A Commercial Study Comparing the Effects of Antibiotic and Direct-Fed Microbial Supplementation on Gut Lactic Acid Bacteria Populations in Turkeys

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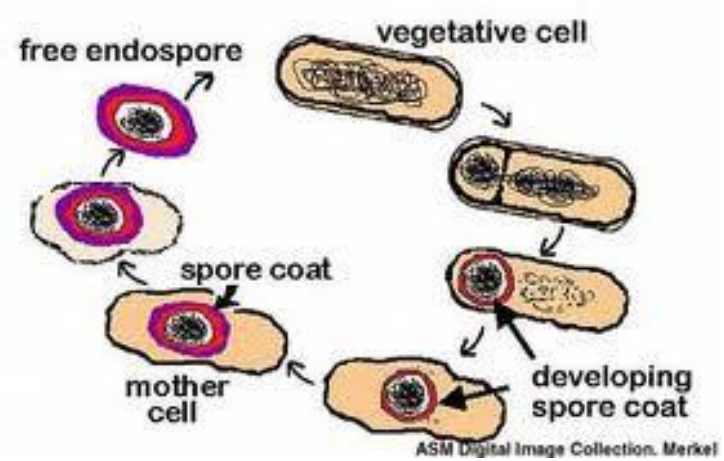
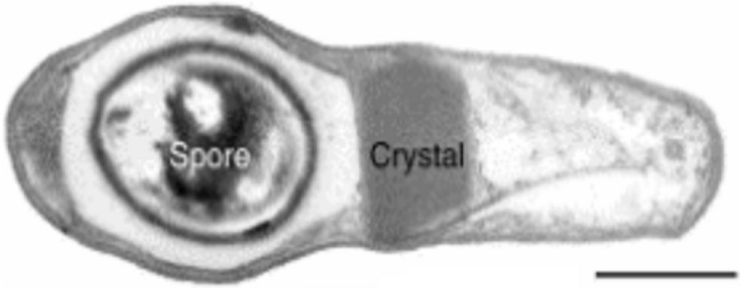
What is a Direct Fed Microbial?

- Currently in the U.S. livestock probiotics are referred to as Direct Fed Microbials or DFMs
  - DFMs are not antibiotics, nor vaccines
- Bacillus organisms are often selected as DFMs for their attributes like:
  - Readily form spores
  - Heat stable
  - Viable microorganism beneficial to the GIT

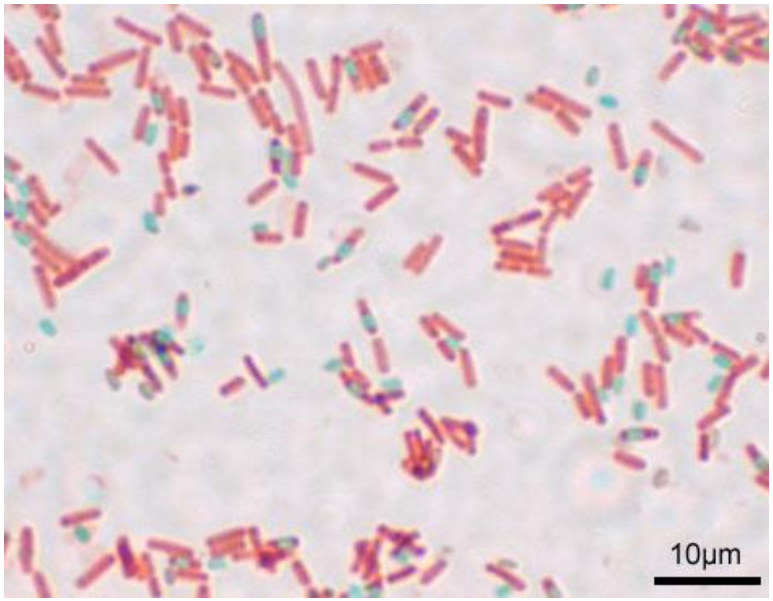




What is a Direct Fed Microbial?

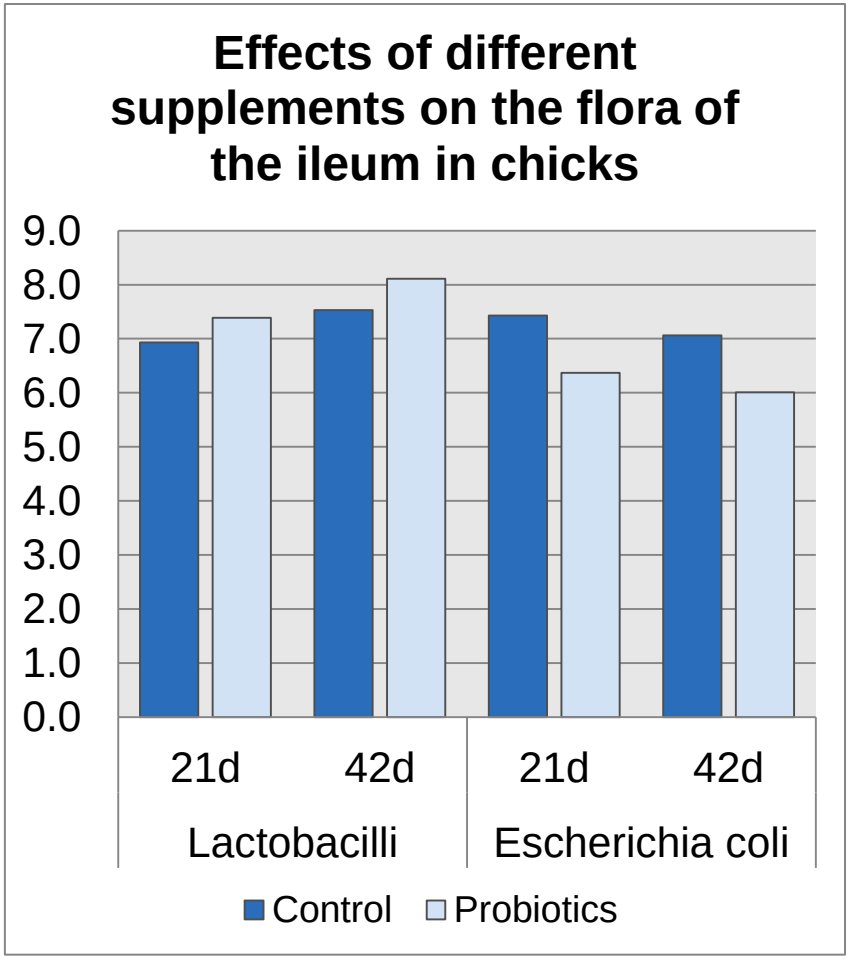
- DFMs influence host by:
  - Inhibition of enteric pathogenic bacteria
    - Through direct and indirect interaction
  - Balancing of intestinal microbiota populations
  - Regulation of mucosal cell immune response
  - Promoting epithelial barrier integrity
  - Enhancing digestive physiology

- Differences in DFM influenced microbial community changes have been directly linked to improved performance and increased energy metabolism (Torok *et al.*, 2008)



Gastrointestinal ecology and health

- Avian gastrointestinal tract (GIT) microbiota
  - Are dense and a metabolically active population
  - Influence on the health and development of the host.
  - Helps host resist disturbances
- Some dietary components have been shown to affect community composition.
- Studies have shown that dense populations of *Bacillus* and *Lactobacillus* in the small intestine of the host shows increased levels of lactic acid bacteria, and a decrease in enteric pathogens (Li *et al*., 2009)



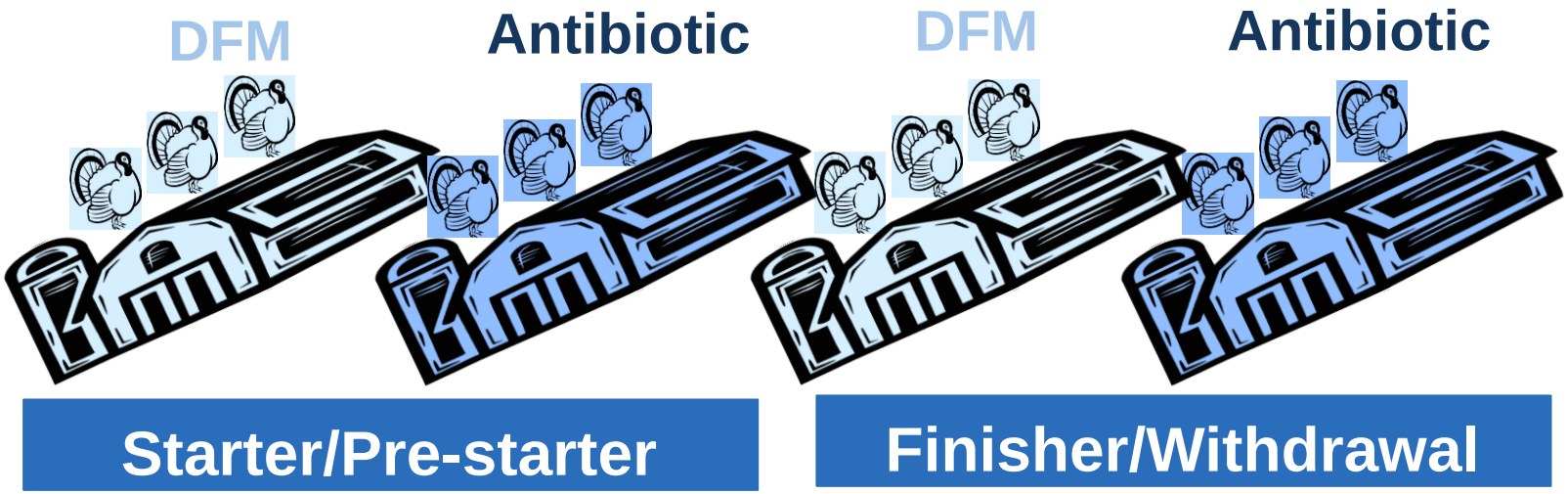
Adapted from Li *et al.,* 2009

Objective

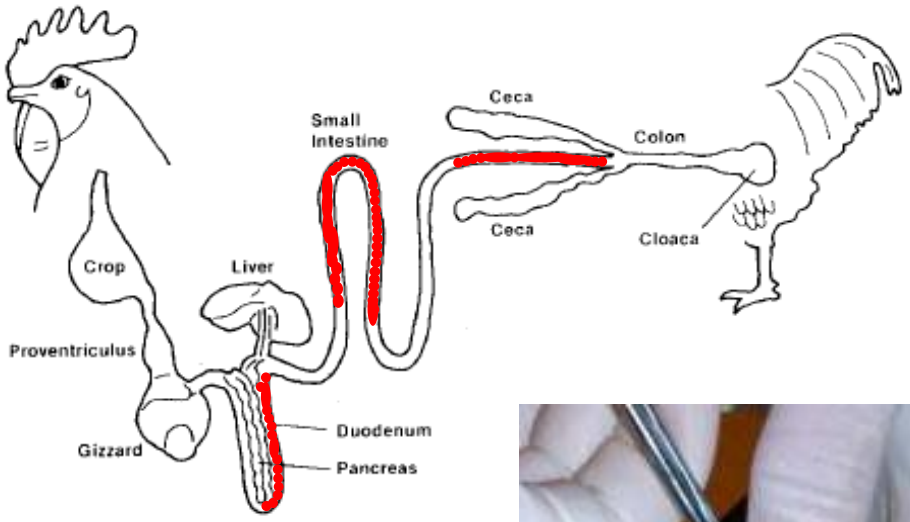
- To evaluate the differences in the gastrointestinal microbiota of commercially raised turkeys administered different feed additives.

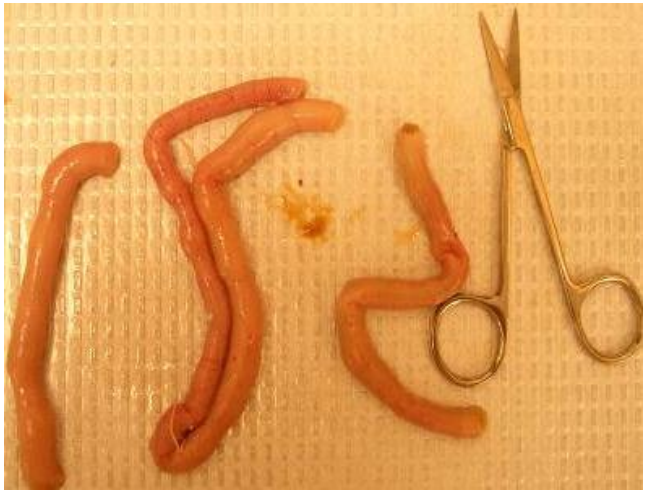
Trial Design

- 2x2 Factorial Design – analyzed using Proc Mixed procedure of SAS
  - Feed Additive
    - DFM – Three strain *Bacillus* included at 0.05% in diet
      - BMD50 included at 0.005% in pre-starter/starter diets
    - Conventional Antibiotic Program – BMD50 included at 0.005% in pre-starter/starter phase and Virginiamycin included at 0.02% in finisher/withdrawal diet
  - Feeding Phase
    - Starter/Pre-starter
    - Finisher/Withdrawal
- Six houses per treatment



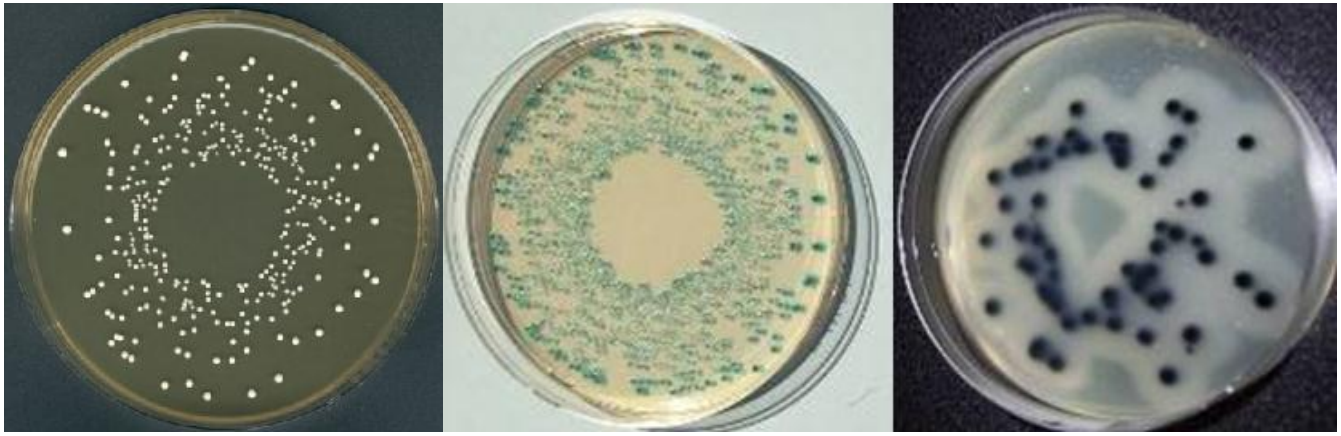
Poultry Samples



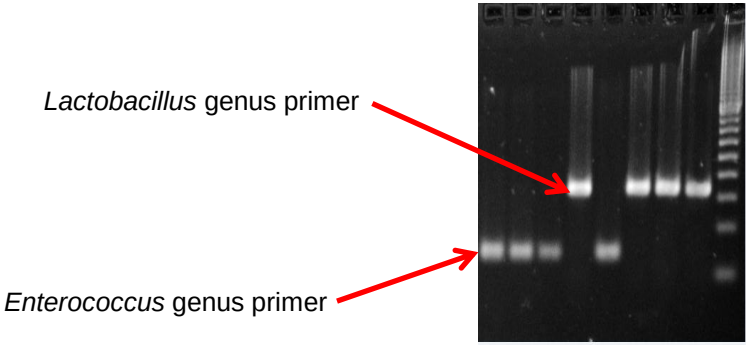


Microbial Sampling

- Poultry samples were plated on selective agars for three different organisms:

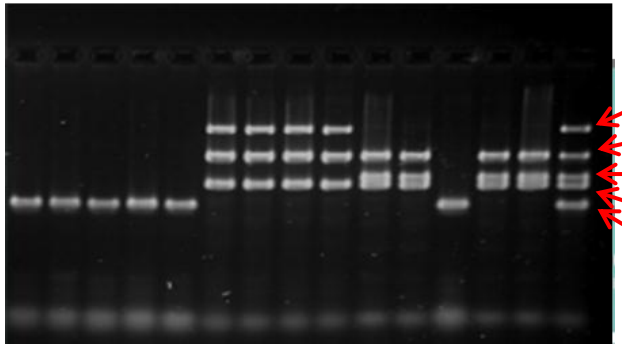


Lactic Acid Bacteria electrophoresis gel image



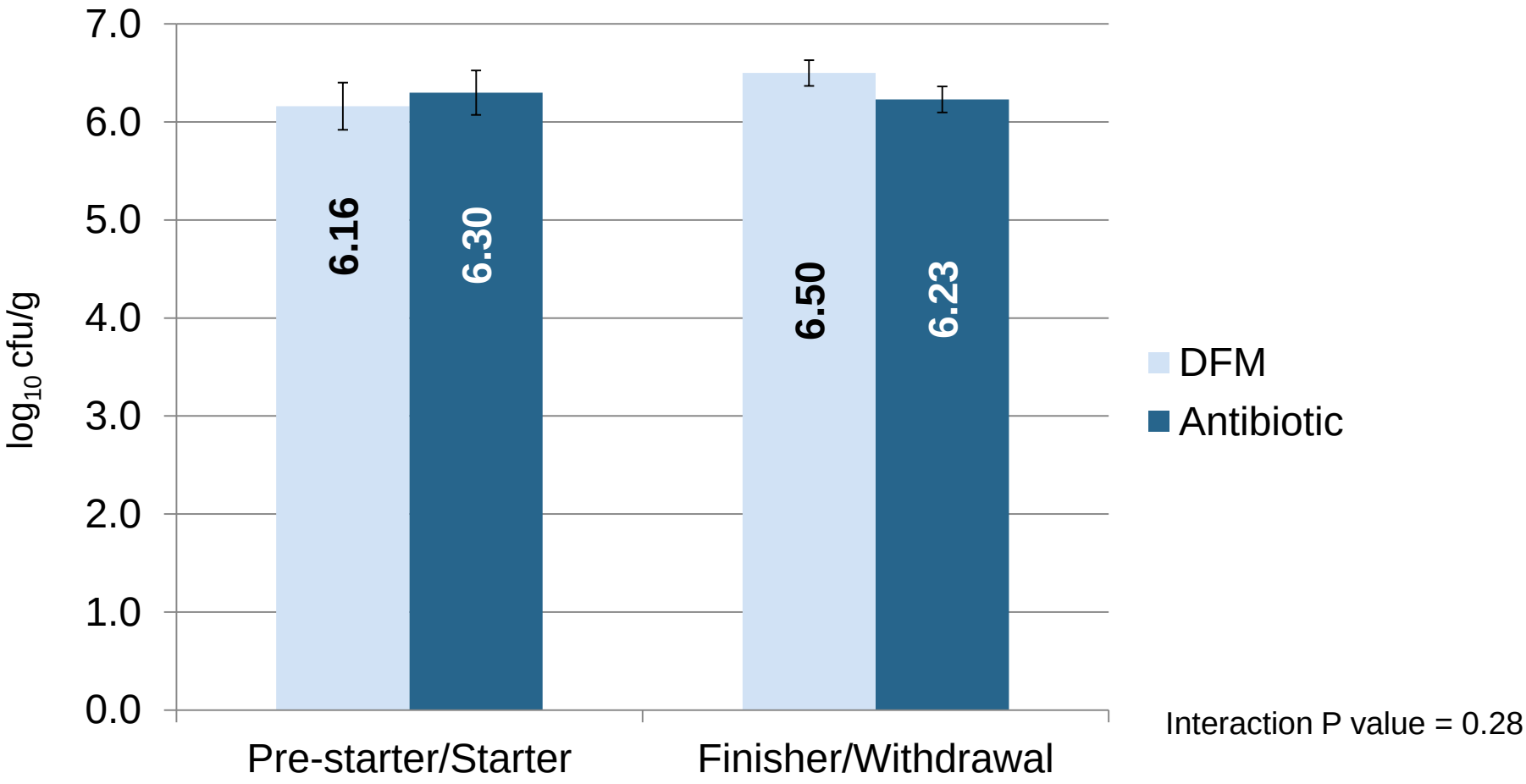
Walter, J. et. al. (2001) *Applied and Environmental Microbiology* **67**, 2578-2585.
Rinttilä, T. et al. (2004). *Journal of Applied Microbiology* **97**, 1166-1177.

Avian pathogenic *E. Coli* electrophoresis gel image



Ewers, C., et al. (2009) *Applied and Environmental Microbiology* ***75(1), 184-192.***

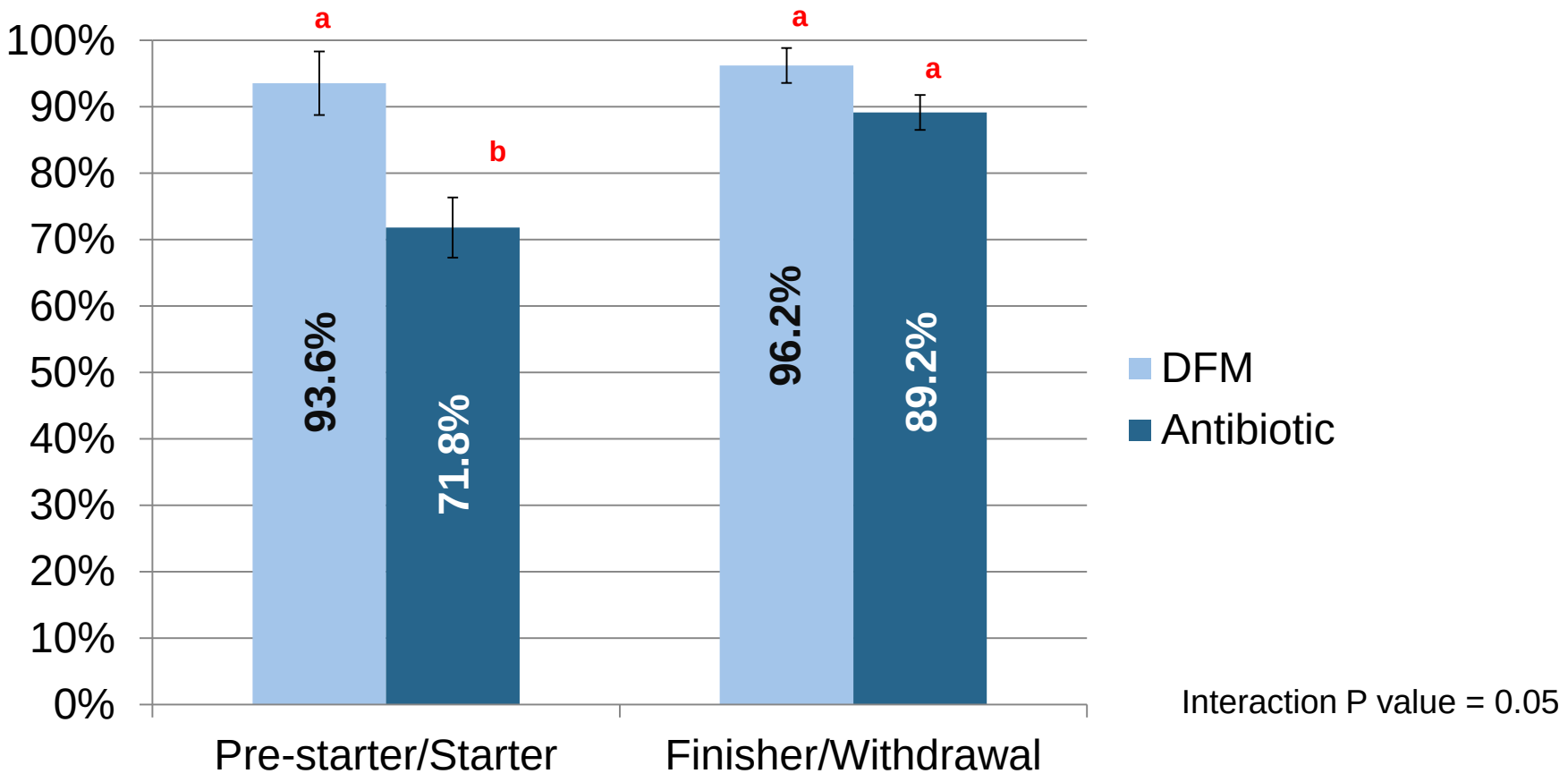
Total lactic acid bacteria log_{10} cfu/g of GI tissue



Interaction P value = 0.28

Lactobacillus percent of total LAB

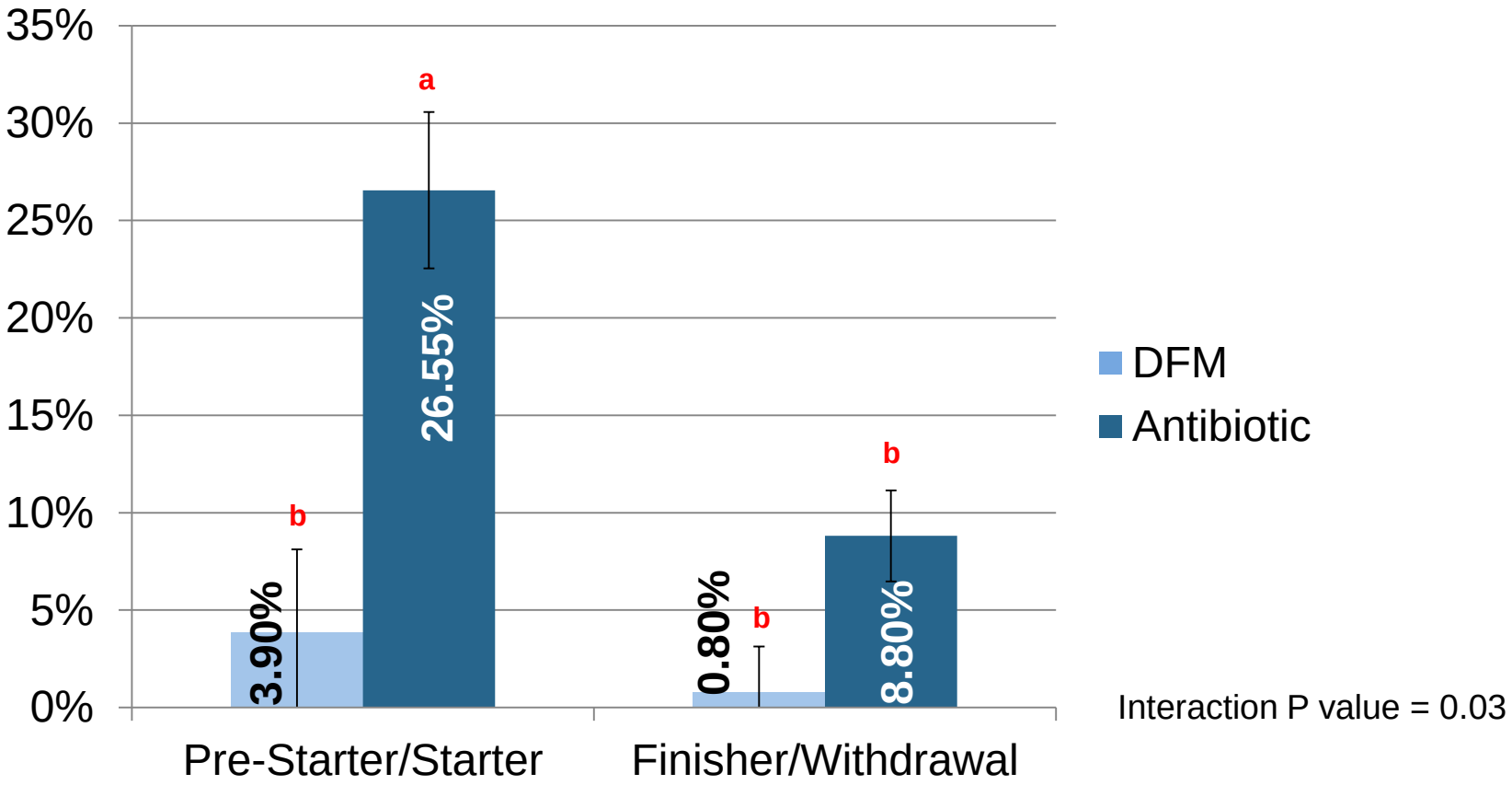
- *Lactobacillus* proportions of the DFM diet were greater in the pre-starter/starter phase when compared to antibiotic diets for the same feeding phase.



Interaction P value = 0.05

Enterococcus percent of total LAB

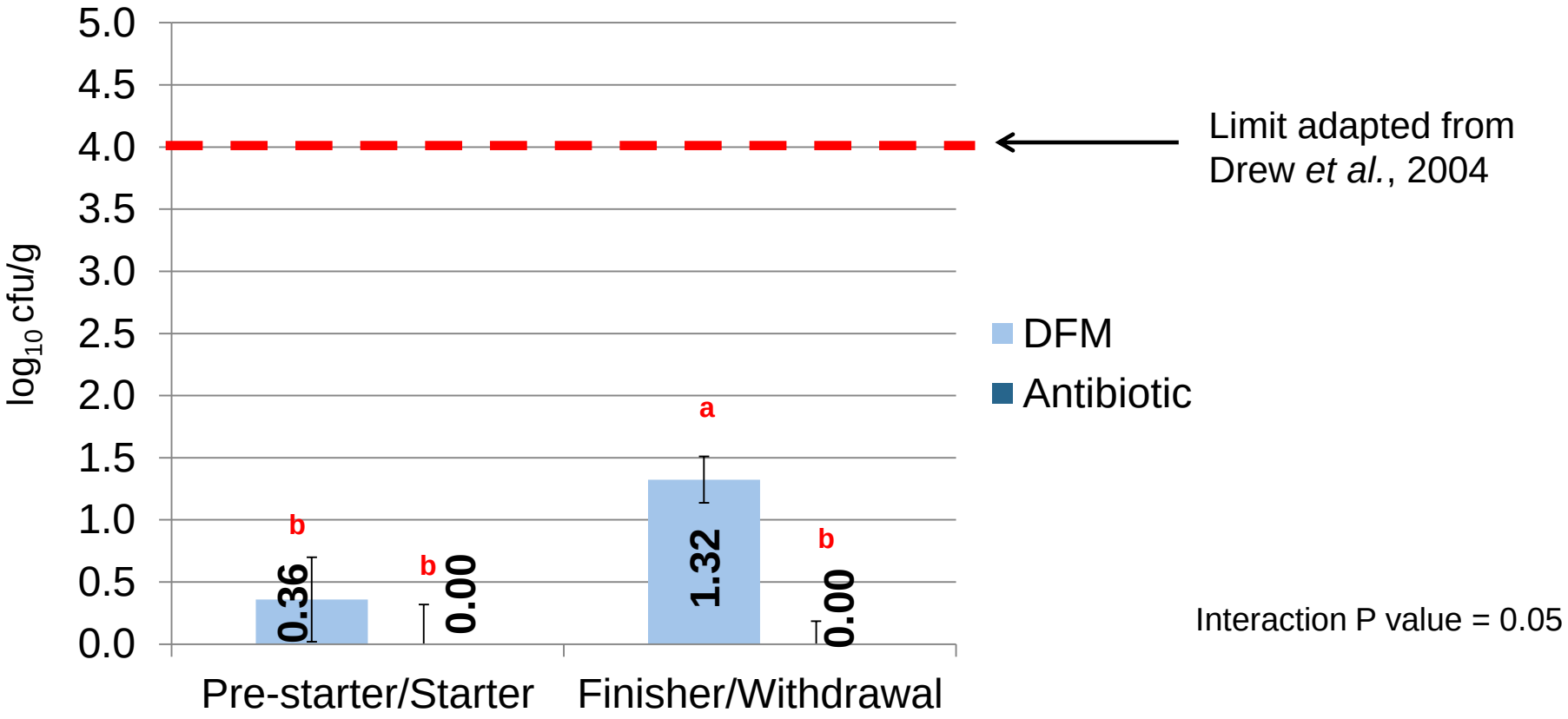
- *Enterococcus* proportions were greater in the antibiotic diet when compared to the DFM diet during the initial feeding phases.



Interaction P value = 0.03

Clostridium perfringens $\log_{10}$ cfu/g of GI tissue

- The DFM diet showed a higher level of *Clostridium perfringens* in the Finisher/Withdrawal diets when compared to all other treatments.



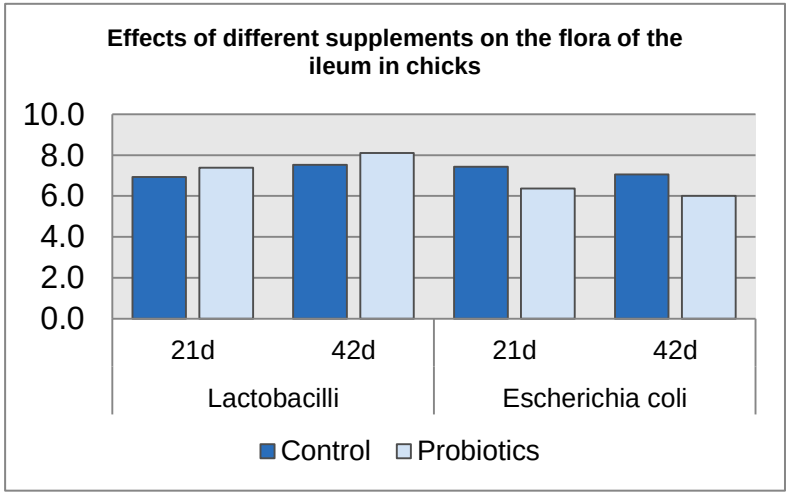
Avian Pathogenic *E. coli* $\log_{10}$ cfu/g of GI tissue

- APEC levels were significantly decreased in the pre-starter/starter diet when compared to the antibiotic diet of the same feeding phase.

Interaction P value = 0.01

Conclusions

- Neither feeding phase nor feed additive affected total LAB levels.
- Significantly higher levels of *Lactobacillus* in starter phase of the DFM fed birds compared to all other treatments at the expense of *Enterococcus.*
- APEC levels were lowest in the starter DFM treatment compared to all other treatments.



Adapted from Li *et al.,* 2009

Questions?

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