



# RESEARCH FACTS

RESEARCH & TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY



## Why do some cattle shed more E. coli O157:H7?

### Project Title:

Adherence to Escherichia coli O157:H7 to different sections of the intestinal tract from shedding and non-shedding cattle in vitro.

### Researchers:

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4.20

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### Background

The digestive systems of cattle and humans are home to billions of bacteria, including E. coli. Most E. coli strains are harmless to both cattle and humans. However, some strains, like E. coli O157:H7, can cause severe illness in humans but not cattle.

Many of the details regarding how E. coli O157:H7 attaches to the human gut and causes food poisoning have been determined, but there is limited information about how and where E. coli O157:H7 colonizes the digestive tract of cattle. This is important to know in order to understand why some feeder cattle are much more likely to shed E. coli O157:H7 in their manure than others. Some infected cattle shed E. coli O157:H7 for less than a week (non-persistent), some shed for up to a month (moderately persistent), and some shed for up to a year (persistent shedders). Cattle that are shedding E. coli O157:H7 at the time of processing are more likely to contribute to beef contamination and human illness.

The likelihood of an infected animal becoming a persistent E. coli O157:H7 shedder may depend on what region of the digestive tract is colonized, and/or how the organism attaches to the wall of the digestive tract. A more thorough understanding of E. coli colonization and attachment mechanisms will help develop ways to combat E. coli O157:H7 in cattle.

### Objectives

To determine whether the region of the digestive tract colonized by E. coli O157:H7 and the way that E. coli O157:H7 attaches to the gut influences whether cattle become persistent or intermittent E. coli O157:H7 shedders..

### What they did

In a controlled research environment, calves were tubed with known numbers of E. coli O157:H7. Manure samples were collected

over an 11 week period and monitored for the organism. Cattle were then classed as persistent, moderately persistent or non-persistent shedders based on the duration of E. coli O157:H7 shedding. At the end of the trial, tissue samples were collected throughout the digestive tract and examined for signs of E. coli O157:H7 infection and tissue damage.

### **What they learned**

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Persistent shedders were colonized by greater numbers of E. coli O157:H7 than non-persistent shedders. E. coli O157:H7 could infect any region of the intestinal tract, but four specific regions (the jejunum and ileum in the small intestine, and the colon and rectum in the large intestine) were less able to eliminate the infection. Intermittent shedders were typically only infected in the large intestine, whereas persistent shedders were also colonized in the small intestine. This indicates that colonization of the small intestine, upstream from the large intestine, is critical in determining whether an animal becomes a persistent or an intermittent shedder.

The mechanism by which E. coli O157:H7 attaches to the intestine appeared to be the same in both persistent and intermittent shedders. However, persistent shedders were often colonized by E. coli O157:H7 strains that produce large amounts of toxin. Cattle that were colonized by high-toxin producing strains were also more likely to be co-infected by other strains of E. coli O157:H7.

Damage to the intestinal lining was seen in some infected cattle. More damage was seen in persistent shedders that were heavily colonized with E. coli O157:H7. This damage began to heal once the animal had stopped shedding. No signs of animal illness were reported. Larger scale studies would be necessary to determine whether this damage impacts feed efficiency.

### **What it means**

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New interventions targeting E. coli O157:H7 at the farm cost \$10-12 per head. Food safety interventions at meat plants across Canada that target numerous pathogens cost approximately \$5-6/head. Investing in research is important to reduce both the incidence rate and costs associated with infectious diseases in both cattle and humans.

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