

Salmonella: 100 Years Later... We're Still Fighting It

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Key Points:

- There appears to be a correlation between on-farm *Salmonella* status and the *Salmonella* status of processed carcasses after chilling.
- Speakers at the 2013 *Salmonella* Summit concluded that the use of a Direct-Fed Microbial (DFM) is an important component in a *Salmonella* control strategy.
- In a long-term study using CALSPORIN[®], significant reductions were observed in *Salmonella typhimurium* in the carcass rinse samples.

The bacteria we call *Salmonella* formally obtained its name in the year 1900. It is well known that the organism was named after the USDA researcher Dr. Daniel Salmon, who was investigating the causes of hog cholera at the end of the 19th century. At that time the bacteria was consistently isolated from sick hogs by Dr. Salmon's colleague and was named *Salmonella cholera-suis*. Although hog cholera was later proven to be caused by a virus, *Salmonella* continues to be a blight on human health, particularly in regard to food-borne illness. Now, over 100 years and 3000 serotypes later, recent reports suggest that the battle against this bacteria continues, particularly in regard to food-borne illness and *Salmonella*'s association with poultry products.

Current Studies Using Trusted Techniques

The contamination of retail poultry products is frequently linked to cross-contamination at the processing facility. Although exact scientific data identifying a direct linkage is sketchy, numerous recent food safety trace-back reports from the USDA and CDC have correlated the presence of bacterial contaminants in the processing facility to food-borne disease outbreaks. However the news is not all negative. A report in a 2012 issue of Food Control noted that the prevalence of poultry carcass contamination has dropped in the last 12 years. Yet the risk to human health remains constant and the report suggests a modified approach in predicting

food-borne disease outbreaks based on post-process *Salmonella* culturing results.

The consistency of *Salmonella* serotypes throughout the broiler grow-out continues to be investigated. Dr. Randy Singer from the University of Minnesota, Department of Veterinary and Biomedical Sciences reported on an extensive investigation of *Salmonella* prevalence in the broiler environment during the recent 2013 *Salmonella* Summit held in West Siloam Springs, OK. In his report, broiler house environmental samples were collected using boot-socks, drag-swabs, fecal samples and litter samples. The environmental samples were correlated with samples taken at the processing plant. The results concluded that there appears to be a correlation between on-farm *Salmonella* status and the *Salmonella* status of processed carcasses after chilling.

Old Data Has Become New Data

The conclusions by Dr. Singer were echoed by several speakers at the Summit. The idea presented is that a reduction in *Salmonella* prevalence during the broiler grow-out phase has direct correlation in post-processing carcass contamination levels. Several live production interventions to reduce the *Salmonella* load entering the processing establishment were suggested. A common thread among the speakers was that the use of a Direct-Fed Microbial (DFM) is an important component in a *Salmonella* control strategy.

The use of a DFM or competitive exclusion product as a *Salmonella* intervention is not new. The archetypal report for live production *Salmonella* intervention was published in 1973 by Nurmi and Rantala, where adult chicken cecal contents were used to protect chicks from *Salmonella* infection. Later that decade (1979), Snoeyenbos et al. noted that a competitive exclusion product from adult chicken microflora could protect chicks from *Salmonella* colonization for 8 to 9 weeks post-treatment. Throughout most of the 1980s and 1990s researchers focused on either large homogenates of adult chicken microflora as a *Salmonella*



intervention, or specific components of the homogenates, such as *Lactobacillus* and *Bifidobacter* species.

The fragile nature of some bacterial species as a *Salmonella* intervention was changed by a 1995 report by Maruta et al. This study focused on the reduction of *Salmonella* in chicken cecal contents in broilers fed CALSPORIN® (*Bacillus subtilis* C-3102). This bacteria is more resistant to environmental pressures as it is fed in the sporulated form and is able to resist pelleting systems up to 90°C. The birds were fed the CALSPORIN® at an inclusion rate of 300,000 CFU/g feed from 21 days-of-age to 53 days-of-age. A significant reduction in cecal colonization by *Salmonella* bacteria was noted. Later work conducted by Fritts et al. in 2000 showed a significant reduction in carcass *Salmonella* prevalence when broilers were fed CALSPORIN®. This report involved two floor pen trials using commercial broilers fed CALSPORIN® from day 1 until harvest at 42 days-of-age. Carcass rinse samples were used in both trials, demonstrating a reduction in *Salmonella* prevalence.

Most recently, in a long term study, Sims et al. reported in 2008 on floor pen research where broilers were fed CALSPORIN® at an inclusion rate of 300,000 CFU/g of feed for three consecutive flocks. A high-dosage *Salmonella typhimurium* challenge was added to the feed at 10 days-of-age during the initial grow-out of broilers. The two successive replacement flocks were monitored for *Salmonella* bacterial contamination using the carcass rinse procedure. The first flock was unaffected. However, the immediate replacement flock and the second replacement flock (cycle 2 & 3) showed significant reductions in *Salmonella typhimurium* in the carcass rinse samples.

New Research to Fight an Old Foe

Latest research reports indicate that current interventions can and have had an impact on the prevalence of *Salmonella* in poultry products. *Salmonella*-related food-borne disease outbreaks have declined during the last 30 years. Post-processing sampling results appear to correlate with the decline in illness reports. According to Dr. Singer an interesting phenomena may be surfacing in regards to *Salmonella*. He noted that it appears that when success is achieved in eliminating one type of *Salmonella* serotype, often a different serotype surfaces. Therefore, as advocated by many of the speakers at the *Salmonella* Summit, a broad-based approach in *Salmonella* intervention is needed. The results reported by several researchers indicate that a DFM has that broad-based *Salmonella* intervention effect during the live production phase. This supports the work published by Maruta, Fritts and Sims, which all point out that all *Salmonella* serotypes were reduced in broilers fed CALSPORIN®.

About the Author

Dr. Schleifer, located in the Gainesville, GA area, has over 20 years of poultry medicine experience. He received his BS in Microbiology and Doctor of Veterinary Medicine from Iowa State University. He continued his education at the University of Georgia where he received an MS in Medical Microbiology. His research focused on the susceptibility of broilers to *Salmonella* infection. With a focus on poultry intestinal health, he helped introduce salinomycin to the US broiler industry under the trade name Bio-Cox, and later identified the microflora implications of growth promotant antibiotics in chickens and turkeys, particularly in regard to the use of bambermycins. Dr. Schleifer has experience in broiler live production medicine as well as teaching and research. He has authored numerous articles on poultry health issues for trade journals as well as research articles in peer-reviewed journals and scientific forums. Most recently he completed work at USDA-FSIS where he served as a Supervisory Veterinary Medical Officer and Inspector In-Charge at several poultry processing plants in the Southeast.

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