Effect of dietary inclusion of a *Spirulina* (*Arthospira platensis*) by-product in post-weaning diets on pig growth to day 44 post-weaning, haematology and selected intestinal gene expression

J.P. Glynn, C. Negrini, G.E. Gardiner, L. Giblin, P.G. Lawlor

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Spirulina as an alternative feed ingredient

- → *Spirulina* is one of the most widely cultivated microalgae globally
  - ✓ High protein content[1], vitamins, minerals, pigments, bioactive compounds, AA profile
    → sustainable alternative to conventional feedstuffs

- **Whole *Spirulina* inclusion in pig diets post-weaning**
  - ✓ Low inclusion levels (0.05-0.1%[2]; 0.2-2%[3]) ↑ average daily gain and feed efficiency
  - ✓ High inclusion levels (10%) can reduce pig growth performance and digestibility[4]
  - ✘ No studies to date on *Spirulina* by-product inclusion in post-weaning diets in pigs

[1](Spínola *et al.*, 2022), [2](Liu *et al.*, 2019)
[3](Grinstead *et al.*, 2000), [4](Martins *et al.*, 2021)

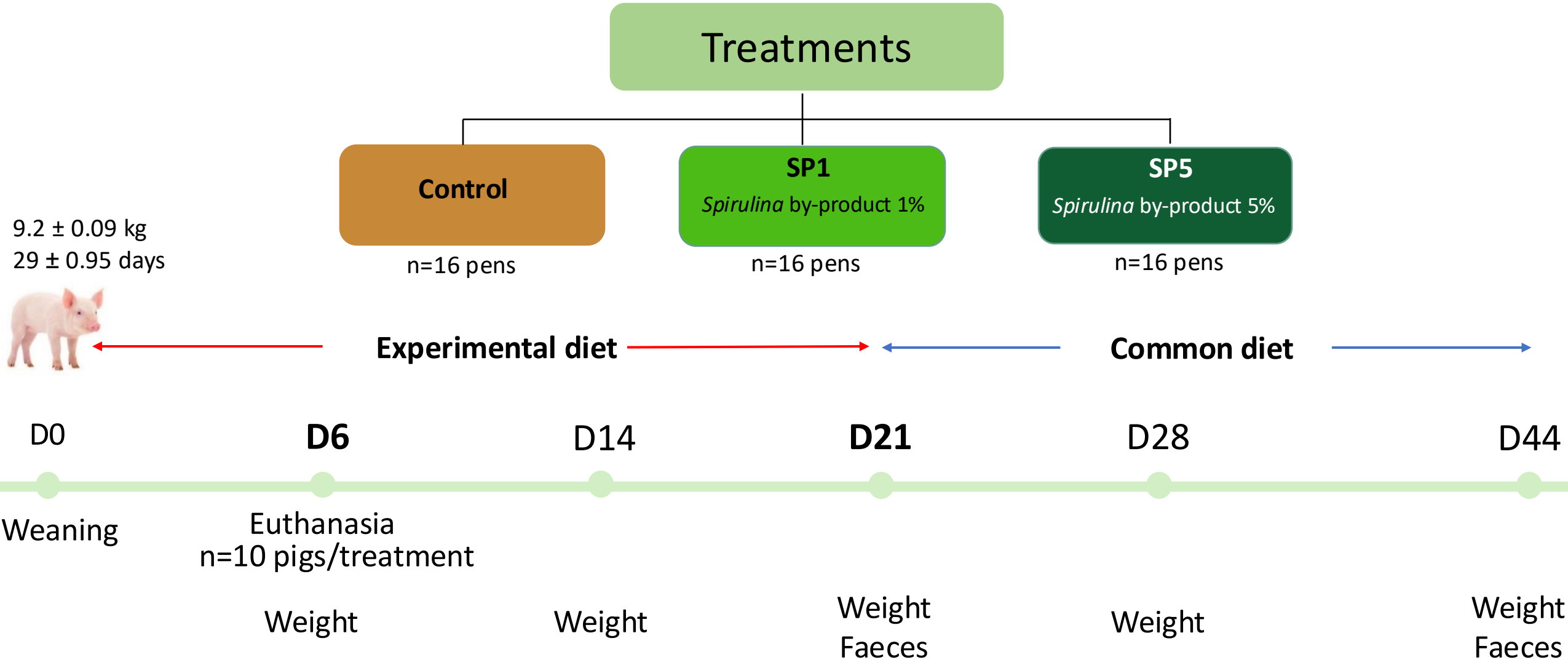
Spirulina by-product

Phycocyanin extraction → Spent biomass → Purified Water → High pressure → Spray-drying → Dry biomass (93.4% DM, 41.6% CP) → Heavy metals, dioxins, proximate analysis, minerals, AA's → Diets formulated to NRC (2012)

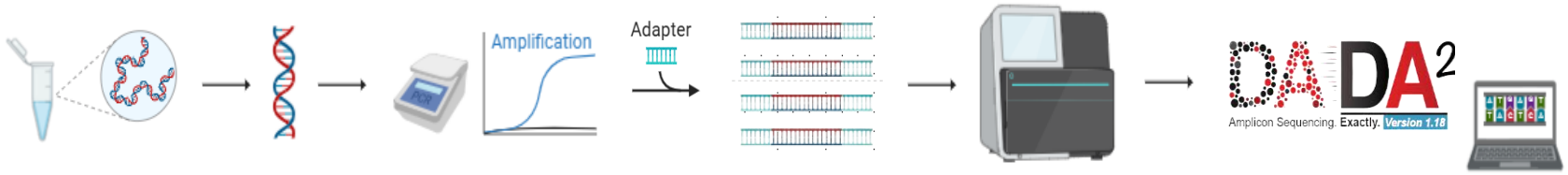
Study aim

Evaluate the effect of a *Spirulina* by-product on growth, haematology, intestinal histology, mRNA data and microbiome profile in post-weaning pigs

Materials & Methods



Statistical & Microbiome Analysis

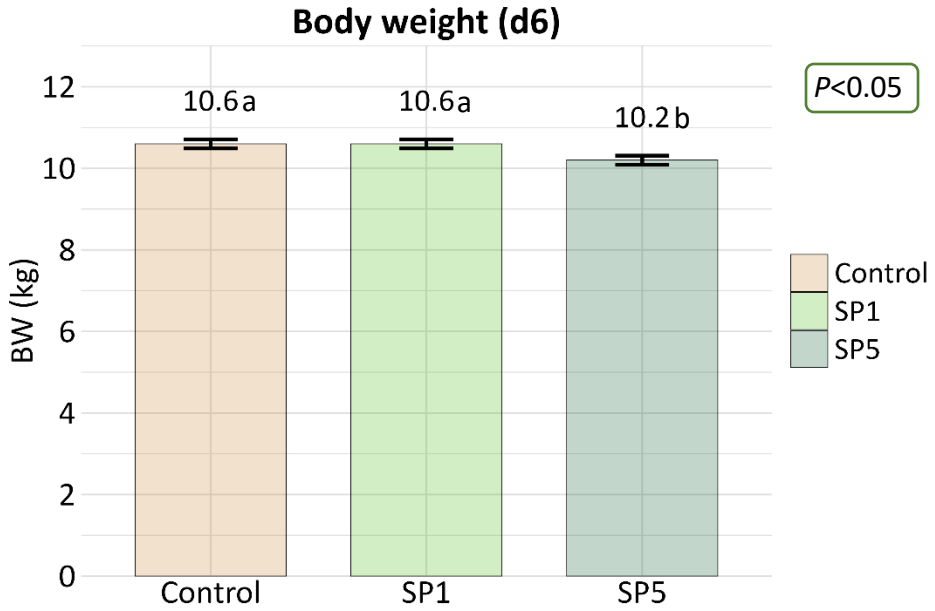


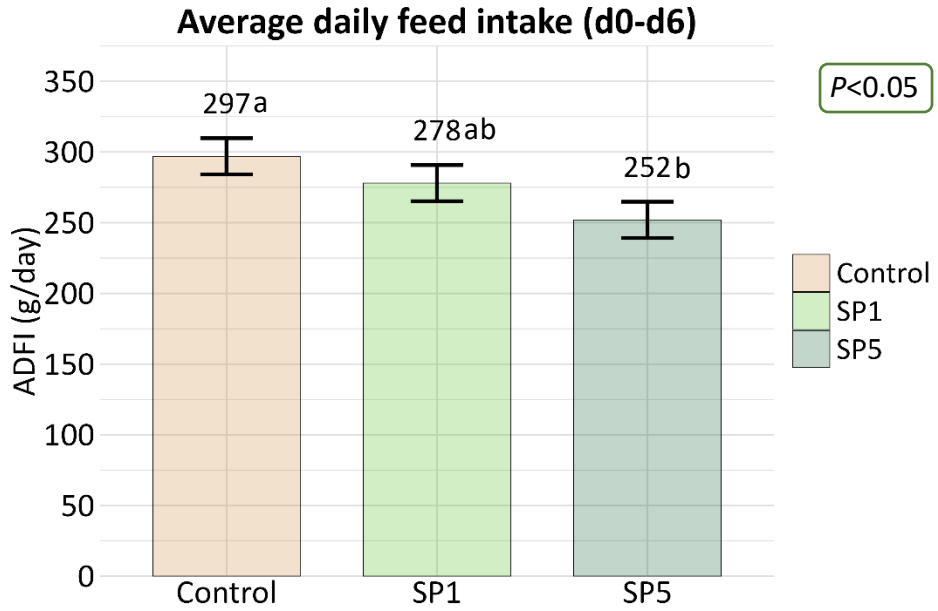
Statistical analysis- SAS
LM & GLM models
Tukey-Kramer adjustment

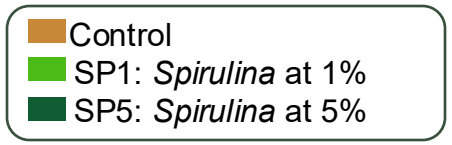
Microbiota analysis - DNA extraction from digesta and faeces and sequencing of V3-V4 region of 16S rRNA gene

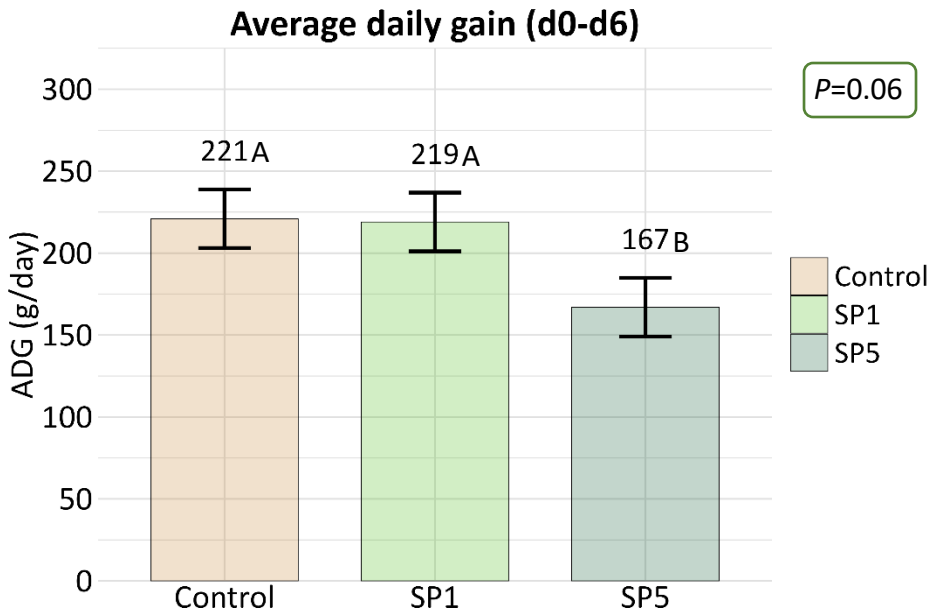
Alpha diversity – Beta diversity – LEfSe analysis → R studio

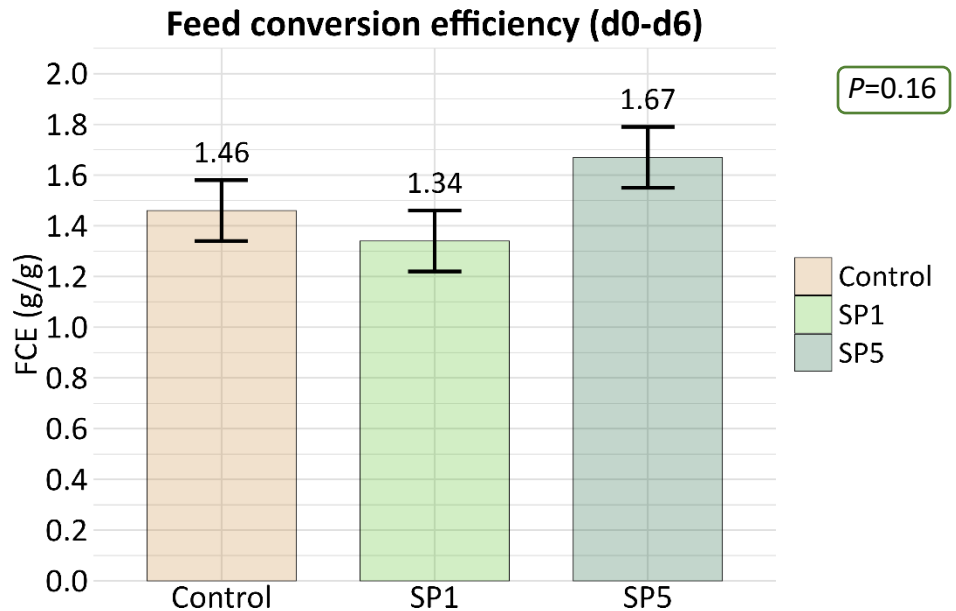
Pig growth performance from D0-6 PW



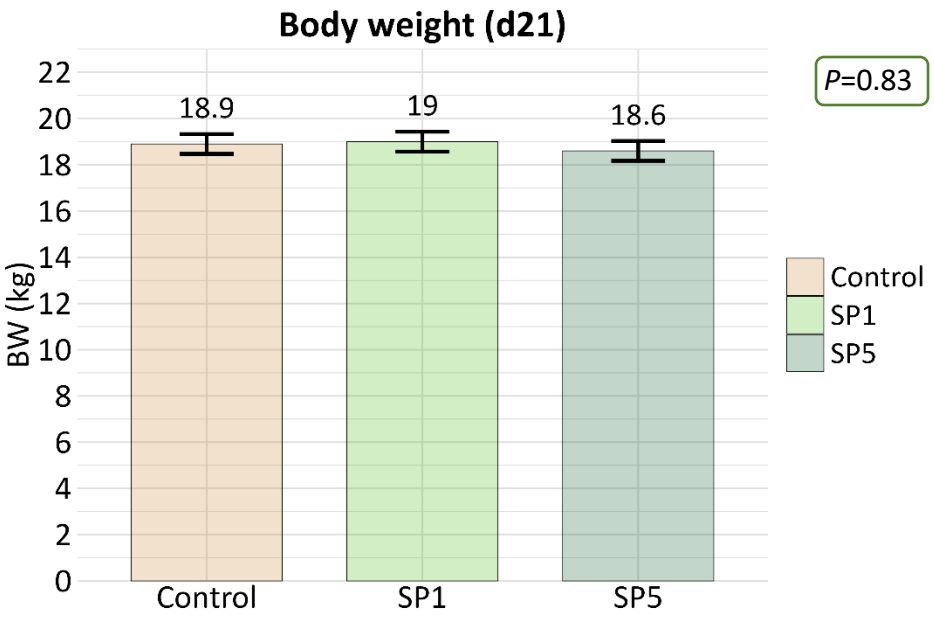


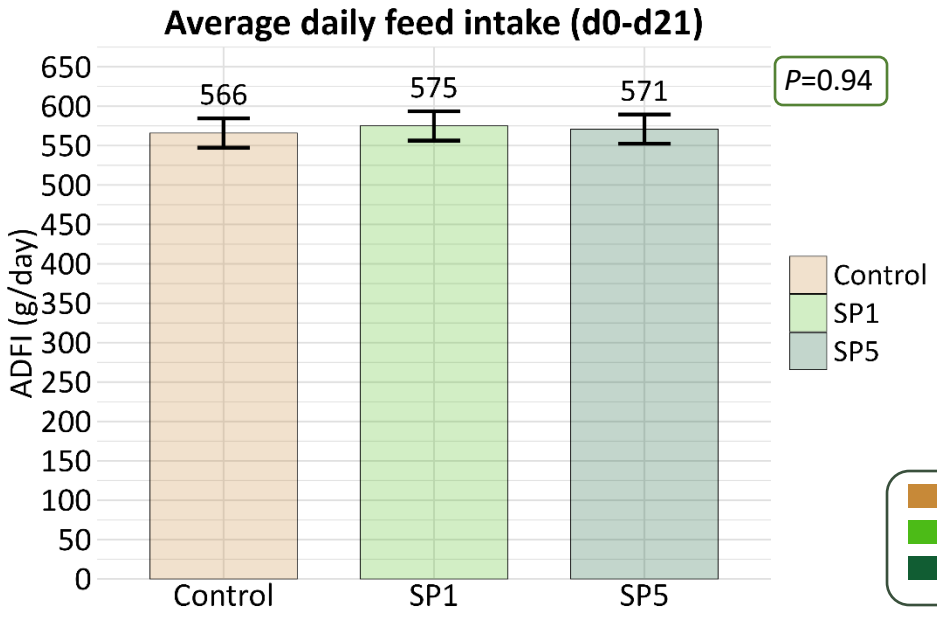


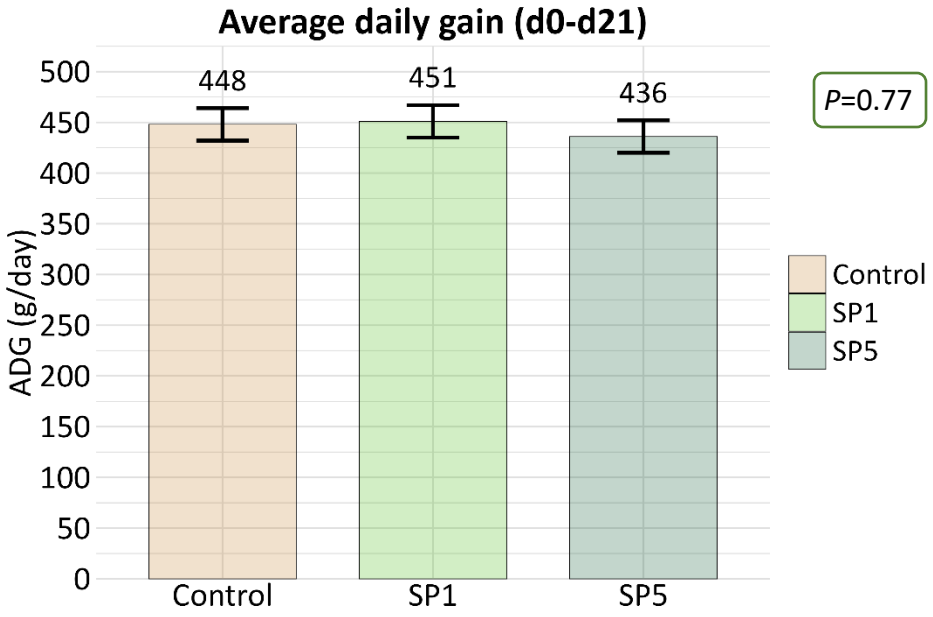


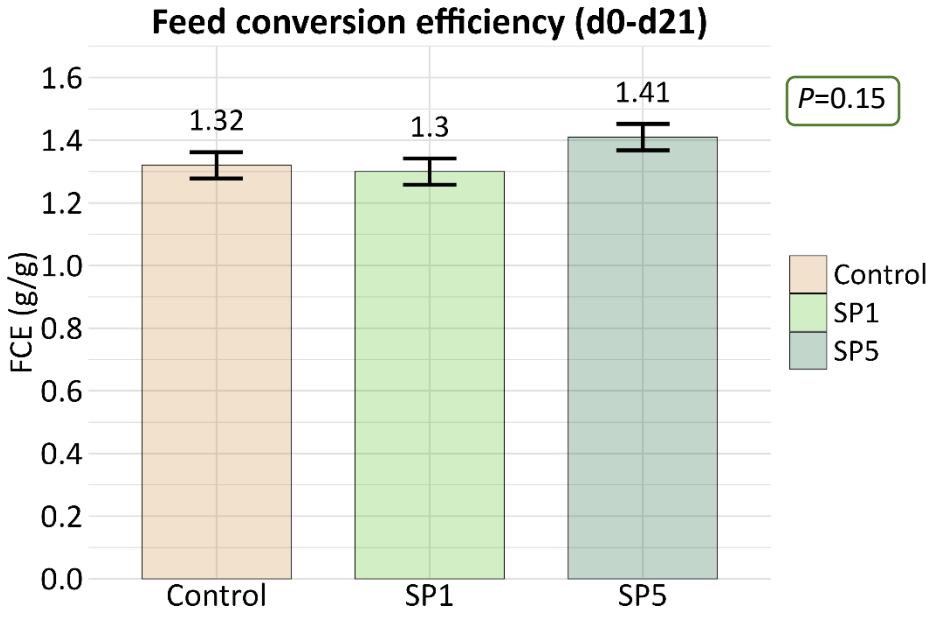


Pig growth performance from D0-21 PW



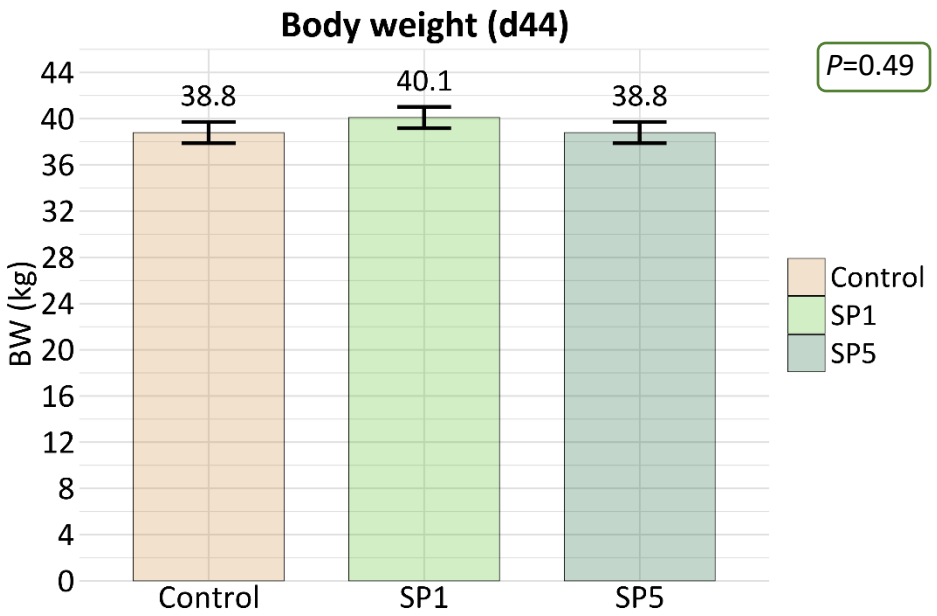


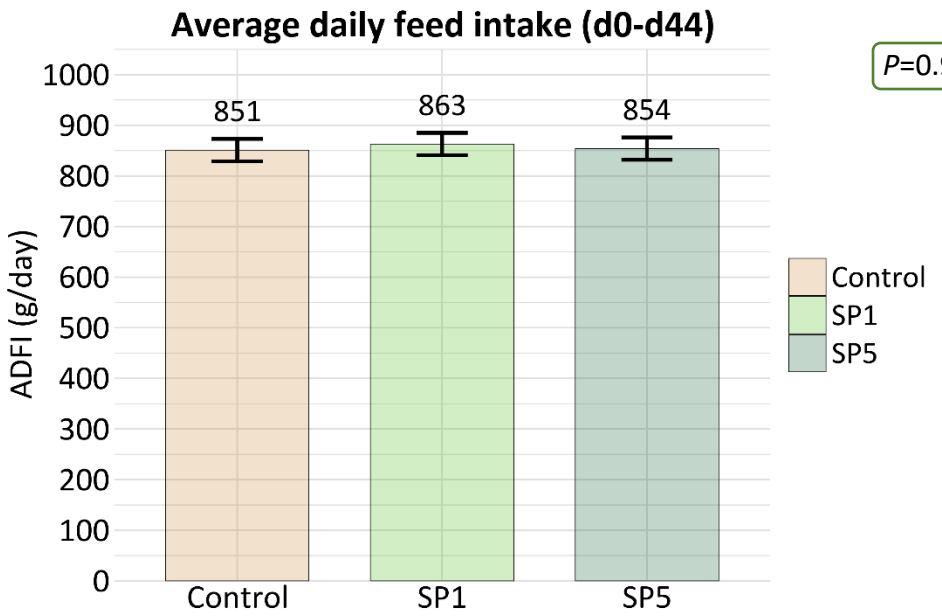


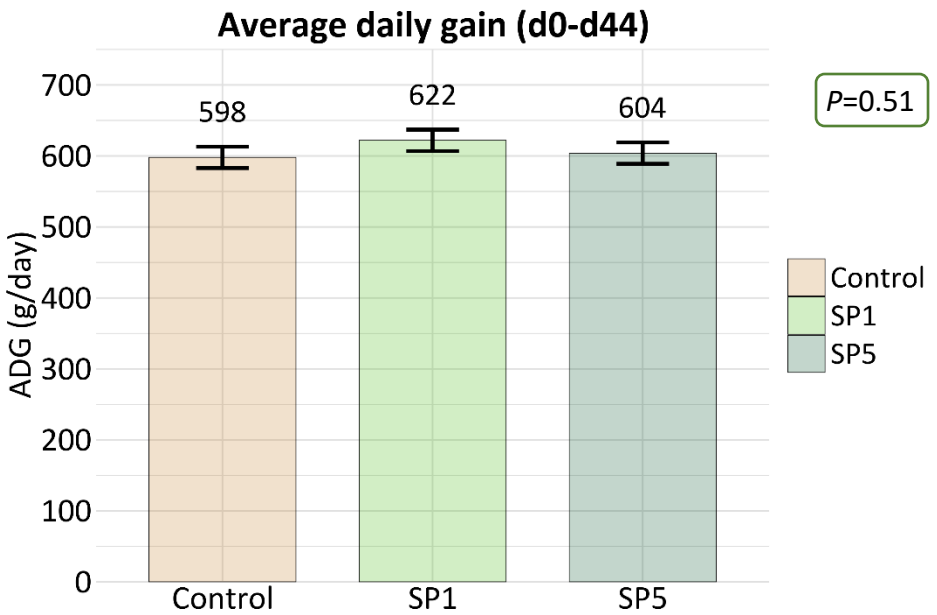


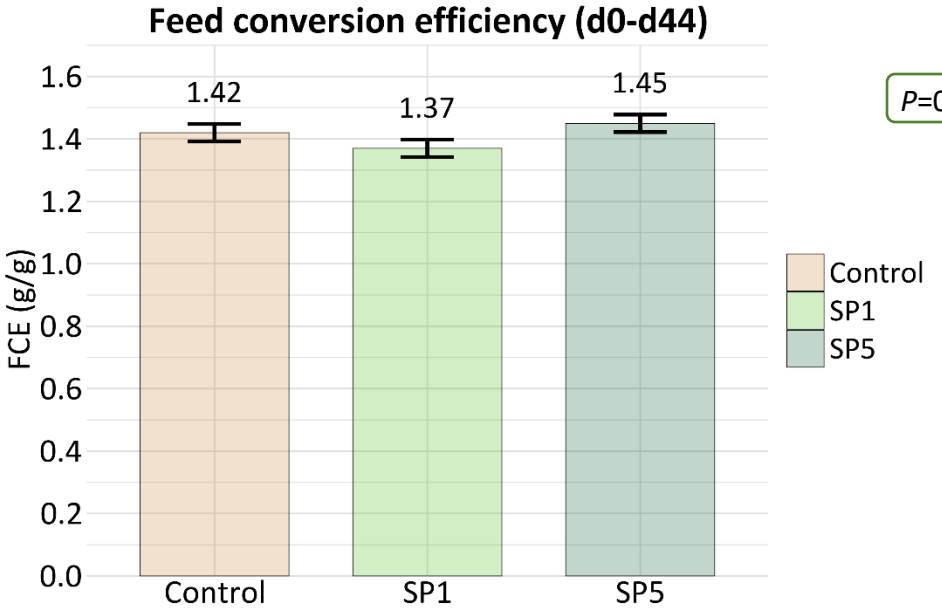
Control
SP1: *Spirulina* at 1%
SP5: *Spirulina* at 5%

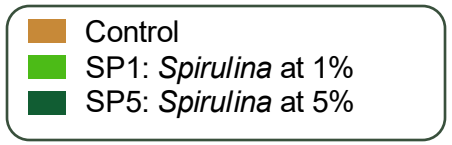
Pig growth performance from D0-44 PW





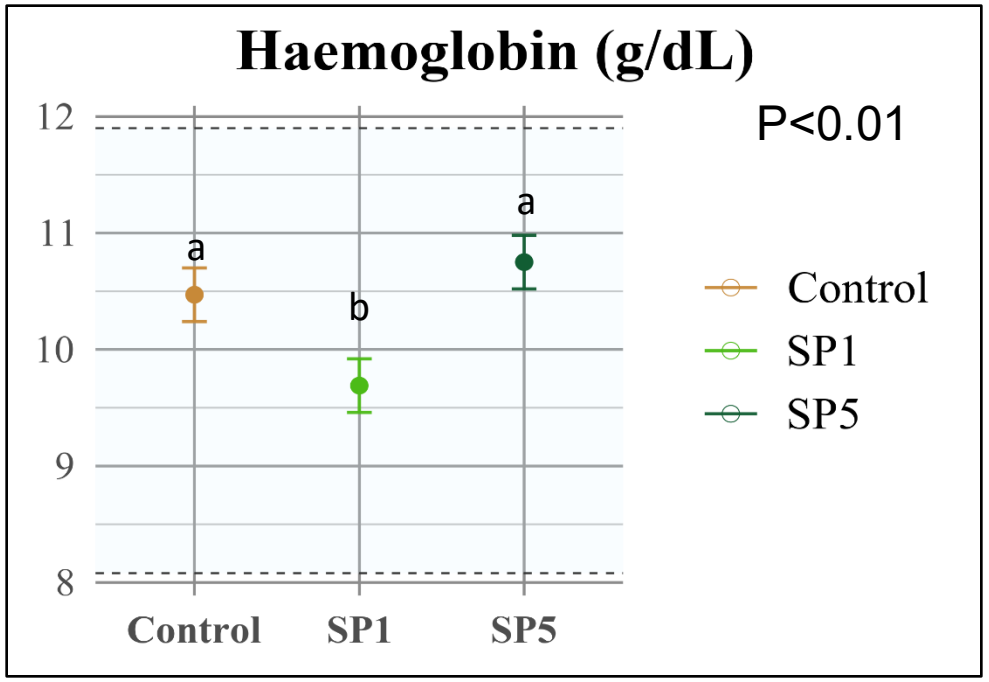




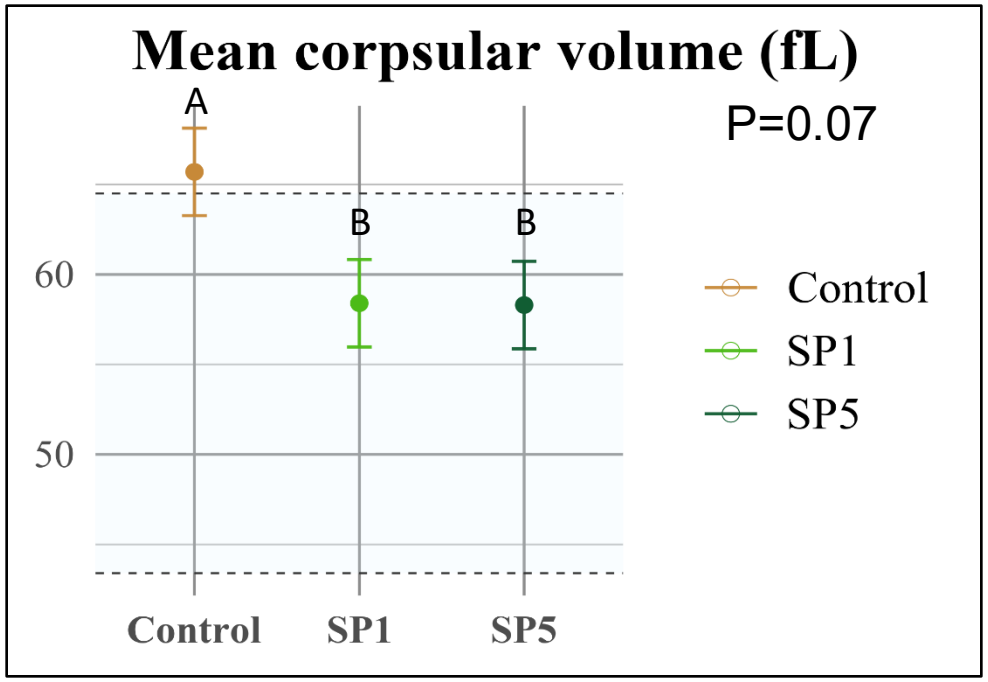


Haematology

Reference ranges[1] 8.08 – 11.9



Reference ranges[1] 43.4 – 64.5



[1]Normal reference ranges for pigs from 0 to 6 weeks old (Iowa State University, 2011)

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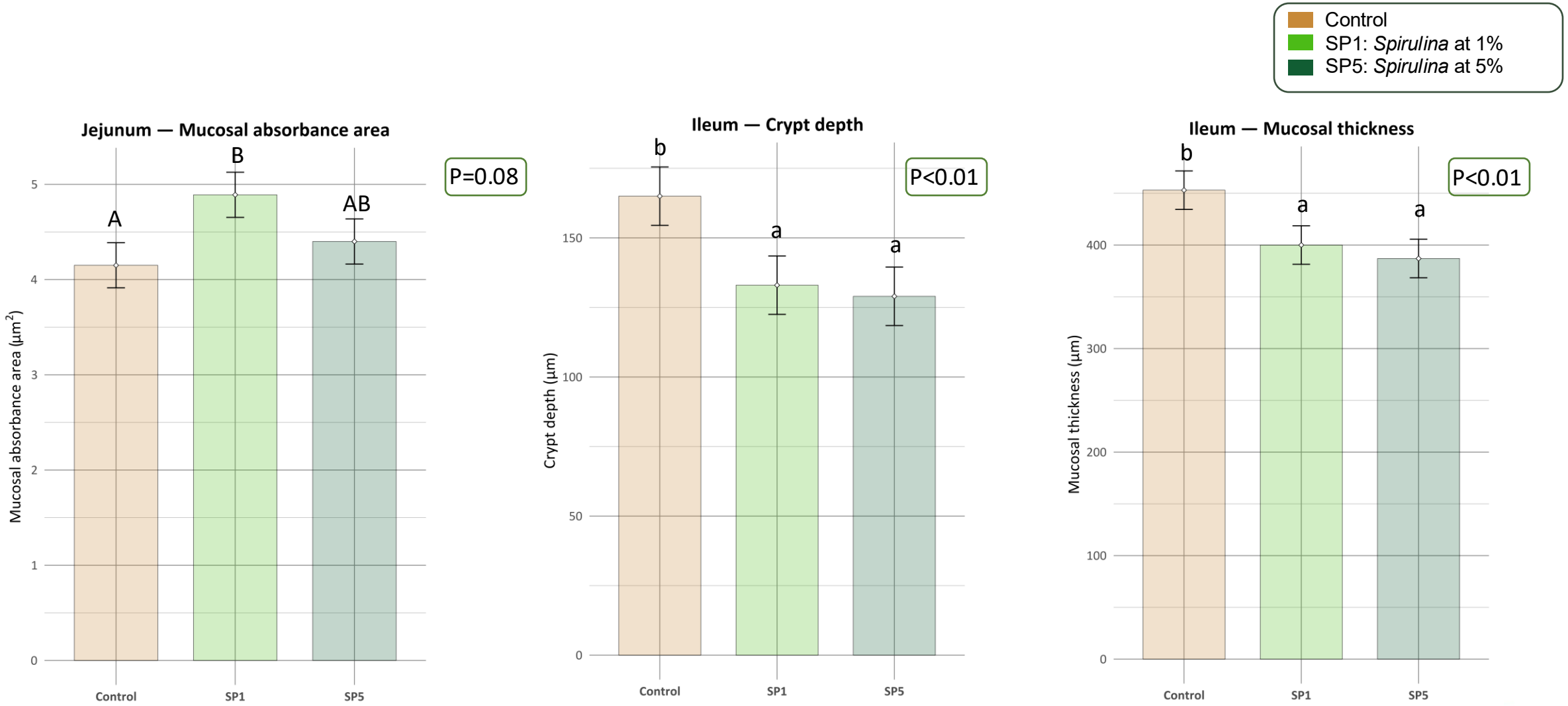
Small intestine histology



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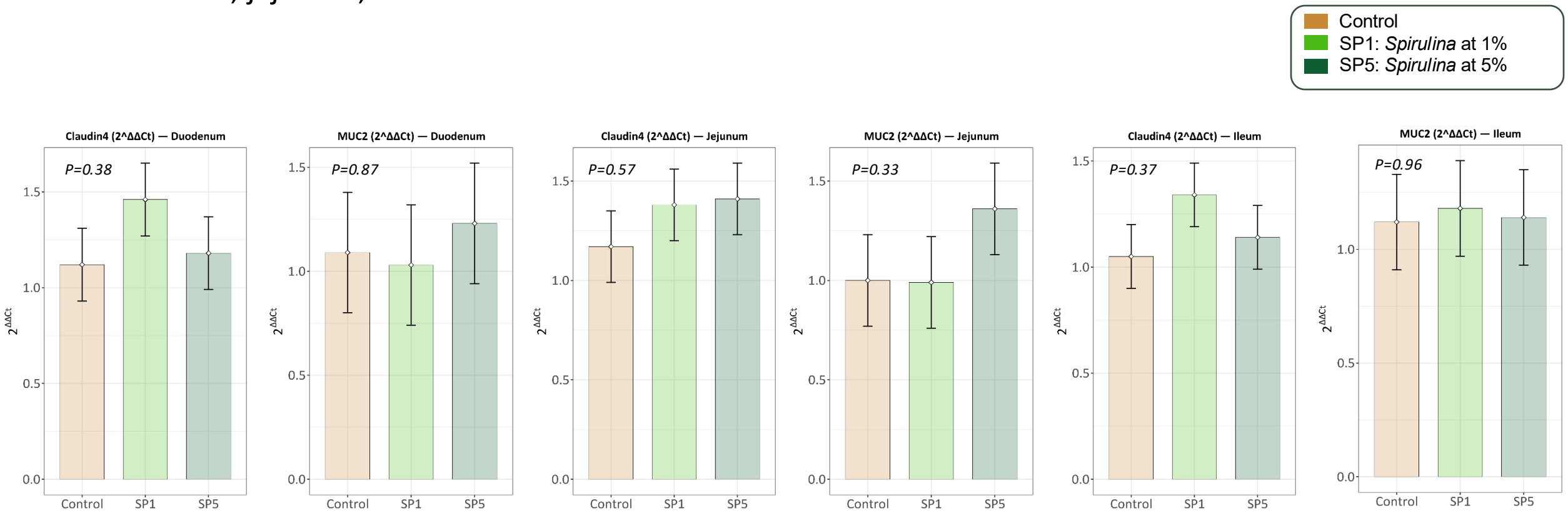
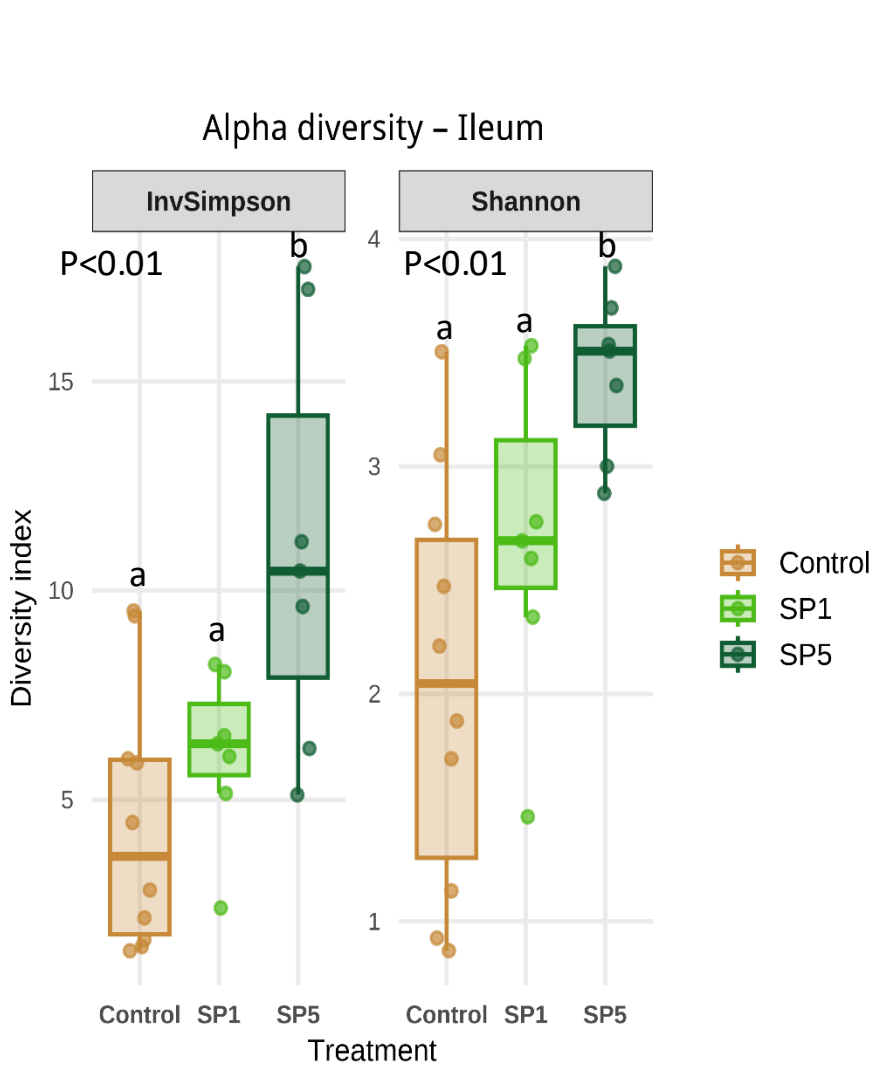
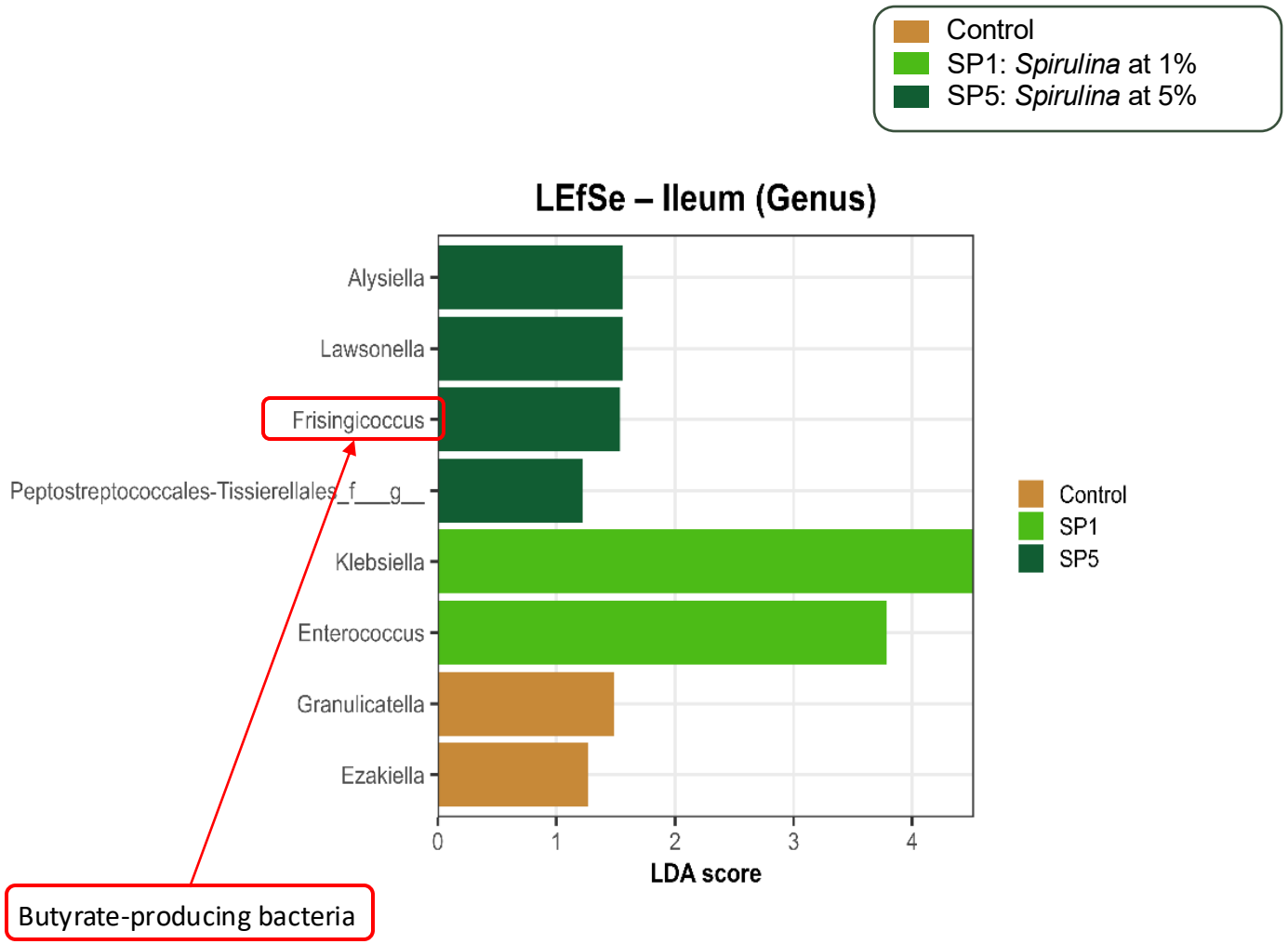
mRNA data

- *Spirulina* by-product did not influence mRNA transcript levels of *Claudin-4* and *Mucin-2* in duodenum, jejunum, or ileum



Microbiota results- Ileum





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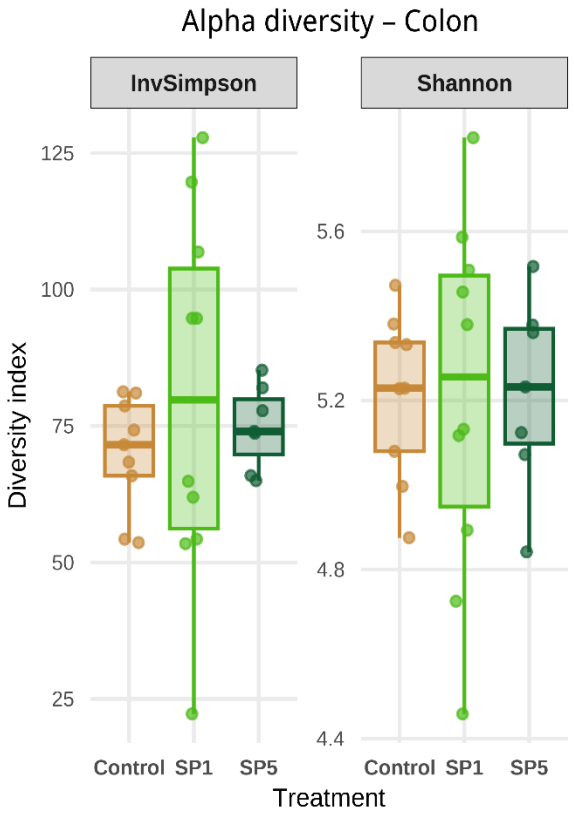
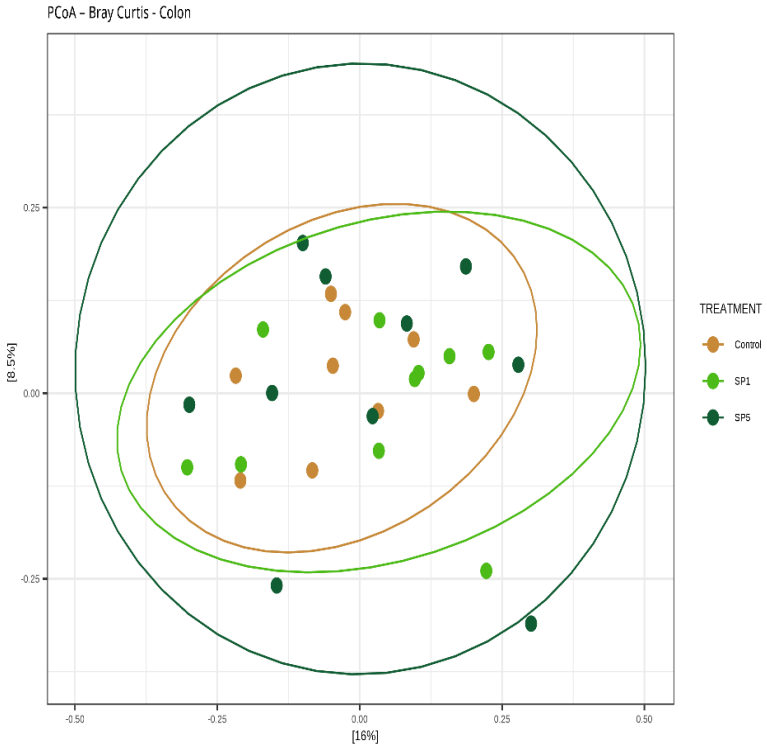
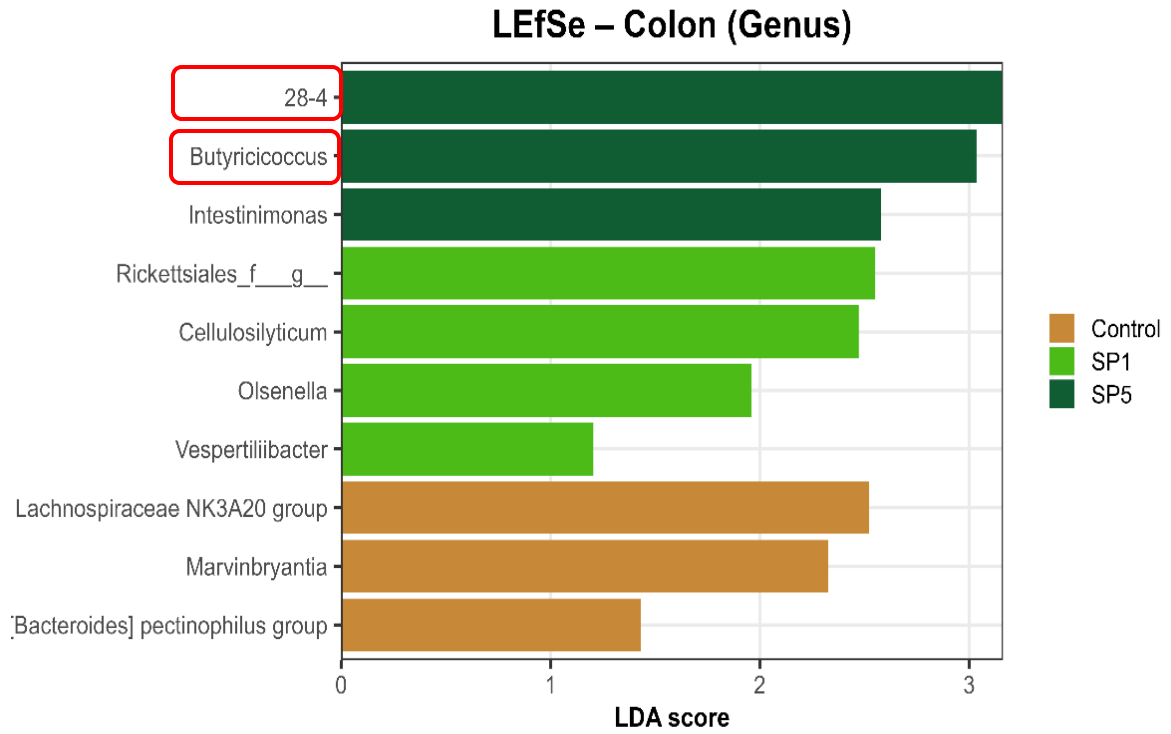
Microbiota results- Colon

Control
SP1: *Spirulina* at 1%
SP5: *Spirulina* at 5%







Butyrate-producing bacteria

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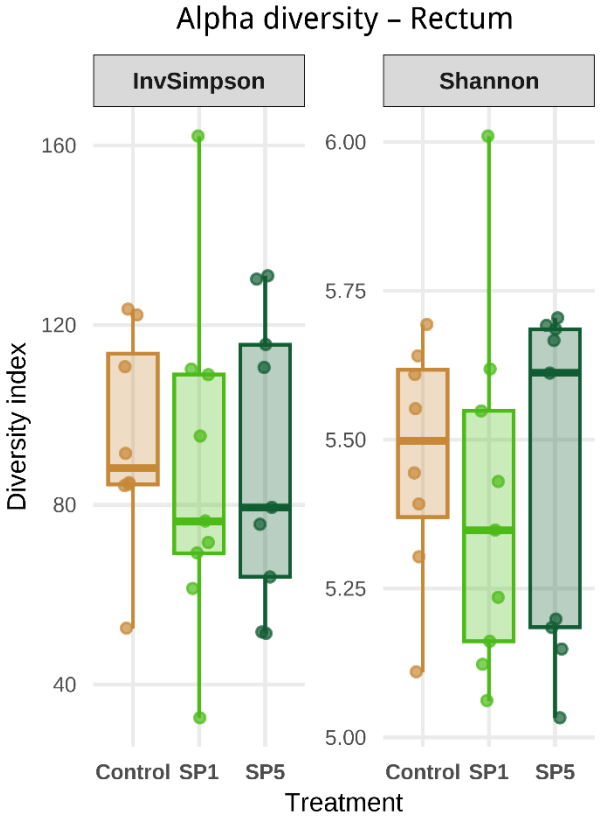
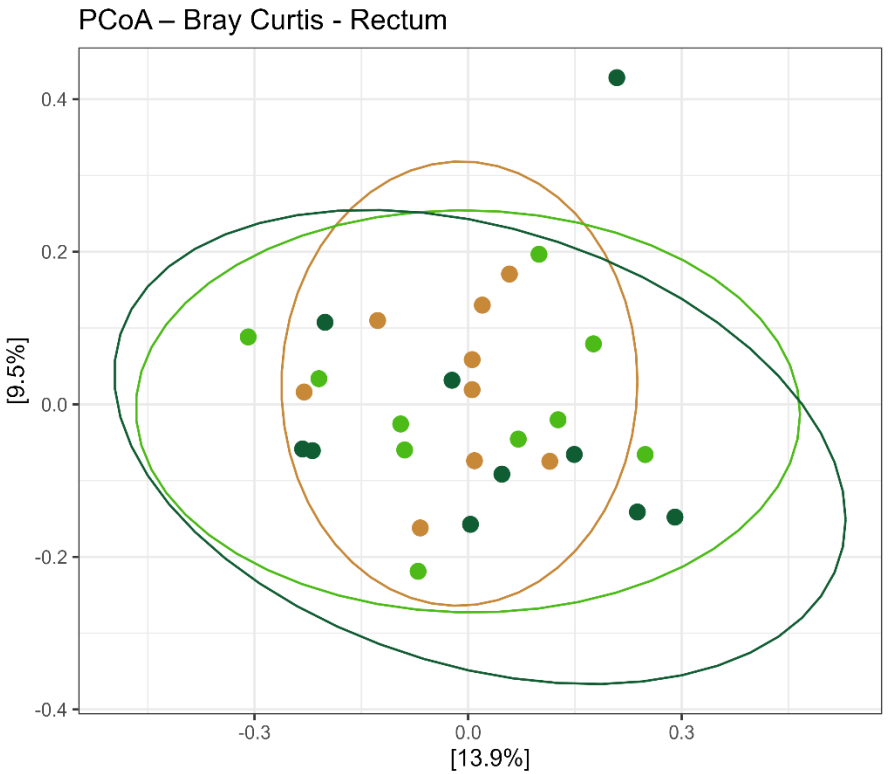
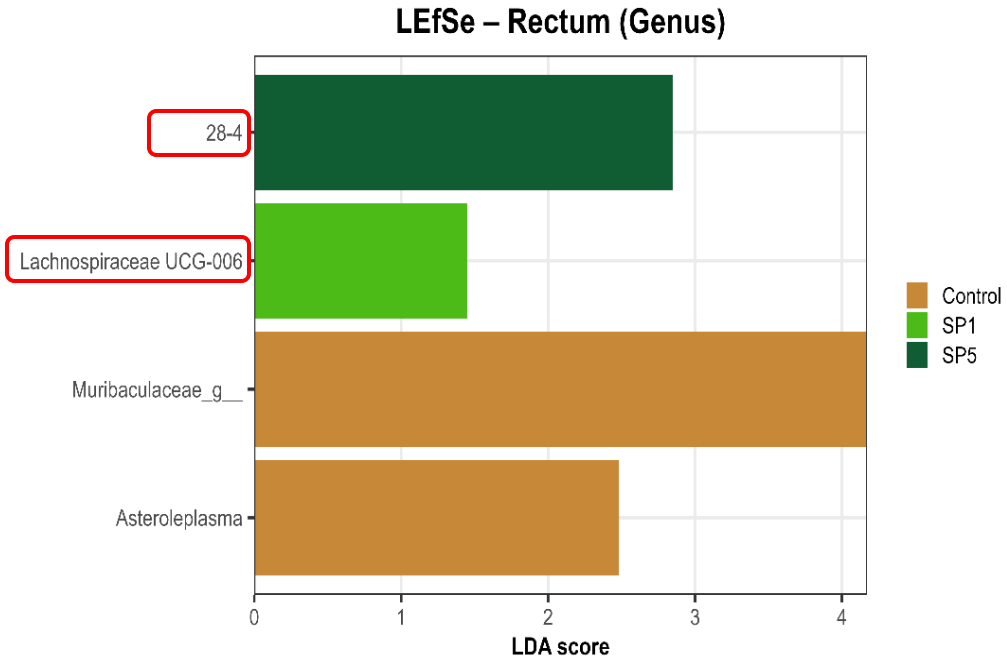
Microbiota results- Rectum

Control
SP1: *Spirulina* at 1%
SP5: *Spirulina* at 5%



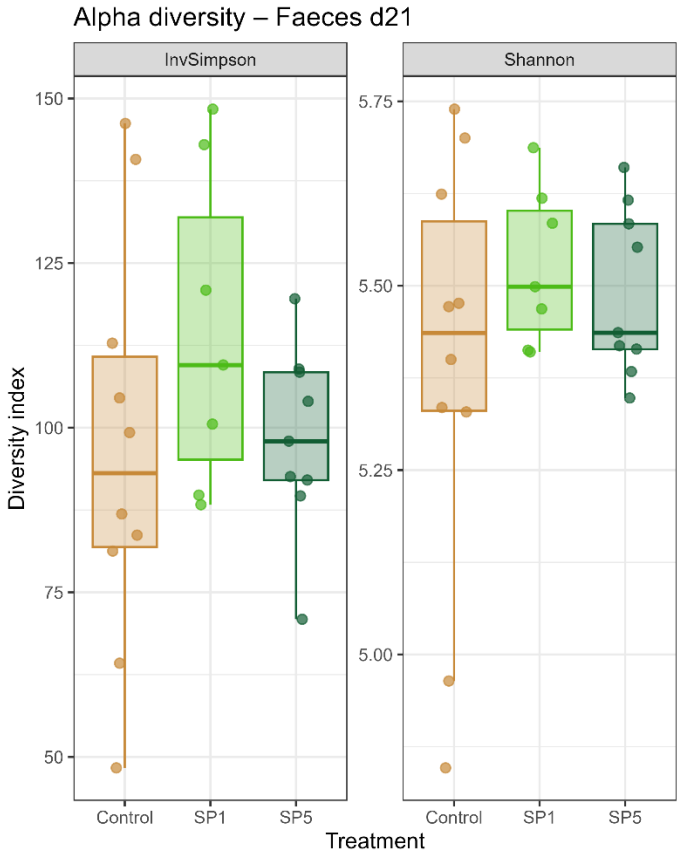


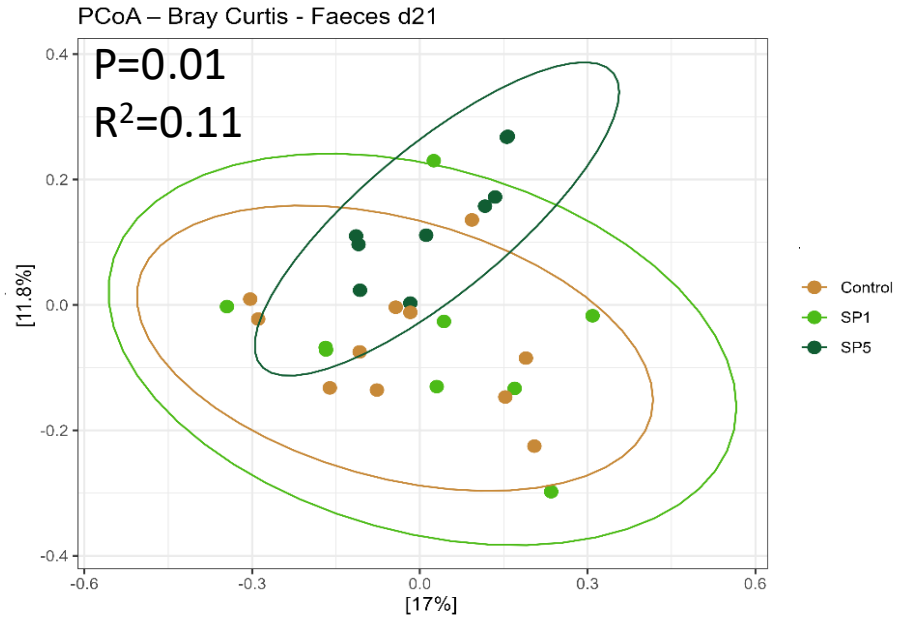


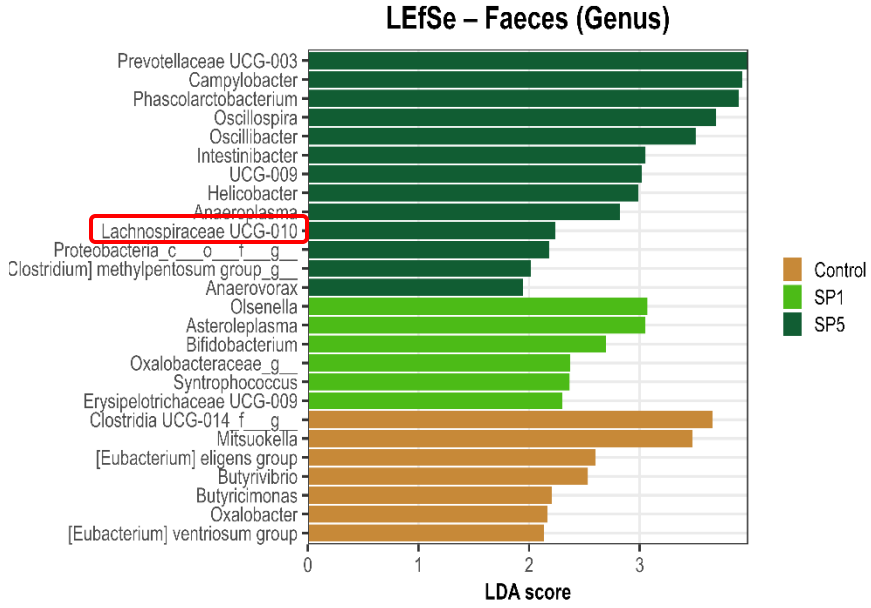
Butyrate-producing bacteria

Microbiota results- Faeces D21 PW

Control
SP1: *Spirulina* at 1%
SP5: *Spirulina* at 5%







Butyrate-producing bacteria

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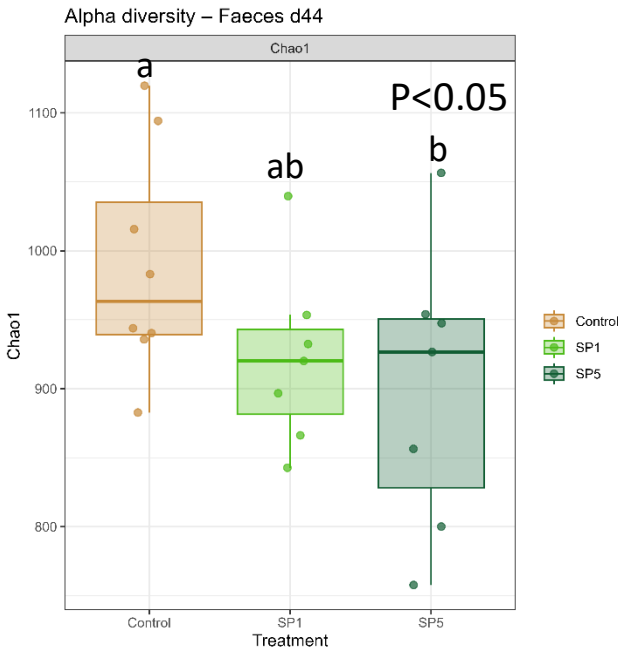
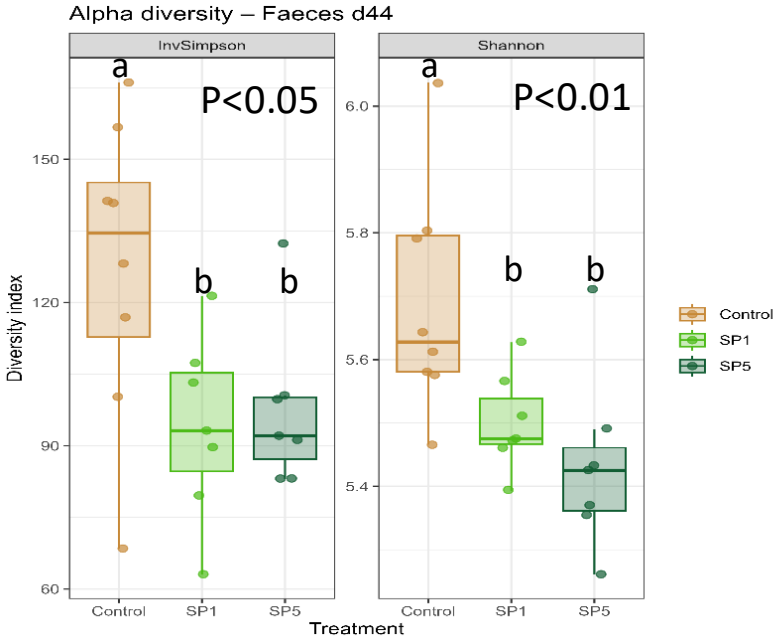
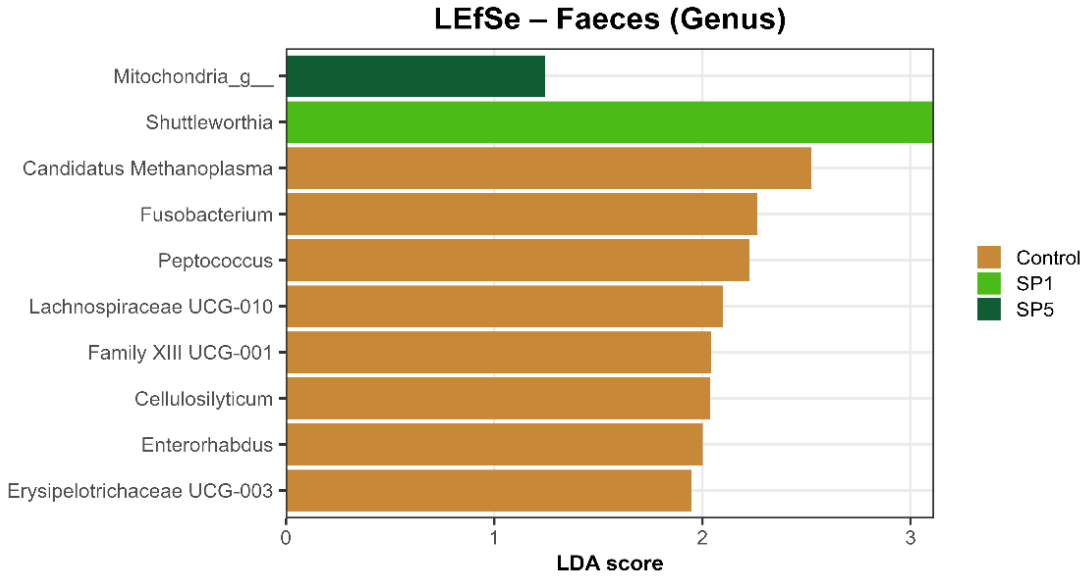
Microbiota results- Faeces D44 PW

Control
SP1: *Spirulina* at 1%
SP5: *Spirulina* at 5%







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Summary

→*Spirulina* by-product inclusion at 5% ↓ BW and ADFI during the first week PW

→Minor effects on haematology → values remained within reference ranges

→*Claudin-4* and *Mucin-2* mRNA transcripts levels not affected by treatment

→Ileal crypt depth and mucosal thickness ↓ in both *Spirulina* by-product groups

→Enriched butyrate producing bacteria →

→↑ Non-digestible carbohydrates in *Spirulina* by-product groups

Implications

→ *Spirulina* by-product can be safely incorporated into post-weaning piglet diets at inclusions of up to 5%

→ limit to 1% during the first week post-weaning?

Thank you!!

Acknowledgements

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Any questions?

Joe.Glynn@teagasc.ie

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