

Effect of *Salmonella* on Eggshell Quality

While researching *Salmonella enteritidis* in poultry, ARS veterinary medical officer Jean Guard Bouldin (nee Petter) found an interesting phenomenon. Not only is *Salmonella* present inside seemingly uncracked chicken eggs, but other bacteria are there too.

These other bacteria are usually found in eggs that have cracks in the shell. How could they get into unbroken eggs?

Bouldin and her colleagues at the Southeast Poultry Research Laboratory in Athens, Georgia, noticed a decrease in shell quality among infected birds in some experiments. They guessed that the reason other bacteria besides *Salmonella* gained entry into the egg was that shell integrity was being compromised.

To test her theory, Bouldin consulted with Jeff Buhr, of the ARS Poultry Processing and Meat Quality Research Unit in Athens, Georgia, on mechanical methods that could be used to measure the strength of the shell. They inoculated chickens with *S. enteritidis* and evaluated eggs with an Instron, a standard laboratory instrument used to test food firmness through compression. The eggs were compressed until a hairline crack formed. Eggs from *Salmonella*-infected hens cracked more easily than those from non-infected hens. “*Salmonella enteritidis* seems to target the hen’s reproductive tract, which sometimes results in an egg with a less resilient shell,” says Bouldin.

Other experiments that used a high dose of bacteria in hens confirmed that *S. enteritidis* targeted the avian reproductive tract, because the reproductive tract organs involuted, or shrank, after exposure, even though the hen continued to appear healthy.

At a low-dose infection, Bouldin found that *S. enteritidis* actually stimulated egg production, particularly in older hens. This increased production may have stretched the limited eggshell material—calcium—a bit too thin, literally. Other diseases of chickens can also decrease shell quality, but they usually decrease egg production and cause symptoms of illness.

Though eggshell quality normally decreases over the lifespan of a laying hen, Bouldin wonders whether the decline also occurs from pathogen infection. Either way, her discovery could inadvertently lead to a way to detect *Salmonella*-infected birds—by testing eggshell integrity.

“Our next step is to develop methods to use as a sensitive assay of bird health in general, leading to a possible control of *S. enteritidis* infection and a way to detect other pathogens that result in poor shell quality,” says Bouldin.—By **Sharon Durham, ARS.**

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“D”creasing Elders’ Slips and Falls

Older adults who get supplemental vitamin D in their diets are less likely to slip and fall down, according to an analysis by ARS-funded scientists and their colleagues.

About one-third of people over age 65—and up to half of those over 80—get injured from falling every year. What’s more, such falls lead to 40 percent of all nursing facility admissions and are the largest single cause of injury-related deaths among the elderly.



Bess Dawson-Hughes, a physician specializing in bone health and nutrition, along with colleagues in academia and medicine, researched all major vitamin D clinical trials in older populations conducted from January 1960 to February 2004. Dawson-Hughes is director of the Bone Metabolism Laboratory at the Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts University in Boston, Massachusetts.

Based on five double-blind, randomized, controlled trials involving 1,237 participants, the researchers found that elderly people fell 22 percent less often if they took vitamin D supplements. The folks studied, who averaged about age 70, were in stable health and were either community dwelling or living in some type of care facility.

Previously, it had been shown that vitamin D supplementation was good for bone health and that very severe vitamin D deficiency led to muscle weakness. But less was known about any association between milder vitamin D deficiency and muscle weakness or risk of falling. When the activated form of vitamin D binds to receptors in muscle tissue, it promotes growth and strengthens muscles, which can in turn reduce falls, according to Dawson-Hughes.

Fall-related injuries are likely to account for more than \$32 billion in future medical-, hospital-, and rehabilitative-care costs annually, experts say. The findings underscore the importance of adequate vitamin D intake for the prevention of falls in the elderly and a need for further related studies. The paper was published in the April 2004 issue of the *Journal of the American Medical Association*.—By **Rosalie Marion Bliss, ARS.**

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