A lipopolysaccharide challenge in young piglets to quantify immune competence

Effect of dietary interventions on systemic immune competence

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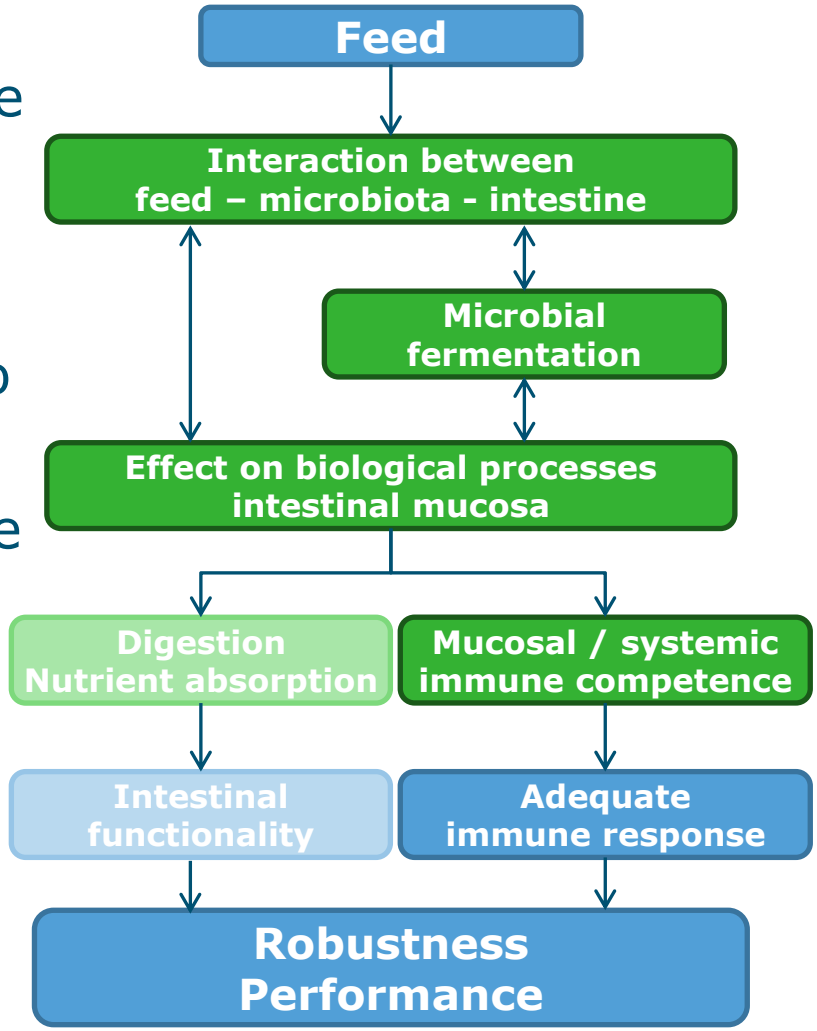
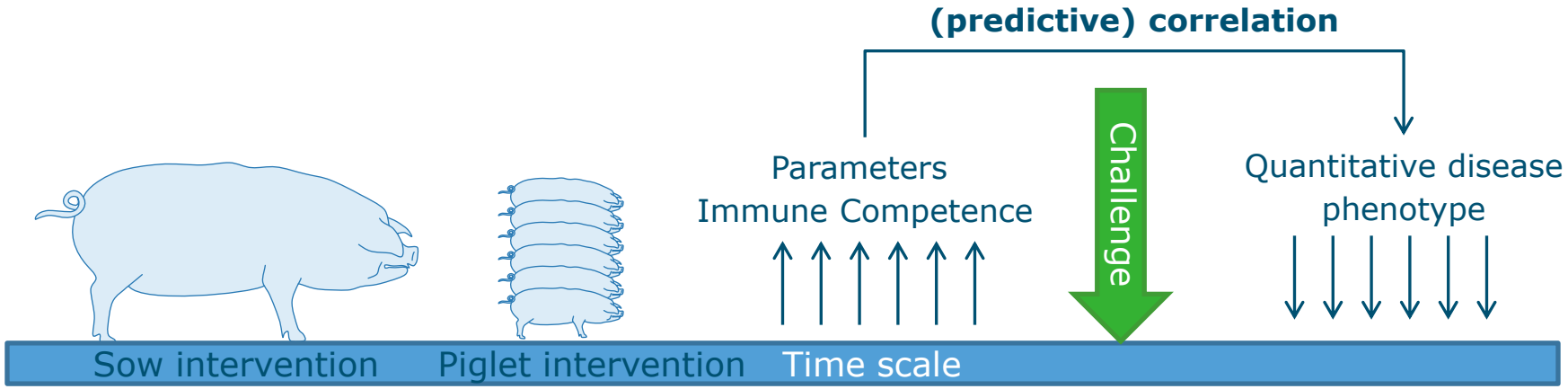
Background

- Goal Feed4Foodure is to determine immune competence of livestock after dietary interventions
- Immune competence is the potential to adequately respond to stimuli
- Problem: How to measure immune competence in healthy animals?
- Immunological challenge required to determine response potential
- Systemic lipopolysaccharide challenge suitable?



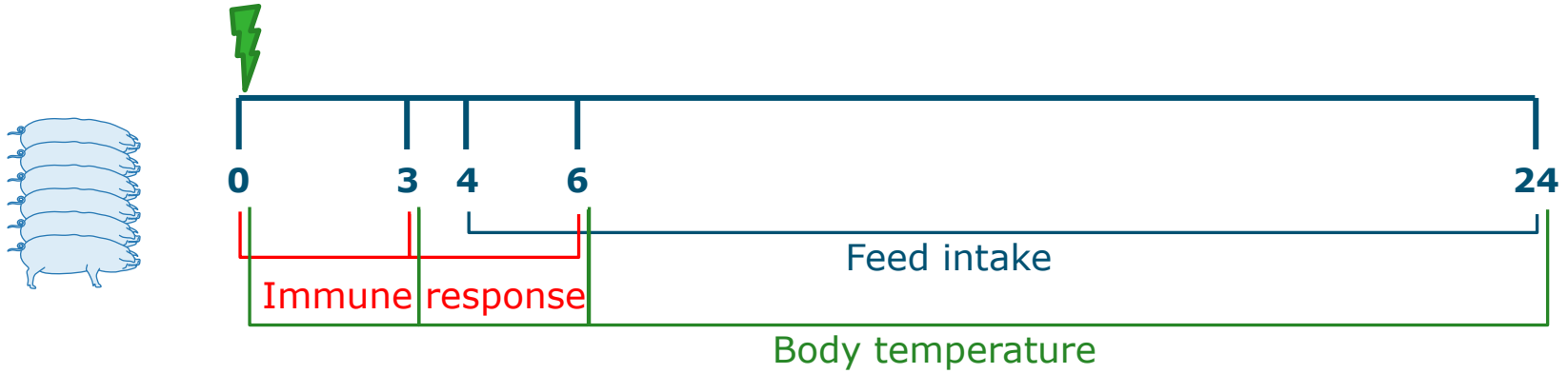
Challenge model

- To develop parameters for immune competence that are predictive for the quantitative disease phenotype, a challenge model is required
- Here we determine whether a lipopolysaccharide (LPS) challenge can be used as a challenge model
  - Is LPS a good immunological challenge?
  - Can dietary interventions affect the response to LPS?



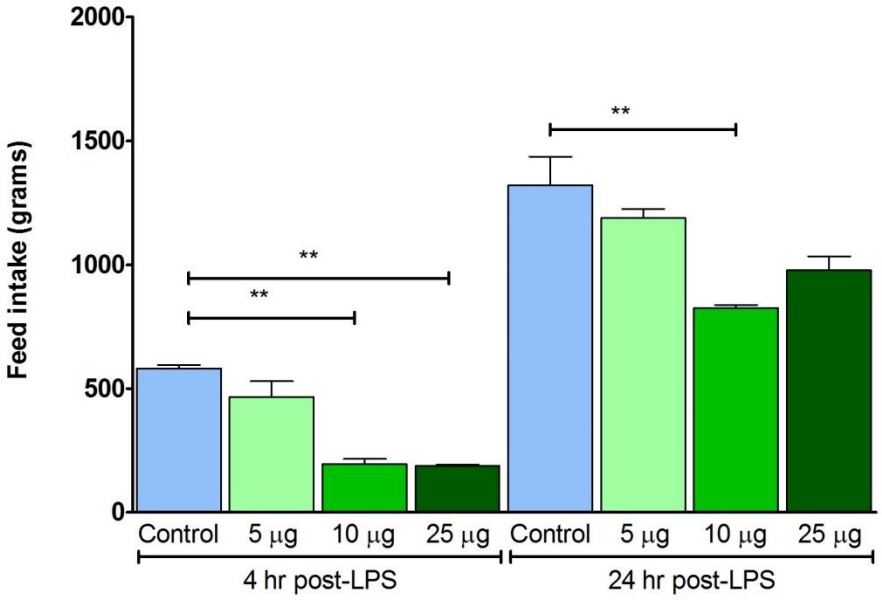
Pilot study LPS challenge: design

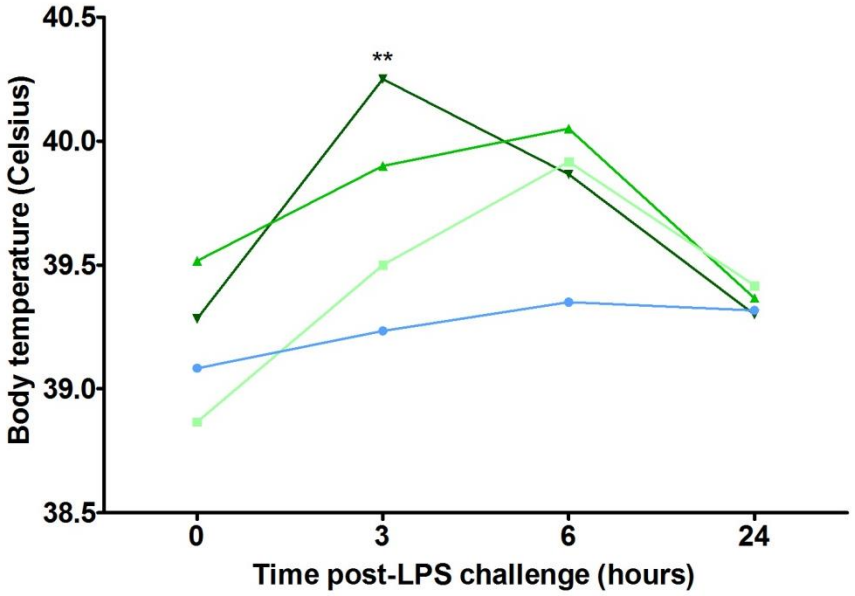
- Four groups of 6 piglets post-weaning (5 weeks of age)
- Challenge with LPS intraperitoneally: 0, 5, 10, 25 µg of LPS
- Readout parameters at 0, 3, 4, 6 and 24 hours after challenge
  - Body temperature
  - Feed intake
  - Immune response (3 cytokines)



Pilot study LPS challenge: results

Feed intake & Body temperature





- LPS response very fast
  - Effect on feed intake
  - Transient effect on body temperature

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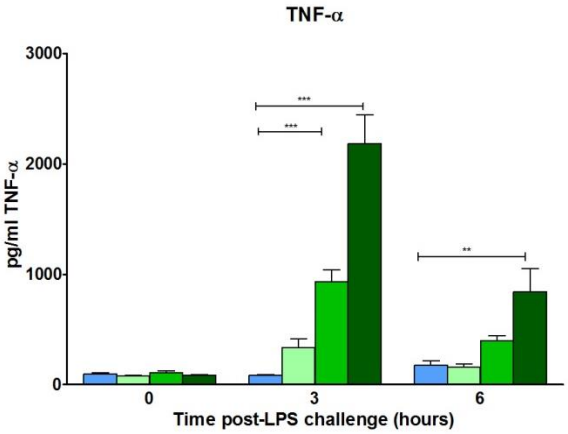
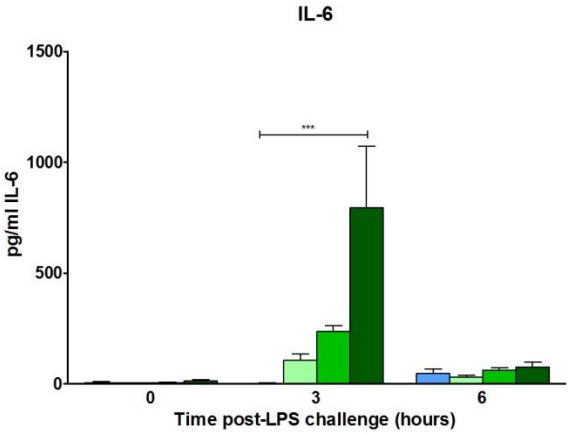
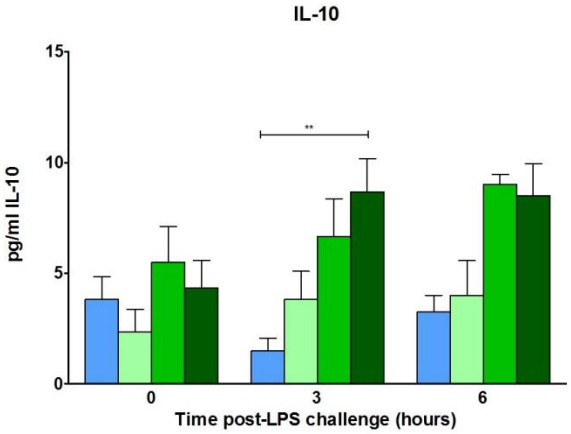
Pilot study LPS challenge: results

Immune parameters





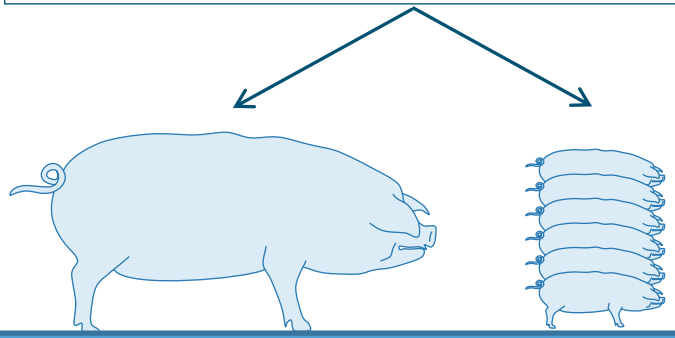


- Colour of bars represent LPS dose
- Fast dose dependent response on TNF-α and IL-6 expression in blood
- Very weak IL-10 response

Maternal and pre-weaning feed intervention

Effect on LPS challenge - schematic

Treatments:
Control
Medium Chain Fatty Acids (C10 / C12)
Beta-glucans - Macrogard®
Galacto-ologosaccharides – Vivinal®GOS



(predictive) correlation

Parameters
Immune Competence

LPS-Challenge

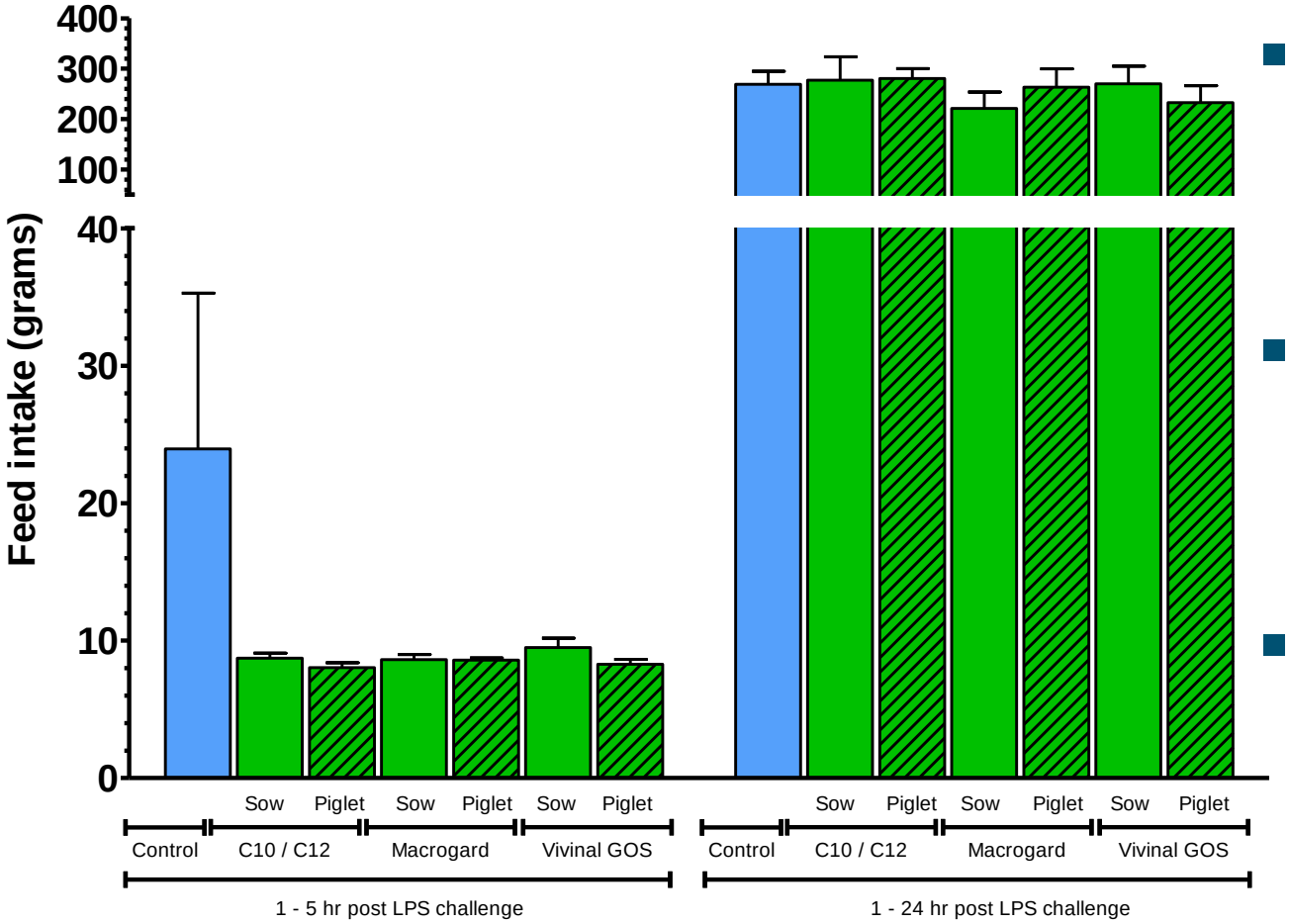
Quantitative disease phenotype

Sow intervention or Piglet intervention

Parameters:
Feed Intake
Body temperature
Immune parameters
@ 0, 2, 4, 24 hours post-LPS challenge

Feed intervention & LPS challenge

Feed intake & temperature



- No significant differences in temperature due to treatment
- Transient large effect on feed intake due to LPS challenge
- No significant difference in feed intake between treatment groups

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Feed intervention & LPS challenge

Cytokine expression (1)

Cytokine	Time (hr)	Interaction Treatment * sex	Treatment	Sex
IL-1-β	0	NS	0.02323	NS
IL-1-β	2	NS	NS	NS
IL-1-β	4	NS	NS	NS
TNF-α	0	NS	NS	0.03991
TNF-α	2	NS	NS	NS
TNF-α	4	NS	NS	NS
IL-6	0	NS	NS	NS
IL-6	2	NS	NS	NS
IL-6	4	NS	NS	NS

- In general, no differences in cytokine expression due to feed interventions
- Two significant differences in cytokine responses
  - Effect on IL-1-β expression in orally fed piglets
  - Sex effect on TNF-α expression

Conclusion / discussion

- LPS challenge is a good quantifiable immunological challenge in young piglets after weaning
- Dietary interventions hardly affect responses after LPS challenge
    - Oral administration of nutritional intervention increases basal IL-1β expression; probably stress induced
    - Basal TNF-α expression differs between boars and sows
- LPS challenge is a systemic challenge
- Mucosal challenge maybe more suitable for defining the intestinal immune competence after dietary (mucosal) interventions

Central Veterinary Institute

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