STEC – a flour milling perspective

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Hot Topics in Microbiology Seminar – Campden BRI
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What is STEC (Shiga toxin-producing \textit{E.coli})?

- \textit{E.coli} occur naturally in intestines of animals of humans.
- STEC refers to strains of \textit{E.coli} that can produce Shiga toxin.
- STEC usually occur in intestines of ruminants such as cattle, sheep and goats. Found in wild birds and vermin too.
- STEC can be found in soil, water and food.
- STEC serotypes which can cause disease in humans referred to as enterohemorrhagic \textit{E.coli} (EHEC). These are the bacteria of most concern.
- STEC infection vary in severity of symptoms:
  - No symptoms
  - Water to bloody diarrhoea
  - Haemolytic-uremic syndrome (HUS)
What is the link to milling?

- STEC can be found in flour. Not just wheat flour, a range of cereal and non-cereal flours too.

- Flour and flour-based raw products implicated in some food poisoning incidents.

- Investigation ongoing in French pizza incident.

<table>
<thead>
<tr>
<th>Year</th>
<th>Country</th>
<th>Product</th>
<th>Serotype(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>USA</td>
<td>'Ready-to-bake cookie dough'</td>
<td>O157:H7</td>
</tr>
<tr>
<td>2016</td>
<td>USA</td>
<td>Flour / dough</td>
<td>O121 and O26</td>
</tr>
<tr>
<td>2016</td>
<td>USA</td>
<td>Baking mix</td>
<td>O157:H7</td>
</tr>
<tr>
<td>2016-17</td>
<td>Canada</td>
<td>Flour</td>
<td>O121:H19</td>
</tr>
<tr>
<td>2017</td>
<td>Canada</td>
<td>Flour</td>
<td>O121</td>
</tr>
<tr>
<td>2019</td>
<td>USA</td>
<td>Flour</td>
<td>O26</td>
</tr>
<tr>
<td>2022</td>
<td>France</td>
<td>Frozen pizza (raw dough)</td>
<td>O103 and O26</td>
</tr>
</tbody>
</table>
### STEC positive rates in flour - various studies / surveys

<table>
<thead>
<tr>
<th>Origin</th>
<th>Monitoring period</th>
<th>Sample number (n)</th>
<th>Flour types</th>
<th>Flours sampled from</th>
<th>Number of mills covered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>2018-19</td>
<td>347</td>
<td>Wheat only</td>
<td>Retail</td>
<td>-</td>
</tr>
<tr>
<td>Germany (2014-17)</td>
<td>2014-17</td>
<td>51</td>
<td>Wheat, rye</td>
<td>Mills</td>
<td>-</td>
</tr>
<tr>
<td>Germany (2018)</td>
<td>2018</td>
<td>328</td>
<td>Wheat, rye, spelt</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Austria (2018)</td>
<td>2018</td>
<td>31</td>
<td>Range of cereals</td>
<td>Mills</td>
<td>Not stated, potentially significant % of UK mills</td>
</tr>
<tr>
<td>Switzerland (2019)</td>
<td>2019</td>
<td>93</td>
<td>Wheat, wheat mixed with other cereals</td>
<td>Retail, bakeries, food service, mills</td>
<td>12</td>
</tr>
<tr>
<td>UK - PHE (2020)</td>
<td>2020</td>
<td>846</td>
<td>Wheat, rye, spelt, non-cereal</td>
<td>Mills</td>
<td>-</td>
</tr>
<tr>
<td>UK - UKFM (2019-21)</td>
<td>2019-21</td>
<td>60</td>
<td>Wheat only</td>
<td>Mills</td>
<td>-</td>
</tr>
</tbody>
</table>
A low positive rate in the UK?

• Wild birds and vermin potential sources of contamination when wheat growing and in storage. But UK farm storage standards very high.

• Manures unlikely to be contamination source for wheat, owing to application timing.

• UK mills are fully enclosed processes and the majority operate 24/7, 364 days a year. Build up in dead spaces minimal.

• Equipment dry cleaned regularly during planned maintenance.

• Mill environmental monitoring has not found pathogens.

• Types of flour being surveyed playing a role?
What is the risk?

• Although the UK positive rate low, a risk exists.
• Flour is a raw ingredient with no sterilisation step.
• Flour a dry product and STEC heat-sensitive.
• Don’t know the US rate, but STEC in flour has led to food safety incidents there.
• Different cultural practices contributing?
• Over 2020/21, UK millers added advisory labelling to flour, mixes and raw flour-based products, e.g. doughs. Branded and own-label.

‘Flour is a raw ingredient and must be cooked or baked before consumption.’
What next?

- Cultural differences significant, but could be other risk factors?
- Is updated FSA guidance needed?
- US FDA/CDC ran a public information campaign alongside label changes. Run something similar in the UK?
Knowledge gaps / further research

• Follow up with mills that find positive results. Look at wheat and mill itself. Difficult thus far as so few positives have been found.

• Better understanding of UK consumer behaviour so guidance covers all bases?

• Developments in flour sterilisation technology?

• Raw doughs more of a risk?

• Cheaper / faster testing?
Concluding remarks

• STEC can be found in flour, although UK flour appears to have a much lower incidence than other countries, and food safety incidents linked to STEC in flour have not been seen here.

• UK farm storage and mill hygiene standards are high. Our low rate means it is difficult for follow-up investigation as we’re not finding many positive results.

• Flour products carry advisory labelling, but consumers may need better guidance on handling flour, mixes and doughs at home.

• Still a number of knowledge gaps that need to be addressed. UKFM and our members happy to collaborate!
Thank you

Any questions?

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