Understanding dairy cow feeding behavior to optimize nutritional management

Balchem Real Science Lecture Series
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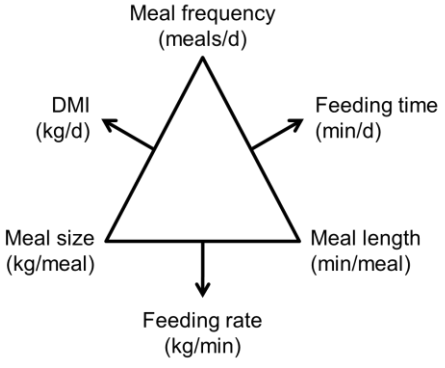
tdevries@uoguelph.ca

Why do we care about feeding behavior?

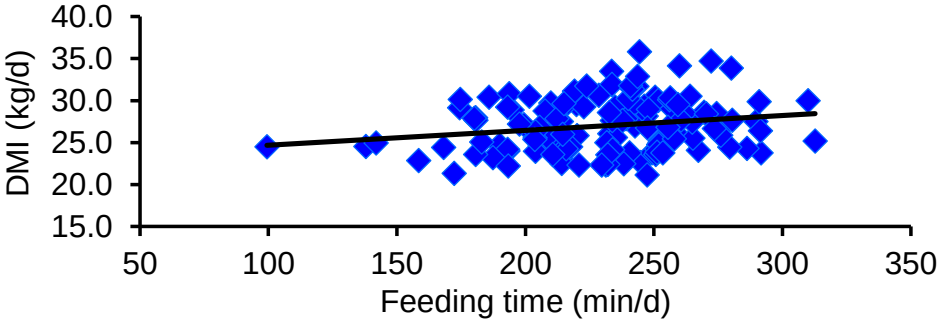
- Changes in intake must be mediated through changes in feeding behavior



Nielsen . B. L. 1999. Appl. Anim. Beh. Sci. 63:79-91

More time and meals at the bunk = greater intake!

- DMI was associated with:
  - feeding time (+0.02 kg/min) and meal frequency (+0.2 kg/meal)

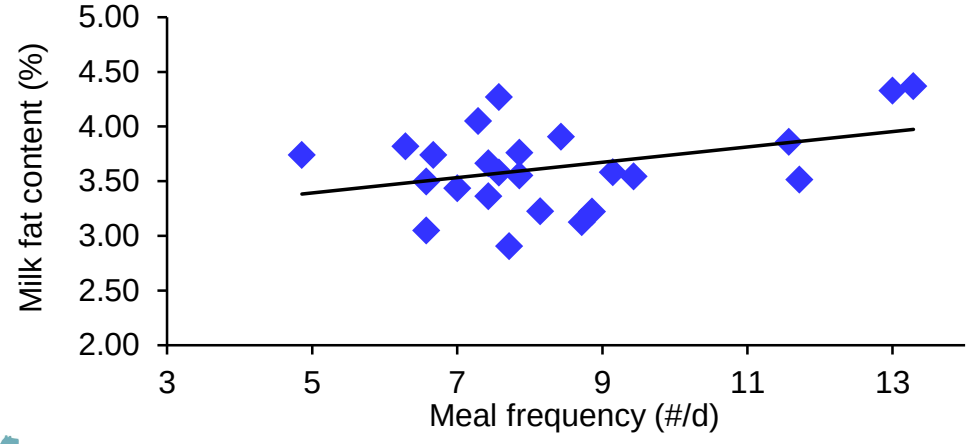


Data from Johnston and DeVries. 2018. J. Dairy Sci. 101:3367-3373

Why do we care about feeding behavior?

- Changes in intake must be mediated through changes in feeding behavior
- Feeding behavior may be directly linked to rumen function and health

Meal patterning and eating rate will impact rumen health and production



Data from DeVries and Chevaux. 2014. J. Dairy Sci. 97:6499-6510

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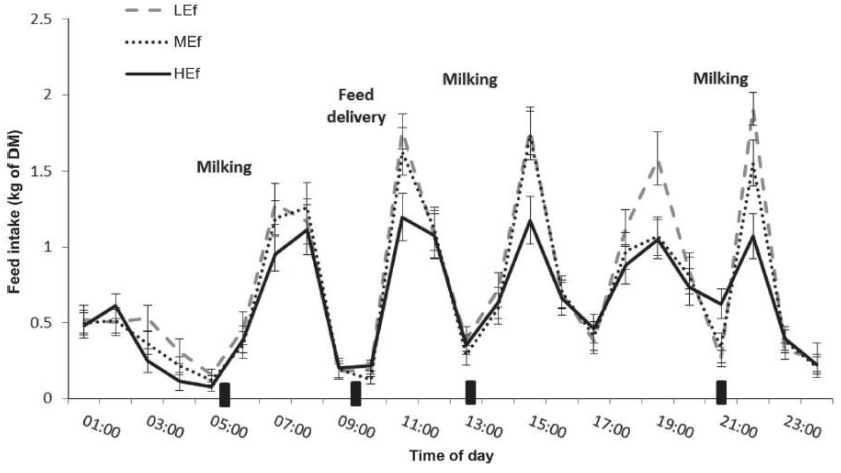
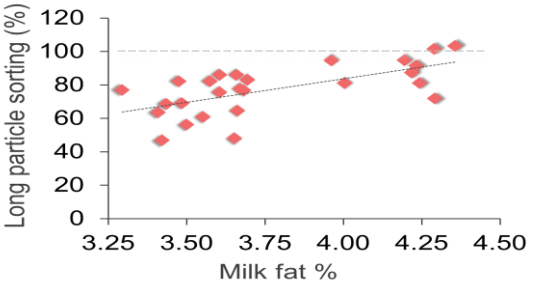
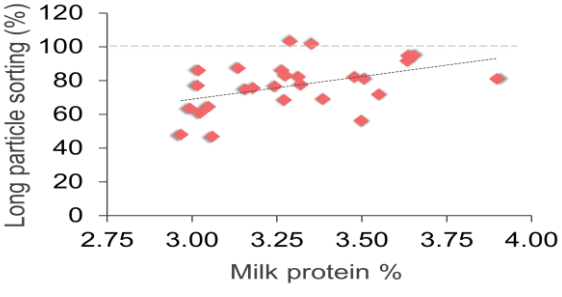


Data from Ben Meir et al. 2018. J. Dairy Sci. 101:10973-10984

What the cows consumes from her diet also has an impact on rumen function!

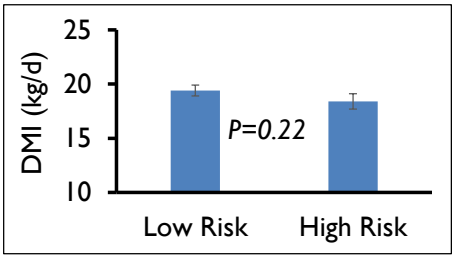
More sorting at a cow level = lower milk components

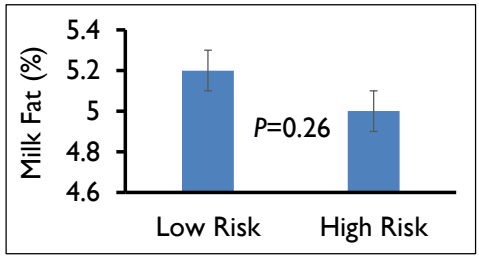


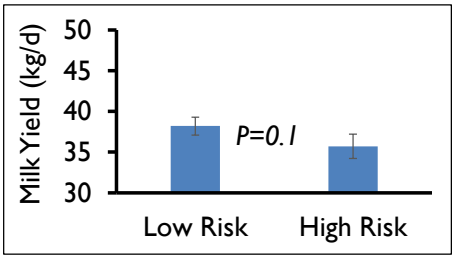


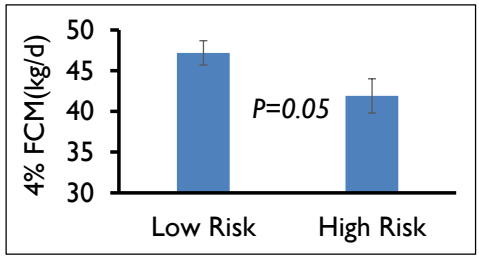
Miller-Cushon and DeVries. 2017. J. Dairy Sci. 100:2213-2218

Production differences in early lactation cows based on acidosis risk…as influenced by feed sorting!









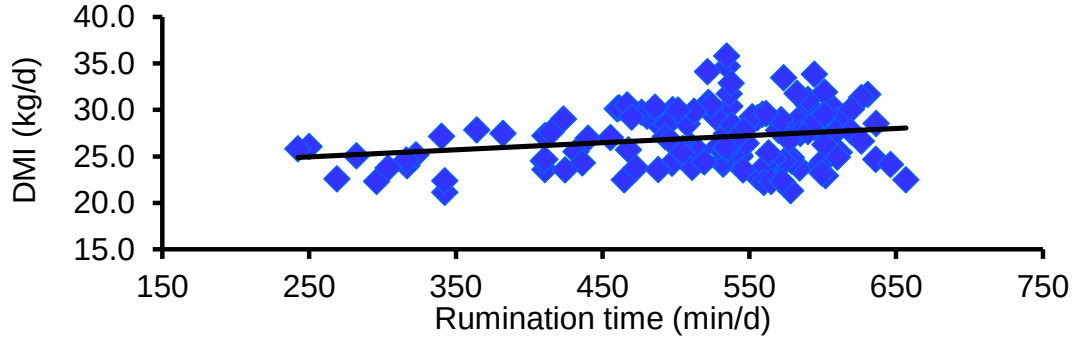
Coon et al. 2019. J. Dairy Sci. 102:652-659

Also…need to remember what the cow does after she has eaten!

- Rumination keeps the rumen working and healthy!
  - Reduce size of feed particles, increase surface area
  - Buffer the rumen

More rumination = greater intake!

- DMI was associated with:
  - rumination time (+0.2 kg/60min)



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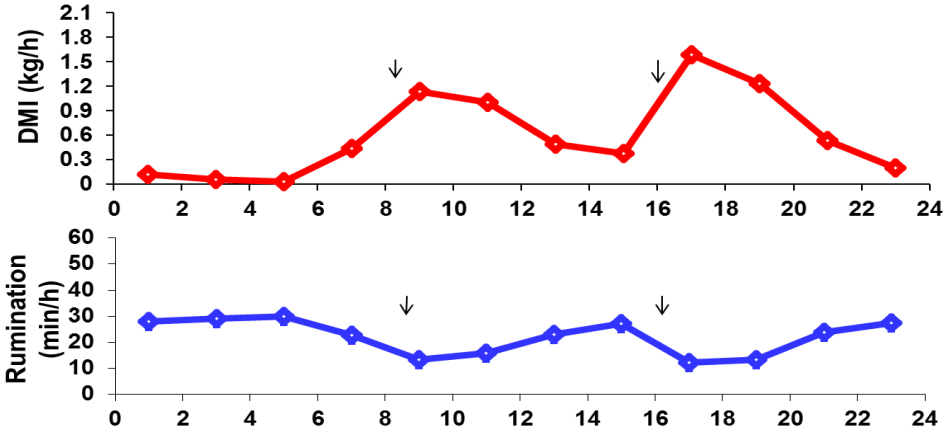
Data from Johnston and DeVries. 2018. J. Dairy Sci. 101:3367-3373

When do cows ruminate?



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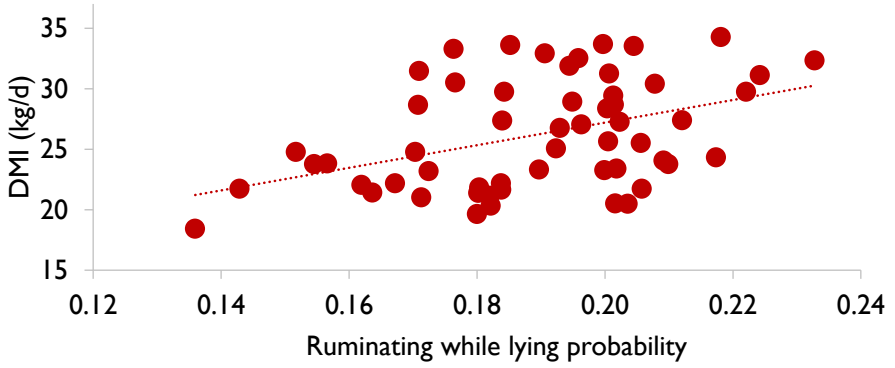
Schirmann et al. 2012. J. Dairy Sci. 95:3212-3217

Where cows ruminate may influence intake and production!

- Cows need time (and space) to ruminate!



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McWilliams et al. 2022. JDS Communications. 3:66-71

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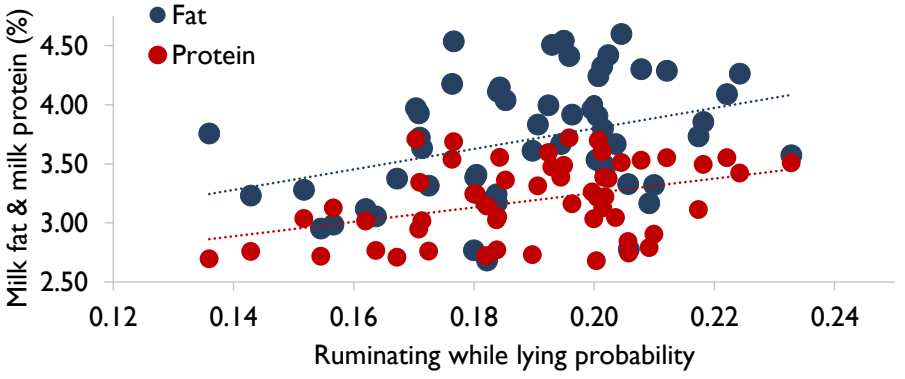

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McWilliams et al. 2022. JDS Communications. 3:66-71

What does this mean from a nutritional management standpoint?

- Diets should be formulated encourage consumption of small, frequent meals, are difficult to sort, and stimulate rumination

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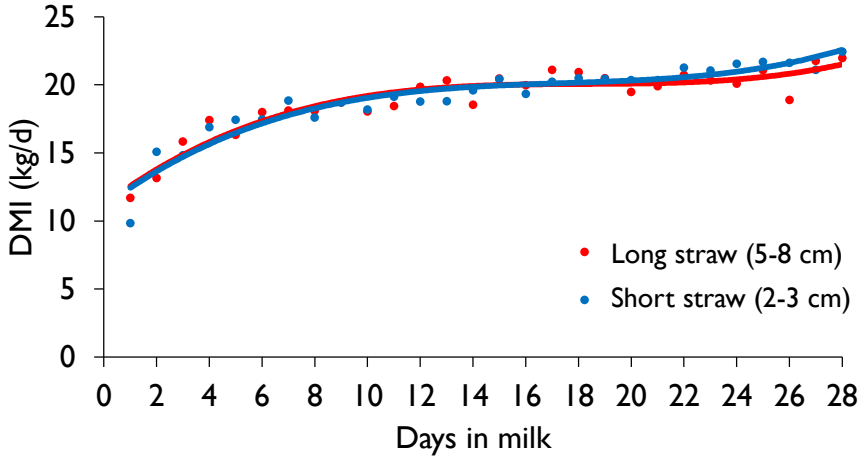
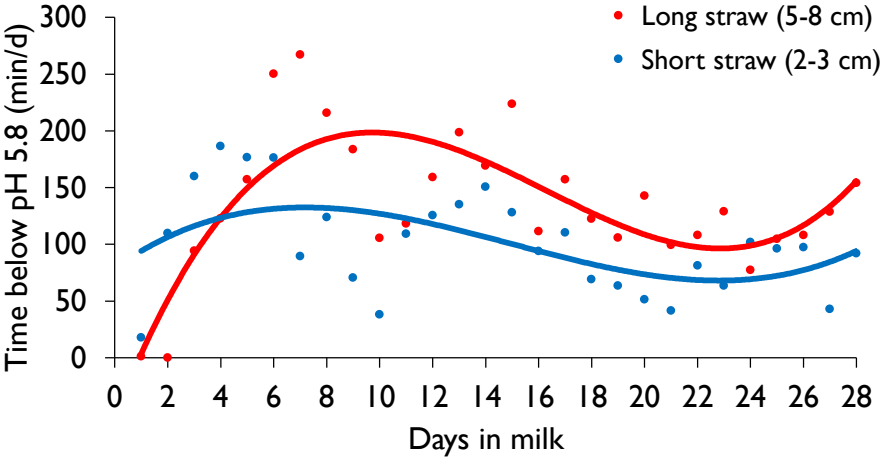
- Diets should be formulated encourage consumption of small, frequent meals, are difficult to sort, and stimulate rumination
  - Proper forage management
    - Quality
    - Quantity
    - Type
    - Particle size

Impact of straw particle size in fresh cow diets…



Coon et al. 2018. J. Dairy Sci. 101:6375-6387

Impact of straw particle size in fresh cow diets…



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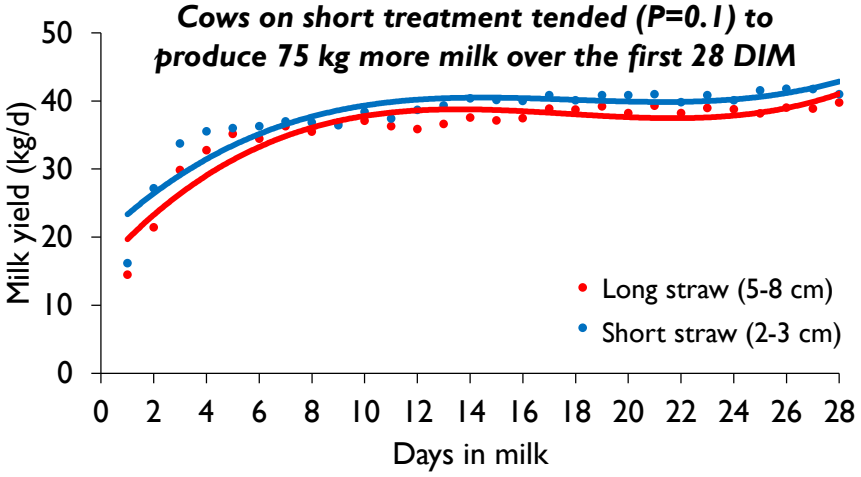

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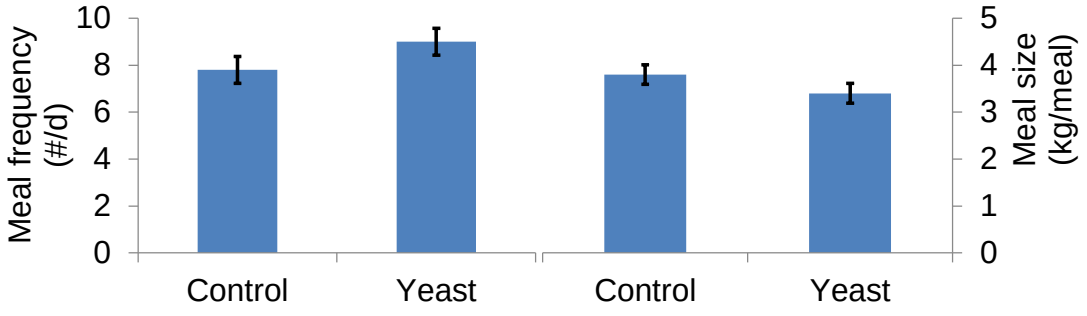
What does this mean from a nutritional management standpoint?

- Diets should be formulated encourage consumption of small, frequent meals, are difficult to sort, and stimulate rumination
  - Utilize feed additives which stabilize rumen conditions
    - Monensin (Erickson et al., 2003; Lunn et al., 2005; Mullins et al., 2012)
    - Sodium bicarbonate (Gonzalez et al., 2008)
    - Yeast supplements (Bach et al., 2007; DeVries and Chevaux, 2014; Yuan et al., 2015)

Greater frequency of smaller meals with yeast supplementation = greater rumination and milk fat



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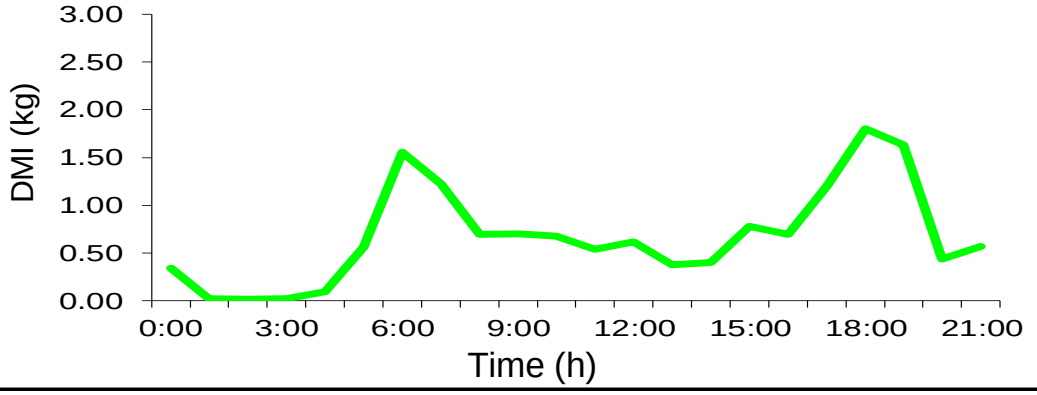
What does this mean from a nutritional management standpoint?

- Diets should be formulated encourage consumption of small, frequent meals, are difficult to sort, and stimulate rumination
- Manage feeding to ensure cattle are stimulated to access their feed throughout the day

When does a cow go and eat at the feed bunk?

- When she is hungry
- After certain management events

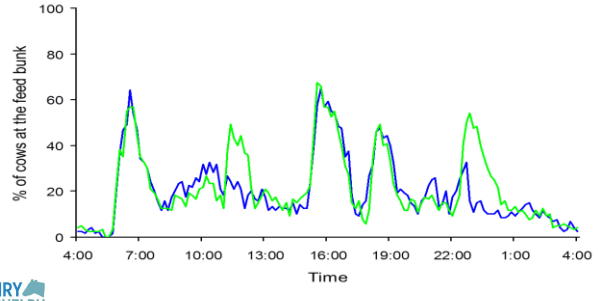


When does a cow go and eat at the feed bunk?

- When she is hungry
- After certain management events
  - Feed delivery!

How do we stimulate cows to access their feed throughout the day?

- Deliver feed more often…
  - More time at the bunk
  - More meals per day



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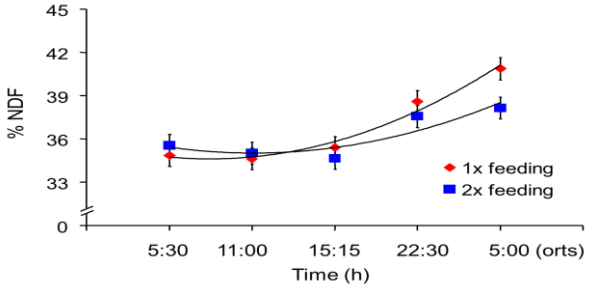
DeVries et al, 2005; J. Dairy Sci. 88: 3553-3562

How do we stimulate cows to access their feed throughout the day?

- Deliver feed more often…
  - Less feed sorting



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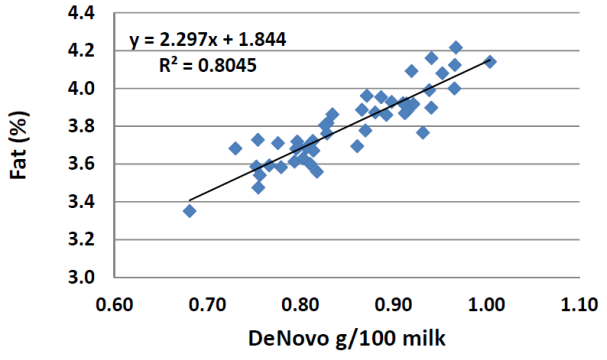
DeVries et al, 2005; J. Dairy Sci. 88: 3553-3562

More frequent feed delivery = more consistent consumption = improved rumen health

- High de-novo free-stall herds tended to be 5x more likely to feed 2x vs 1x per day



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Woolpert et al. 2017. J. Dairy Sci. 100:5097-5106

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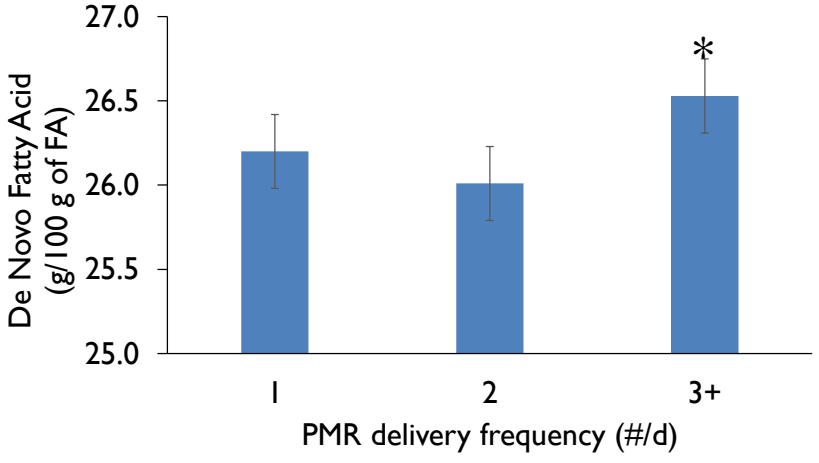

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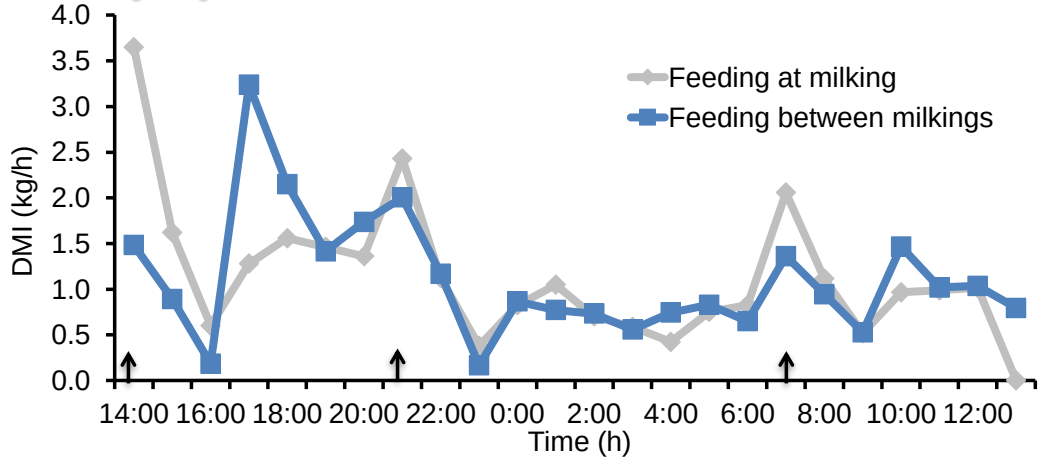
*P=0.05

Castro et al. 2022. J. Dairy Sci. 105:5097-5108

Delivering feed multiple times per day may not always be practical…

Providing more stimulation to feed across the day by staggering milk and feeding = improved efficiency by 7%



↑ = milking

King et al. 2016. J. Dairy Sci. 99:1471-1482

Need to ensure feed is present when cows go to the bunk!

Ensuring feed is available allows cows to use their time efficiently!

- 41 AMS herds in Canada
  - Frequency of feed push ups (average = 8x/d; range= 2 to 24)
    - + 0.1 h/d lying duration per extra 2 push-ups per day

King et al. 2016. J. Dairy Sci. 99:9069-9079

Ensuring feed is available ensures cows are not limited in their consumption!

- Feed needs to be consistently pushed up and available
  - 197 robot farms across Canada
    - Mean = 12.8 feed pushes/day (SD = 8.3)
    - For every 5 extra feed pushes…
      - +0.77 lb/d (0.35 kg/d) milk yield

Matson et al. 2021. J. Dairy Sci. 104:7971-7983

We need to minimize the amount of time cows are without feed…

Impact of reduced feed access time increased with overcrowding

- Overcrowding and feed restriction (0100 to 0600 h):
  - Up to 9 h/d greater subacute rumen acidosis (pH < 5.8)
  - Reduces NDF digestion rate by up to 50%

Campbell and Grant, 2016

Ensuring cows have access to feed when they want to…

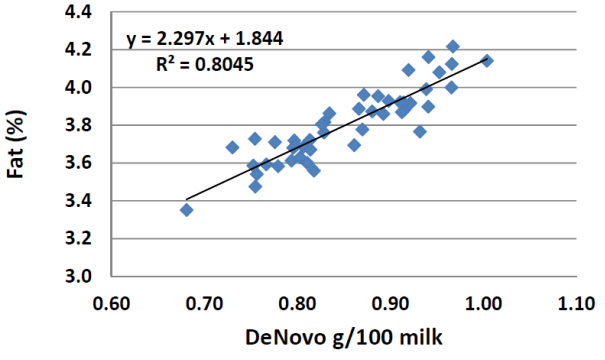
More bunk space = improved eating behaviour = improved milk composition

- Field study of Canadian dairy herds
  - Mean = 22 inch (56 cm)/cow (range 14 to 39 inches/cow)
  - For every 4 inch (10 cm) increase in feed bunk space…
    - +0.06% milk fat

Sova et al. 2013. J. Dairy Sci. 96:4759-4770

More bunk space = improved eating behaviour = improved milk composition

- High de-novo herds tended to be 10x more likely to have >18 inches (46 cm)/cow of bunk space



Woolpert et al. 2017. J. Dairy Sci. 100:5097-5106

Take home messages:

- How cows eat is just as important as the nutritional composition of their feed in ensuring cow health, efficiency, and productivity

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- How cows eat is just as important as the nutritional composition of their feed in ensuring cow health, efficiency, and productivity
  - Dietary composition
  - Management of that feed and environment of the cow

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Questions???

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