

Colonization of *Salmonella* Enteritidis (SE) in ceca and ovaries, after SE challenge, in *Salmonella* vaccinated commercial layer hens fed *Saccharomyces cerevisiae* components

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ABSTRACT

This trial evaluated the effect of Cascade (hydrolyzed yeast plus yeast culture; HY/YC; Natural Biologics, Newfield, NY) and Naverde™ (yeast cell wall plus hydrolyzed yeast; YCW/HY; Natural Biologics, Newfield, NY) on the colonization of *Salmonella* Enteritidis (SE) in the ceca and ovaries of SE challenged layers vaccinated (Avipro® Megan Egg® Elanco) for *Salmonella*. Seventy-two, 25-week-old Hy-line brown layers were allotted to three treatments: Challenged, control (C), Challenged, HY/YC (100 g/ton), or Challenged, YCW/HY (100 g/ton), with 12 replicates per treatment and two layers per cage. All birds were vaccinated at day of hatch and at eight weeks of age. Layers were fed a non-medicated commercial diet that met the requirements for Hy-line brown layers. After a four-week adaptation period, layers were orally challenged with nalidixic acid resistant SE (10⁹ cfu/mL). Seven-days post-challenge, layers were necropsied to analyze the ceca and ovaries for *Salmonella* prevalence and load with the BAX® System SalQuant® Real-Time PCR Assay. Egg production and feed intake were measured to calculate FCR. Also, layers were orally gavaged with FITC-d (8.32 mg/kg of body weight). One-hour post-gavage, blood was collected, and FITC-d was measured to evaluate gut permeability. Treatment did not affect (P>0.05) egg production, feed intake, or FCR. *Salmonella* was not detectable in any ovaries. Cecal *Salmonella* prevalence and load were numerically (P>0.05) higher in the C than both the YCW/HY or HY/YC. *Salmonella* prevalence was 95.8%, 91.7%, and 83.3% for the C, HY/YC, and YCW/HY, respectively. While *Salmonella* load was 94.8, 10.5, and 10.5 CFU/g and 0.441, 0.170, and 0.133 log CFU/g for the C, HY/YC, and YCW/HY, respectively. There was no difference in FITC-d between treatments (34.15, 38.08, and 36.40 ng/ml, for C, HY/YC, and YCW/HY, respectively). *Salmonella* challenge did not affect gut permeability. Feeding vaccinated laying hens either YCW/HY or HY/YC numerically reduced cecal *Salmonella* load post-infection, suggesting yeast-derived components as a feed intervention, combined with *Salmonella* vaccination of laying hens, can help prevent *Salmonella* contamination of shell eggs.

OBJECTIVE

This experiment was conducted to determine if feeding hydrolyzed yeast plus yeast culture (HY/YC; Cascade) or yeast cell wall plus hydrolyzed yeast (YCW/HY; Naverde™) to *Salmonella*-vaccinated laying hens would reduce their *Salmonella* load to help prevent the foodborne pathogen from contaminating table eggs.

MATERIALS & METHODS

Seventy-two, 25-week-old Hy-line brown hens were used in this experiment. Hens were vaccinated with a live, attenuated *Salmonella* Typhimurium vaccine (Avipro® Megan Egg®, Elanco) at day of hatch and at eight weeks of age. There were three treatment groups: 1. Challenged, control (C), 2. Challenged, HY/YC (100 g/ton), and 3. Challenged, YCW/HY (100 g/ton). There were two layers per cage with a total of 36 cages. There were three treatment groups with 12 replicate pens per treatment. At 29 weeks, following a four-week adaptation to dietary treatments, layers were challenged with SE (10⁹ cfu/mL) via oral gavage. Ceca and ovaries were collected seven-days post-challenge to determine *Salmonella* prevalence and load. Also, at seven-days post-challenge, layers were orally administered FITC-d (8.32 mg/kg of body weight), and a blood sample was collected to determine gut permeability.

RESULTS

Figure 1. The effect of Naverde on *Salmonella* load in layers under a *Salmonella* Enteritidis challenge and vaccinated for *Salmonella*.*

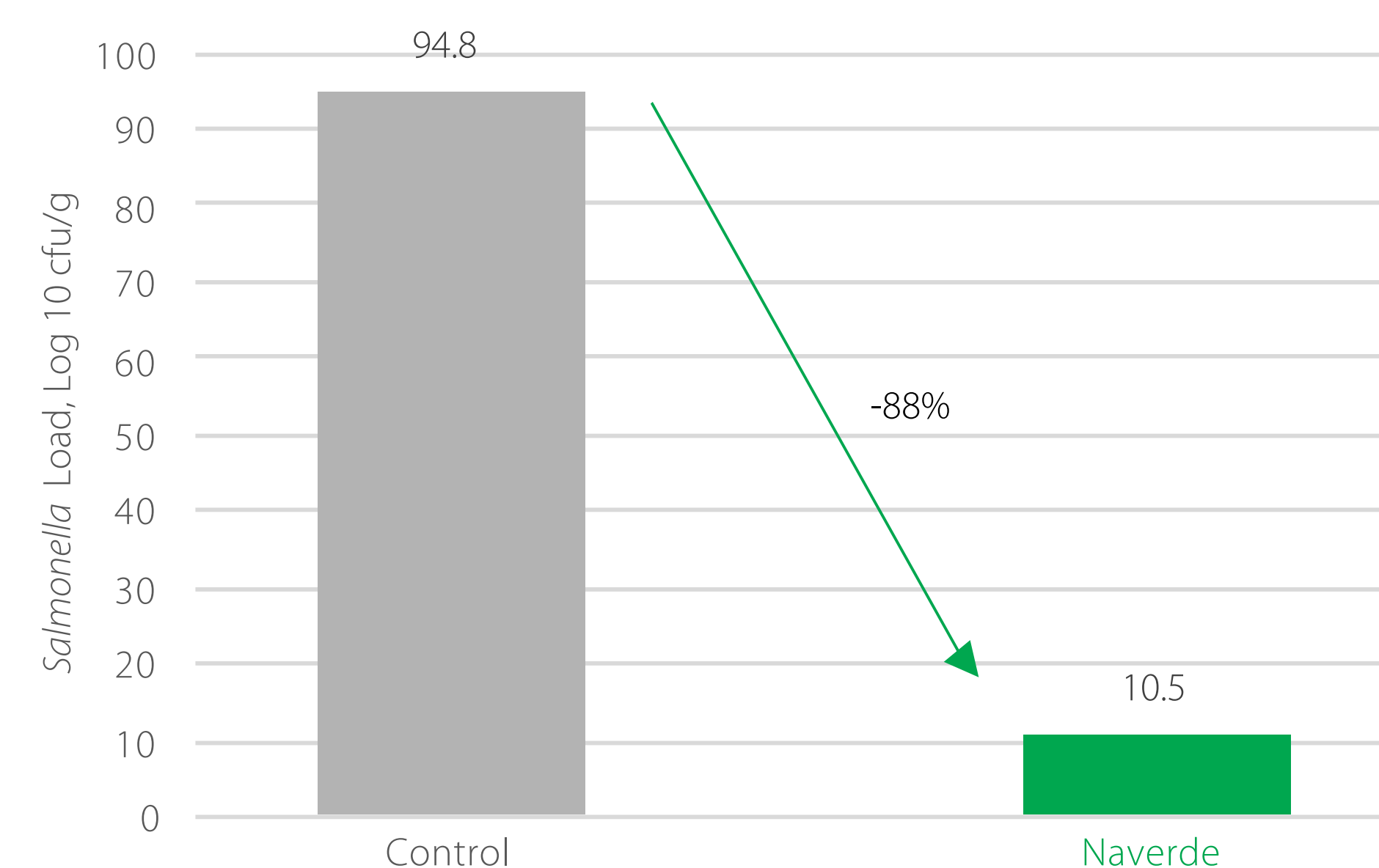


Figure 3. The effect of Cascade on *Salmonella* load in layers under a *Salmonella* Enteritidis challenge and vaccinated for *Salmonella*.*

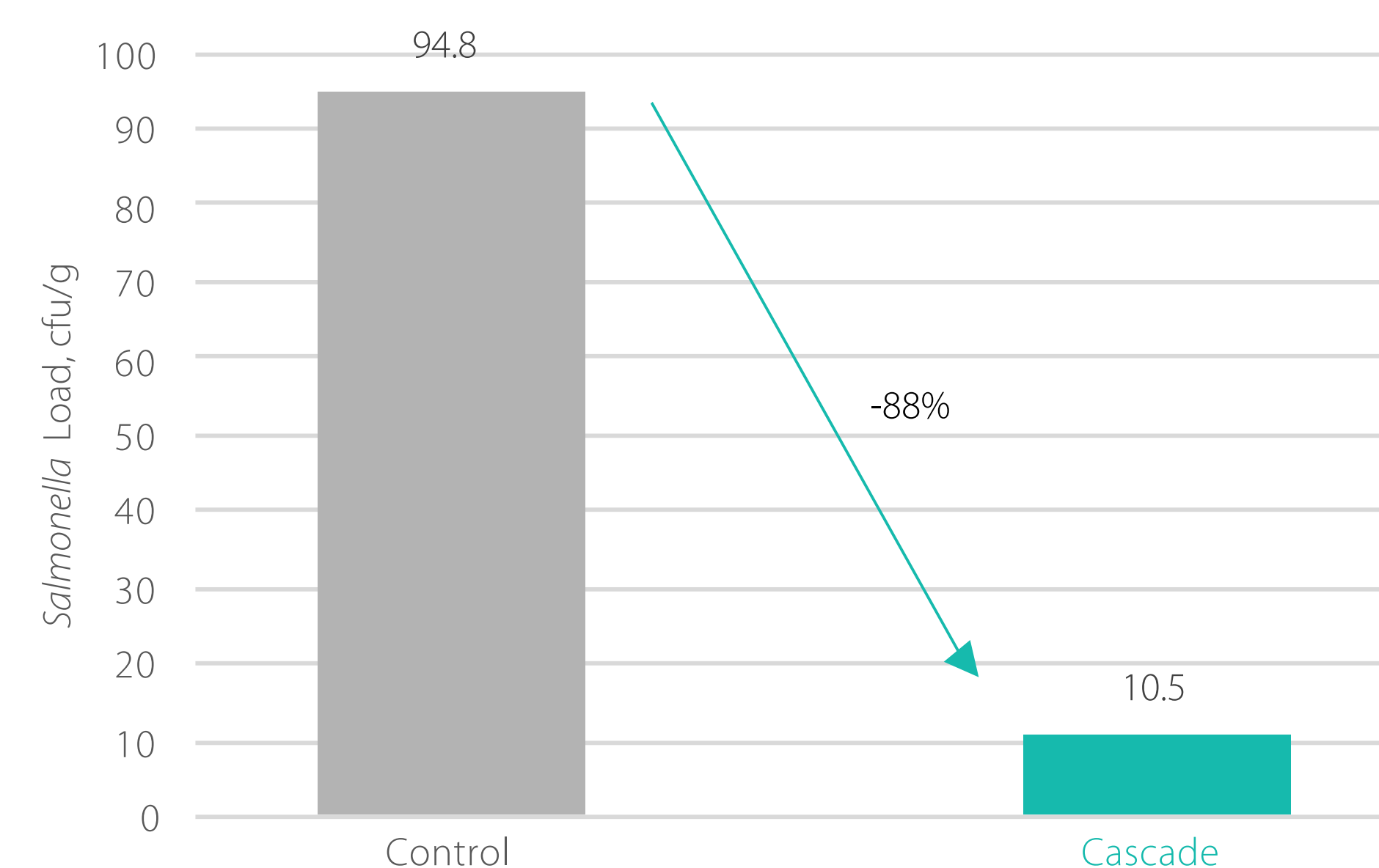


Figure 2. The effect of Naverde on cecal *Salmonella* load of layers under a *Salmonella* Enteritidis challenge and vaccinated for *Salmonella*.*

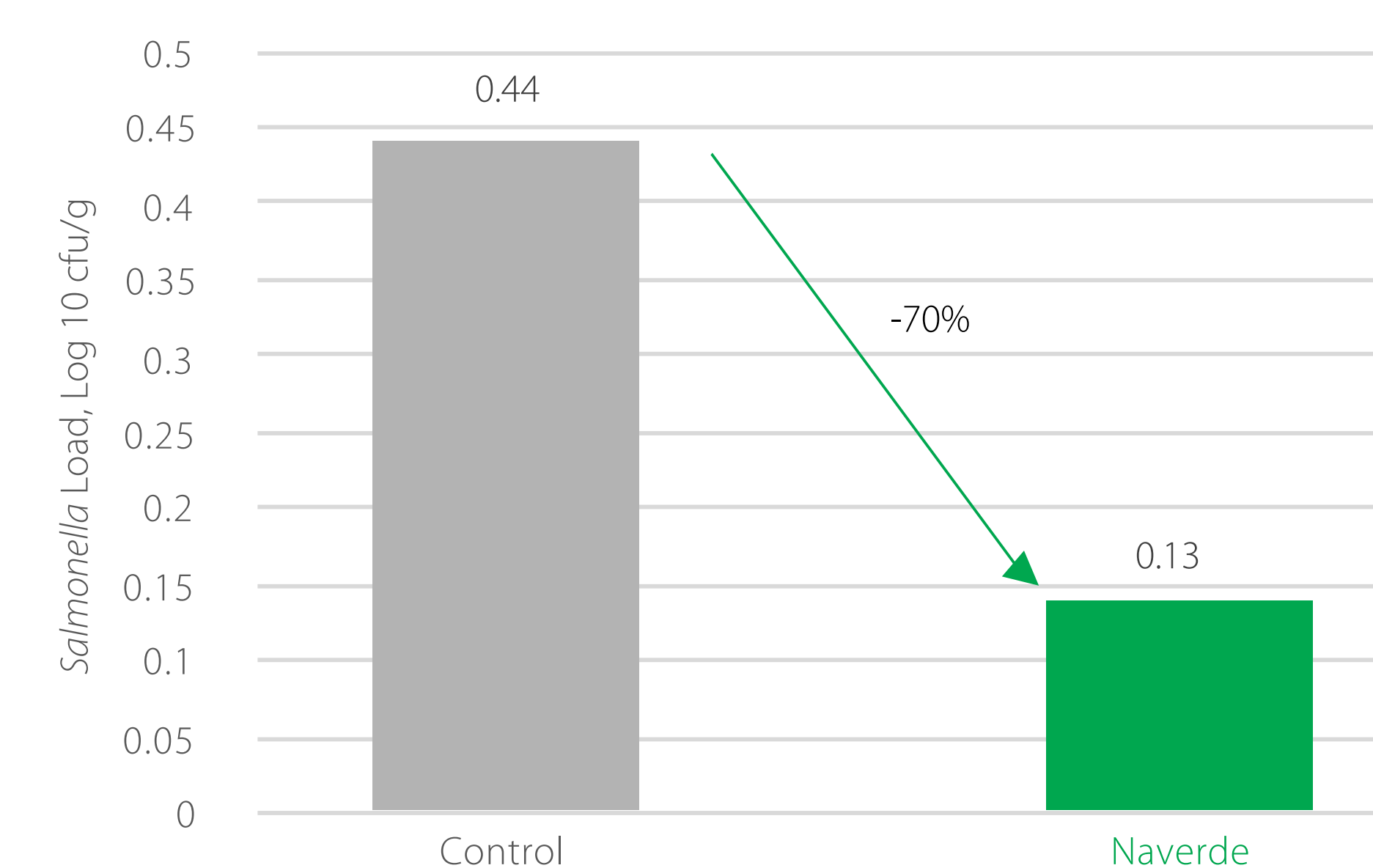
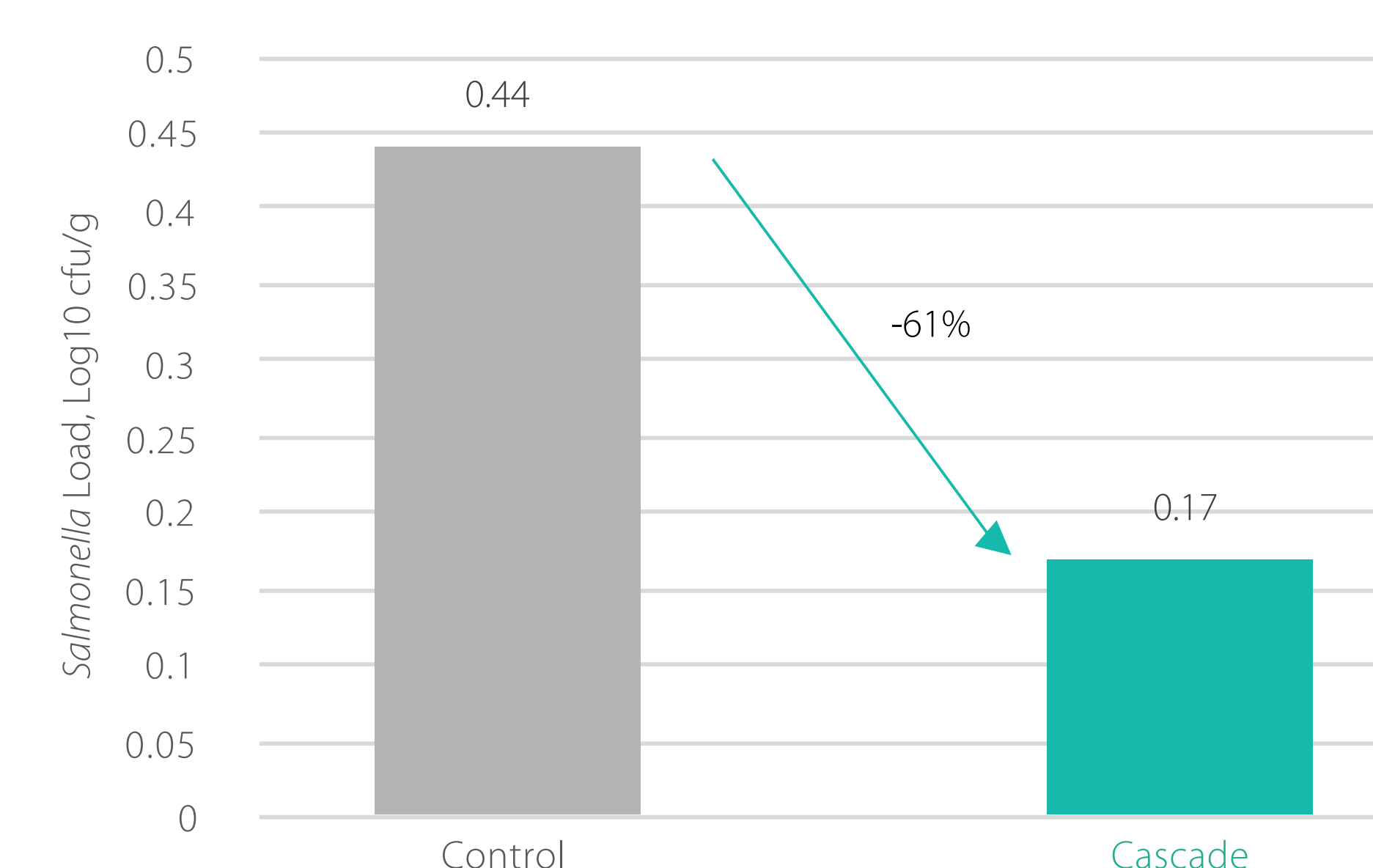


Figure 4. The effect of Cascade on cecal *Salmonella* load of layers under a *Salmonella* Enteritidis challenge and vaccinated for *Salmonella*.*



RESULTS

- Dietary treatment or SE challenge did not affect (P>0.05) weekly or total egg production, feed intake, FCR, or gastrointestinal tract permeability.
- At seven days post-infection, *Salmonella* was not detectable in the ovaries. However, *Salmonella* did colonize in the ceca.
- Cecal *Salmonella* prevalence & load were numerically (P>0.05) higher in the C treatment group than both the YCW/HY or HY/YC treatment groups
- *Salmonella* prevalence was 95.8%, 91.7%, and 83.3% for the C, HY/YC, and YCW/HY treatment groups, respectively. While *Salmonella* load was 94.8, 10.5, and 10.5 CFU/g and 0.441, 0.170, and 0.133 log CFU/g for the C, HY/YC, and YCW/HY treatment groups, respectively (Figures 1, 2, 3, and 4).

DISCUSSION

- The duration of this trial was relatively short, and the hens may not have been on their treatment diets long enough for them to have an effect on their rate of egg production, feed intake, or FCR.
- Cecal colonization of *Salmonella* occurs in vaccinated and unvaccinated layers, as well as in layers fed feed additives with *Saccharomyces cerevisiae*-derived components.
- Research data consistently demonstrate that cecal *Salmonella* load is significantly or numerically reduced with the inclusion of *Saccharomyces cerevisiae*-derived feed additives in layer diets.
- Gut permeability, as measured by FITC-D, was low and highly variable both within and between treatments.

CONCLUSIONS

Feeding vaccinated laying hens either YCW/HY or HY/YC numerically reduced cecal *Salmonella* load post-infection. This indicates that *Saccharomyces cerevisiae*-yeast derived components as a feed intervention, along with *Salmonella* vaccination of laying hens, can be combined to help prevent *Salmonella* contamination of shell eggs. This may reduce the risk of foodborne illness.

KEYWORDS Layers, *Salmonella* Enteritidis, Yeast, Food Safety, Gut Health