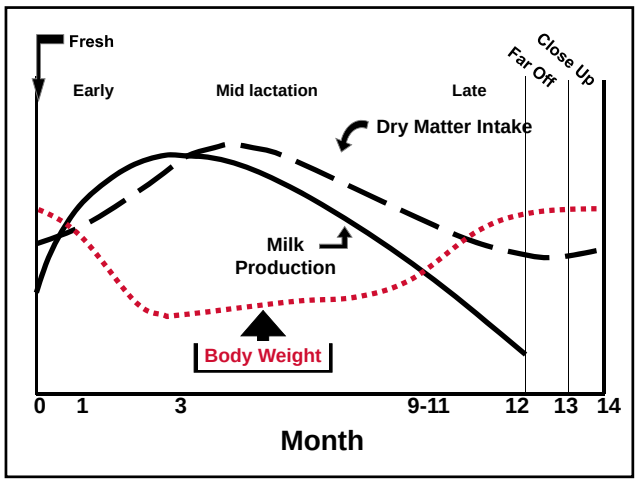
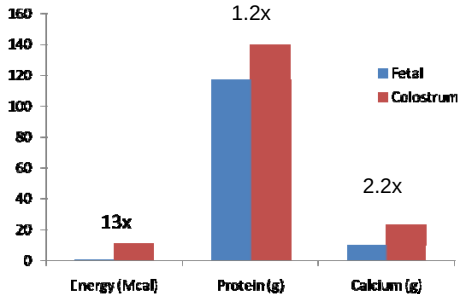
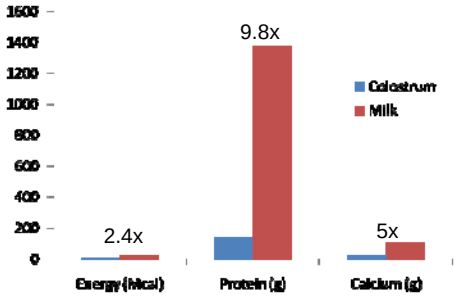


Extra nutrients: pregnancy to colostrum



Daily fetal demands end of gestation vs colostrum of

Extra nutrients: colostrum to milk



Colostrum production vs milk production on day 4

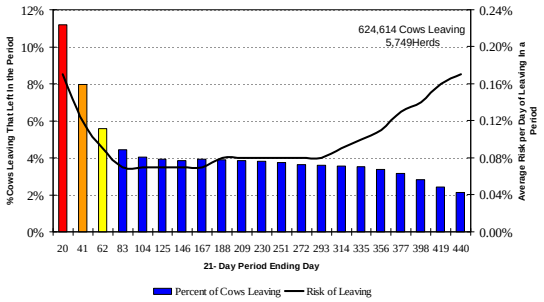
Metabolic Disorders

- **True Metabolic disorder**
  - **Inherited excess or deficiency of catalyst(s) or enzyme(s)**
  - **dUMPs (deficiency of uridine-5'-monophosphate synthase)**
- **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**

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

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.

Hypocalcemia (Milk Fever)

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

Curtis et al., 1985 J Dairy Sci
Gröhn et al., 1989 J Dairy Sci

Milk Fever

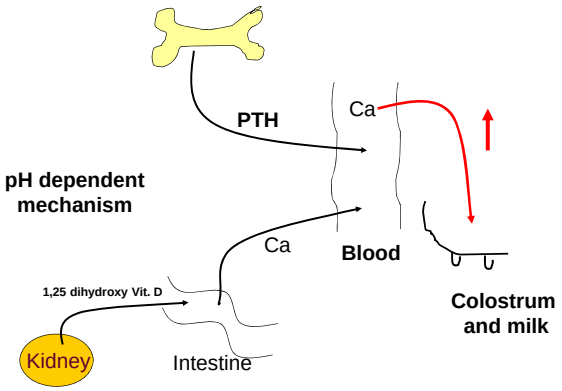
- **Etiology:**
  - **Onset of lactation (usually first 72 hr postpartum)**
  - **Low blood Ca^{2+}**
    - **Normal: 10 mg/dL**
    - **Subclinical: <7 mg/dL**
    - **Milk fever: <6 mg/dL**
  - **Affects older cows and Jersey breed more often**

Milk Fever

- **Clinical symptoms:** Low Blood Ca (below ~ 7 mg/dL)
  - Staggering
  - Downer cow unable to rise
  - Head displacement to the side
  - Anorexia, dry muzzle, cold ears
  - Complications: retained placenta, displaced abomasum, bloat, etc.
  - Delayed treatment:
    - Slower response to treatment
    - Coma and death

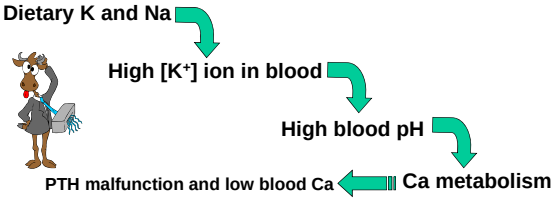
Treatment of Milk Fever

- 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^-



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

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

- 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**
  - **Consider anionic salts**

Additional Management Measures

- **Feeding anionic salts (negative DCAD) last 3 wk of gestation (close-up ration)**
  - **CaCl,**
  - **Ca sulfate (More palatable, less effective)**
  - **Mg chloride + CaCl (not a bad choice and works)**
  - **Measure urine pH in close-up cows (method to measure effective dose of anionic salts)**
    - **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

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**

Decrease in feed intake
(3 wk before and 4 wk after calving)

↓

Mobilization of body fat

↓

Increase in blood non-esterified fatty acids (NEFA)

↓

Conversion of acetyl-CoA to acetone, acetoacetate and β-hydroxybutyrate

↓

Underutilization of ketones leads to excess protons (H^+) in blood

↓

Inability to buffer blood pH leads to acidosis caused by ketones "ketoacidosis"

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

- Increase blood sugar
  - 500 mL of 50% Dextrose solution (i.v.)
  - Others
    - Glucocorticoid injection (Dexamethasone)
    - Oral administration propylene glycol
      - 7-10 days before calving
      - Increases glucose, 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.

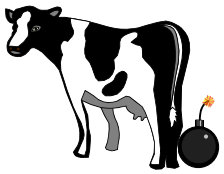
- **Feeding dry cows for a targeted body condition of 3.5 on a 5-point scale at calving**
  - **A cow with higher body condition probably has less of an appetite and more metabolic problems**
- **Provide plenty of fresh and palatable high quality feed**
- **Drenching cows with propylene glycol during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

Rumen 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
- Poor rumen function
- Hoof and leg issues (laminitis)
- Milk fat depression

Subclinical Ruminal Acidosis

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



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

Rumen Buffers Function

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

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
- Over-conditioning ↑ risk substantially
- Higher conditioned cows more often due to ↓ intakes prior to and after calving

Dystocia

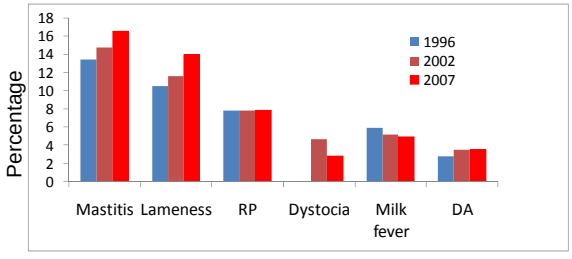
- Over-conditioning increases risk substantially
- Due to:
  - High stress, twins, poor technique, etc.
- 12x as likely to retain placenta
- 4.9x as likely to have metritis
- Most often accompanied by the cascade of fresh problems

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

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

Change in health problems 1996 to 2007



National Animal Health Monitoring Survey (NAHMS) 1996, 2002, 2007

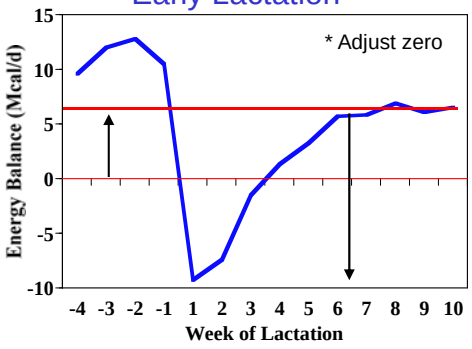
Fresh Cow Problems

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

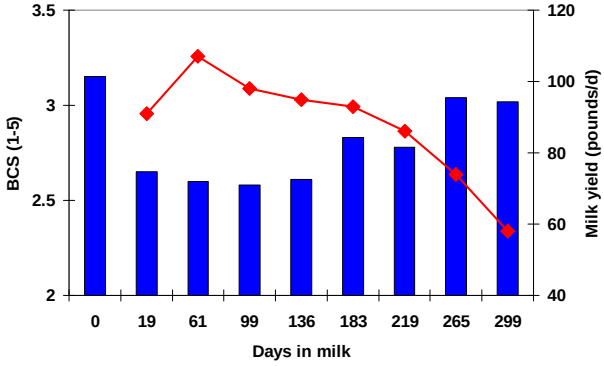
Is energy balance important?

- Thought to affect reproductive program, herd health program and response to bST
- Negative energy balance associated with:
  - Peripartum disorders
  - Immunosuppression
  - Increased times to first ovulation

Energy Balance of Cows During Early Lactation



Commercial Herd in Washington



Theurer and McGuire, unpublished

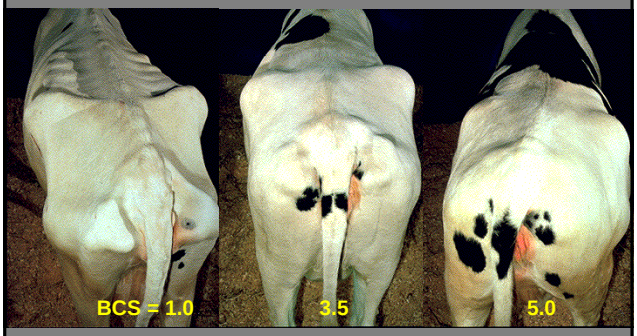
Simple Correlations Between Variables

	DMI	Milk yield	NEFA	BCS
EB	0.751 *<.0001*	0.051 *0.37*	-0.582 *<.0001*	-0.136 *0.017*
DMI		0.511 *<.0001*	-0.471 *<.0001*	-0.148 *0.009*
Milk yield			-0.297 *<.0001*	-0.327 *<.0001*
NEFA				0.258 *<.0001*

Negative Energy Balance

- Has little effect on immune system directly
  - May be related to cortisol associated with calving
- Is not related independently to effects on reproduction
  - Except time to nadir and ovulatory function
- Is associated with feet and leg problems and digestive problems

Which Cow is Thin?



Which Cow is in Negative Energy Balance?

Conclusions

- Do NOT equate high production with high stress
- Sick cows produce LESS milk not more milk.

Conclusions

- Cows can use body reserves to supplement energy needs without a significant cost to productivity.
- DMI is THE critical factor in minimizing duration of negative energy balance.
- Selection for milk production results in cows that partition more nutrients to milk.