A lipopolysaccharide challenge in young piglets to quantify immune competence

Effect of dietary interventions on systemic immune competence


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Feed4Foodure

CENTRAL VETERINARY INSTITUTE
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Session 7: Nutritional and management strategies in animal disease prevention
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?

Diagram:

- Feed
  - Interaction between feed – microbiota - intestine
    - Microbial fermentation
    - Effect on biological processes intestinal mucosa
      - Digestion Nutrient absorption
      - Mucosal / systemic immune competence
        - Intestinal functionality Adequate immune response
          - Robustness Performance
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)
LPS response very fast
- Effect on feed intake
- Transient effect on body temperature
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

Sow intervention or Piglet intervention

**Parameters:**
Immune Competence

**(predictive) correlation**

LPS Challenge
Quantitative disease phenotype

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
Feed intervention & LPS challenge

Cytokine expression (1)

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- 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
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