Baseline data from a Belgium-wide survey of *Campylobacter* spp. contamination in chicken meat preparations

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• **Contents:**
  – Introducing *Campylobacter*
  – 2007 survey of *Campylobacter* in Belgian chicken meat preparations:
    • *Why we did it?*
    • *How we did it?*
    • **RESULTS: Baseline data**
  – Conclusions

• **Campylobacter**:
  – Gram-negative
  – Microaerobic
  – Thermophilic (e.g. *C. jejuni*)
  – Thin, spiral
  – Highly motile

  – Colonizes avian caecum
  – Cause diarrhoea in humans, mammals
- Campylobacteriosis remains since 2005 the most frequently reported zoonotic disease in humans.
- The incidence in Flanders, especially in the province Antwerp, is twice as high as compared to Wallonia.

Weekly number of cases of Campylobacter in 2006, Belgium.
Source: Sentinel Laboratory Network

- Cases are reported during the entire year, with a peak in the summer.
- Campylobacter isolation rates are higher in the group of children below 5 years of age.
Sources of *Campylobacter* infection:
- barbecue
- contact with pets or other animals
- overseas travel
- cross-contamination in kitchen
- **poultry meat (important source):**
  - Case-control studies
  - Epidemiological evidence
    - Belgium: 40% reduction in *Campylobacter* infections during dioxin crisis
  - Outbreak data:
    - More than 80 employees eating chicken salad in a canteen (Denmark, 2005)
  - FAVV: “The rate of *Campylobacter* positive poultry samples in Belgium is high, but stable” !!!!
Aim of the work:

- To generate prevalence and count data on *Campylobacter* contamination in chicken meat preparations in Belgium.

- To evaluate the impact of certain processing-related variables on *Campylobacter* risk profile (Imca Sampers).
Sampling plan:

► Target product:
- Meat preparations based on chicken meat, from Belgian raised chicken flocks:
  - Portioned, cut or minced meat intended to undergo a heat treatment before consumption. Presented as seasoned, marinated, coated, with herbs and spices, or other ingredients are added to improve sensory properties or texture.
  - Also satés of chicken meat, marinated and spiced chicken wings = intact structure either with or without skin.

► Sampling point:
- Chicken meat industry level
  - Targeting the supply of majority (>85%)
  - Allow sampling in combination with processing audit

Sampling frame:

Companies selection was based on targeted sample in accordance with the EFSA guidelines:

- 11 companies across Belgium, distributed in a way that allows visiting equally over randomised sampling days each month;
- The big, medium and small companies supplying more than 85% of the Belgian distribution chains;
- Sampling from different batches of portioned and minced products, and from different preparations types;
- Year-around (Feb to Nov) survey to avoid seasonality bias.

Geographical distribution of companies (n=61) included in the Belgian chicken meat preparation survey (11 selected factories, February to May 2007).
Microbiological testing

- Measurement uncertainty for the method used was estimated during the 1st phase of the project.

Performance characteristics and estimation of measurement uncertainty of three plating procedures for *Campylobacter* enumeration in chicken meat

I. Habibi*, I. Sampers±, M. Uyttendaele±, D. Berkhoven, L. De Zutter*

- 656 samples over the period from Feb to Nov 2007:
  - Quantitative and qualitative detection in parallel.
  - Microbiological testing based on the ISO method and the EFSA recommendations.
  - PCR confirmation instead of biochemical tests.

SURVEY RESULTS
**Overview of Campylobacter spp. contamination in tested samples**

- **Variation in Campylobacter spp.**
  - **48.02% (315/656)**
    - of the Belgian chicken meat preparations samples were tested positive for *C. jejuni* and *C. coli*
  - **58.99%** were less than 10 CFU/g.
  - The average count was **1.68 log10 CFU/g** with a standard deviation of ± 0.64 log10 CFU/g.

**[A] Overview of Campylobacter spp. contamination in tested samples**

![Diagram](image)

- **Frequency**
  - **29.4%** ± 10 to < 100 CFU/g
  - **11.63%** > 100 CFU/g

<table>
<thead>
<tr>
<th>Id</th>
<th>No. sampled</th>
<th>Total positive no. (%)</th>
<th>Mean (log10 CFU/g) ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>54</td>
<td>18 (34.62)</td>
<td>1.39 ± 0.40</td>
</tr>
<tr>
<td>B</td>
<td>38</td>
<td>29 (76.32)</td>
<td>1.62 ± 0.45</td>
</tr>
<tr>
<td>C</td>
<td>52</td>
<td>35 (67.31)</td>
<td>1.76 ± 0.68</td>
</tr>
<tr>
<td>D</td>
<td>79</td>
<td>67 (84.81)</td>
<td>1.86 ± 0.54</td>
</tr>
<tr>
<td>E</td>
<td>70</td>
<td>38 (54.29)</td>
<td>1.50 ± 0.58</td>
</tr>
<tr>
<td>F</td>
<td>43</td>
<td>4 (8.89)</td>
<td>1.25 ± 0.44</td>
</tr>
<tr>
<td>G</td>
<td>70</td>
<td>25 (35.71)</td>
<td>1.27 ± 0.48</td>
</tr>
<tr>
<td>H</td>
<td>45</td>
<td>8 (17.78)</td>
<td>1.27 ± 0.38</td>
</tr>
<tr>
<td>I</td>
<td>77</td>
<td>45 (58.44)</td>
<td>1.67 ± 0.63</td>
</tr>
<tr>
<td>J</td>
<td>77</td>
<td>25 (32.47)</td>
<td>1.72 ± 0.67</td>
</tr>
<tr>
<td>K</td>
<td>51</td>
<td>21 (41.18)</td>
<td>2.21 ± 1.08</td>
</tr>
</tbody>
</table>

- **Producer [D]** is by far the most significant (P value <0.0001) in providing Campylobacter contaminated samples.
- **Producer [F]** were remarkably the lowest.
- **[D],[B],[C]**: the three producers with the most significantly higher incidence were also the most significantly higher for Campylobacter counts among their tested products.

**[B] Variation in Campylobacter spp. contamination between producers**

![Diagram](image)

- All producers provided **Campylobacter positive samples**
In biological terms, portioned form products are associated with higher probability (Odds Ratio (OR)=1.7; P value= 0.002; 95% CI: 1.2-2.5) of a sample being positive for Campylobacter.

Incidence of Campylobacter in marinated and seasoned products was higher compared to other preparations.
- Significantly higher count ($P$ value = 0.002) was associated with chickens *wings* with mean count 2.21 log10 CFU/g.

- There was no notable difference between various preparation types (marinade, seasoning sauce, and coated (e.g. with herbs, cheese, etc) on *Campylobacter* concentration.

There was a gradual increase, however not statistically significant, in the number of *Campylobacter*-positive samples during May and June. This increase became statistically significant ($OR=4.0; P= 0.007$ in July. There was no significant change in *Campylobacter* counts over sampling months.
[E] Effect of direct culture versus selective enrichment on the isolation of Campylobacter from chicken meat preparations

Distribution of 315 Campylobacter + samples according to culture method:
- Direct culture: 156
- Enrichment culture: 113, 46

- 41.0% detected by direct plating compared to 24.2% by selective enrichment

- Very positive statistical relation (logistic regression analysis, $P$ value $< 0.0001$), indicating that the likelihood of obtaining positive result by selective enrichment increases with the increase of Campylobacter concentration in the sample.

- With lower Campylobacter concentration the likelihood of obtaining positive result using selective enrichment is declining compared to direct plating.

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[F] Using a Bayesian modelling approach to predict the true prevalence, in view of the imperfect sensitivity of detection methods

- Prior: What we knew before
- Likelihood: What the data tells us
- Posterior: What we know now
Conclusions and Recommendation

- Almost **HALF** of the Belgian made chicken meat preparations are positive for **Campylobacter**.
  - What about flock prevalence and bio-security level at farm??!!
  - Slaughter hygiene??!!

- The present survey provides the first representative quantitative data on chicken meat preparations in Belgium (and one of very few available over Europe).

- Our study shows that there is a **variability** in **Campylobacter** contamination level among different companies and that is evident quantitatively and qualitatively.

- Sensitivity of detection by enrichment becomes lower as the initial concentration of **Campylobacter** decrease; For the case of chicken meat preparations products combination of direct and enrichment culture is **recommended**.
Campylobacter should be a priority food safety matter

- High Campylobacter prevalence: more consumers are exposed to the foodborne illnesses.
- It may not be correct to assume that gastrointestinal infection risk of Campylobacter is low because of the low counts.
- Theoretically, the consumer risk of rare conditions like Guillain-Barré syndrome might be higher in view of the C. jejuni high prevalence.

Industry + Science + Food authorities...
Need to work together against Campylobacter risk in chicken-meat chain.

This case is not in Belgium, but we do not like to see this young girl in Belgium!!

Thank you