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Researchers developing way to distinguish between salmonella strains

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(PhysOrg.com) -- As scientists with the federal government search for the source of the salmonella that made thousands of people sick this summer and trace how it spread, researchers in Penn State's College of Agricultural Sciences are developing a new and more accurate method of acquiring the bacteria's identity.

The outbreak began last May. By August, at least 1,000 more people than usual around the country had gotten sick with salmonella poisoning. Investigators from the Food and Drug Administration discovered that two large enterprises in Iowa supplied eggs that carried a common type of salmonella, Salmonella Enteritidis, frequently associated with eggs. More than 500 million eggs from those farms were recalled, and investigators are piecing together how the outbreak occurred.

Hospitals reported the cases to state health authorities, who took a kind of genetic fingerprint of the bacteria and passed that information along to the Centers for Disease Control and Prevention in Atlanta. But in this case, the genetic fingerprint wasn't very helpful for tracing the bacteria because it was the most common fingerprint for Salmonella Enteritidis in CDC's database.

As a result, "Investigators couldn't tell if all those people really got sick from the same thing," said Stephen Knabel, professor of food science, who has been working with faculty colleague Edward Dudley for the past year to develop a new and more accurate method for DNA fingerprinting the top 10 types of salmonella bacteria.

"The problem is that different strains of Salmonella Enteritidis are highly related and very difficult to distinguish between," Knabel said. "The CDC uses a method of DNA fingerprinting called PFGE to track the strain that caused the outbreak, but it doesn't work so well with Salmonella Enteritidis."

Greatly simplified, PFGE differentiates strains of bacteria based on different DNA fragment patterns that result when the chromosomes of the bacteria are digested with specific enzymes, Knabel explained. However, the approach being developed at Penn State looks at the actual DNA sequences of specific genes, which allows scientists to accurately differentiate the different outbreak strains.

"We are not a public health lab, and thus we won't do routine testing, but we are hoping that the molecular subtyping method we are perfecting will allow scientists in public health labs to distinguish between different outbreak strains of salmonella, including Salmonella Enteritidis," he said. "CDC recently sent us 30 isolates associated with the current outbreak with the hope that our new method will help identify the true source of the Salmonella Enteritidis that caused this outbreak."
The Department of Food Science at Penn State has been involved in trying to reduce the threat from salmonella associated with eggs for more than a decade. Initially collaborating with the late David Kradel, a veterinary diagnostician and epidemiologist in Penn State's Veterinary Science Department who helped develop Pennsylvania's Egg Quality Assurance Program, Knabel initially conducted research on Salmonella Enteritidis and egg washing.

"Dave [Kradel] came to me about 15 years ago because he was concerned about Salmonella Enteritidis contamination of shell eggs during high-speed, high-volume egg washing, and we were able to get a Pennsylvania Department of Agriculture grant to fund a study focused on controlling Salmonella Enteritidis during egg washing," Knabel

recalled. "We looked at samples of egg-wash water and discovered that high pH and elevated temperature during egg washing destroyed Salmonella Enteritidis on egg shells and in egg-wash water."

"Eventually, high pH and elevated temperature during egg washing became part of the state's Egg Quality Assurance Program," he said. "Ramaswamy Anantheswaran, professor of food science, and I also looked at different methods for rapidly cooling eggs after washing and the effect these had on both egg-shell cracking and the penetration and growth of salmonella in eggs."

According to Anantheswaran, while it is important to lower the temperature of the eggs quickly to prevent the growth of Salmonella Enteritidis, the industry needs to be careful not to use too high a rate of cooling. "Our research showed that too rapid cooling, as encountered when using cryogenic methods, could induce microcracks within egg shells, which could enhance penetration of Salmonella Enteritidis into the eggs," he said.

Penn State researchers also found that adding a small amount of iron to pooled egg enrichments in the laboratory promoted salmonella growth. "So even low numbers of Salmonella Enteritidis could be detected 100 percent of the time," Knabel said.

The research conducted in Penn State's Department of Food Science has made a big impact on food safety, Knabel contended. "We have dramatically increased our ability to detect, track and control Salmonella Enteritidis in shell eggs," he said. "And that protects both consumers and a very important food industry in Pennsylvania and throughout the United States."

Provided by Pennsylvania State University