Calf Research Updates

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Feedstuffs with Biologically Active Proteins

- Milk
- Colostrum
- Whey Protein Concentrates/Isolates
- Plasma or serum
- Other animal-derived feedstuffs
  - Fish meal
  - Meat and bone meal
- Fermented animal-based products
  - Yeast
  - Lactobacillus organisms
- Soy products

Production of Bioactive Peptides From Biologically-Inactive Proteins

- Peptides produced from intact inactive proteins by incomplete digestion via proteases in stomach and duodenum or via microbial proteases in rumen or during feed processing (fermentation)
- Many of these biologically active peptides (typically 2-4 amino acid residues) are stable from further digestion
  - Some peptides bind to specific epithelial receptors in intestinal lumen and induce physiological reactions
  - Some peptides are absorbed intact by a specific peptide transporter system into the circulatory system and transported to target organs

Adding Bioactive Peptides to Colostrum Replacers

Objective

To characterize the absorption of a colostrum supplement or replacer containing a fraction of bovine plasma with elevated concentrations of IGF-1 and TGF-8

Experimental Procedure

- Holstein bull calves (n=40)
- Treatment groups
  - Pooled colostrum (MC): 1.9 L of pooled colostrum at 1 and 8 h of age
  - Low concentration (LC): 1.9 L of CS at 1 and 8 h of age
  - Low concentration with 5% GF (LG): 1.9 L of CS + GF at 1 and 8 h of age
  - High concentration (HC): 1.9 L of CR at 1 h and 1.9 L MR at 8 h of age
  - High concentration with 5% GF (HG): 1.9 L of CR + GF at 1 h and 1.9 L of MR at 8 h of age
Xylose Absorption

- Treatments HC, HG, and MC (n=15)
  - 2 d of age
- Oral xylose solution (0.5 g d-xylose/kg BW)
  - Administered approximately 4 h after morning meal
- Jugular blood samples obtained at 0 h and 2 h post xylose ingestion
- Xylose concentration determined by spectrophotometric assay

Change in IgG from 0-24 h

<table>
<thead>
<tr>
<th>Treatment</th>
<th>IgG (g/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HC</td>
<td>10</td>
</tr>
<tr>
<td>HG</td>
<td>12</td>
</tr>
<tr>
<td>LG</td>
<td>8</td>
</tr>
<tr>
<td>MC</td>
<td>14</td>
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</table>

Apparent Efficiency of Absorption

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>HC</td>
<td>35</td>
</tr>
<tr>
<td>HG</td>
<td>30</td>
</tr>
<tr>
<td>LG</td>
<td>25</td>
</tr>
<tr>
<td>MC</td>
<td>40</td>
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Xylose Absorption

<table>
<thead>
<tr>
<th>Treatment</th>
<th>mg/dl</th>
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<tbody>
<tr>
<td>HC</td>
<td>70</td>
</tr>
<tr>
<td>HG</td>
<td>60</td>
</tr>
<tr>
<td>LG</td>
<td>50</td>
</tr>
<tr>
<td>MC</td>
<td>75</td>
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Fermented Soy Products in Calf Starter

- 80 calves
  - 40 with conventional textured calf starter
  - 40 with fermented soy product replacing soybean meal
- Parameters of interest:
  - Feed efficiency
  - Age at weaning (1.5 lbs. per day for 3 consecutive days)
  - Immune system development

Immunological Development

- T-cells
  - CD4+ cells
  - CD8+ cells
- B-cells
  - Memory cells
- Non-specific mitogen-induced lymphocyte proliferation
  - Two levels of concanavalin A (Con A)
  - Two levels of lipopolysaccharide (LPS) with and without cortisol
- Complete differential cell counts
Weekly Calf Weights

Practical Feeding Strategies
- Bowls vs. buckets
  - Feed efficiency
  - Age at weaning

Weaning Age by Feeder Type (Healthy Calves Only)
- Dark buckets - 24.7 days
- Light-colored bowls - 25.7 days
- Blue bowls - 21.0 days
- Dark bowls - 19.5 days

Suckling Aggressiveness
- Brown Swiss vs. Holstein and aggressive sucklers vs. calves that fail to suckle
  - Factors affecting hunger
    - Ghrelin
    - Leptin
    - Free fatty acids
    - Glucose
  - Measured at birth, pre-suckling, 5- and 10-minutes into suckling

RESULTS and FOLLOW-UP STUDY
- No differences in ghrelin or leptin at any time
- Glucose was higher and NEFA's lower in pre-suckling samples for calves that failed to suckle as compared to those that aggressively suckled
  - Breed differences apparent as well
- Manipulating calf appetite with insulin or glucose at birth was not 100% effective in inducing either hunger or satiety

Colostrum Replacers
- Different formulations
  - Absorption efficiency
- Different irradiation techniques
  - Absorption efficiency
Effect of Irradiation on Absorption Efficiency of Ig from Colostrum Replacer

<table>
<thead>
<tr>
<th>Treatment</th>
<th>MC</th>
<th>120 L</th>
<th>130 L</th>
<th>130 H</th>
<th>140 L</th>
<th>150 L</th>
<th>SEM</th>
<th>t</th>
<th>0.05</th>
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<tbody>
<tr>
<td>Birth BW, kg</td>
<td>30.3</td>
<td>31.3</td>
<td>31.6</td>
<td>30.6</td>
<td>30.3</td>
<td>32.5</td>
<td>0.27</td>
<td>0.29</td>
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<td>IgG intake, g</td>
<td>33.8</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
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<tr>
<td>Serum IgG, g/L</td>
<td>0 h</td>
<td>0.16</td>
<td>0.16</td>
<td>0.16</td>
<td>0.16</td>
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<tr>
<td>24 h</td>
<td>4.51</td>
<td>4.51</td>
<td>4.51</td>
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<td>4.51</td>
<td>0.01</td>
<td>0.01</td>
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<tr>
<td>Change 0 to 24 h</td>
<td>4.36</td>
<td>4.36</td>
<td>4.36</td>
<td>4.36</td>
<td>4.36</td>
<td>4.36</td>
<td>0.0</td>
<td>0.0</td>
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</tr>
<tr>
<td>Serum total protein, g/L</td>
<td>0 h</td>
<td>3.8</td>
<td>3.8</td>
<td>3.8</td>
<td>3.8</td>
<td>3.8</td>
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<td>0.0</td>
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<tr>
<td>24 h</td>
<td>3.79</td>
<td>3.79</td>
<td>3.79</td>
<td>3.79</td>
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<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Change 0 to 24 h</td>
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<td>0.01</td>
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FUTURE PROJECTS

- Neutrophil function
  - First line of defense for newborns
- Bioactive peptides
  - Fermented soy products
  - Colostrum replacers
- Practical management issues
  - Feeding approaches
  - Ventilation and drainage and air quality
  - Effects on performance and immunity

Summary

- Low dose irradiation (3-7 kGy) did not reduce AEA of IgG enough to increase the incidence of FPT in calves fed 130 g of IgG
- A higher level (15-20 kGy) of irradiation reduced 24 h serum IgG, serum protein, and AEA of IgG and increased the incidence of FPT
- Increasing mass of IgG fed to calves linearly increased 24 h serum IgG, serum total protein, and decreased AEA of IgG

Predictive Measures of Fetal Distress in Calves During Delivery

- 58 calves (Holstein, Jersey, and Holstein x Jersey) were monitored during parturition
- Duration of calving was noted as the first appearance of hooves until umbilical cord rupture
- Tongue parameters were measured approximately every 2 min from time the tongue was visible until cord rupture

Feeder Height and Feed Efficiency

- Mature cows fed near ground level produce more saliva and are more feed efficient
- Calf feeding issue?
  - Ave. wither heights at birth:
    - Holstein – 30 inches
    - Jersey – 24 inches

Materials and Methods

- 58 calves (Holstein, Jersey, and Holstein x Jersey) were monitored during parturition
- Duration of calving was noted as the first appearance of hooves until umbilical cord rupture
- Tongue parameters were measured approximately every 2 min from time the tongue was visible until cord rupture
Oxygen Tension is Related to Tongue Color

**Distribution of final tongue length of calves across calving ease**

(least squares means ± standard error of the mean)

**Distribution of the final tongue reflex of calves across calving ease**

(least squares means ± standard error of the mean)