## Metabolic Disorders

- **True Metabolic disorder**
  - Inherited excess or deficiency of catalyst(s) or enzyme(s)
- **Acquired metabolic disorder**
  - Primarily management- production related and not due to inborn error in metabolism
  - Increased demands for particular nutrient
  - Inability of the animal's metabolic reserve to sustain the particular nutrient at physiological concentrations

# Metabolic Disorders

From Dr. Amin Ahmadzadeh and
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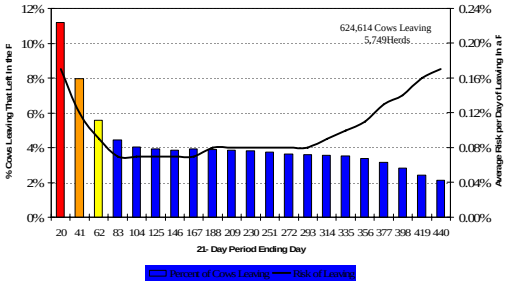
## Acquired Metabolic Disorder

- **Metabolic disorders of early postpartum cows:**
  - Fostered by management practices that are aimed at greater production
  - Related to dry cow (transition cow) management
  - Related to early postpartum period

## When Cows Leave Leave the Herd During a 5-Year Period in MN DHIA (10/96 – 10/01)




**Source:** 2002, Steve Stewart, DVM, Dipl.-ABVP, Univ. of Minnesota, College of Vet. Med.

## Transition Period

- Last 3 wk of gestation through first 3 wk of lactation
  - transition from pregnant and dry to non-pregnant and lactating
- Critical period
  - animal welfare
  - economics
- Much research

## Estimated costs of metabolic disorders

| Disorder | Deaths | Culls | Discarded milk (lbs) | Lost milk (lbs) | Avg. cost per case |
|---|---|---|---|---|---|
| Left DA | 2.0% | 8.0% | 308 | 880 | $312 |
| RP | 1.5% | 6.0% | 330 | 550 | $206 |
| Milk fever | 4.0% | 5.0% | 0 | 286 | $181 |
| Dystocia | 1.0% | 2.2% | 352 | 392 | $161 |
| Ketosis | 0.5% | 5.0% | 0 | 506 | $151 |

C. Guard, Hoards 2003, W-98; NAHMS, 1996; JDS, 1995 78:1693

## Hypocalcemia

- 5.9% of U.S. Cows (NAHMS, 1996)
- Ketosis:23.6x
- 3+dystocia: 7.2x
- Retains: 4x
- Mastitis: 5.4x
- Subclinically present in up to 50-65% of fresh cows

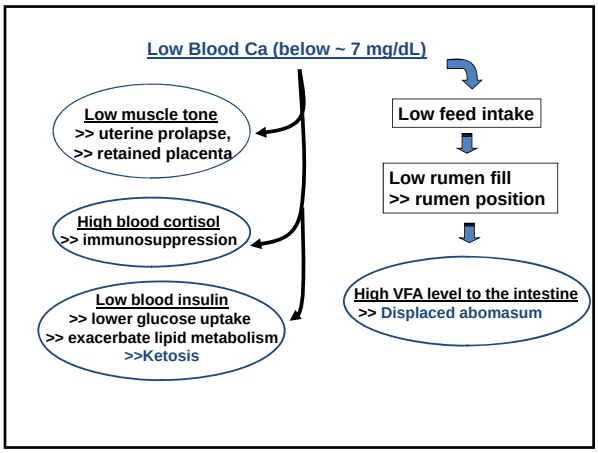
- ↓ Smooth muscle function
  - rumen, abomasum, uterus
- Release of cortisol accompanies (↓ immune function)
- K and Na alkalinize blood and alter Ca

## Milk Fever

- **Etiology:**
  - **Onset of lactation (usually first 72 hr postpartum)**
  - **Low blood $Ca^{2+}$**
    - **Normal:10 mg/dL**
    - **Subclinical: <7 mg/dL**
    - **Milk fever: ~5 mg/dL**
  - **Affects older cows and Jersey breed more often**

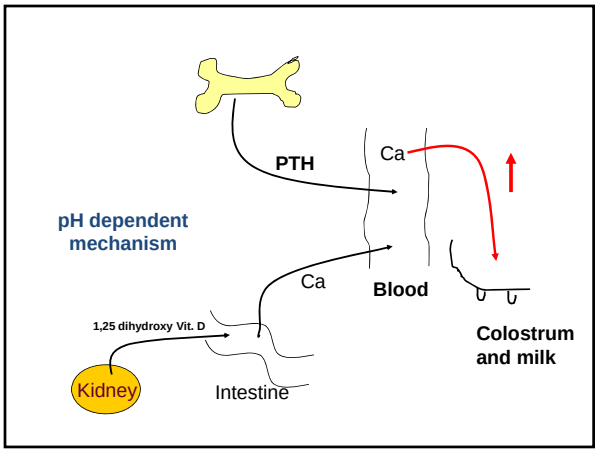
## Milk Fever

- **Clinical symptoms:**
  - **Staggering**
  - **Downer cow unable to rise**
  - **Head displacement to the side**
  - **Anorexia, dry muzzle, cold ears**
  - **Complications: RP, DA, bloat, etc.**
  - **Delayed treatment:**
    - **Slower response to treatment**
    - **Coma and death**




## Treatment of Milk Fever

- Restoration of Ca ASAP
  - Ca gluconate (25%), i.v. 250-500 ml
  - Can be administered s.c. in multiple sites
  - Retreat 8-12 hr later, if needed
  - Combination with dextrose in severe cases
- Cows with previous experience
  - Ca gel orally 1 day before and 1 day after calving
    - risk of aspiration pneumonia
    - labor



blood and urine pH = Δ Dietary cation and Dietary anion
Balance between [+] charges and [-] charges

Major dietary ions that contribute to blood and urine pH are $K^+$, $Na^+$, and $Cl^-$

Dietary K and Na

High [$K^+$] ion in blood

High blood pH

Ca metabolism

PTH malfunction and low blood Ca

Symptoms and problems appear at onset of lactation

But

The problems start during the prepartum period
(dry cow and transition period)

Mainly due too much $K^+$ intake
(cation-anion imbalance)

The problem is less likely due to High $Ca^{2+}$ intake

DCAD (Dietary cation-anion difference) =

$(Na^+ + K^+) - (Cl^- + S^{2-})$

or

$(Na^+ + K^+ + 0.15\ Ca^{2+} + 0.15\ Mg^{2+}) - (Cl^- + 0.6\ S^{2-} + 0.5\ P^{3-})$

## Contributors to the high dietary $K^+$

- Alfalfa and other legumes are high in $K^+$
  - The plant needs about 2% $K^+$
- Common practice:
  - over fertilization
    - To prevent winter kill
    - Increase in herd size thus land application of manure
- Cool season grass (e.g., orchard, blue grass)
  - Also high in $K^+$ compared to 20 years ago (due to land application of manure)

- If legumes and winter grasses are high in K, then what should feed our dry cows?
  - Timothy hay
  - Corn silage
  - Mature alfalfa
  - 2nd and 3rd cut alfalfa

## What can we do?

1) Reduce $K^+$ land application
2) Withhold $K^+$ fertilization from a field that is in its last year of production and use that crop for dry cows?!
3) Use more mature alfalfa (full bloom) and use late cuttings
4) Timothy grass is not a bad option
5) Find low $K^+$ hay source and combine with corn silage (ration with < 2% $K^+$)

## Additional Management Measures

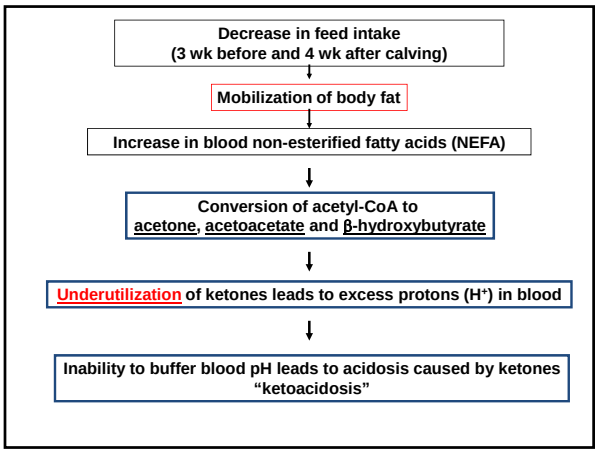
- **Feeding anionic salts (negative DCAD) last 3 wk of gestation**
  - CaCl, ammonium chloride
  - Ca sulfate, ammonium sulfate
    - More palatable, less effective
  - Mg chloride + CaCl (not a bad choice and works)
  - Measure urine pH in close-up cows
    - Should be about 6; 8.0 is BAD
- **Dietary P: set at 0.4 (30-50 g/d)**
  - High P inhibits 1,25 dihydroxy Vitamin D
- **Do not trust K values determined by near infrared analysis**

## Ketosis

- 4.6% of U.S. cows (NAHMS, 1996)
- Energy demand skyrockets and more often than not cannot be met by intake alone
- Mobilization of body reserves ensues

## Ketosis (fresh-cow disease)

- **Etiology:**
  - **Occurs during the first 60 days postpartum**
  - **Ketone bodies accumulate in the body fluid**
  - **Gluconeogenesis becomes impaired, resulting in hypoglycemia**
  - **Affects cows that are over conditioned during dry period**




**acetone, acetoacetate and β-hydroxybutyrate are ketones**

**Clinical signs:**

- Abrupt drop in milk production
- Loss of appetite
- Foul smelling breath
- Constipation
- Lack of coordination
- Weight loss

**Diagnosis:**

- Smell of breath
- Measuring ketone level in urine
  (Ketostix, Chemstrip 9)
- Looking for other problems
  (e.g. mastitis, indigestion, DA, etc)

## Treatment

- Increasing blood sugar
  - 500 mL of 50% Dextrose solution (i.v.)
  - Glucocorticoid injection (Dexamethasone)
  - Oral administration propylene glycol
    - 7-10 days before calving
    - Increase glucose, reduces insulin >> reduces fat mobilization

## Management and Prevention

- **Energy intake must not be compromised before and after calving**
  - **Keep cows on feed!**
- **Be aggressive in treating other fresh-cow diseases (e.g., milk fever, retained placenta, etc.)**
- **Adjusting the diet of close-up cows (3 wk before calving) by increasing appropriate amount of concentrates in the ration.**

**Management and Prevention of Ketosis Cont.**

- **Feeding dry cows for a targeted body condition of 3.5-3.75 on a 5-point scale at calving**
  - **A cow with higher body condition probably has less of an appetite and more metabolic problems**
- **Provide plenty of fresh and palatable high quality feed**
- **Drenching cows with propylene glycol during the last 7-10 days before calving (selective cows?)**

## Displaced Abomasum

- 2.8% of U.S. cows (NAHMS, 1996)
- 53.5x as likely to experience ketosis
- ↓ flow and ↓ muscle contraction allow the abomasum to float
  - chewing activity, ruminal fill, motility, VFA concentrations
- Higher conditioned cows more often due to ↓ intakes prior to calving

## Dystocia

- Over-conditioning increases risk substantially
- Due to:
  - High stress, twins, poor technique, etc.
- 12x as likely to retain placenta
- 4.9x as likely to have metritis
- Most often accompanied by the cascade of fresh problems

## Retained Fetal Membranes & Metritis

- 7.8% of U.S. Cows (NAHMS, 1996)
- 16.4x as likely to have ketosis
- Retains are 5.7x as likely to develop metritis
- Atony of uterus (i.e., $Ca^{2+}$)
- Impaired immune function: ↓ ability to ward off bacteria
- Unsanitary conditions inoculate the uterus

## Acidosis

- Introduction to an energy dense diet will lead to acidosis if not properly adjusted
- Ruminal populations ill-suited to dense rations after ~8 weeks on a dry cow diet
- Gram "-" toxins → ↓ immune function

- **DO NOT YOUR FORGET YOUR DRY COW ESPECIALLY DURING THE 3 WEEKS BEFORE CALVING!!**
- **THEY ARE GOING TO BECOME YOUR LACTATING COWS!!**

## Goals for Metabolic Disorders

| Disorder | Goal |
|---|---|
| Displaced abomasum | 0% |
| RP/metritis | 0% |
| Milk fever ($\geq 2^{nd}$ lactation) | 0% |
| Dystocia | 0% |
| Ketosis | 0% |

## Goals for Metabolic Disorders

| Disorder | Goal |
|---|---|
| Displaced abomasum | 2% |
| RP/metritis | 5% |
| Milk fever ($\geq 2^{nd}$ lactation) | 2.5% |
| Dystocia | 10% |
| Ketosis | 2.5% |