Measures to control Campylobacter in broilers and broiler meat
Interventions to control Campylobacter in the broiler production

Report of an International Expert Consultation
Copenhagen, Denmark, 26-27 November 2007

Report of Expert Consultation

www.vet.dtu.dk/
Default.aspx?ID=8561
Talk outline

• Recommendations from an Expert Consultation on interventions to control Campylobacter in the broiler production
  – pre-slaughter measures
  – at-slaughter measures
  – post-slaughter measures

• Experiences from EU countries which have implemented interventions
  – implemented interventions
  – changes in prevalence of broiler flocks
  – changes in number of human cases

• Conclusions
Thanks to

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Aim of expert consultation

• to provide information and recommendations on the most useful interventions in the broiler production for reducing the human exposure to *Campylobacter*

• to facilitate and guide the decision-making for a new Danish five-year action plan for *Campylobacter* in broilers and broiler meat
Experts were asked

- To identify and discuss the pros and cons of different intervention methods, before, at and post slaughter
- To evaluate interventions in terms of effect, cost, applicability, and consumer acceptability
- To prioritise and evaluate the interventions they believed to be most useful under Danish conditions

The conclusions of the expert consultation are, therefore, not necessarily applicable in other countries where the *Campylobacter* prevalence in broilers is different to that of Danish broilers or where different legislation applies, e.g. legislation on the use of chemical decontaminants.
Interventions before slaughter

- Two categories relating to **mechanism**
  
  1. Interventions aimed at preventing flocks from being colonized
  
  2. Interventions aimed at reducing the concentration of Campylobacter in the broiler chicken gut after colonization
## Interventions before slaughter

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Prevents colonization of flocks</th>
<th>Reduces concentration in gut</th>
<th>Ready to implement</th>
<th>Needs further development</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biosecurity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farm/farmer hygiene</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Environment around broiler houses</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Insect control (fly screens)</td>
<td>+</td>
<td>-</td>
<td>(+)</td>
<td>+</td>
</tr>
<tr>
<td><strong>Slaughter broilers young</strong></td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td><strong>Thinning</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Drinking water / feed additives</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organic acid, bacteria, caprylic acid, probiotics, fatty acids, ...</td>
<td>+/-</td>
<td>+</td>
<td>+/-</td>
<td>+</td>
</tr>
<tr>
<td><strong>Phage therapy</strong></td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td><strong>Bacteriocins</strong></td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td><strong>Vaccination</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Genetic resistance - broiler breeds able to clear campy</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td><strong>Water supply quality</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(chlorinated, UV)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Reduced presence of other animals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Interventions before slaughter - given a high score

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biosecurity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farm/farmer hygiene</td>
<td>Applicable, efficient, low costs</td>
<td>Consistent compliance?</td>
</tr>
<tr>
<td>Environment around broiler houses</td>
<td>Good effect – if other biosecurity measures are in place, relatively low costs</td>
<td>No guarantee of free flocks</td>
</tr>
<tr>
<td>Insect control (fly screens)</td>
<td></td>
<td>Not commercially available</td>
</tr>
<tr>
<td><strong>Slaughter broilers young</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(31-33 days)</td>
<td>Applicable</td>
<td>Relatively costly</td>
</tr>
<tr>
<td></td>
<td>Effective in Iceland</td>
<td>Not always possible if a special size is required</td>
</tr>
<tr>
<td><strong>Thinning</strong> – hygiene precautions by catchers</td>
<td>Production more profitable Possibility of different bird sizes</td>
<td>Difficult to thin without causing breach of biosecurity</td>
</tr>
</tbody>
</table>
Interventions before slaughter - given a low score

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<thead>
<tr>
<th>Intervention</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drinking water / feed additives</td>
<td>Easy to apply</td>
<td>No clear indication that these work efficiently</td>
</tr>
<tr>
<td></td>
<td>Relatively cheap</td>
<td>May need legal changes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Needs further investigation</td>
</tr>
<tr>
<td>Organic acid, bacteria, caprylic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>acid, probiotics, fatty acids, ...</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phage therapy</td>
<td>Documented effect</td>
<td>Reduction of Campylobacter may be short lived – development of resistance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Needs further development</td>
</tr>
<tr>
<td>Bacteriocins</td>
<td>Documented effect</td>
<td>Needs legal changes</td>
</tr>
<tr>
<td></td>
<td>under experimental</td>
<td>Needs further investigation</td>
</tr>
<tr>
<td>conditions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vaccination</td>
<td>Could be good</td>
<td>Needs investigation</td>
</tr>
<tr>
<td>Genetic resistance – broiler breeds</td>
<td>Could be good</td>
<td>Needs investigation</td>
</tr>
<tr>
<td>able to clear campy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water supply quality</td>
<td>Documented effect</td>
<td>Difficult to maintain</td>
</tr>
<tr>
<td>(chlorinated, UV)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduced presence of other animals</td>
<td>Evidence that it is a risk factor</td>
<td>Difficult to change on current farms, but relevant in relation to location and design of new farms</td>
</tr>
</tbody>
</table>
Interventions before slaughter - prioritized interventions

- Biosecurity measures in and around farms
- Fly screens
- Improved procedures re thinning of flocks
Biosecurity – farm/farmer hygiene

Ante-room

Empty period, proper cleaning
Biosecurity – environment around broiler houses

Vegetation free zone
Drained zone
Dust free zone
Biosecurity – insect control, fly screens
% *Campylobacter* positive flocks at slaughter
June - November 2003-5 and 2006

Hald et al. 2007
Interventions at slaughter

- Two categories:

1. **Hygienic measures** - interventions aimed at reducing fecal contamination (GMP)

2. **Decontamination** - interventions aimed at reducing the concentration on carcasses
   - **Chemical** (acidified sodium chlorite, chlorine, chlorine dioxide, trisodium phosphate, cetylpyridinium chloride, ozone, and peroxy acids)
   - **Physical** (freezing, crust freezing, steam-ultrasound, steam/hot water, forced air chilling, heat treatment, irradiation)
# Interventions at and after slaughter - given a high score

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
</table>
| **Scheduled slaughter** followed by decontamination of positive flocks or production of safe to handle products (e.g. oven-ready or ready-to-eat) | Proven effect  
May be based on past performance to limit testing  
Production of safe to handle products may be cheap | Pre-slaughter testing, expensive, needs a low prevalence  
Needs a marked |
| **Physical decontamination that leaves the meat fresh** | Fairly effective, relatively low costs  
Limited effect, may be combined with other methods  
Limited effect, may be combined with other methods  
Fairly effective | New equipment  
Needs further development  
Relatively expensive  
Relatively expensive  
Difficult to achieve success i.e. reduction while still maintaining product quality |
| Steam-ultrasound  
Crust freezing  
Forced air chilling  
Steam or hot water | May be effective and cheap  
Only for a limited production - needs a marked  
More research needed | |
# Interventions at and after slaughter - given a low score

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevention of fecal leakage</td>
<td>May be effective (CARMA)</td>
<td>No equipment developed</td>
</tr>
<tr>
<td><strong>Chemical decontamination of all carcasses</strong></td>
<td>Effective, relatively cheap</td>
<td>Needs consumer acceptance Substances needs approval and authorization</td>
</tr>
<tr>
<td>Physical decontamination of all positive flocks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freezing</td>
<td>Effective</td>
<td>Not fresh meat, expensive Risk of marked distortion (opening to imports)</td>
</tr>
<tr>
<td>Heat-treatment</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Name and shame - publicity exposing producers and companies, who produce/sell highly contaminated products</strong></td>
<td>Used in DK (case-by-case risk assessment), seems fairly effective Transparency</td>
<td>Expensive – many batches controlled</td>
</tr>
<tr>
<td>Consumer information -- labeling about Campy</td>
<td>Cheap</td>
<td>Efficacy uncertain Effect minimal</td>
</tr>
<tr>
<td>Information on hygiene</td>
<td>Relatively cheap</td>
<td></td>
</tr>
<tr>
<td>Logistic slaughter -- to avoid contamination from positive to negative flocks</td>
<td>Incentive for the industry to do something</td>
<td>Minimal effect, not feasible, expensive</td>
</tr>
<tr>
<td>Physical decontamination of all carcasses</td>
<td>Very effective</td>
<td>Strong consumer resistance Expensive</td>
</tr>
<tr>
<td>Irradiation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Interventions at and after slaughter - prioritized interventions

- Channeling of flocks based on Campy history of producers to
  1. decontamination by methods that keep the meat fresh, chilled
  2. Safe to handle products

- Education, especially of children
### Implemented interventions in EU countries

EFSA Zoonosis report 2007 - Focus of the year

**Table 2. Specific measures within countries with *Campylobacter* control strategies, 2006**

<table>
<thead>
<tr>
<th></th>
<th>DK</th>
<th>FI</th>
<th>LT</th>
<th>ES</th>
<th>SE</th>
<th>UK</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandatory (+/-)</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>N.S.</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

**Control measures**

**FARM**

- **Biosecurity**
  - ✓
  - ✓
  - ✓
  - ✓
  - ✓
  - ✓

- **Personal hygiene**
  - ✓
  - ✓
  - ✓
  - ✓
  - ✓
  - ✓

- **Buildings**
  - ✓
  - ✓
  - ✓
  - ✓
  - ✓
  - ✓

- **Environment**
  - ✓
  - ✓
  - ✓
  - ✓
  - ✓
  - ✓

- **Treatment of drinking water**
  - +
  - +
  - +
  - ✓
  - +
  - +
  - ✓

- **Feed additives**
  - ✓
  - +
  - ✓
  - ✓
  - ✓
  - ✓

**ABATTOIR**

- **Logistic slaughter**
  - ✓
  - ✓
  - ✓
  - +
  - +
  - +

- **Freezing of meat from positive flocks**
  - ✓
  - +
  - +
  - N.S.
  - +
  - +
  - ✓

- **Heat treatment of meat from positive flocks**
  - +
  - +
  - ✓
  - ✓
  - +
  - +

- **Improved GHP³**
  - +
  - +
  - ✓
  - ✓
  - ✓
  - ✓

- **Removal of faecal contamination**
  - +
  - ✓
  - ✓
  - N.S.
  - +
  - ✓
  - ✓

- **Use of chemicals**
  - +
  - +
  - ✓
  - ✓
  - +
  - +

**RETAIL**

- **Labelling**
  - +
  - +
  - +
  - +
  - ✓
  - ✓

- **Leak-proof packaging**
  - ✓/+  
  - ✓
  - ✓
  - ✓
  - ✓
  - ✓/+  

**CONSUMERS**

- **Education**
  - ✓
  - ✓
  - ✓
  - ✓
  - ✓
  - ✓
  - ✓
Broiler flock prevalences

EFSA Zoonosis report 2007

- **Denmark**: The percentage of positive broiler flocks shows a steady decline from 40% in 2002 to approximately 15% in 2006.

- **Sweden**: The percentage of positive broiler flocks starts at 25% in 2002 and decreases to around 15% in 2006.

- **Finland**: The percentage of positive broiler flocks remains relatively stable, with a slight increase from 5% to 7% over the years.

- **Norway**: The percentage of positive broiler flocks decreases from 7% in 2002 to 3% in 2006, with a slight increase in 2005.
Campylobacter in broiler meat at two largest Danish processing plants

% positive samples above 10 cfu/g

Year

2004 2005 2006 2007
Numbers of human Campylobacter infections
EFSA Zoonosis report 2007
Hypothesis of positive effect in Denmark

Economical incentives

- Rewarding farmers for compliance with industry code of practice
- Rewarding farmers for delivering Campylobacter free flocks
Conclusion

With the control measures available:

It is possible to reduce (not eliminate) the occurrence of Campylobacter in broilers and broiler meat

And to reduce (slightly) the numbers of human Campylobacter infections
The Icelandic experience
figure borrowed from Sigurborg Dadadottir

Comparison between poultry meat consumption and domestic human Campylobacter cases 1990 - 2006

- Poultry meat per inhab.
- Chicken meat per inhab.
- Human Dom Campy-cases

Kg poultry meat per inhabitant per year
No. of Human Dom Campy/cases/100,000 inhab.
Thank you for your attention!

_Bon appetit!_