

PATHKINEX UPDATE



Coccidiosis: An Industry-Wide Problem

Cocci can wreak havoc on the gut epithelium in a variety of livestock species, but what is happening to bacterial loads when cocci are present? In this PathKinex update, we explore the impact of cocci on gastrointestinal pathogens, specifically

the association between *Eimeria tenella*, one of the most pathogenic *Eimeria* species in poultry, on opportunistic pathogen load in broiler ceca.



Coccidiosis in Poultry and Livestock

Coccidiosis is a parasitic infection known for its damaging effects on gut health across poultry and livestock species. In swine, there are no proven widely accepted anticoccidial medications for use in sows that are effective at controlling the disease in neonates. In dairy, cocci are managed to some extent with the use of coccidiostats, while in poultry a combination of vaccination and preventative medication is used. Despite available tools, coccidiosis remains a costly disease across all sectors. The poultry industry bears the highest costs of coccidiosis, estimated at \$3 billion annually worldwide¹.

Coccidiosis begins with the ingestion of sporulated oocysts via fecal contamination. *Coccidia* replicates in the epithelial cell layer lining the gastrointestinal tract causing enteritis, intestinal cellular tissue damage, and mucus secretions, ultimately resulting in malabsorption issues, decreased performance, and sometimes mortality.

In poultry, it is well known that coccidiosis can open the door to bacterial infections such as necrotic enteritis associated with *C. perfringens*, but little is understood about the association of cocci with other bacterial pathogens.



Bacterial Pathogen Burden in Broilers Harboring *Eimeria tenella*

Our PathKinex™ dataset consisted of qPCR data from cecal swab DNA collected from broilers across the US and internationally. The PathKinex™ panel includes qPCR assays for genus- or species-specific marker and virulence genes unique to bacterial, viral, and fungal pathogens of interest, including *Eimeria tenella*.

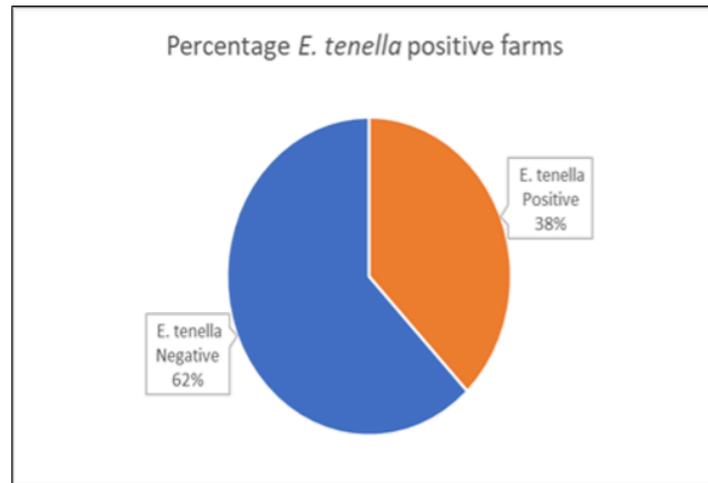
For this comparison, we used data from 274 broiler ceca samples from 37 farms collected between 2019 and 2022. To test differences by *Eimeria tenella* marker gene presence/absence, log-transformed gene data from birds positive or negative for the *Eimeria tenella* marker gene was compared using Welch's T-test

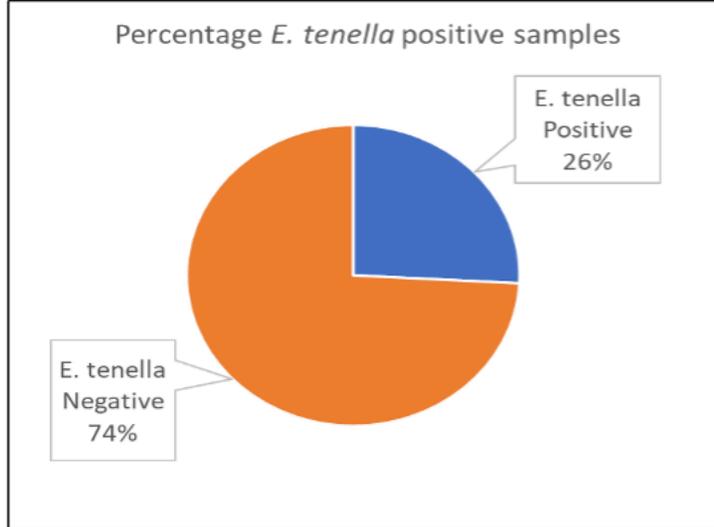
for unequal variance with Bonferroni correction for multiple comparisons (15 virulence genes).



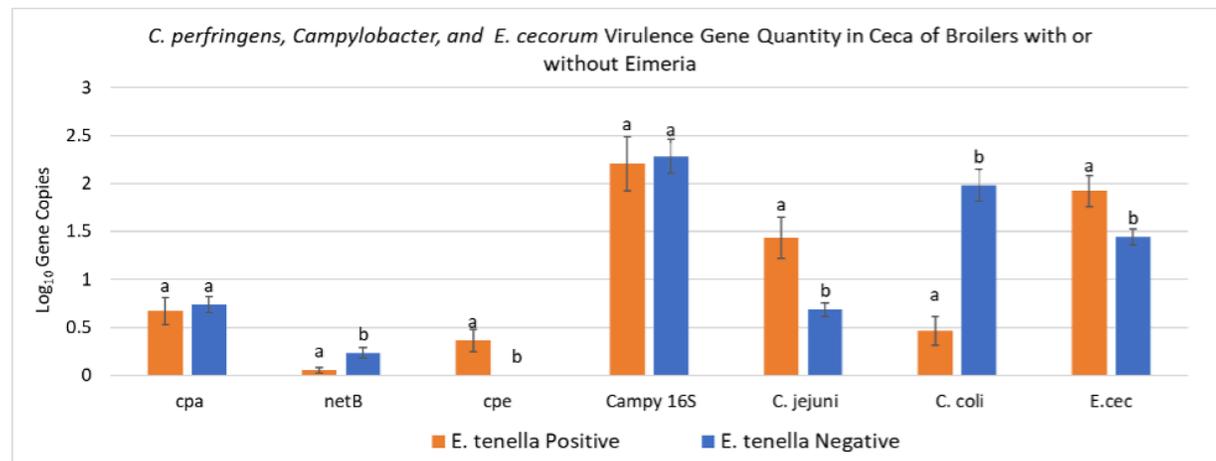
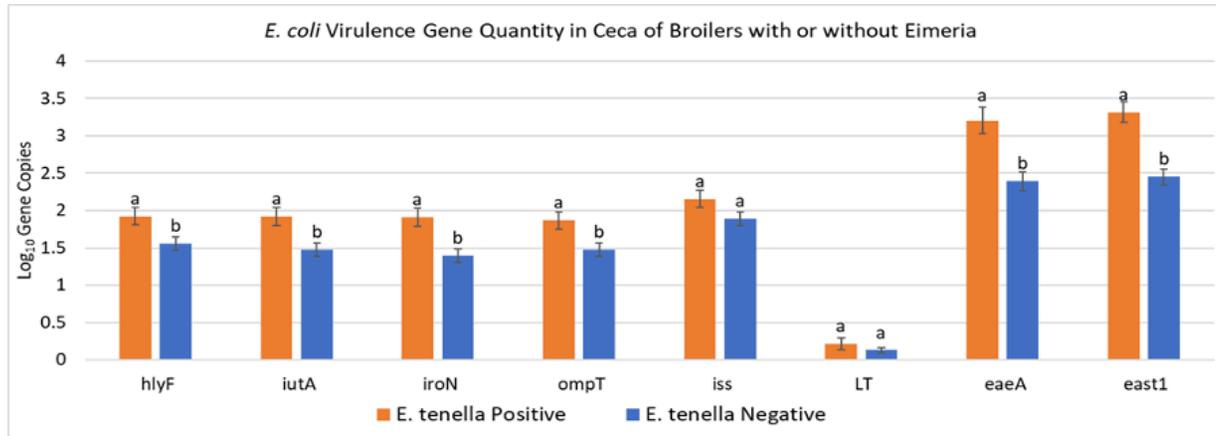
***Eimeria tenella* Carriage is Associated with Significantly Higher Levels of Key Pathogens**

Eimeria tenella was present in over one-third of the commercial flocks sampled in the poultry PathKinex™ program, despite the use of a variety of vaccination and medication strategies (**Figures 1 and 2**). When *E. tenella* was present, gene markers for cecal populations of opportunistic pathogens including avian pathogenic *E. coli*, and some markers for *C. perfringens*, *Campylobacter jejuni* and *E. cecorum* were found in higher quantities (**Figures 3 and 4**), implying that cocci may exacerbate the effects of bacterial infections with negative impacts on host health and performance.





Figures 1 and 2: The proportion of farms and samples with the percentage of cecal samples testing positive for *E. tenella*.



Figures 3 and 4: Pathogen gene quantities in samples with cecal with or without *E. tenella*.

Solutions

Prophylactic use of anti-coccidial drugs or live parasite vaccination, improved sanitation, and good flock management are important tools in the prevention of common, endemic parasites like *Eimeria*. However, additional strategies to promote bird health and to reduce the severity of the opportunistic bacterial infections associated with coccidial infection may still be needed. PathKinex™ surveys in dairy have also demonstrated increases in pathogen load when cocci are present² indicating that this phenomenon may be a universal problem across species.

Bacillus-based DFM Strains

Supplementation with a targeted *Bacillus*-based DFM containing strains selected for antimicrobial activity may improve gut integrity and provide secondary microbial control in both the GI tract and the litter, promoting bird health and setting up other treatment strategies for success.

Exploring Emerging PathKinex Trends

Together United Animal Health and Microbial Discovery Group are pioneering the investigation of relationships between microbial virulence genes and animal health. Our PathKinex™ platform and growing database of rectal and intestinal swab samples provide a unique resource for identifying and exploring connections between microorganisms and host or environmental factors.



Discussion Question

How are parasites interacting with key bacterial pathogens in the swine, poultry, and dairy and where can DFMs make an impact?

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We enjoy hearing from you! We welcome your questions, comments, and suggestions on PathKinex™ updates. Please contact us at AnimalAg@mdgbio.com

References

1. Noack S, Chapman HD, Selzer PM. Anticoccidial drugs of the livestock industry. *Parasitol Res.* 2019 Jul;118(7):2009-2026.
2. Lange AM, Galbraith EA, Arias RP, Fensterseifer SR, Son S, King MR. Microbial virulence genes in rectal swab samples are correlated with environmental, metabolic, and gut health stressors in US dairy cows. (2291W) Poster presented at: American Dairy Science Association Annual Meeting, 2022 Jun 19-22, Kansas City, MO.

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