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Preventing Foodborne Illness: Campylobacteriosis[1]

Soohyoun Ahn, Renée M. Goodrich-Schneider, and Keith R. Schneider[2]

This is one in a series of fact sheets discussing common foodborne pathogens of interest to food handlers, processors and retailers.

What is *Campylobacter*?

Bacteria of the genus *Campylobacter* are Gram-negative rods that are spirally curved and motile. Because these organisms are microaerophilic, they require only a low level of oxygen to survive; this property is partly responsible for the relatively recent detection (1970s) of the genus. With respect to growth temperatures, bacteria in the genus *Campylobacter* are generally mesophilic, with a growth range from about 25°C to 45°C and optimal growth at 37°C or 42°C for the thermophilic species (Robinson et al., 2000). These organisms are normally found in wild birds, poultry, pigs, cattle, domesticated animals, unpasteurized milk, and contaminated water. They are transmitted to humans by fecal–oral routes and by ingestion of contaminated water and ice, but most commonly by consuming raw or undercooked meat (Robinson et al., 2000).

What causes campylobacteriosis?

Campylobacteriosis is an infection caused by bacteria of the genus *Campylobacter*. There are approximately sixteen species associated with *Campylobacter*, but the most commonly isolated are *C. jejuni, C. coli*, and *C. upsaliensis*. The most prevalent species associated with human illness is *C. jejuni.* The Centers for Disease Control and Prevention (CDC) estimated that over 800,000 cases

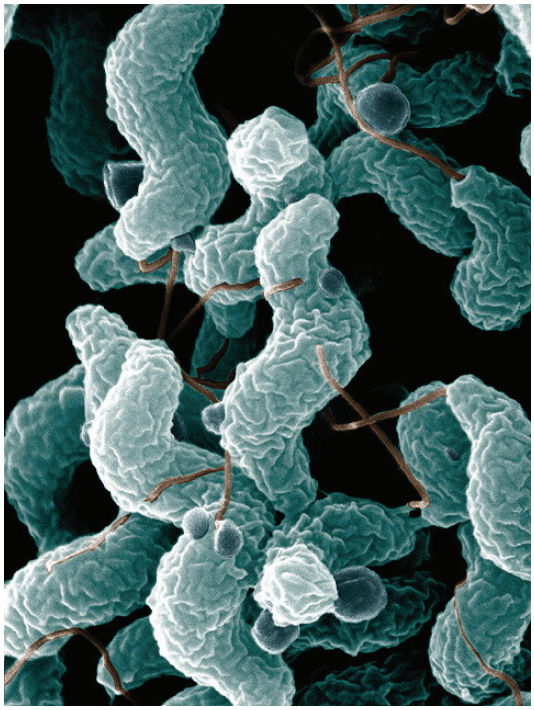

Figure 1. *C. jejuni* cells and related structures.
Credits: USDA–ARS 2008 photo by De Wood; digital colorization by Chris Pooley.

per year of diarrheal disease in the United States (9% of total foodborne illness cases) were linked to *Campylobacter*, being ranked No. 4 in the pathogens causing foodborne illnesses (CDC, 2011). *Campylobacter* is also responsible for 15% of foodborne illness-related hospitalizations, and 6% of foodborne illness-related deaths (Scallan et al., 2011; CDC, 2011).

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2. S. Ahn, assistant professor; R. M. Goodrich-Schneider, associate professor; K. R. Schneider, associate professor; Food Science and Human Nutrition Department, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL 32611. The authors wish to acknowledge the contributions of M. A. Kirby, former UF/IFAS graduate student, to the 2003 edition of this document.

What are the symptoms of campylobacteriosis?

The symptoms associated with this disease are usually flu-like: fever, nausea, abdominal cramping, vomiting, enteritis, diarrhea, and malaise. Symptoms begin within 2–5 days after ingestion of the bacteria, and the illness typically lasts 7–10 days. Because most people normally recover from this infection on their own, treatment is not usually necessary. However, antibiotics such as azithromycin and erythromycin are effective against *Campylobacter*, and can be prescribed for patients with severe diarrhea. Recurrence of this disease can occur up to three months after pathogen ingestion (Robinson et al., 2000).

Other complications can include meningitis, urinary tract infections, and short-term reactive arthritis. Some individuals may develop Guillain–Barré (GB) syndrome, a nerve disorder that causes muscle weakness and paralysis of the limbs, about 2–4 weeks after infection (NIAID, 2007). GB symptoms can last several weeks to many years. About 1 in 1,000 people with campylobacteriosis are expected to develop GB, and it is estimated that 40% of GB cases in the US may have been triggered by campylobacteriosis (CDC, 2008).

Who is most at risk?

Campylobacteriosis can affect everyone, but the most vulnerable are the very young (under 5 years) and the elderly. This infection is also associated with the immuno-compromised and found to affect males more commonly than females. Those working in hospitals, nursing homes, nursery schools and food preparation locations are more susceptible to infections than the rest of the population (Mead et al., 1999).

What foods have been commonly associated with *Campylobacter*?

Most cases of *Campylobacter* infections are associated with eating raw or undercooked poultry (Robinson et al., 2000). Other common sources of *Campylobacter* include cattle, pigs, sheep, ostriches, shellfish, dogs, cats, unpasteurized milk, contaminated water and ice. Fruits and vegetables can also be a source of infection when washed with contaminated water or when prepared on the cutting board that was used for raw poultry meat and then unwashed.

What sanitation methods are used to prevent campylobacteriosis?

When storing raw meats that are commonly associated with campylobacteriosis, freezing temperatures are best because the number of bacteria can be reduced. Cross contamination can be prevented by using separate cutting boards for meat and for fruits/vegetables. Plastic bags should be used to wrap the fresh meat to prevent blood or juices from dripping on other food surfaces (USDA–FSIS, 2011).

Foods should be cooked to their appropriate safe-minimum internal temperatures as recommended by the USDA (**Table 1**). In May of 2011, these recommendations were updated.

Avoiding unpasteurized milk and untreated surface water will also help prevent infection.

Because diarrhea is associated with people infected with *Campylobacter,* handwashing must be carefully and thoroughly executed. It is important to wash hands before, during, and after handling raw foods, smoking, cleaning, using the restroom, and touching soiled equipment or clothing (NIAID, 2007).

Good practices for food product receiving, handling, processing and storage

The FDA defines Current Good Manufacturing Practices for food (cGMPs) in 21 CRF, Part 110 (FDA, 2004). These cGMPs outline minimal sanitary and processing requirements for FDA-inspected food handling and processing facilities. In addition, the sanitation recommendations for food service and retail food facilities outlined in the FDA Food Code (FDA, 2009) have been adopted into many state and local regulations. As there may be some variation in Food Code adoption, it is important that each facility checks with the appropriate state and/or local regulatory authority. The Florida statutes can be found at http://www.flsenate.gov/statutes, Title 33: Chapter 509.

In addition to setting and adhering to strict sanitation requirements in the facility, a retail establishment should also develop Standard Operating Procedures (SOPs) for receiving and storage of food products and ingredients. If

Table 1. Safe Minimum Cooking Temperatures Chart

Category	Food	Temperature (°F)	Rest Time
Ground meat & meat mixtures	Beef, Pork, Veal, Lamb	160	None
	Turkey, Chicken	165	None
Whole cuts of beef/veal/lamb	Steaks, roasts, chops	145	3 minutes
Whole cuts of poultry	Chicken & Turkey, whole	165	None
	Poultry breasts, roasts	165	None
	Poultry thighs, legs, wings	165	None
	Duck & Goose	165	None
	Stuffing (cooked alone or in bird)	165	None
Whole cuts of pork	Fresh pork chops, loin	145	3 minutes
	Fresh ham (raw)	145	3 minutes
	Precooked ham (to reheat)	140	None
Eggs & egg dishes	Eggs	Cook until yolk and white are firm	None
	Egg dishes	160	None
Leftovers & Casseroles	Leftovers	165	None
	Casseroles	165	None
Seafood	Fin Fish	145 or cook until flesh is opaque and separates easily with a fork.	None
	Shrimp, lobster, and crabs	Cook until flesh is pearly and opaque.	None
	Clams, oysters, and mussels	Cook until shells open during cooking.	None
	Scallops	Cook until flesh is milky white or opaque and firm.	None

Source: USDA for FoodSafety.gov (http://www.foodsafety.gov/keep/charts/mintemp.html)

food is processed in the facility, appropriate controls and requirements should be established and strictly adhered to. FDA Food Code outlines appropriate processing and cooking requirements for many food products processed in a retail facility. However, if certain high-risk food products (such as sushi, fresh juice, specialty meats, and others) are processed in the retail establishment rather than in a more traditional processing facility, additional controls and the issuance of a variance by the regulatory authority are required before processing can occur (Food Code 3-502.11). The growing retail practice of cooking/preparing/packaging foods traditionally processed in controlled plant environments raises safety concerns. Any processing of food at the retail level should be closely monitored.

As an establishment becomes increasingly clean, it becomes harder to detect foodborne pathogens, and that is why programs that promote and monitor the use of the barriers and/or hurdles are so important. Measures such as irradiation, pasteurization, freezing, refrigeration, and controlling of pH and/or water activity should be taken to destroy or prevent the growth of undesirable microorganisms. When instituted properly, these activities will reduce the risk of a foodborne illness. Since most consumers prefer a fresh product, programs should be implemented that reduce the probability of illness to a point that it is minuscule.

Receiving

Specifications for receiving can be found in section 3-202.11 of the 2009 Food Code (http://www.fda.gov/Food/FoodSafety/RetailFoodProtection/FoodCode/FoodCode2009/default.htm). The following guidelines cover the basic points that should be addressed:

- Potentially Hazardous Food (PHF) should be at a temperature of 5°C or below when received, unless specified by law (e.g., milk, shellfish).
- Raw shell eggs should be received at an ambient air temperature of 7°C or less.
- PHFs that are received hot should be at a temperature of 60°C or above.

PHFs should be received with no evidence of temperature abuse such as evidence of thawing.

Processing

One of the easiest ways to prevent foodborne campylobacteriosis is ensuring that foods are cooked thoroughly. It should be noted that most foods would be made safe through a simple cooking step; however, for certain types food that are typically served undercooked (e.g., raw eggs in sauces and salad dressings), cooking might not be an option. For these items, other factors such as sanitation, worker hygiene, and proper storage take on much greater importance (FDA, 2009).

- Instead of using raw eggs in your recipes, try purchasing a pasteurized egg product.
- Cook eggs and egg dishes thoroughly.
- Cook whole meats to an internal temperature of 145°F or above for a minimum of 15 seconds.
- Cook ground meat products to an internal temperature of 160°F or above for a minimum of 15 seconds.
- Cook poultry to an internal temperature of 165°F or above for a minimum of 15 seconds.
- Reheat previously cooked material to an internal temperature to 165°F.

For more specific recommendations, consult the 2009 Food Code (http://www.fda.gov/Food/FoodSafety/RetailFoodProtection/FoodCode/FoodCode2009/default.htm).

Storage

Once a product has been received and/or processed, it is most often displayed or stored. Brief summary of general guidelines governing these practices is listed below (FDA, 2009):

- Frozen food should remain frozen until it is used.
- If frozen food is displayed in a refrigerated case and allowed to thaw, the food should remain at 5°C or below.
- Frozen food should be thawed at a temperature of 5°C or below or under running water at a temperature of 21°C or below.
- Food products may be thawed as part of the cooking process.
- Food products should be cooled adequately. Refer to sections 3-501.14 and 3-501.15 of the 2009 Food Code for details (http://www.fda.gov/Food/FoodSafety/RetailFoodProtection/FoodCode/FoodCode2009/default.htm).
- Cooked food should be main tained at 57C or above; all food that is displayed or stored in cooling or cold holding equipment should be maintained at 5°Cor less.
- All stored products should be properly labeled.

For more specific recommendations, consult the 2009 Food Code (http://www.fda.gov/Food/FoodSafety/RetailFoodProtection/FoodCode/FoodCode2009/default.htm).

Personal hygiene

Wash your hands! The major cause of foodborne illness in retail establishment comes from poor personal hygiene and particularly a lack of proper hand washing. Dirty hands can contaminate food. Although hands may appear clean, the bacteria that cause illness are too small to be seen with the naked eye. Therefore, whenever you are preparing food and come in contact with items that are not part of the food preparation process, rewash your hands. The same is true even when wearing gloves. THERE IS NO FIVE SECOND RULE WHEN IT COMES TO FOOD SAFETY! Millions of bacteria and other germs can be transferred on contact. Following is a list of when hands should be washed (FDA, 2009):

- Before handling, preparing, or serving food.
- Before handling clean utensils or dishware.
- After using the restroom.
- After touching your face, cuts, or sores.
- After smoking/eating/drinking.
- After handling raw meat—especially poultry.
- After touching unclean equipment, working surfaces, soiled clothing, soiled wiping cloths, etc.
- After collecting and taking out the garbage.

PROPER PROCEDURE FOR HANDWASHING

- Wet your hands with warm water.
- Apply soap and wash your hands for 20 seconds.
- Rinse and dry with a single-use paper towel.
- Use the paper towel to shut off the water.

Resources

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