In vitro and in vivo evaluation of A220, as an in-feed antibiotic alternative for enteric pathogen control in poultry and swine

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A220 is an all-natural feed additive (Amlan International, Chicago, IL) featuring a blend of a proprietary toxin-adsorbing mineral with essential oils and medium-chain fatty acids that is optimized for pathogen control in livestock production. The antimicrobial ingredients of A220 have been shown to have a broad-spectrum bacteriostatic/bacteriocidal activity in vitro at minimal inhibitory concentrations against C*. perfringens*, *E. coli* O157, *E. coli K88+*, *P. multocida*, *S. Enteritidis* and *C. jejuni* at 0.08 to 0.6 mg/ml. Of note, for a variety of common zoonotic pathogens, the virulence is mostly associated with their ability to produce toxins. The enterosorbent mineral component of A220 can also effectively bind various exotoxins produced by *E. coli* (heat-labile and Shiga-like toxins), *C. perfringens* (α-and NetB toxins), and *V. parahaemolyticus* (PirA and PirB toxins). Effects of A220 on animal health and performance was further examined in various in vivo pathogen-challenged experimental models. In two studies using a *C. perfringens*-induced necrotic enteritis model, for broilers fed A220, body weight gain, feed intake, feed conversion ratio, necrotic enteritis-associated mortality and lesion scores were lower ($P < 0.05$) than challenged control (CH) birds and were not different to birds supplemented with BMD ($P > 0.05$) in both experiments. Further, ELISA demonstrated a marked reduction in cecal *C. perfringens* populations and cecal alpha-toxin levels compared to the CH group ($P < 0.05$). In a *S. Heidelberg* (SH) infection model, compared to CH broilers, A220 significantly reduced the prevalence of SH in cecal contents (50% vs. 83.3%, $P < 0.05$). In pigs challenged with an enterotoxigenic *E. coli*, A220 at 0.25% and 0.50% increased post-infection (PI) feed efficiency and reduced diarrhea frequency during the study ($P < 0.05$). A220 also promoted a well-balanced gut microbial ecosystem by selectively increasing the relative abundance of *Firmicutes*, especially that of *Lactobacillaceae*, but reduced *Bacteroidetes* and *Proteobacteria* in feces on d7 PI ($P < 0.05$).

Collectively, A220 has potential for enteric pathogen control in poultry and swine by targeting pathogenic bacteria and their exotoxins, and can be an effective, all-natural alternative to in-feed antibiotics.

Key Words: *C. perfringens*, *S. Heidelberg*, enterotoxigenic *E. coli*, bacterial toxin, antibiotic alternative