

# Microbial Pathogens Associated with Produce

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Although illness associated with produce is not common, a wide variety of fresh fruits and vegetables have been associated with diseases caused by microbial pathogens. Unfortunately, when an outbreak does occur, the impact can be widespread. An excellent and thorough review of pathogenic microorganisms associated with fresh produce was recently published by Beuchat (1996). This article will focus on microbial pathogens that have received the greatest attention in the past few years.

### Microorganisms share common features

Bacterial pathogens such as *Shigella*, *E. coli* O157:H7, and *Salmonella*; the virus Hepatitis A; and parasites *Cyclospora* and *Cryptosporidium* have almost become household words in the food industry. These microorganisms are physiologically diverse but they do share some common features (Table 1). They all originate from enteric environments — that is they are found in fecal material of humans or animals. Humans and animals can shed these pathogens without signs of illness. Illnesses can be severe especially in susceptible individuals (young children, elderly, and immunosuppressed). Finally, infective doses (numbers of organisms causing illness) can be very low. A low infective dose means that the microorganism need only contaminate the food. While enhancing the likelihood of illness, temperature abuse and multiplication of the microorganisms is not always necessary.

illnesses tend to be significantly underreported. However, greater volumes of fruits and vegetables are being produced from central locations and distributed over much greater geographical areas to many more people. This coupled with increased global trade potentially increases exposure to foodborne pathogens and increases the chances that an outbreak will be detected. There is increasing evidence that the pathogens themselves are evolving: to cause illness at lower levels and to survive for longer times in relatively hostile environments (e.g. acidic environments). There has also been an increase in the population of susceptible individuals including elderly and immunocompromised.

### Mechanism of contamination

As raw agricultural products, fresh produce should be expected to harbor a wide variety of microorganisms including some pathogenic varieties. After all, with the exception of greenhouse operations, produce is still grown out doors and animals, birds, and insects can all carry human pathogens. Produce can become contaminated with microbial pathogens by a wide variety of mechanisms (Figure 1).

### Is produce a greater risk for foodborne illness today that it has been in the past?

This is a difficult question to accurately answer because foodborne

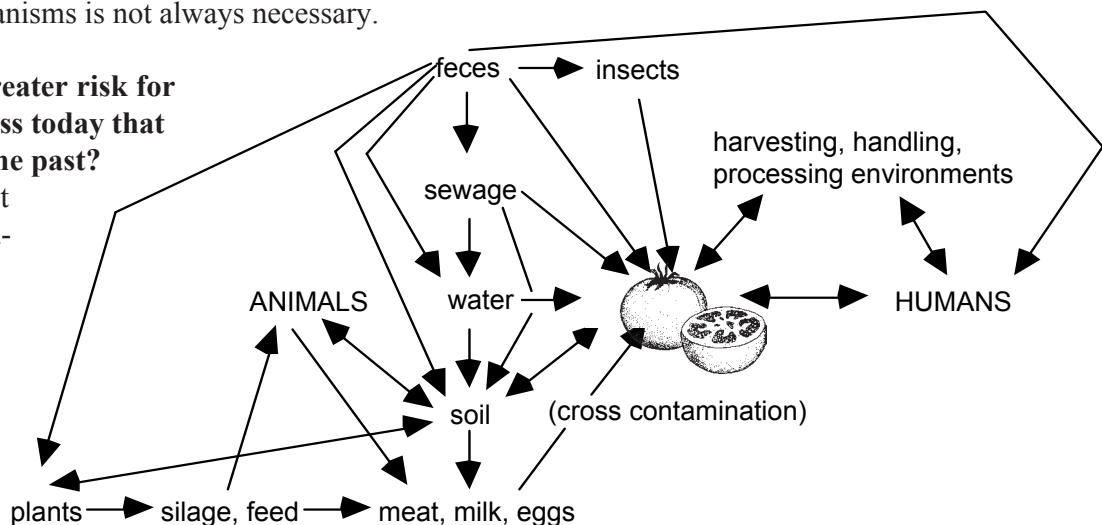


Figure 1. Mechanisms by which produce can become contaminated with pathogenic microorganisms (adapted from Beuchat, 1996)

Contamination can and has occurred:

- during production or harvest
- during processing, and
- at the retail, food service
- or in the home kitchen.

Contamination at any point in the chain can be exacerbated by improper handling and storage of the product prior to consumption.

While pathogens cannot be totally eliminated from produce there are a number of things that can be done to significantly reduce the risk of contamination. All potential mechanisms of contamination (Figure 1) should be systematically evaluated on each farm and in each processing or food service

facility and where possible, control measures should be implemented. To this end, numerous produce-related associations and individual companies have begun to implement good manufacturing practices and hazardous analysis critical control points programs from production through processing and retail distribution. For example of model HACCP plans see Beuchat (1996) or contact the International Fresh-cut Produce Association (703 -522 -1345 ext 151) or Western Growers Association (714 -863 -1000).

**Reference**

Beuchat, L.R. 1996. Pathogenic microorganisms associated with fresh produce. *J. Food Prot.* 59:204-216.

Table 1. Some microbial pathogens that have been associated with fresh produce.

Microorganism	Incubation Period	Symptoms	Infectious Dose (Number of cells)	Source	Examples of Produce Associated with Outbreaks
<b>BACTERIA</b>					
<i>E. coli</i> O157:H7	2 to 5 days	Watery diarrhea often containing blood, abdominal pain. Can lead to hemolytic uremic syndrome and kidney failure especially in children	10 to 1000	animal feces, especially cattle, deer and human	apple cider, alfalfa sprouts, lettuce, radish sprouts
<i>Salmonella</i> spp.	18 to 36 hours	Abdominal pain, diarrhea, chills, fever, nausea, vomiting	10 to 100,000	animal and human feces	alfalfa sprouts, apple cider, melons, tomatoes
<i>Shigella</i> spp.	1 to 3 days	Abdominal pain, diarrhea, fever, vomiting	10	human feces	lettuce
<b>PARASITES</b>					
<i>Cryptosporidium</i> spp.	1 to 12 days	Profuse watery diarrhea, abdominal pain, anorexia, vomiting	<30	human and animal feces	apple cider
<i>Cyclospora</i> spp.	1 to 11 days	Watery diarrhea, nausea, anorexia, abdominal cramps (duration 7 to 40 days)	unknown, probably low	human feces, others?	raspberries, basil, lettuce
<b>VIRUSES</b>					
Hepatitis A	25 to 30 days	Fever, malaise, anorexia, nausea, abdominal pain, jaundice, dark urine	10 to 50	human feces and urine	frozen strawberries, lettuce