As published in

PoultryAdvisor™

***Research Update***

# Commercial broiler field trial: The effects of Original XPC™ on *Salmonella* prevalence and load, as measured by environmental sampling and carcass rinse at rehang

**By Don McIntyre, Ph.D., PAS**
Director, North America Poultry Research & Technical Service
Diamond V

**Doug Smith, Ph.D.**
Director, Poultry Food Safety
Diamond V

The incidence of *Salmonella* infection in humans has remained relatively steady since 1997, with 42,000 cases reported annually (CDC, 2011). An estimated 37% of reported *Salmonella* cases have been associated with poultry meat and eggs (Russell, 2009).

*Salmonella* can be found in the poultry environment, live birds, and poultry products. Therefore, effective on-farm, pre-harvest food safety practices, which impact *Salmonella* prevalence and load in poultry prior to processing, can aid in controlling foodborne pathogens.

Research has shown that feeding Original XPC™ (XPC) to poultry from hatch to market age can significantly reduce prevalence and load of the foodborne pathogen *Salmonella* (Ibukic et al., 2012; McIntyre, 2013; Broomhead, 2014). The objective of the current study was to evaluate the effects of adding XPC to broiler feed under commercial field conditions on *Salmonella* prevalence and load in birds received at the processing plant.

**Trial design**

A field study was conducted by a vertically-integrated commercial broiler company implementing an antibiotic-free (ABF) program. The test site was a large farm with 16 broiler houses, each housing approximately 16,000 birds at placement. Birds in even-numbered houses were assigned to the control feed treatment (PC). Birds in odd-numbered houses were assigned the test treatment, which consisted of PC + 2.5 lb/ton XPC (XPC) from 0 days of age until market (46 d). Both dietary treatments included a *Bacillus licheniformis* product and a chemical coccidiostat.

All barns were tested for *Salmonella* prevalence prior to marketing; two environmental samples per barn were collected via boot socks. At 46 days of age all birds were marketed. The marketing schedule allowed birds from each barn to be the first lot into a clean plant each morning. At random, 25 carcasses were chosen from each barn and carcass rinses collected at rehang according to USDA-FSIS protocol. Environmental and rinse samples were labeled and shipped overnight to the University of Georgia, College of Veterinary Medicine, PDRC Diagnostic Laboratory for analysis.

Upon arrival to the lab, tetrothionate broth was added to individual samples, sterile saline was added to each sample, and the sample was stomached. From each sample, a 1 mL aliquot was removed for most probable number (MPN) analysis and a 10X tetrothionate broth (Difco) solution added. All samples were incubated overnight at 41.5°C. Following incubation, a loopful of each sample was struck onto xylose lysine tergitol-4 agar (XLT-4, Difco) plates, which were incubated overnight at 37°C. Up to three colonies were selected and confirmed as *Salmonella* positives using Poly-O *Salmonella* Specific Antiserum (Mira Vista, Indianapolis, IN) according to Berghaus et al., 2013.

All samples were evaluated for the presence of *Salmonella* (percentage prevalence). *Salmonella* organisms were enumerated from positive samples to determine load using the MPN (Berhaus et al., 2013).

*Salmonella* prevalence for environmental boot socks and rehang carcass rinses were compared between treatment groups using generalized estimating equations (GEE) logistic models to account for the correlation between responses of birds from the same house. Carcass rinse *Salmonella* MPNs were compared between treatment groups using linear mixed models, with house as a random effect. The MPN per mL (MPN/mL) values of rinse solution were multiplied by the volume of buffered peptone water used in the USDA-FSIS carcass rinse method (i.e., 400 mL/carcass) to yield the total MPN per carcass (MPN/carcass). MPN values were log-transformed prior to statistical analysis.

**Results**

The average market age of all birds in the trial was 46.5 days of age. Body weight averaged 6.65 lb, with no differences between treatments. Feed conversion (feed to gain) adjusted to 6.0 lb was 1.75 vs. 1.83 for XPC and PC, respectively. Total condemnations of XPC birds equaled 0.67%, compared to PC at 1.58%.

Boot sock samples indicated *Salmonella* was present in the environment of all barns (81.8% for XPC vs. 77.3% for PC). At processing, each treatment was represented 200 times (25 carcasses X 8 barns) via carcass rinse collections. A significant ($P$ = 0.011) reduction in *Salmonella* prevalence was detected in XPC compared to PC (Table 1).

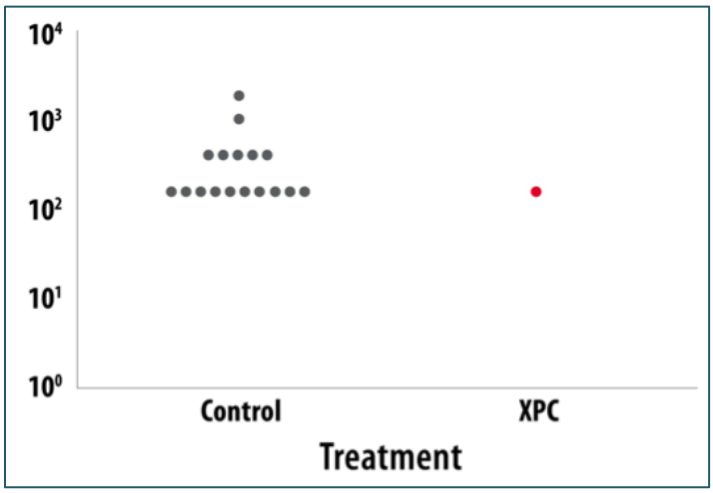
**Table 1. *Salmonella* prevalence in rehang carcass rinses**

| Treatment | Samples[1] | Number (%) Positives | *P*-value |
|---|---|---|---|
| **Control** | 200 | 17 (8.5%) | 0.011 |
| **XPC, 2.5 lb/ton** | 200 | 1 (0.5%) | |

[1]Rinses from 25 carcasses per barn with 8 PC and 8 XPC barns.

*Salmonella* MPN for culture-positive carcass rinse samples collected during the sampling period are illustrated in Figure 1. Enumerations for the 17 PC *Salmonella*-positives averaged 2.43 $Log_{10}$. The single XPC *Salmonella*-positive equaled 2.20 $Log_{10}$. Figure 1 shows the difference in *Salmonella* load received at the processing plant from each treatment.

**Figure 1. Dot plot diagram of MPN *Salmonella* enumeration***




*Control (PC) positives = 17; XPC positives = 1

## Summary

- In this field trial, addition of Original XPC to antibiotic-free (ABF) broiler feed (XPC treatment at 2.5 lb/ton) resulted in a feed conversion eight points (0.08) lower than the Control diet (PC).
- XPC-fed broilers had less than half the number of condemned carcasses than Control birds (0.67% vs. 1.58%, respectively).
- Birds fed XPC had significantly less carcass *Salmonella* (0.5%) compared to Control birds (8.5%).
- Feeding XPC to commercial broilers in this trial resulted in reduced *Salmonella* prevalence and reduced *Salmonella* load when birds were brought to the processing plant.

**References**


Berghaus, R., S.G. Thayer, B.F. Law, R.M. Mild, C.L. Hofacre and R.S. Singer, 2013. Enumeration of *Salmonella* and *Campylobacter* in environmental farm samples and processing plant carcass rinses from commercial broiler chicken flocks, Appl. Environ. Microbiol. 1-37.

Broomhead, J. 2014. Effects of feeding Original XPC™ to broilers on *Salmonella* Typhimurium prevalence and load during a challenge study. Field trial reported in PoultryAdvisor, January 2014.

CDC, 2011 Estimates: Findings. 2011. CDC Estimates of Foodborne Illness in the United States. http://www.cdc.gov/foodborneburden/2011-foodborne-estimates.html#annual

Ibukic, M., D. Trampel, T. Frana, C.M. Logue, and J. Broomhead. 2012. Evaluation of Diamond V Original XPC for reducing cecal colonization by *Salmonella* Enteriditis in layer pullets. In: Proceedings of the 93rd Conference of Research Workers in Animal Diseases. Chicago, IL. (See also PoultryAdvisor, February 2013.)

McIntyre, D.R., 2013. Original XPC™ helps reduce *Salmonella* in turkey field trial. Field trial reported in PoultryAdvisor, June 2013.

Russell, S.M., 2009. *Salmonella* Intervention Strategies and Testing Methods. 04 April 2009. http://www.thepoultrysite.com/articles/1357/*Salmonella*-intervention-strategies-and-testing-methods


Diamond V®

The Trusted Experts In Nutrition & Health™