Enumeration of *Salmonella* in Ground Meat and Poultry as a Means to Protect Public Health

A Discussion
June 19, 2013

**Objectives**

- To discuss how reducing the actual levels of *Salmonella* (measured by enumeration) in ground meat and poultry products will reduce the number of illnesses associated with these products irrespective of serovar.
- To encourage enumeration options as a means to measure food safety program effectiveness.
- Identify research gaps.

**BACKGROUND**

Salmonellosis in the United States

Foodborne Illness Outbreaks in Different Commodities 2001-2010

Source: Center for Science in the Public Interest, 2013
Salmonella Performance Standards

- 1996 FSIS defined the standard as the number of samples within a sample set that can test positive for generic Salmonella (N varies by commodity)
- Qualitative standard (presence or absence)
- Defined by FSIS baselines (measured process capability)

Performance Standards and Prevalence

<table>
<thead>
<tr>
<th>Product</th>
<th>Original Salmonella Performance Std</th>
<th>Updated Salmonella Performance Std</th>
<th>% positive: 2010 Data 29,734 samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground Chicken</td>
<td>44.6%</td>
<td></td>
<td>18.8%</td>
</tr>
<tr>
<td>Broilers</td>
<td>20%</td>
<td>9.8%</td>
<td>6.7%</td>
</tr>
<tr>
<td>Ground Turkey</td>
<td>49.9%</td>
<td>10.2%</td>
<td></td>
</tr>
<tr>
<td>Turkeys</td>
<td>NA</td>
<td>7.1%</td>
<td>4.6%</td>
</tr>
<tr>
<td>Market Hog</td>
<td>8.7%</td>
<td>2.4%</td>
<td></td>
</tr>
<tr>
<td>Ground Beef</td>
<td>7.5%</td>
<td>2.2%</td>
<td></td>
</tr>
<tr>
<td>Cow/bull</td>
<td>2.7%</td>
<td>0.5%</td>
<td></td>
</tr>
<tr>
<td>Steer/heifer</td>
<td>1%</td>
<td>0.1%</td>
<td></td>
</tr>
</tbody>
</table>

[1](http://www.fsis.usda.gov/PDF/Serotypes_Profile_Salmonella_2010.pdf#page=98), Table 7 (turkey), table 5 (beef), table 6 (chicken), 2010 data

Outcomes

- Provided useful information when first implemented
- An improvement in establishments meeting performance standard criteria
- Overall industry prevalence rates below performance standard criteria
- Meat and poultry are still contributors to salmonellosis

How do we move forward?
Hypothesis

- The risk of foodborne illness is influenced by the concept of infectious dose; that is, the consumption of different levels of Salmonella is correlated with different probabilities of illness.

- Reducing the actual levels of Salmonella in ground meat and poultry will reduce the number of illnesses associated with these products irrespective of serovar.

- A heightened focus on enumerating samples of ground meat and poultry and ascertaining the number of Salmonella that are present in a given sample, versus relying solely on the qualitative approach of prevalence, will allow for a food safety system more capable of ensuring food related illness, and provide for better public health protection.

Hypothesis - Objections

- How can there be a safe level defined?
- What about the susceptible human population?
- Some serovars are more likely to cause illness than others.
- Isn’t the relationship between prevalence and level correlated?
- Enumeration methodologies are difficult and expensive.

Therefore: the only way to regulate is with prevalence.

Model


“Plants with higher average contamination levels and/or higher variation in levels between batches contribute the most to consumer risks and reducing (variation in) contamination in these plants has the highest impact [on public health].”

CASE STUDY: PREVALENCE VS. LEVELS

Average Salmonella MPN and Daily Prevalence in Ground Turkey

Case Study: Use of Enumeration in Control Programs

- High Pressure Processing (HPP) product line.
- Raw material: known to have higher prevalence rate and levels of Salmonella.
- HPP
  - Validated for 3-4 log destruction in inoculation trials.
  - Does reduce prevalence rate but does not achieve zero
  - Should the success of an intervention like HPP be based solely on qualitative data?
- Proposal: Validate control point to consistently achieve low level of Salmonella.
Using Enumeration in Control Programs

- Validation trial
- 100 data points
- Validate reduction to point below critical level
- Critical control points: HPP time, temperature, pressure

Results

- Mean values dropped from 1.32 log to 0.40 log
- Variance dropped from 9.2 log to 2.8 log
- Number above 1.0 CFU/gram: 19.7% to 4.8%
- Prevalence rate dropped from 69% to 54%

Conclusion

- HPP is a validated intervention for the reduction of high levels of Salmonella (counts >1.0 CFU/gram)

Research Needs

- Enumeration of samples to establish how widely the levels of Salmonella in ground meat and poultry products vary;
- Understanding the factors that result in the high levels and/or higher variation of Salmonella in the product;
- Understanding and characterizing treatments that result in the elimination or significant reduction of Salmonella in ground meat and poultry products;
- Increased development of enumeration methods;
- Increased knowledge on infectious dose and risk modeling.

Summary Comments

- Ultimately the hypothesis can be supported.
- Continue to collect the data to overcome the objections.
- Further discussion should take place on how to most effectively use Salmonella enumeration data in meat and poultry control programs.
- Control programs and supply chains that focus on achievement of consistently low levels of Salmonella are an effective means of managing risk.