Listeria monocytogenes in smoked salmon

A case study to evaluate the suitability of available Belgian data for exposure assessment

Sigrid Van Boxstael (Scientific Secretariat FASFC),
Scientific Committee FASFC and Scientific Committee Microbiology Working Group
1. Introduction

– FASFC Control program
  • Biological parameters
    – e.g. *Salmonella*, *Campylobacter*, *Listeria monocytogenes*, *Staphylococcus aureus*, *Bacillus cereus*, ....
  • Chemical parameters
    – e.g. dioxins, PCB’s, heavy metals, mycotoxins, ....
  • Animal diseases
    – e.g. tuberculosis, disease of Aujeszky, BSE, ....

– Sci Com case studies:
  • can these data be used for probabilistic exposure assessment/risk assessment?
Microbiological case study:
How suitable are the available Belgian data for exposure assessment of *Listeria monocytogenes* in smoked salmon?
2. Exposure assessment: component of risk assessment

1. Hazard identification
2. Hazard characterization
3. Exposure assessment
4. Risk characterization
2.1. Hazard identification

*Listeria monocytogenes*

- Food pathogen (ubiquitous in the environment)
  - meat products: pâté, filet américain, minced meat
  - soft cheese and milk products
  - ready-to-eat meals
  - smoked fish, salads

- Can multiply at refrigeration temperature:
  - growth possible > – 2 °C ($T_{opt}$: between 30-37 °C)
Human invasive listeriosis

- Severe disease, high mortality (till 30%)
- Food = major vector of infection
- Incubation period after ingestion: ± 20 - 30 days
- 4b, 1/2a en 1/2b, with 4b as most prevalent serotype

- Susceptible groups:
  - Pregnant women
  - Immunocompromised persons
  - Older persons
Evolution of Belgian listeriosis cases

Number of Human *Listeria monocytogenes* cases

<table>
<thead>
<tr>
<th>Year</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>46</td>
</tr>
<tr>
<td>2000</td>
<td>48</td>
</tr>
<tr>
<td>2001</td>
<td>57</td>
</tr>
<tr>
<td>2002</td>
<td>44</td>
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<tr>
<td>2003</td>
<td>76</td>
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<tr>
<td>2004</td>
<td>89</td>
</tr>
<tr>
<td>2005</td>
<td>62</td>
</tr>
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<td>2006</td>
<td>67</td>
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IPH, Institute for Public Health
2.2. Hazard Characterization

- Dose-respons curves, many different models available:

2.3. Exposure assessment

• Probabilistic approach

• Purpose of the exposure assessment = quantitative estimation of the probable intake of *Listeria monocytogenes* by consumption of a portion of smoked salmon

• Two types of information required
  – Level of contamination by *Listeria monocytogenes* on smoked salmon (cfu/g)
  – Portion size of smoked salmon consumed (g)


## Level of contamination by *L. monocytogenes* on smoked salmon

- **DATA Control Program FASFC 2002-2006**

<table>
<thead>
<tr>
<th>Analysis of <em>L. monocytogenes</em> in smoked salmon</th>
<th>Time of analysis</th>
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<tr>
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<td>Production</td>
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- **two different times of analysis**
- **semi-quantitative data**

≥ 0.04 cfu/g

≥ 100 cfu/g
Level of contamination by *L. monocytogenes* on smoked salmon

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- Detection in 0.01 g

| Total number of analysis : | 0 | 209 |
| Number of positives : | / | 10 (4.8 %) |

- two different times of analysis

- semi-quantitative data

> > 0.04 cfu/g

> > 100 cfu/g
Level of contamination by *L. monocytogenes* on smoked salmon

**ASSUMPTIONS on DATA FASFC:**
1) Time of analysis: both end of shelf life
2) Semi-quantitative data $\Rightarrow$ quantitative data
   expert opinion: max. level $10^5$ cfu/g + exponential

![Probability Distribution 'Level of Contamination'](chart.png)
Portion size smoked salmon (g)

- Data Belgian consumption survey 2004 (IPH)
  - Interview of 3245 Belgian citizens on 2 days
  - Classification in different age categories
  - Information on consumption of smoked salmon:

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Portion size smoked salmon (g)

DATA CONSUMPTION (IPH)

Probability distribution 'Portion size'

- 15-59 year
- 59-99 year

Probability (%)

G smoked salmon per portion

0-10
10-20
20-30
30-40
40-50
50-60
60-70
70-80
80-90
90-110
110-130
130-150
150-160

0
10
20
30

Federal Agency for the Safety of the Food Chain
Workshop FASFC Scientific Committee 23 November 2007
Exposure assessment:

Probability distribution of contamination level

Probability distribution of portion size

Monte Carlo Simulation

Probability distribution 'exposure assessment per portion smoked salmon'

cfu $L.\text{monocytogenes}$ per portion smoked salmon

15-59 year

59-99 year
## Exposure assessment: percentiles

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2.4. Risk characterization

- Estimation of the number of listeriosis cases per year due to consumption of smoked salmon per million of immunocompromised people based on:
  - Dose-respons curve
  - Exposure assessment
  - Number of consumed portions smoked salmon per year
2.4. Risk characterization

<table>
<thead>
<tr>
<th>Used Dose-Respons Model</th>
<th>Average number of listeriosis cases per year per million immunocompromised people due to consumption of smoked salmon</th>
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<td>Lindqvist et. al (2000)</td>
<td>40</td>
</tr>
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<td>Buchanan et al (1997)</td>
<td>8</td>
</tr>
<tr>
<td>WHO (2004)</td>
<td>0.5</td>
</tr>
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- Uncertainty is very large
  - Exposure assessment: assumptions (time/semi-quantitative data)
  - Large difference according to the used dose-respons model
- The number of reported cases in Belgium is in the same order of magnitude as the estimates
3. Conclusions

• The purpose of the study:
  – to evaluate the suitability of available Belgian data for exposure assessment: *L. monocytogenes* in smoked salmon

  – Scientific secretariat: acquire experience with probabilistic methodology

• Exposure assessment was performed
  – Large uncertainty
3. Conclusions

• Contamination data suitable?
  – Semi-quantitative + different analysis time
  – Many assumptions required (increases uncertainty)
  – Recommendation to FASFC: quantitative data required

• Consumption data suitable?
  – Data available for different age groups (not < 15 year)
  – OK for use for exposure assessment

• Other data?
  – Information susceptible persons, e.g. number of immunocompromised persons: difficult to acquire
3. Future perspectives

• Scientific Secretariat :
  – Experience with microbiological exposure assessment

• Next steps :
  – Perform exposure assessments for *L. monocytogenes* in different foods
    • New data in the framework of Reg. 2073/2005 : quantitative determination of *L. monocytogenes* at distribution
  – Ranking of different foods according to risk to the consumer
Acknowledgements

• FASFC Scientific Committee

• FASFC Scientific Committee Microbiological Working Group:
  – L. Herman & W. Messens (ILVO)
  – M. Uyttendaele, L. De Zutter, F. Devlieghere (UGent)
  – G. Daube (ULg)
  – K. Dierick (IPH)
  – A. Geeraerd (KULeuven)
  – K. Baert, K. Vereecken, J. Duculot, B. Pochet (FASFC)

• FASFC Scientific Secretariat

• FASFC DG Laboratory

• IPH (Department Epidemiology)