

Technical Literature

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Performance and Gut Health of Coccidiosis Vaccinated Broilers with Tannic Acid Extract and *Bacillus coagulans*¹

Abstract

The aim of the present study tested the effect of tannic acid extract (TAE) alone or in combination with a direct-fed microbial, *Bacillus coagulans* (TAE+BC), on performance and gut health of coccidiosis vaccinated broilers. Broilers were either unchallenged or challenged with a late *Eimeria* infection. The study looked at performance and gut health during two time periods: vaccination only (0-49 days) and late cocci challenge (vaccination + cocci challenge; 28-35 days). For the late cocci challenge, a subset of vaccinated broilers were split into two groups: Treatment In (treatments kept in feed) and Treatment Out (treatments removed from feed), in order to determine if TAE and TAE+BC would have an impact on immunity development to *Eimeria* following vaccination. Performance and gut health measurements were taken at 35 days. TAE+BC had numerically lower average oocysts shedding than TAE, ionophore and chemical in both the Treatment In and Treatment Out groups. Removal of TAE+BC and TAE from feed did not negatively impact performance of vaccinated broilers challenged with *Eimeria*, whereas removal of the chemical resulted in decreased weight gain and numerically similar FCR to control. The results of the study indicate that TAE+BC not only positively impacted performance during late cocci challenge, but did not negatively impact development of immunity to *Eimeria* following vaccination.

Introduction

Coccidiosis, caused by the protozoan parasite *Eimeria*, is estimated to cause worldwide economic losses of over \$11 billion in the poultry industry.² Of these losses, a significant portion is due to subclinical coccidiosis, which not only reduces broiler performance but can also predispose birds to necrotic enteritis.³⁻⁶ Controlling necrotic enteritis without antibiotics is a global challenge in the poultry industry, therefore, preventing subclinical coccidiosis through the use of alternative products is critical to the profitability of ABF poultry producers.

Natural molecules extracted from plants, like polyphenols, are generally involved in plant defenses to environmental threats. Tannic acid is a large polyphenolic compound that has antioxidant,^{7,8} anti-inflammatory,⁹ astringent^{10,11} and antimicrobial^{11,12} properties. Kemin determined that additional processing of tannic acid improved the bioactivity of tannic acid extract. Tannic acid extract (TAE) product has previously been shown in coccidiosis battery challenge studies to effectively reduce intestinal lesion scores¹³⁻¹⁵ and oocyst shedding¹⁴⁻¹⁵ in broilers challenged with mixed *Eimeria*. Products such as direct-fed microbials (DFMs) have also been identified as positive influencers of early gut microflora balance, which may benefit gut health and improve performance of vaccinated broilers. *B. coagulans* (BC) has a unique mode of action where it can produce both acetic and lactic acids, which may prevent pathogen colonization in the intestine.¹⁶ The combination of *B. coagulans* with TAE may provide a product to improve gut microbial balance.

The objectives of this study were to determine if TAE+BC can improve broiler performance during late cocci vaccination without negatively impacting development of immunity to *Eimeria* following vaccination.

Methods and Materials

The base diet was a non-medicated (no antibiotic and anticoccidial) corn-soybean diet (Control). The growth period was divided into three phases: starter (0-21 days), grower (21-35 days) and finisher (35-49 days). The diets and water were provided ad libitum throughout the experimental period.

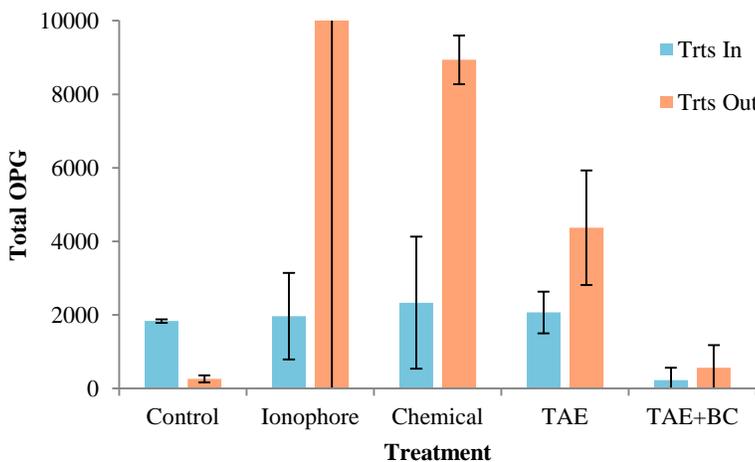
The coccidiosis vaccination trial was conducted at Southern Poultry Research (SPR) in Athens, Georgia, USA. On day of hatch, Cobb x Cobb 500 chicks were spray vaccinated with ADVENT®, a live coccidiosis vaccine, and randomly assigned to 5 treatment groups (15 reps/trt; 40 birds/pen): Control, Ionophore, Chemical, TAE and TAE+BC. Ionophore and chemical were used at the recommended dosage. Means for pen feed consumption (FC), body weight gain (WG), feed conversion ratio (FCR) and mortality were measured for 0-49 days.

On day 28, a subset of vaccinated birds from each treatment were divided into two groups: Treatment In and Treatment Out. Treatment In groups were provided with the same grower feed containing treatment materials as were provided for days 0-28. For Treatment Out groups, all pens were provided non-treated feed (Control diet) for the duration of the *Eimeria* challenge study. On day 29, all birds were challenged with a mixed *Eimeria* of sporulated oocysts. On day 35, feed consumption, weight gain and FCR were determined for the Treatment In and Treatment Out groups, and groups were analyzed together. Lesion scores and oocysts per gram (OPG) of fecal material were also measured.

Results

At day 35, average lesion scores of TAE+BC were numerically lower compared to other treatments for the Treatment In group; however, there were no numerical differences between treatments for Treatment Out group. Compared to the Treatment In groups, total OPG in the Treatment Out groups increased greater than two-fold for all groups. However, TAE+BC group showed lower total OPG counts than Chemical, Ionophore and TAE birds for both Treatment In and Treatment Out (Figure 1).

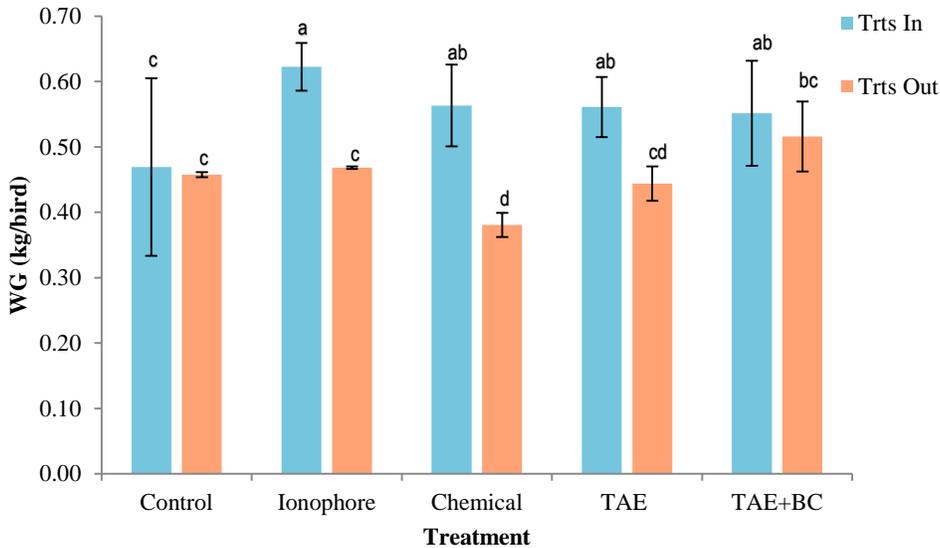
Figure 1. Comparison of vaccinated broiler lesion scores during *Eimeria* challenge.



Mean ± SD
 *Error bars represent one standard deviation

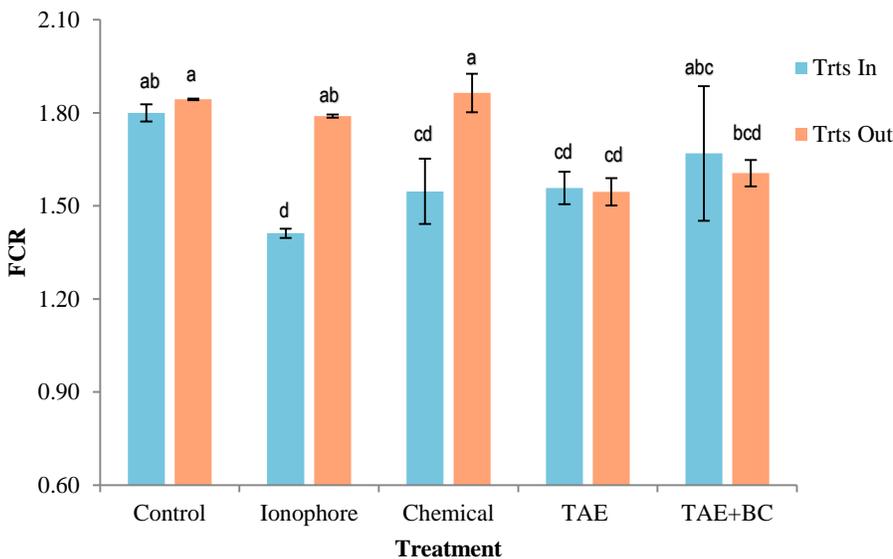
Weight gain of TAE+BC was maintained between Treatment In and Treatment Out group compared to Ionophore, Chemical and TAE (Figure 2). For Treatment In group, Ionophore was higher in weight gain compared to control, but comparable to the other treatments. For Treatment Out groups, TAE+BC was higher in weight gain compared to Chemical but comparable to TAE and Ionophore. FCR of Ionophore and Chemical were reduced in the Treatment Out groups compared to Treatment In groups (Figure 3). Ionophore had improved FCR compared to control and TAE+BC in Treatment In group; however, Ionophore and TAE+BC were comparable for Treatment Out group. In addition, TAE and TAE+BC had improved FCR compared to Chemical.

Figure 2. Comparison of vaccinated broiler weight gain (WG) during *Eimeria* challenge.



Mean ± SD
 Error bars represent one standard deviation
^{a-d}Values with different superscript letters are statistically significant (P < 0.05)

Figure 3. Comparison of the vaccinated broiler feed conversion ratio (FCR) during *Eimeria* challenge.



Mean ± SD
 Error bars represent one standard deviation
^{a-d}Values with different superscript letters are statistically significant (P < 0.05)

Conclusions

TAE+BC showed improvement in FCR and gain effects to vaccination, which were more pronounced when the additives were removed from the diet during the late cocci challenge. Furthermore, certain positive benefits of *B. coagulans* added to TAE were observed during the *Eimeria* challenge. TAE+BC consistently lowered both OPG and lesion scores compared to TAE. This result indicates the addition of *B. coagulans* to TAE may provide the additional gut health benefits observed.

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