The potential effect of plant extracts and other bioactive natural substances (PENS) on GIT microbial activity measured by the *in vitro* gas production technique

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MESSAGE

1. *In vitro* fermentation kinetics suggest that inulin type fructans may act at different sites of the intestinal tract
2. The effect of added PENS on the *in vitro* microbial activity strongly depend on the type of substrate used
3. Dose-response additions of PENS used in the current studies did not seem to affect microbial activity *in vitro*

Objective

- Assess how complex microbial communities respond to plant extracts and other natural substances (PENS) using *in vitro* cumulative gas production techniques

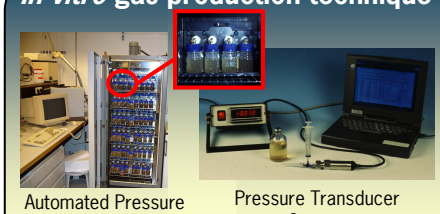
Materials & Methods

in vivo part

Faecal donor animals

- Trial 1. Three pigs, BW = 45.7 ± 1.1kg, receiving a a barley-, wheat-, and native potato starch-based diet
- Trial 2. Twelve piglets, 11, 15 and 19d post-weaning, receiving a standardized barley-, wheat-based diet (EU-reference diet)
- Trial 3. Eighteen piglets, 11d post-weaning, receiving a standardized barley-, wheat-based diet (EU-reference diet)

In vitro gas production technique



Automated Pressure Evaluation System

Pressure Transducer System

in vitro part

Inoculum preparation & gas production

- Faecal material was collected *per rectum* and used as inoculum (Williams *et al.* 2005)
- Gas production (GP) was measured as described by Theodorou *et al.* (1994) and Davies *et al.* (2000)
- A monophasic model was fitted to the data points (Groot *et al.*, 1996), and maximum rate of gas production was calculated as described by Bauer *et al.* (2005)

RESULTS

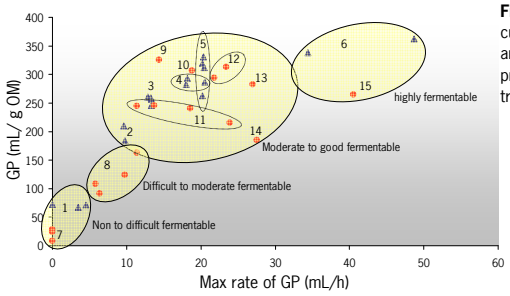


Fig.1. Relation between the cumulative gas production (GP) and the maximum rate of gas production for PENS tested in trial 1 (▲) and trial 2 (●).

In trial 1 the substrates *Chlorella vulgaris* (untreated, ultrasonic, electroporated) (**1**; Fig.1), sugar beet pulp with added daidzein or ipriflavone (**2**), compound feed with added alginate (**3**), glucose with added daidzein or ipriflavone (**4**), raftilose P95, raftiline GR, raftiline HP, topinambur syrupe (**5**), topinambur 15 and topinambur 40 (**6**) were tested for their fermentability. In trial 2 the substrates ulvan, fucan, carboxy-methylcellulose (**7**), the seaweed derived fractions oligo-mannuronic (saturated & unsaturated), soycomil, linseed (**8**), native potato starch (**9**), citrus pulp (**10**), the seaweed derived fractions laminaran, xylan, mannuronic block, oligo-laminaran (**11**), guargum (3500 & 5000) (**12**), glucose (**13**), carob meal (**14**) and the seaweed derived fraction oligo-xylan (**15**) were tested for their fermentability.

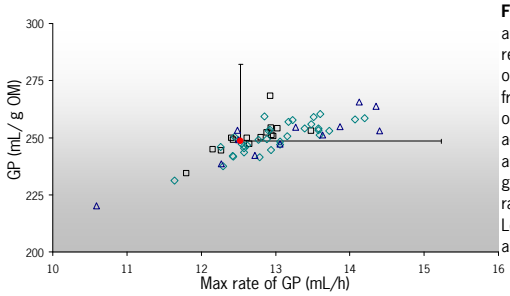


Fig.3. Relation between the GP and the max rate of GP for EU-reference diet either without (●) or with addition of seaweed fractions (□), a range of etheric oils, cinnamaldehyde, benzoic acid, naringin and saponin (◇), and carob pulp, citrus pulp, guar gum, topinambur 40, raftilose P95 and soycomil (△). Least significant differences are indicated.

In trial 3 a more complex substrate (EU-reference diet) was used to test the effect of PENS addition to microbial activity. Compared to the control substrate the addition of PENS showed to have a differential and non significant effect on GP and max rate of GP. Dose-response treatments did not show any consistent effects

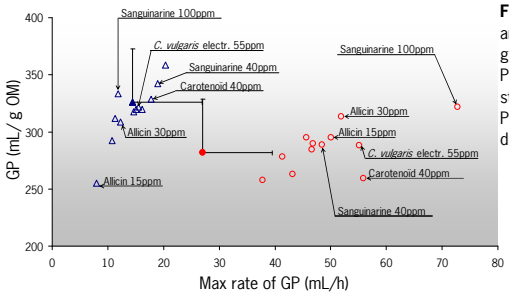


Fig.2. Relation between the GP and the max rate of GP for glucose with (○) or without (●) PENS added, and native potato starch with (△) or without (▲) PENS added. Least significant differences are indicated.

In trial 2 *C. vulgaris* (untreated, ultrasonic, electroporated; 0, 35, 55ppm), allicin (0, 15, 30ppm), seaweed derived carotenoïds (0, 40, 100ppm) and sanguinarine (0, 40, 100ppm) were tested as an additive to either glucose or native potato starch (Fig.2). In combination with glucose the max rate of GP clearly increased (38 – 73mL/ h). The GP changed differentially and non significantly. In combination with starch GP varied over a larger range compared to glucose, but effects were non significant

Conclusions

- In general the inulin type products can be regarded as highly fermentable. Topinambur products can be used to manipulate or stimulate fermentation in the more proximal parts of the GI tract, whilst Orafti products would act more distal.
- The max rates of GP increased in successive order for; laminaran (11.4mL), xylan (13.7mL), citrus pulp (18.8mL), guargum5000 (21.8mL), guargum3500 (23.4mL), oligo-laminaran (23.9mL), carob meal (27.5mL), oligo-xylan (40.5mL). This indicates that these products may give possibilities to manipulate or stimulate fermentation in different segments of the GI tract.
- Addition of the soy derived antioxidant daidzein and ipriflavone, alginate, *C. vulgaris* (untreated & ultrasonic) did not affect the *in vitro* measured fermentation kinetics of the substrates, i.e., microbiota activity was not measurably affected by addition of these PENS.
- In combination with glucose allicin, sanguinarine, carotenoïd and C. vulgaris (electroporated) showed most promising results to influence the *in vitro* measured fermentation kinetics.

Further information

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Acknowledgements

This work was financially supported by the EU, **Feed for Pig Health** (FP6-FOOD-506144)