Dietary Strategies to Reduce Hypocalcemia

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Presented at the Fond du Lac County Forage Council’s 2014 Dairy-Forage Day
Friday, December 12, 2014

The Transition Period
- Most critical time in the life of a dairy cow
- Metabolism is in severe stress
- High nutrient demand to meet requirements for milk production
- Most susceptible to some diseases and metabolic disorders
  - Milk fever
  - Retained placenta
  - Displaced abomasum
  - Mastitis

Transition Period Goals
- High milk production
- Low incidence of metabolic disorders
- Minimum loss of immunological capacity
- Controlling or decreasing days to first ovulation
- Maintaining or enhancing fertility
- Low stillborn rate
- Healthy calves

Demand for Calcium

Calcium Demand Around Calving
- Start of Lactation Challenges
  - Colostrum and milk are very high in Ca
  - Cows must draw on bone Ca to survive
  - Negative Ca balance continues for first 2 months of lactation
- Failing to adapt:
  - 5% clinical milk fever
  - 47% subclinical milk fever in 2nd and greater lactations
  - Blood calcium ≤ 8 mg/dL
  - New cutpoint ≤ 8.5 mg/dL from calcium

The Start of Each New Lactation...
Prevalence of Milk Fever
- Jersey and Guernsey breeds are more susceptible
- Rarely occur in first calf heifers
- Incidences (Reinhardt, et al., National Animal Disease Center)
  - First Lactation 1%
  - 2nd Lactation 4%
  - 3rd Lactation 7%
  - 4th Lactation 10%
  - Total herd incidence 5%

Role of Calcium
- Skeleton tissue
- Smooth muscle
- Nerve function
- Immune function

Defining the Disease
- Hypocalcemia
  - Decline in calcium to which there is a loss of homeostatic function
  - Blood calcium typically below 5.0 mg/dL
  - Clinical signs:
    - Staggering
    - Cold ears
    - Lying in head tuck position
  - Categorized by symptoms
    - Stage 1: Early signs of milk fever without going down
    - Stage 2: Cows that are down but not flat on her side
    - Stage 3: Cows lying flat and severely depressed

What you don't see...
- Subclinical:
  - Not detectable or producing effects that are not detectable

Defining the Disease
- Subclinical hypocalcaemia
  - Low blood calcium concentrations without clinical signs of milk fever
  - Blood serum calcium level of less than 8.5 mg/dL 12 to 24 hours post-partum

Cascading Effect of Hypocalcemia
- Hypocalcemia
  - Clinical or Subclinical
  - Skeletal Muscle Function
  - Smooth muscle function
  - Abomasal motility
  - Displaced abomasum
  - Ketosis
  - Dry matter intake
  - Injury
  - Milk Production

Source: Gary Oetzel
Implications of Subclinical Hypocalcemia

- Result in lower milk production, poor reproductive performance, decreased responsiveness of the immune system
- Increased risk for:
  - Developing uterine prolapse
  - Retained placenta
  - Metritis (3.2 x)
  - Displaced abomasum
  - Ketosis (1.0 vs 0.7 mmol/L increased BHBA)
  - Longer median days open (123 vs 109 days)
- Affects nearly 50% of second and later lactation dairy cattle fed typical pre-fresh diets (Goff, 2008)
- If anions are used, percentage of hypocalcemia cows is reduced to about 15-25% (Getzel, 2004)

More Costly Than Clinical Milk Fever...

- Clinical Cases:
  - Herd size: 2,000 cows
  - Annual incidence of clinical milk fever: 2%
  - Cost per case: $300
  - Total cost: $12,000 per year

- Subclinical Cases:
  - Higher percentage of cows in herd
  - Herd size: 2,000 cows
  - Annual incidence of subclinical milk fever: 30%
  - Cost per case: $125
  - Total cost to producer: $48,750 per year

Current Preventative Practices

- Anionic salts in close-up dry cow feed
- 26.7% of operations
- 44.5 % of cows in US
- Limited potassium in dry cow ration
- 46.9% of operations
- 62.8% of cows in US

Minimizing Hypocalcemia

- Nutritional means of prevention
  - Low calcium diets pre-fresh (dietary Ca restriction)
  - Low potassium forages/diets pre-fresh
  - Feeding anionic salts for 21+ days pre-fresh (dietary acidification)
  - Supplemental dietary Mg
- Individual cow treatments;
  - Oral supplementation
  - Intravenous preparations

Dietary Calcium Restriction

- Require very low calcium intake to work best
  - <20 g/day
- Activates the Ca homeostatic mechanisms
  - PTH is increased prior to calving
- Must avoid pre-partum alfalfa
  - Utilize grass hay with additional corn silage

Dietary Acidification

- More important controlling milk fever than calcium intake
- Lowering pre-fresh DCAD by 300 mEq/kg (136 mEq/lb) results in:
  - 5.1 x reduction in clinical milk fever
  - Decrease dry matter intake by 11.3%
  - Decrease urinary pH from 8.1 to 7.0
**Dietary Magnesium**

- Magnesium plays an important role in maintaining calcium homeostasis.
- Higher pre-fresh dietary Mg lowers risk.
- Mg is needed for parathyroid hormone release.
- Mg is needed to synthesize active Vitamin D.
- Suggest 0.30 to 0.45% Mg in diet dry matter.
- ~40 to 50 grams of Mg per day.


**Treatment of Hypocalcemia**

**Stage 2 and Stage 3**

- Intravenous calcium.
- Do not give oral administration to down cow.
- To reduce risk of relapse:
  - Additional oral calcium once alert and able to swallow.
  - 2nd oral supplementation approximately 12 hours later.

**Source:** Thilsing Hansen, et al., 2002; Oetzel, 2011.

**Treatment of Hypocalcemia**

**Stage 1**

- Oral administration.
- Best approach for standing cows with hypocalcemia.
- Do not give IV Ca to standing cows.
- Cows absorb oral Ca rapidly and sustain blood levels for 4 to 6 hours, peak levels within 30 minutes.

**Effect of IV Calcium Treatment**

**Strategic Use of Oral Ca Boluses**

- Early stage 1 milk cases:
  - Cold ears, wobbly, tricep tremors, poor GI.
  - One dose now, one does 12 hours later.
- After successful IV treatment of down cows:
  - One dose after cow is up and swallowing, one dose ~12 hours later.
- Off feed early lactation cows.
  - Cover for secondary hypocalcemia.

**Forms of Calcium for Oral Administration:**

- Calcium chloride.
- Calcium propionate.
- Calcium carbonate.
- Boluses of multiple calcium forms.
### Preventative Treatments With Use of Oral Ca Boluses

- Herds with hypocalcemia problems:
  - Clinical cases
  - Jerseys
  - No anionic salts
  - High prevalence of measured hypocalcemia
  - Blanket supplementation 2+ lactation with oral Ca (2 doses)

- Herds without hypocalcemia problems
  - Supplement lame and high previous lactation milk cows with oral Ca (2 doses)

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### Non-Nutritional Factors

- Proper stocking density
- Avoiding excessive pen moves
- Segregating cows and heifers during transition period
- Heat abatement

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### Five Key Principles

- Second-lactation and greater cows have a transient hypocalcemia around calving
- Hypocalcemia is linked to other fresh cow problems
- Supplementation with oral calcium is preferred approach for supporting cows exhibiting early signs of milk fever but still standing
- Subclinical hypocalcemia has greater associated costs to dairy than clinical cases
- Even herds with successful anionic salts programs and minimal cases of milk fever will benefit from strategic use of calcium supplements

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