

# Listeria can grow on unrefrigerated caramel apples

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Caramel apples punctured with dipping sticks and left unrefrigerated over the course of a couple of weeks may harbor a bacterium called *Listeria monocytogenes*, according to a study published this week in *mBio*, an online open-access journal of the American Society for Microbiology.

Studying listeria growth on a group of Granny Smith apples dipped in caramel and stored at either room temperature or in the refrigerator, researchers from the University of Wisconsin-Madison's Food Research Institute found the average population of *L. monocytogenes* increased 1,000-fold on caramel apples with sticks stored at room temperature for three days. By contrast, listerial growth was delayed on caramel apples without sticks stored at room temperature.

Listerial growth was significantly lessened among apples stored in the refrigerator: those with sticks had no listerial growth for up to a week but then some growth over the next three weeks. Those without sticks had no listerial growth during four weeks of storage.

Neither caramel because of its low amount of water nor apples because of their acidity are normal breeding grounds for listeria, said lead study coauthor Kathleen Glass, PhD, associate director of the institute. But inserting a stick into the apple causes a little bit of juice to migrate to the surface, she said, and that moisture, trapped under a layer of caramel, "creates a microenvironment that facilitates growth of any *L. monocytogenes* cells already present on the apple surface." Both moisture

transfer and microbial growth are accelerated at room temperature compared to refrigeration, she said.

To be safe, she said, consumers should look for refrigerated caramel apples or eat them fresh.

The study was prompted by an outbreak of listeriosis in late 2014, in which 35 people from 12 states were infected and seven people died, Glass said. Twenty-eight (90 percent) of 31 ill people interviewed reported eating commercially produced, prepackaged caramel apples before becoming ill, prompting a voluntary recall of prepackaged caramel apples by three manufacturers.

Listeriosis symptoms include fever, headache, stiff neck and gastrointestinal illness and may not appear until three to four weeks after eating affected foods.

For the study, Glass and colleagues prepared a cocktail of four *L. monocytogenes* strains associated with the outbreak and swabbed it on the skin, stem and calyx regions of a group of Granny Smith apples. They inserted wooden sticks through the stems of half of the apples.

They dipped all apples into hot caramel using either the sticks or tongs, then allowed them to cool. The apples were then stored either at 25 degrees Celsius (77° F) or 7 degrees Celsius (44.6° F) for up to four weeks.

Dipping the apples in hot caramel killed off a lot of the surface bacteria, Glass said. "But those that still survived were the ones that were able to grow. If someone ate those apples fresh, they probably would not get sick. But because caramel-dipped apples are typically set out at [room temperature](#) for multiple days, maybe up to two weeks, it is enough time for the bacteria to grow."

Caramel apple manufacturers may wish to thoroughly disinfect apples before dipping them in caramel, add growth inhibitors to the caramel coating or apple wax, or use better temperature-time controls to inhibit the [growth](#) of *L. monocytogenes*, she said.

Provided by American Society for Microbiology

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