Letters to the Editor

Salmonella enteritidis in Eggs

To the Editor:

I'm calling on *Infection Control and Hospital Epidemiology* to possibly find an explanation for the increase in *Salmonella enteritidis* in eggs.

Are there any studies showing an increase in the eggs from factory farm (caged) vs. free range chickens?

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This letter was forwarded to Russell W. Currier, DVM, Iowa Department of Public Health, and Susan C. Trock, DVM, Centers for Disease Control, Atlanta, Georgia.

The problem of *Salmonella enteritidis* in eggs remains elusive and frustrating for the poultry industry and public health. Numerous common-source outbreaks have been described, primarily in the northeastern states, but egg-associated outbreaks have not been limited to that section of the country. Centers for Disease Control (CDC) surveillance indicates that human S *enteritidis* isolates as a percentage of all human *Salmonella* serotypes increased from 10% in 1984 to 14% in 1986.[1] Michael St. Louis, of the CDC, published a review indicating that eggs were implicated in 27 (77%) of 35 foodborne *S enteritidis* outbreaks." Earlier, egg-associated *Salmonella* outbreaks have been associated with cracked or "checked" eggs, but recent investigation in the northeast and midwest have demonstrated the presence of *S enteritidis* in intact shell eggs. Other studies have recovered *S enteritidis* from the ovary and oviduct of chickens, indicating that transovarian transmission is occurring.

Chickens are produced on a three-tiered model: primary flock (grandparent or genetic stock), multiplier-breeder (parent flock) and production (commercial flock). *S enteritidis* has been recognized at all three levels.

A perspective from the United Kingdom indicates that during 1987 and 1988, 49 *S enteritidis* outbreaks were reported in Britain, affecting over 1,000 people. Studies of over one million eggs, sponsored by the British egg industry, failed to identify a single S *enteritidis*-positive egg. Investigation of eggs known to have caused human illness were "traced to only 12 producers, nine of which were small 'free range' farms where hens are allowed to roam freely.'" Only a small fraction of the 59 billion eggs produced in the United States annually are from free range birds.

It would appear that caged layers or closed house layers would be more amenable to disease management, since the birds'environments can be more carefully controlled. After identification as infected, flocks may be depopulated or their eggs designated for pasteurization. Both of these options are subject to negative publicity and loss of business. One large U.S. food purveyor has refused to knowingly purchase processed eggs from contaminated lots or flocks, even if pasteurized.

Currently, the rate of U.S. egg contamination with *S enteritidis* is estimated to be between 4/1,000[4] to 1/14,000.[5] An FDA official has observed that "the probability of an infected hen laying a contaminated egg is 'very low,' perhaps one in every 200 eggs laid.'" Shedding of the organism may be stress-related, as observed in *Salmonella* infection in other species.

The risk of human illness due to *S enteritidis* in eggs can be reduced by improved time-temperature control in the interval from purchaser to consumer. Baker et al. inoculated eggs with *Salmonella* serotype typhimurium, then incubated them at 45°F or 54" for 24 hours. They found a 10.6-fold increase of *Salmonella* organisms when the eggs were allowed to incubate at 54°F for 24 hours. This can allow an initial low dose of organism to reach a level capable of causing human illness and in some instances, death. Currently, replication of this work using the S *enteritidis* organism is being done.

These data clearly show the value of refrigeration. The federal law governing the temperature for eggs was passed in the 1960s. This law requires shell eggs to be held at a temperature not to exceed 60°F.[8] Clearly, this temperature allows rapid multiplication of *S enteritidis*.

However, even this basic consideration is compromised by practical operations. For instance, egg pickup and transportation to the processor may be daily during peak yields for a chicken flock. When yields are reduced, pickups are scheduled less frequently (twice a week, once a week or less) for efficiency. Flock producers do not usually refrigerate (45°F or less) stored eggs, partially due to cost and partially since it is not required.

One solution to the on farm time-temperature problem is daily pickup of eggs, or refrigeration of the eggs at 45°F or less while on the farm. This step, in combination with refrigeration while in transit, can eliminate the time-temperature problem that allows for the rapid multiplication of this human pathogen. Since cool eggs will explode