Session
Food Safety and Inspection IAFI
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RISK ASSESSMENT ON LISTERIA MONOCITOGENS POLICY MANAGEMENT

Giuseppe Scordella*, Roberto Bresolin, Deborah Baldi
and Silva Rubini,
Summary

• Introduction
• *L. monocitogenes*: ID Card & Limits
• Listeriosis
• Regulations
• Conclusions
Introduction

• *L. monocytogenes* is widely distributed in the general environment including fresh water, coastal water and live fish from these areas

• It has been isolated from both domestic and imported, fresh, frozen and processed seafood (crustaceans, molluscs and finfish)
• Highly processed seafood with extended shelflife, at refrigeration temperatures, are able to support *L. monocytogenes* growth

• Lightly preserved products (<6% water-phase salt, pH >5) are involved, such as hot and cold smoked fish products, lightly salted products (caviar, brined cooked shrimp) or marinated seafood
• *Listeria monocytogenes* has been established as an important foodborne pathogen (from 1979)

• Because of the incidence in food related listeriosis outbreaks, *Listeria* is now considered a pathogen of major concern
L. monocitogenes: ID Card
• Gram positive bacteria
• Widespread occurrence
• Sources: soil, vegetation, silage, sewage, humans, animals, water etc
• Serious pathogen
• Able to survive and grow at cold temperature and in moist wet processing environment

(Luber et al., 2011; Sofos, 2006)
• Incubation Period: 7 to 60 day
• Duration of illness: short to long
• Mostly cases sporadic or clusters; some outbreaks
• Noninvasive gastrointestinal: flu-like
• Invasive: abortion, stillbirth, septicemia, sepsis, meningitis, endocarditis, osteomyelitis, pleural infection, peritonitis

(Luber et al., 2011; Sofos, 2006)
• High risk groups: Pregnant women, newborns, immuno compromised, cancer patients, organ transplant recipients, HIV infected, elderly

• Case fatality rate: 20-30%

(Luber et al., 2011; Sofos, 2006)
Limits for *L. monocytogenes* (growth and survival)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Optimal</th>
<th>Survives (without growth)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T (°C)</td>
<td>-1.5 to +3</td>
<td>45</td>
<td>30 to 37</td>
<td>-18</td>
</tr>
<tr>
<td>pH</td>
<td>4.2 to 4.3</td>
<td>9.4 to 9.5</td>
<td>7.0</td>
<td>3.3 to 4.2</td>
</tr>
<tr>
<td>Water activity</td>
<td>0.90 to 0.93</td>
<td>&gt;0.99</td>
<td>0.97</td>
<td>&lt; 0.90</td>
</tr>
<tr>
<td>Salt (%)</td>
<td>&lt;0.5</td>
<td>12 to 16</td>
<td>N/A</td>
<td>≥20</td>
</tr>
</tbody>
</table>

(Todd, 2005)
Listeriosis: main outbreaks

<table>
<thead>
<tr>
<th>Location</th>
<th>Year</th>
<th>Food</th>
<th>Cases</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>1993</td>
<td>Pate (pork)</td>
<td>39</td>
<td>12</td>
</tr>
<tr>
<td>France</td>
<td>1992</td>
<td>Pork tongue in jelly</td>
<td>279</td>
<td>85</td>
</tr>
<tr>
<td>US</td>
<td>1998-2002</td>
<td>Luncheon meats</td>
<td>100</td>
<td>21</td>
</tr>
<tr>
<td>UK</td>
<td>1987-1989</td>
<td>Pate</td>
<td>355</td>
<td>94</td>
</tr>
<tr>
<td>Switzerland</td>
<td>1983-1987</td>
<td>Raw milk cheese</td>
<td>122</td>
<td>31</td>
</tr>
<tr>
<td>Canada</td>
<td>1981</td>
<td>Coleslaw mix</td>
<td>41</td>
<td>17</td>
</tr>
<tr>
<td>New Zealand</td>
<td>1980</td>
<td>Shellfish, raw fish</td>
<td>22</td>
<td>7</td>
</tr>
<tr>
<td>Sweden</td>
<td>1994-1995</td>
<td>Cold smoked trout</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Canada</td>
<td>2008</td>
<td>Deli meats</td>
<td>57</td>
<td>23</td>
</tr>
</tbody>
</table>

(Farber and Peterkin, 2000; Kovacevic et al., 2012)
EU situation

• Human cases of Listeria infection has been relatively stable in the last four years

• Listeriosis had the highest impact among the elderly (>64 years) with the highest confirmed case rates and high mortality

(European Centre for Disease Prevention and Control, 2011)
• Most Listeriosis cases were indigenous (not imported);

• In 2010, 1,601 confirmed cases of Listeriosis were reported by 28 EU countries;

• There seem to be two main peaks in August – September and in January

(European Centre for Disease Prevention and Control, 2011; EFSA Journal, 2012)
Listeriosis in seafood

- Fish and shellfish implicated in disease transmission included processed **ready-to-eat** (RTE)
- Concentration data are available for RTE
- Literature data on Listeria in raw, unprocessed fish, report prevalence of the pathogen, but no information on concentration
• Prevalence of Listeria is often high, while concentrations of bacteria are typically low.

Some examples:

• Eklund et al. (1995) report that on 48 out of 61 samples of USA cold-smoked salmon contained Listeria, its concentration ranged from 0.3 to 34.3 colony forming units (CFU)/g with a mean of 6.2 CFU/g.

(USDA, 2012)
Jorgensen and Huss (1998) show data on **Danish cold-smoked salmon**, where 34 of 64 samples were positive to Listeria, on which:

- 28 of them containing fewer than 10 CFU/g
- 5 samples containing between 10 and 100 CFU/g
- 1 sample containing between 100 and 1,000 CFU/g

(USDA, 2012)
• On smoked fishes in the **German market**, 23 samples (of 380) were positive for Listeria, with:
  – 5 samples containing less than 1 CFU/g
  – 14 samples containing 1 -100 CFU/g
  – 4 samples containing between 100 and 10,000 CFU/g

• Gombas et al. (2003) surveyed eight categories of RTE foods from retail markets in two states of USA, over a 14-23 month period, for presence of *L. monocytogenes*:
  – Total numbers of positive seafood salads and smoked seafood samples were 229 out of 5,090 tested
  – Most samples of all foods had concentrations of the pathogen of less than 10 CFU/g

(EFSA Journal, 2012)
• Furthermore, Johansson et al. (1999) reported that 50% of vacuum-packed smoked fish contained <100 CFU/g

• Inspite of this high number of positive results, the confirmed case rate in EU is 0.35 per 100,000 population, in the 2010

(EFSA Journal, 2012; Jorgensen and Huss, 1998)
### EU Criteria for Listeria in foods

<table>
<thead>
<tr>
<th>Category</th>
<th>Sampling plan</th>
<th>Limits</th>
<th>Where criterion applied</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) RTE foods for infants and SMP</td>
<td>N=10</td>
<td>Absence in 25g</td>
<td>Products in the market</td>
</tr>
<tr>
<td></td>
<td>C=0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2) RTE foods able to support the growth of Listeria, other than (1)</td>
<td>N=5</td>
<td>Absence in 25g</td>
<td>Before it has left the processor</td>
</tr>
<tr>
<td></td>
<td>C=0</td>
<td>100 CFU/g</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N=5</td>
<td></td>
<td>Product in the market</td>
</tr>
<tr>
<td></td>
<td>C=0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RTE foods unable to support the growth of Listeria, other than (1)</td>
<td>N=5</td>
<td>100 CFU/g</td>
<td>Product in the market</td>
</tr>
<tr>
<td></td>
<td>C=0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SMP = special medical purposes

(Regulation EC 2073/2005; Todd, 2005)
Different Regulations

• A different regulatory approach has been recorded in others Countries

• For example:
  – USA, Japan and Malaysia apply zero-tolerance
  – Canada applies an intermediate situation
New challenges

• In 2009, an international group of experts from industry, academia and governments met in Amsterdam to discuss approaches for controlling Listeria in ready-to-eat (RTE) foods

• The workshop involved: Michigan State University, the European Federation of Food Science and Technology and the Global Harmonization Initiative

(Luber et al., 2011)
• There is a need for a risk-based policy with input from all the stakeholders at local and national levels

• A consensus is required for supporting the Codex Alimentarius microbiological criteria for Listeria in RTE foods:
  – following a risk-based approach, differentiate between RTE foods where no growth of the pathogen occurs and those RTE foods where growth is possible

(Codex Alimentarius Commision, 2009; Luber et al., 2011)
Conclusions

• An improvement of controls of Listeria and human Listeriosis is required

• Control measures for Listeria need to address every aspect of the farm-to-fork continuum

• Industries have to:
  – be encouraged to focus on products with highest risk for Listeria contamination and growth,
  – monitoring its control procedures to correct any deviations from GHP, GMP and HACCP
• Most of predictive models have to be based on inoculum studies on food (i.e. Challenge-test)

• A risk-based policy, with input from all the stakeholders, has to be performed and applied

• Countries should enhance risk assessment studies and modelling
• Control measures reported in the Codex Alimentarius Guidelines are generalized

• To be effective they must be applied according a common and unique context to each Country

• Better communication strategies for consumers and other stakeholders have to be improved
• “Zero-tolerance” policy for *L. monocytogenes* occurs in several countries

• This standard can be currently not always achievable for many RTE food products

• Countries should adopt the Codex Guidelines as standards

• The harmonization of standards and Regulations should be improved
Listeria can grow and multiply in certain foods, even if stored under refrigeration.

Information is required on critical points related to possible contamination of food by Listeria.

Determination of an adequate shelf life (by Challenge-test) and correct characterization of the growth potential in RTE foods, are crucial.

Harmonization of regulations is required.
Giuseppe Scordella
Hydra Coop - Institute of Cooperative Research
giuseppe.scordella@hydracoop.it

Roberto Bresolin
STUDIO BIOECO Coop
Institute of Cooperative Research

Silva Rubini, Deborah Baldi
Istituto Zooprofilattico Sperimentale
della Lombardia e dell’Emilia Romagna

Thank you ....