Dr. Mom was right -- and wrong -- about washing fruits and vegetables

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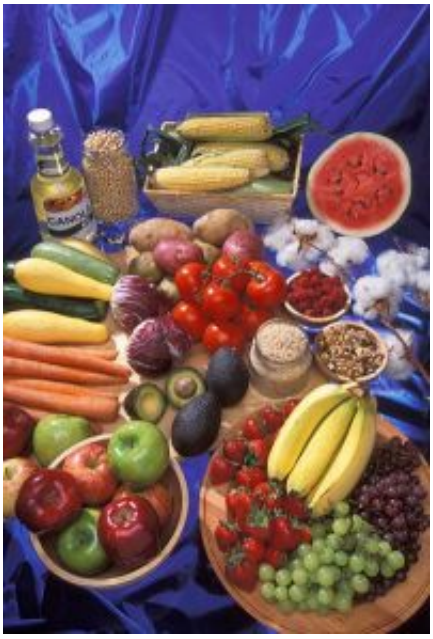

A new study shows that irradiation could be key to removing hard-to-reach pathogens inside fruits and vegetables. Courtesy of USDA-Agricultural Research Service, photo by Stephen Ausmus

Washing fresh fruits and vegetables before eating may reduce the risk of food poisoning and those awful episodes of vomiting and diarrhea. But according to new research, described today at the 235th national meeting of the American Chemical Society, washing alone — even with chlorine disinfectants — may not be enough.

Studies show that certain disease-causing microbes are masters at playing hide-and-go seek with such chemical sanitizers. These bacteria can make their way inside the leaves of lettuce, spinach and other vegetables and fruit, where surface treatments cannot reach. In addition, microbes can organize themselves into tightly knit communities called biofilms that coat fruits and vegetables and protect the bacteria from harm. This kind of bacterial community can harbor multiple versions of infectious, disease-causing bacteria, such as Salmonella and E. coli.

Now, new findings from scientists at the U.S. Department of Agriculture suggest that irradiation, a food treatment currently being reviewed by the FDA, can effectively kill internalized pathogens that are beyond the reach of conventional chemical sanitizers.

Irradiation exposes food to a source of electron beams, creating positive and negative charges. It disrupts the genetic material of living cells, inactivating parasites and destroying pathogens and insects in food, including E. coli and Salmonella.

Using this technique on fresh and fresh-cut fruits and vegetables could provide a reliable way to reduce the numbers of foodborne illnesses reported each year in the United States, says Brendan A. Niemira, Ph.D., a microbiologist with the USDA's Agricultural Research Service in Wyndmoor, Pa., who directed the study.

“When bacteria are protected — whether they’re inside a leaf or inside a biofilm — they’re not going to be as easy to kill,” Niemira says. “This is the first study to look at the use of irradiation on bacteria that reside inside the inner spaces of a leaf or buried within a biofilm.”

The quantity of fresh fruits and vegetables in the United States has increased every year in the last decade. Unfortunately, the increase in consumption has been accompanied with an increase in the number of

outbreaks and recalls due to contamination with human pathogens such as E. coli. Fresh fruits and vegetables carry the potential risk of contamination because they are generally grown in open fields with potential exposure to pathogens from soil, irrigation water, manure, wildlife or other sources.

“The spinach outbreak in the fall of 2006, in particular, raised questions about how these organisms survived the various treatments that are applied – the rinses and the washes and things,” Niemira says.

At the time, research had already demonstrated that pathogens like Salmonella and E. coli can be drawn into fruits after they've formed, and can migrate into them during fruit growth and maturation if the plant is exposed to them during pollination or in the irrigation water. But questions remained as to whether a penetrating process such as irradiation could kill a pest located inside a leaf.

To see how internalized sources of bacteria responded to various treatments, Niemira and his colleagues devised a way to pull bacteria into the leaves of leafy green vegetables. The scientists cut leaves of romaine lettuce and baby spinach into pieces and submerged them in a cocktail mixture of E. coli. The bacteria was pushed inside the leaves with a vacuum perfusion process. The leaves were then treated with either a three-minute water wash, a three-minute chemical treatment or irradiation.

After treatment, the leaves were suspended in a neutral buffer solution and crushed to recover and count the internalized bacteria. The study showed that washing with plain water was not effective at reducing the levels of the pathogen on either spinach or lettuce. The chemical treatment, a sodium hypochlorite solution, did not result in significant reductions of E. coli cells in spinach leaves, and an gave less than 90 percent reduction of E. coli in the romaine lettuce samples.

Ionizing radiation, in contrast, significantly reduced the pathogen population in both the spinach and the lettuce leaves. The level of kill was dependent on the dose applied, with reductions of 99.99 percent on romaine lettuce and 99.9 percent on spinach at the highest dose tested.

The researchers then conducted lab tests with biofilms to see how well different strains of Salmonella and E. coli, which were buried inside the biofilms, stood up to irradiation.

The biofilms that contained Salmonella tended to die more easily with irradiation, while those that were infected with E. coli were a bit more resistant, Niemira says.

“In the most resistant cases, we saw a difference of a few percent, but it was nothing at all compared to the resistance you might see if you were using a chemical treatment,” he says.

The scientists now are conducting studies of biofilms on leafy green vegetables to better gauge how irradiation might work on plants in the field.

Niemira says it’s still not clear if human pathogens can actually increase in population within plant tissues, or if they merely persist.

“This is an important question, because if the pathogens don't reproduce effectively within these protected spaces and stay below minimally infective population sizes, then the risk they pose to consumers is less,” he says. “If they are able to reproduce inside, then they may increase to more dangerous levels.”

Though some activist groups continue to speak against irradiation, consumer confidence in the application has grown steadily through the years as studies have shown its effectiveness in reducing pathogens that

cause foodborne illnesses, says Christine Bruhn, Ph.D., who focuses on consumer issues in food safety and quality at the University of California at Davis.

“Sixty to 90 percent of consumers indicate that they would buy irradiated food when told of the benefits of the process and the endorsement of health authorities,” Bruhn says.

She and Niemira have submitted a proposal to the USDA to further explore the applications of irradiation in leafy greens and to gauge consumer acceptance of this application.

Source: American Chemical Society