Potential Risk of *Listeria* in Refrigerated Foods with Long Shelf Life

17 September 2014
Listeriosis

• A primarily foodborne disease caused by *Listeria monocytogenes* (*LM*)
  – Most healthy people: asymptomatic or have only flu-like symptoms
  – Pregnant women: miscarriage or stillbirth, or her newborn resulting in septicaemia or meningitis
  – Elderly and immunocompromised individuals: septicaemia and meningitis

• An increasing trend of reported listeriosis in Hong Kong in recent years is noted
Listeria monocytogenes

• Universally found in the environment
  – low levels of LM in food (e.g. < 100 cfu/g) pose very little risk to consumers

• Can be killed under normal cooking temperature and cannot grow at frozen temperature

• Unlike other food poisoning bacteria, it may continue to grow slowly at refrigerated temperature as low as 0°C
Refrigerated Foods with Long Shelf life

• Long shelf life (greater than five days) refrigerated (excluding frozen) ready-to-eat foods are potential high risk items for listeriosis
  – E.g. cheese, smoked seafood, processed meat, salad

• Prolonged storage in refrigerator may allow $LM$ to have sufficient time to grow gradually to exceed 100 cfu/g throughout the shelf life
Refrigerated Foods with Long Shelf life

• The growth of LM in ready-to-eat food can be controlled by various approaches
  – Formulation e.g. pH, Aw
  – Basic cleaning and disinfection programmes
  – Temperature
  – Shelf life etc.

• Some refrigerated food with long shelf life may have adopted these measures to control the growth of LM
Study on High Risk Foods

• Objectives: To assess the microbiological quality, particularly the level of LM, of prepackaged long shelf life refrigerated products at the end of shelf life

• Sampling period: Mid-September 2013 to February 2014

• 100 ready-to-eat samples (cheese, smoked seafood, processed meat and salad)
Laboratory analysis

- Samples were stored in a monitored laboratory refrigerator (4±3°C) until they were ready for testing, i.e. within the week which the sample expired

- Food Safety (If “Unsatisfactory”, potentially injurious to health and/or unfit for human consumption)
  - *Listeria monocytogenes* count

- Hygienic quality
  - Aerobic colony count (ACC) and *Escherichia coli* count
  - Results in this study expressed as colony-forming unit or most probable number
Aerobic colony count (ACC)

- Total number of bacteria found in food; includes those naturally occur and those as a result of contamination

- A quality but not safety indicator
  - High level of ACC does not indicate an immediate risk to public health; however, it may indicate a sub-optimal hygienic conditions and further improvement on the hygienic conditions is required
Escherichia coli

• A commonly used surrogate indicator to reflect the hygienic quality of food

• Indicates direct or indirect faecal contamination

• Substantial number in food suggests a general lack of cleanliness in handling and improper storage
Data analysis

• In general, the results were compared against the respective criteria set out in the local “Microbiological Guidelines for Food” effective in August 2014
  – *E. coli* in cheese (made from raw milk) and *LM* in samples: Referred to other criterion for study purpose
Study Results
Listeria monocytogenes criterion (for this study)

- This study aims to assess if there is any outgrowth of LM in the samples at the end of shelf life, the LM count in each sample was analysed
  - “Unsatisfactory: Potentially injurious to health and/or unfit for human consumption” if the LM count is greater than 100 cfu/g
Results – *Listeria monocytogenes* count

- None of the samples contained excessive *LM* i.e. the count in all samples (n=100) were <20 cfu/g
### ACC criteria (for this study)

<table>
<thead>
<tr>
<th>Food category</th>
<th>Microbiological quality Result (colony-forming unit (cfu/g))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Satisfactory</td>
</tr>
<tr>
<td><strong>Aerobic colony count (ACC) [30°C/48 hours]</strong></td>
<td></td>
</tr>
<tr>
<td>8. Extended shelf life food products requiring refrigeration</td>
<td>&lt;10^6</td>
</tr>
<tr>
<td>Smoked seafood and process meat samples</td>
<td></td>
</tr>
<tr>
<td>12. Fresh fruit and vegetables, products containing raw vegetables</td>
<td></td>
</tr>
<tr>
<td>Salad samples</td>
<td></td>
</tr>
<tr>
<td>13. Fermented, cured and dried meats, fermented vegetables, ripened cheeses</td>
<td></td>
</tr>
<tr>
<td>Cheese samples</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Results – ACC (I)

- 48/ 56 (86%) samples contained ACC <10^8 cfu/g at the end of shelf life

- A smoked fish and 7 processed meat samples contained ACC ranged from 1.7 × 10^8 – 3.9 × 10^8 cfu/g

<table>
<thead>
<tr>
<th>Microbiological results (cfu/g)</th>
<th>Satisfactory</th>
<th>Borderline</th>
<th>Unsatisfactory</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;10^6</td>
<td>10^6- &lt;10^8</td>
<td>≥10^8</td>
</tr>
<tr>
<td>Smoked seafood (n=28)</td>
<td>16</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>Processed meat (n=28)</td>
<td>17</td>
<td>4</td>
<td>7</td>
</tr>
</tbody>
</table>
Results – ACC (II)

• It is expected that samples analysed at the end of shelf life, their ACC may approach the upper “borderline” limit

• Excessive ACC found in the concerned samples indicated possible post-processing contamination e.g. during slicing and/or the length of time and temperature control in storage or facilitates was inadequate to prevent bacterial growth
**E. coli criterion (for this study)**

<table>
<thead>
<tr>
<th>Microbiological quality Result (cfu/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfactory</td>
</tr>
<tr>
<td>&lt;20</td>
</tr>
</tbody>
</table>

- **E. coli** criterion for ready-to-eat food in general does not apply to cheeses made from raw milk; low levels of **E. coli** may be present in raw milk
- UK HPA survey (2012) suggested establishing microbiological criteria including **E. coli** for raw milk cheeses, with the proposed level of **E. coli** ≥100/g
- # In this study, the microbiological quality of cheese made from raw/ unpasteurised milk is considered unsatisfactory if the **E. coli** level was greater than 100 cfu/g
Results – *E. coli* count (I)

- All samples (n=100), except 3 Camembert cheeses, contained *E. coli* count < 20 cfu or MPN/g
  - Excessive *E. coli* in product might be due to the use of raw milk contaminated with *E. coli*

- 1 contained *E. coli* count at 240 MPN/g
Results – *E. coli* count (II)

- 2 contained *E. coli* count > 1,100 MPN/g, but the information on the ingredient list may not clearly indicate the use of raw milk

EU: ‘Camembert de Normandie’ is a lightly-salted soft cheese made from raw milk of Normande cows

Information available from Manufacturer’s website:
Cheeses made from raw milk

- Raw milk can harbour pathogens that can pose serious health risks to consumers; no person shall sell for human consumption any milk or any milk beverage which has not been heat-treated (Cap. 132AQ)
  - does not apply to cheese made from raw milk

- During the production of raw milk Camembert cheese, no specific step has been introduced for the inactivation of microorganisms

- Important for the susceptible population to avoid consuming relevant products made from raw milk by making informed food choices
Labelling of cheeses
(from pasteurised milk or raw milk)

<table>
<thead>
<tr>
<th>Information provided on label</th>
<th>Number of samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pasteurised milk or microfiltered milk</td>
<td>16</td>
</tr>
<tr>
<td>Raw milk or unpasteurised milk</td>
<td>4</td>
</tr>
<tr>
<td>Milk</td>
<td>7</td>
</tr>
<tr>
<td>Fresh milk</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>28</strong></td>
</tr>
</tbody>
</table>

Food and Drugs (Composition and Labelling) Regulations (Cap.132W): prepackaged food shall be legibly marked or labelled with a list of ingredients.
Follow up actions

• Samples with unsatisfactory microbiological quality –
  o Unsatisfactory hygienic quality

• This indicates a need for improvement on the food production and processing

• The CFS gave health advice to relevant premises and took follow-up samples; all follow-up samples were satisfactory
Limitations

• Only 100 prepackaged long shelf life refrigerated ready-to-eat samples were taken, covering selected types of products

• Non-prepackaged products were not covered in this study

• Samples were stored in a monitored laboratory refrigerator at 4±3°C, which may be different from those at home

• Laboratory analysis was conducted within the week which the sample expired, but not exactly on the expiry date
Conclusions

• None of the samples contained excessive LM

• Majority (89%) of the samples was of satisfactory or borderline microbiological quality at the end of shelf life

• Samples with unsatisfactory quality were due to excessive ACC or E. coli count (Both are quality but not safety indicators)
  – Indicate a need for improvement on the food production and processing
  – Three cheeses samples with high E. coli count: This might be due to the use of raw/unpasteurised milk contaminated with E. coli
Advice to public

• Read food labels carefully to make informed food choices

• Follow the storage instructions e.g. "keep in a refrigerator” provided by the manufacturer and avoid cross-contamination

• Do not use food after the "use by" date as shown on the food label
Advice to susceptible populations including pregnant women, the elderly and immunocompromised individuals

• Avoid high risk foods especially refrigerated ready-to-eat foods with long shelf life

• Choose cheeses carefully before consumption
  – Hard and extra hard cheeses are generally safe
  – Avoid soft cheeses such as Feta, Brie, Camembert, blue cheeses (e.g. Danish blue, Gorgonzola and Roquefort)
  – For other types of cheeses, choose only those made from pasteurised milk
  – Do not eat if in doubt

• Cook food thoroughly and consume cooked food promptly after cooking
Advice to trade

• Maintain good food and personal hygiene at all food processing stages

• Provide an adequately refrigerated environment (at or below 4°C) throughout the supply chain

• Provide sufficient information on food label for the consumers to make informed food choices, e.g. indicating raw/ unpasteurised or pasteurised milk used for making cheese products

• Ensure all information provided on food label complies with the legal requirements
For further information

• Risk Assessment Study report

• Food Safety Information: *Listeria monocytogenes* in Cheese Products published in *Food Safety Focus*
Thank you