Vitamin D Signaling in the Bovine Immune System

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Vitamin D Endocrine System

Vitamin D: Beyond Calcium Homeostasis

- Vitamin D has been implicated in a number of diseases
  - Tuberculosis
  - Autoimmune disorders (Multiple Sclerosis, Inflammatory Bowel Disease)
  - Cancer (Prostate, Colon, Breast)

- Vitamin D signaling in the immune system is distinct from the endocrine system
  - extra-renal 1,25(OH)2D3 synthesis
  - Not regulated by Ca2+ homeostasis

1α-OHase Gene Expression during Mastitis

- Three cows infected with Streptococcus uberis
- Tissue samples from three locations of the control and infected quarters

1α-OHase Gene Expression in Monocytes

- Toll-like receptors (TLR) recognize pathogen associated molecular patterns
- TLRs activate innate immune responses

1α-OHase Gene Expression in Milk Cells

- 4 cows infected with Streptococcus uberis
- Somatic cells (immune cells) isolated from milk

1α-OHase is expressed in mammary tissue during mastitis

1α-OHase is expressed in monocytes during mastitis
Summary

- Monocytes produce 1,25(OH)₂D₃ when activated
- What effect does 1,25(OH)₂D₃ have on immune responses?

Effect of 1,25(OH)₂D₃ on Monocyte Gene Expression

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Implications for Cattle Producers

- Current nutritional requirements
  - 25K IU/day for lactating cow
  - 20-50 ng/mL 25(OH)D₃
  - Based on endocrine system
- Optimal immune function
  - < 30 ng/mL is insufficient
  - More work needed
- Rising cost of vitamin D

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