Poultry Processing Food Safety Update-Campylobacter

Scott M. Russell, Ph.D.
Department of Poultry Science
The University of Georgia

Campylobacter

- Campylobacter are bacteria that are spiral-shaped and may cause disease in humans and animals
- Campylobacter jejuni is the main species of concern
- Campylobacter jejuni grows best at the body temperature of a bird, and seems to be well adapted to birds, who carry it without becoming ill
- These bacteria are fragile
  - They cannot tolerate drying
  - May be killed by oxygen
- They grow only in low oxygen, high CO2 environments
- Freezing chicken reduces their number

Campylobacteriosis

- Campylobacteriosis is an infectious disease caused by Campylobacter
- Most people who become ill with campylobacteriosis get diarrhea, cramping, abdominal pain, and fever within two to five days after exposure to the organism
- The diarrhea may be bloody and can be accompanied by nausea and vomiting
- Illness typically lasts one week
- Some infected people do not have any symptoms
- Implicated in Guillain-Barre Syndrome (CDC)

Campylobacter

- “Many chicken flocks are silently infected with Campylobacter; that is, the chickens are infected with the organism but show no signs of illness. Campylobacter can be easily spread from bird to bird through a common water source or through contact with infected feces. When an infected bird is slaughtered, Campylobacter can be transferred from the intestines to the meat. More than half of the raw chicken in the United States market has Campylobacter on it.” (CDC)

Campylobacteriosis

- Campylobacteriosis is an infectious disease caused by Campylobacter
- Most people who become ill with campylobacteriosis get diarrhea, cramping, abdominal pain, and fever within two to five days after exposure to the organism
- The diarrhea may be bloody and can be accompanied by nausea and vomiting
- Illness typically lasts one week
- Some infected people do not have any symptoms
- Implicated in Guillain-Barre Syndrome (CDC)

Campylobacter

- Campylobacteriosis is an infectious disease caused by Campylobacter
- Most people who become ill with campylobacteriosis get diarrhea, cramping, abdominal pain, and fever within two to five days after exposure to the organism
- The diarrhea may be bloody and can be accompanied by nausea and vomiting
- Illness typically lasts one week
- Some infected people do not have any symptoms
- Implicated in Guillain-Barre Syndrome (CDC)

Campylobacter

- A study was conducted on chicken in supermarkets in Minnesota where inspectors purchased chicken throughout the St. Paul/Minneapolis area to cover a variety of supermarket types, from big chains to mom-and-pop stores
- Prior surveys showed Campylobacter contamination on fresh chicken between 40 and 60 percent
- However, in the Minnesota study, they found that 88% were contaminated
- In USDA-ARS studies, more than 90% of poultry tested positive for Campylobacter, in levels ranging from one cell to over a million cells per bird

Campylobacter

- Campylobacteriosis is an infectious disease caused by Campylobacter
- Most people who become ill with campylobacteriosis get diarrhea, cramping, abdominal pain, and fever within two to five days after exposure to the organism
- The diarrhea may be bloody and can be accompanied by nausea and vomiting
- Illness typically lasts one week
- Some infected people do not have any symptoms
- Implicated in Guillain-Barre Syndrome (CDC)
Why?

Salmonella prevalence by week in live broilers

Salmonella is cycling down in the flock at catch

Difference in the two bacteria

- Chickens enter the plant with:
  - 40% chance of having *Salmonella*, but at low levels
  - 76% chance of having *Campylobacter*, but at VERY HIGH levels (> 1,000 Campy per mL of rinse)

Campylobacter prevalence by week in live broilers

New *Campylobacter* Regulation

- “*Campylobacter* performance standards and sample set criteria for tracking and reporting to establishments will be applied to results from the smaller of the two laboratory *Campylobacter* sample portions (1 mL), which detects higher levels of contamination, making the performance standards 10.4 percent for young chickens”
Why would USDA-FSIS enact a new regulation for Campy?

- *Campylobacter* is one of the most common causes of diarrheal illness in the United States
- 13 cases are diagnosed each year for each 100,000 persons in the population
- Many more cases go undiagnosed or unreported, and campylobacteriosis is estimated to affect over 2.4 million persons every year, or 0.8% of the population
- Campylobacteriosis occurs much more frequently in the summer months than in the winter
- Although *Campylobacter* does not commonly cause death, it has been estimated that approximately 124 persons with *Campylobacter* infections die each year (CDC)

**Conclusion:**

Chicken is the main culprit for campylobacteriosis

**Campylobacter in Europe**

![Graph showing the occurrence of Campylobacter in Europe](Graph)

**Campylobacteriosis in Europe**

![Graph showing the trend of campylobacteriosis in Europe](Graph)

**Campylobacteriosis in Europe is trending upward**

![Graph showing the percentage of Campylobacter positive broiler carcasses exiting the chiller in the U.S., European Union, Australia](Graph)

**Viljugrein et al. 2010**
Different from Salmonella

- Because the European model targets a specific pathogen (Salmonella) and efforts are made in the field to eliminate it, these efforts have NO impact on Campylobacter.
- Vaccines for Salmonella and competitive exclusion cultures designed to control Salmonella have little effect on Campylobacter.
- This means that the enormous cost associated with efforts to control Salmonella will have to be doubled and adjusted for Campylobacter.
- No cost-effective field interventions exist for Campy.

Campy is different than Salmonella

- Campylobacter-specific antibody response is slow in chickens because Campy infection in chickens does not cause a strong inflammatory response or tissue damage in the intestine.
- It is still largely unknown how Campylobacter interacts with the chicken immune system to trigger the immune response.
- Campy has been isolated from the spleen, liver, and blood in young chickens, thus, it may invade intestinal epithelial cells and become systemic.
- There seems to be a mechanism Campy uses to escape rapid clearance through short-term epithelial invasion and evasion, combined with fast replication in the mucus.

Processing Interventions

- After developing the graph, adjust each system until it is effective in REDUCING Campylobacter.
- Chemicals will eliminate Campylobacter from chickens.
- 10 ppm free available chlorine can eliminate Campylobacter in 120 minutes.
- 30 ppm free available chlorine can eliminate Campylobacter in 6 minutes.
- 50 ppm free available chlorine can eliminate Campylobacter from the water in 3 minutes.

Processing Intervention

- Use the biomapping technique to determine how each process is able to impact Campy levels.
- Very few companies do this currently.
- All birds MUST BE from the SAME FLOCK.
- Flock variance is greater than bird to bird variance.
- Develop the following graph for your plant.
Processing Interventions

• Sounds easy, doesn't it?

• The problem is:
  − You are trying to make as many chickens have ZERO Campy as possible
  − You can eliminate 3 logs of Campy and still be positive (not have any effect on prevalence)
  − That is LYSOL efficacy on a kitchen counter!!

• That is why multiple interventions are necessary

Conclusions

• Campylobacter is a significant source of food-borne illness in the U.S. and is causing a CRISIS in Europe, Australia, and New Zealand

• No cost effective field interventions exist for Campy

• Great effort should be made at the plant to biomap Campy and make adjustments to control it through each process

• It will be difficult for poultry companies to meet or exceed the new USDA-FSIS standard for Campy at 10.4% positive

• If FSIS continues to lower the standard, the industry may not be able to meet the standard

• Multiple interventions are still rare and should be implemented much more frequently

• The cost of these interventions is currently VERY difficult to stomach because of grain prices