Escherichia coli:

Is one of the predominant enteric species in the human and animal gut and, as part of the normal intestinal flora. Is gram-negative , facultative anaerobic, rod-shaped bacterium belong to Enterobacteriaceae family. Currently, there are five recognized pathogenic groups:

- Enterotoxigenic *E. coli* **(ETEC)** -----» watery diarrhea without blood.
- Enteropathogenic *E. coli* **(EPEC)** -----» stool has mucous but not blood.
- Enterohemorrhagic *E. coli* **(EHEC)** ----» watery diarrhea with blood.
- Enteroinvasive *E. coli* **(EIEC)** -----» hemorrhagic diarrhea.
- Enteroaggregative *E. coli* **(EAEC)** -----» watery diarrhea.

Of these, the first four groups are well known to be transmitted via contaminated food or water; EHEC, especially, are often implicated in major food-borne outbreaks worldwide.

What good are E. coli?

- Protects the intestinal tract from bacterial infection.
- Assists in digestion.
- Produces small amounts of vitamins B_{12} and K.
- Colonizes newborns GI tract within hours after birth.
- And is used as an indicator organism in determining the fecal content of water and food.
- Used in biotechnology for transformation and production of cloned gene.

What is E. coli 0157:H7?

Are an enterohemorrhagic strain of the bacterium *Escherichia coli* and a cause of illness through food. Infection may lead to hemorrhagic diarrhea, and to renal failure. It is highly virulent, with a low infectious dose: an inoculation of fewer than 10 to 100 CFU of *E. coli* O157:H7 is sufficient to cause infection, compared to over one-million CFU for other pathogenic *E. coli* strains. Most of

the problems caused by the bacteria are due to two Shiga toxins, termed Stx 1 and Stx 2 and also termed Vero toxins.

How do people contract E. coli 0157:H7?

Infection with *E. coli* O157:H7 follows ingestion of contaminated food or water, or oral contact with contaminated surfaces. The bacteria are found in animal feces, particularly cattle feces, and contact with the feces can lead to contamination of many types of food and fluids. A main source of infection is undercooked ground beef; other sources include consumption of unpasteurized milk and juice, and contact with infected live animals. Waterborne transmission occurs through swimming in contaminated lakes, pools, or drinking inadequately treated water. Less commonly, *E.coli* O157:H7 can be transmitted from one person to another, usually by direct physical contact (Diaper changing, improper sanitation, Day care & chronic adult care facilities).

Symptoms:

The **initial symptoms** of *E. coli* O157:H7 infection usually appears about three to five days after a person ingests the bacteria; the symptoms include: nausea, vomiting, stomach cramps, and diarrhea that often is bloody. The person may have a mild fever of about (37.7 - 38.3 ^{0}C). These symptoms can be seen in infected children and adults.

The **later symptoms** *E. coli* O157:H7 infections in normal adults are resolve without antibiotics in about five to seven days. While children under the age of 5 and the elderly develop more severe signs and symptoms, and these people usually require hospitalization and aggressive treatment. These symptoms or complications fall into three main categories: bloody diarrhea, Hemolytic-uremic syndrome (HUS) and Thrombotic thrombocytopenic purpura (TTP).

What is the treatment for E. coli 0157:H7?

Patients, especially healthy adults, often require no treatment for *E. coli* O157:H7 since many infections are self–limited. Treatment of *E. coli* infection generally consists of managing dehydration caused by diarrhea. If you develop a severe blood problem, such as anemia, you will receive fluids and, if necessary, have a blood transfusion. If you develop kidney problems, you may have wastes removed from your blood (dialysis). Hemolytic uremic syndrome is a life-threatening condition usually treated in an intensive care unit. Blood transfusions and kidney dialysis are often required. HUS and TTP require complex supportive care (for example, plasma exchange) in the hospital. Consultation with a critical care specialist often is recommended for the care of patients that develop HUS or TTP.

STRAIN	ABBREVIATION	SYNDROME	THERAPY[1]
Enterotoxigenic E. coli	ETEC	Watery diarrhea	Antibiotics may be useful.[2]
Enteropathogenic E. coli	EPEC	Watery diarrhea of long duration, mostly in infants, often in developing countries	Antibiotics may be useful.[2]
Enterohemorrhagic E. coli	EHEC	Bloody diarrhea; Hemorrhagic colitis and hemolytic uremic syndrome (HUS)	Avoid antibiotics because of the possible risk of potentiating HUS.
Enteroinvasive E. coli	EIEC	Bloody diarrhea	Rehydration and correction of electrolyte abnormalities.
Enteroadherent E. coli	EAEC	Persistent watery diarrhea in children and patients infected with HIV	Rehydration and correction of electrolyte abnormalities.

E. coli 0157:H7 and prevention of outbreaks:

The CDC recommends the following to prevent infections from *E. coli* 0157:H7:

1. Wash hands thoroughly after using the bathroom or changing diapers, and before preparing or eating food. Wash hands after contact with animals.

2. Cook meats thoroughly.

3. Avoid raw milk, unpasteurized dairy products, and unpasteurized juices.

4. Avoid swallowing water when swimming or playing in lakes, ponds, streams, swimming pools, and backyard "kiddie" pools.

5. Prevent cross contamination in food preparation areas.

6. Because *E. coli* 0157:H7 is routinely found in the intestines of cattle, companies have developed a vaccine to reduce the number of these bacteria in cattle. The first vaccine for cattle was FDA approved in 2009. There is no vaccine available for *E. coli* 0157:H7 in humans.

Campylobacteriosis :

Infectious disease caused by bacteria of genus *Campylobacter* (meaning "twisted bacteria") belong to the *Campylobacteraceae* family. It is also referred to as *Campylobacter* enteritis or gastroenteritis. Some species previously classified as *Campylobacters* have been reclassified in the genus *Helicobacter*. *C.jejuni* and *C.coli* are considered the most common causative agents of human diarrheal disease in many countries worldwide.

What is Campylobacter jejuni ?

C.jejuni has been confirmed as a causative agent in many food-borne illnesses, are Gram-negative, spiral; motile with either unipolar or bipolar flagella, and microaerophilic (5 % oxygen, 10% C02, and 87% N2 for growth).Growth temperature ranges between 32 and 45°C, with optimum 42°C. They are sensitive to many environmental parameters, including oxygen (in air), NaCI (above 2.5%), low pH (below pH 5.0), temperature (below 30°C), heat (pasteurization), and drying. However, they survive well under refrigeration and for months in the frozen state.

Pathogenesis:

The infection is acquired by the oral route from food (especially undercooked chicken and foods contaminated by raw chicken), drinking contaminated water or raw (unpasteurized) milk, or contact with infected animals or animal products, can also be transmitted from person to person by the fecal-oral route.
C.jejuni is susceptible to gastric acid, and ingestion less than 500 cells are usually necessary to produce infection.

Pathogenesis of *C.jejuni* is dependent on motility, ability to adhere, invade epithelial cells & produce toxins (***enterotoxin , cytotoxin , cytolethal distending toxin & LPS***) which are responsible for enteric disease symptoms. In addition; the strains produce an invasive factor. Following ingestion, motile bacteria reach to the mucus layer. Chemotaxis and requirement for iron drive the bacteria to reach to the epithelial surface where they colonize. The organisms multiply in the small intestine, invade the epithelium, and produce inflammation that results in the appearance of red and white blood cells in the stools. Occasionally, the bloodstream is invaded and a clinical picture of enteric fever develops. Localized tissue invasion coupled with the toxic activity appears to be responsible for the enteritis.

Symptoms:

Incubation period is typically 2–4 days. Campylobacteriosis is characterized by diarrhea (frequently bloody), abdominal pain, fever, and occasionally nausea and vomiting. More severe illness can occur, including dehydration, bloodstream infection, and symptoms mimicking acute appendicitis or ulcerative colitis.
Consequence of Campylobacteriosis in humans result in a chronic disease called **Guillain-Barre syndrome**, a debilitating generalized paralysis. Chronic infection promotes antibody production against *Campylobacter* antigen, which reacts with nerve cells causing impaired nerve function. Another consequence of Campylobacteriosis is arthritis, also known as **Reiter's syndrome**.

Treatment:

The disease is generally self-limited, lasting a week or less. Affected persons should drink plenty of fluids to avoid dehydration. Antidiarrheal medications may be effective in reducing the intensity of some symptoms. Antibiotics used in severe cases of gastroenteritis to decreases the duration of symptoms if administered early in the course of disease and Macrolide antibiotics including Erythromycin are effective and may shorten course of illness. Resistance developing to Fluoroquinolone antibiotics due to use in poultry feed**.**

How can Campylobacteriosis be prevented?

- Use safe food preparation techniques.

- Wash your hands and all cooking equipment with soap and warm water after handling raw meat.

- Thaw meats in the refrigerator, never on the counter.

- Avoid cross contamination in the kitchen by using separate cutting boards for meats and vegetables.

- Cook meat thoroughly and to the proper cooking temperatures.

- Wash your hands frequently after handling animals.

- Wear disposable gloves if you are in contact with sick animals.