Diet-induced changes in the jejunal microbiota of broilers during development, greatly affecting *Enterococcus hirae* and *Enterococcus faecium*

September 2024, Dirkjan Schokker *et al*.

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Acknowledgements

Knowledgebase project

"Towards a circular climate positive today society" (*KB-33-006-005*)

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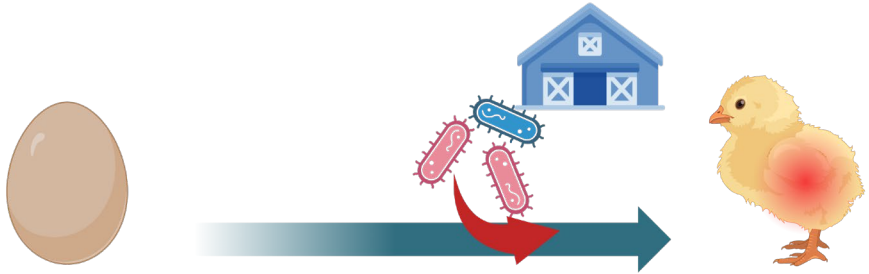
Wageningen Bioveterinary Research

Wageningen Livestock Research

Early Broiler Development Critical



Important Role for the Gut

- Nutrient uptake
- Physical barrier
- Gatekeeper of health

Animal performance

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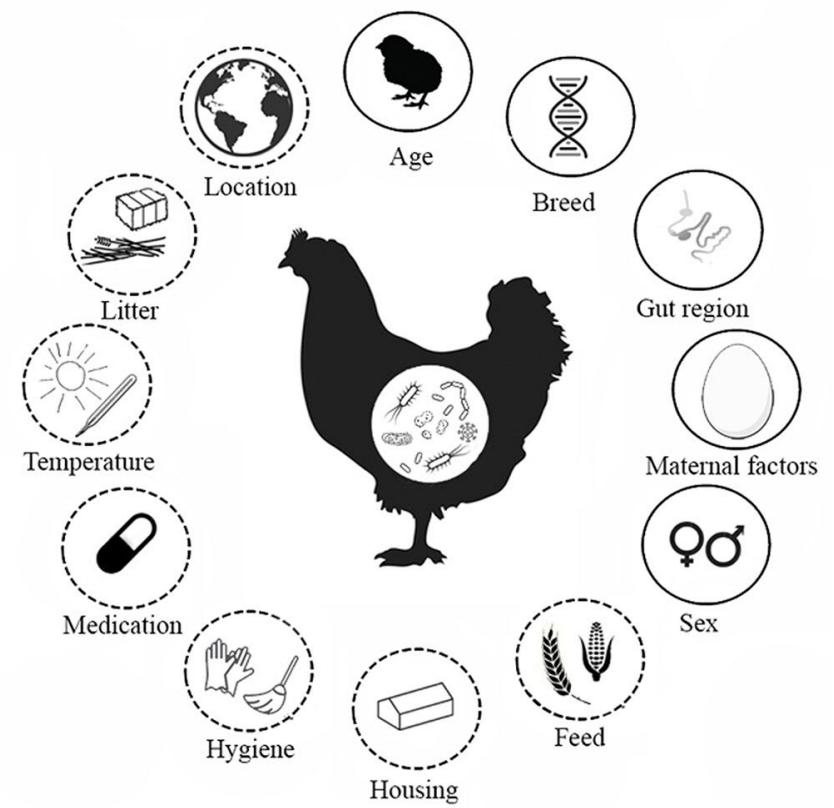
Characteristics Influencing Gut Microbiota



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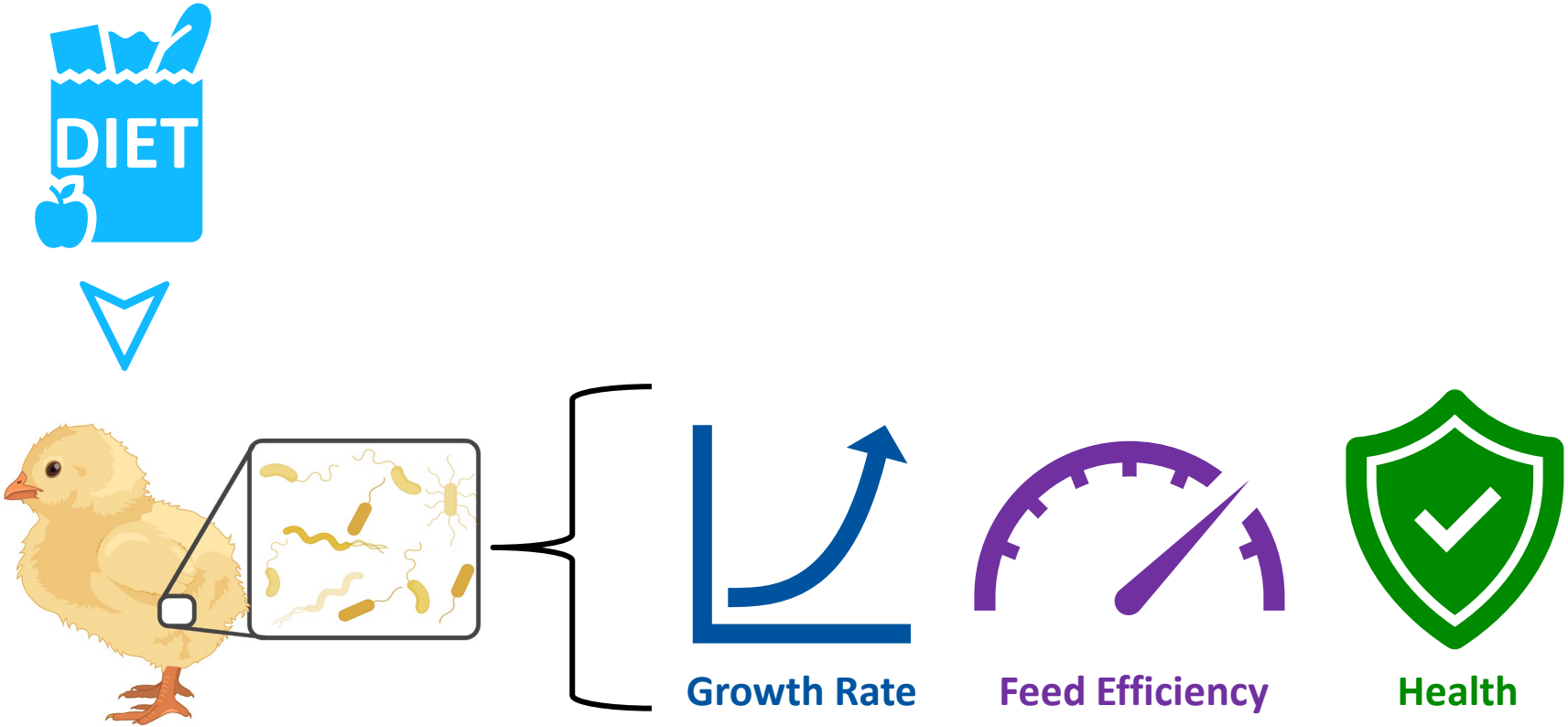
https://doi.org/10.3389/fmicb.2018.00235

Impact of Diet on Gut Microbiota



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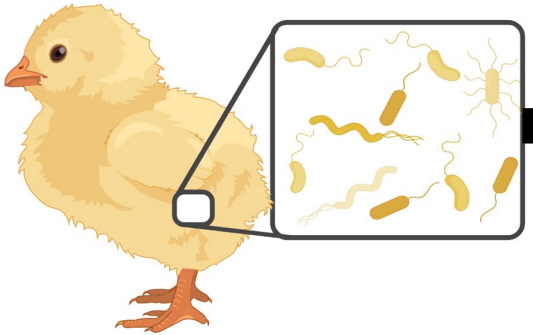
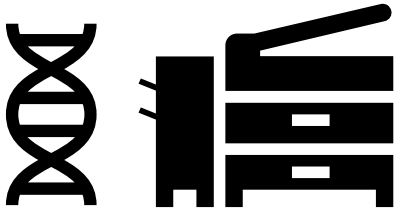
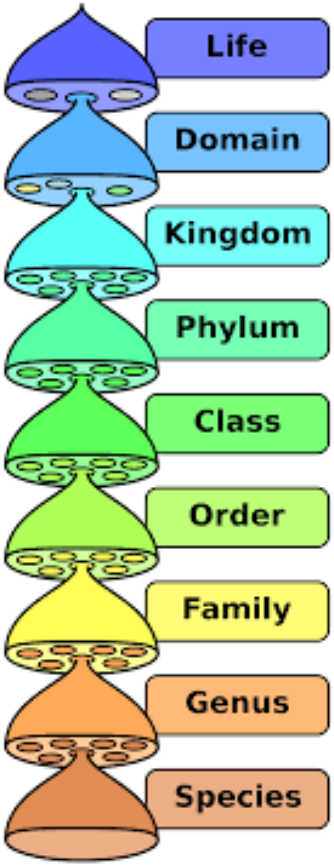
Defining the Microbiota



Sequencing Technique





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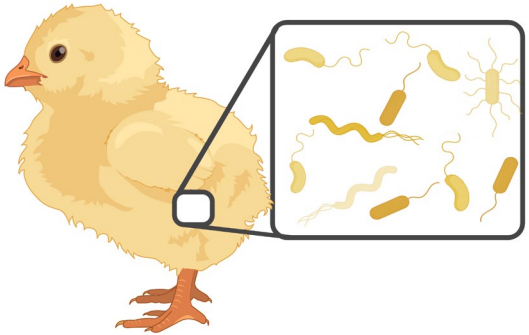
Objective

DIET

Assess dietary impact on jejunal microbiota composition at species level in broilers



Growth Rate

Feed Efficiency

Health

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Experimental Design

1,344 day-old Ross 308 male broiler chickens [average weight of 43.3 g]

Floor pens with wood shavings as substrate

ad libitum access to feed and water

Randomly allotted to 6 diets in a completely randomized block design

This study subset of 4 diets

CON	control diet without any supplementation
BUT	control diet supplemented with micro-encapsulated sodium butyrate
MCFA	control diet supplemented with a mixture of medium-chain fatty acids
HFLP	a diet with a higher fiber and lower protein content compared to the control diet

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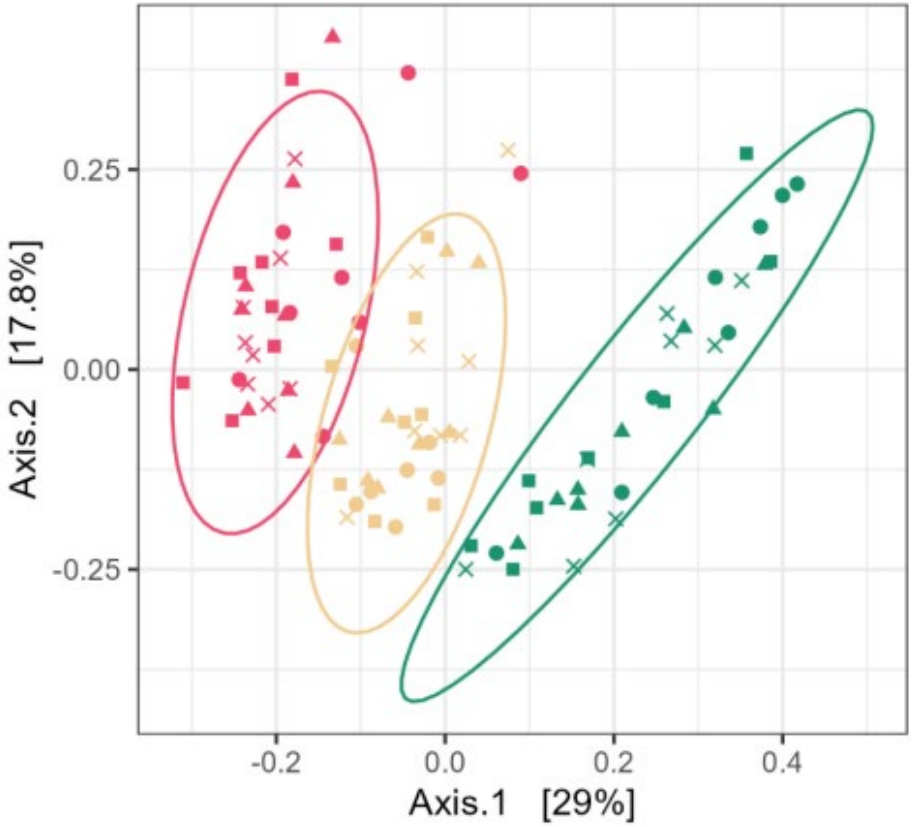
Significant Age-Dependent Effect

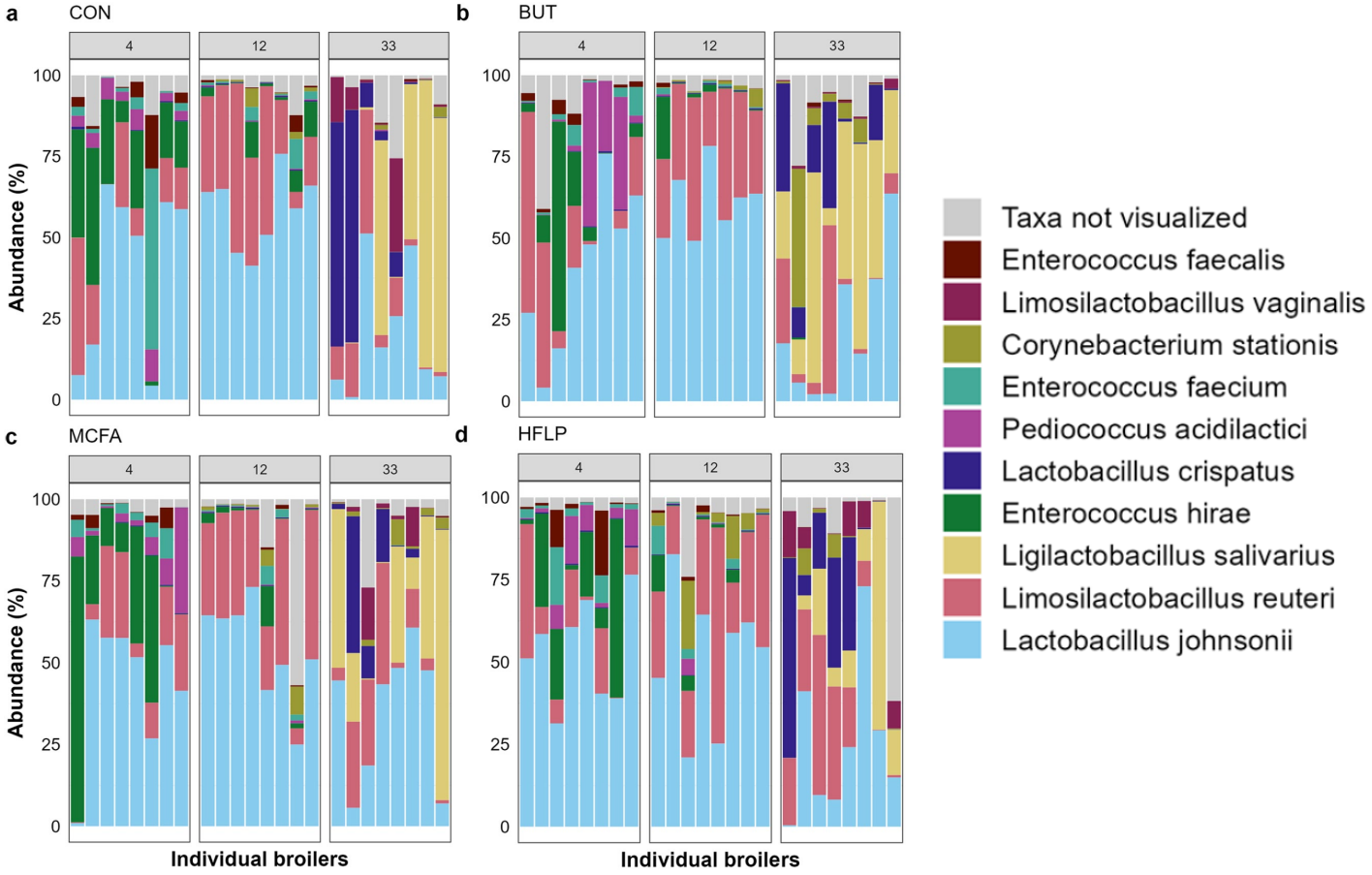


Diet
- CON
- BUT
- MCFA
- HFLP

Age
- 4
- 12
- 33

Factor	Pr(>F)
Age	0.001
Block	0.110
Diet	0.151

For the purists ;)



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Five Species with the Largest Effect Size

These genera show the largest change in relative abundance over time

- *Lactobacillus johnsonii*
- *Limosilactobacillus reuteri*
- *Corynebacterium stationis*
- *Lactobacillus crispatus*
- *Ligilactobacillus salivarius*

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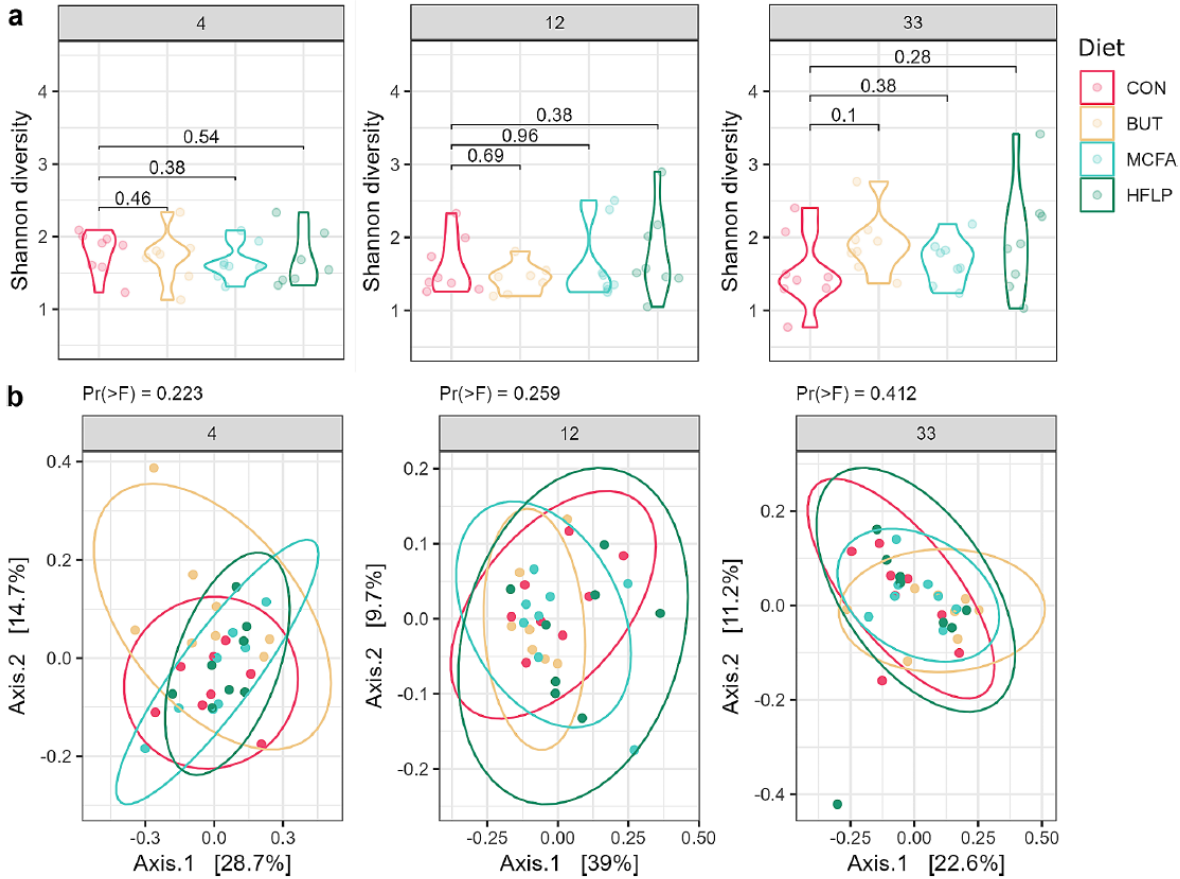
Diet Not a Main Driver of Microbiota Composition



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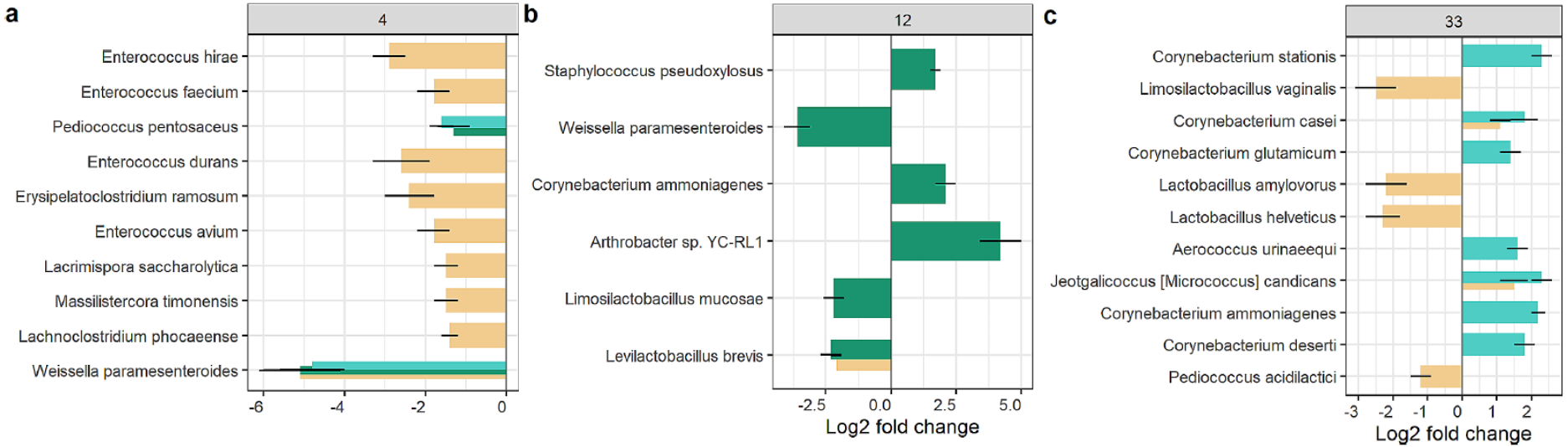
Changes Specific to Age / Diet

1. **Across all diets →** prevalence > 10% + abundance > 0.001%
2. **Per diet group →** abundance > 0.01% + an absolute fold change > 2



BUT / MCFA / HFLP

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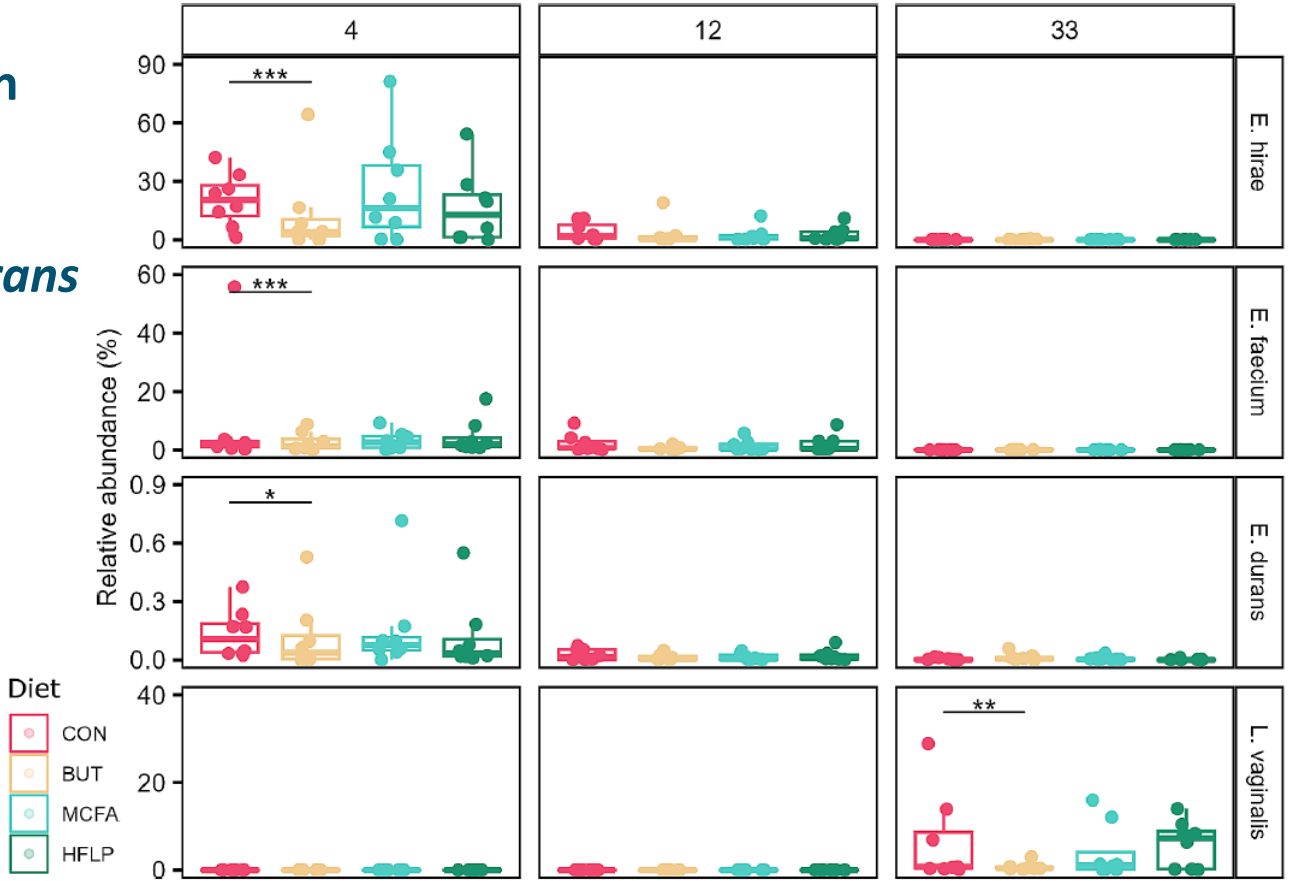
Reduced Relative Abundance Pathogens

High relative abundance in CON of opportunistic pathogens:
E. hirae*, *E. faecium*, *E. durans

Day 4 effects significant between BUT vs. CON



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Conclusions

- **Metagenomic shotgun sequencing** enabled us to study **species-specific** effects

- BUT, MCFA and HFLP diets induced changes in the jejunal microbiota composition of **specific bacterial species** of broilers at d4, d12, and d33 post-hatch

- Most notable was the effect of BUT 4 days post-hatch, reducing the abundance of ***E. faecium*** and the opportunistic pathogen ***E. hirae***

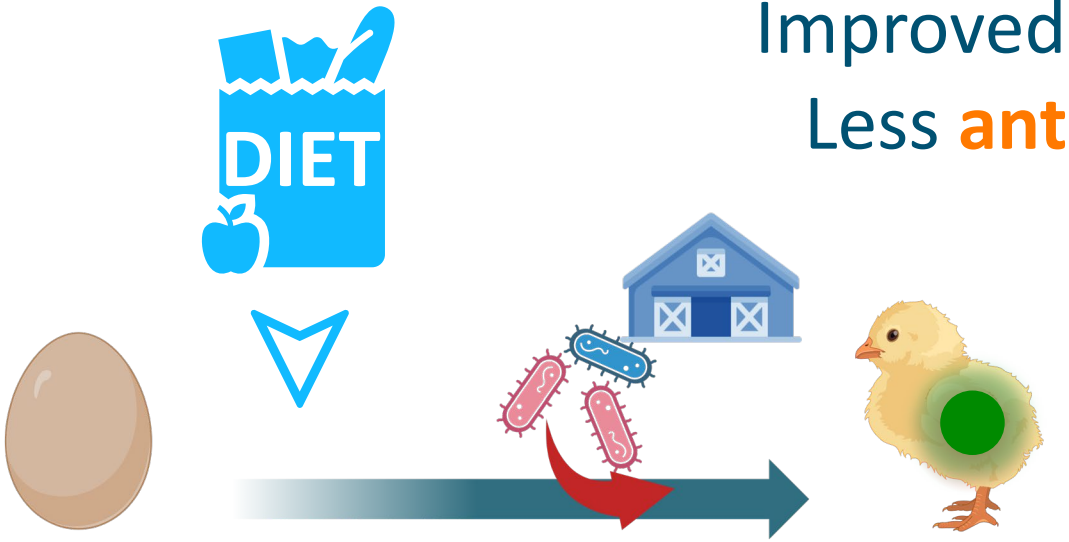
Take home message

Diet induces change on *species level* **>**

Fewer **opportunistic pathogens >**

Improved **(gut) health >**

Less **antibiotic usage**



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To explore the potential of nature to improve the quality of life

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