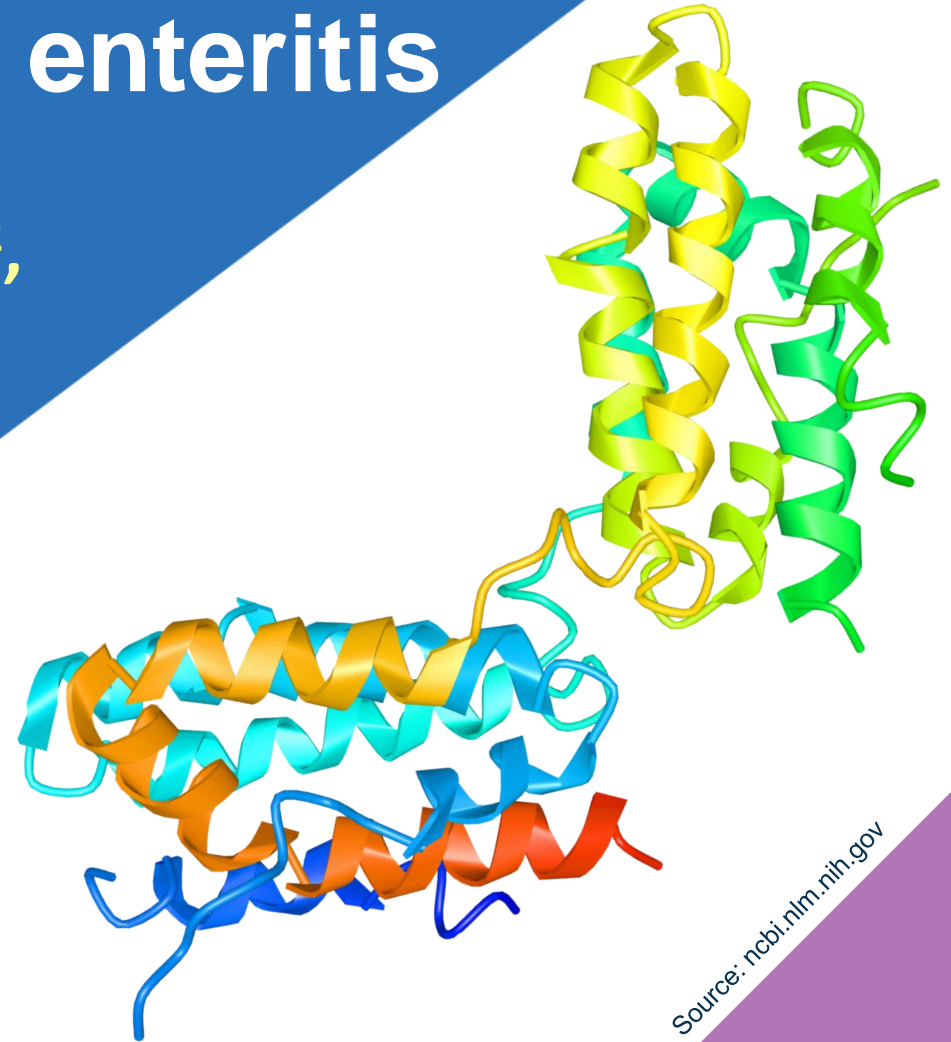


Efficacy of dried egg product administered to male broiler chickens during experimental necrotic enteritis

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1. Elanco Animal Health,
2. Southern Poultry Research
3. Ab E Discovery



Source: ncbi.nlm.nih.gov

18 December 2019

USDA 3rd International Symposium on Alternatives to Antibiotics
Bangkok, Thailand

Elanco

Necrotic enteritis (NE)

- “NE is the most common and financially devastating bacterial disease in modern broiler flocks” (poultryhub.org)
- Wet litter, diarrhea, increase in mortality
- Depression of growth rate and feed efficiency
- Multifactorial disease
 - Coccidiosis: the trigger!
 - *Clostridium perfringens*
- Current efforts:
 - Vaccination, medication, and management



Figure 1: Score = 1



Figure 2: Score = 2

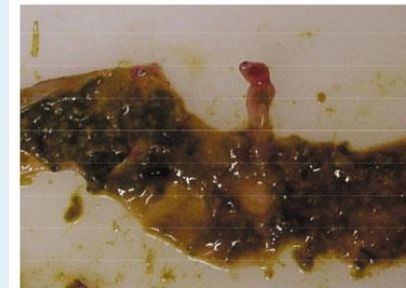


Figure 3: Score = 3



Figure 4: Score = 4

Source: poultryhub.org

Interleukin-10

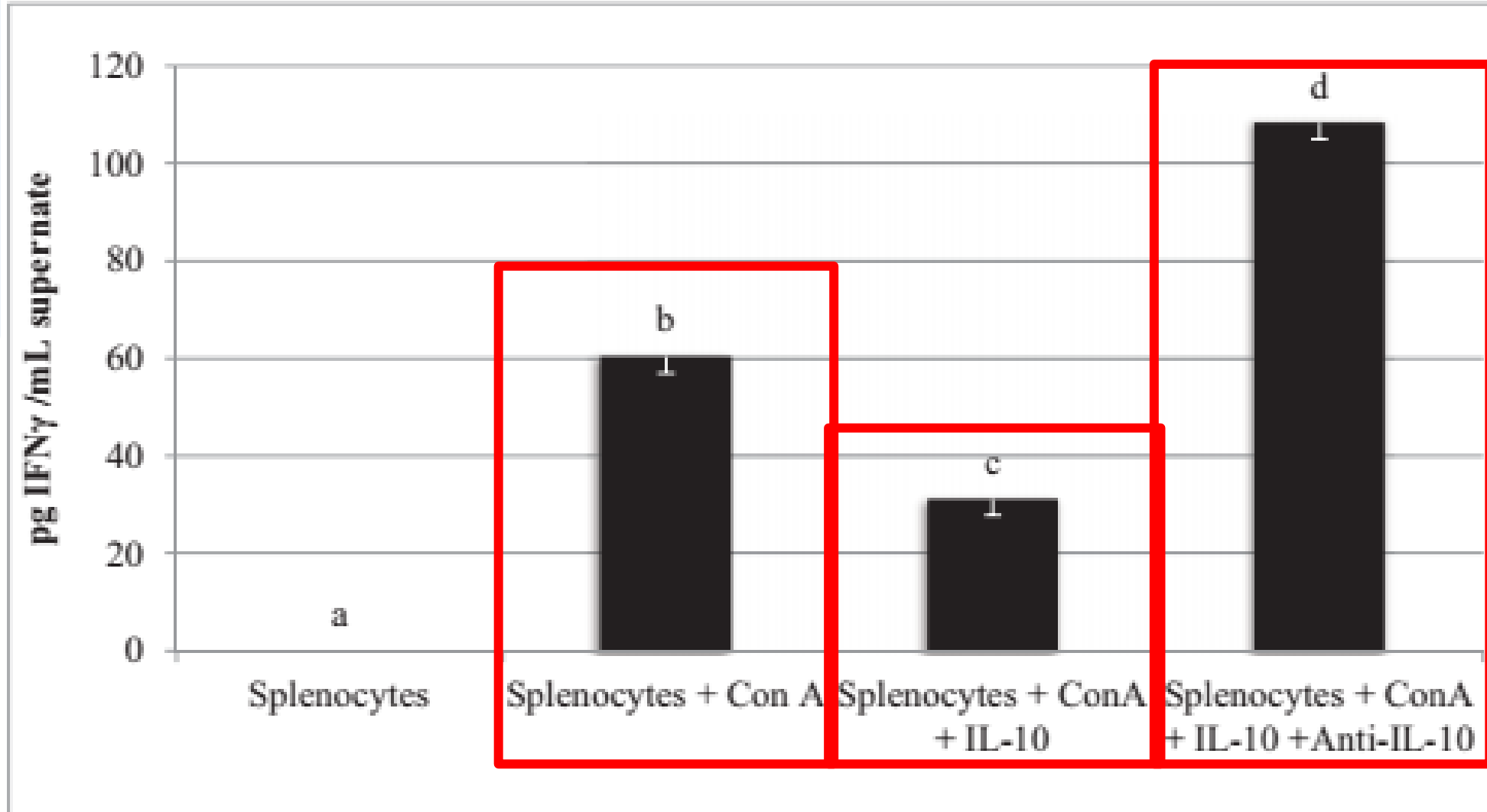
IL-10 is a potent anti-inflammatory cytokine that decreases:

- Innate immune response
 - MHC Class II proteins, costimulatory molecules, and reactive oxygen intermediates
- Adaptive immune response
 - Antigen specific T-cell generation
- Inflammation
 - Inhibits production of **IFN- γ** , TNF- α , IL-1, IL-2, IL-6 and GM-CSF

IL-10 main function

- “Resolve” inflammatory processes

IL-10 reduces IFN- γ production and release in ConA-stimulated chicken splenocytes *in vitro*



Role of IL-10 in pathogenesis

- Epstein Barr Virus encodes for IL-10 and inhibits anti-viral response
- *Yersinia pestis* upregulates IL-10 production and favors its survival
- *Leishmania donovani* upregulates IL-10 and IL-10 KO mice are resistant
- *Eimeria* resistant chickens express low IL-10
- *Eimeria* infection increases IL-10 levels



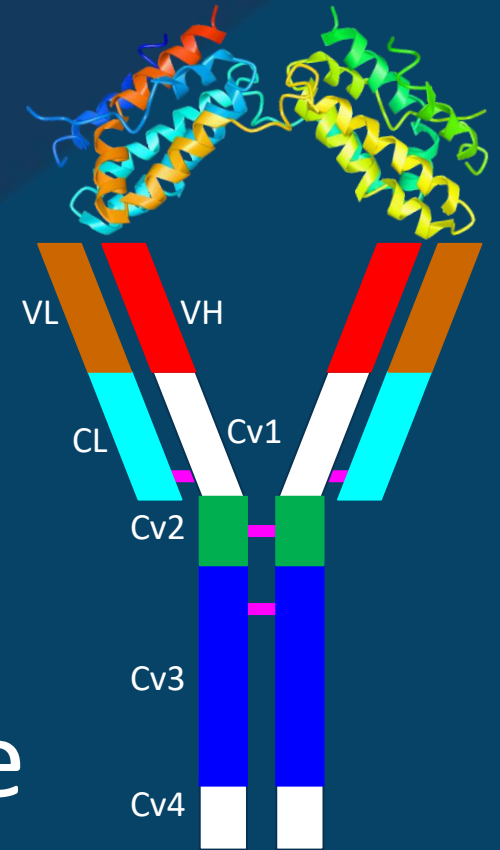
Source: hindustantimes.com

Certain pathogens appear to use high expression of IL-10 to thwart and fool an immune response

.... a cloaking mechanism

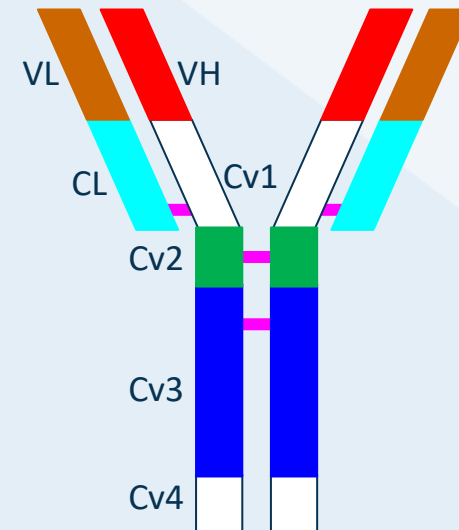
Hypothesis

Neutralization of intestinal secreted IL-10 with an IgY may contribute to increase IFN- γ production to elicit an appropriate immune response resulting in better growth performance of broilers with necrotic enteritis



Dried Egg Product (DEP)

- **Patents:** 8652457; US20150037277; 9505836; US20160280778; US20160008436
- Laying hens are hyper-immunized with a patented peptide against chicken IL-10 (Arendt et al., 2016 Poultry Sci. 95:430)
- Eggs containing anti-chicken IL-10 IgY antibodies
- Eggs are dried in a manner to preserve IgY binding activity



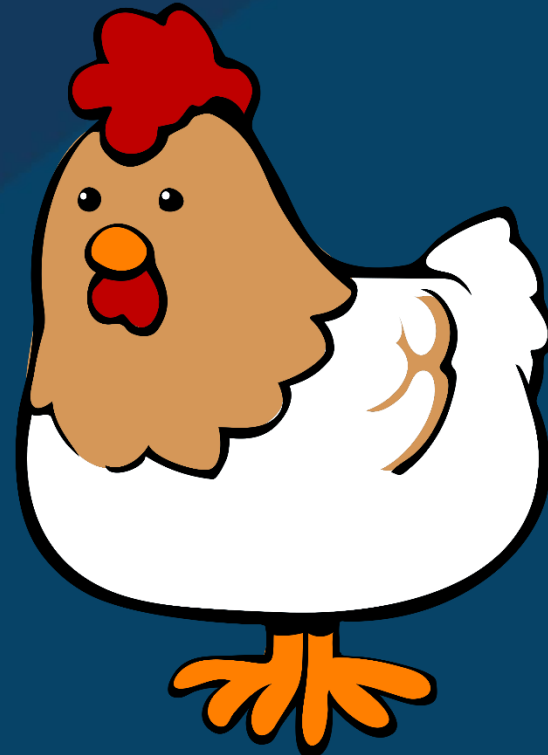
Experimental design and analyses

- Randomized complete block design
- Six DEP doses (0, 143, 287, 358, 430, and 573 U/MT)
 - Starter and Grower; no Finisher
- Cobb 500 males
- 50 birds/pen
- 70 floor pens (10 pens/treatment)
- Study length: 42 d
 - Starter (d 0 to 14), Grower (d 14 to 28), and Finisher (d 28 to 42)
- Southern Poultry Research

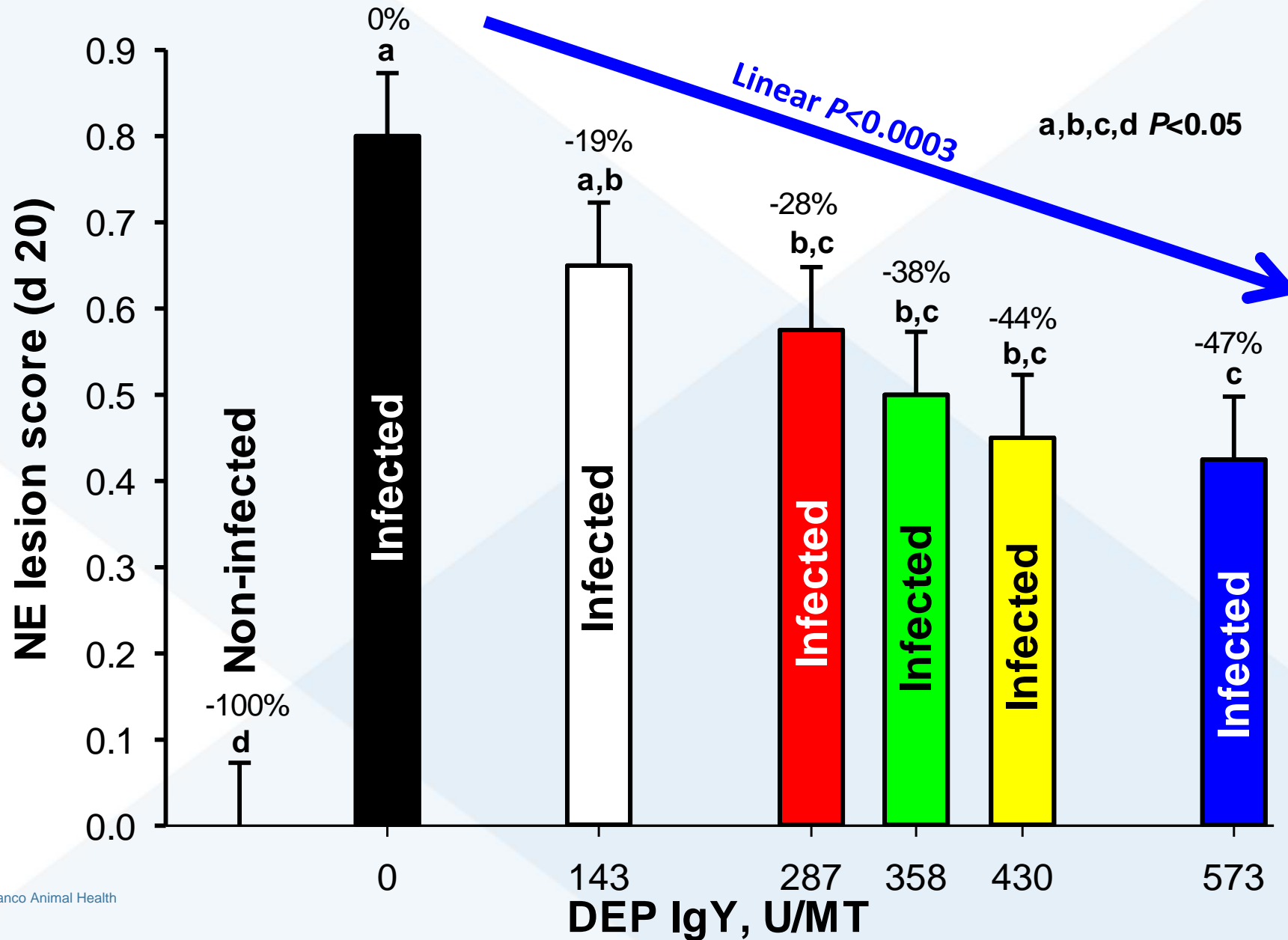
Experimental design and analyses, continued

- Experimental necrotic enteritis
 - Coccivac[®] B52 (Merck Animal Health, Kenilworth, NJ) spray vaccination on day of hatch according to label
 - *Clostridium perfringens*
 - 10^8 cfu/bird/d in feed
 - Day 18, 19 and 20 of study
- 4 bird/pen randomly selected for NE lesion scoring on d 20
- Growth performance
 - Each feeding phase and overall
- Pen was the experimental unit with treatment as a fixed effect and block as a random effect (JMP v.14.1)

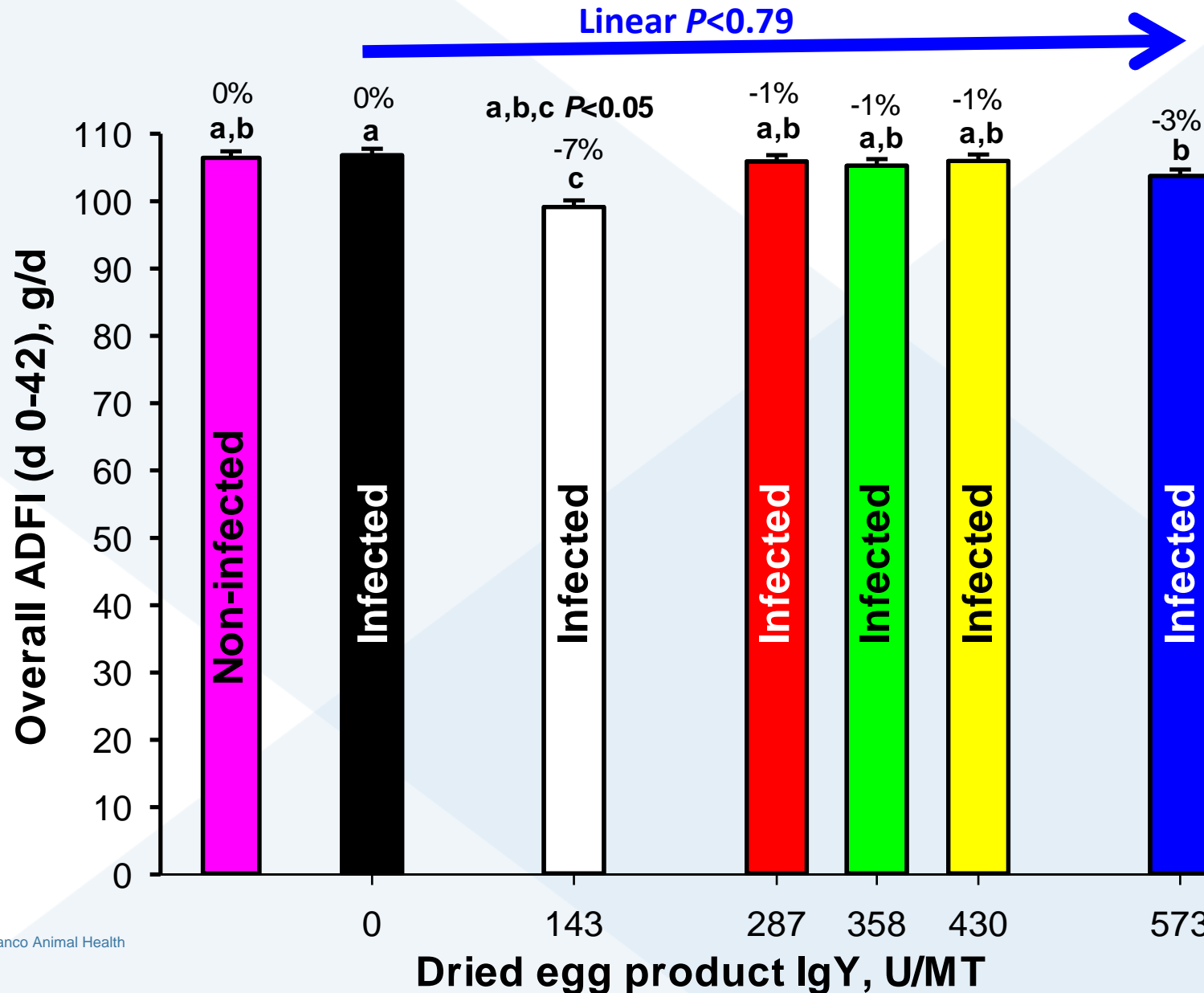
Results



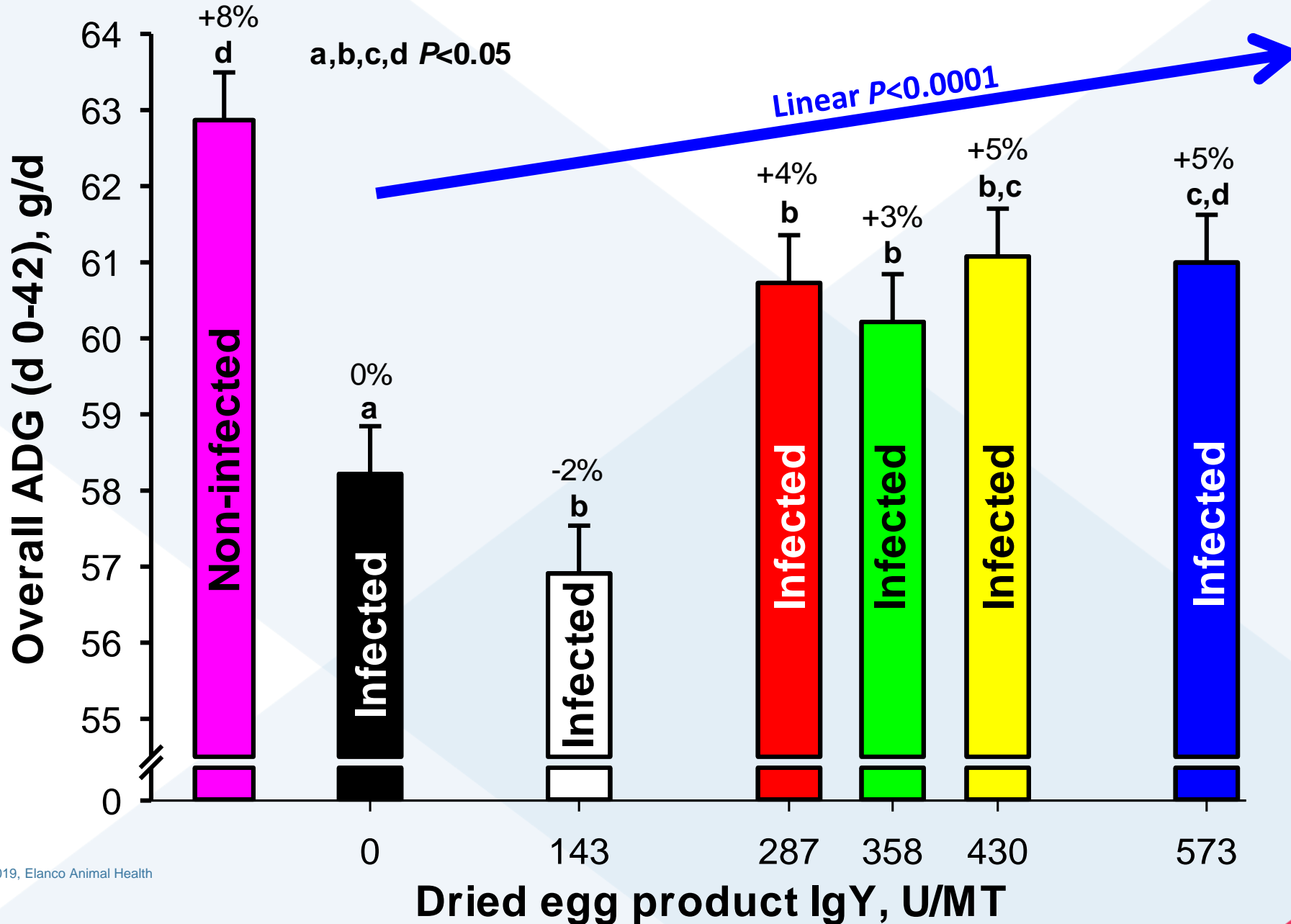
Necrotic enteritis lesion scores (d 20)



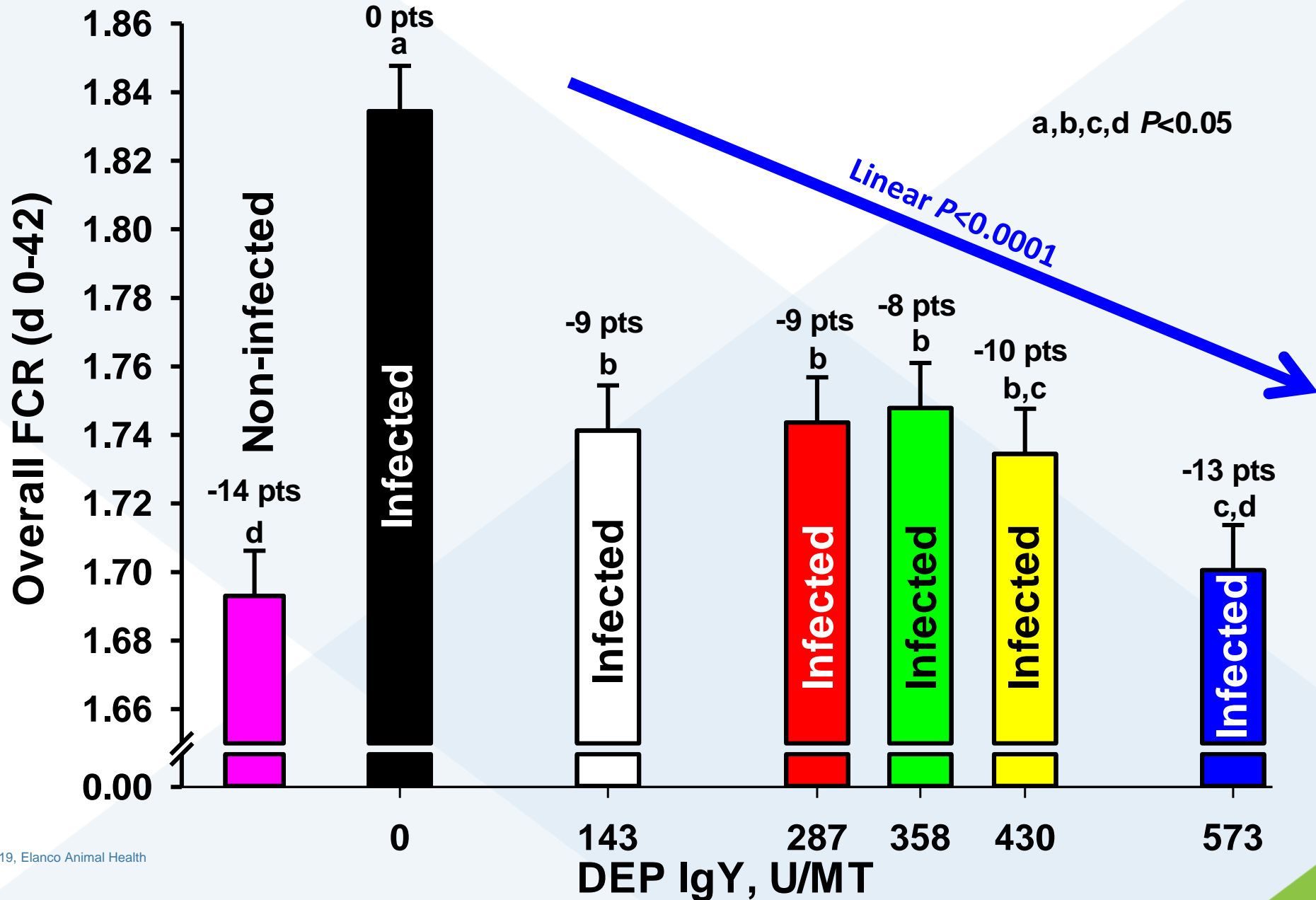
Overall average daily feed intake (d 0-42)



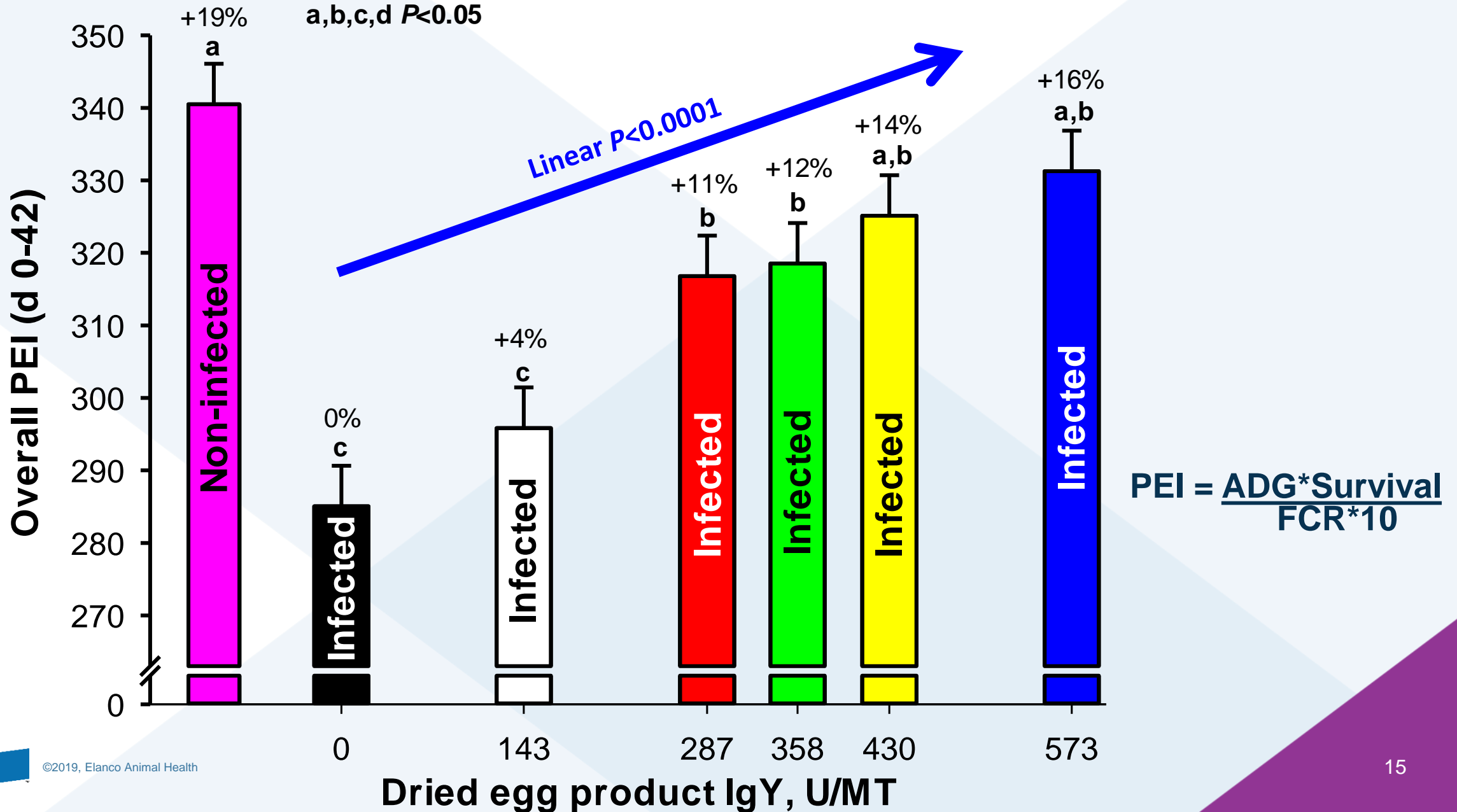
Overall average daily gain (d 0-42)



Overall feed conversion ratio (d 0-42)



Overall production efficiency index (d 0-42)



Summary

- Inclusion of dried egg product containing anti-chicken-IL-10:
 - Reduced necrotic enteritis lesions
 - Improved growth performance

Conclusion

- Use of dried egg product containing anti-chicken-IL-10 may be a viable alternative to reduce the negative effects of coccidiosis and thus ameliorating necrotic enteritis in broilers

References

- Arendt *et al.* 2016. Interleukin-10 neutralizing antibody for detection of intestinal luminal levels and as a dietary additive in *Eimeria* challenged broiler chicks. *Poult. Sci.* 95:430-438.
- Ohga *et al.* 2002. Immunological aspects of Epstein-Barr virus infection. *Crit. Rev. Ocol/Hematolog* 44:203-215.
- Ping Ouyang *et al.* 2014. IL-10 encoded by viruses: a remarkable example of independent acquisition of a cellular gene by viruses and its subsequent evolution in the viral genome. *J. Gen. Virology* 95:245–262
- Rothwell *et al.* 2004. Cloning and characterization of chicken IL-10 and its role in the immune response to *Eimeria maxima*. *J. Immunol.* 173:2675-2682.
- Yu *et al.* 2008. Measles virus infection in adults induces production of IL-10 and is associated with increased CD4⁺CD25⁺ regulatory T Cells. *J. Immunol.* 181:7356-7366.
- Redpath *et al.* 2014. Protection and pathology during parasite infection: IL-10 strikes the balance. *Parasite Immunol.* 36:233-252.

Thank you, questions?

International Poultry Scientific Forum at IPPE 2020

- Efficacy of dried egg product administered to chickens during an enteritis infection caused by *Eimeria spp.* and *Clostridium perfringens*
- Binding kinetics of IgY contained in a dried egg product to recombinant chicken IL-10

