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?

Harry J. Silver, MD
Los Angeles, California

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

https://doi.org/10.1017/S0899823X00081332 Published online by Cambridge University Press

when they come in contact with warm wash solution, the processor must allow time for the eggs to warm before processing. The result would be that eggs, like every other raw food of animal origin, are held under strict time-temperature control to ensure a safe, wholesome product reaches the consumer.

In summary, *S enteritidis* in poultry does not appear to be a problem that is a function of high production, controlled environment husbandry methods, but is an evolving problem throughout the industry, complicated by transovarian transmission.

Accordingly, institutional food service operations, such as hospitals, should recognize the special susceptibility to their patients and adhere to published guidelines of "Safe Handling of Eggs in Quantity."" Four key guidelines from this document are:

- Avoid serving raw eggs and foods containing raw eggs; institutionally prepared Caesar salad and Hollandaise sauce, for example. Products such as homemade ice cream, homemade eggnog and homemade mayonnaise also should be avoided, but commercial forms of these products are safe to serve since they are made with pasteurized eggs.
- Cook eggs thoroughly until both the yolk and white are firm, not runny, in order to kill any bacteria that may be present. There may be some risk in serving eggs lightly cooked; soft-cooked, soft-scrambled or sunny-side-up, for example.
- Realize that serving lightly cooked foods containing eggs, such as soft custards, meringues and french toast, may be particularly risky for people with weakened immune systems and other high-risk groups.
- Review recipes and food-handling practices to consider using pasteurized egg products instead of shell eggs whenever possible.

Russell W. Currier, DVM
Susan C. Trock, DVM

REFERENCES

1. Hargrett-Bean NJ, Pavia AT, Tauxe RV: *Salmonella* isolates from humans in the United States. *MMWR* 1988; SS-2:25-31.
2. St. Louis ME, Morse DL, Potter ME, et al: The emergence of grade A eggs as a major source of Salmonella *enteritidis* infections. *JAMA* 1988; 259:2103-2107.
3. British ad warns against using uncooked eggs. ***Food Chemical News 1988;*** 43:47-48.
4. Incidence of *Salmonella*-contaminated eggs reported low. ***Food Chemical News 1988;*** 12:6-7.
5. Conner MW, Crouch EA, Green LC, et at: Assessment of safety of grade A shell eggs. In a risk assessment sponsored by the Egg Nutrition Center, Washington. DC, 1988.
6. AMS to announce model program for egg testing. ***Food Chemical News 1988;*** 26:36.
7. Baker RC, Hogartv S, Poon W, et al: Survival of *Salmonella typhimurium* and *Staphylococcus aureus* in eggs cooked by different methods. *Poultry Science* 1983; 62:1211-1216.
8. Code of Federal Regulations; Agriculture. Federal Register 1987; 56(Jan 1):133-134.
9. Safe handling of eggs in quantity. *Food Service Institutions Bulletin*, Food and Drug Administration; September 1988: 1.

Diamidine Use in Treatment of *Pneumocystis carinii*

To the Editor:

The reintroduction of pentamidine into therapy for peumocystosis was preceded by an unusual chapter in pharmacologic investigation. The basic studies formed a romantic search for a compound that would influence the metabolism of glucose, an essential metabolite of trypanosomes. In 1935, an investigation of hypoglycemic-producing guanidine derivatives was initiated.' Synthalin (decamethylene diguanidine hydrochloride) was determined to have trypanocidal activity, an action later found not due to hypoglycemia.' Subsequently, an exploration of compounds in which aromatic carrier chains were substituted for the alkyl chains and a shift to terminal amidine groups was made." The fundamental chemotherapeutic constitutent was determined to be the aromatic diamidine group. Oxygen, nitrogen and sulfur linkages were also introduced into the alkane chain. Four promising compounds were isolated (stilbamidine, pentamidine, propamidine and phenamidine). The last three compounds contained an oxygen link in the alkane chain.

These aromatic diamidines have therapeutic activity in human trypanosomiasis, leishmaniasis and gram-positive bacterial infections. Although stilbamidine seemingly was the most effective drug, its neurotoxicity made pentamidine the agent of choice for such therapy. At a later time, stilbamidine was demonstrated to be satisfactory treatment for blastomycosis.[4] Advantage was taken of its neurotoxicity in the treatment of tic douloreux." The use of the diamidines for such purposes is a far cry from the agent sought as a hypoglycemic drug for trypanosomiasis, and the story is a tribute to the many investigators who by perseverence and perhaps, serendipity, brought these compounds to modern medicine for the treatment of *Pneumocystis carinii.*

Joseph M. Miller, MD
Baltimore, Maryland

REFERENCES

1. von Jancso II, von Jancso H : Chemo-Therapeutische Wirkung und Kohlehydratstoffwechsel. Die Heilwirkung von Guanidinderivaten auf die Trypanosomeninfektion. Ztschr f. Immunitatsforsch. *u exper Therap* 1935; 86: 1-30.
2. Lourie EM, Yorke W: Studies in chemotherapy. XVI. The trypanocidal action of synthalin. *Ann Trop Med Parasitol 1937;* 31:435-445.
3. Ashley JN, Barber I IJ. Ewins AJ, ct al: A chemotherapeutic comparison of the trypanocidal action of some aromatic diamidines. *J Chem Soc* Pat-t I, 1942; 20:103-116.
4. Schoenbach EB, Miller JM, Ginsberg AJ, et al: Systemic blastomycosis treated with stilbamidine (preliminary report). *JAMA 1951;* 146:1317-1318.
5. Smith GW, Miller JM: The relief of tic douloureux with stilbamidine. *Ann Intern* Mud 1953; 38:335-338.

Letters to the Editor should be uddressed to INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY Editorial Offices, C41 General Hospital, University of Iowa Hospitals and Clinics, Iowa City, IA 52242. All letters must be typed, double spaced, and may not exceed four pages nor include more than one figure or table. The editors reserve the right to edit for purposes of clarity on brevity.

https://doi.org/10.1017/S0899823X00081332 Published online by Cambridge University Press