Transition Cow Management and Nutrition: *the latest producers need to know*

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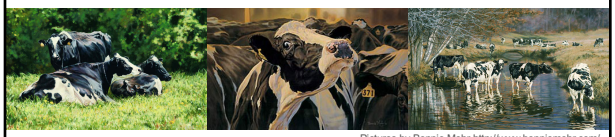


Pictures by Bonnie Mohr http://www.bonniemohr.com/

UF UNIVERSITY of FLORIDA

High Plains Dairy Conference

Timeline Management of Dairy Cows For Successful Transition

Provide Proper Comfort and Heat Abatement

1. **Dry off**
   - 230 days of gestation
   - Proper body condition
   - Control of mastitis
   - Routine hoof trimming
   - Vaccination program
   - Proper diet to avoid over and under consumption of nutrients

2. **Close up**
   - Move based on days pregnant - 255 days of gestation
   - Proper grouping
   - Vaccination program
   - Feed diets to minimize metabolic disorders in early lactation.

3. **Parturition**
   - Training of personnel
   - Minimize intervention
   - Reduce calving related disorders

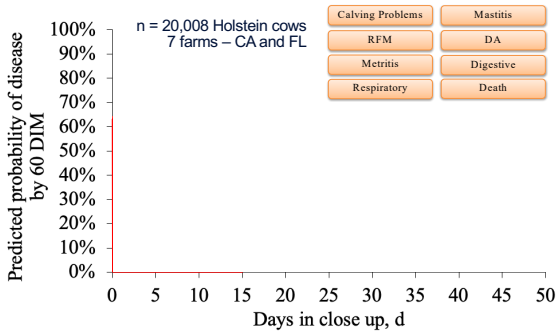
4. **Early Postpartum**
   - Monitor health for early diagnosis of diseases and treatment.
   - Feed diets that do not limit intake.
   - Control ketosis.

5. **High group**
   - Feed diets that maximize milk production and recovery of body condition

- 45 d | -21 d | Calving | 0 to 28 d | > 28 DIM

Day Relative to Calving

Days in Close Up Pen and Morbidity



Vieira-Neto et al. J. Dairy Sci. (2020) Abstr.

Holstein Cows at Peak Production

Average Holstein cow peaks at 45 kg/day

- Maintenance energy required: 15 Mcal/d of ME
- Energy for milk synthesis 55 Mcal of ME/d
- Total energy needed = 70 Mcal of ME/d
- **Therefore, consuming at 4.6 times maintenance**

Selz-Pralle Aftershock peaked at 123 kg/day

- Maintenance energy required: 16 Mcal/d of ME
- Energy for milk synthesis 134 Mcal of ME/d
- Total energy needed = 150 Mcal of ME/d
- **Therefore, consuming at 9.3 times maintenance**

Santos et al. (2010) Reprod. Dom. Rum. VII:387-404

Risk factors for resumption of estrous cycles by 65 days postpartum and pregnancy at 1st AI in lactating dairy cows

Variable	Cyclic, % (n/n)	Adjusted OR (95% CI)	*P* value
BCS change from calving to 65 DIM			
Lost 1 unit or more	58.7 (279/475)	Referent	-------
Lost < 1 unit	74.6 (2,507/3,361)	1.96 (1.52, 2.52)	< 0.001
No change	80.9 (2,071/2,560)	2.39 (1.74, 3.28)	< 0.001
Milk yield in the first 90 DIM			
Q1, 32.1 kg/d	72.7 (1,011/1,390)	Referent	------
Q2, 39.1 kg/d	77.6 (1,204/1,552)	1.34 (1.13, 1.60)	< 0.01
Q3, 43.6 kg/d	77.6 (1,350/1,739)	1.36 (1.15, 1.62)	< 0.001
Q4, 50.0 kg/d	75.3 (1,292/1,715)	1.21 (1.02, 1.43)	0.04

Variable	Pregnant, % (n/n)	Adjusted OR (95% CI)	*P* value
BCS change from calving to 65 DIM			
Lost 1 unit or more	28.9 (132/472)	Referent	------
Lost < 1 unit	37.3 (1204/3230)	1.42 (1.13, 1.79)	< 0.01
No change	41.6 (1008/2422)	1.69 (1.32, 2.17)	< 0.001
Milk yield in the first 90 DIM			
Q1, 32.1 kg/d	37.2 (496/1,334)	Referent	------
Q2, 39.1 kg/d	38.9 (576/1,481)	1.06 (0.91, 1.24)	0.42
Q3, 43.6 kg/d	39.3 (652/1,661)	1.09 (0.93, 1.26)	0.26
Q4, 50.0 kg/d	37.6 (620/1,648)	1.03 (0.88, 1.21)	0.65

Santos et al. (2009) Anim. Reprod. Sci. 110: 207–221

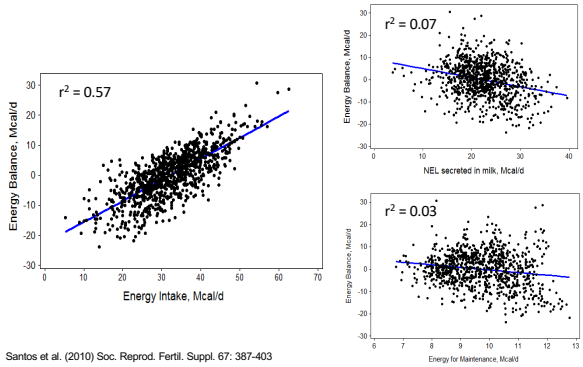
Take Home Message

✓ Avoid excessive body condition loss with the onset of lactation

✓ Ideally, cows should not lose more than 0.5 units of body condition from the week before calving to first AI

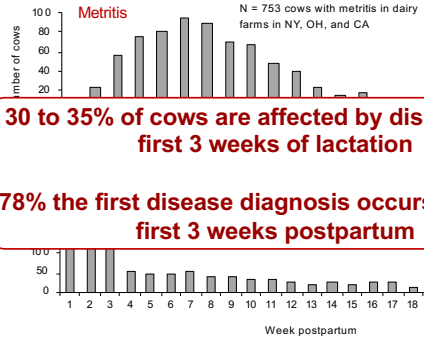
Important that cows and heifers do not calve overconditioned

If Energy Balance is a Major Drive of Reproductive Success in Dairy Cows, then the Focus Should be on Intake and not Milk Yield



Santos et al. (2010) Soc. Reprod. Fertil. Suppl. 67: 387-403

Morbidity is a Problem of Early Lactation Cows

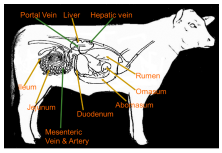


30 to 35% of cows are affected by disease in the first 3 weeks of lactation

78% the first disease diagnosis occurs within the first 3 weeks postpartum

Ribeiro et al. (2016) J. Dairy Sci. 99: 2201-2220

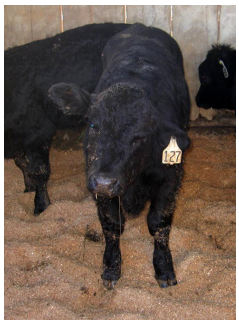
Disease Reduces Nutrient Balance



- ✓ Control/Fed
  - Fed *ad libitum* and not challenged
- ✓ Control/Fasted
  - Fasted for 72 h (-14 to +58 hours relative to challenge) and not challenged
- ✓ Challenge/Fed
  - Fed *ad libitum* and underwent intra-tracheal challenge with *M. haemolytica*
- ✓ Challenge/Fasted
  - Fasted for 72 h (-14 to +58 hours relative to challenge) and underwent intra-tracheal challenge with *M. haemolytica*

Burciaga-Robles PhD Dissertation (2009)

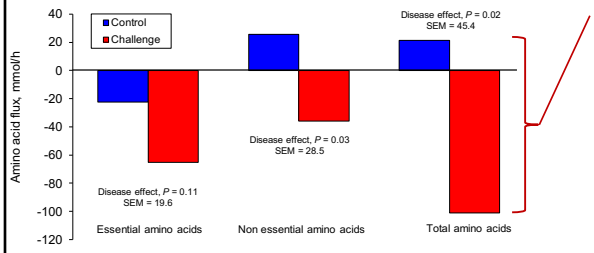
Two Conditions that Induce Systemic Inflammatory Responses



Amino Acid Hepatic Flux in Steers Without (Control) or with (Challenge) an Intratracheal Challenge with *M. haemolytica*

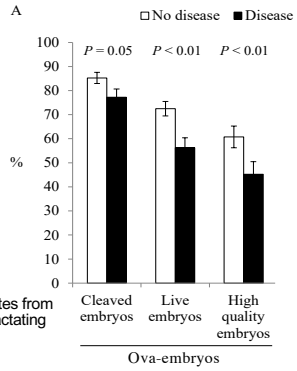
At 0.67 efficiency, this is equivalent to the true protein in 8 kg of milk (18 lbs)

Difference of 2.6 moles/day → ~ 380 g of AA for a 400 kg steer



Burciaga-Robles PhD Dissertation (2009)

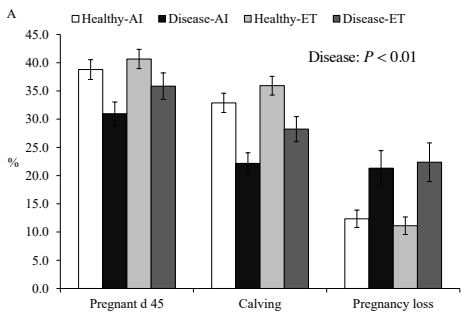
Disease Influences Development to Morula



419 embryo-oocytes from single ovulating lactating Holstein cows

Ribeiro et al. (2016) J. Dairy Sci. 99:2201–2220

Negative Impacts of Disease on Fertility Are Not Bypassed by Embryo Transfer (ET)



N = 4,206 cows

Ribeiro et al. (2016) J. Dairy Sci. 99:2201–2220

Bovine Conceptus Changes its Gene and Protein Expression to Allow Maintenance of Pregnancy

Downregulation of genes that alert the maternal immune system

Tolerance to conceptus alloantigens

Ribeiro et al. (2016) Biol. Reprod. (2016) 94(4):97, 1–18

Take Home Message

✓Stimulate DM intake

- ✓ Intake influences nutrient balance that is critical for resumption of ovarian cyclicity
- ✓ Cyclic cows have increased estrous expression, pregnancy per AI, and improved maintenance of pregnancy

✓Minimize disease

- ✓ Disease causes inflammation and tissue damage, which alters function
- ✓ Alters partition of nutrients to favor control of infection and tissue repair in place of tissue accretion
- ✓ The priority shifts from production/growth to survival
- ✓ Creates long-term negative effects on reproduction

Prepartum Diet Formulation

Focus on 4 important aspects

✓Avoid excessive caloric intake (gain of adipose tissue or BCS)

✓Reduce fatty liver and ketosis

✓Prevent hypocalcemia

✓Supply adequate amount of metabolizable protein

Formulate Proper Diets for Prepartum Cows

If you let them choose, *they can make bad choices*!

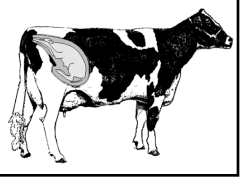
Prepartum diets should be simple!

Caloric Needs of Prepartum Cows

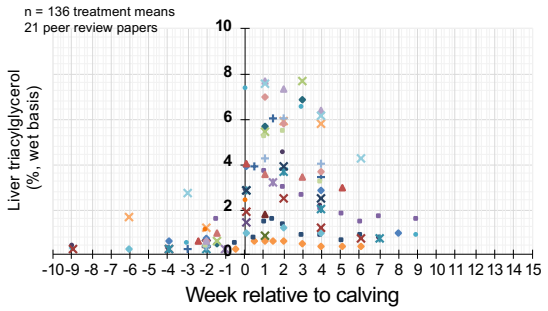
- ✓ Last 3 weeks of gestation for a pregnant Holstein cow weighing 680 kg plus 40-50 kg of uterine/fetal weight
  - ✓ Cow needs ~11 Mcal/d of NE_L ($680^{0.75}$ x 0.08)
  - ✓ She needs another ~4 Mcal for fetal/uterine tissue accretion
  - ✓ To account for cow to cow variability and diet selection/competition, a total of 17 Mcal/d should be offered prepartum
  - ✓ This cow eats 11 to 13 kg of DM daily (23 to 28 lb;d); therefore, the diet should contain:
  - ✓ ~ 17 Mcal/12 kg = **1.42 to 1.45 Mcal/kg DM (0.65 Mcal/lb for a cow eating 26 lb DM)**

Typical diet

- ✓ Diet with 70 to 75% forage
- ✓ 45 to 50% NDF
- ✓ 15 to 18% starch
- ✓ 25 to 30% NFC
- ✓ 3% fatty acids

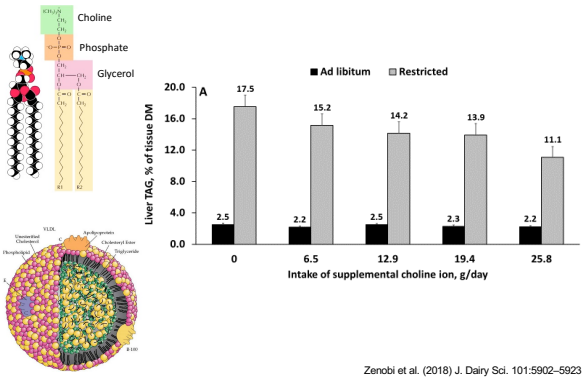


Hepatic Triacylglycerol Around Calving



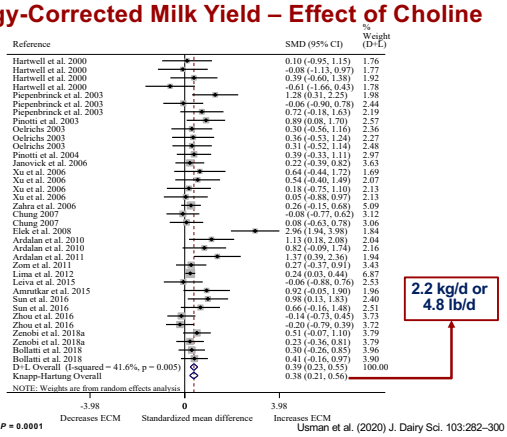
Summarized by M. Zenobi

Choline Reduces Fatty Liver



Zenobi et al. (2018) J. Dairy Sci. 101:5902–5923

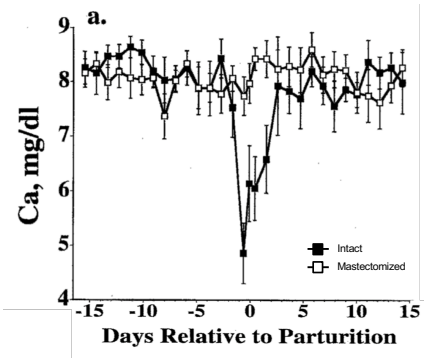
Energy-Corrected Milk Yield – Effect of Choline



WMD = 0 z = 5.63 P = 0.0001

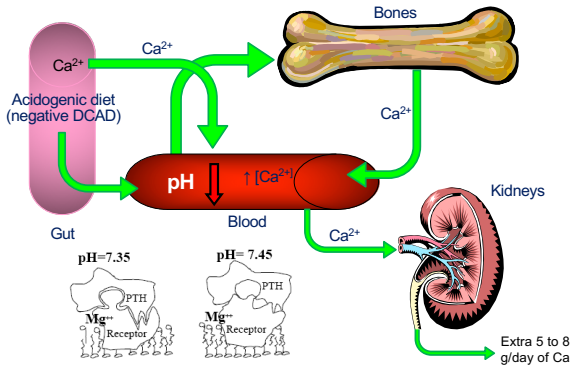
Usman et al. (2020) J. Dairy Sci. 103:282–300

Mastectomized Cow

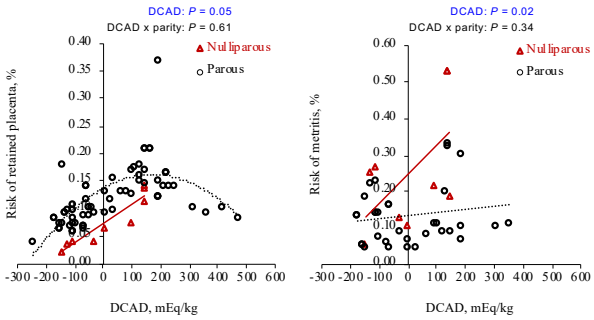


Goff et al. (2002) J. Dairy Sci. 85:1427-1436

Mechanisms of Acidogenic Diets

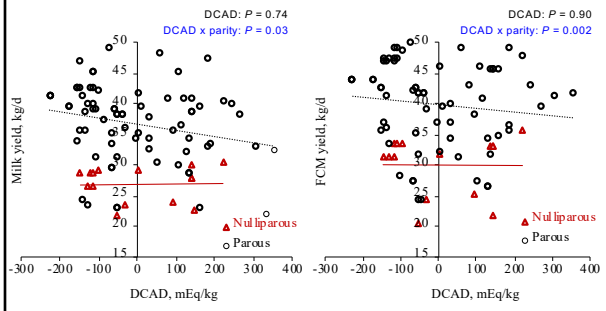


Effect of DCAD on Risk of Retained Placenta or Metritis



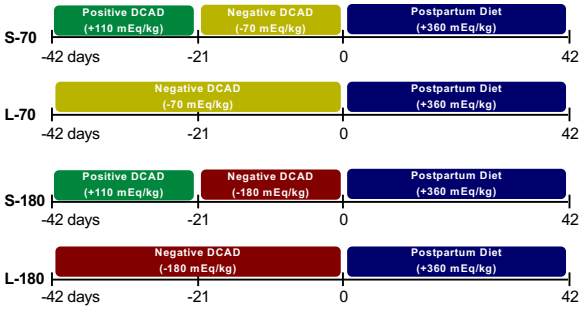
Santos et al. (2019) J. Dairy Sci. 102:2134–2154

Effect of DCAD on Yields of Milk and FCM According to Parity



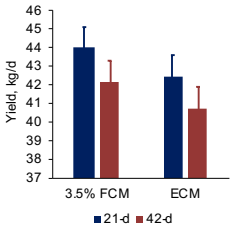
Santos et al. (2019) J. Dairy Sci. 102:2134–2154

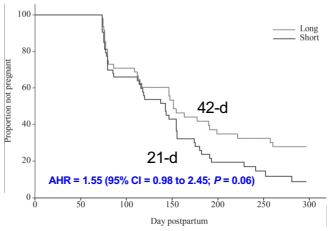
How Long Should We Feed Acidogenic Diets Prepartum



Lopera et al. (2018) J. Dairy Sci. 101:7907–7929

Feeding Acidogenic Diets During the Entire Dry Period

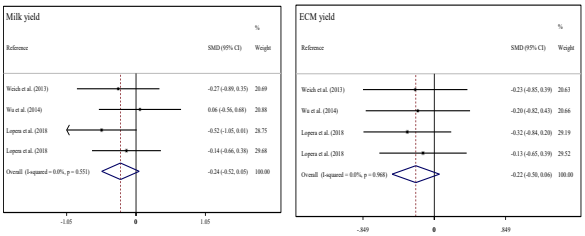




Lopera et al. (2018) J. Dairy Sci. 101:7907–7929

Feeding Acidogenic Diets During the Entire Dry Period

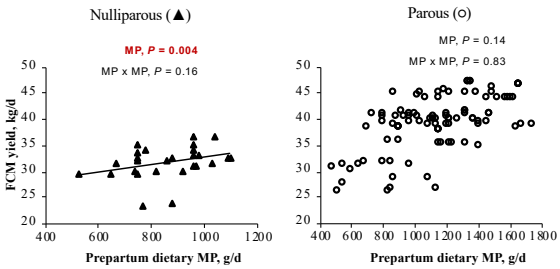
3 experiments show the same responsee



Protein Needs of Prepartum Cows

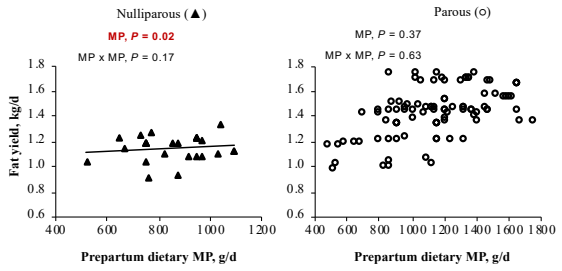
- ✓ Dry cows weighing 600 to 650 kg dry cow requires approximately 480 g/d of metabolizable protein for maintenance
- ✓ Metabolizable protein needed for gravid uterus accretion assuming calf birth weight of 43 kg
  - 270 d of gestation = 340 g/d
- ✓ Nulliparous are still growing and have requirements for lean tissue accretion
  - 250 g of MP for accretion of lean tissue
- ✓ Estimated requirements for MP
  - Parous cows = 820 g/d to meet maintenance and gravid uterus accretion (~ 2 lbs/d of digestible amino acids)
  - Nulliparous cows = 1,100 g/d to meet maintenance, gravid uterus accretion, and lean tissue accretion (~ 2.5 lbs/d of digestible amino acids)

Effect of Prepartum Supply of Metabolizable Protein on Yield of FCM



Husnain and Santos (2019) J. Dairy Sci. 102:9791–9813

Effect of Prepartum Supply of Metabolizable Protein on Milk Fat Yield



Husnain and Santos (2019) J. Dairy Sci. 102:9791–9813

Meta-Analysis of Lipid Supplementation During the Transition Period

- ✓ 17 experiments and 26 comparisons with 1,385 cows
- ✓ 7 different fat sources
- ✓ Effects of lipid supplementation
  - ✓ 27% increase in risk of pregnancy per AI (e.g. 32 vs. 40%)
  - ✓ Days open tended to be reduced
  - ✓ Milk yield tended to increase
  - ✓ Concentration of milk fat unchanged and milk protein tended to decrease
  - ✓ Body weight unchanged

Diets for early lactation cows should contain 1 to 1.5% supplemental fat to result in 4 to 5% total fatty acids (DM basis)

Rodney et al. (2015) J. Dairy Sci. 98:5601-5620

Summary of Diet Manipulations

- ✓ Feed prepartum diets to supply 17 Mcal of NE/d (~ 1.45 Mcal/kg or 0.65 Mcal/b)
- ✓ Supplement rumen-protected choline pre- and early postpartum
  - ✓ At least 13 g of choline ion
- ✓ Formulate prepartum diets with a DCAD of ~ -100 mEq/kg
  - ✓ Plan for 3 weeks in the close up pen (move at 255 d of gestation)
- ✓ Formulate prepartum diets for parous and nulliparous cows separately
  - ✓ Nulliparous need more MP prepartum (~ 1,100 g/d) which is achieved with diets with 14 to 15% CP
  - ✓ Parous cows require less MP (~ 800 to 900 g/d), which can be achieved with 12 to 13% CP
- ✓ Supplement moderate amounts of FA to improve fertility (1 to 1.5% diet DM in early lactation)
- ✓ Prepartum diets should be simple and transition programs should be easy to implement

Thank you

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