 4 b, 38%. By contrast, none of the meat isolates were of the 4 b serotype and the greatest percentage (46%) has been found in serotype 3 a, which is virtually absent from human isolates. The balance of the 32 isolates fell into 1/2 a (23%) and 1/2 b (31%).

Pathogenicity was not more strongly associated with one serotype over another.

These preliminary data suggest the possibility that meat is not a primary source of the serotype most commonly associated with human illness. However, the data also suggests that 40% to 50% of the Listeria found in processed meats have been identified with human illness. Further clarification of these relationships is in order.

There are five methods employed in the detection of Listeria in foods:

- **Cold enrichment** (1-6 months)
- **FDA** 10-14 days
- **USDA** 10-14 days
- **ELISA** 2 days neg., 5 days, pos.
- **Gene-Probe** 2 days neg., 5 days, pos.

Extensive biotechnology is being applied to laboratory procedures to provide improved research and analytical tools. The USDA method is recommended for meat products. Each of the procedures is under constant review and a recent modification of the USDA media has been described by Sperber (1988) of The Pillsbury Co. which also allows confirmation of negative results to be determined in two days.

Researchers have been less productive in suggesting control procedures which could be investigated. In a call for research proposals by ILSI-NF, only two control-oriented protocols were received. One of the more novel suggestions is the use of lysozyme. Laboratory demonstrations suggest that lysozyme, a naturally-occurring enzyme in human mucosa, tears, eggs and milk, might be employed in certain products to destroy Listeria during manufacture.

The Food Research Institute (Doyle and Schoeni, 1987) has investigated the thermal inactivation of Listeria monocytogenes in selected meat products and has observed that L. monocytogenes is about four times more heat tolerant than Salmonella. D-values for Salmonella at 135°F and 145°F were 3.8-4.2 min. and 0.6-0.7 min.,

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respectively, whereas D-values for *L. monocytogenes* at these temperatures were 15.7 min. and 2.56 min., respectively. *Listeria* in "naturally" contaminated meat were about two to four times more sensitive to heat than laboratory cultures. The significance of this observation is unknown, but may reflect differences in strains of *L. monocytogenes*.

The U.S. Department of Agriculture has contracted with ABC Research, Inc. to perform further research on thermal tolerance of *L. monocytogenes* under a variety of time/temperature parameters.

The Committee on Food Microbiology of the ILSI-NF has published a current bibliography of *Listeria* research papers and will provide periodic updates. The listing could be helpful to any researcher contemplating investigations of *Listeria* in foods (ILSI-NF 1988).

The AMI initiated a *Listeria* monitoring program of ready-to-eat meats in 1987 and it has been reactivated in 1988. In these studies, samples of packaged ready-to-eat meats have been sent to a commercial laboratory for *Listeria* analysis using both a 25gm. and 1gm. sample and the USDA analytical protocol. Results are shown in Table 1. The number of samples is too meager to draw conclusions, but the results do demonstrate that some plants have contributed disproportionately to the number of positives. We believe that data point to frankfurters as being the most likely carrier of *L. monocytogenes* and that this is related to the environmental conditions prior to packaging.

Avoiding post-processing contamination under these circumstances is a formidable challenge requiring effective management of people, equipment and environment in addition to a totally reliable sanitation program. Under the best managed programs, results have been erratic, but in all instances the companies have reported an extended shelf life in their ready-to-eat products. A guideline for reducing the incidence of *Listeria* in meat products has been prepared by AMI (1987).

The industry response to an awareness of a potential public health problem is further illustrated by data taken from the USDA Quarterly Monitoring program. In 1984, the USDA began examining cooked roast beef and cooked corned beef for *E. coli* in addition to Salmonella. The *E. coli* numbers demonstrate the response of the industry to the need for tightening process controls. As seen in Figure 1, the percentage of samples with *E. coli* has been reduced from approximately 23% of the samples to 12%. A further improvement is yet to be accomplished, but progress, though slow, seems assured. The last *Salmonella* found in these products was in 1986, which is a further demonstration of control associated with these products.

In 1987, the Food Safety and Inspection Service piggybacked a *Listeria* monitoring program onto the existing *Salmonella* program for ready-to-eat meats (Table 2). To date, *L. monocytogenes* has been confirmed in two cooked corned beef processes.

The other FSIS-administered *Listeria* monitoring program is on Prosciutto ham production. The monitoring was prompted by the finding of *Salmonella* in this product class and monitoring was initiated for both pathogens. Neither of

Table 1. AMI Listeria Monitoring of Ready-To-Eat Meat Products.

<table>
<thead>
<tr>
<th>Sample</th>
<th>L. m. Positive (%)</th>
<th>25 gms.</th>
<th>1 gm.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1987 All Products</td>
<td>87</td>
<td>10(11.5)</td>
<td>4(4.6)</td>
</tr>
<tr>
<td>All Plants</td>
<td>22</td>
<td>10(45)</td>
<td>4(18)</td>
</tr>
<tr>
<td>Plant A</td>
<td>3</td>
<td>2(66)</td>
<td>1(33)</td>
</tr>
<tr>
<td>Plant B</td>
<td>6</td>
<td>3(50)</td>
<td>1(17)</td>
</tr>
<tr>
<td>1988 Frankfurters</td>
<td>21</td>
<td>8(38)</td>
<td>5(24)</td>
</tr>
<tr>
<td>Luncheon Meat</td>
<td>25</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Ham</td>
<td>9</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>22</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>All Products</td>
<td>77</td>
<td>10(13)</td>
<td>7(10)</td>
</tr>
</tbody>
</table>
these bacteria has been confirmed in Prosciutto hams. The FSIS has also shifted their attention to Salmonella in franks and luncheon meats and are currently monitoring these on the basis of a statistical sampling plan. This plan will include Listeria testing later this year. No samples have been contaminated with Salmonella.

In summary, there is a growing industry awareness that meat safety cannot be taken for granted and that even minor deviations in quality will, from time to time, attract national attention. This means the industry will be required to establish a new, higher level of consumer confidence and to find innovative ways of achieving the standards. The Listeria initiative provides some insight into the challenge for the industry.

References


