

Efficacy of protected benzoic acid in broilers subject to *Eimeria* challenge as affected by diet type

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It is recognized that the benefits of eubiotic feed additives are not consistently demonstrated in research trials, especially in a clean environment without any challenge. Understanding factors affecting their efficacy will facilitate mechanism of action investigation and guide practical application. A battery trial was conducted with 384 day-old male broilers to evaluate the effect of protected benzoic acid on growth performance and gut health of broilers subject to *Eimeria* challenge as affected by diet type. The study consisted of 6 dietary treatments in a 3 x 2 factorial arrangement with 3 types of diet (rye 10%, canola meal 7.5% and poultry meal 3%, and their combination) and 2 levels of protected benzoic acid (0 and 500 g/ton AVIMATRIX® Novus International, Inc.). Each diet was fed to 8 replicate pens of 8 birds. All birds were orally gavaged with a coccidiosis vaccine at 10X recommended dose on d 14. Body weight, feed intake, FCR, and mortality were determined on d 7, 14, 19, and 26. On d 27, blood samples were collected for serum coloration, IL-10 and IL-4 determination. Data were subject to 2-way ANOVA to evaluate main effects and interaction; means were separated by Fisher's protected LSD test. Body weight was reduced with inclusion of 10% rye on d 7, 14, and 19 regardless of canola and poultry meal (CPM) inclusion ($P < 0.05$). Benzoic acid increased body weight on d 7 and 14 regardless of diet type ($P < 0.05$). On d 26, without benzoic acid, birds fed CPM weighed higher than those fed the combination, and the rye fed birds weighed in between not significantly different from either; benzoic acid increased 26-d BW of broilers fed the combination by 12%, not in the other two types, accounting for a trend of interaction ($P = 0.09$). Up to d 14, FCR was not significantly affected by diet type, but improved by benzoic acid by 17 and 7 points on d 7 and 14 respectively ($P \leq 0.05$). There was an interaction between diet type and benzoic acid on d 19 ($P = 0.07$) and 26 ($P < 0.05$) where combining rye and CPM led to higher FCR, which was reversed by benzoic acid supplementation. Feed intake was affected by diet type on d 14, 19, and 26 ($P < 0.05$) in which higher BW typically corresponded to higher feed intake, but not significantly affected by benzoic acid ($P > 0.10$). Serum IL-4 was the highest in birds fed rye, followed by CPM and rye, and then by CPM ($P < 0.05$), indicating rye was capable of inducing inflammatory responses. In summary, protected benzoic acid improved growth performance of broilers subject to *Eimeria* challenge in all three diet types, and the efficacy was greater when diet complexity was increased by combining viscous grain and low digestible protein ingredients.

Keywords: benzoic acid, *Eimeria*, broiler