Gut microbiome and incidence of foodborne pathogens are affected by diet in pasture-raised chickens

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The pasture-raised system

Conventional chicken operations

Pasture-raised chicken operations

The pasture-raised system

The pasture-raised system used in this study:

In this system, we tested 2 different supplements:

1) Soy-containing supplement (**SB**)
(18.1% soybean)

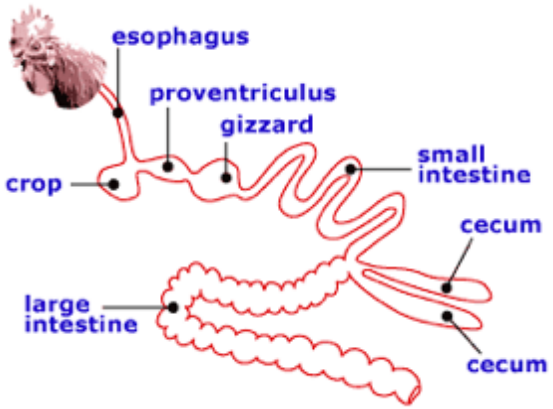
2) Soy-free supplement (**SF**)

- 3 flocks of birds were fed SB
- 2 flocks of birds were fed SF

Multiple samples were collected using a farm-to-fork approach:

GIT from 1-day-old chicks

Feces from the pasture at 4, 7, and 12 weeks of age



Cecal contents at the slaughterhouse (12 weeks-old)

WCR at 12 weeks-old (day of processing)

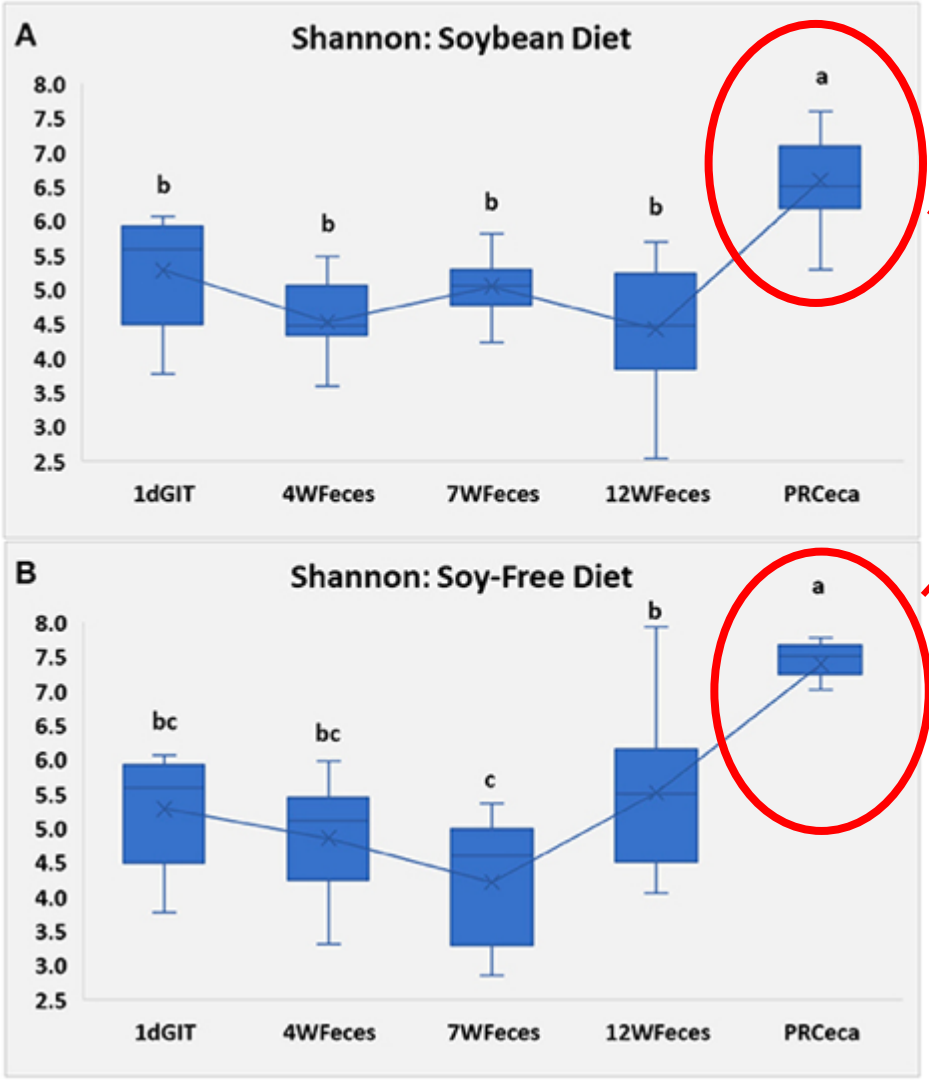
WCR after frozen for 1 month (final product)

Sample processing

- DNA was extracted from all of those samples (GIT from 1-day-old chicks, feces, ceca, WCRs)
- Samples were then submitted for sequencing of the 16S rRNA gene (hypervariable V4 domain)
- Sequencing results were processed and analyzed using the QIIME pipeline (v1.9.1)

RESULTS

Microbial richness and diversity



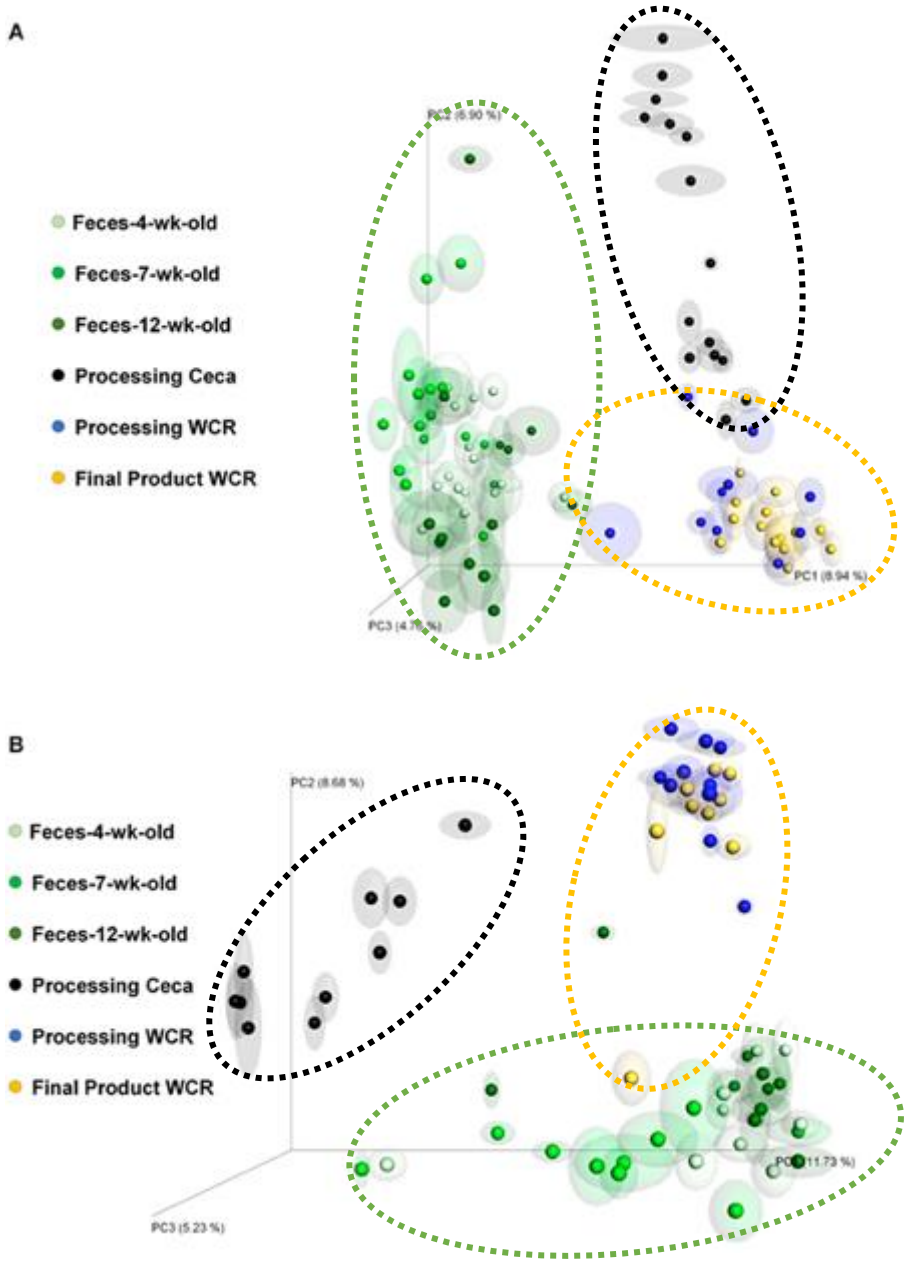
Effect of diet on α diversity indices

Item	Supplement		*P*-value
	Soybean	Soy-free	
Shannon Index (diversity)			
Cecal Contents from bird processing	6.6	7.4	**0.001**

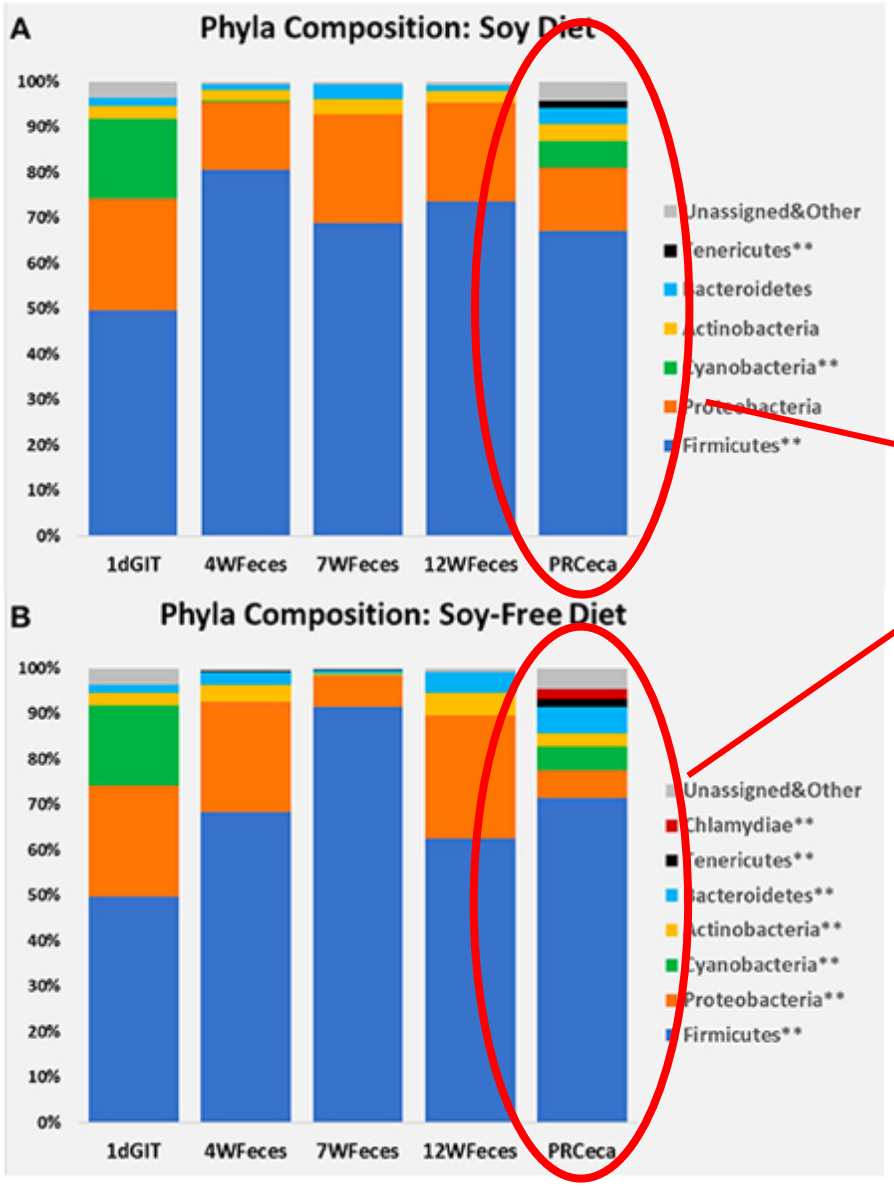
Effect of diet on α diversity indices

Item	Supplement		*P*-value
	Soybean	Soy-free	
Chao1 (richness)			
Cecal Contents from bird processing	647	1,065	**0.001**

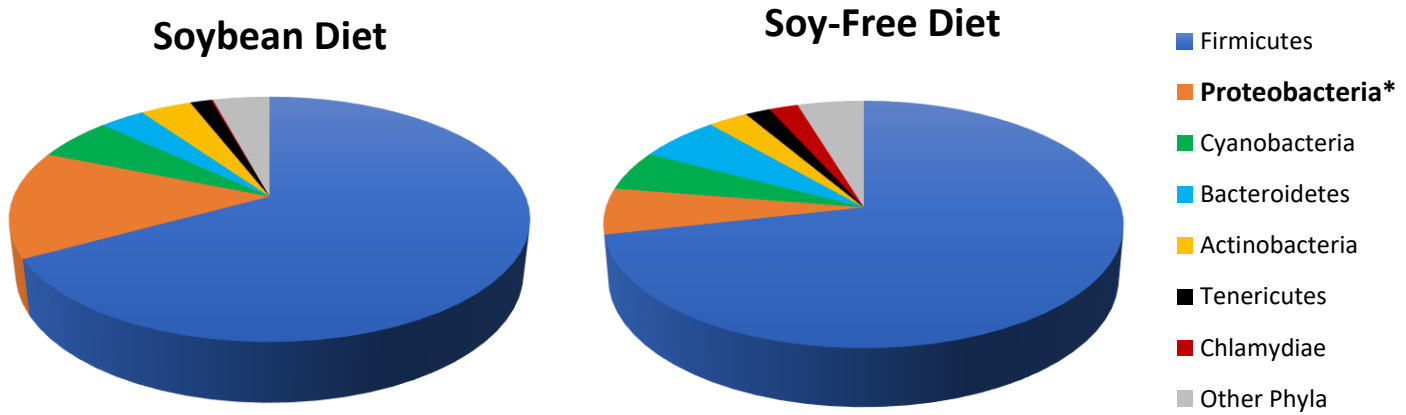
Beta-diversity: A) Top = Soybean diet; B) Bottom = Soy-free diet



Results: Main phyla



Cecal contents collected during bird processing



The phylum *Proteobacteria* includes several pathogens, such as: *Escherichia*, *Salmonella*, *Vibrio*, *Helicobacter*, *Campylobacter*, and others.

Foodborne pathogen groups found in the final product (frozen chicken carcass)

Effect of diet on abundance of foodborne pathogens (parts-per million) in the whole carcass rinses of the final product

Pathogen Group	Supplement		*P*-value
	Soybean	Soy-free	
Genus *Salmonella*	1,170	321	0.38
Genus *Acinetobacter*	208,000	118,300	**0.05** ✓
Genus *Campylobacter*	3,940	28	**0.04** ✓

Foodborne Pathogens: *Campylobacter*

Effect of diet on relative abundance of *Campylobacter* (parts-per million)

Type of Sample Evaluated	Supplement		*P*-value
	Soybean	Soy-free	
Feces from 4-week-old birds	1,160	278 ✓	0.25
Feces from 7-week-old birds	52	46 ✓	0.83
Feces from 12-week-old birds	63	7 ✓	**0.003** ✓
Processing Stage - Cecal Contents	1,220	499 ✓	0.28
Processing Stage - Whole Carcass Rinse	10,000	3,720 ✓	0.24
Final Product - Whole Carcass Rinse	3,940	28 ✓	**0.04** ✓

Conclusions

- Regardless of which supplement was used, microbial diversity was greater in the cecal contents, compared to the feces
- Microbial richness and diversity were greater in the cecal contents of birds fed the soy-free supplement
- **Supplementing broilers with the soy-free feed resulted in decreased populations of *Campylobacter* and *Acinetobacter* in the final product**

For additional information on this study, please refer to these 2 publications:

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The Successional Changes in the Gut Microbiome of Pasture-Raised Chickens Fed Soy-Containing and Soy-Free Diets

*Jeferson M. Lourenco[1], Michael J. Rothrock Jr.[2], Francis L. Fluharty[1] and Todd R. Callaway[1]**

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The succession of bacterial species as birds mature can impact their growth efficiency, health, and food safety due to the ability of a mature gastrointestinal microbial population

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The Effects of Feeding a Soybean-Based or a Soy-Free Diet on the Gut Microbiome of Pasture-Raised Chickens Throughout Their Lifecycle

*Jeferson Menezes Lourenco[1], Michael J. Rothrock Jr.[2], Yasser M. Sanad[3,4] and Todd R. Callaway[1]**

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Soybean is one of the primary ingredients in poultry diets, but it causes problems in some consumers with allergies. Thus, production of poultry without soybean in their diets has increased in recent years. In addition, consumers are increasingly supporting

Thank you!

Any questions?

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