Pathogen specific response of the bovine mammary gland to lipopolysaccharide from E. coli and lipoteichoic acid from S. aureus

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Introduction

- Mastitis – common disease, economic losses
- Pathogens
- E. coli and S. aureus
- gram-positive, gram-negative
- Endotoxins
Immune response of the bovine mammary gland towards cell wall components of different pathogens

- LTA from S. aureus
- LPS from E. coli
LTA vs. LPS

- **LTA** (Lipoteichoic acid):
  - in Gram-positive bacteria like *S. aureus*
  - component of the capsule (murein capsule)
  - *S. aureus* causes subclinical mastitis

- **LPS** (Lipopolysaccharide):
  - in Gram-negative bacteria like *E. coli*
  - component of the outer membrane
  - *E. coli* causes mainly clinical mastitis
Experimental design

Challenge with LPS or LTA

Mammary tissue

Sampling at 0, 6, and 12 h

Milk

SCC

RT-qPCR: mRNA of TNFα, IL-1β, IL-8, Lf

TNFα by RIA

LDH by enzymatic test

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Parameters

**Milk cells: SCC (Somatic Cell Count)**
- first line of defense in the udder
- migration into the udder during infection

**TNFα: Tumor Necrosis Factor α**
- pro-inflammatory cytokine
- recruitment of leukocytes
- stimulating the production of secondary mediators

**LDH: Lactate Dehydrogenase**
- secreted during an inflammatory process by leukocytes
  and damaged cells of the udder’s epithelial and interstitial cells
Immune Factors

**IL-1β: Interleukin-1β**
- pro-inflammatory cytokine
- many effects similar to those of TNFα
- mediates local and systemic inflammatory response

**IL-8: Interleukin-8**
- chemokine
- recruits neutrophils
- induced by exogenous and endogenous pro-inflammatory stimuli

**Lf: Lactoferrin**
- bactericidal glycoprotein with various properties
- secreted by mammary epithelial cells and milk cells
Results
**Milk: Somatic Cell Count**

- LTA 10µg (n=8)
- LPS 0.2µg (n=8)
- Control (n=16)

* Means differ significantly (p<0.05) to time 0 h

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**Milk: TNFα and LDH**

- **LTA 10µg (n=8)**
- **LPS 0.2µg (n=8)**
- **Control (n=16)**

* Means differ significantly (p<0.05) to time 0 h

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Mammary tissue: TNFα

- **LTA 10µg (n=8)**
- **LPS 10µg (n=5)**
- **Control (n=13)**

* Means differ significantly (*p*≤0.05) to time 0 h
Mammary tissue: IL-1β

LTA 10µg (n=8)
LPS 10µg (n=5)
Control (n=13)

* Means differ significantly (p<0.05) to time 0 h

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Mammary tissue: IL-8

* Means differ significantly (p ≤ 0.05) to time 0 h

LTA 10µg (n=8)
LPS 10µg (n=5)
Control (n=13)

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Mammary tissue: Lactoferrin

LTA 10µg (n=8)
LPS 10µg (n=5)
Control (n=13)

* Means differ significantly (p≤0.05) to time 0 h

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• LPS induced a stronger response of the measured factors than LTA despite similar SCC response.

• The present results are consistent with earlier investigations which showed a reduced and slower reaction of TNFα and IL-8 towards bacterial infection with S. aureus than with E. coli.
Thanks for your attention!

Questions?