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QTI™ ANIMAL HEALTH & NUTRITION

Campylobacter Reduction in Broiler Chickens Using CALSPORIN® as a Pre-Harvest Invervention

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Key Points:

- *Campylobacter* currently is the Number One food safety bacterial risk in the US.
- Pre-harvest interventions have proven to reduce the incidence and numerical prevalence of *Campylobacter* colonization of broilers.
- Trials conducted throughout the world show *Campylobacter* counts were significantly reduced with a diet containing CALSPORIN.

Campylobacteriosis

Campylobacteriosis is an infectious disease caused by bacteria of the genus *Campylobacter*. Campylobacteriosis is a gastrointestinal disease estimated to affect over 1.3 million persons every year in the US. Of all bacterial gastrointestinal diseases, Campylobacteriosis is considered number one in respect to total cost of illness and loss of quality-adjusted life years (Batz et al., 2012). Studies continue to indicate that the consumption of poultry is a common source of the bacteria. Paradoxically, the bacteria readily and rapidly colonize the chicken or turkey intestinal tract without making the animal sick. Despite its ability to grow somewhat unimpeded in a bird's gut, these bacteria are actually quite fragile. They cannot tolerate drying and can be killed by oxygen. This makes the laboratory cultivation process difficult.

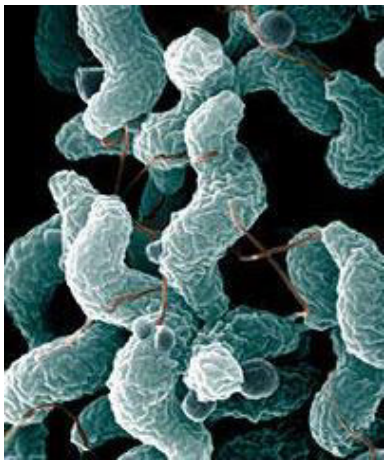

Figure 1. *Campylobacter jejuni* ("*Campylobacter*", Wikipedia).

Campylobacter in Broilers during the Production Phase

Studies show the incidence of *Campylobacter* colonization of broilers is very low during the first 2–3 weeks of life (Lee and Newell, 2006). After that age, spread of the bacteria and colonization often occurs rapidly. The ceca is the section of the intestine with highest level of infestation. Both the number of birds infected and the level of infection in regard to numbers of *Campylobacter* escalate as the bird approaches 35–40 days-of-age. Prevalence of *Campylobacter* contamination of broiler carcasses ranges from 50% to >90% at the time of harvest (Berghaus et al., 2013 and Northcutt et al., 2003).

In an effort to significantly reduce the incidence of *Campylobacter* in poultry products by 2020, USDA Food Safety and Inspection Service (FSIS) has recently announced new *Campylobacter* Performance Standards for young chicken carcasses, chicken parts and ground chicken. These new standards address the frequency in carcass samplings, the products sampled, as well as the microbiology methods. (Federal Register 81:28, 2016). A recurring theme in *Campylobacter* reduction is the utilization of pre-harvest interventions that quantitatively and qualitatively reduce the bacteria during that production phase.

CALSPORIN® (*Bacillus subtilis* C-3102 spores) as a Pre-Harvest Intervention

The use of probiotics, particularly CALSPORIN have long been known to reduce *Campylobacter* incidence and colonization. Twenty years ago, Maruta et al. (1996) reported that the dietary inclusion of *Bacillus subtilis* C-3102 at 300,000 cfu/g feed numerically reduced by almost 100-fold, the level of *Campylobacter* of cecal contents in 50-day-old replacement pullets. This reduction in bacterial populations was observed after the chickens were orally dosed with high levels of the bacteria. Additionally, the percentage of birds culturing positive for *Campylobacter* was decreased by 90% with

Table 1:
Effect of dietary *Bacillus subtilis* C-3102 (300,000 cfu/g feed) on *Campylobacter* spp. in feces from Cobb broiler chickens at 56 days of age in a commercial field trial in Japan.

Dietary Treatment	Fecal *Campylobacter* spp. (log10 cfu/g)		Positive/Total Samples
Control, 0-56 days (house A; 6,500 chicks)	6.23	±0.79	50/50
Bacillus subtilis, 34-56 days (house B; 6,500 chicks)	4.20**	±1.27	20/50*
Bacillus subtilis, 17-56 days (house C; 6,500 chicks)	3.77**	±0.46	8/50*

*P<0.05 for each *Bacillus subtilis* treatment vs. Control, and **P<0.01 for each *Bacillus subtilis* treatment vs. Control.

Table 2:
Effects of dietary probiotics or prebiotic on Ross PM3 male and female broiler body weight (BW, kg) and cecal *Campylobacter* spp. counts at 14, 35, and 42 days of age.

Dietary Treatment	Body weight, kg			Positive/Total Samples		
	14 days	35 days	42 days	14 days	35 days	42 days
Control	0.406	1.958	2.769	8.23	7.50	6.29
CALSPORIN	0.439	2.091	2.919	7.98	7.75	4.59*
Probiotic A	0.382	1.844	2.607	8.43	6.38	5.01
Probiotic B	0.446	2.053	2.915	7.69	5.62	6.70
Probiotic	0.392	1.873	2.828	8.18	7.93	3.17

Inclusion levels were: CALSPORIN 0.1% (1,000,000 cfu/g feed). Probiotics A & B 0.1%. Prebiotic 0.125%.
*P<0.05 difference for log reduction of cecal *Campylobacter spp*. enumerations compared to Control.

this probiotic treatment. In a subsequent (unchallenged) broiler field trial, there were significant decreases in the level and incidence of *Campylobacter* with dietary *Bacillus subtilis* C-3102 as shown in Table 1.

The most recent data also support the use of CALSPORIN in the reduction of *Campylobacter* colonization during the pre-harvest phase. Guyard-Nicodème et al. (2015) evaluated a number of feed additives for their effects on *Campylobacter* enumerations of the ceca in Ross PM3 male and female broilers. *Campylobacter spp*. counts were conducted at 14, 35, or 42 days of age. Total weight gains were also analyzed. To increase colonization, broilers were individually orally inoculated at 11 days-of-age with a high level of *Campylobacter jejuni*. For purposes of this report, only the control, probiotic (3), and prebiotic (1) treatments will be shown; however, plant extract and short-chain fatty acid product results are available in the reference article. Results are shown in Table 2.

This recent study showed the feeding CALSPORIN from one day-of-age resulted in the greatest weight gain. It also resulted in a significant reduction in the cecal colonization of *Campylobacter spp*., compared to the other products tested.

The CAMPYBRO Project and CALSPORIN

The concern for *Campylobacter* control in broilers is global. A consortium of major research institutes and stakeholders in the European poultry industry are currently collaborating on an expansive project called the CAMPYBRO Project. This large initiative is European-funded and comprises eight of Europe's largest poultry research institutes. The purpose of the project is to determine pre-harvest *Campylobacter*-reduction strategies. One important strategy is the effect of feed additives on *Campylobacter*.

Many different feed additives have been investigated as reported in the scientific literature. Products such as organic acids, monogycerides, essential oils, plant extracts, yeast preparations and various probiotics have been studied in the CAMPYBRO Project thus far.

A recurring finding by researchers is that cecal colonization of *Campylobacter spp*. is reduced when the feed additive product contains CALSPORIN. The most conclusive results were reported by Casabuena et al, (2015). In this trial broilers were fed CALSPORIN at 1,000,000 cfu/g feed inclusion rate, in combination with a monoglyceride organic acid. All birds were challenged with a high level

of *Campylobacter jejuni* at 14 days-of-age. A 3-4 log10 reduction in the enumerations of *Campylobacter* in the ceca in the CALSPORIN + monoglyceride treatment, when compared to the Control group. These results were superior to any feed additive intervention examined thus far. This reduction was consistent throughout the life of the challenged birds, when ceca were examined at 21, 35 and finally at 42 days-of age.

Review of *Campylobacter* and CALSPORIN

Campylobacter continues to make food safety headlines and is a significant concern to producers, government agencies, as well as the general public. The concern is global. Increasingly, researchers and live production personnel are looking at pre-harvest intervention strategies to ultimately reduce *Campylobacter* contamination of poultry carcasses. The feed additive use of CALSPORIN has proven to be a consistent and reliable pre-harvest intervention strategy based on historic data. Now, the most current findings associated with the CAMPYBRO project are substantiating the effectiveness of CALSPORIN in broiler diets.

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