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# E. coli

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## Key facts

- **Escherichia coli (E. coli)** is a bacteria that is commonly found in the lower intestine of warm-blooded organisms. Most E.coli strains are harmless, but some can cause serious food poisoning.
- **Shiga toxin-producing E. coli (STEC)** is a bacterium that can cause severe foodborne disease.
- **Primary sources of STEC outbreaks** are raw or undercooked ground meat products, raw milk, and faecal contamination of vegetables.
- **In most cases, the illness is self-limiting**, but it may lead to a life-threatening disease including haemolytic uraemic syndrome (HUS), especially in young children and the elderly.
- **STEC is heat-sensitive.** In preparing food at home, be sure to follow basic food hygiene practices such as "cook thoroughly".
- **Following the WHO “Five keys to safer food”** is a key measure to prevent infections with foodborne pathogens such as STEC.

## Overview

*Escherichia coli* (*E. coli*) is a bacterium that is commonly found in the gut of humans and warm-blooded animals. Most strains of *E. coli* are harmless. Some strains however, such as Shiga toxin-producing *E. coli* (STEC), can cause severe foodborne disease. It is transmitted

to humans primarily through consumption of contaminated foods, such as raw or undercooked ground meat products, raw milk, and contaminated raw vegetables and sprouts.

STEC produces toxins, known as Shiga-toxins because of their similarity to the toxins produced by *Shigella dysenteriae*. STEC can grow in temperatures ranging from 7 °C to 50 °C, with an optimum temperature of 37 °C. Some STEC can grow in acidic foods, down to a pH of 4.4, and in foods with a minimum water activity ( $a_w$ ) of 0.95.

STEC is destroyed by thorough cooking of foods until all parts reach a temperature of 70 °C or higher. *E. coli* O157:H7 is the most important STEC serotype in relation to public health; however, other serotypes have frequently been involved in sporadic cases and outbreaks.

## Symptoms

Symptoms of the diseases caused by STEC include abdominal cramps and diarrhoea that may in some cases progress to bloody diarrhoea (haemorrhagic colitis). Fever and vomiting may also occur. The incubation period can range from 3 to 8 days, with a median of 3 to 4 days. Most patients recover within 10 days, but in a small proportion of patients (particularly young children and the elderly), the infection may lead to a life-threatening disease, such as haemolytic uraemic syndrome (HUS). HUS is characterized by acute renal failure, haemolytic anaemia and thrombocytopenia (low blood platelets).

It is estimated that up to 10% of patients with STEC infection may develop HUS, with a case-fatality rate ranging from 3 to 5%. Overall, HUS is the most common cause of acute renal failure in young children. It can cause neurological complications (such as seizure, stroke and coma) in 25% of HUS patients and chronic renal sequelae, usually mild, in around 50% of survivors.

Persons who experience bloody diarrhoea or severe abdominal cramps should seek medical care. Antibiotics are not part of the treatment of patients with STEC disease and may possibly increase the risk of subsequent HUS.

## Sources and transmission

Most available information on STEC relates to serotype O157:H7, since it is easily differentiated biochemically from other *E. coli* strains. The reservoir of this pathogen appears to be mainly cattle. In addition, other ruminants such as sheep, goats, deer are considered significant reservoirs, while other mammals (such as pigs, horses, rabbits, dogs, and cats) and birds (such as chickens and turkeys) have been found infected.

*E. coli* O157:H7 is transmitted to humans primarily through consumption of contaminated foods, such as raw or undercooked ground meat products and raw milk. Faecal contamination of water and other foods, as well as cross-contamination during food preparation (with beef and other meat products, contaminated surfaces and kitchen utensils), will also lead to infection. Examples of foods implicated in outbreaks of *E. coli* O157:H7 include undercooked hamburgers, dried cured salami, unpasteurized fresh-pressed apple cider, yogurt, and cheese made from raw milk.

An increasing number of outbreaks are associated with the consumption of fruits and vegetables (including sprouts, spinach, lettuce, coleslaw, and salad) whereby contamination may be due to contact with faeces from domestic or wild animals at some stage during cultivation or handling. STEC has also been isolated from bodies of water (such as ponds and streams), wells and water troughs, and has been found to survive for months in manure and water-trough sediments. Waterborne transmission has been reported, both from contaminated drinking-water and from recreational waters.

Person-to-person contact is an important mode of transmission through the oral-faecal route. An asymptomatic carrier state has been reported, where individuals show no clinical signs of disease but are capable of infecting others. The duration of excretion of STEC is about 1 week or less in adults but can be longer in children. Visiting farms and other venues where the general public might come into direct contact with farm animals has also been identified as an important risk factor for STEC infection.

## Prevention

The prevention of infection requires control measures at all stages of the food chain, from agricultural production on the farm to processing, manufacturing and preparation of foods in both commercial establishments and household kitchens.

## Industry

The number of cases of disease might be reduced by various mitigation strategies for ground beef (for example, screening the animals pre-slaughter to reduce the introduction of large numbers of pathogens in the slaughtering environment). Good hygienic slaughtering practices reduce contamination of carcasses by faeces but do not guarantee the absence of STEC from products.

Education in hygienic handling of foods for workers at farms, abattoirs and those involved in the food production is essential to keep microbiological contamination to a minimum. The only effective method of eliminating STEC from foods is to introduce a bactericidal treatment, such as heating (for example, cooking or pasteurization) or irradiation.

## Household

Preventive measures for *E. coli* O157:H7 infection are similar to those recommended for other foodborne diseases. Basic good food hygiene practices, as described in the WHO "*Five keys to safer food*", can prevent the transmission of pathogens responsible for many foodborne diseases, and also protect against foodborne diseases caused by STEC.

The five keys to safer food are:

- **Keep clean.**
- **Separate raw and cooked.**
- **Cook thoroughly.**
- **Keep food at safe temperatures.**
- **Use safe water and raw materials.**
- **[Five keys to safer food manual](#)**

Such recommendations should in all cases be implemented, especially "cook thoroughly" so that the centre of the food reaches at least 70 °C. Make sure to wash fruits and vegetables carefully, especially if they are eaten raw. If possible, vegetables and fruits should be peeled. Vulnerable populations (such as small children and the elderly) should avoid the consumption of raw or undercooked meat products, raw milk, and products made from raw milk.

Regular handwashing, particularly before food preparation or consumption and after toilet contact, is highly recommended, especially for people who take care of small children, the elderly or immunocompromised individuals, as the bacterium can be passed from person to person, as well as through food, water and direct contact with animals.

A number of STEC infections have been caused by contact with recreational water. Therefore, it is also important to protect such water areas, as well as drinking-water sources, from animal waste (4).

## Producers of fruits and vegetables

WHO's "*Five keys to growing safer fruits and vegetables*" provides rural workers who grow fresh fruits and vegetables for themselves, their families and for sale in local markets, with key practices to prevent microbial contamination of fresh produces during planting, growing, harvesting and storing.

The five keys to growing safer fruits and vegetables are:

- **Practice good personal hygiene.**
- **Protect fields from animal faecal contamination.**

- **Use treated faecal waste.**
- **Evaluate and manage risks from irrigation water.**
- **Keep harvest and storage equipment clean and dry.**
- **Five keys to growing safer fruits and vegetables**

## WHO response

WHO provides scientific assessments to control STEC in food. These assessments serve as the basis for international food standards, guidelines, and recommendations developed by the Codex Alimentarius Commission.

WHO promotes the strengthening of food safety systems by promoting good manufacturing practices and educating retailers and consumers about appropriate food handling and avoiding contamination.

During *E. coli* outbreaks, such as those in Europe in 2011, WHO supports the coordination of information sharing and collaboration through International Health Regulations and the International Food Safety Authorities Network (INFOSAN) worldwide. WHO works closely with national health authorities and international partners, providing technical assistance and the latest information on outbreaks.

## Related

- **More about food safety**
- **Responding to food safety emergencies (INFOSAN)**
- **International Health Regulations**
- **Estimating the burden of foodborne diseases**