A comparison of performance of coccidiosis vaccinated broilers fed a coated blend of essential oils, a coated blend of organic and inorganic acids with essential oils, or bacitracin methylene disalicylate

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The objective of the two studies was to determine the influence of RepaXol, a blend of double coated essential oils (EO), AciXol, an encapsulated blend of organic and inorganic acids along with EO (ACI) or bacitracin methylene disalicylate (BMD), an antibiotic, on the performance of coccidial vaccinated broiler chickens reared to 42 days of age. Both studies had a similar experimental design. The second study used built up litter with a higher level of coccidial oocysts and Clostridium. The stocking density was 0.07 sq. meters per male bird. All chicks were spray vaccinated with a commercial coccidial vaccine. A randomized block design with 8 replications was used. The test treatments were nonmedicated, EO 50 ppm (study 2) and 100 ppm, ACI 500 ppm (study 1), or BMD 55 ppm. Results showed a significant improvement in Day 42 performance, both feed conversion and weight gain with EO 50 and 100 ppm, ACI 500 ppm, and BMD 55 ppm compared to the nonmedicated controls. The feed conversion and weight gain for EO and BMD were not significantly different in either study. No matter the background challenge level, EO, ACI, and BMD improved performance of coccidial vaccinated broiler chickens.

Keywords: Coccidiosis, RepaXol, AciXol, BMD, Vaccine

Introduction

Due to a need for drug free birds and to resistance issues with anticoccidial drugs, the use of coccidiosis vaccination has grown tremendously worldwide. Coccidiosis vaccines are comprised of coccidial oocysts from the most commonly found species in broiler production (Chapman, 2000). Vaccination programs use live oocysts which are administered using spray, gel puck, or in-ovo injection (Williams, 1998). Coccidial vaccines work because *Eimeria* are very immunogenic. With each cycle of coccidia in the host, immunological protection increases. The cycling routinely peaks around 18-24 days. Associated with this coccidiosis cycling is intestinal disruption resulting in loss of performance both weight gain and feed conversion (Mathis, 2001).

The objective of the two studies was to determine if RepaXol, a homogeneous blend of double coated essential oils (EO), AciXol a blend of organic and inorganic acids (citric, fumaric, malic and ortho-phosphoric) along with the protected essential oils (as in RepaXol) (ACI), or Bacitracin Methylene Disalicylate (BMD), an antibiotic, in conjunction with a coccidiosis vaccine improves performance of broiler chickens grown to 42 days of age.

Materials and Methods

Two independent studies were conducted. Similar experimental design was used for both studies. Both studies used built up litter with the second study's litter having a higher level of coccidial oocyst and *Clostridium perfringens* present. Both studies consisted of 32 pens of 50 male broiler chickens. Floor space was 0.23 sq. meters per bird. All chicks were spray vaccinated with the label recommended dosage of a coccidiosis vaccine (Coccivac-B, Schering-Plough Animal Health) on day of hatch. The treatments were replicated in eight blocks, randomized within blocks of four pens each. The test treatments were nonmedicated (NM), EO 50 ppm (study 2) and 100 ppm, ACI 500 ppm (study 1), or BMD 55 ppm, from Day 0 to 42. Study 2 birds and feed were weighed Day 0, 21, 35 and 42. The first study evaluated the level of coccidiosis immunity. On Day 28, five representative birds were removed from each pen, tagged with pen number, group weighed by pen, placed into new pens labelled with corresponding treatment number, and given nonmedicated feed. Sets of five birds from the control pen were removed, tagged with pen number and N (noninfected, positive control) or I (infected, negative control), group weighed in sets of five, placed into new pens labelled with corresponding N or I, and given nonmedicated feed. Twenty-four hours later all treatment birds and all of the I birds were challenged orally with a mixed inoculum of *E. acervulina, E. maxima*, and *E. tenella*. Six days post inoculation, all birds from each of the immunity challenged pens and N and I pens were humanely sacrificed, group weighed by pen and lesion scored. Lesion scores were recorded. The upper, middle, and cecal regions of the intestine were scored, using the system of Johnson and Reid (1970) wherein 0 is normal and 1, 2, 3, or 4 indicate increasing severity of infection. To confirm coccidiosis vaccine viability and cycling, on Day 21 oocysts per gram litter were determined for all pens.

Results and Discussion

For the experimental model to be successful the coccidiosis vaccine had to be viable and coccidia had to cycle. Expected levels of oocysts were detected in all pens confirming viability of vaccine.

In both studies, there was a significant improvement in performance with all feed additives (Tables 1, 2, and 3). In the first study, the Day 42 feed conversion of the NM birds was 1.842, EO 1.785, ACI 1.792, and BMD 1.762. Average live weight gain showed a significant improvement with both EO and BMD. The weight gains of the NM birds was 2.123 kg, EO 2.210 kg, ACI 2.165 kg, and BMD 2.230. No interference with development of coccidial immunity was shown with any of the feed additives (Table 1).

In the second study with the more infective litter, the EO 50 ppm and 100 ppm and BMD significantly improved performance at all weigh periods. The Day 42 feed conversion of the NM birds was 1.922, significantly less was the EO 50 ppm 1.830, EO 100 ppm 1.805, and BMD 1.797. The weight gains of the NM birds was 1.876 kg, EO 50 ppm 1.959, EO 100 ppm 1.983, and BMD 2.003. The feed conversion and weight gain for EO 100 ppm and BMD were not significantly different. No matter the background challenge level, EO 50 ppm or 100 ppm, ACI 500 ppm, and Bacitracin Methylene Disalicylate 55 ppm, improved performance of coccidial vaccinated broiler chickens.

Table 1. Study 1: Comparison of Day 42 performances and development of coccidial immunity

Treatment	Feed conversion[1]	Live wt. gain[2]	Lesion score[3] E. acervulina	E. maxima	E. tenella
1. NM	1.842 a	2.123 c	0.1 a	0.0 a	0.0 a
2. EO 100 ppm	1.785 bc	2.210 ab	0.1 a	0.1 a	0.1 a
3. ACI 500 ppm	1.792 b	2.165 bc	0.2 a	0.2 a	0.1 a

4. BMD 55 ppm	1.762 c	2.230 a	0.2 a	0.1 a	0.1 a
Immunity Control NM			2.2 b	1.4 b	2.2 b

NM nonmedicated, EO 100 ppm of a blend of double coated essential oils (RepaXol), ACI 500 ppm of a blend of organic and inorganic acids with essential oils (AciXol), bacitracin methylene disalicylate (BMD) 55 ppm
[a-c] Means within a column with no common superscript differ significantly (P< 0.05).
[1] Feed conversion: total feed consumption/ ((final live weight (Day 42) + mortality weight)-initial weight)
[2] Live weight gain (kg): (final weight (Day 42)/ number of live birds)- (initial weight/ number of birds)
[3] Immunity challenge birds lesion scored for *E. acervulina, E. maxima*, and *E. tenella* using the system of Johnson and Reid , wherein 0 is normal and 1, 2, 3, or 4 indicate increasing severity of infection.

Table 2. Study 2: Comparison of feed conversion of birds coccidiosis vaccinated and fed EO or BMD

Treatment	Day 21 Feed conversion[1]	Day 35 Feed conversion[1]	Day 42 Feed conversion[1]
1. NM	1.531 a	1.853 a	1.922 a
2. RepaXol 50 ppm	1.487 b	1.770 b	1.830 b
3. RepaXol 100 ppm	1.442 c	1.737 bc	1.805 bc
4. BMD 55 ppm	1.448 c	1.729 c	1.797c

NM nonmedicated, EO 50 ppm and 100 ppm of a blend of double coated essential oils (RepaXol), bacitracin methylene disalicylate (BMD) 55 ppm
[a-c] Means within a column with no common superscript differ significantly (P< 0.05).
[1] Feed conversion: total feed consumption/ ((live weight + mortality weight)-initial weight)

Table 3. Study 2: Comparison of weight gain of birds coccidiosis vaccinated and fed EO or BMD

Treatment	Day 21 Weight Gain[1]	Day 35 Weight Gain[1]	Day 42 Weight Gain[1]
1. NM	0.432 b	1.297 b	1.876 b
2. RepaXol 50 ppm	0.457 a	1.370 a	1.959 a
3. RepaXol 100 ppm	0.459 a	1.390 a	1.983 a
4. BMD 55 ppm	0.456 a	1.374 a	2.003 a

NM nonmedicated, EO 50 ppm and 100 ppm of a blend of double coated essential oils (RepaXol), bacitracin methylene Disalicylate (BMD) 55 ppm
[a-c] Means within a column with no common superscript differ significantly (P< 0.05).
[1] Live weight gain (kg): (live weight / number of live birds)- (initial weight/ number of birds)

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