Salmonella Typhimurium Fecal Shedding following *Salmonella* Choleraesuis-Typhimurium Vaccination via Drinking Water and Challenge

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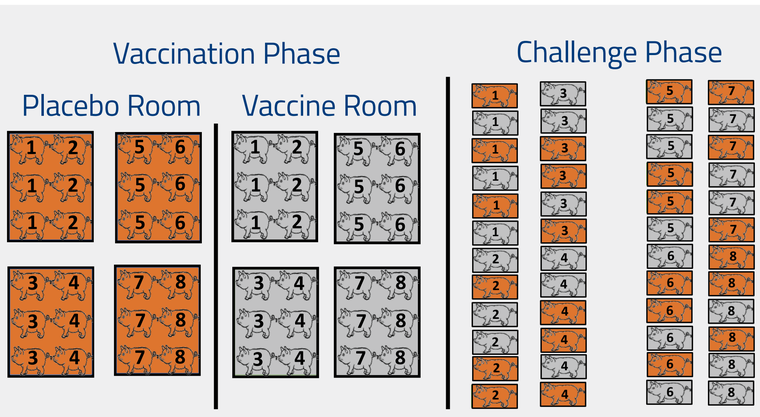
INTRODUCTION

Salmonella enterica serovar Typhimurium (ST) and Salmonella Choleraesuis are primary pathogens in swine. ST is a primary cause of enteritis and subclinical production losses in growing and finishing swine and contributes to environmental and carcass contamination. The objective of this study was to evaluate fecal shedding of *Salmonella* by pigs vaccinated with a commercial, avirulent live culture (ALC) Salmonella Choleraesuis-Typhimurium vaccine when challenged with virulent ST.

MATERIALS AND METHODS

Eight litters of 2-week-old pigs were blocked by litter, six pigs per litter. Vaccine (Enterisol® Salmonella T/C) or Placebo was administered in the drinking water. Pigs were housed by treatment during the vaccination phase to avoid unintentional exposure of ALC vaccine to the Placebo group and were re-penned individually for the challenge phase with treatments comingled in the same room. During the challenge phase, pen dividers prohibited nose-to-nose contact and fecal spread amongst pigs.



Four weeks after treatment, all pigs were challenged intranasally with 2 ml of the virulent ST strain, Universal Killer ($4x10^8$ CFU/dose). Fecal samples were collected daily for 14 days post-challenge (DPC) then three times weekly until 84 DPC. Fecal samples were tested at Iowa State University Veterinary Diagnostic Laboratory via modified enrichment culture and reported as positive or negative. The study was conducted under the approval of the Midwest Veterinary Services Animal Use Protocol.

ANALYSIS

Mitigated fractions and prevented fractions range from -1.0 to 1.0, and are significant when the lower 95% confidence interval is positive (the closer to 1.0 the more significant). Mitigated fraction describes reduction of severity, and prevented fraction describes prevention of disease.

RESULTS

During the 12-week challenge phase, the probability of a vaccinated pig shedding fewer days relative to a placebo pig was 0.78 which was a statistically significant mitigated fraction estimate (Table 1). The pattern indicative of this reduction of shedding over time is illustrated in Figure 1. The probability of shedding was analyzed using the generalized linear mixed logistic model, and a significant treatment effect of 25.2 days was demonstrated at the midpoint of shedding probability (P<0.0001; Figure 1). When considering the vaccine effect on a sampling basis, the prevented fraction estimate for each day illustrated a reduction in shedding (positive values) for 42 of the 44 collection days post-challenge (Figure 2).

Table 1: Number of Positive Samples by Treatment

Group	N	Mean	Med	Min	Max	MF	Lower & Upper 95 CL
Placebo	23	26.2	26	14	39		
Vaccine	23	15.9	15	5	31	0.788	0.515, 1.000

N = number; Med = Median; Min = Minimum; Max = Maximum; MF = Mitigated Fraction; 95CL = 95 % Confidence Limit

Figure 1: Culture Results over Days Post-Challenge with Logistical Modeling by Treatment

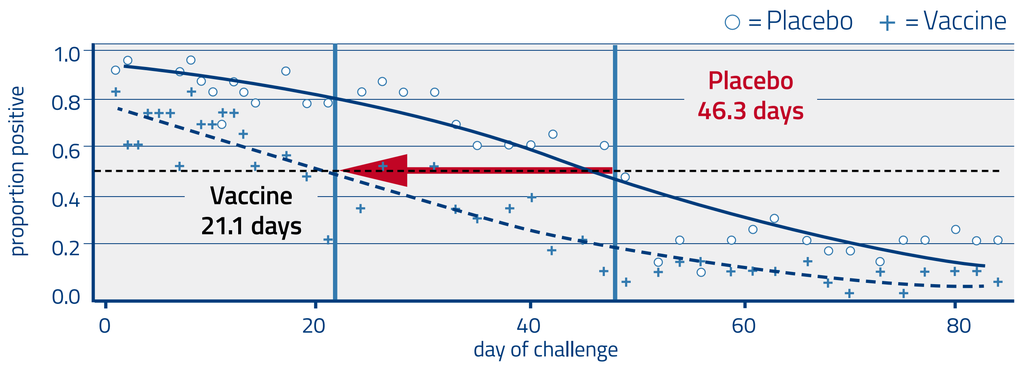
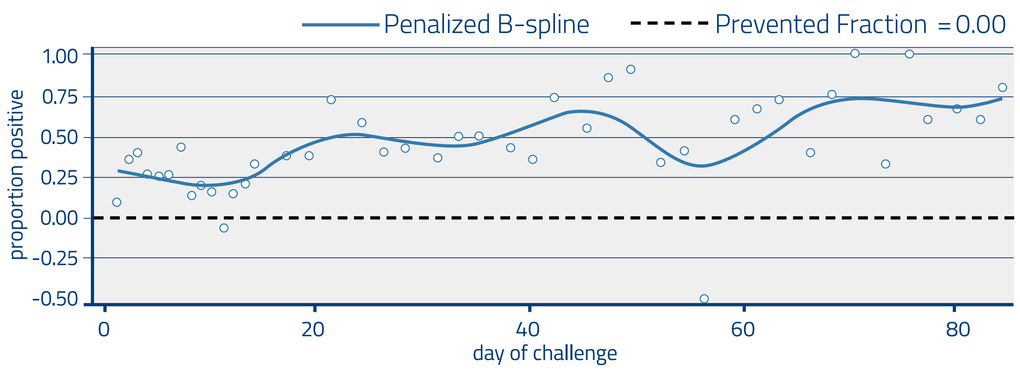


Figure 2: Fecal Shedding Prevented Fractions by Day Post-Challenge with Penalized B-Spline Values



CONCLUSION

Enteric pathogens have sporadic fecal shedding patterns as was observed in this study. While expectations are not that vaccination will eliminate *Salmonella* shedding, the Vaccine group had significantly reduced shedding within two to six weeks post-challenge exposure. At the time of publication, the data from BIVI Study 2014240 had not been reviewed for approval of a shedding claim by the USDA.

TAKE HOME MESSAGE

Use of the commercially available ALC vaccine, Enterisol® Salmonella T/C, resulted in:

- Significant reduction in number of *Salmonella* positive fecal samples post-challenge.
- Approximate one-month reduction in the duration of *Salmonella* shedding post-challenge.
- Clinically relevant shift in the number of animals shedding *Salmonella* each day post-challenge.