

Microwave Cooking Less Efficient At Killing Harmful Bacteria

UNIVERSITY PARK (Centre Co.) — Food is cooked not only to make it taste good, but also to destroy harmful bacteria that can cause food-borne illness. By structuring a series of research projects around how consumers cook with microwave ovens, scientists in Penn State's College of Agricultural Sciences have established that microwave cooking often does not completely eliminate bacteria.

"Most consumers use microwaves to cook to a certain time, rather than to a certain temperature," says Stephanie Doores, associate professor of food science. "Because microwaves heat unevenly, there is a good chance that

not all parts of the food will reach a uniform temperature, and microorganisms will survive the cooking process."

Doores and Roger C. Montemayor, graduate student in food science from Conshohocken, Pa., just completed a project focusing on *B. cereus*, a pathogen commonly found in dried food products.

The *B. cereus* pathogen was chosen because it forms spores, a protective covering that allows the bacteria to survive in a dormant state. In its spore form, *B. cereus* is much more heat-resistant than other food-borne bacteria, Doores explains.

"Some spore-forming bacteria can survive the drying process

used to preserve some foods," Montemayor explains. "Once you mix dry ingredients with water and subject the mixture to heat again, these spores may germinate and cause food-borne illness."

Montemayor prepared three food products — infant formula, instant mashed potato flakes and nonfat dried milk — following the directions as a consumer would. He then placed each product in a microwave oven. Using a fluoroptic probe to measure temperatures in several different locations within the food product, Montemayor established that microwave cooking did not deliver a uniform temperature throughout the food within the recommended cooking time.

Microwaving also did not destroy any of the *B. cereus* spores. Montemayor then subjected the

food to temperature abuse, a food science term that means leaving food out at room temperature for a period of time. Then, he refrigerated the products for four days. In most of the experiments, food-borne disease toxins had formed after temperature abuse.

"What made this project unique is that we used naturally occurring *B. cereus* spores, rather than microorganisms grown in the laboratory," Montemayor says. "Naturally occurring bacteria can be unreliable because you might get none in one sample and product toxin in the other sample. But we used *B. cereus* because bacteria that has been raised in a lab may not behave as naturally occurring bacteria would."

Doores and another researcher, Ronald Heddlson, now at North Carolina State University, performed similar research on such bacteria as *Listeria monocytogenes*, *Staphylococcus aureus* and *Salmonella*. Using laboratory-grown bacteria, the team found

that microwaving greatly decreased bacterial numbers, but did not eliminate them entirely — except in the case of minimally contaminated foods.

"Most people use microwave ovens for reheating leftovers or re-warming take-out food," Doores says. "Because microwave cooking does not kill bacteria to the extent that conventional cooking does, food safety becomes a real concern. If these food products are left out on the counter too long and then are not heated to a consistent temperature for a safe period of time, bacteria might not be killed."

Doores warns that food-borne illnesses can be particularly acute for senior citizens, chemotherapy patients, pregnant women and people with immune systems compromised by disease. "These people also might be more likely to opt for takeout meals or leftovers," Doores says. "We are suggesting that people should rewarm their food to a specific temperature for longer periods of time."

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