

monoguthealth

Optimal gut function in monogastric livestock

Boosting underperforming broilers: feed structure strategies for better gizzard development, intestinal health, and gut microbiota

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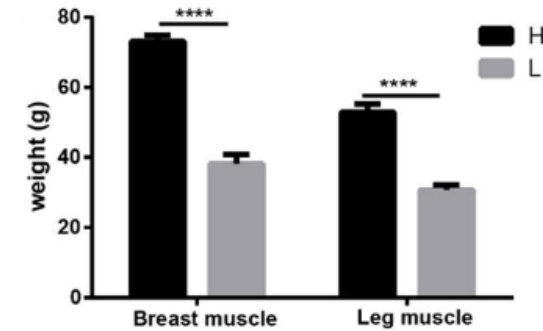
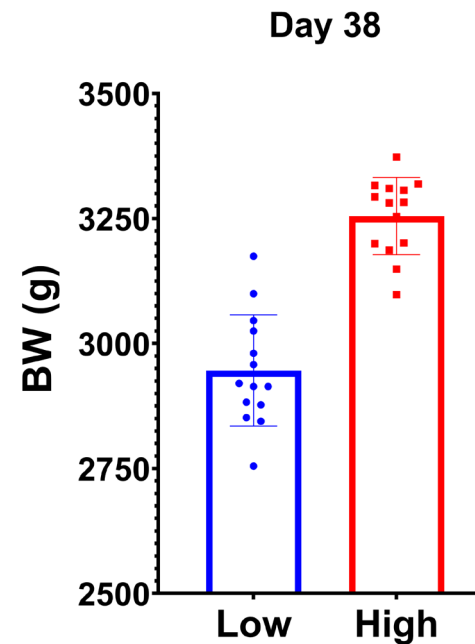
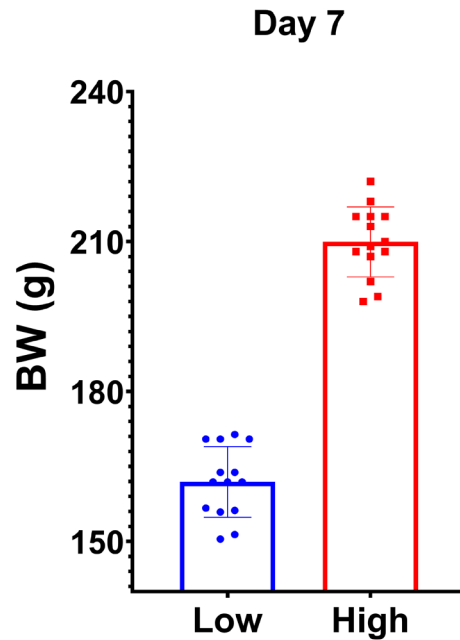
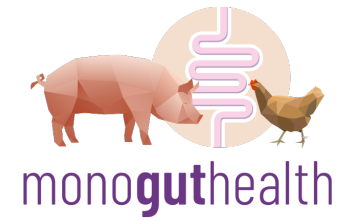


This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 955374.

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Introduction

- In commercial settings, broiler chickens have **different growth rates within a flock** under uniform rearing conditions.
- High weight variations **affects farm operations** and cause huge **economic losses**.



Zhang et al. Microbiome (2022)



Akram et al., 2024; Animal Microbiome

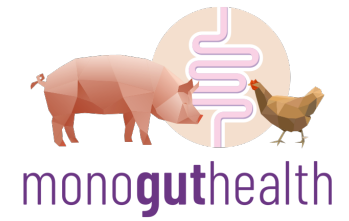


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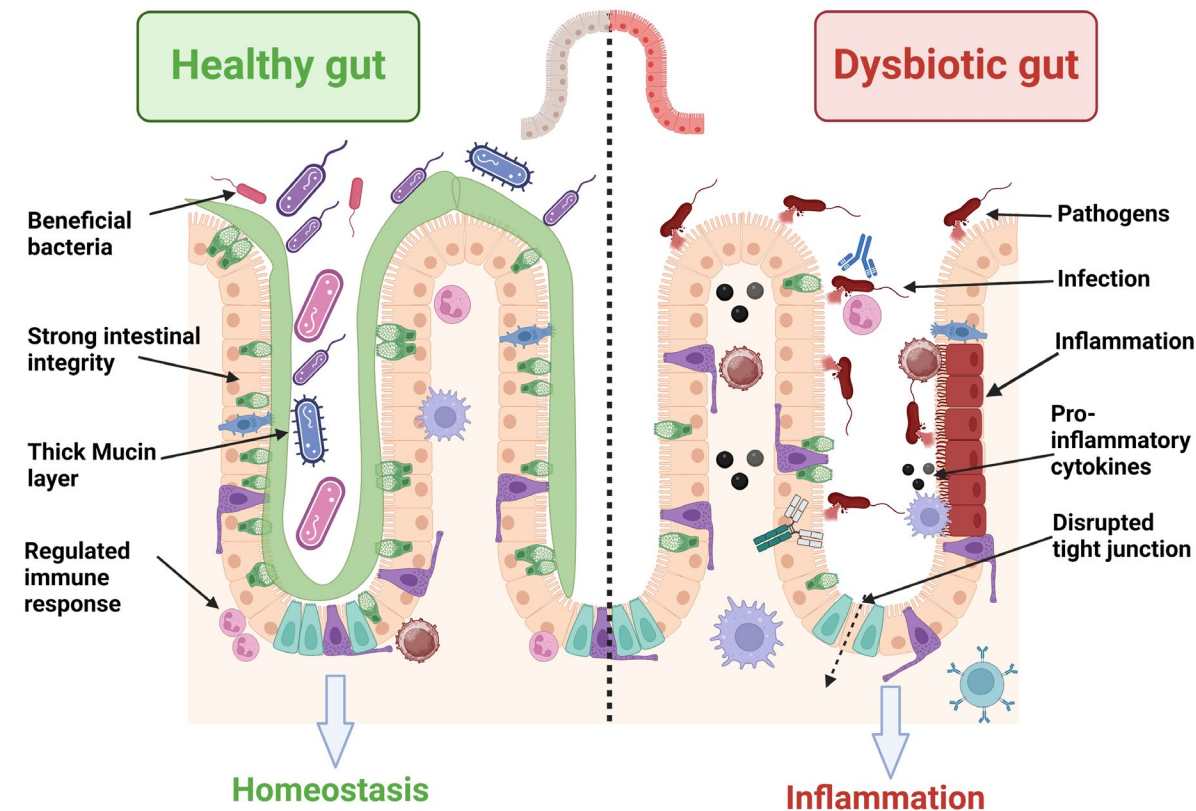
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Introduction



- **Low-weight chicks** tend to have more gastrointestinal related issues.
- Low-weight chickens often experience **intestinal dysfunction** and impaired tight junction barrier.
- Low-weight chickens harbor **imbalanced microbiota**, causing dysbiosis and inflammation.



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Akram et al., 2024a; Animal Microbiome

Akram et al., 2024b; poultry Science

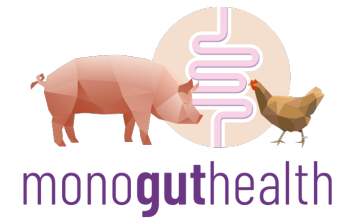


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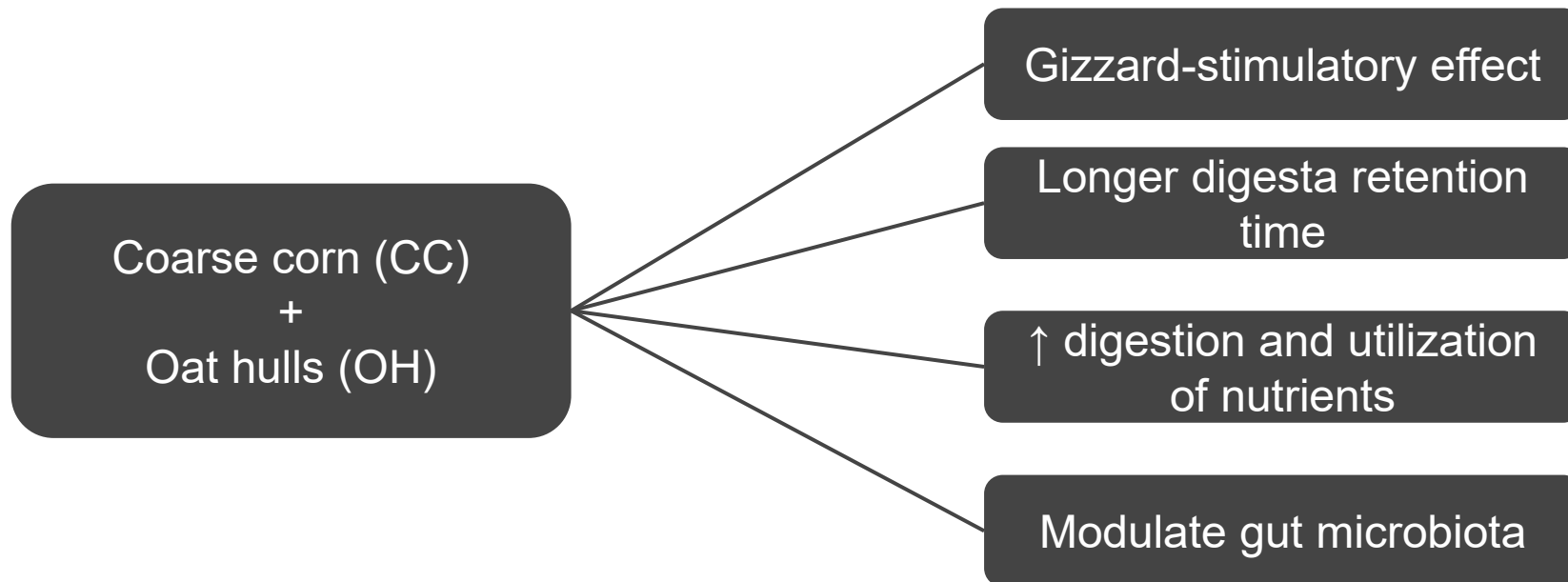
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Selection of coarse corn and oat hulls?



- Chickens have a requirement for **dietary physical structure** to enhance gut development and health.
- A **well-developed gizzard and GIT** have been shown to improve nutrient digestibility and growth performance of chickens.



Kheravii et al., 2017; Li et al., 2016; Downs et al., 2023



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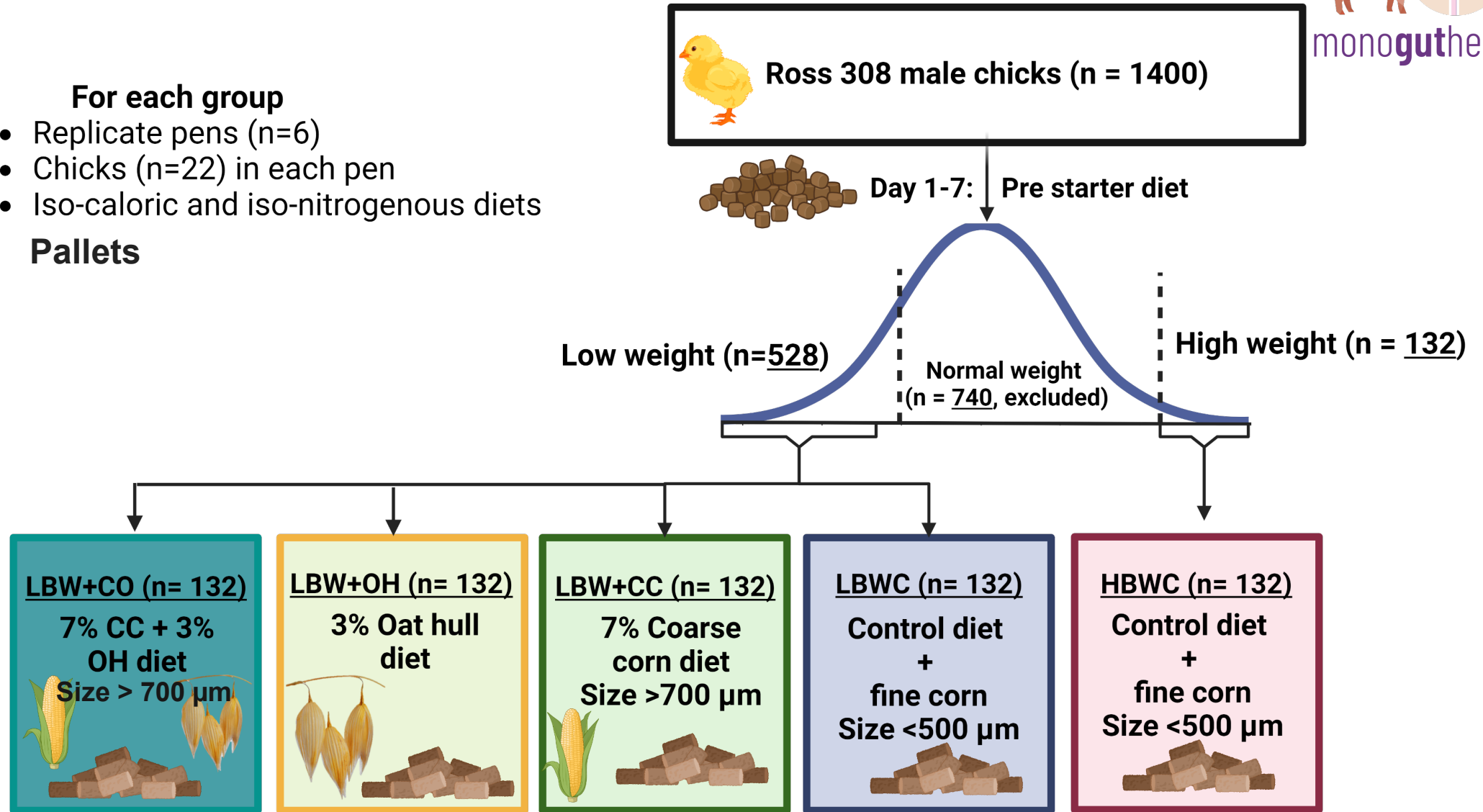
Goal of the study

- To determine the effects of **coarse corn and oat hulls and their combination** on growth performance, GIT development and microbiota of underperforming chickens.
- To evaluate whether **low-weight broiler chickens**, under these dietary treatment, can catch up with their high bodyweight counterparts.

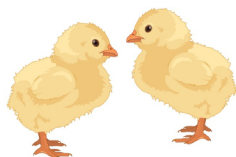
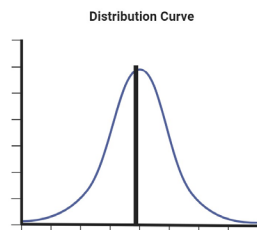
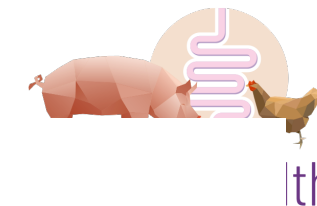
Trial design

- For each group**
- Replicate pens (n=6)
 - Chicks (n=22) in each pen
 - Iso-caloric and iso-nitrogenous diets

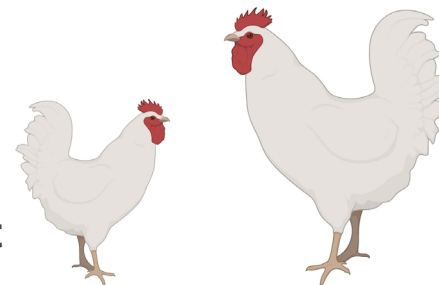
Pallets



Experimental timeline



n = 12 chicks per group / timepoint



Days post-hatching

Day 1



Pre-starter,
d1-7

Day 7



GROW1,
d8-16

Day 14



Day 16



GROW2,
d17-38

Day 21



Day 38



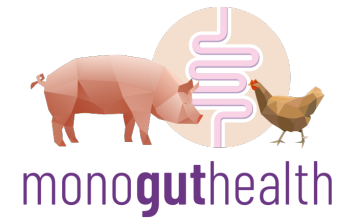
Body weight and feed
intake

Gut tissue and caecal
digesta samples

Blood samples



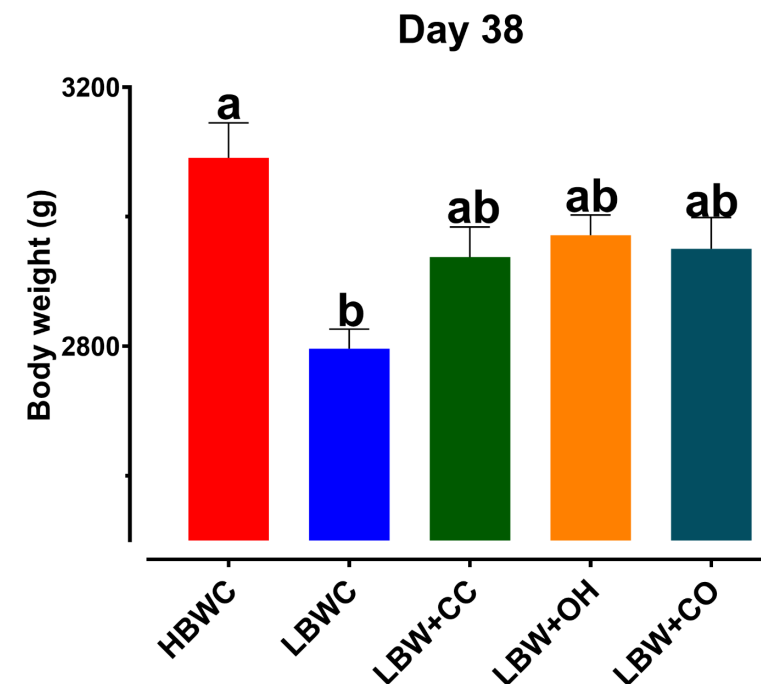
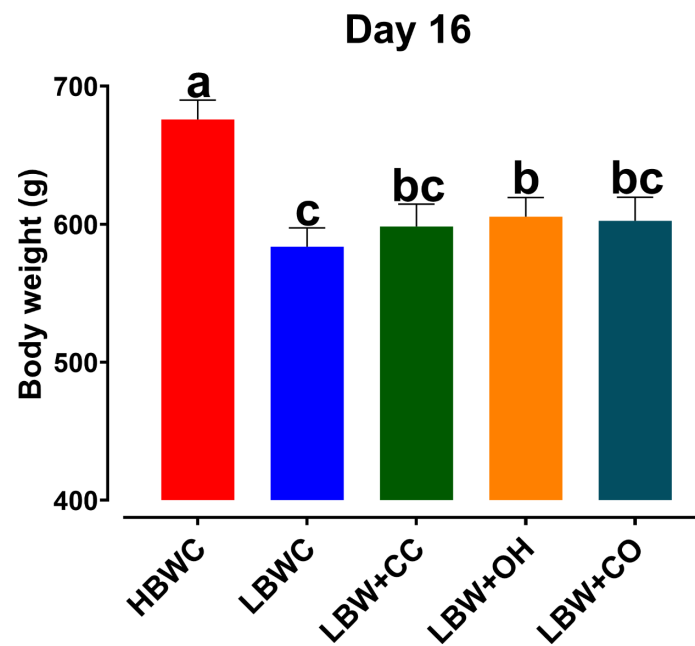
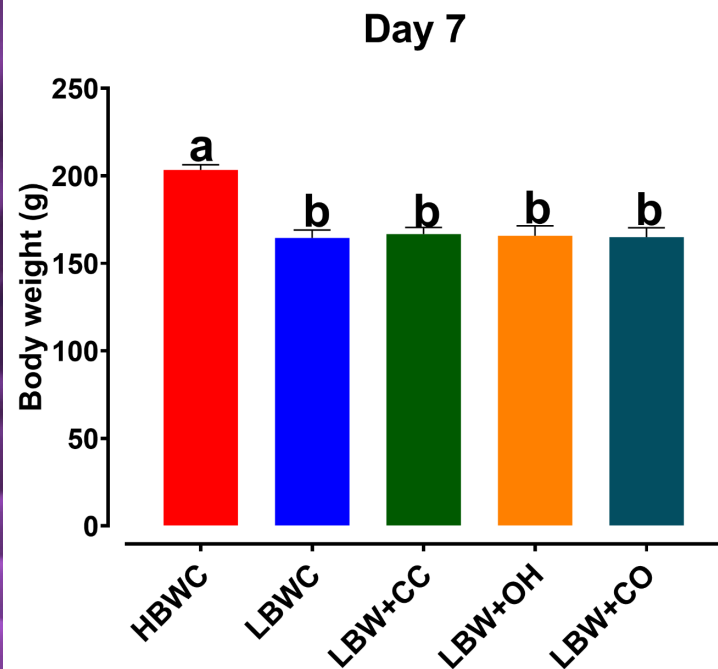
Statistical analysis



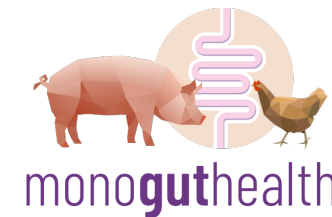
Parameters	Statistical model
Growth performance, gastrointestinal development and in vivo gut permeability	One-way ANOVA Tukey HSD $< P < 0.05$
Caecal microbiota analysis	Dada2 and Silva 138 database LEfSe, >2.0 cut-off with $FDR < 0.05$ One-way ANOVA



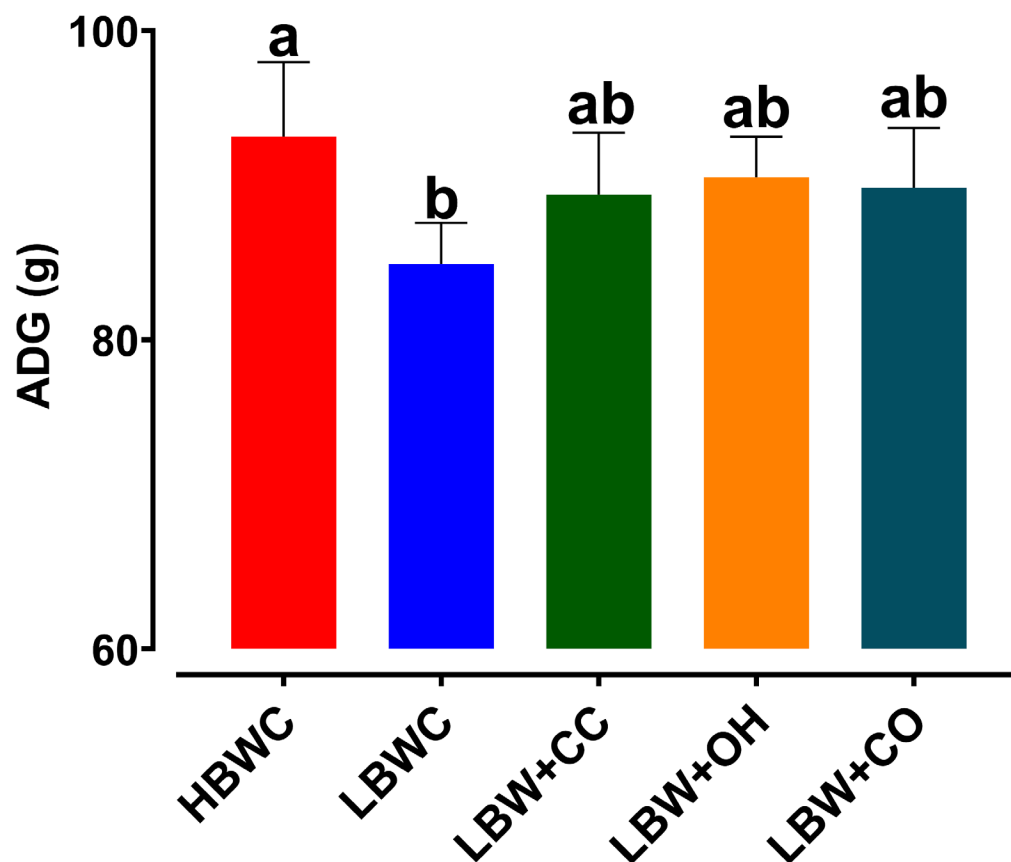
Body weight



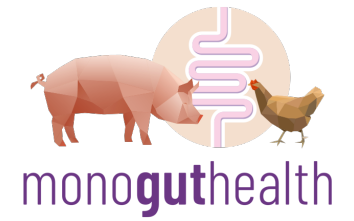
Average daily gain



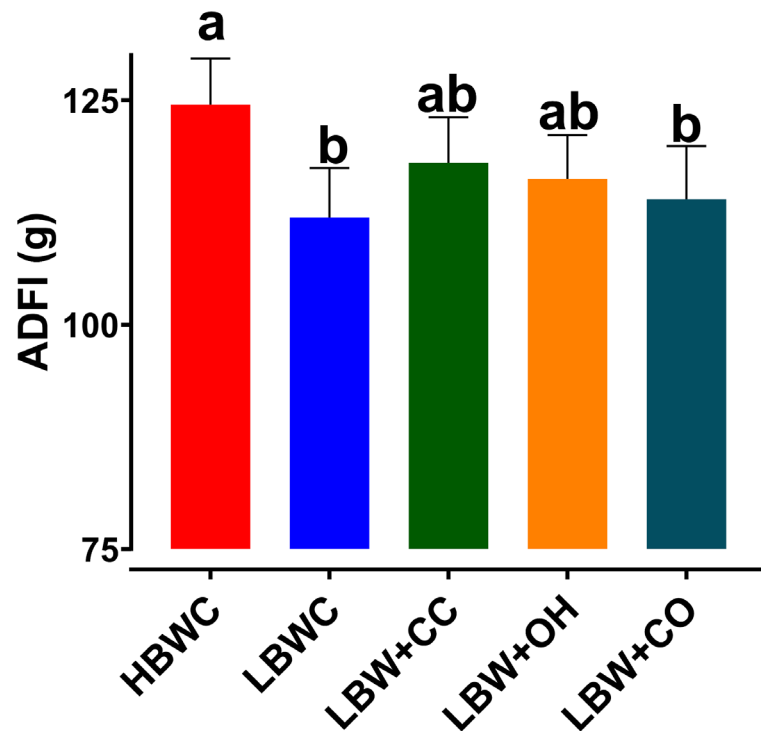
Average daily gain (8-38 days)



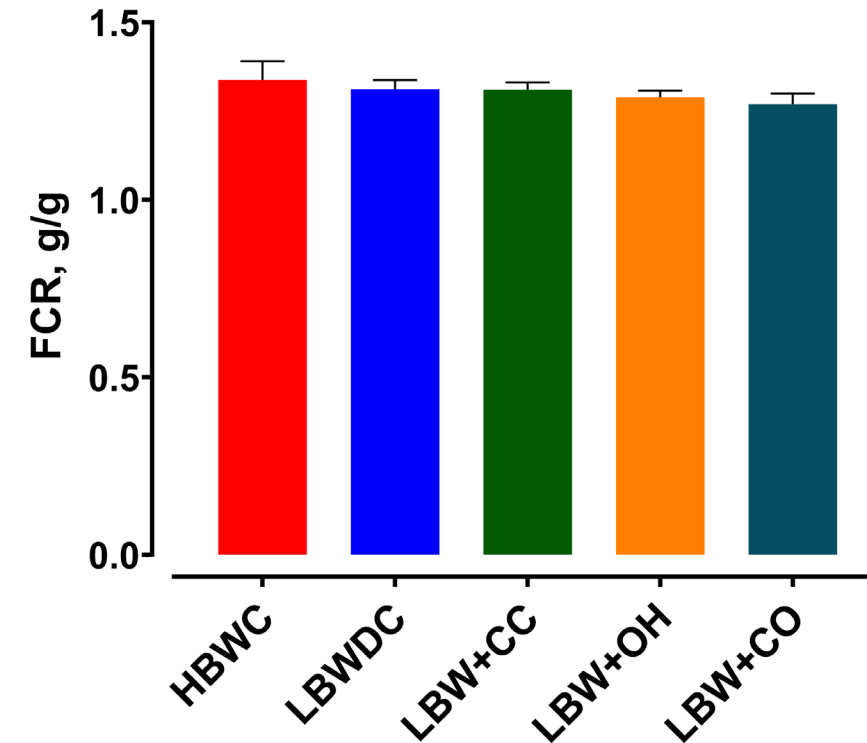
Feed intake and feed conversion ratio



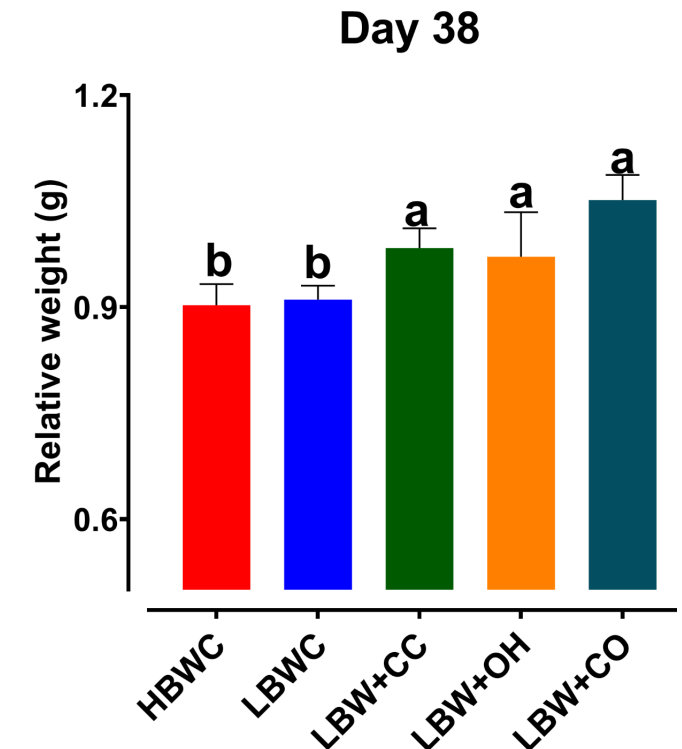
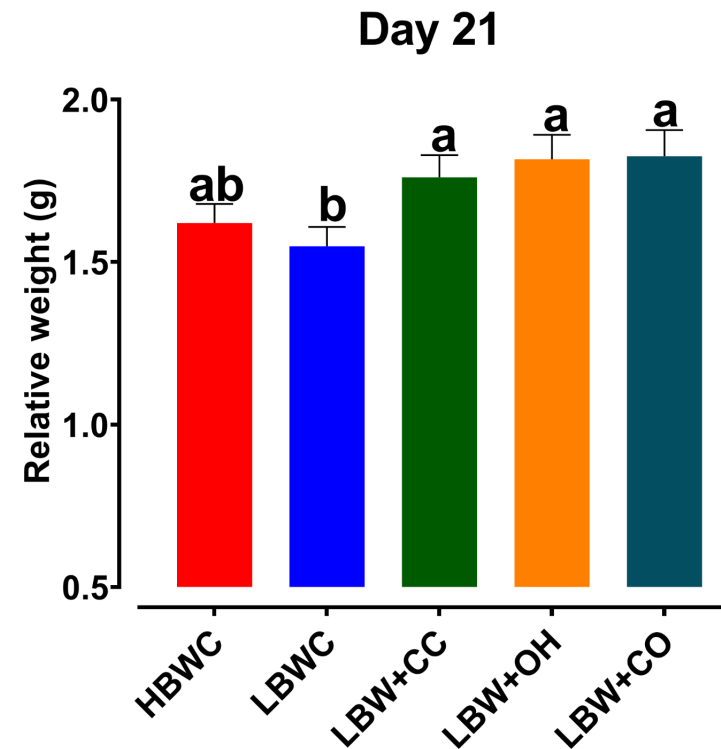
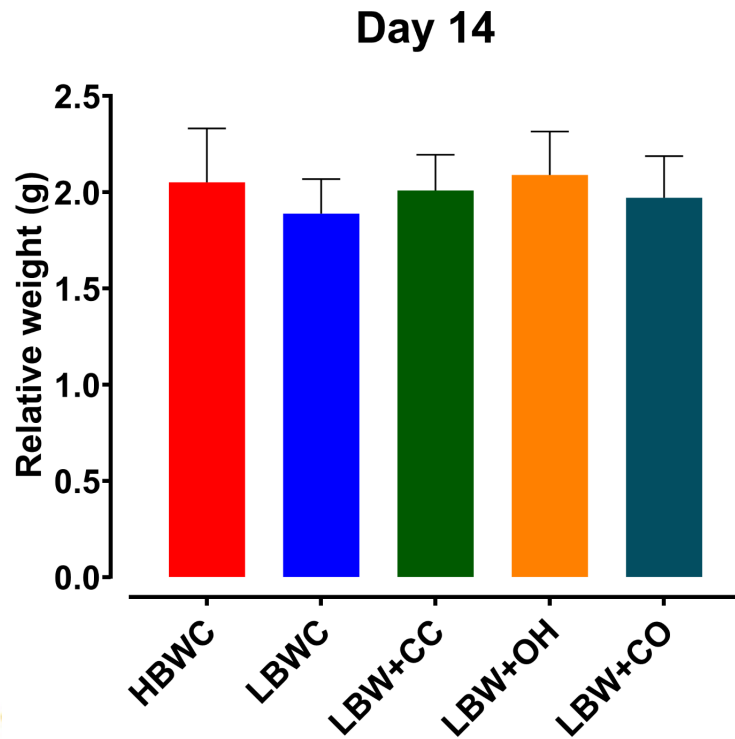
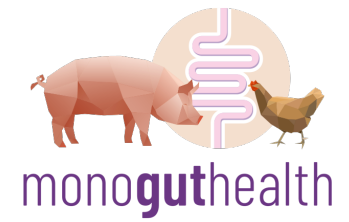
Average daily feed intake
(8-38 days)



Feed conversion ratio
(8-38 days)

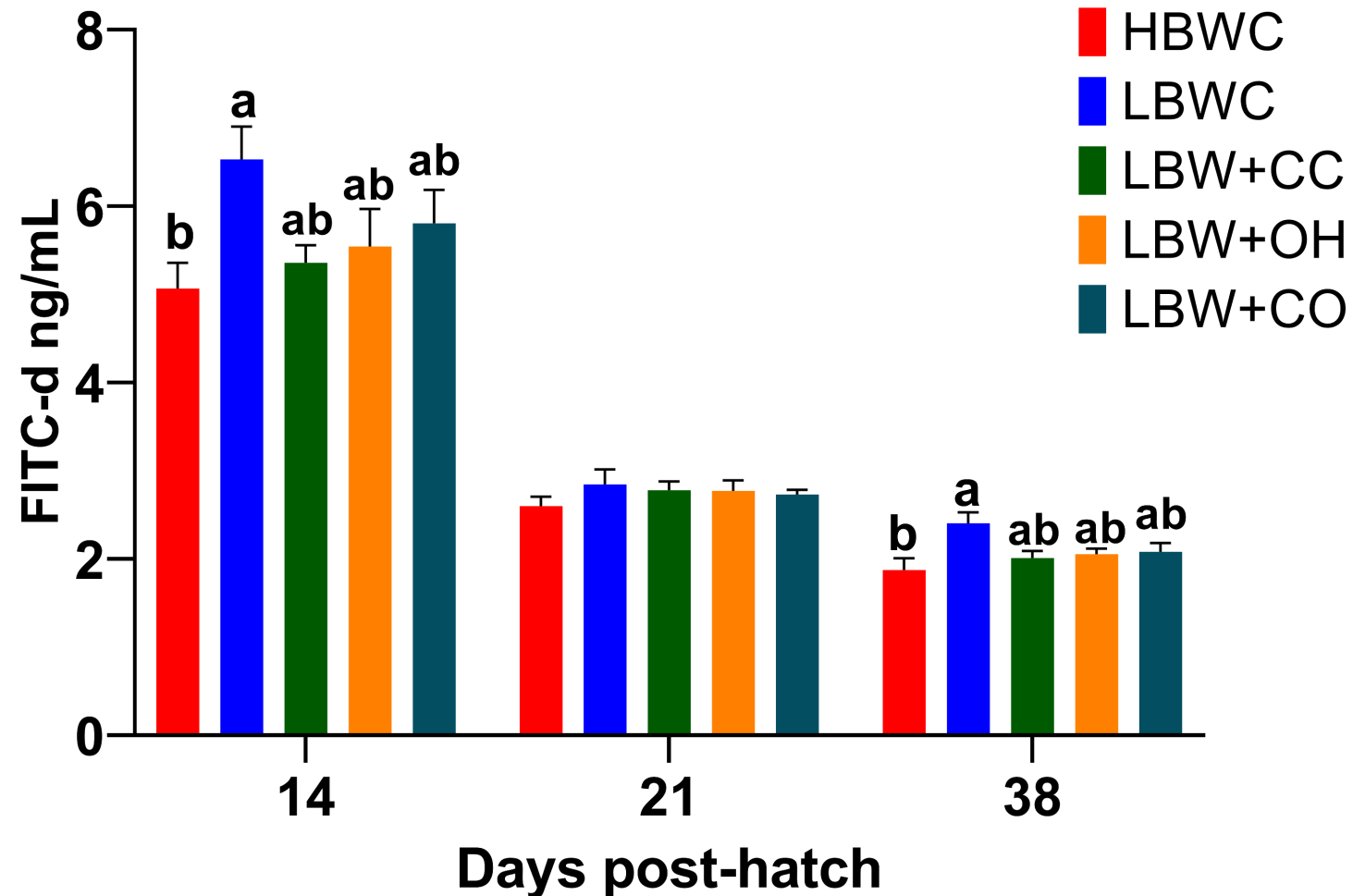


Relative weight of Gizzard (g/100 g of body weight)

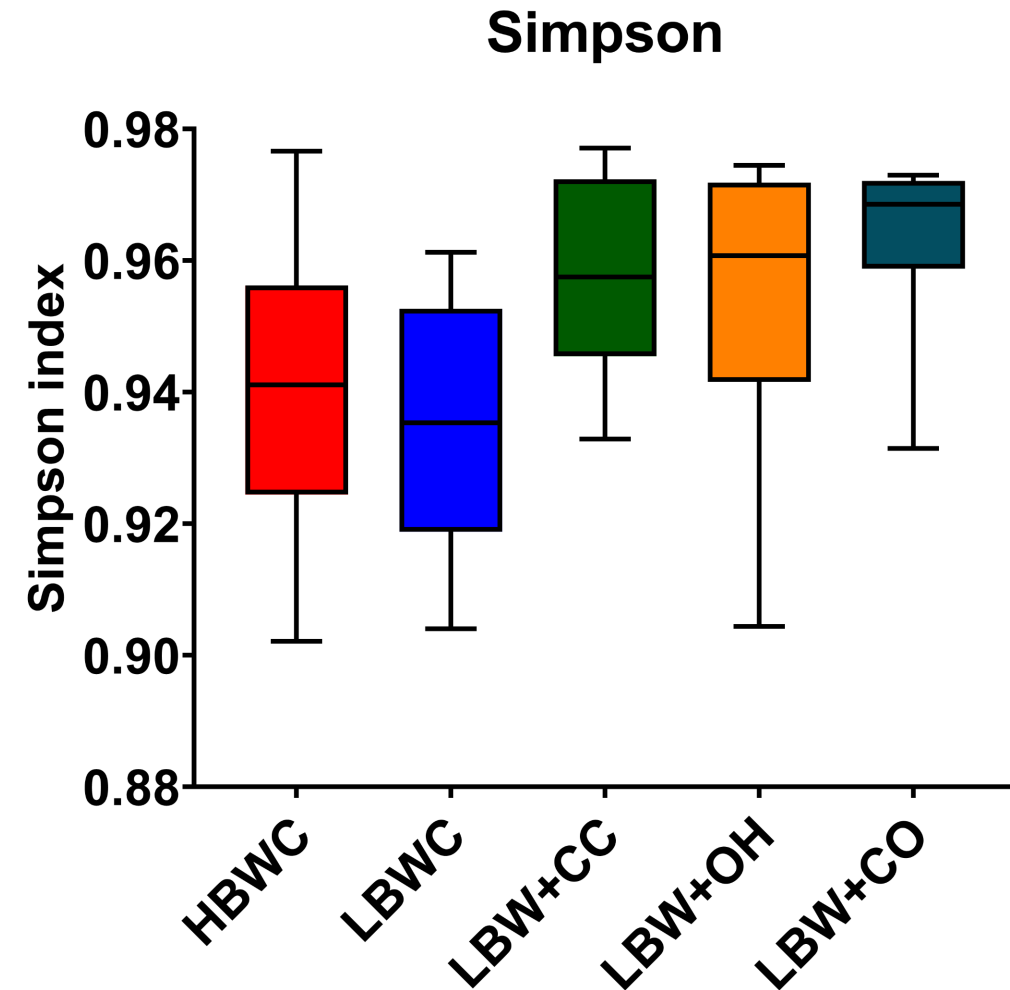
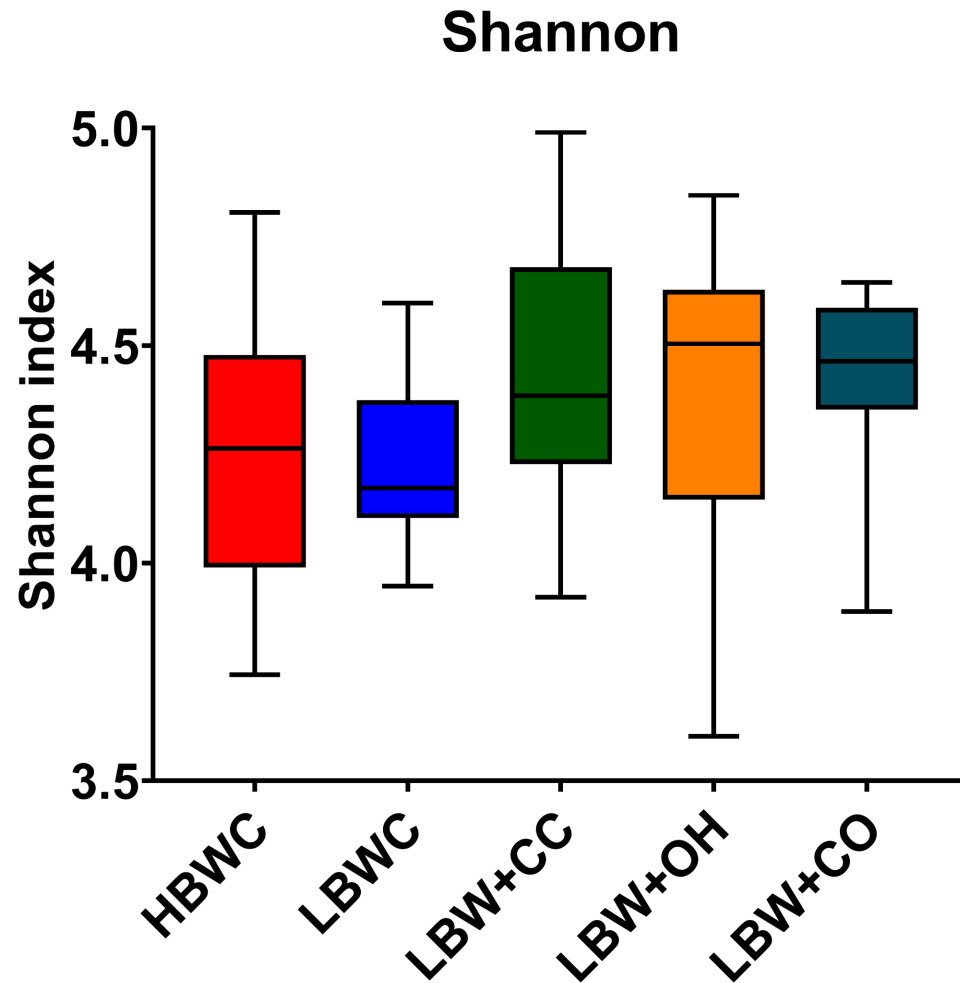
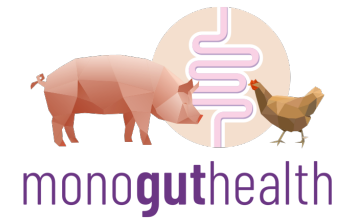


In vivo gut permeability

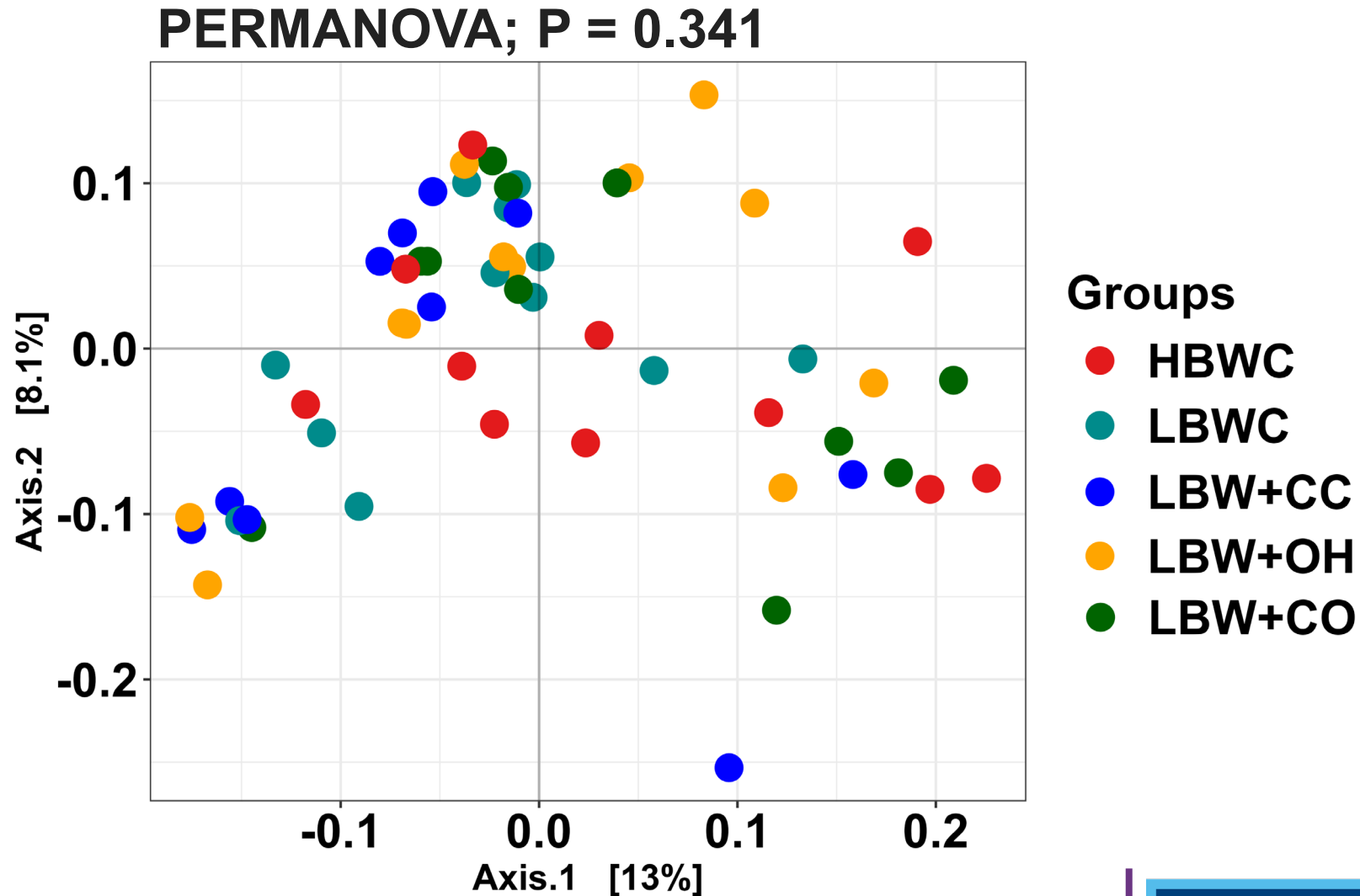
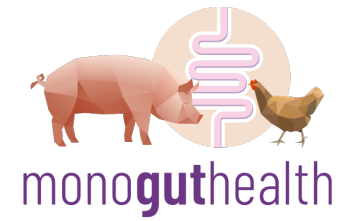
Relative FITC-Dextran



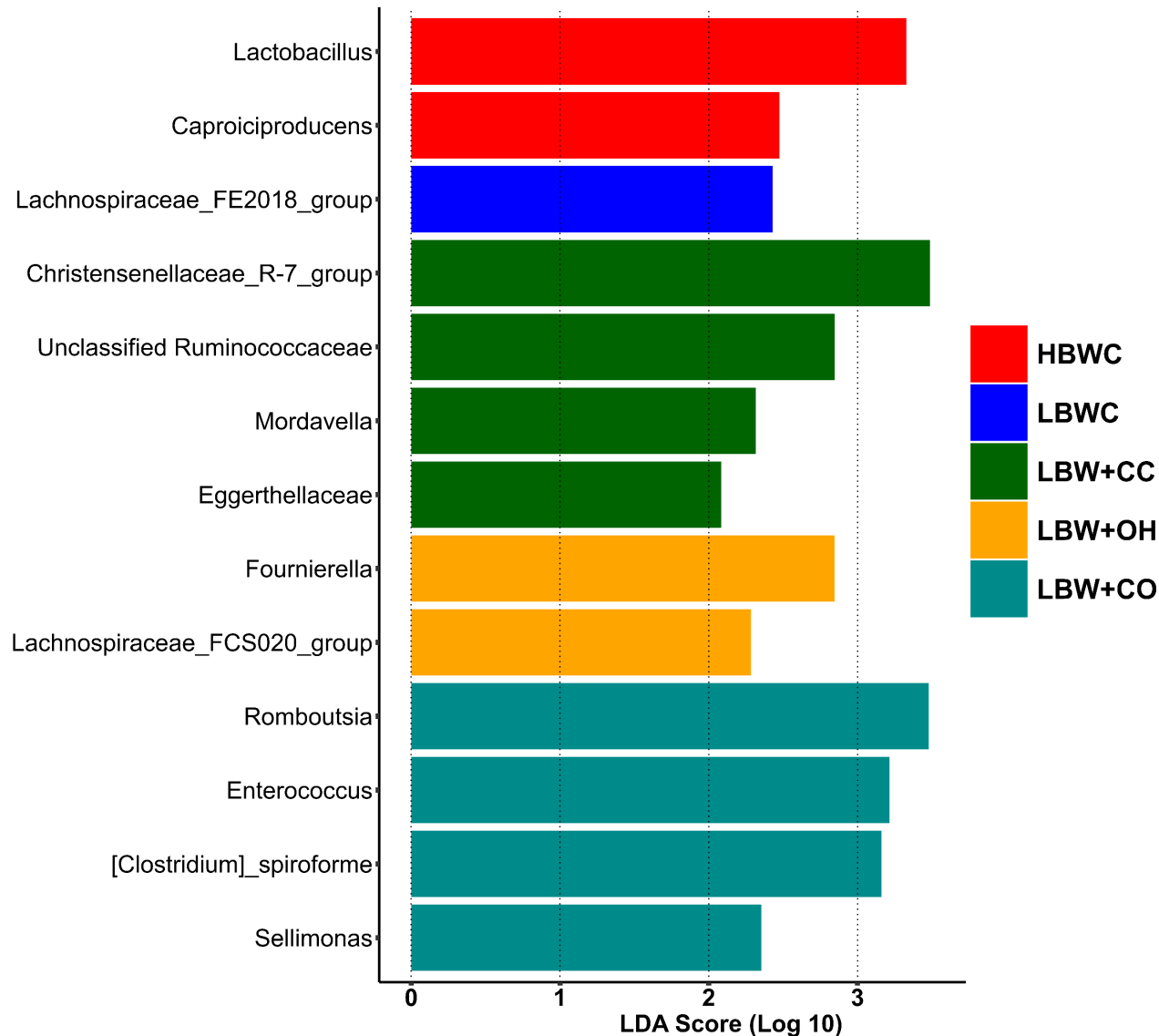
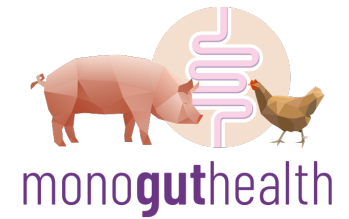
Microbiota: Alpha diversities



Microbiota: Beta diversity



Microbiota: Differential abundant bacterial genera



HBWC:

- Acidifying
- Gut health
- SCFA production

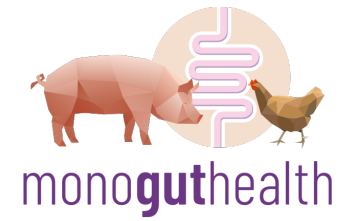
LBWC:

- Negative BW correlation

LBW+CC, LBW+ OH & LBW+CO:

- Gut health and performance
- SCFA producers

Conclusions



- HBW chicks **outperform** their LBW counterparts on control diets.
- Coarse corn, oat hulls, and their combinations positively **impacted GIT development and enhance the Gizzard size** in LBW chickens.
- LBW groups with feed structures had **lower gut permeability** and more **favorable microbiota characteristics**.
- **7% Coarse corn and 3% oat hulls** aided in improving growth performance of low-weight broilers, paralleling to performance of high-weight broilers – suggest a **potential dietary strategy for improving flock uniformity**.



THANK YOU

Do you have any questions?

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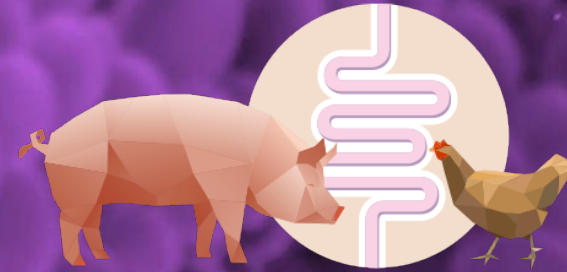
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Nutrition & Animal
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