

DEMYSTIFYING E.COLI

A tale of E.coli and the company they keep

Introduction

Escherichia coli (a.k.a. E.coli) are oft-mentioned but little understood organisms. We are told that we cannot use a beach because it's "polluted": the E.coli count is too high. We are warned to cook hamburger until very well done or we risk being infected, maybe dying, from E.coli. We draw the conclusion that these are always very dangerous bacteria. In fact, the only connection between the above statements is the identity of the bacteria involved. E.coli in poorly cooked meat can indeed cause severe illness. E.coli in the lake are highly unlikely to do so.

Escherichia at home

The bacteria called E.coli are found in the intestines of all vertebrates - human, frog, toad, bird, wolf, etc.- where they are actively breaking down food matter. They live and thrive in this dark, warm, damp, low oxygen environment. They are anaerobes (prefer living without oxygen) but they may survive for a short time in its presence. They will not survive and thrive for any length of time in the open water of your lake. In their normal existence, E.coli are harmless. But we cannot say that about the company they keep. In the gut of humans and other vertebrates, E.coli may be accompanied by other organisms, which are serious pathogens, that is, organisms that can make us very sick indeed. These pathogens from human fecal material can get into our lakes and streams from septic systems that are too close to the water, do not have enough appropriate material in the leaching bed or are not properly maintained. Farms that do not properly manage the manure from their animals also are responsible for the introduction of pathogens from animal fecal material into streams, rivers and lakes. Both ground water (the source of water in drilled wells) and surface water which runs off into streams and lakes, can be contaminated by improperly maintained septic systems or poor management of animal manure. However, the bottom line is that normally E.coli are not themselves a problem even if they do reach your lake and survive for awhile. It is not E.coli that causes ear infections or eye trouble for people who swim at a polluted beach. The problem comes from other organisms that are found in water.

Beach Closed: High E.coli Count

We have seen that E.coli are considered a normally harmless component of our gut fauna. If E.coli are not the real problem at our swimming beaches, why do we hear so much about them? E.coli are familiar to us because we hear about them in drinking water samples or reports about beach pollution. They are looked for in water samples for two main reasons:

- Water contaminated with sewage contains large amounts of normal, usually harmless, intestinal bacteria, such as E.coli, which are easy to grow and count in a laboratory;
- E.coli are not normally found in lakes and rivers. When they are found they indicate that pollution from human or animal excreta has occurred. Thus E.coli are used as indicator organisms. If they are present there is a strong possibility that real pathogens are also present.

Water-Borne Pathogens

So why do we count E.coli instead of the real pathogens, such as cholera, typhoid or hepatitis? Surely an ideal water test would search directly for the pathogens transmitted by water? One reason is that pathogenic organisms are relatively sparse in water although only a very few in each liter can cause many cases of disease. For example, if feces from a single person with typhoid fever find their way into a lake used for drinking water, hundreds of cases of typhoid fever may follow. As well, even if a water sample contains some of these disease organisms, we still might not find them. Pathogens are hard to cultivate in a laboratory. Pathogenic organisms are outgrown on the culture plate by the far more numerous "fecal coliforms" (bacteria such as E.coli found in the colon) while the pathogens may not be found. Microbiologists consider the direct detection of pathogens in water or sewage to be difficult and demanding, if not impossible. Therefore, because it is so hard to detect disease organisms themselves, the safety of water is determined indirectly by looking for intestinal bacteria that indicate other pathogens may be present. "Coliforms" (bacteria resembling colon bacteria, but which may normally grow outside the gut) and "fecal coliforms" are the most frequently used bacterial indicators. To be just, we should look upon E.coli as a friendly messenger that helps to warn us of dangerous pathogens in our water.

What About E.coli and Hamburger Disease?

Like many bacteria, E.coli have developed different strains. some quite virulent. One particularly bad character is E.coli 0157:H7. If this or any other pathogenic strain is introduced into the body. a poison affecting the intestines is produced. Pathogenic E.coli 0157:H7 are particularly harmful. They can grow and produce the toxin inside the body and only a very small amount of bacteria need to be ingested to cause illness. Symptoms can range anywhere from mild diarrhea to death. This E.coli strain is usually found in contaminated hamburger and other meats and in unpasteurized milk. It has rarely been found in open water, and, like other E.coli strains, does not live or reproduce in lakes and rivers. Fortunately, all the pathogenic strains of E.coli are killed by heating to 71 C (160 F.).

Take-Home Lessons

- High numbers of E coli in your lake are not the problem but they do indicate that feces are getting into the lake. This is a big problem. When sewage enters the lake the E. coli could be accompanied by other organisms (such as hepatitis, cholera, typhoid and other pathogens) that are also carried in the human gut. As well, if sewage is getting into the lake, there will also be lots of phosphorus and nitrate, which cause eutrophication or premature aging, of your lake.
- Each of us must ensure that our septic systems are functioning properly, just as farmers must manage farm manure systems to prevent contaminated runoff into open water.
- And, be sure to ask for your hamburger well done.

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