Effects of peat and lignocellulose on the colonic fermentation of pigs in an *ex vivo* simulation model

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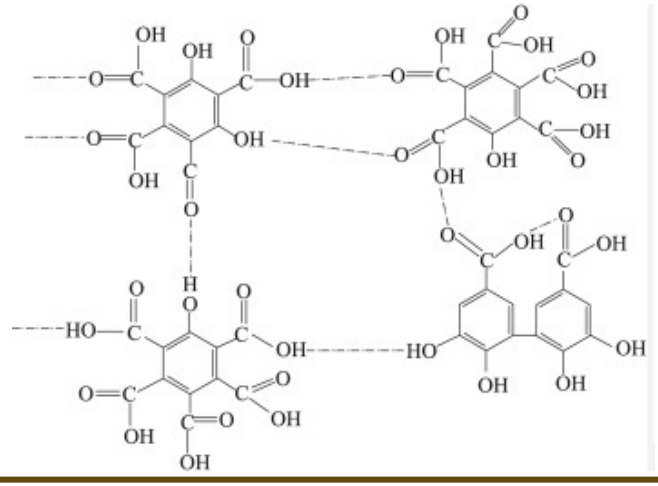
Introduction

- Fiber is essential for the digestion and intestinal condition of piglets.
- Lignocellulose (wood fiber) is frequently used fiber in piglet diets.
- Wood pellets can be used as an environmental enrichment material.
- Recently, heat-treated pellets made from a specific type of peat became available.
- The present study compared the effects of peat and lignocellulose on the colonic microbial fermentation of pigs in an *ex vivo* simulation model.

Why peat?

- Peat is a natural source of prebiotic fibre and humic acids, both considered beneficial for intestinal wellbeing.
- In a recent experiment, peat improved the weight gain of piglets when given as enrichment material.
  - Fecal samples of peat-fed piglets showed more butyrate and less branched chain fatty acids, and a positive modulation of microbiota



Humic acid molecule

Humic acids have been suggested to protect intestinal epithelium *e.g.* by binding toxins.

Test materials and simulation treatments

- 3 peat types (A, B, C) and a lignocellulose sample were sourced from Finland (Neova Oy)
- In the simulation, the finely ground materials (target size 0.25 mm) were tested at 1% concentration and with 4 replicates.

Simulation treatments

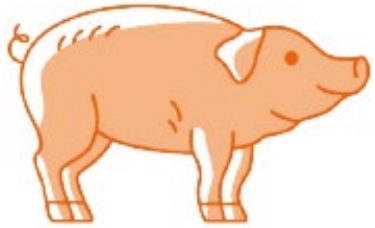
1) Control with no test products
2) Lignocellulose
3) Peat A
4) Peat B
5) Peat C

Steps of the simulation procedure

PRE-TREATMENT OF TEST MATERIALS

PREPARATION OF AUTHENTIC GROWTH MEDIUM AND MICROBIAL INOCULUM

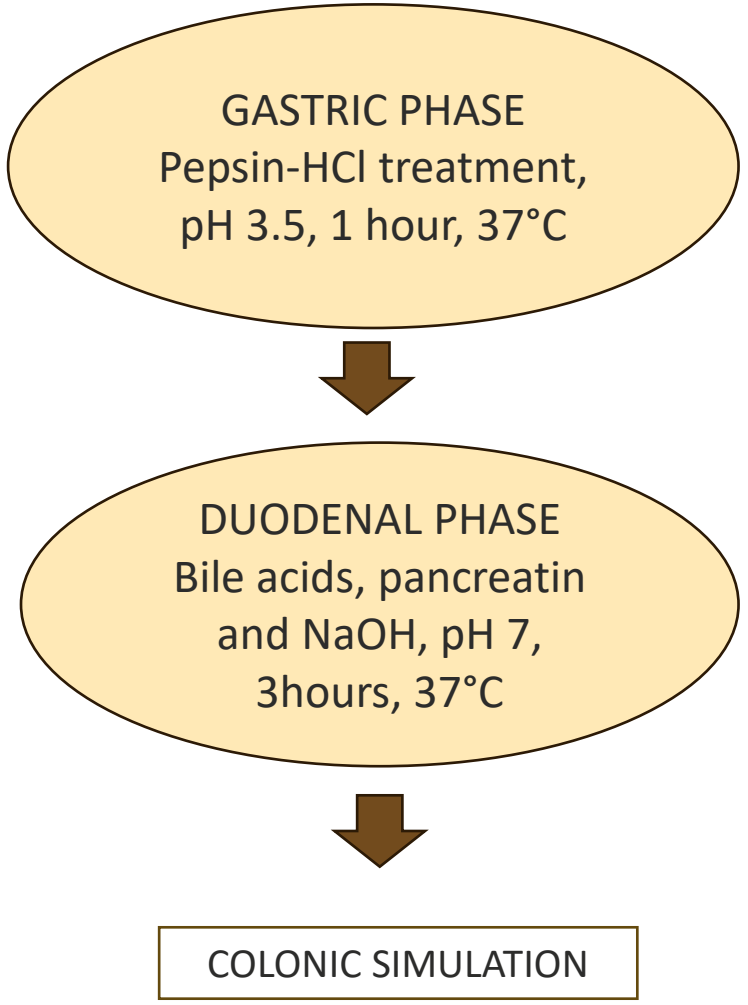
ACTUAL COLONIC SIMULATION



Pre-treatment for the test materials

Fiber eaten by a piglet gets exposed to digestive fluids in the stomach and small intestine before it encounters colonic microbiota.

For an authentic colonic simulation, the test materials were pre-treated by “gastric and duodenal digestion” phases.



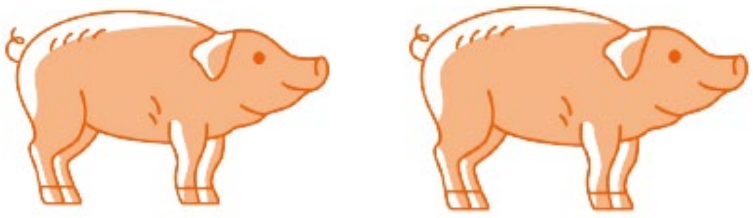
Growth substrate and microbial inoculum

GROWTH SUBSTRATE

Colonic microbiota grows on digesta that arrives to colon from ileum and caecum.

Authentic growth substrate was prepared from the distal ileal, cecal, and proximal colonic contents of two piglets of ~30 kg.

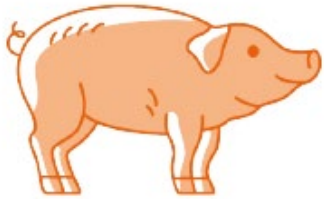
The digesta samples of individual animals were pooled at 1:1:1 ratio, centrifuged, and suspended into anaerobic buffer.



MICROBIAL INOCULUM

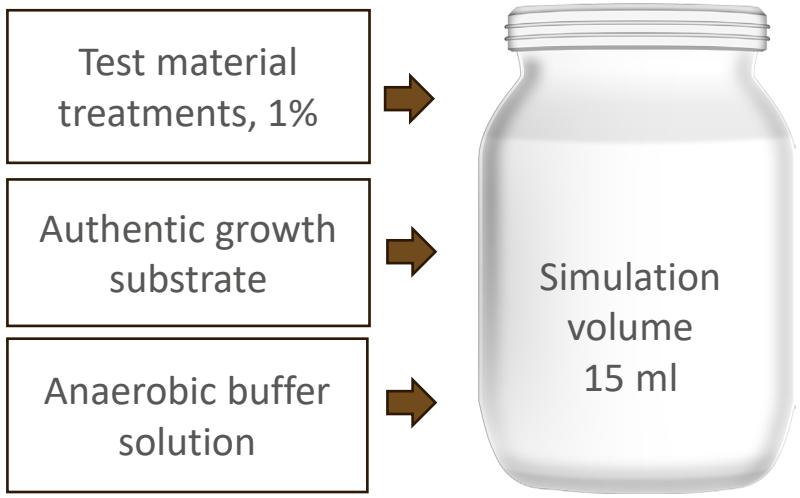
Microbial inoculum was collected from the distal colon of one additional pig on the simulation day.

The samples were homogenized, filtered, and suspended into anaerobic buffer, and used immediately to initiate the simulation.



Simulation in an anaerobic chamber

A. Loading the simulation vessels



50-ml glass vials with thick butyl rubber stoppers

B. Initiating the simulation by injecting microbial inoculum into the vial by needle and syringe

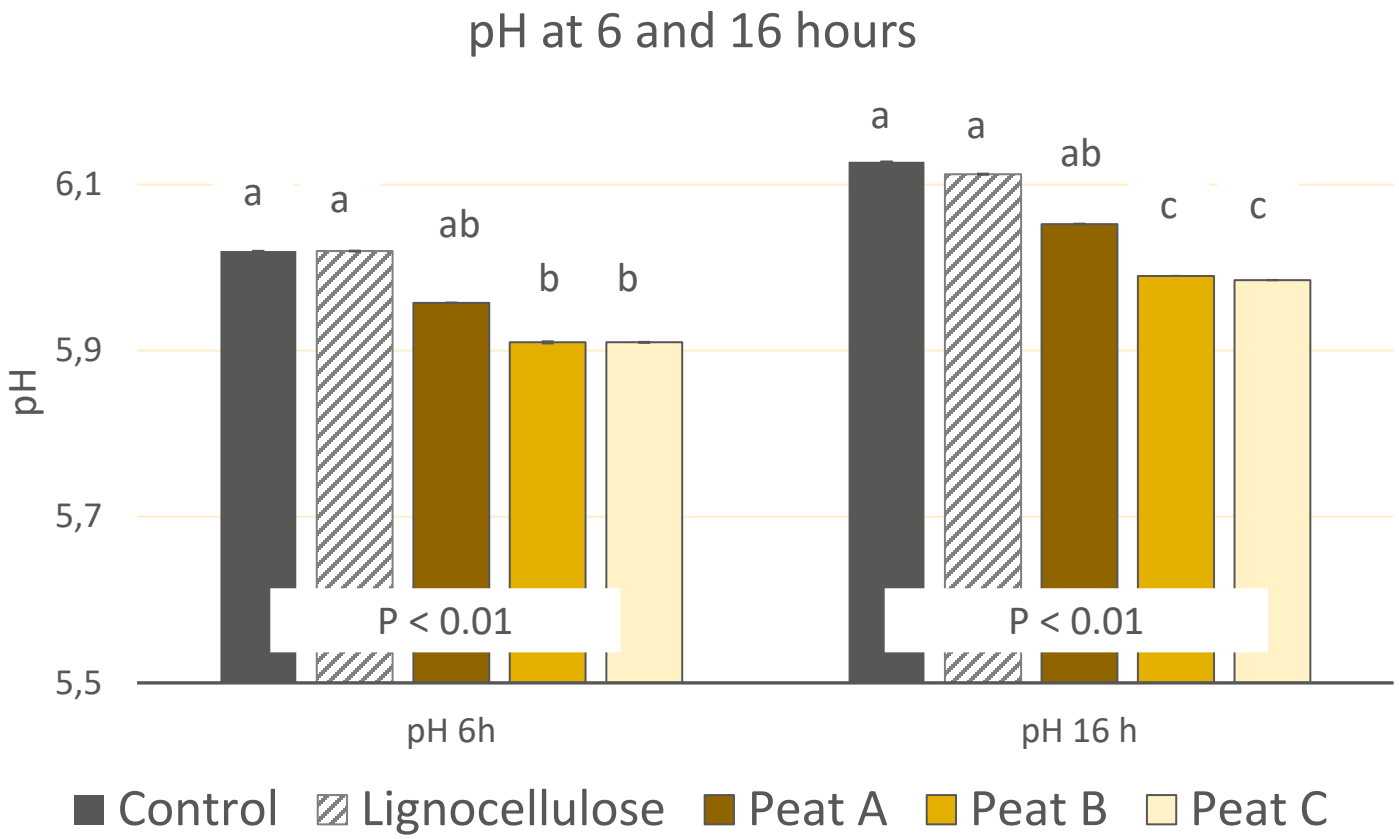
C. Keeping the vials at 37°C, under constant gyratory shaking for 16 hours

D. Sampling the vials at 6 and 16 hours for the analysis of gas volume, pH and VFA profile

Data analysis: ANOVA and Tukey's test, $p<0.05$ as a limit of significance.

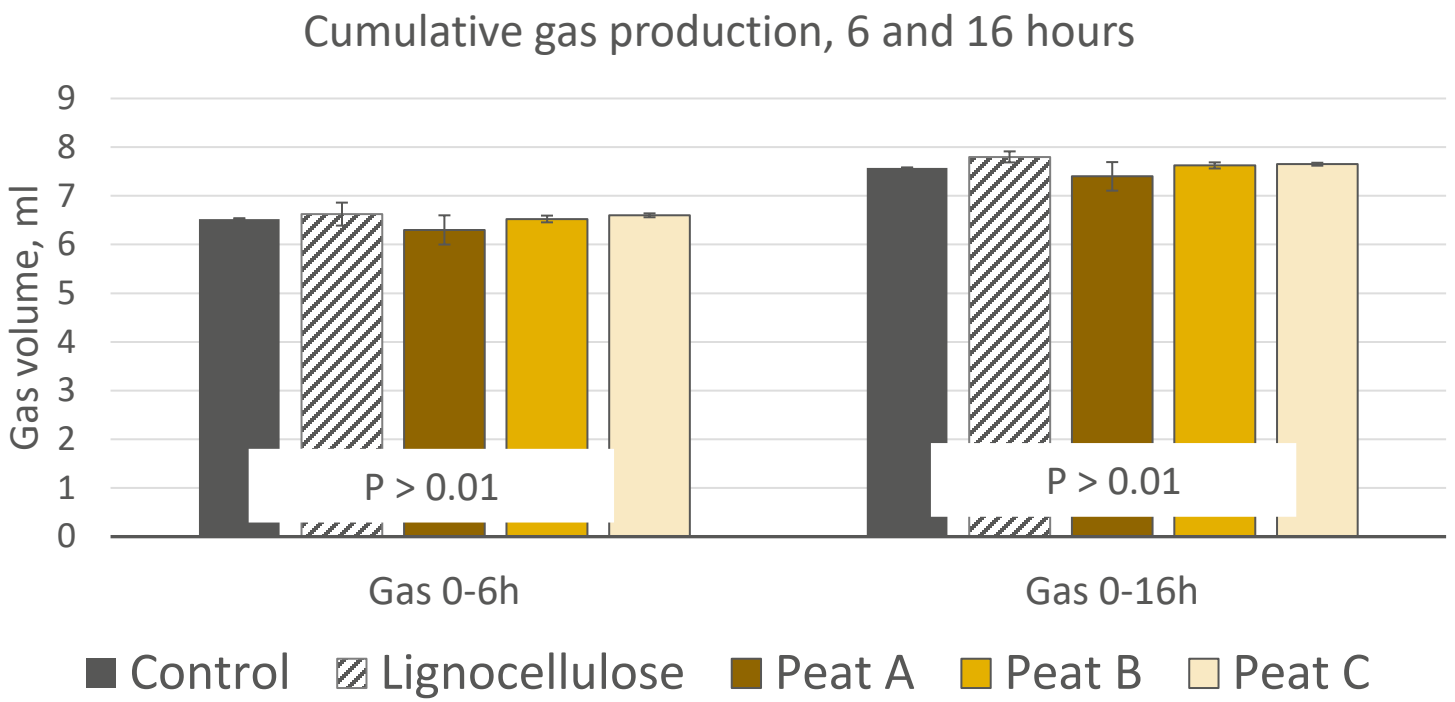
Results: pH

Peats B and C significantly decreased pH at both time points, compared to control and lignocellulose.



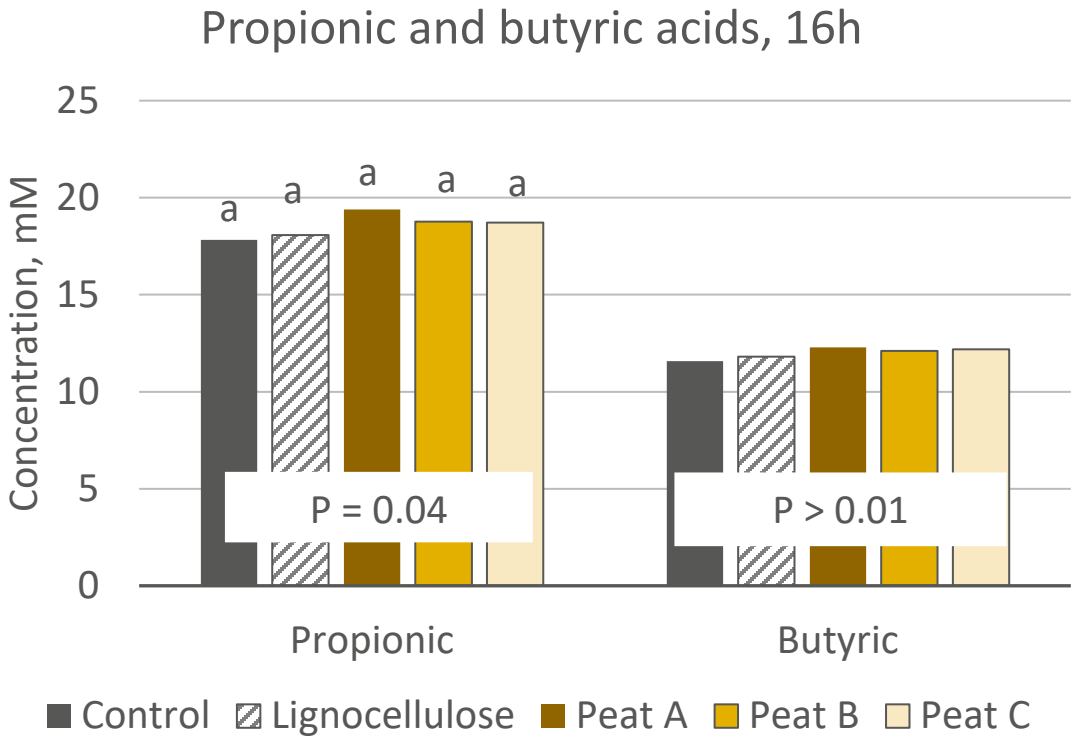
Results: Gas volume

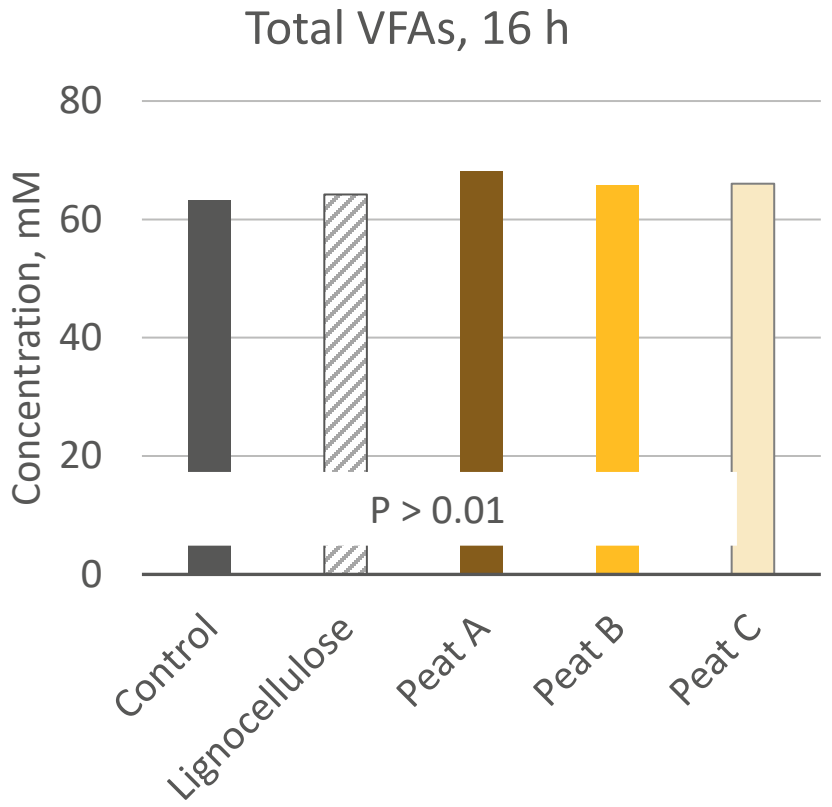
Cumulative gas production in the vials was not affected by either lignocellulose or peat.



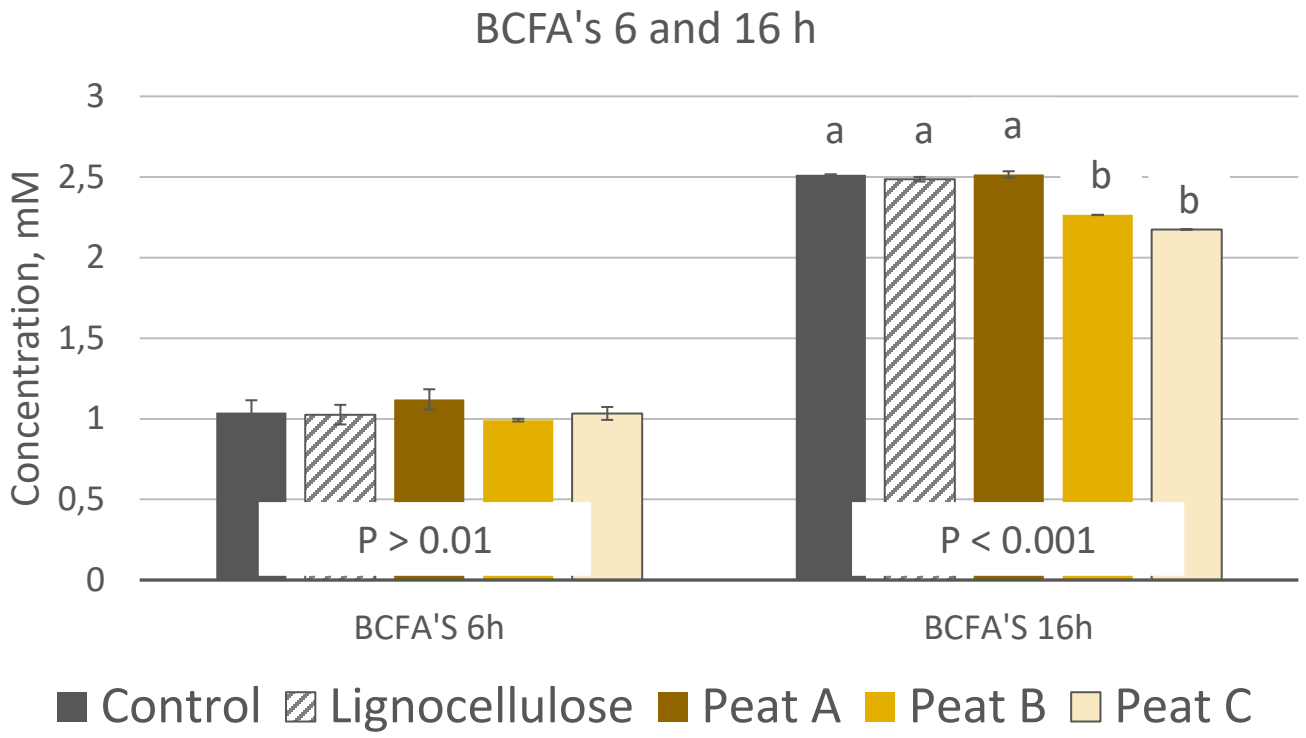
Results: Volatile fatty acids

- At 6 hours, VFAs were not affected by the treatments.
- At 16 hours, Propionic acid was higher for the peat treatments





Results: Branched-chain VFAs



At 16 hours, peats B and C showed significantly less branched chain VFAs (iso-butyric, 2-methyl-butyric, iso-valeric acids) than the other treatments.

BCFAs are considered to reflect fermentation of amino acids, and not positive to intestinal condition.

Summary and conclusions

- Lignocellulose had no effects on the measured parameters, compared to control.
- Peats B and C showed positive effects on pH and VFA's, especially BCFAs
- **In conclusion,** using selected peat types as a fiber source may promote beneficial colonic fermentation in piglets, potentially offering advantages over lignocellulose.

Thank you!

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