Escherichia coli poisoning

Wetlands supporting groups of susceptible animals

Wildlife ✓
Livestock ✓
Human ✓

Synonyms: *E. coli*, colibacilliosis, colisepticaemia

KEY FACTS

What is *Escherichia coli* poisoning?

Escherichia coli is a bacterium that is commonly found living in human and animal intestines. Most of the hundreds of strains are harmless and some are even beneficial to humans and animals but others can cause illness. One such strain is *E. coli* O157, which is pathogenic in a number of species, produces a powerful toxin often referred to as Shiga toxin or verotoxin, and can cause severe illness and potentially death.

Once excreted from human and animal intestinal tracts, the bacteria may not survive, but some do find their way into lakes and streams, where they can persist for several weeks in water, sediment or sand. Frequent sources of *E. coli* include direct release of untreated sewage, leakage from sewage pipes, run-off from human developments, domestic animal faeces, and run-off from land or premises where animals are kept or grazed. Dog and cat faeces may be carried along by storm sewers, deposited directly into streams and pathogens may be released into groundwater by insufficiently maintained septic systems. Wild mammals and birds may directly release faeces into waterways.

The *E. coli* strain O157 which is carried mainly by ruminants can cause severe disease in vulnerable humans (particularly the elderly and children under five years old). It is likely that widespread use of antibiotics in livestock has helped increased prevalence of *E. coli* O157 in many parts of the world with some cattle, in particular, becoming 'super-shedders' of this zoonotic bacterium. The excretion of antibiotics into the environment directly from farms or even through sewage farms, contributes to genetically determined resistance in these and other bacteria in the environment. Infection occurs directly *via* contact with infected farm (or to a lesser extent wild) animals and their environments or from consumption of contaminated meat or unpasteurised milk.

A recent concern is the emergence of a new type of antibiotic resistance (called extended-spectrum beta-lactamase or ESBL) *E. coli*. Scientists are now finding strong evidence that a significant amount of antibiotic resistance in human *E. coli* infections comes from farm animals (particularly poultry but also pigs and cattle), contributing to increasing resistance in urinary-tract infections and blood poisoning in people.

Causal agents

- enterotoxigenic *E. coli* (ETEC)
- enteroinvasive *E. coli* (EIEC)
- enteropathogenic *E. coli* (EPEC)
- enterohaemorrhagic *E. coli* (EHEC)

Species affected

Mammals (including humans, pigs, sheep, goats, cattle, dogs, cats, horses and wild mammals) and to a lesser extent birds.

Geographic distribution

Occurs worldwide.

Environment

Wetlands inhabited by susceptible species, particularly domestic ruminants.

TRANSMISSION AND SPREAD

Vector(s)

E. coli is not vector-borne although some mechanical transfer from contaminated areas is possible.

How is the disease transmitted to animals?

Animals (livestock in particular) become infected with *E. coli* by exposure to items including food, water and inanimate objects (fomites) contaminated with faeces from which bacteria can be ingested. Susceptible animals include those which are immunocompromised, stressed, young, old, breeding or with associated environmental pressures.

How does the disease spread between groups of animals?

Animals can serve as carriers of the bacteria *i.e.* without the bacteria causing illness. The bacteria can be found in sheep, pigs, deer, cattle, dogs, poultry and other animals, although cattle are the main carriers. Infected animals, in particular young animals, shed the bacteria in their faeces, thus leading to exposure of other animals.

How is the disease transmitted to humans?

Most people are infected with *E. coli* from contaminated food (*e.g.* undercooked ground beef) or unpasteurised milk or contact with animal faeces from the environment. Animals do not have to be ill to transmit *E. coli,* including *E. coli* O157, to humans.

IDENTIFICATION AND RESPONSE

Field signs

Signs of *E. coli* infection in animals may include watery or bloody diarrhoea, fever and abdominal cramps, together with nausea and vomiting in animals such as cats and dogs. Resulting illness may be mild or severe.

In humans, incubation period ranges from 1-8 days but the duration of the illness is usually approximately 3–5 days. However, the bacteria can continue to be passed in faeces for up to three weeks post infection. Symptoms vary from mild to severe and include diarrhoea, vomiting, stomach-ache and fever. In adults, for most strains, the infection clears on its own in about a week.

Recommended action if suspected

Alert the relevant authorities of any suspected cases.

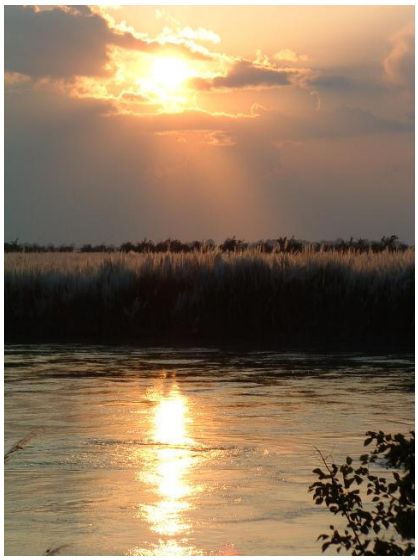
Diagnosis

Many laboratory-based methods for detection of *E. coli* bacteria involve collection of environmental or faecal samples and isolating the bacteria or using polymerase chain reaction (PCR) methodologies to test water for bacteria. The latter method is rapid and can differentiate between *E. coli* of human and non-human sources.

PREVENTION AND CONTROL IN WETLANDS

Environment

Following laboratory confirmation, a **response system** may be activated if bacteria levels have risen to unacceptable limits based on bacterial water quality standards. Accepting that domestic ruminants pose the greatest risk of transmission of pathogenic strains of *E. coli*, **treatment wetland systems** can help treat water running off from agricultural premises and animal holdings.



Reedbed in Koshi Tapu Wildlife Reserve, Nepal. Natural or constructed treatment wetlands can significantly reduce bacterial contamination from livestock entering waterways (*WWT*).

Livestock

E. coli exposure can be limited in animals by **preventing faecal contamination** of feed and water, thus reducing the opportunity for ingestion of the bacteria.

Wildlife

Similarly, *E. coli* exposure can be limited in wildlife by **preventing faecal contamination** of wetlands, particularly by domestic ruminants, thus reducing exposure to the bacteria. If appropriate, wildlife can be kept away from possible sources of contamination *e.g.* by constructing physical barriers. Wetland treatment systems can also be used to reduce the risk of infection [►**Environment**]. Separating livestock from wildlife reduces risk to the latter.

Humans

Reducing exposure to *E. coli* by **preventing/reducing faecal contamination** of the environment including food and water plus **hygiene control measures** are key to reducing risk to humans. Hands should be frequently washed with soap after handling animals, or working in their environment, and disposable gloves should be worn if in contact with sick animals.

Medical attention should be sought for severe cases.

IMPORTANCE

Effect on wildlife

Wildlife in human agricultural landscapes, in particular species closely associated with livestock pastures *e.g.* wild rabbits, scavenging and feral species, have been shown to be infected, albeit at low levels, with *E. coli* O157 and in certain circumstances can act as a reservoir for *E. coli* O157. Wildlife populations may be in danger of fatalities or morbidity particularly if there are con-current infections or other stressors present. This is a problem of developed intensive agricultural systems and there is no evidence of widespread infection from extensive rangeland systems and natural environments.

Effect on livestock

Whilst domestic mammals generally only serve as carriers (or reservoirs) of the bacteria, some strains of *E. coli* do cause illness. For example, *E. coli* can cause illness in domestic animals either as a primary pathogen (diarrhoea in young pigs) or in association with other disease such as coronaviruses in cattle. *E. coli* mastitis in dairy cows can be very severe and potentially fatal, and adult pigs and cattle can be affected by urinary tract and other infections caused by pathogenic *E. coli*. Colibacillosis in pigeons and poultry is usually secondary to stress or con-current viral infection. *E. coli* in poultry can cause

mortality, drops in weight gain and hatchability.

Effect on humans

Disease can be fatal; *E. coli* O157 can cause severe illness including deaths particularly in the young and old. Attacks of *E. coli* gastroenteritis may result in some infants developing a disaccharidase and lactose intolerance, which may become clinically manifested as chronic diarrhoea. There is now compelling evidence that animals reared for food are a reservoir for both antibiotic-resistant pathogenic and commensal *E. coli*, colonising or infecting humans, whilst also serving as a reservoir for resistance genes which can transfer to *E. coli* and can cause infections in humans.

Economic importance

Livestock infections can affect productivity *e.g.* in poultry [► **Livestock**].

FURTHER INFORMATION

Useful publications and websites

- Department for Environment, Food and Rural Affairs (DEFRA). **Summary profile for verocytotoxin producing *E. coli* (VTEC 0157).** archive.defra.gov.uk/foodfarm/farmanimal/diseases/vetsurveillance/profiles/documents/sp-vtec.pdf. [Accessed March 2012].
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