

Evaluation of Intervention Strategies for Idiopathic Diarrhea in Commercial Turkey Brooding Houses

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Primary Audience: Veterinarians, Researchers, Nutritionists, Growers

SUMMARY

In 3 separate commercial turkey brooder houses, we compared the effects of selected probiotic bacteria or antibiotics on performance of poults within a complex that was routinely experiencing mild idiopathic diarrhea and stunting. In all experiments, treatments of probiotic cultures or antibiotics were administered in the water. Poults were tagged and placed into individual pens (20 per pen, 4 replicate pens per treatment) within the brooding house, and performance was evaluated by body weight or body weight gain. In the first experiment, poults receiving 1 of 2 probiotic cultures weighed significantly more than nontreated or antibiotic-treated poults. In the second experiment, there were no significant differences among any of the groups. A third experiment was performed during a clinically significant *Salmonella seftenburg* infection. In this experiment, poults receiving antibiotics followed by a probiotic culture had significantly higher weight gain than nontreated or probiotic-treated poults.

Key words: antibiotic, probiotic, poult, turkey, brooding, performance

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DESCRIPTION OF PROBLEM

In northwest Arkansas and other areas of the United States, some turkey growers are suffering losses due to idiopathic diarrhea in the brooding house, commonly thought to be initiated by astrovirus or other enteric viruses. Clinical response to therapeutic antibiotics has led to the belief that these enteric conditions are often complicated by secondary bacteria. In our area, this occurs in approximately 30% of brooding houses during warm weather and affects poults between 1 and 3 wk of age. Clinical signs include diarrhea, listlessness, and lack of weight gain. Mortality can vary from 0 to 10%. This research

was performed to evaluate the effectiveness of typical prophylactic antibiotic use compared with use of probiotics, or a combination of both, in turkey brooding houses. In each case, the antimicrobial chemotherapy selected mimicked selection by the commercial turkey producer, based upon historical diagnostic testing and clinical response.

MATERIALS AND METHODS

Experimental Design

In these experiments candidate brooding houses, deemed likely to experience an outbreak of idiopathic diarrhea, were selected based upon

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TABLE 1. Treatments administered and mean body weight in experiment 1

Group	Treatment	Days administered ⁴	Mean body weight ⁵
Control	No treatment	—	353.79 ± 4.30 ^b
Probiotic 1	1.31 × 10 ⁷ cfu/mL	8, 12, 17	371.03 ± 5.72 ^{ab}
Probiotic 2	1.17 × 10 ⁸ cfu/mL	8, 12, 17	380.91 ± 5.62 ^a
Antibiotics ¹	Amprolium ²	7–9	370.46 ± 4.77 ^{ab}
	Neomycin ³	7–13	

^{ab}Different letters within columns indicate significant differences ($P < 0.05$).

¹Antibiotics were administered in the drinking water on the direction of a licensed veterinarian within the bounds of a valid veterinarian-client-patient relationship.

²At 0.012% in the drinking water.

³There was 71.5 g of neomycin sulfate per 128 gal of drinking water.

⁴Days of administration are expressed as the age of the poult at the time of treatment.

⁵Mean body weights were measured on d 21 of age, the experiment began on d 7.

clinical experiences in the immediately preceding flock. Three trials were conducted during the summer of 2003. Poults within one house for each experiment were compared. Within each house, we assembled 1.22 × 1.22 m wire panel pens, with additional small mesh wire across the bottom of each panel. The panels were assembled with cable ties and placed in a single row along the center aisles of the brooding houses. We used a maximum of 16 pens, with treatments assigned to pens in a block random fashion. Each pen was equipped with a single feeder and 20-L drinker. Poults were hand-fed and watered daily throughout the duration of the experiment. Water treatments were administered as described for each experiment. Feed for each experiment contained 0.1875% nitarsonone [1] but no other medication. On d 1 of each experiment, poults were trapped with panels in different areas of the brooding house and were randomly assigned to pens. They were each tagged and weighed on the first day of the experiment and weighed again at intervals throughout the experiment. Mean weights and weight gain were used to evaluate the efficacy of the probiotics or antibiotics on poult performance.

Probiotic Cultures

Two probiotic cultures were evaluated in these experiments. Probiotic 1 contained 2 bacterial isolates: *Lactobacillus casei* and *Lactobacillus bulgaricus*. Probiotic 2 contained 11 isolates, including the isolates from probiotic 1: 3 *Lactobacillus bulgaricus*, 3 *Lactobacillus fermentum*, 2 *Lactobacillus casei*, 2 *Lactobacillus cellobiosus*, and 1 *Lactobacillus helveticus* [2].

Experiment 1

Experiment 1 began when poults were 7 d old, the day after the surrounds (brooder rings) were removed. Sixteen pens were placed down the center aisle of the house, and 18 poults were placed in each pen as described above. Four treatments were evaluated, with 4 replicate pens for each treatment. Treatments were administered as described below. Poults that received probiotic 1 or 2 also received a commercial organic acidifier [3] in the drinking water for 1 d prior to probiotic administration (see Table 1). Antibiotics were administered for 7 d according to label-directed dilutions [4, 5], and probiotics were administered at intervals between d 7 and 21. Control poults received no treatments.

Experiment 2

Experiment 2 was performed on a different farm from experiment 1 and began when poults were 8 d old. The experimental design was the same as experiment 1, and the treatments were similar as described in Table 2 [4, 5].

Experiment 3

In experiment 3, poults were already experiencing a severe outbreak of enteritis when the study began. Clinical signs included severe diarrhea, low feed and water consumption, listlessness, and mortality. The Arkansas State Diagnostic Laboratory in Springdale, Arkansas, confirmed that the only pathogen identified in this specific outbreak was *Salmonella seftenburg*. The experiment began when poults were 12 d old and continued until the flock was 47 d

TABLE 2. Treatments administered and mean body weight in experiment 2

Group	Treatment	Days administered ⁴	Mean body weight ⁵
Control	No treatment	—	900.00 ± 30.89 ^a
Probiotic 1	9.58 × 10 ⁶ cfu/mL	9, 13, 18	909.39 ± 32.82 ^a
Probiotic 2	6.82 × 10 ⁶ cfu/mL	9, 13, 18	913.14 ± 20.47 ^a
Antibiotics ¹	Amprolium ²	8–10	912.86 ± 14.59 ^a
	Neomycin ³	8–14	

^{a,b}Different letters within columns indicate significant differences ($P < 0.05$).

¹Antibiotics were administered in the drinking water on the direction of a licensed veterinarian within the bounds of a valid veterinarian-client-patient relationship.

²At 0.012% in the drinking water.

³There was 71.5 g of neomycin sulfate per 128 gal of drinking water.

⁴Days of administration are expressed as the age of the poult at the time of treatment.

⁵Mean body weights were measured on d 33 of age, the experiment began on d 8.

old. Only 12 pens with 20 poult per pen were evaluated, and 3 treatment groups were evaluated. Poults that received probiotic 1 or 2 did not receive commercial acidifier in the water before probiotic treatment in this experiment [6]. Chemotherapeutic treatments were selected by the company veterinarian and were followed by probiotic 1 (with one additional roxarsone treatment on d 26) as described in Table 3 [4, 5, 7, 8].

All data were analyzed by SAS software using the least squares means test and were further separated using the general linear models procedure [9].

RESULTS AND DISCUSSION

Poult were weighed on d 7, 14, and 21 during experiment 1. Poults were clinically normal in this experiment. There were no significant differences between pens receiving the same treatment, so replicate pens were pooled for anal-

ysis. On d 21, the poult that received probiotic 2 had significantly higher mean body weight than control poult (Table 1). However, the poult receiving antibiotics or probiotic 1 did not have significantly higher body weights than the nontreated control poult. Mortality was not different among treatments in this experiment.

For experiment 2, poult were weighed on d 15, 25, and 33. There were no significant differences in weight or weight gain at any time during the experiment, and data from replicate pens were pooled (Table 2). Mortality also was not different among pens or treatments.

In the third experiment, poult were weighed at 12, 29, and 47 d of age. As in the previous 2 experiments, mortality was not different among pens or treatments. Due to the lack of uniformity within each pen at the beginning of the experiment, we calculated the mean weight gain from the individual weight gain of each poult. Mean

TABLE 3. Treatments administered and mean body weight gain in experiment 3

Group	Treatment	Days administered ⁵	Days 12 to 47	Days 29 to 47
Control	No treatment	N/A	745.82 ± 20.37 ^b	339.62 ± 7.82 ^b
Probiotic 2	4.74 × 10 ⁶ cfu/mL	13, 17, 22	777.18 ± 24.18 ^b	372.92 ± 17.33 ^{ab}
Antibiotics ¹	Penicillin ²	12-14, 19-21	856.62 ± 19.58 ^a	379.12 ± 12.14 ^a
	Roxarsone ³	12-14, 19, 20,		
	Neomycin ⁴	26		
	Probiotic 1 (~10 ⁶ cfu/mL)	16		
		22		

^{a,b}Different letters within columns indicate significant differences ($P < 0.05$).

¹Antibiotics were administered in the drinking water on the direction of a licensed veterinarian within the bounds of a valid veterinarian-client-patient relationship.

²Five hundred million units of Penicillin G Potassium per 128 gal of drinking water.

³There was 28.3 g of roxarsone per 256 gal of drinking water.

⁴There was 71.5 g of neomycin sulfate per 128 gal of drinking water.

⁵Days of administration are expressed as the age of the poult at the time of treatment.

weight gain between d 12 and 47 are shown in Table 3. Poult receiving the antibiotics followed by probiotic 1 gained significantly more weight than probiotic 2 alone or untreated controls. When we evaluated weight gain at the end of

the experiment between d 29 and 47 we found that poult receiving probiotic 2 did not have significantly lower gain than those receiving antibiotics and probiotic 1.

CONCLUSIONS AND APPLICATIONS

1. In experiments 1 and 2, we found that prophylactic administration of a selected probiotic culture regimen resulted in performance that was either significantly higher than or equal to that of poult receiving a selected antibiotic treatment regime.
 2. In experiment 3, in the presence of a severe bacterial infection, poult that received a selected antibiotic regimen followed by treatment with probiotic 1 had significantly higher weight gain over the duration of the experiment compared with the probiotic 2 alone or no treatment.
 3. These data suggest that some probiotic culture treatment regimens may provide measurable protection against some enteric disease problems in poult. However, as in the case of experiment 3, appropriately selected therapeutic antimicrobial treatment regimes, followed by selected probiotic use, are sometimes more effective than the evaluated probiotic treatment regimes alone for treating clinical enteritis.
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REFERENCES AND NOTES

1. Histostat-50, Alpha, Fort Lee, NJ.
2. Each bacterial isolate was grown individually in MRS broth and combined for administration in the drinking water. They were administered with 0.1% skim milk as a stabilizer.
3. Perform-Max, Wynco LLC, Lowell, AR.
4. Amprolium 128, administered at 0.012% in the drinking water, manufactured by Merial Limited, Duluth, GA, distributed by Phibro Animal Health, Fairfield, NJ.
5. Neo-Sol 50, 71.5 g of neomycin sulfate per 128 gal of drinking water, Alpha, Fort Lee, NJ.
6. The importance of the use of a water acidifier in these trials is not known. Anecdotal evidence with a commercially available probiotic suggested that treatment of commercial water lines with an acidifier may increase the efficacy perhaps because the acidifiers reduce biofilm capture of the microorganisms or for other unknown reasons. At the time these experiments were initiated, we had limited unpublished data in commercial houses using automated water lines that this was indeed true. However, during the course of the present studies, we observed in our laboratory trials that pretreatment with a water acidifier in our individual drinkers did not affect the ability of these cultures to reduce *Salmonella* infection, possibly supporting the idea that biofilms within commercial water lines may interfere with delivery of selected microflora. As we were using individual pen waterers in this study, we elected to forego the water acidification in the third experiment. As we do not have a final conclusion on the value of water line acidification, we would prefer to not complicate the manuscript with these speculations.
7. R-Pen, 500 million units of Penicillin G Potassium per 128 gal of drinking water, Alpha, Fort Lee, NJ.
8. 3-Nitro W, 28.3 g of roxarsone per 256 gal of drinking water, Alpha, Fort Lee, NJ.
9. SAS Institute. 1991. SAS User's Guide. SAS Institute Inc., Cary, NC.