

## Preventing Foodborne Illness Associated with *Clostridium perfringens*<sup>1</sup>

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

### The *Clostridium perfringens* organism:

*Clostridium perfringens* is a Gram-positive bacterial pathogen that has the capability of forming an endospore. The dormant spores can change to potentially harmful vegetative cells if exposed to cooking temperatures and allowed to stand at temperature between 41°F and 120°F, especially in the temperature range from 70°F and 120°F. *Cl. perfringens* vegetative cells are killed in foods when the foods are cooked at 140°F or above. However, spores may still be present after cooking. Spores can survive the cooking process. *Cl. perfringens* can only thrive in conditions of very little or no oxygen: that is, it is an anaerobic organism. *Cl. perfringens* will not grow at refrigeration or freezing temperatures.

### Where is *Clostridium perfringens* found?

*Cl. perfringens* is found dispersed in the environment in locations such as soil, sediment, and in the intestines of domestic and feral animals, and humans. The organism is also found in sewage and in areas prone to animal and sewage contamination. *Cl. perfringens* spores have also been isolated from raw food.

*Cl. perfringens* typically causes foodborne sickness when foods are served after improper storage, or held at *Cl. perfringens* typically causes foodborne sickness when foods are served after improper storage, or held at inadequate storage temperatures such as on an improperly maintained steam table. It is a problematic microorganism for institutional food service handlers.

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## What kinds of foods are associated with *Clostridium perfringens*?

*Cl. perfringens* thrives in high-protein foods of animal origin such as meat and meat products, meat dishes, stews, soups, gravies, and milk. To a lesser extent, poultry products, pork, lamb, fish, shrimp, crab, legumes (beans), potato salad, and macaroni and cheese may contain *Cl. perfringens*. These protein-containing foods, when kept at inadequate storage temperatures between 41°F and 120°F, provide the greatest risk of infection and disease from *Cl. perfringens*, since spores present after cooking can germinate and potentially grow to high, dangerous numbers. A danger zone exists between 70°F and 120°F. Foods need to be cooled rapidly through this zone on their way down to 41°F. The food code recommends that food should not be in this zone for more than 2 hours. In the majority of cases involving these foods, keeping food in the danger zone too long was the main cause of *Cl. perfringens* food poisoning.

## Populations most at risk for *Cl. perfringens* foodborne illness:

Hospitals, nursing homes, prisons, school cafeterias are places that pose the highest risk of an outbreak of foodborne illness due to *Cl. perfringens*. In these locations, foods are cooked but may not be kept at safe, adequate temperatures, prior to serving. Although present in small numbers in (raw) foods, improper storage and handling of these foods allows the pathogen to grow to large, harmful numbers.

The young and elderly are the most susceptible and are frequent victims of *Cl. perfringens* poisoning; experiencing longer and more severe symptoms. There are fewer complications in persons younger than 30 years of age.

## The Disease and Symptoms:

*Cl. perfringens* gastroenteritis can result after 8 to 22 hours of consuming food contaminated with large numbers of the vegetative form of *Cl. perfringens*. In the intestines, the vegetative cells of *Clostridium* produce the heat-resistant enterotoxin which causes the foodborne illness. This is called a food toxicoinfection. Symptoms are severe

abdominal cramps and pain, diarrhea, and flatulence. These symptoms occur during 8 to 24 hours after consuming a contaminated meal. They usually last a single day, but less severe symptoms may continue for 1 to 2 weeks. These longer episodes are usually associated with the extremely young or the elderly. Other common symptoms include fever, chills and headache. In severe cases, dehydration and other complications can result in death of the infected individual. However, most symptoms usually last approximately 24 hours, leading many infected individuals to believe that they had a case of the "24-hour flu". *Cl. perfringens* can also produce toxins in foods if held at unsafe temperatures which can lead to a foodborne illness known as an intoxication. The storage conditions which can lead to *Cl. perfringens* growth are an environment with proper air and moisture levels, and temperatures ranging between 70°F and 140°F. To date, only one death due to a case of *Cl. perfringens* intoxication has ever been officially reported.

## Human Diagnosis of *Clostridium perfringens* disease:

Associated symptoms and the diseases delayed onset, precedes confirmation by toxin detection in fecal (stool) samples of affected individuals. The illness can also be confirmed by the detection of the causative organism in the suspected food which was consumed or by its presence in the patient's feces.

## Disease Occurrence of *Clostridium perfringens*:

Gastroenteritis, inflammation of the stomach and/or intestines, is the most common outcome of *Cl. perfringens* related illness. Large numbers of persons are typically affected. Some estimates have put the number of annual outbreaks to be in excess of 600 per year. According to CDC estimates, as many as 250,000 individuals are affected by *Cl. perfringens* each year. The number of *Cl. perfringens* foodborne illnesses is under-reported due to the mildness of symptoms, brief illness duration and lack of routine testing by public health officials.

## How can *Cl. perfringens* foodborne illness be controlled and prevented?

Since *Cl. perfringens* can grow rapidly at elevated temperatures and forms heat resistant spores, preventing growth is paramount. Foods should be cooked to an internal temperature of 165°F or higher to inactivate vegetative cells. Additionally, the cooked food must be chilled rapidly to 41°F or less, or kept at hot holding temperatures of 140°F or higher to prevent any activation and growth of *Cl. perfringens* spores.

Large portions of meat, broth, gravies and other common *Cl. perfringens* associated foods must meet specific guidelines noted in the 2001 FDA Food Code. These guidelines specify that potentially hazardous food shall be cooled with 2 hours from 140°F to 70°F and within 6 hours from the initial 140°F to 41°F or less. Large containers of food may take an extended period of time to cool to 41°F and therefore should be separated into smaller portions, such as pans with a food height of no more than four inches. In addition, storage containers should be stacked to encourage good airflow both above and below to facilitate rapid cooling. Leftover foods should be reheated to 165°F or greater, which can inactivate any vegetative cells which have germinated during cooling, as well as other of other foodborne pathogens which may have cross-contaminated.

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