

Preventing Foodborne Illness: Campylobacteriosis¹

Soohyoun Ahn, Renée M. Goodrich-Schneider, Rachael Silverberg, and Keith R. Schneider²

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. These organisms are microaerophilic, which means they require low levels of oxygen to survive. This unusual 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 temperature range from about 25° to 45°C for growth and 37°C or 42°C for optimal growth of the thermophilic species (Robinson et al. 2000). These organisms have been found in wild birds, poultry, pigs, cattle, domesticated animals, unpasteurized milk, produce, and contaminated water. They are transmitted to humans by a fecal-to-oral route and the ingestion of contaminated water and ice, but most commonly by consuming raw or undercooked meat (Robinson et al. 2000).

What causes campylobacteriosis?

Campylobacteriosis is a gastrointestinal infection caused by bacteria of the genus *Campylobacter*. There are 17 species (and 6 subspecies) associated with *Campylobacter*, but the most commonly isolated are *C. jejuni*, *C. coli*, and *C. upsaliensis* (WHO 2015). The most prevalent species

associated with human illness is *C. jejuni*. The US Department of Agriculture (USDA) lists *Campylobacter* as the fifth most costly foodborne pathogen, accounting for \$1.9 billion, 845,024 cases, 8,463 hospitalizations, and 76 deaths annually (USDA 2014a). It is estimated that 9% of total foodborne illness cases, 15% of foodborne illness-related hospitalizations, and 6% of foodborne illness-related deaths every year are attributable to the bacteria (Scallan 2011; CDC 2012).

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, with illness typically lasting 7–10 days. Because most people normally recover from this infection on their own, treatment is not usually necessary or documented by public health organizations. Symptomatic treatment with liquids and electrolytes is enough for most cases. However, for patients with severe diarrhea, antibiotics have been prescribed. Recurrence of symptoms 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. One in 1000 individuals with campylobacteriosis may develop

1. This document is FSHN032, one of a series of the Department of Food Science and Human Nutrition, UF/IFAS Extension. Original publication date January 2003. Revised July 2012, December 2015, and November 2024. Visit the EDIS website at <https://edis.ifas.ufl.edu> for the currently supported version of this publication.

2. Soohyoun Ahn, assistant professor; Renée M. Goodrich-Schneider, professor, Department of Food Science and Human Nutrition; Rachael Silverberg, student, College of Public Health; and Keith R. Schneider, professor, Department of Food Science and Human Nutrition; UF/IFAS Extension, 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.

Guillain-Barré syndrome (GBS). Evidence suggests that 25%–40% of all GBS cases are triggered by campylobacteriosis infections. GBS is a nerve disorder that causes muscle weakness and paralysis of the limbs about 1–3 weeks after *C. jejuni* infection (Nyati et al. 2013; CDC 2014). GBS symptoms can last from several weeks to many years. In addition, *Campylobacter* has been associated with periodontitis (Humphrey et al. 2007) and rare cases of gastrointestinal perforation have been reported (Jassim 2011).

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 immunocompromised 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 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). In the UK, *Campylobacter* is the leading cause of foodborne illness and has been detected in 73% of chickens available in retail settings (FSA 2015). In the United States, the USDA detected the bacteria in 6.9% of 2,396 samples of chicken and in 1.2% of 522 samples of turkey (USDA 2014b). Other common sources of *Campylobacter* include cattle, pigs, sheep, ostriches, shellfish, dogs, cats, unpasteurized milk, and contaminated water and ice. In 2015, six residents of northern California were diagnosed with campylobacteriosis after consuming unpasteurized milk purchased from a farm in San Benito County, CA. The company issued a mandatory recall and quarantined affected products after the California Department of Public Health (CDPH) confirmed the presence of *Campylobacter* in multiple bottles of raw milk (CDPH 2015). Fruits and vegetables can also be a source of infection when washed with contaminated water or prepared on improperly cleaned cutting boards that were used for raw poultry preparation.

What sanitation methods are used to prevent campylobacteriosis?

When storing raw meats that are commonly associated with campylobacteriosis, freezing temperatures are preferred so as to limit bacterial proliferation. Cross-contamination may be prevented by using separate cutting boards for meat and

for fruits/vegetables. Plastic bags should be used to wrap fresh meat to prevent blood or juices from dripping on other food surfaces (USDA-FSIS 2015).

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 also helps to prevent *Campylobacter* infection.

Because diarrhea is a common symptom for those infected with *Campylobacter*, proper hand washing 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.

What are good practices for food product receiving, handling, processing, and storage?

The FDA defines the “Current Good Manufacturing Practices” for food (cGMPs) in 21 CFR, 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 2013 FDA Food Code (FDA 2013) 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. Florida currently operates under the 2009 FDA Food Code. 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 storing food products and ingredients. If food is processed in the facility, appropriate controls and requirements should be established and strictly adhered to. The 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.

Receiving

Specifications for receiving can be found in section 3-202.11 of the 2017 Food Code (<https://www.fda.gov/food/fda-food-code/food-code-2017>). The following guidelines cover the basic points that should be addressed:

- Potentially Hazardous Foods (PHF) should be at or below a temperature of 5°C (41°F) when received, unless specified by law (e.g., milk, shellfish).
- Raw shell eggs should be received at an ambient air temperature of 7°C (44.5°F) or less.
- PHFs that are received hot should be at a temperature of 57°C or above.
- PHFs should be received with no evidence of temperature abuse, such as thawing.

Processing

One of the easiest ways to prevent foodborne campylobacteriosis is to ensure that foods are cooked thoroughly. It should be noted that most foods are made safe through a simple cooking step. However, for certain types of foods that are typically served raw/undercooked (e.g., raw eggs in sauces and salad dressings), safe consumption may not be guaranteed. For these items, other factors such as sanitation, worker hygiene, and proper storage take on much greater importance (FDA 2013). Consider the following guidelines for the processing of foods:

- 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 63°C (145°F) or above for a minimum of 15 seconds.
- Cook ground meat products to an internal temperature of 155°F or above for a minimum of 15 seconds.
- Cook poultry to an internal temperature of 74°C (165°F) or above for a minimum of 15 seconds.
- Reheat previously cooked material to an internal temperature of 74°C (165°F).

For more specific recommendations, consult the 2017 Food Code (<https://www.fda.gov/food/fda-food-code/food-code-2017>).

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 2017 Food Code for details (<https://www.fda.gov/food/fda-food-code/food-code-2017>).
- Cooked food should be maintained at 57°C or above; all food that is displayed or stored in cooling or cold holding equipment should be maintained at 5°C or less.
- All stored products should be properly labeled.

For more specific recommendations, consult the 2017 Food Code (<https://www.fda.gov/food/fda-food-code/food-code-2017>).

Personal Hygiene

Wash your hands! The major cause of foodborne illness in retail establishments comes from poor personal hygiene and particularly a lack of proper hand washing. Dirty hands may contaminate food. Although hands may appear clean, bacteria that cause foodborne illness are far too small to be seen with the naked eye. Therefore, whenever you prepare food and come in to contact with items that are not part of the food preparation process, rewash your hands and/or change gloves. **THERE IS NO FIVE SECOND RULE WHEN IT COMES TO FOOD SAFETY!** Millions of bacteria can be easily transferred to food contact surfaces from unclean hands or gloves.

It is recommended that you wash your hands

- before handling, preparing food, 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, lather, 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

California Department of Public Health (CDPH). 2015. “CDPH Issues Warning About the Dangers of Consuming Raw Milk.” Accessed November 20, 2024. <https://www.cdph.ca.gov/Programs/OPA/Pages/NR15-025.aspx>

Centers for Disease Control and Prevention (CDC). 2012. “CDC Estimates of Foodborne Illness in the United States.” *Findings*. Accessed November 20, 2024. [PDFs/FACTSHEET_A_FINDINGS_updated4-13.pdf](https://www.cdc.gov/foodsafety/factsheet/A_FINDINGS_updated4-13.pdf)

Centers for Disease Control and Prevention (CDC). 2014. “*Campylobacter*.” National Center for Emerging and Zoonotic Infectious Diseases. Accessed November 20, 2024. <https://www.cdc.gov/campylobacter/>

Food and Drug Administration (FDA). 2004. “Good Manufacturing Practices (GMPs) for the 21st Century — Food Processing.” *Current Good Manufacturing Practices (CGMPs)*. Accessed November 20, 2024. <http://www.fda.gov/Food/GuidanceRegulation/CGMP/ucm110877.htm>

Food and Drug Administration (FDA). 2013. “Food Code 2017.” *U.S. Public Health Service*. Accessed November 20, 2024. <https://www.fda.gov/food/fda-food-code/food-code-2017>

Food Standards Agency (FSA). 2015. “A Microbiological survey of campylobacter contamination in fresh whole UK produced chilled chickens at retail sale (2014–15).” Accessed November 20, 2024. <https://www.food.gov.uk/sites/default/files/media/document/Final%20Report%20for%20FS241044%20Campylobacter%20Retail%20survey.pdf>

Humphrey, T., S. O’Brien, and M. Madsen. 2007. “Campylobacters as zoonotic pathogens: A food production perspective.” *International Journal of Food Microbiology* 117(3): 237–57. doi:10.1016/j.ijfoodmicro.2007.01.006. PMID 17368847.

Jassim, S.S., A. Malik, and A. Aldridge. 2011. “Small bowel perforation: An unusual cause.” *Grand Rounds* 11(1): 17–9. doi:10.1102/1470-5206.2011.0006.

Mead, P., L. Slutsker, V. Dietz, L. F. McCraig, J. S. Bresee, C. Shapiro, P. M. Griffin, and R. V. Tauxe. 1999. “Food-Related Illness and Death in the United States.” Centers for Disease Control and Prevention, Atlanta, Georgia, USA. Accessed November 20, 2024. wwwnc.cdc.gov/eid/article/5/5/pdfs/99-0502.pdf

Nyati, K. K. and R. Nyati. 2013. “Role of *Campylobacter jejuni* Infection in the Pathogenesis of Guillain-Barré Syndrome: An Update.” *BioMed Research International*. vol. 2013 (Article ID 852195). Accessed October 9, 2015. <http://dx.doi.org/10.1155/2013/852195>

Robinson, R. K., Carl A. Batt, and P. D. Patel. 2000. *Encyclopedia of Food Microbiology*. San Diego: Academic Press.

Scallan, E., R. M. Hoekstra, F. J. Angulo, R. V. Tauxe, M. Widdowson, S. L. Roy, J. L. Jones, and P. M. Griffin. 2011. “Foodborne Illness Acquired in the United States — Major Pathogens.” *Emerging Infectious Diseases* 17:7–15. Accessed November 20, 2024. http://wwwnc.cdc.gov/eid/article/17/1/p1-1101_article.htm

United States Department of Agriculture (USDA). 2014a. “Cost Estimates of Foodborne Illnesses.” *Economic Research Service*. Accessed November 20, 2024. <http://www.ers.usda.gov/data-products/cost-estimates-of-foodborne-illnesses.aspx>

United States Department of Agriculture (USDA). 2014b. “Progress Report on *Salmonella* and *Campylobacter* Testing of Raw Meat and Poultry Products, 1998–2014.” Accessed November 20, 2024. https://www.fsis.usda.gov/sites/default/files/media_file/2021-02/Progress-Report-Salmonella-Campylobacter-CY2014.pdf

United States Department of Agriculture. Food Safety and Inspection Services (USDA-FSIS). 2015. “Kitchen Companion: Your Safe Food Handbook.” Accessed November 20, 2024. https://www.fsis.usda.gov/sites/default/files/media_file/2020-12/Kitchen-Companion.pdf

World Health Organization (WHO). 2015. *Campylobacter*. Accessed November 20, 2024.

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: Keep Food Safe (http://www.foodsafety.gov/keep/charts/mintemp.html)			