Metabolic Disorders

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- Meeting the energy demand of lactation
- Maintaining normal blood Ca
- Reducing immunosuppresion

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Early Post partum Facts

- **Cows use body reserve in early lactation to support milk production**
- **Fatty acids are used to meet the energy demand, but beyond the capacity of the liver**
- **On average DMI decreases by 20 to 30% the 5 days around calving**
- **→ Energy intake MUST NOT compromised around calving**

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Strategies for Preventing Energy deficit

1. **Close-up cows should have BCS = 3.5 at calving**
   - ✓ **Cows with BCS=3.5 eat better than cow w/ BCS=3.75**
2. **For fat cows decrease NEL to 0.58 and CP to 11% during far-off than put them in close up ration 3 wks before calving**

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Strategies for Preventing Energy deficit

3. **Make sure cows are in close-up ration 24 days before calving (± 9 days variation in calving)**
4. **Increase the starch in the close-up ration to increase glucose production**
   - ✓ **Increase NFC to ~38% (fresh cow diet has ~42-45% NFC)**
   - ✓ **Caution!! High NFC >> low NDF diet >>> risk of DA**

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Strategies for Preventing Energy deficit

- **Adequate effective fiber:**
  - **Forage w/ 1.5" long, maybe adding straw!?**
  - **TMR with ~60% DM**
  - **Alphalpha haylage and fine corn silage are not good**
- **Good ration for close up:**
  - **NDF = Min 33%**
  - **No need for adding fat**
  - **No need to increase CP (can go down to 14%)**

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Fresh Cow ration

- If there is not much problem with production and peak milk, keep the rations similar to lactating cow ration

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Acquired Metabolic Disorder

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

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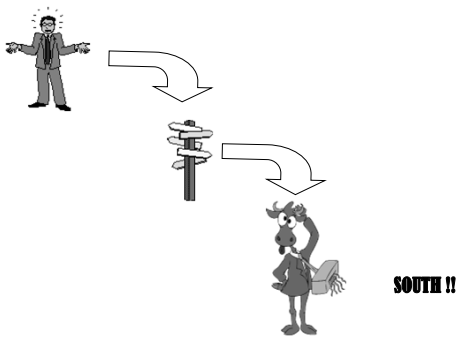

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Milk Fever (MF)

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

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Treatment of MF

- **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 <u>before</u> and I day <u>after</u> calving**
  - **Vit. D or 1,25 dihydroxy vit D, 8 days before calving, s.c.**

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blood and urine pH = Δ Dietary <u>cation</u> and Dietary <u>anion</u>
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

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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

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- 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**

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What can we do?

1) **Reduce K^+ land application**
2) **Withhold K^+ fertilization from a filed 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^+)**

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Additional Mgt. Measures

- **If MF occurs too often**
  - Measure urine pH in close-up cows
  - Should be 6-6.5; 8.0 is BAD
- **Feeding Anionic salts**
  - CaCl, ammonium chloride
  - Ca sulfate, ammonium sulfate
    - More palatable, less effective
  - Mg Chloride + CaCl (not a bad choice and works)
- **Dietary P: set at 0.4 (30-50 g/d)**
  - High P inhibits 1,25 DH Vit.D
- **Do not trust K vales determined by near infrared analysis**

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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

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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

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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**
  - **Highly associated with fatty liver syndrome**
  - **Affects high producing cows and cows that are over conditioned during dry period**

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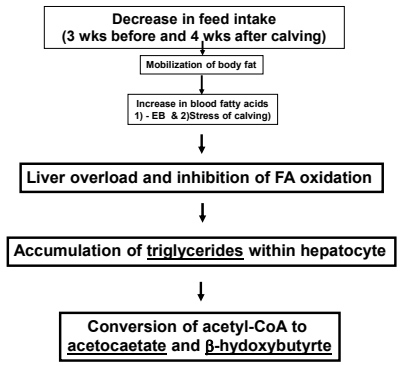

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acetocaetate and β-hydoxybutyrte

are ketones and can be toxic

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)**

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Management and Prevention

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

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Management and Prevention Cont.

- **Feeding dry cows for a targeted body condition of 3.5 on a 5-point scale**
  - **A cow with higher body condition probably has less of an appetite and more metabolic problems**
- **Feed fresh and palatable quality feed**
- **Provide nice, ventilated, clean space for dry cows and make the transition well in advance of calving**
- **Drenching cows with propylene glycol (PG) during the last 7-10 days before calving (selective cows?)**

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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

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DA

- Too much NFC > 43% and not enough effective NDF < 27%
- Too much starch and not enough fiber

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Dystocia

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

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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
- Impaired immune function: ↓ ability to ward off bacteria
- Unsanitary conditions inoculate the uterus

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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

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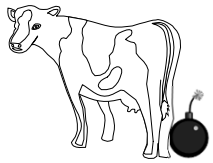
Subclinical Ruminal Acidosis

- Related to misfeeding of carbohydrates
  - Underfeeding of effective fiber
  - Overfeeding/slug feeding rapidly digested carbohydrate
- Ruminal pH < 5.5
- Other factors



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Rumen Buffers Function

- Maintain pH 6.25
- Stimulate DM intake
- Improve rumen environment

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Effects of Acidosis

- Shift rumen microbial population
- Shift rumen VFA pattern
- Slow the rate of feed passage
- Lower feed digestibility, especially fiber

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Rumen Acidosis

- Lack of cud chewing
- Appearance of hoof lines
- Abnormal hoof growth
- Loose manure
- Eating of soil or bedding
- Milk fat depression
- Free choice buffer consumed
- Fat test responses to buffers
- Variable dry matter intake

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Milk Components

- Milk fat <0.4 point below milk protein
- Milk fat 1 full point below herd average

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Buffer Research Results

- 2,087 cows (1975 to 1985)
- Increase of 2.2 lb (3.5% FCM)
- $ 2.30 return per dollar invested

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Recommended Amounts

	Lb/Day
Sodium bicarbonate	0.3 - 0.5
Sodium sesquicarbonate	0.3 - 0.5
Magnesium oxide	0.1 - 0.2
Sodium bentonite	1.0 - 2.0
Calcium carbonate	0.2 - 0.4
Potassium carbonate	0.5 - 0.8

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Strategies with Buffers

- Add 0.75% ration DM
- Conditions that favor response
  - Ration ADF < 19%
  - Ration NDF < 28%
  - eNDF < 20%
  - Over 6 lb of grain per meal
  - Over 2% BW as concentrates
- Monitor dry matter intake

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Disease	Definition	Herd Alarm	Cost/case
Ketosis	Decreased appetite, elevated milk, urine, and blood ketones in the absence of other disease (BHBA > 1.2 mmol/L)	15%	$289
Fatty Liver	Accumulation of fat within the cow's liver without any pathognomonic signs. Only diagnosed by liver biopsy.	50%	>$150
Milk Fever	Calcium deficiency causing progressive neuromuscular dysfunction with flaccid paralysis, circulatory collapse, and depression of consciousness	5%	$246
LDA	Decreased appetite accompanied by a high-pitched tympanic resonance by percussion of the left abdominal wall.	3%	$700
Retained Placenta	Fetal membrane visible at vulva or in vagina or uterus by vaginal examination for more than 24h after parturition	5%	$232
Metritis	Abnormal cervical, vaginal, or uterine discharge.	10%	$218
Mastitis	Visually abnormal milk from one or more quarters with or without signs of inflammation of the udder.	3%	$376

Adapted from: Melendez and Risco (2005), McArt et al. (2015), Liang et al. (2017), Caixeta et al. (2017)

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Fresh Cow Problems

Health event	Goal	Intervention	cost
DA	<3%	> 4%	$500
Milk fever	<2%	>5%	$300
Retained placenta	<5%	>8%	$250
Metritis	<5%	>8%	$200
Ketosis	5%	>10%	$220
Acidosis	None		??

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Check list for monitoring factors associated with the occurrence of transition period diseases

- Assess cow comfort
  - Appropriate stocking density
  - Bunk space
  - Access to water
  - Stall design
  - Comfortable and sanitary bedding material
  - Heat abatement
- Manage early lactation cows in "fresh cow pens"
- Routine comprehensive total mixed ration audits
  - Particle length
  - Consistency of the delivered diet
  - Feeding routine
  - Bunk management
- "Test-and-Treat" strategy to monitor hyperketonemia on fresh cows
- Use of anionic salts during the dry period to minimize the occurrence of hypocalcemia and assess urine pH on close up cows
- Use of automated health-monitoring systems for early diagnosis of diseases

Adapted from Caixeta et al., 2017

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