Butyric acid with resistant potato starch improved growth and health of weaned pigs

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Bia agus Mara
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Weaning process

- Most critical stage of pig production
- During weaning:
  - ➢ Separated from sow, littermates and milk
  - ➢ Moved into unfamiliar accommodation with strange pigs and dry-cereal based diet

- These stressors cause:
  - ❖ Reduction in feed intake
  - ❖ Intestinal inflammation
  - ❖ Microbial dysbiosis

Post-weaning diarrhoea and reduced growth rates

Need to identify alternative dietary strategies to increase piglet intestinal health and growth performance post-weaning

Increasing intestinal butyrate levels

Butyrate

- Butyrate is the preferred energy source for colonocytes (Leonel and Alvarez-Leite, 2012)
- Integral for cell growth and differentiation (Canani, 2011)
- Inhibits the expression of pro-inflammatory cytokines which increasing the expression of anti-inflammatory cytokines (Siddiqui and Cresci, 2021)
- Maintains anaerobic conditions limiting the growth of *E. Coli* (Jha et al., 2019)
- Anti-diarrhoeal substance (Hamer et al., 2007)

Butyrate can be increased exogenously (Butyric acid supplementation) or endogenously (prebiotic supplementation)

Prebiotic supplementation

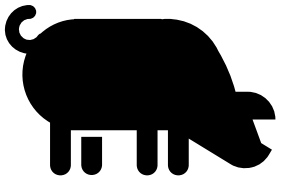
Prebiotics are “selectively fermentable ingredients that allow specific changes, both in the composition and/or activity in the gastrointestinal microflora that confer benefits upon the host well-being and health” (Roberfroid, 2007)

- Inulin
- Wheat bran
- Beta-glucans
- Resistant starch
  - ❖Resistant potato starch

Resistant potato starch

- Proportion of starch resistant to digestion and is fermented in the colon (Buttriss et al, 2008)
- Supplementing resistant potato starch:
  - ❖ Increases the abundance of beneficial bacteria in the colon (Tan et al, 2021)
  - ❖ Increases the availability of starch for fermentation (Tan et al, 2021)
  - ❖ Increases butyrate production and absorption (Trachsel et al, 2019)

The supplementation of butyric acid may have an immediate effect, while the supplementation of resistant potato starch may have a delayed effect as the microbes adapt



Objective

To evaluate the performance and intestinal health of post-weaned pigs offered a diet containing either exogenous butyrate **(Butyric acid)** or a diet promoting the production of endogenous butyrate **(Resistant potato starch)** or a combination of both

Hypothesis

It was hypothesised that the combination of butyric acid with resistant potato starch would increase intestinal butyrate concentrations while supporting endogenous butyrate production

Experimental design

96 newly weaned piglets (28 days) with an average weight of 7kg were assigned to 1 of 4 dietary treatments in a

2 X 2 factorial design for 35 days

- SID lysine 12.0 g/kg
- Net energy 10.6 MJ/kg

Control

Control + **1.5%** Butyric acid

Control + **1%** Potato starch

Control + **1.5%** Butyric acid + **1%** Potato starch

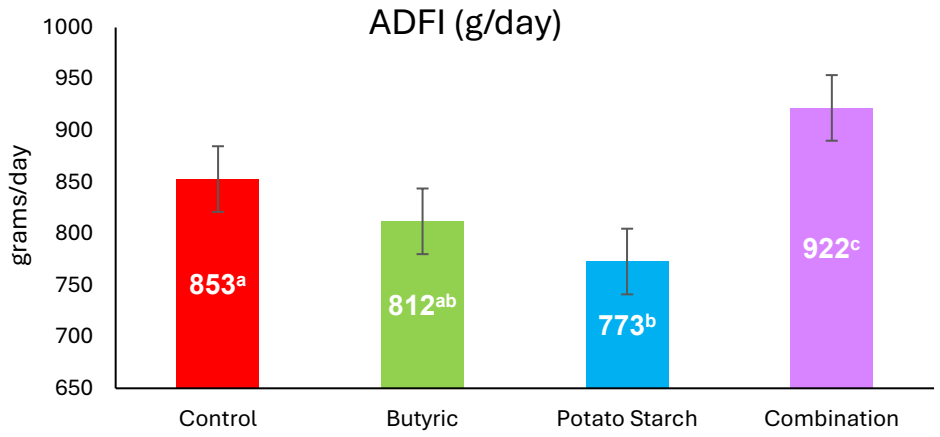
- Supplementing 1% Potato starch improved faecal scores compared to 0.5% (Heo et al 2014)
- 3% Butyric acid improved FCR but reduced feed intake (Connolly et al, unpublished)

Experiment data collection

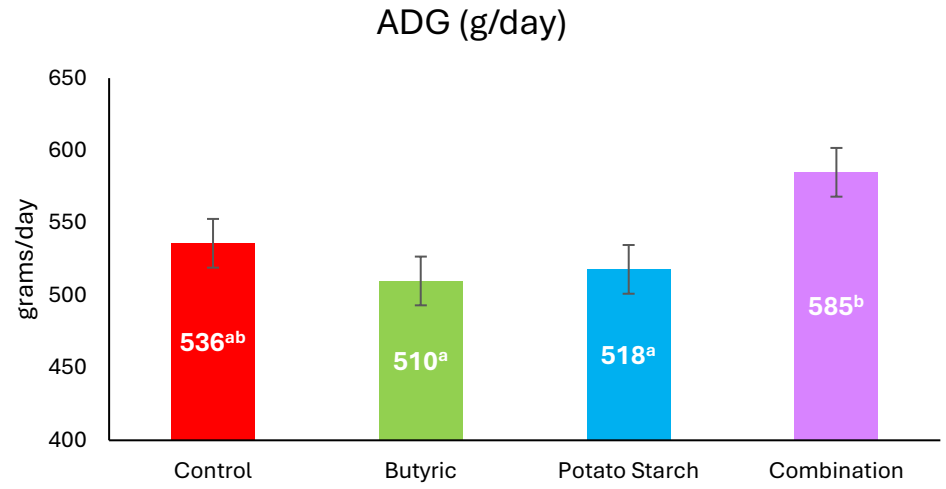
- Piglets housed in groups of 3
- Piglets weighed weekly
- Average daily gain (ADG), average daily feed intake (ADFI), feed conversion ratio (FCR) calculated weekly
- Faecal scoring on a scale of 1-5 carried out twice a day in the am and pm
- Fresh faecal samples from each pen (n=8) collected on day 8 post-weaning for volatile fatty acid and microbiome analysis using 16s rRNA sequencing

Growth performance results

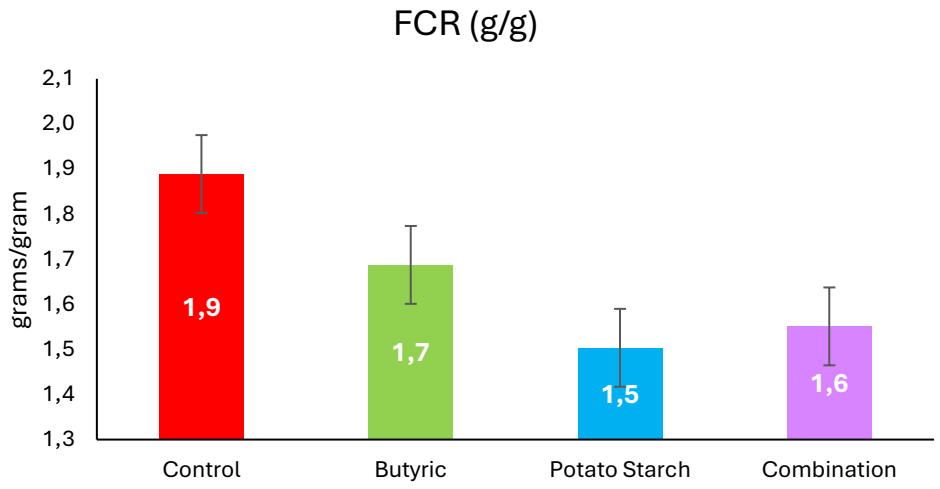
Butyric x starch *p* value =0.05



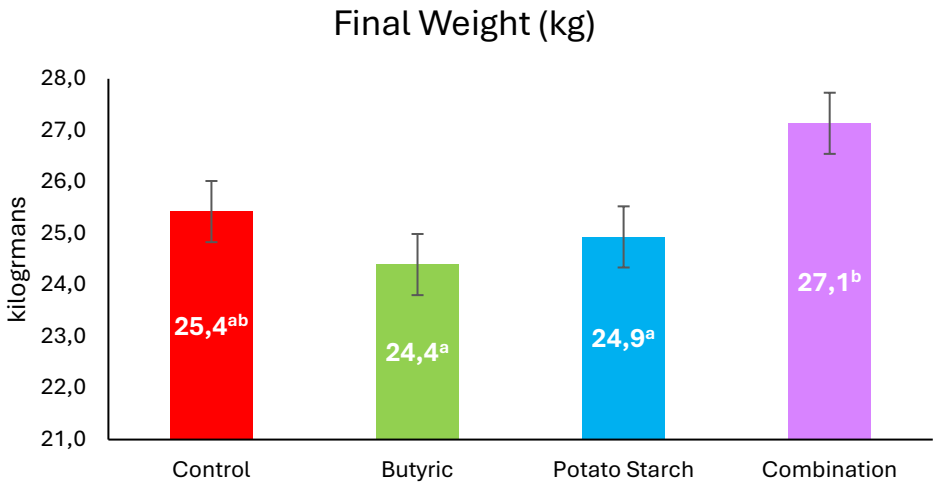
Butyric x starch *p* value <0.05



Starch *p* value =0.05

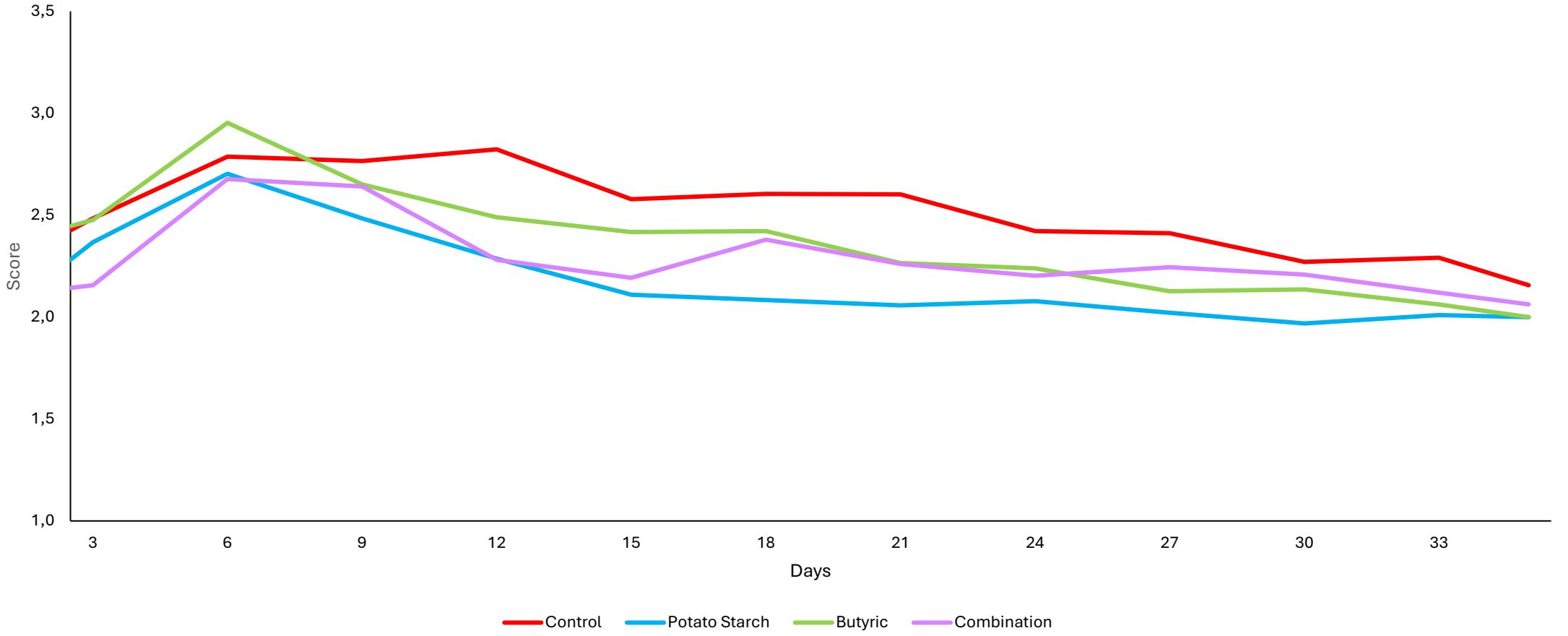


Butyric x starch *p* value <0.05



Faecal scores for the 35 days post-weaning

Butyric x starch *p* value <0.05



Faecal Volatile fatty acid (mmol/g faeces)

	Treatments				SEM	p Values		
	Basal	Butryic	Starch	Combination		Butyric	Starch	Butyric X Starch
Total VFA	228.20	260.66	301.62	321.96	44.85	0.533	0.120	0.886
Acetate	132.03	147.11	177.38	172.04	25.96	0.842	0.159	0.676
Proprionate	50.31	61.02	64.72	73.48	11.02	0.352	0.203	0.925
Butyrate	26.98	26.24	35.78	46.65	8.20	0.514	0.068	0.454
BCFA*	18.89	26.29	23.75	29.79	4.32	0.108	0.310	0.867

*BCFA branched chain fatty acids

Conclusions

- The supplementation of resistant potato starch improved faecal scores and FCR and tended to increased faecal butyrate concentrations
- The resistant potato starch and butyric acid combination diet improved faecal scores and had the highest ADFI, ADG and final body weight of all dietary treatments
- The resistant potato starch and butyric acid combination diet is a potential strategy to improve growth performance in light of European restrictions

Thank you!

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