How much does ketosis cost and how can we minimize this impact?

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Overview

- Herd-level impact of ketosis
- Herd-level disease monitoring
- Calculation of ketosis costs
- Ketosis prevention

Understanding herd-level impact of ketosis

Do we know which cows are ketotic?

- If we don't look for hyperketonemic cows, we don't know they are there.

- We know hyperketonemic cows:
  - Produce less milk
  - Have an increased risk of disease
  - Have poorer reproductive outcomes

= economic losses!

Does treatment fix this economic loss?

- Treating hyperketonemic cows reduces some milk loss and subsequent disease risk.

But not all!

- Reduce economic losses by:
  1. Monitoring herd-level prevalence
  2. Diagnosing and treating individual cows
  3. Adjusting management to reduce early lactation hyperketonemia

Applications of hyperketonemia testing

- Identifying individual hyperketonemic cows
  - Cow-side test for treatment decisions
- Identifying herds with hyperketonemia problems
  - Herd-level testing for management decisions

How many ketotic cows do herds have?

- Incidence:
  - Average ~ 45%
  - Range =25 to 85%

- Prevalence:
  - Average ~ 20%
  - Range = 0-70%

What is the difference between incidence and prevalence??

Ospina et al., *JDS*, 2010; McArt et al., *JDS*, 2011; Chapinal et al., *JDS*, 2012; Surthar et al., *JDS*, 2013; Kerwin et al., *JDS*, 2022

Incidence

- Number of new cases of ketosis within a period of time / number of cows at risk

- *Example:*
  - 20 cows are measured for ketosis daily from 1-21 d in milk
  - 10 diagnosed as ketotic at some point between 1-21 d in milk
  - Incidence = 10/20 = 50%

- Requires repeatedly measuring the same cows
- Often only in research studies

Prevalence

- Number of cases of ketosis measured on a single day/ number of cows measured on that day

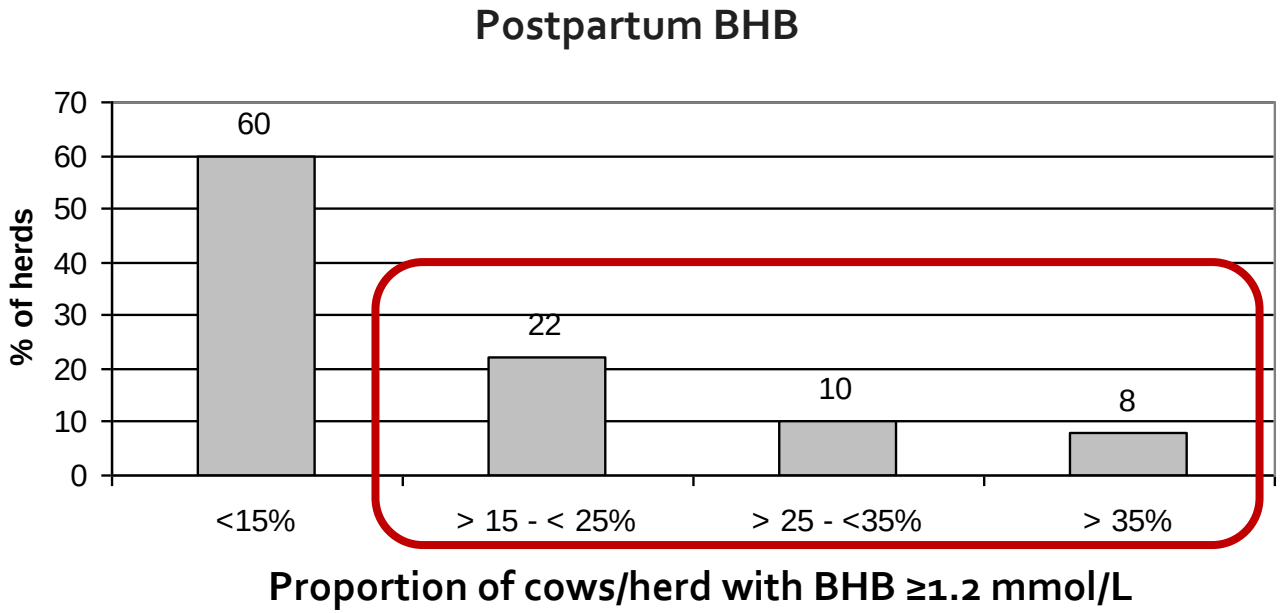
- *Example:*
  - 20 cows between 1-21 d in milk are measured for ketosis on 10/03/2023
  - 5 diagnosed as ketotic on 10/03/2023
  - Prevalence = 5/20 = 25%

- Most common method of herd-level monitoring
- For ketosis, prevalence is lower than incidence
- Multiply prevalence by 2 to 2.5 to estimate incidence

Hyperketonemia at the herd level

- Herds with ≥15 to 25% of sampled cows with elevated postpartum BHB
  - Increased postpartum disease
  - Poorer reproduction
  - Lower milk production

<u>40%</u> of herds above herd alarm level!



Ospina et al., *JDS*, 2010; Chapinal et al., *JDS*, 2012

How do we measure herd-level disease?

Herd-level hyperketonemia monitoring

- Goal: determine herd-level prevalence
  - Sample cows between 3 to 16 DIM
  - A larger sample size will result in a more precise estimate

- Which cows to sample?
  - All cows in DIM range are eligible
  - Most really sick cows will not be hyperketonemic

- Consistent sampling method
  - Cow selection
  - Measurement method
  - Time of day

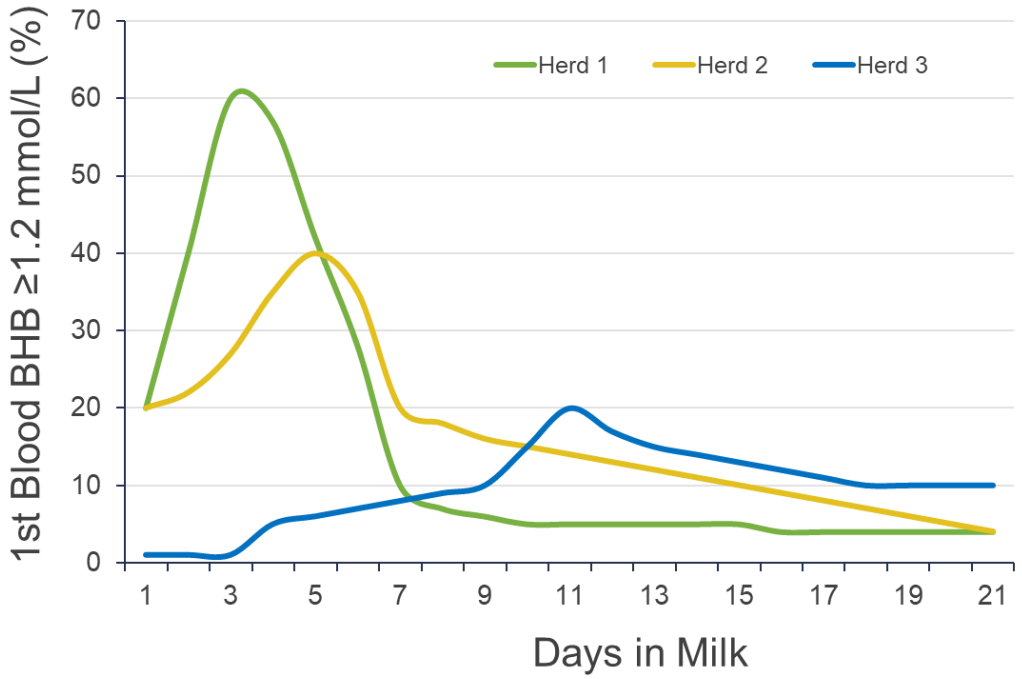
What if I don't have enough cows to test?

1) Monitor incidence
   - Test fresh cows 2 x per week
   - Gives you a rolling herd-level incidence and you find all ketotic cows to treat
   - *Example:*
     - Farm calves 4 cows per month
     - You test all cows 3-16 DIM on Mondays and Thursdays
     - Monthly incidence = # ketotic cows/4 cows that calved that month
     - Rolling year incidence = # ketotic cows/all cows that calved in the previous 12 months

2) Monitor prevalence
   - Once per week or month measure all cows in DIM range
   - Add that information to previously collected data
   - Gives you a rolling herd-level prevalence
   - *Example:*
     - Farm calves 4 cows per month
     - You test all cows 3-16 DIM the first Monday of every month
     - Monthly prevalence = # ketotic cows/4 cows that calved that month
     - Rolling year prevalence = # ketotic cows/all cows that calved in the previous 12 months

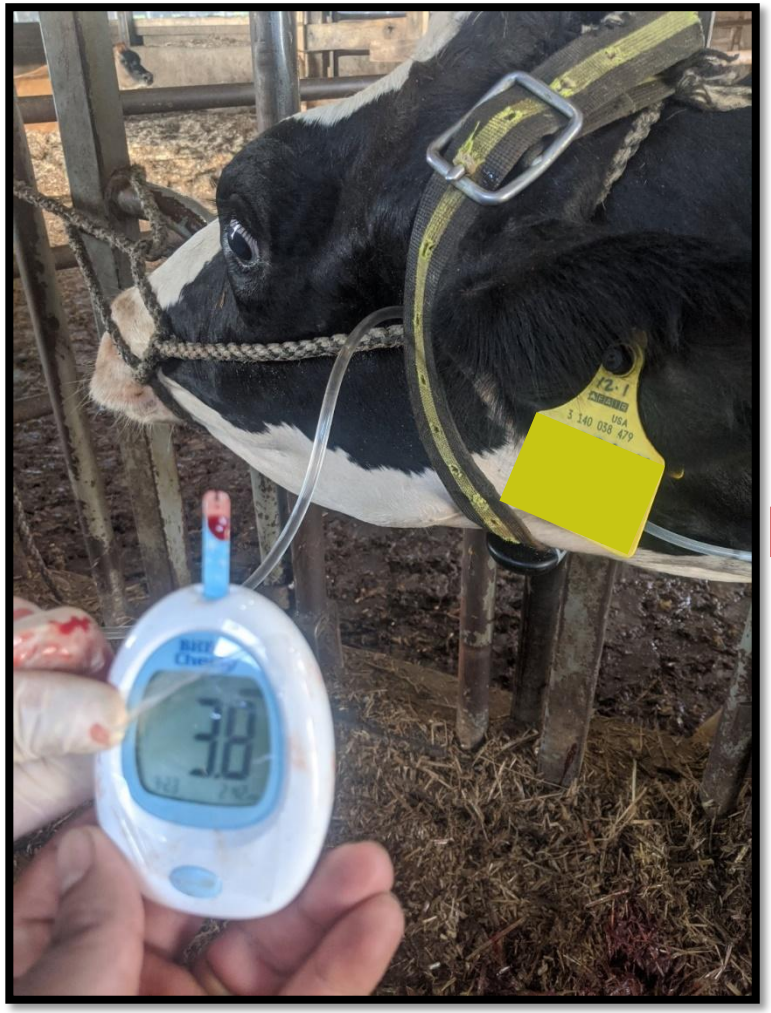
Interpretation of herd-level BHB monitoring

- Goal ≤15% prevalence of cows with BHB ≥1.2 mmol/L
  - Treat hyperketonemic cows according to farm protocols
  - Consider blanket treatment if prevalence is ≥40%
- Monitor prevalence over time
- Prevalence estimates in smaller herds much more variable
- Blood or milk



Why is knowing the cost of ketosis important?

Ketosis cost: diagnosis & treatment



True cost of hyperketonemia

- How much does hyperketonemia cost?
  - Not just diagnosis and treatment costs!
  - Milk loss
  - Increased risk of other diseases
  - Several other hidden costs

- Understanding cost helps frame economics of prevention

Two types of costs

- Component cost:
  - Consequences of the impact of hyperketonemia on milk production, treatment, and culling
  - Cost without consideration of other associated disease impacts

- Total cost:
  - Component cost
  - Cost of other diseases attributable to hyperketonemia

Component cost of disease

= direct costs + indirect costs

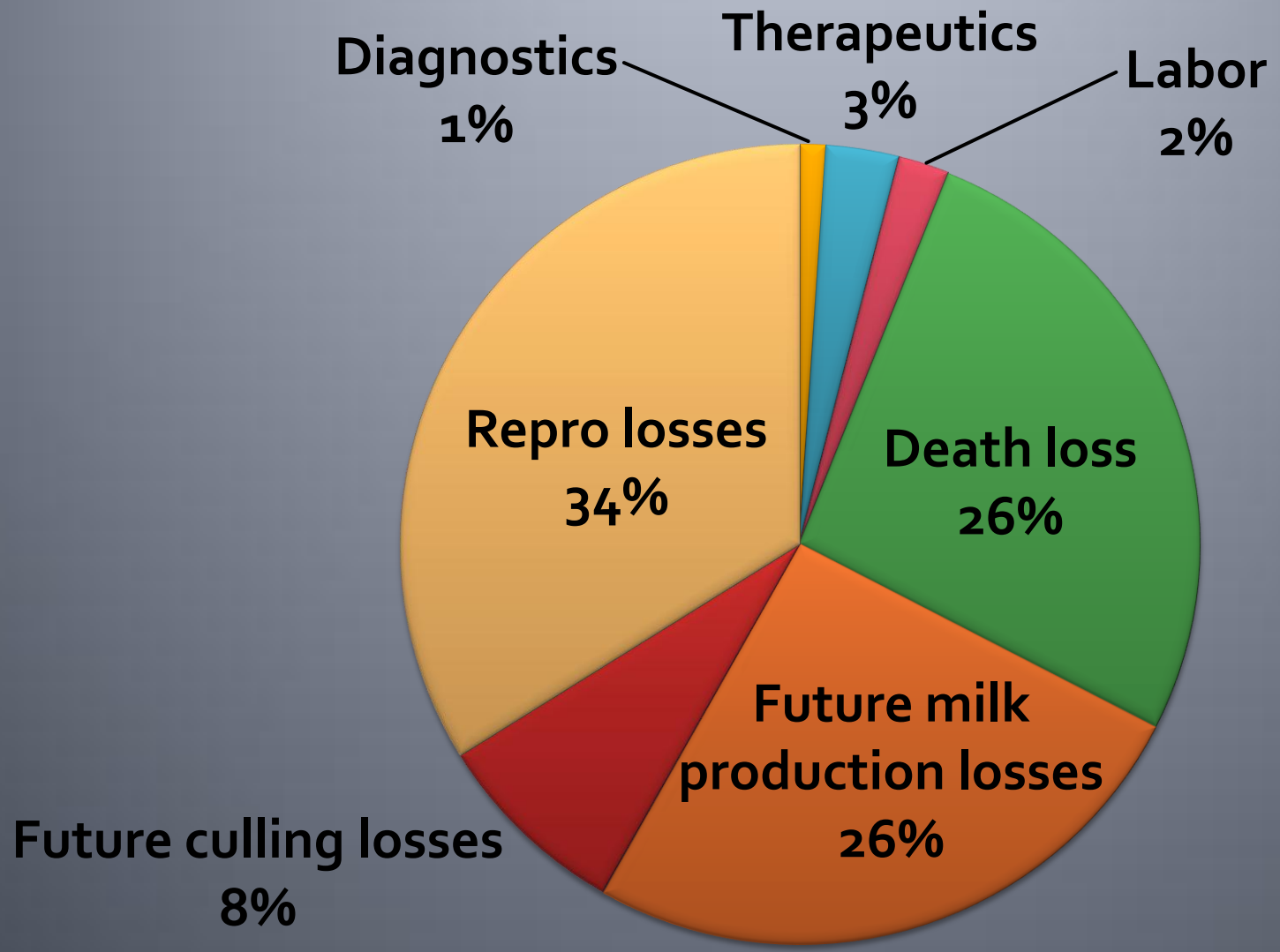
- Direct costs:
  - Diagnostics
  - Therapeutics
  - Discarded milk
  - Veterinary service
  - Labor
  - Death loss
- Indirect costs:
  - Future milk production losses
  - Future culling losses
  - Repro losses

McArt et al., 2015, *JDS*

Component cost of hyperketonemia

	Cost per case LACT = 1	Cost per case LACT >1	Avg. cost per case
Direct Cost of Hyperketonemia			
Diagnostics	($1)	($1)	($1)
Therapeutics	($3)	($3)	($3)
Discarded milk	$0	$0	$0
Veterinary service	$0	$0	$0
Labor	($2)	($2)	($2)
Death loss	($36)	($29)	($31)

Component cost of hyperketonemia



McArt et al., 2015, *JDS*

Total cost of disease

= component cost + attributable costs

- Attributable diseases: DA and metritis
  - Calculated using same method as for hyperketonemia
  - Direct costs and indirect costs
- 88% of DA cases attributable to hyperketonemia
- 70% of metritis cases attributable to hyperketonemia

Total cost of hyperketonemia

	Cost per case LACT = 1	Cost per case LACT >1	Avg. cost per case
Component Cost of Hyperketonemia			
Direct Cost of Hyperketonemia	($43)	($36)	($38)
Indirect Cost of Hyperketonemia	($90)	($75)	($79)
Total	($134)	($111)	($117)

Economic impact of hyperketonemia

- Different calculations for cost of hyperketonemia
  - McArt et al., JDS, 2015: us$289 per case (€255)
  - Raboisson et al., *PVM*, 2015: €257 (range = €72 – €442)
- Emphasizes impact of management and prevention
- Per 100 calvings in a herd with a 20% prevalence:
  - 40% of fresh cows are hyperketonemic

    100 x 0.40 x €255 ~ €10,200

  - Decrease prevalence from 20% to 10%: ~ €5,100

How do we prevent or reduce hyperketonemia incidence?

Dry cow prevention – nutrition

- Access to water
- Controlled energy diet
- Monensin
  - Controlled release capsule, given 3 wk prior to calving, 335 mg per d for 95 d
  - Meta-analyses show reduced BHB concentration, increased milk yield
- Rumen-protected choline

Duffield et al., *JDS*, 2008; Mammi et al., 2021

Dry cow prevention – social factors

- Limit pen moves
- Stocking density:
  - Reduced stocking density helps during regrouping
    - Decreases feed bunk displacements
    - Increases lying time
  - Not a big difference between 80% and 100% prepartum

Talebi et al., *JDS*, 2014; Silva et al., *JDS*, 2014; Lobeck-Luchterhand et al., *JDS*, 2015

Dry cow prevention – heat abatement!

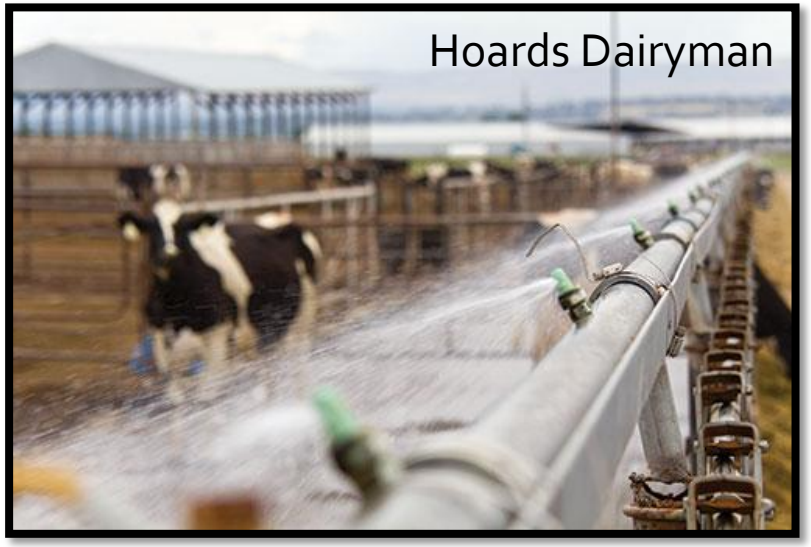
- Heat stress during late gestation:
  - Impaired mammary growth
  - Decreased milk production

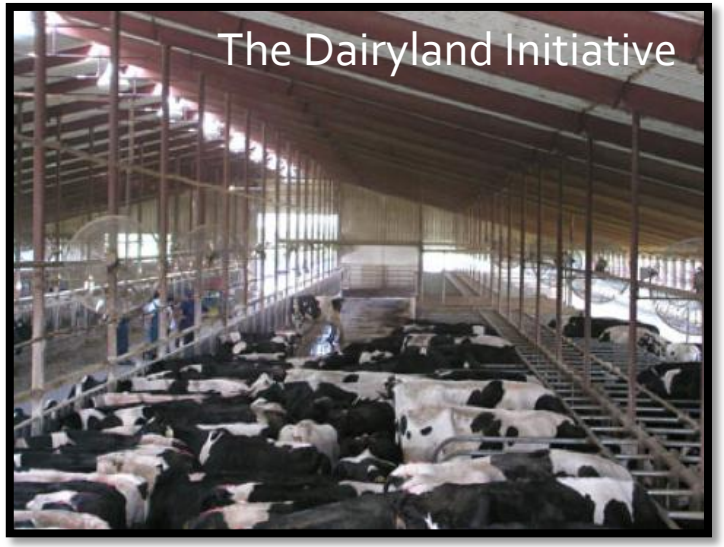
- In utero exposure to heat stress:
  - Decreased weight gain (0.2 kg/d)
  - Less likely to enter milking herd (66% vs. 85%)
  - Produced less milk (5 kg/d)

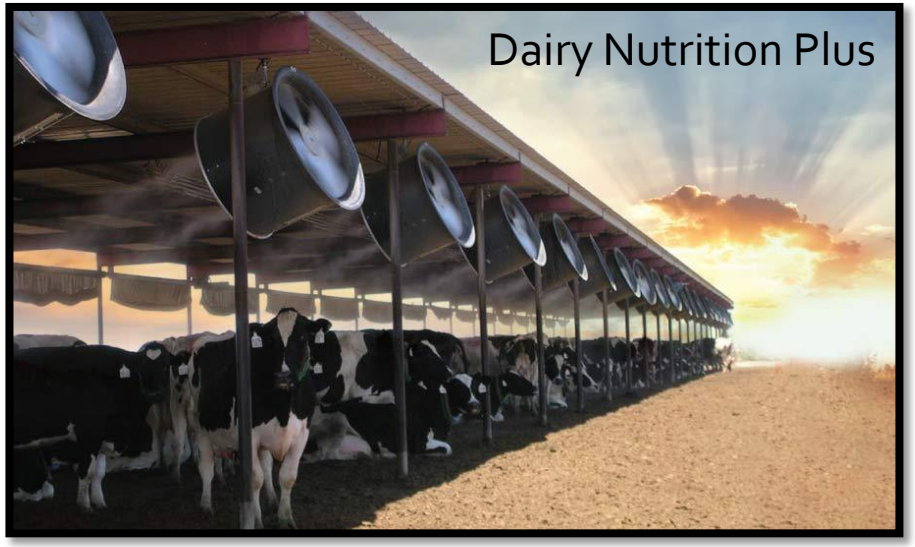
Tao and Dahl, *JDS*, 2013; Monteiro et al., *JDS*, 2016; Laporta et al., *JDS*, 2017

Dry cow prevention – heat abatement

- Fans/air flow
- Soakers
- Fly control
- Shade







Fresh cow prevention – nutrition

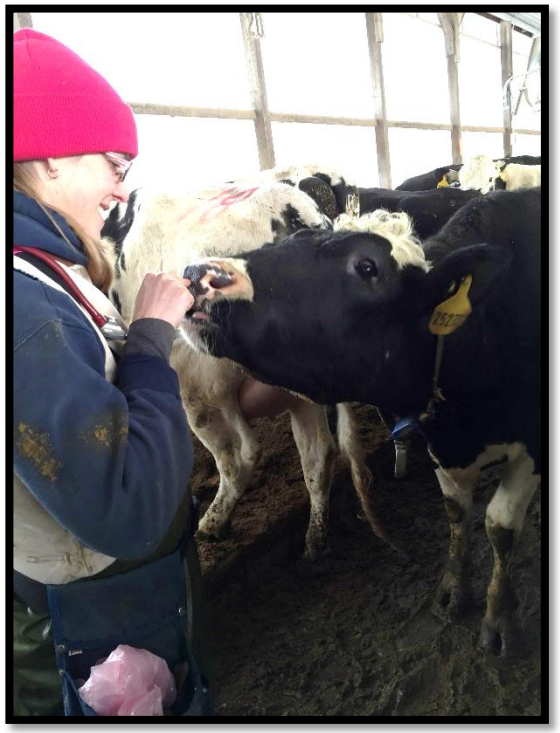
- Access to water
- Access to fresh feed!
- High starch diet with good rumen health/fiber
- Monensin (largest time of impact)
- Other dietary supplements: rumen-protected choline, branched-chain amino acids

Fresh cow prevention – other factors

- Heifers separate from cows if possible
- Stocking density <85%
- Heat abatement
- Good health monitoring

Summary of prevention:

- Feed them right!
- Keep them comfortable.
  - Heat abatement
  - Decrease social stressors
- Monitor production and disease.
- Adjust nutrition and management to keep hyperketonemia prevalence <15%.



Is it worth it?

- Current management and resulting farm hyperketonemia incidence has a cost.

- Making no change:

  → choosing to maintain cost

- Adjusting management to reduce ketosis incidence:

  → choosing to reduce cost

Summary

- Excessive energy deficit is prevalent in early lactation cows.
- Hyperketonemia is an expensive disease that increases the risk for other expensive diseases.
- Routine monitoring is important.
- Prevention through appropriate transition period management and nutrition is key.

Acknowledgements

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