Exposure to bacterial toxin in utero alters pre-weaning growth performance, and metabolic and immune response of calves

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Introduction

- In other species (rats, birds), immune challenge of the dam during gestation improves immune response in offspring
  - No data in livestock species
Methods

- Pregnant crossbred cows (n = 50) were randomly assigned to 1 of 2 treatments based on expected calving date
  - Saline administered subcutaneously (CONTROL)
  - 0.1 μg/kg BW of bacterial toxin administered subcutaneously (Bacteria)

- Cows were administered Bacteria or saline in late gestation

- Cows were managed as a single herd on bahiagrass pasture until weaning
Methods

- 12 heifer calves from each treatment were challenged with same bacterial toxin following weaning

- Blood samples were collected to determine changes in metabolic and immune parameters
Results
Cow Vaginal Temperature

Baseline (covariate) – $P = 0.01$
Treatment – $P = 0.01$
Time – $P = 0.01$
Treatment x Time – $P = 0.01$
Calf Birth Weight

- Birth weight, lb
- Control vs. Bacteria
- Steers: 77.7 lb vs. 70.0 lb
- Heifers: 70.0 lb

Statistical Analysis:
- Treatment: $P = 0.18$
- Gender: $P = 0.03$
- Treatment x Gender: $P = 0.24$
Calf Average Daily Gain

<table>
<thead>
<tr>
<th>Control</th>
<th>Bacteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.82</td>
<td>1.94</td>
</tr>
</tbody>
</table>

- Treatment $- P = 0.02$
- Gender $- P = 0.04$
- Treatment x Gender $- P = 0.28$

- Steers: 1.94 lb/d
- Heifers: 1.82 lb/d
205-d Weaning Weight

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Bacteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steers</td>
<td>444.3</td>
<td>474.3</td>
</tr>
<tr>
<td>Heifers</td>
<td>443.8</td>
<td>474.7</td>
</tr>
</tbody>
</table>

Treatment – $P = 0.02$
Gender – $P = 0.02$
Treatment x Gender – $P = 0.20$
BACTERIAL TOXIN CHALLENGE OF HEIFER CALVES
Heifer Vaginal Temperature

- **Baseline (covariate)** – $P = 0.01$
- **Treatment** – $P = 0.31$
- **Time** – $P = 0.01$
- **Treatment x Time** – $P = 0.01$

Lancaster et al., 2014
Immune Response

- Blood parameters related to inflammatory response were not different between treatments.
Metabolic Response

- Glucose, mg/dL vs. Time Relative to Bacteria Challenge, h
  - Control
  - Bacteria

- Urea N, mg/dL vs. Time Relative to Bacteria Challenge, h
  - Control
  - Bacteria

Legend:
- Treatment – *P* = 0.01
- Time – *P* = 0.01
- Treatment x Time – *P* = 0.04

*P* < 0.05 at that time point
Summary

• Birth weight was not affected, but administration of bacteria toxin during late gestation increased weaning weight 30 lb.

• Immune response of heifers was altered by prenatal exposure to bacteria toxin such that heifers may develop acquired immunity more effectively.

• Metabolic response of heifers was altered by prenatal exposure to bacteria toxin such that heifers mobilized more nutrients to fight the pathogen.
Disclaimer

• Bacteria injection of pregnant cows can cause abortion

• Much more needs to be learned before this can be utilized in the beef industry

• It is not recommended that producers administered bacteria toxins to pregnant cows at this time
Questions