A Look to Transition Beyond the Fresh Pen

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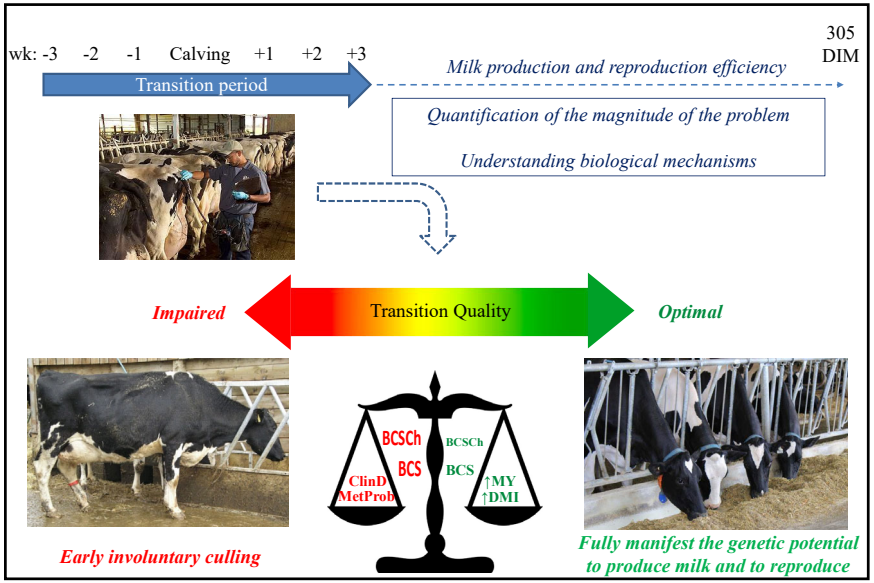


Transition Quality Features

Parameter	Impaired	Optimal
Length of dry period	< 30, > 60 days	40-50 days
BCS at dry-off	> 3.5	3.0-3.5
BCS at calving	< 3.0, > 3.5	3.0-3.5
Calving	Dystocia, twins	Eutocia, single calf
Feed intake	Poor appetite	Good appetite
Postpartum loss of BCS	≥ 1 unit	< 1.0 unit
Health	Clinical disease	No clinical disease
	HypoCa, HyperKeto	No metab. problems

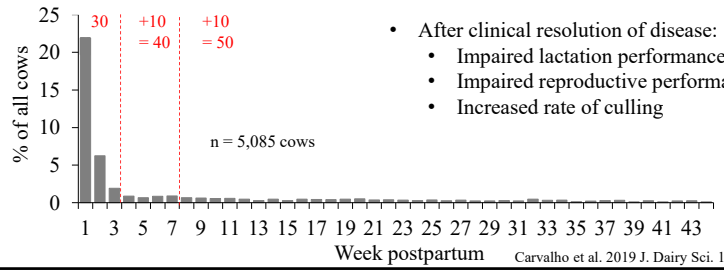
Impaired ← Transition Quality → *Optimal*

Postpartum Clinical Diseases – ClinD (Collective Effect)

● RP ● Metritis ● Mastitis ● Lameness ● Digestive problem ● Respiratory problem

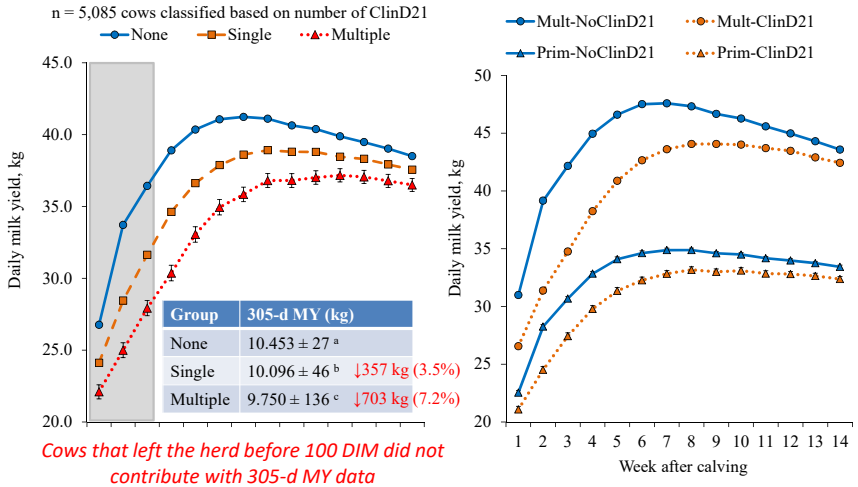
Window	Average
By 305 DIM	~ 50%
By 60 DIM	~ 40%
By 21 DIM	~ 30%

- Most cases are solved shortly after diagnosis
- During clinical presentation of the disease:
  - Expenses with drugs, supplies, labor
  - Cow welfare concerns
  - Toll on farmer and staff well-being
- After clinical resolution of disease:
  - Impaired lactation performance
  - Impaired reproductive performance
  - Increased rate of culling



Carvalho et al. 2019 J. Dairy Sci. 102:11701–11717

Long-term Consequences of ClinD on Lactation Performance

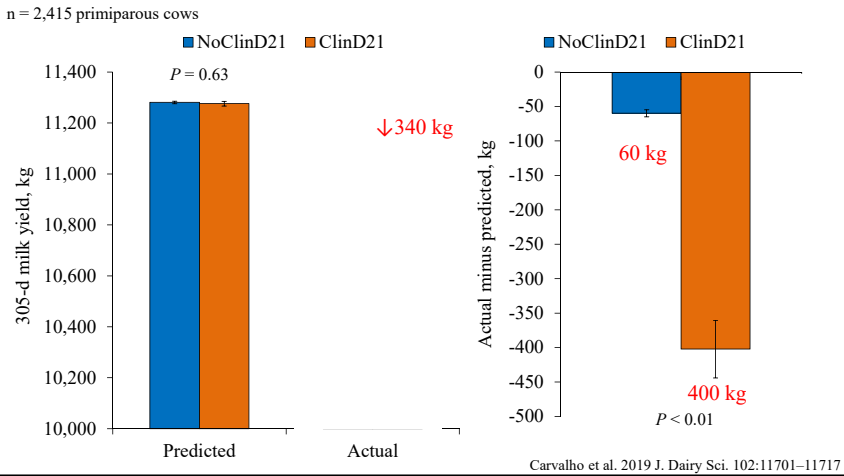


Group	305-d MY (kg)
None	10.453 ± 27 [a]
Single	10.096 ± 46 [b] ↓357 kg (3.5%)
Multiple	9.750 ± 136 [c] ↓703 kg (7.2%)

Cows that left the herd before 100 DIM did not contribute with 305-d MY data

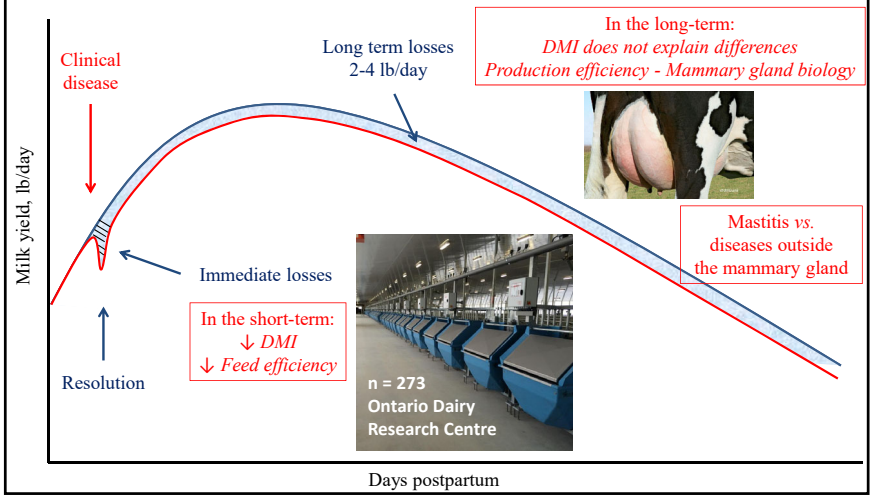
Carvalho et al. 2019 J. Dairy Sci. 102:11701–11717

Effect of ClinD21 on 305-d Yield in First Lactation Cows: Genomic Prediction *vs.* Actual Production



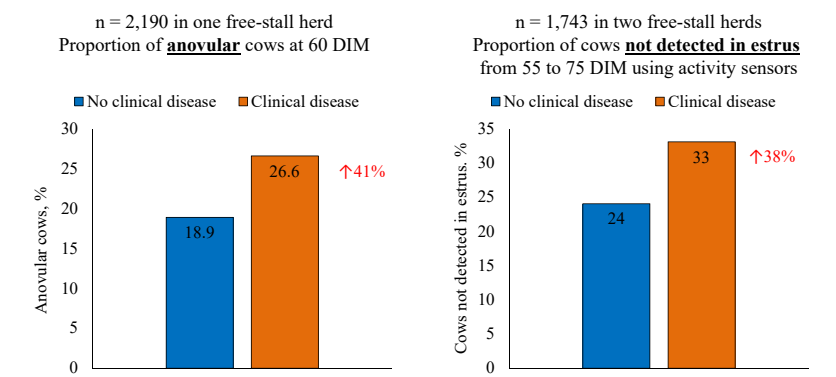
Carvalho et al. 2019 J. Dairy Sci. 102:11701–11717

Average Effect of ClinD21 on Lactation of a Single Cow



Long-term Consequences of ClinD on Reproduction

Cows that survived ClinD21 take longer to resume estrous cyclicity and are less likely to be detected in estrus

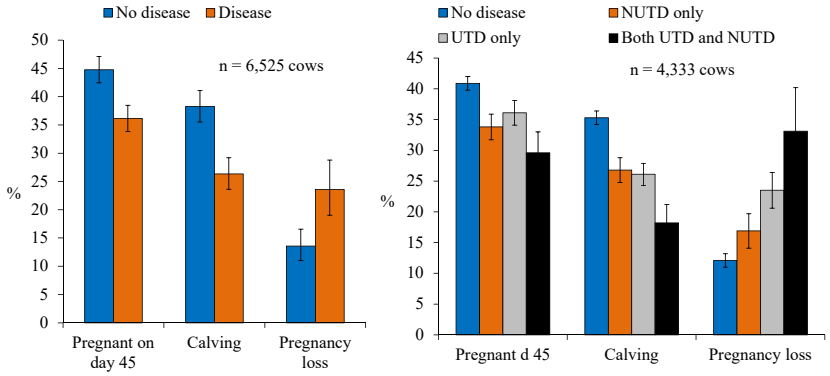


Ribeiro et al. (2016) J. Dairy Sci. 99:2201-2220

Bruinje et al. (2023) J. Dairy Sci. 106: *in press*

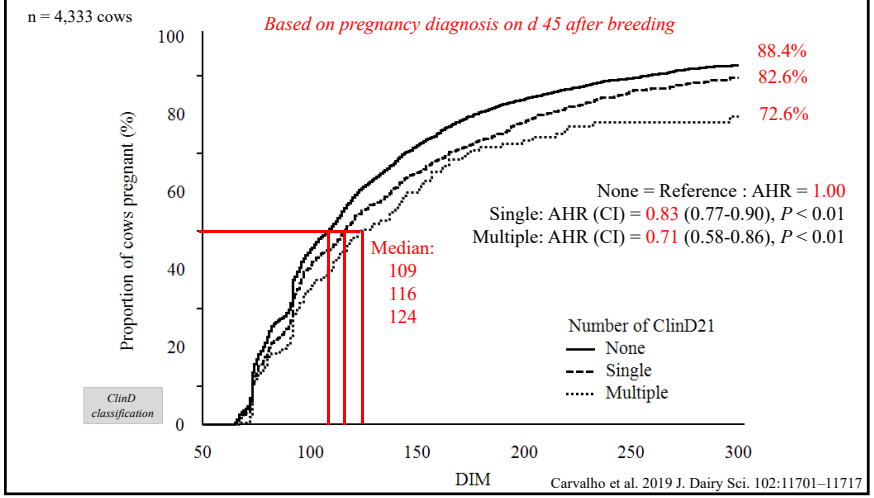
Long-term Consequences of ClinD on Reproductive Performance

Even with synch programs, cows that survived ClinD have reduced pregnancy/AI and higher pregnancy losses



Ribeiro and Carvalho (2017) Anim. Reprod. 14(3):589-600

Long-term Consequences of ClinD on Reproductive Performance



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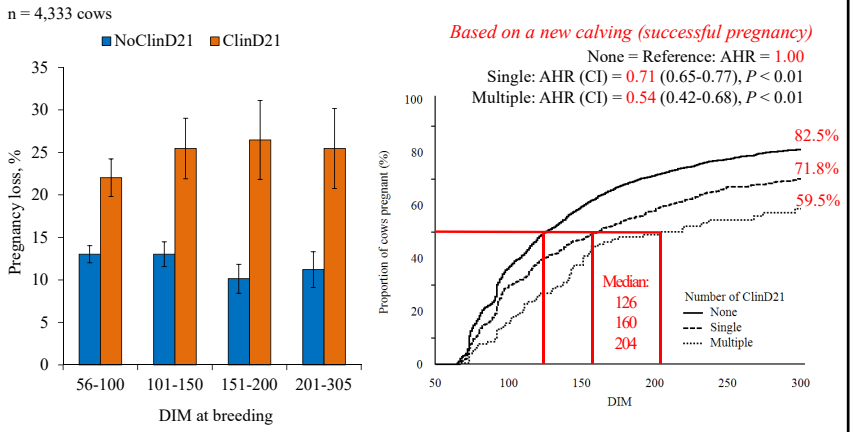
Enduring Effects of ClinD on Subsequent Pregnancy Survival



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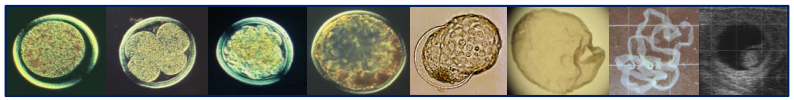
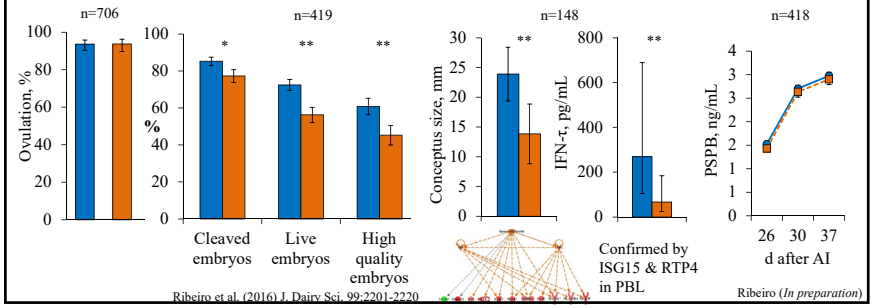
Impact of ClinD on Pregnancy Development



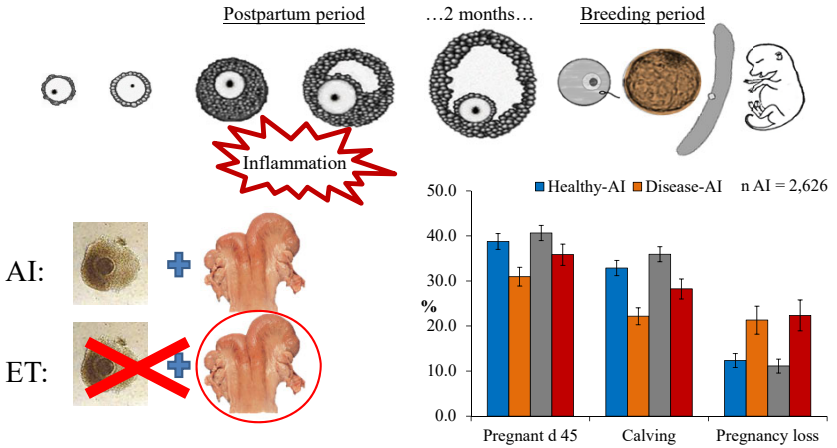
✗ Ovulation ✓Fertilization ✓Development to morula/blastocyst ✓Hatching ✓Elongation ✗Implantation & early placentation



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

Ribeiro (*In preparation*)

Oocyte Quality *vs.* Uterine Environment
Should I Use ET to Bypass the Oocyte Quality Problem?



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

Should the Voluntary Waiting Period (VWP) be Extended to Avoid The Carryover Problems of ClinD21?

The short answer is **NO** because

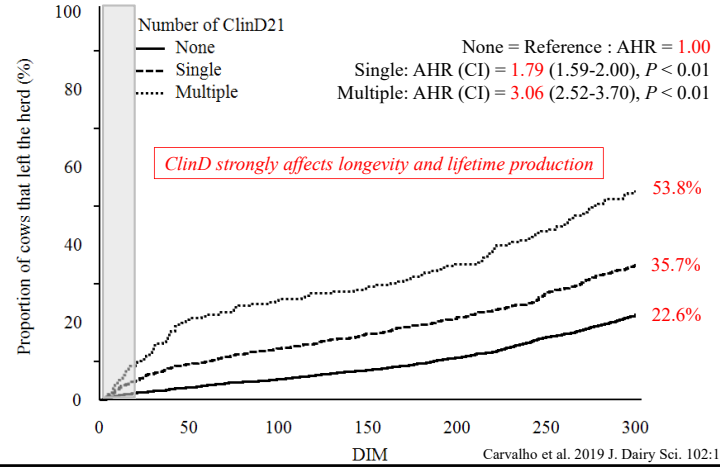
- ClinD effects on pregnancy per AI seem to last through 100-150 DIM
- ClinD effects on pregnancy losses seem to last through 200-305 DIM
- VWP is determined based on the optimal time for pregnancy
  - Compared to healthy cows, cows with ClinD have
    - Reduced milk production
    - Reduced 21-d preg rate

Two reasons to shorten the VWP, not to extend VWP

Ribeiro et al. (2012) Anim. Reprod. 3:370-387

Long-term Consequences of ClinD21 on Culling

n = 5,085 cows



Carvalho et al. 2019 J. Dairy Sci. 102:11701–11717

Economics of ClinD21

Budget analyses for individual cows (n = 5,085) + sensitivity analyses for milk and feed price

Antonatti et al. 2022 J. Dairy Sci.105 (Suppl. 1):42.

Revenue
- Milk sales (kg × price)

Milk price:
- Mod $0.440/kg
- Low $0.352/kg
- High $0.528/kg
- CAN $0.585/kg

Expenses
- Feed costs (DMI × feed price)
- Treatment costs*
- Breeding costs*

*Include labor, drugs, and supplies

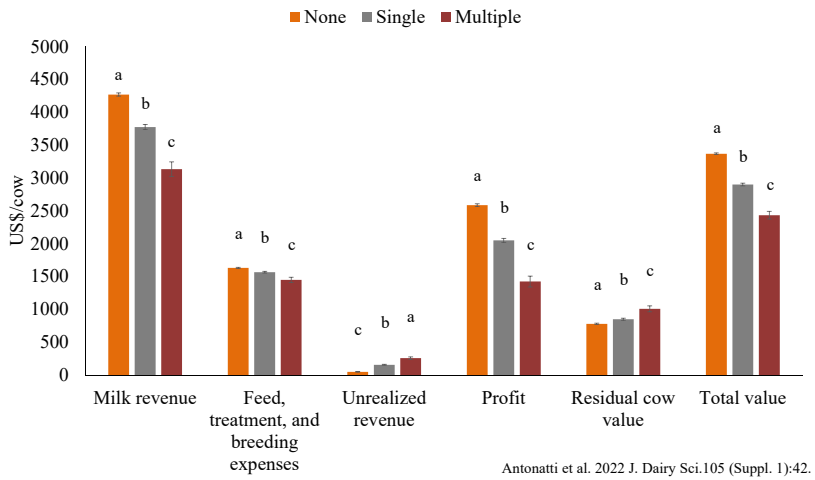
Unrealized revenue
- Milk withdraw (kg × milk price)
- Salvage value for cows that died
  - Mult = $1,100
  - Prim = $1,009

Residual cow value
- Cumulative cash flow projection for each cow and her replacements until 4,000 d after the start of the experiment.

Daily model by DeVries et al. (2016):
- Parity
- Pregnancy status
- DIM when censored

= Profit in the 305-d lactation cycle *+ RCV* *= Total value*

Economics of ClinD21 (US$)



Antonatti et al. 2022 J. Dairy Sci.105 (Suppl. 1):42.

Sensitivity Analyses with Milk Price and Feed Cost: Total Value Difference between ClinD21 and NoClinD21

	Feed Cost ($/kg)					
	Low (0.22)		Moderate (0.26)		High (0.30)	
Milk Price ($/kg)	noClinD21	ClinD21	noClinD21	ClinD21	noClinD	linD21
Low (0.352)	2751.45[a] (±10.28)	2316.85[b] (±15.51)	2518.2[illegible] (±9.48	[illegible]112.55[b] [illegible]14.31)	2284.95[a] (±8.80)	1908.24[b] (±13.28)
Moderate (0.44)	3599.8[illegible] (±14.13	[illegible]039.09[b] [illegible]21.32)	3366.57[a] (±13.08)	2834.79[b] (±19.75)	3133.32[a] (±12.09)	2630.48[b] (±18.25)
High (0.528)	4448.18[a] (±18.51)	3761.33[b] (±27.93)	4214.93[a] (±17.36)	3557.02[b] (±26.20)	3981.69[a] (±16.24)	3352.72[b] (±24.51)

$377 ↓17%

$502 ↓15%

$687 ↓15%

Canada US$ 0.585/L

$740 ↓15%

[a, b] $P < 0.01$ *within price/cost scenario*

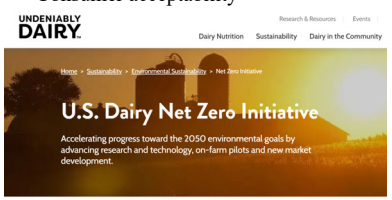
Antonatti et al. 2022 J. Dairy Sci.105 (Suppl. 1):42.

Why Do Economics of ClinD21 Matter?

- For planning and decision making…
- Cost of ClinD21 = US $740 per case
  - Current scenario: 30% of cows with of ClinD21
  - Goal: reduce to 20% (10 percentage points difference)
- Room for investment:
  - Herd size × percentage reduction in ClinD21 × average cost of ClinD21:
    - Example: 200 calvings/year × 10% = 20 fewer cows with ClinD21
      200 * $740 = $14,800/year
- How do I get there:
  - Low hanging fruit opportunities: little to no cost
    - Example: feed bunk management, maternity management, BCS at dry-off
  - Continuous investment: $/cow/d
    - Example: transition diet for 42 d → $14,800 ÷ 200 cows ÷ 42 d = $1.76/cow/d
  - Lump-sum investment: cost recovery analyses
    - Example: infrastructure investment of $100,000 to recover cost in 10 years (4% int)

The Benefits Go Beyond Our Calculations…

We haven't put a $$$ value on:
- New revenue opportunities
- Environmental impact
- Farmer wellbeing
- Consumer acceptability



Kg milk/d	g Co_{2eq} per kg milk
31	530
42	495
52	475

von Soosten et al. (2020)

Lact #	g Co_{2eq} per kg milk
1	1280
2	960
3	860
5	770
8	730

Possible additional effects of ClinD:
- Health and performance on subsequent lactation cycles
- Feed efficiency
- Progeny

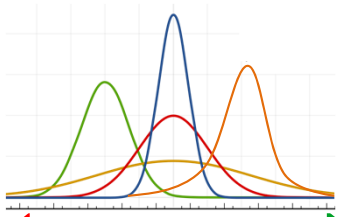
Possible additional benefits of managing for less ClinD21:
- Health and performance of cows without ClinD21

The Benefits Go Beyond Our Calculations…

Improvements in transition management:
↑ Production efficiency
↑ Lifetime production
↓ Environmental impact

↑ Animal welfare
↓ Use of antibiotics
↓ Use of repro hormones
↑ Stewardship
↑ Consumer acceptability

↑ Farmer wellbeing
↑ Profitability



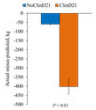
Impaired — Transition Quality — *Optimal*

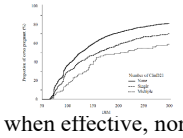
Take Home Messages

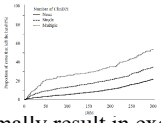
- Transition quality is a spectrum, complex to quantify, and has a large impact on subsequent performance and production efficiency

Impaired — Transition Quality — *Optimal*

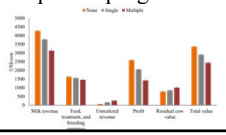
- Suboptimal transition limits the cow's ability to manifest her full genetic potential to produce milk and to reproduce, which impairs longevity and lifetime production







- Investments in transition management, when effective, normally result in excellent ROI and should be considered as part of programs aiming better sustainability

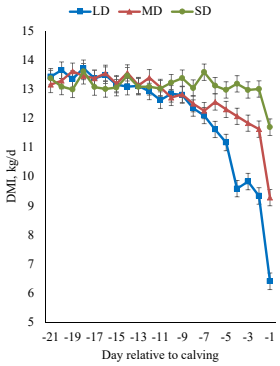


A Look to Transition Beyond the Fresh Pen

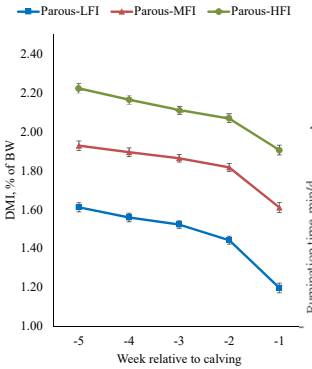
Prevention — Fresh pen — Long-term consequences

Exploring Prepartum Feed Intake as Predictors of Transition Health and Performance of Dairy Cows

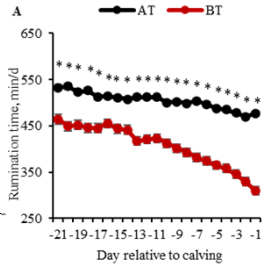
1) Decline in prepartum DMI



2) Level of prepartum DMI



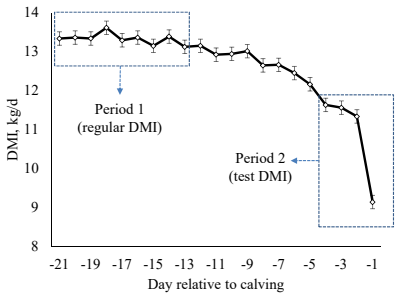
3) Applications in commercial herds



Matheus Santos, unpublished.

Study 1 – Relative Change in Prepartum DMI (RCDMI)

- n = 273 cows with individual feed intake information



$$RCDMI\ (\%) = \left(\frac{xDMIP2 - xDMIP1}{xDMIP1}\right) \times 100$$

Example:

$$RCDMI(\%) = \frac{(8 - 12)}{12}\ x\ 100$$

$$RCDMI = -33.3\%$$

The average DMI (± SD):
Period 1 = 13.8 (± 2.8) kg/d
Period 2 = 11.3 (± 3.0) kg/d

Change in DMI from period 1 to period 2
- -2.5 (± 2.2) kg/d
- -18.1% (± 15.0)
- Range from -75% to +15%

Adj. R-Sq of predictive linear models:
- farm data only: 11% (19% for parous)
- + sensors: 39% (45% for parous)
- + blood met: 45% (53% for parous)

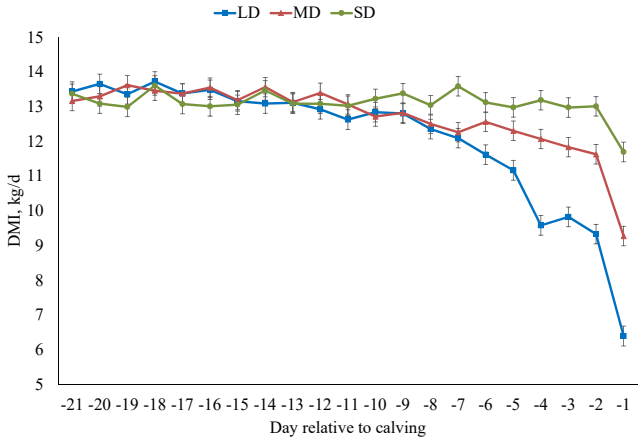
Risk factors for a larger decline:
- Parity
- High BCS and large frame
- MY at dry-off and length of dry period

Study 1 – Relative Change in Prepartum DMI (RCDMI)

Receiver operating characteristic curve statistics regarding the predictive value of relative change in prepartum dry matter intake for postpartum health problems [1]

Item [2]	n	Incidence (%)	AUC (95% CI) [3]	P	Criterion [4]	Se	Sp
All cows							
ClinD21	273	24.9	0.548 (0.487-0.609)	0.28	≤ -31.56	30.9	87.3
M-ClinD21	273	5.1	0.650 (0.591-0.707)	0.08	≤ -24.10	57.1	72.2
SubCC14	238	50.4	0.635 (0.57-0.696)	< 0.01	≤ -13.15	70.3	51.7
M-SubCC14	238	14.7	0.686 (0.623-0.745)	< 0.01	≤ -16.33	80.0	54.7
HE21	238	59.2	0.583 (0.518-0.646)	0.02	≤ -26.34	31.9	86.6
M-HE21	238	24.8	0.670 (0.606-0.729)	< 0.01	≤ -23.89	52.5	77.6
Hyperketonemia	238	19.0	0.674 (0.611-0.733)	< 0.01	≤ -29.02	44.2	84.4
Parous cows only							
ClinD21	173	30.0	0.558 (0.481-0.634)	0.29	≤ -33.09	30.4	89.0
M-ClinD21	173	6.4	0.708 (0.634-0.774)	0.03	≤ -24.10	72.7	71.0
SubCC14	149	59.7	0.630 (0.547-0.707)	< 0.01	≤ -10.94	77.5	43.3
M-SubCC14	149	18.8	0.702 (0.622-0.774)	< 0.01	≤ -16.34	82.1	55.4
HE	149	69.1	0.593 (0.509-0.672)	0.05	≤ -26.08	33.0	89.1
M-HE	149	30.9	0.694 (0.613-0.767)	< 0.01	≤ -23.89	56.5	77.7
Hyperketonemia	149	42.0	0.683 (0.602-0.757)	< 0.01	≤ -29.49	42.9	87.9

Study 1 – Relative Change in Prepartum DMI (RCDMI)

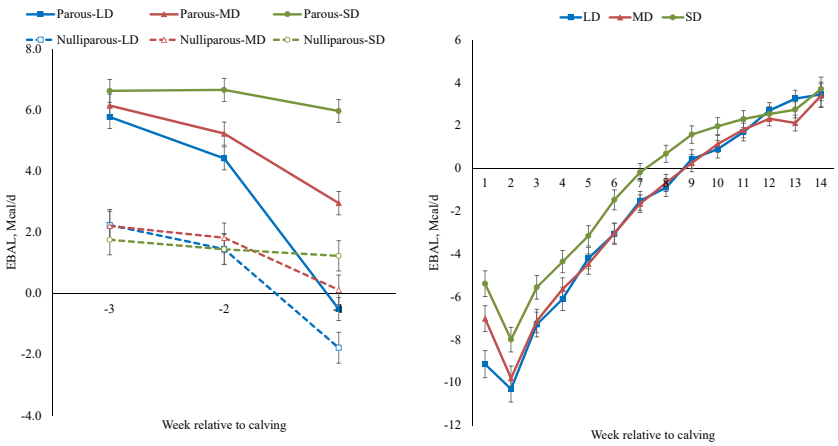


Study 1 – Relative Change in Prepartum DMI (RCDMI)

Number of cows, prepartum dry matter intake, body weight, and body condition score according to experimental groups[1]

	Magnitude of change in prepartum DMI		
Item	Large	Moderate	Small
Number of cows			
Nulliparous	33	34	33
Parous	58	57	58
Total	91	91	91
DMI, kg/d			
Period 1 (d -21 to d -12)	13.3 ± 0.2	13.4 ± 0.2	13.2 ± 0.2
Period 2 (d -4 to d -1)	8.8 ± 0.2 [c]	11.2 ± 0.2 [b]	12.7 ± 0.2 [a]
Change in DMI			
kg/d	-4.5 ± 0.1 [c]	-2.2 ± 0.1 [b]	-0.5 ± 0.1 [a]
%	-33.8 ± 0.9 [c]	-16.2 ± 0.8 [b]	-3.4 ± 0.8 [a]
Body weight, kg			
Mean	788 ± 7 [a]	775 ± 7 [a]	750 ± 7 [b]
Deviation from mean BW	12.5 ± 6.2 [a]	2.4 ± 6.0 [a]	-14.7 ± 6.0 [b]
BCS			
Mean, 1-5 scale	3.68 ± 0.03 [a]	3.64 ± 0.03 [ab]	3.59 ± 0.03 [b]
Greater than 3.5, %	62.7 ± 5.7 [a]	46.5 ± 5.7 [b]	38.2 ± 5.5 [b]

Study 1 – Relative Change in Prepartum DMI (RCDMI)



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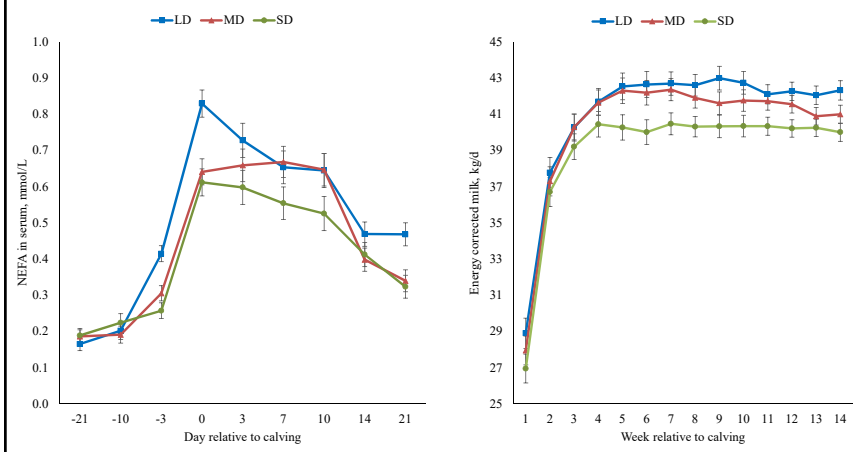
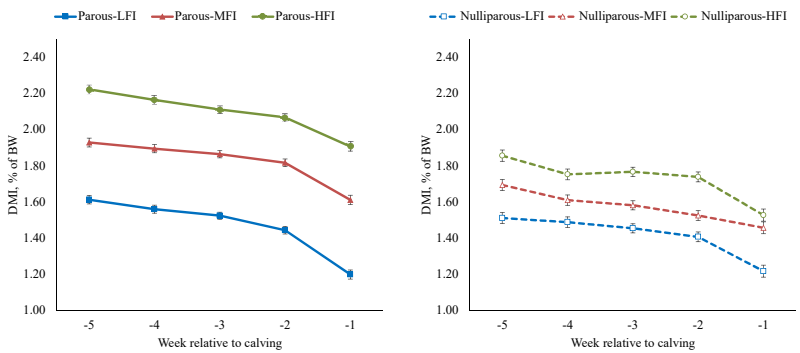


Study 2 – Level of Prepartum DMI % BW



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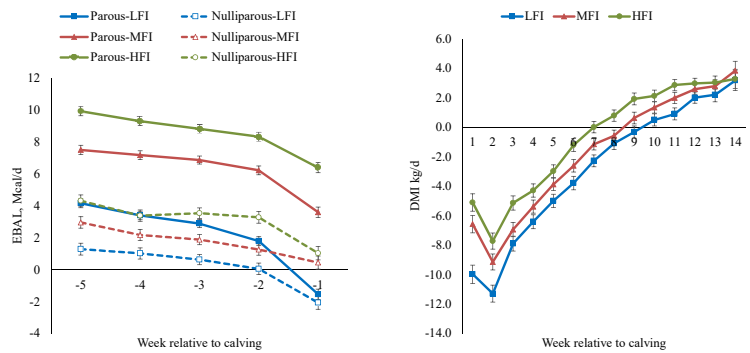

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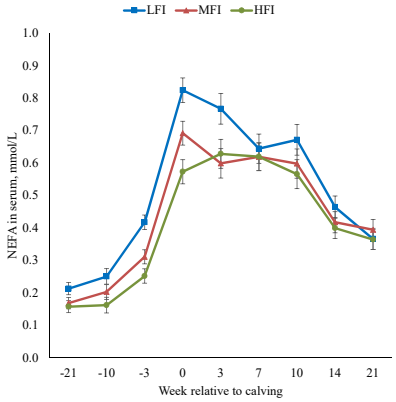
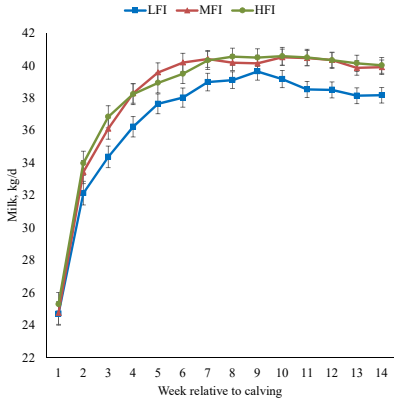




Study 2 – Level of Prepartum DMI % BW

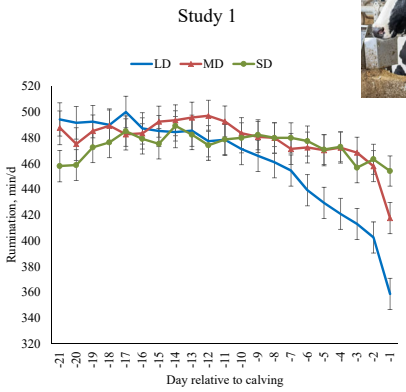
Linear regression models using the continuous variable:

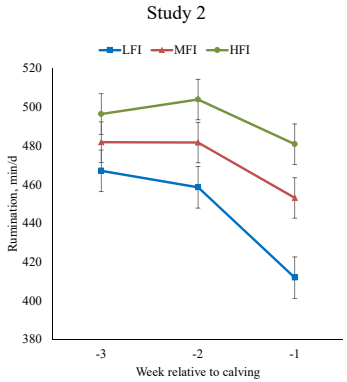
Adj. R-Sq of predictive linear models:
- farm data only: 41% (49% for parous)
- + sensors: 48% (53% for parous)
- + blood met: 60% (59% for parous)

Risk factors for a low feed intake:
- Parity
- High BCS and large frame
- MY at dry-off and length of dry period

ROC models for prediction of postpartum disease:
- None were significant

Exploring Prepartum Feed Intake as Predictors of Transition Health and Performance of Dairy Cows





Exploring Wearable Sensors as Predictors of Transition Health and Performance of Dairy Cows

- Average RT last 2 wk
- Average RT wk -2
- Average RT wk -1

$$\textbf{RT deviation}\ (wk) = cow\ RT - herd\ RT$$

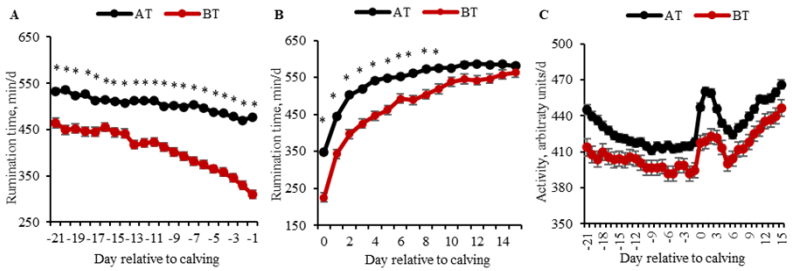
ROC analysis

Above the threshold **(AT)**
Below the threshold **(BT)**

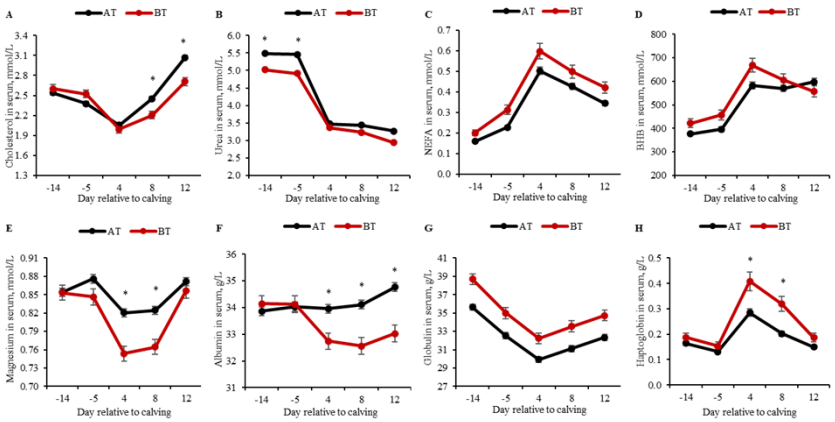
- n = 199 nulliparous and 337 parous cows in St. Marys, ON

Item	AUC (95% CI)	*P*	Threshold (min)	Se	Sp
Nulliparous					
RT last 2 wk	0.51 (0.43-0.60)	0.79	≤ -23	0.37	0.72
RT wk -2	0.53 (0.44-0.61)	0.53	≤ -16	0.46	0.66
RT wk -1	0.51 (0.42-0.59)	0.89	≤ -72	0.92	0.15
Multiparous					
RT last 2 wk	0.64 (0.58-0.70)	< 0.01	≤ -11	0.65	0.55
RT wk -2	0.62 (0.56-0.68)	< 0.01	≤ -32	0.36	0.78
RT wk -1	0.65 (0.60-0.71)	< 0.01	≤ -53	0.43	0.81

Exploring Wearable Sensors as Predictors of Transition Health and Performance of Dairy Cows



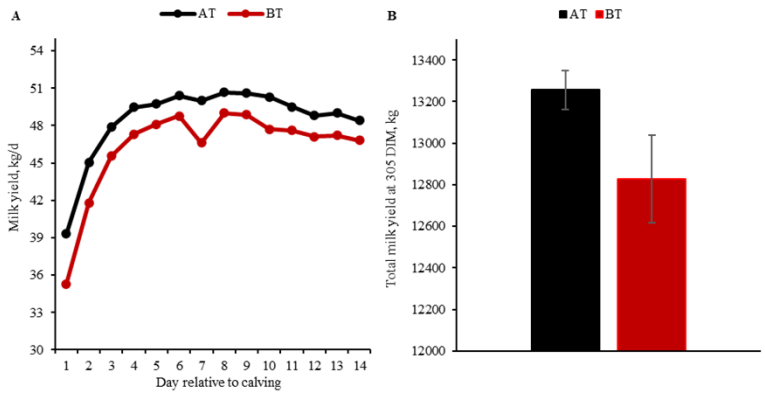
Exploring Wearable Sensors as Predictors of Transition Health and Performance of Dairy Cows



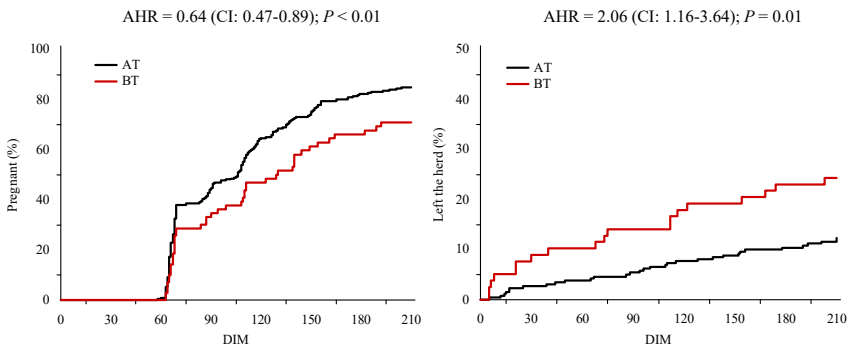
Exploring Wearable Sensors as Predictors of Transition Health and Performance of Dairy Cows

Item	Group			
	AT	BT	OR (CI)	*P*-value
Calving problems	13.9 (36/259)	26.9 (21/78)	1.42 (1.20 to 4.13)	0.01
Retained placenta	8.9 (23/259)	19.2 (15/78)	2.44 (1.19 to 5.01)	0.01
Metritis	16.2 (42/259)	37.2 (29/78)	2.96 (1.67 to 5.25)	< 0.01
Lameness	31.4 (81/258)	55.8 (43/77)	2.86 (1.68 to 4.87)	< 0.01
Uterine disease	18.5 (48/259)	39.7 (31/78)	2.81 (1.61 to 4.91)	< 0.01
Non-uterine disease	34.4 (89/259)	57.7 (45/78)	2.69 (1.59 to 4.56)	< 0.01
Clinical disease	45.9 (119/259)	73.1 (57/78)	3.19 (1.82 to 5.59)	< 0.01
Multiple clinical disease	13.1 (34/259)	34.6 (27/78)	3.48 (1.92 to 6.30)	< 0.01

Exploring Wearable Sensors as Predictors of Transition Health and Performance of Dairy Cows



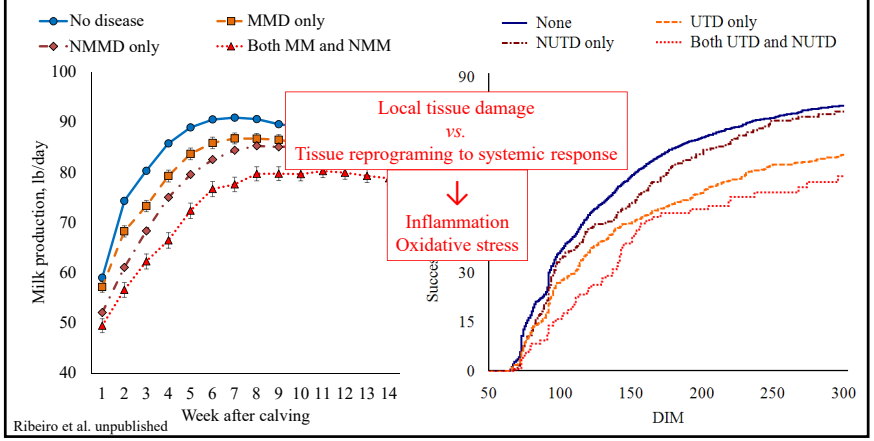
Exploring Wearable Sensors as Predictors of Transition Health and Performance of Dairy Cows



Take Home Messages

- Parity, high BCS, high BW, low MY at dry-off, longer dry periods were risk factors for low level of prepartum DMI and a larger drop in prepartum DMI
- The decline in prepartum DMI was associated with major changes in metabolism, risk for postpartum disease, and greater milk production in the subsequent lactation
- The level of prepartum DMI was associated with major changes in metabolism and reduced milk production in the subsequent lactation (independent of health outcomes)
- Sensors can help with the identification of subgroup of prepartum cows with higher risk of postpartum disease and reduced performance in the subsequent lactation

Long-term Effects of ClinD21 on Milk Production and Reproduction Does the Site of Infection Matter?

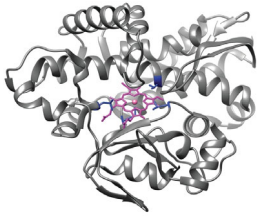


Ribeiro et al. unpublished

Trace Minerals

- Elements required in milligram or micrograms

Co Cu Mn Se Zn



- Selenoproteins
- Metalloproteins
  - Enzymes
  - Transcription factors
  - Transporters

- ✓ Oxidative balance
- ✓ Gene expression
- ✓ Protein synthesis
- ✓ Vitamin synthesis
- ✓ Immune cell function

- TM in feedstuff = basal levels

- Supplementation is recommended to optimize health and performance

Supplementation of Trace Minerals

Supplementation = [recommended] – [basal]

Types of TM supplements:

Differences in bioavailability and $$$

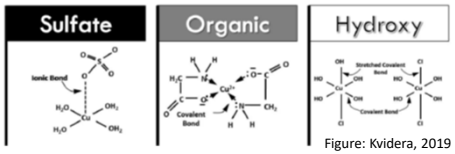
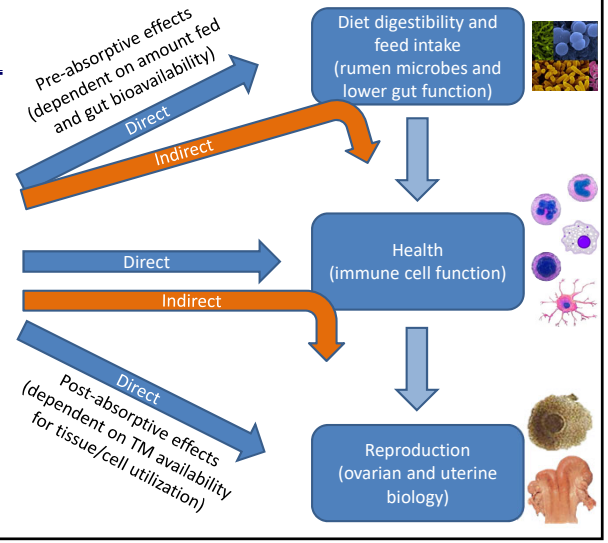


Figure: Kvidera, 2019

- Inorganic salts of TM (**STM**)
  - Sulphates, oxides, carbonates
- Hydroxy TM (**HTM**)
  - It is also inorganic but with covalent bond between the TM and hydroxyl groups
- Organic TM (**OTM**)
  - chelates between the TM and an organic molecule such as a peptide, AA, polysaccharide, propionate, acetate, or picolinate

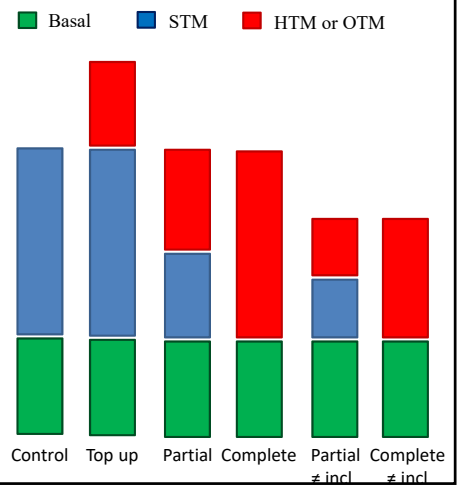
Direct and indirect effects on health and fertility



The amount and form of supplementary TM can have both pre- and post-absorptive effects

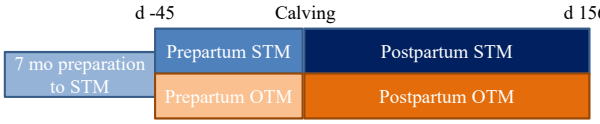
Challenges with Interpretation/Translation of Studies in TM Nutrition

- Inclusion levels
- Consideration of basal
- Strategy of supplementation
- Not all products are the same



Complete Replacement of Salts of Trace Minerals (STM) by Organic Trace Minerals (OTM)

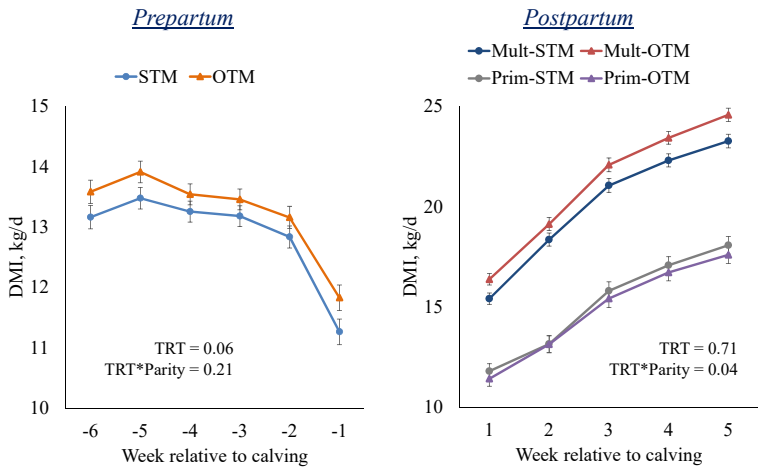
- [Basal Cu, Mn, Zn]: 2-year retrospective data of feed ingredients
- 273 cows individually fed (100 heifers + 173 mature cows)



STM: Co, Cu, Mn, Zn sulfates + Na selenite
vs.
OTM: Co, Cu, Mn, Zn proteinates + selenized yeast

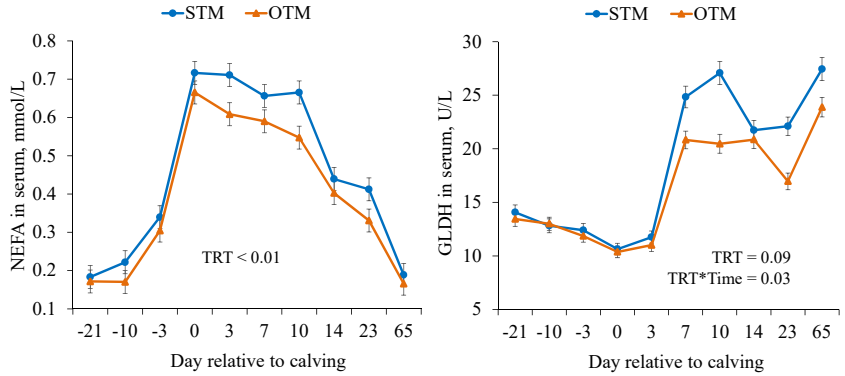
% from suppl.	TM	Inclusion in TMR (mg/kg) Prepartum Guelph	Prepartum NASEM	Postpartum Guelph	Postpartum NASEM
100	Se	0.30	0.30	0.30	0.30
100	Co	0.25	0.20	0.25	0.20
57/59	Cu	13.7	17-19	15.7	8-10
35/45	Mn	40.0	38-43	40.0	26-31
43/59	Zn	40.0	30-35	63.0	57-66

Complete Replacement of STM by OTM: Feed Intake



Mion et al. 2022 J. Dairy Sci. 105: 6693-6709

Complete Replacement of STM by OTM: Fatty Acids Mobilization and Liver Health

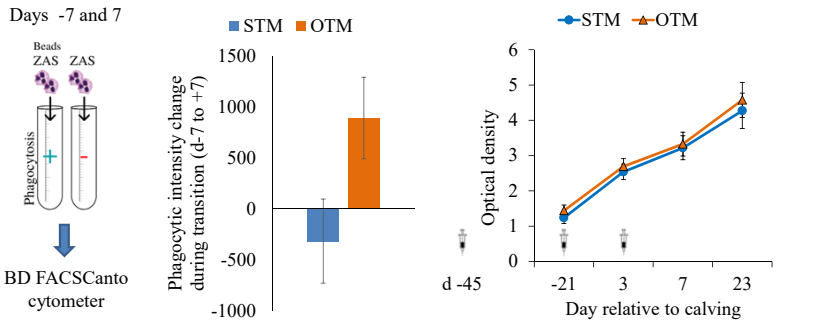


Mion et al. 2022 J. Dairy Sci. 105: 6693-6709
Mion et al. 2023 J. Anim. Sci. 101:skad041

Complete Replacement of STM by OTM: Neutrophil Function and IgG responses to Ovalbumin

Neutrophil function in vitro
n = 129

Anti-ovalbumin IgG responses in vivo
n = 189

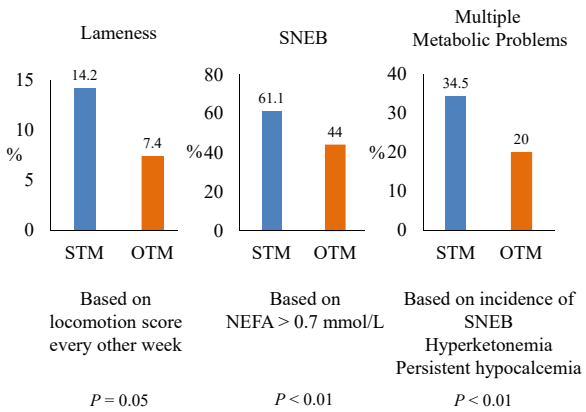


No differences in percentage of neutrophils performing phagocytosis

= 1 mL containing 0.5 mg ovalbumin from chicken egg white suspended in Quil A adjuvant

Ogilvie et al. 2022 J. Dairy Sci. 105: 9944-9960

Complete Replacement of STM by OTM: Postpartum Health Problems

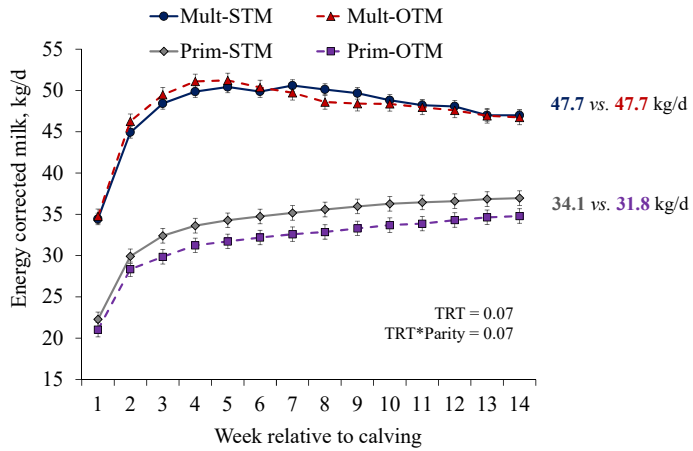


No differences in:

- RP & metritis
- PVD & endometritis
- Mastitis & SCC
- Respiratory & digestive problems

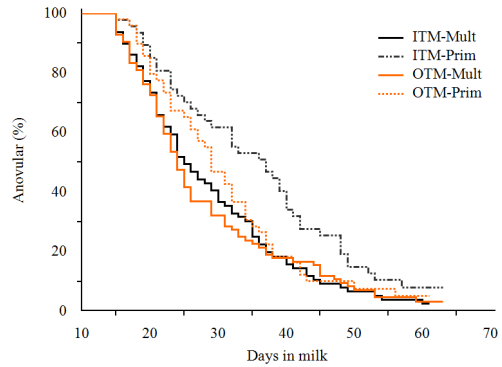
Mion et al. 2023 J. Anim. Sci. 101:skad041

Complete Replacement of STM by OTM: Energy Corrected Milk



Mion et al. 2022 J. Dairy Sci. 105: 6693-6709

Complete Replacement of STM by OTM: Time to Resume Estrous Cyclicity

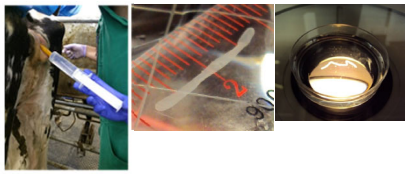


No differences:
- Size of the dominant follicles
- Estrous behavior monitored by AAM
- Size of corpus lutea
- Concentration of progesterone

OTM had ↑[Cu] in follicular fluid (0.89 vs. 0.77 µg/mL).

Mion et al. (2023) J. Dairy Sci. 106:5074-5095

Complete Replacement of STM by OTM: Preimplantation Conceptus Development

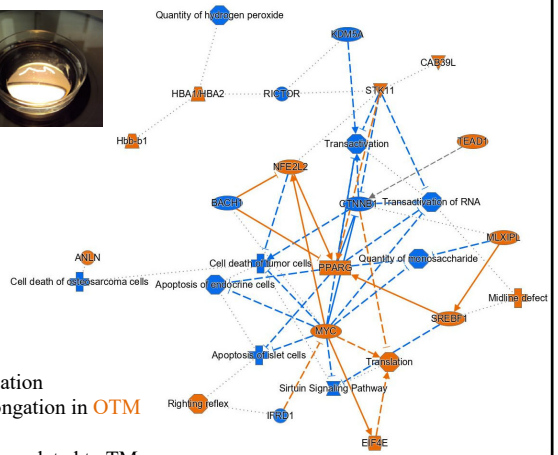


14 conceptuses (d 15 after AI)
8 OTM vs 6 STM (Reference)

589 DET
- 244 downregulated in OTM
- 345 upregulated in OTM

86 transcripts associated with elongation
Of those, 83 indicated advanced elongation in OTM

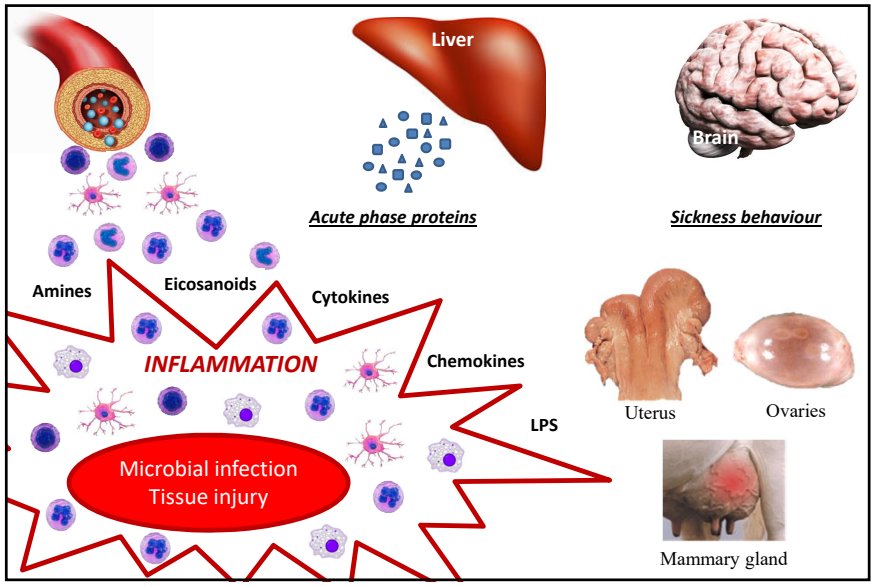
Of the remaining DET, multiple were related to TM



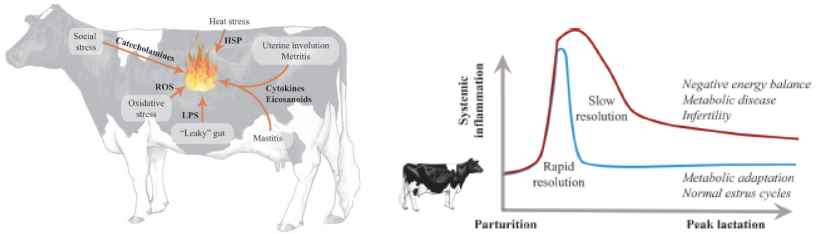
Mion et al. (2023) J. Dairy Sci. 106:5074-5095

Take Home Messages

- Complete or partial replacement of STM by alternative sources of TM (OTM and HTM) have potential to improve health and reproduction in dairy cows
  - Variable responses in the literature but overall positive effects
  - Interactions with other dietary and management factors
- CR of STM by OTM resulted in pre- and post-absorptive effects
  - Pre-absorptive effects are still largely unknown
- Parity specific response to TM should be further investigated
  - Data on pregnant heifers and primiparous cows are very limited



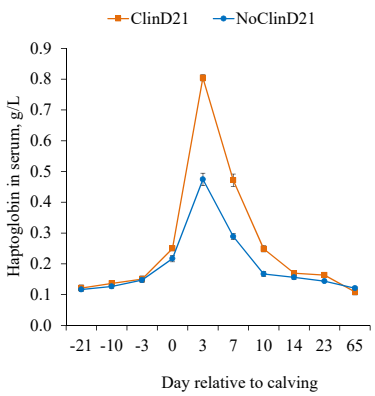
Inflammation Postpartum: Good or Bad?



Bradford et al. 2015 J. Dairy Sci. 98:6631–6650

Postpartum Inflammation in Cows with Clinical Disease

- *ClinD = Inflammation and pain*



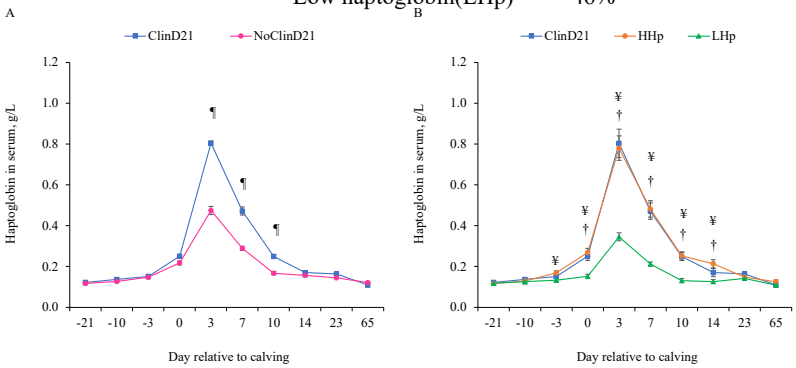
Mion et al. (2022) PhD Dissertation

Postpartum Inflammation in Healthy Cows - Haptoglobin

n = 250 cows

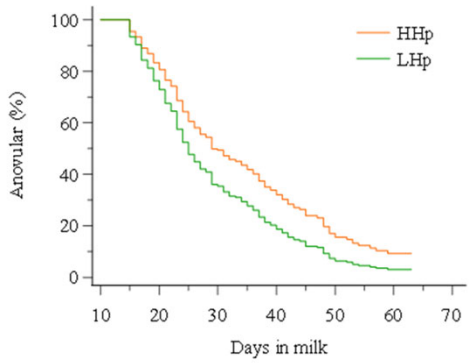
- ClinD21 27%
- NoClinD21 73%

- High haptoglobin (HHp) 27%
- Low haptoglobin(LHp) 46%



Mion (2022) PhD dissertation

Postpartum Inflammation in Healthy Cows: Resumption of Estrous Cyclicity

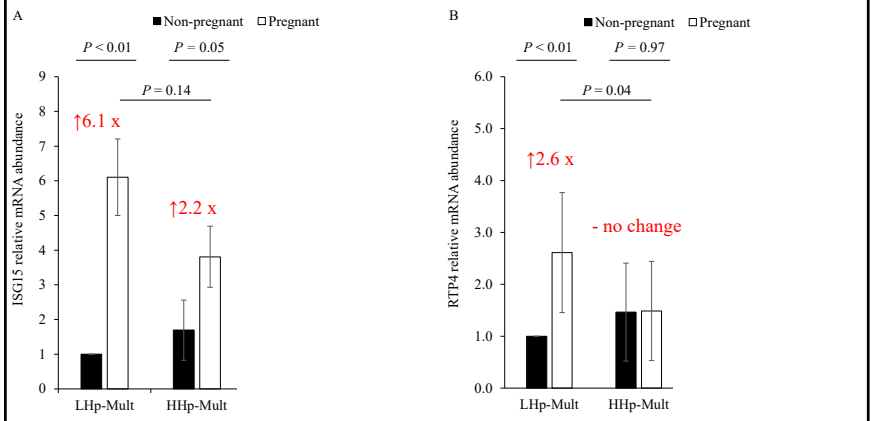


LHp: AHR = 1.00 (reference)
HHp: AHR = 0.70; CI = 0.51-0.97
P = 0.03

AHR = 0.70; 95% CI = 0.51 - 0.97

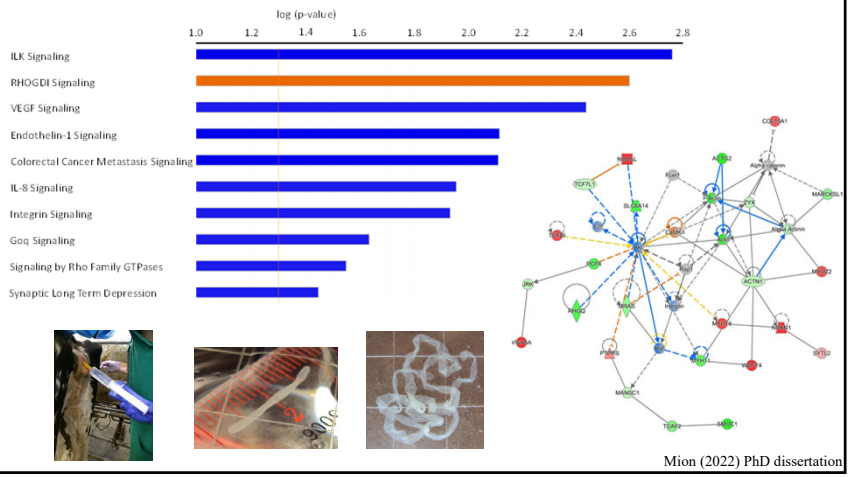
Mion (2022) PhD dissertation

Postpartum Inflammation in Healthy Cows: Preimplantation Conceptus Development In Vivo



Mion (2022) PhD dissertation

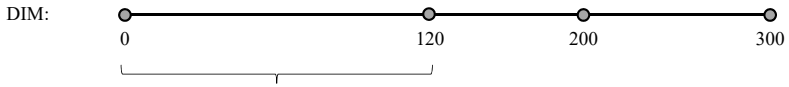
Postpartum Inflammation in Healthy Cows: Preimplantation Conceptus Cells Biology



Mion (2022) PhD dissertation

Treatment Protocols: Adding Meloxicam to the Treatment of Clinical Mastitis

- *n = 509 cows diagnosed with clinical mastitis in 61 European herds*



Diagnosis of mild to moderate clinical mastitis

Cows were assigned to 1 of 2 treatment protocols:
- Control: ATB + placebo (n = 256)
- NSAID: ATB + meloxicam (n = 253)

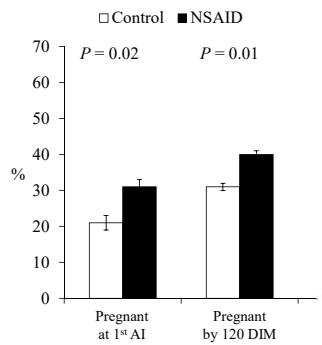
ATB = 1 to 4 intramammary infusion of cephalexin and kanamycin at 24-h intervals

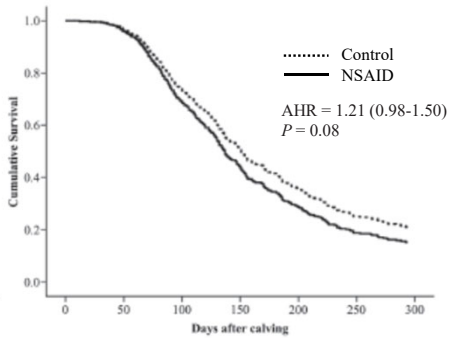
NSAID = single dose of meloxicam (0.5 mg/kg, s.c.)

McDougall et al. (2016) J. Dairy Sci. 99:2026–2042.

Treatment Protocols: Adding Meloxicam to the Treatment of Clinical Mastitis

- *n = 509 cows diagnosed with clinical mastitis in 61 European herds*





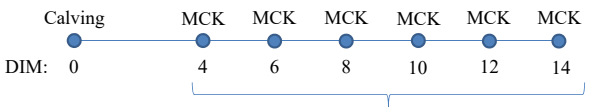
Financial benefit = ~$50

McDougall et al. (2016) J. Dairy Sci. 99:2026–2042.

Treatment Protocols: Adding Meloxicam to the Treatment of Metritis

2,771 Gyr-Holstein cows enrolled in two dairies in Brazil

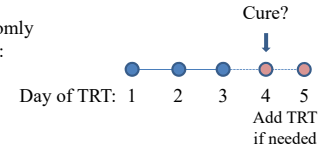
Diagnosis and treatment of metritis:



Cows diagnosed with metritis were randomly assigned into one of two treatment groups:

1. Ceftiofur (**CEF**)
2. Ceftiofur + Meloxicam (**CEFMel**)

3. Cows without metritis (**NoMET**)



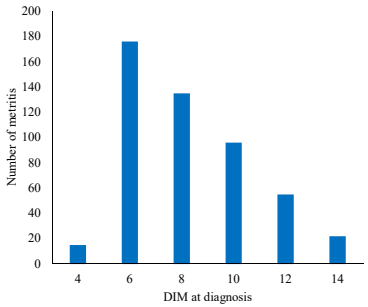
Ceftiofur: 2.2 mg/kg of BW i.m. once daily for 3 days
Meloxicam: 0.5 mg/kg of BW i.m. administered daily for 3 days

Pontes et al. unpublished

Treatment Protocols: Adding Meloxicam to the Treatment of Metritis

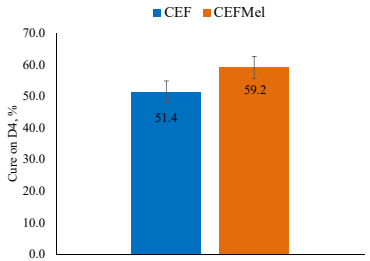
Incidence of metritis:

- 18.1% (501 out of 2771)
  - 251 CEF
  - 250 CEFMel



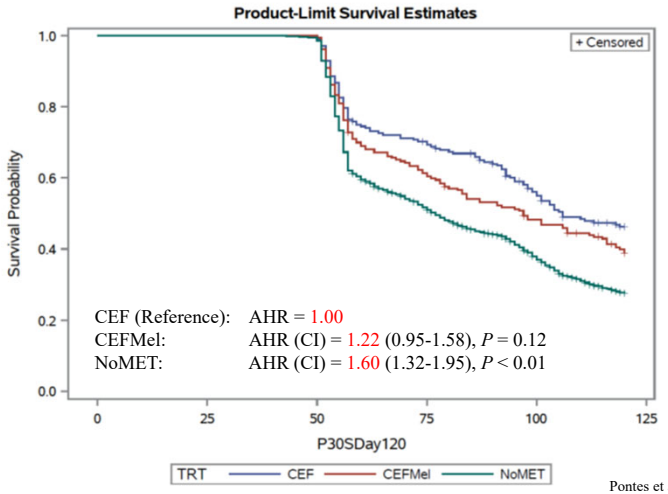
Cure on D4:

- 55% (275 out of 500)



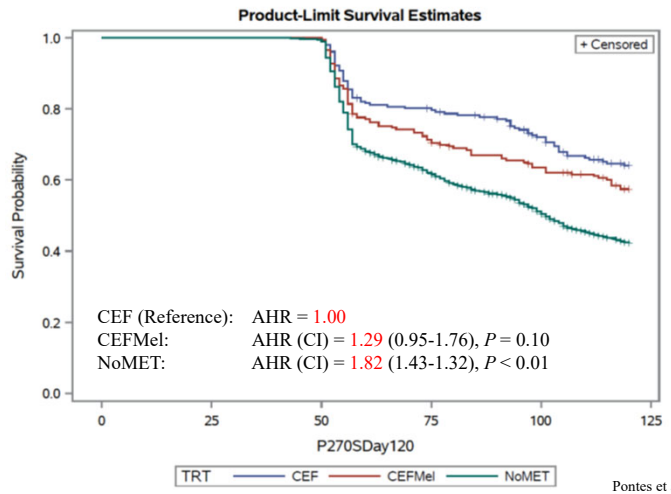
Pontes et al. unpublished

Results – Time to Pregnancy



Pontes et al. unpublished

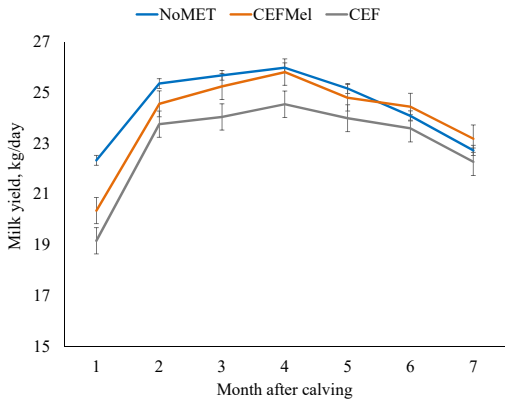
Results – Time to Successful Pregnancy



Pontes et al. unpublished

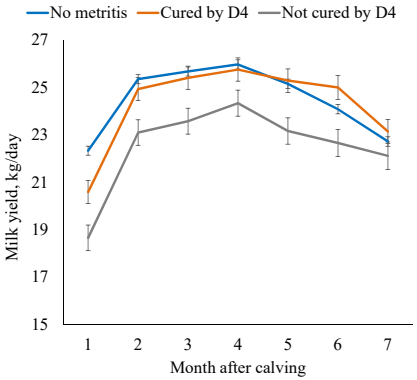
Treatment Protocols: Adding Meloxicam to the Treatment of Metritis

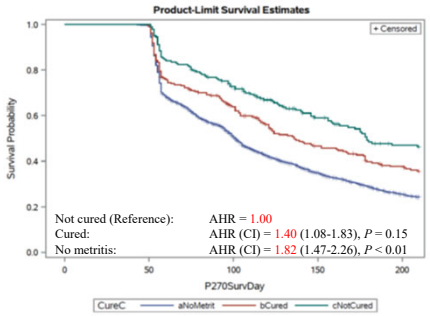
Milk production:



Pontes et al. unpublished

Effect of Clinical Cure of Metritis by D4 Despite of TRT





Pontes et al. unpublished

Early Diagnosis of Disease + Most Effective Treatment

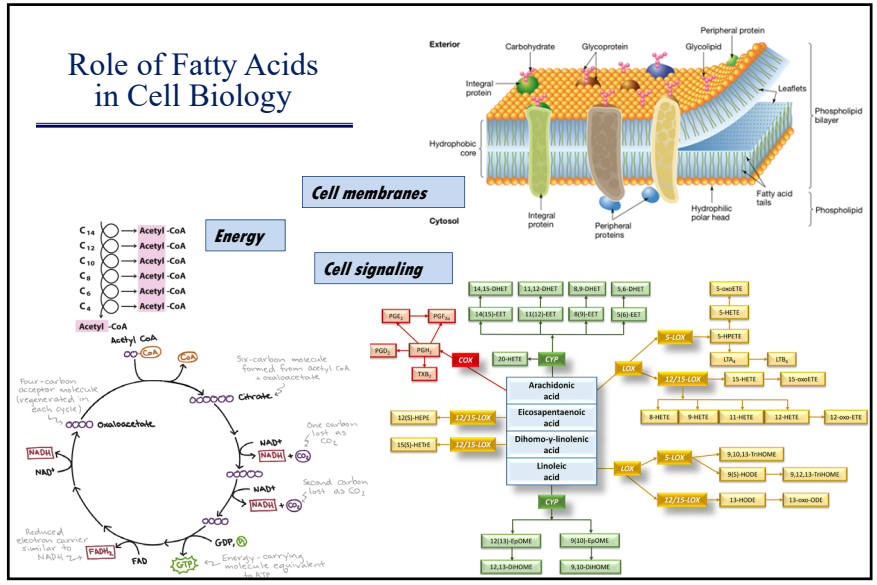
- Goal:
  - Minimize the consequences of disease
- How?
  - Identify a sick cow (or one that will become sick) as soon as possible
  - Treat with the most effective protocol
- Why?
  - Days in the hospital pen
  - Severity of a clinical case
  - Number of clinical cases

Positively associated with subsequent reductions in performance

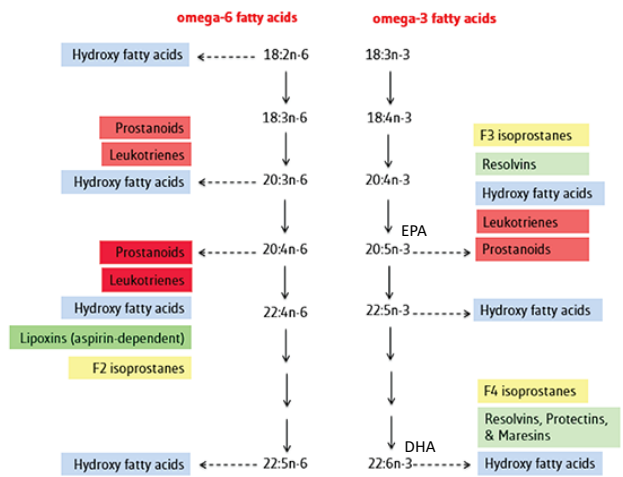
→ *Avoid prolonged lock-up time & excessive handling*

Automated Monitoring Systems:

Role of Fatty Acids in Cell Biology



Oxylipins: Bioactive Lipid Mediators From PUFA



Source: http://lpi.oregonstate.edu/mic/other-nutrients/essential-fatty-acids

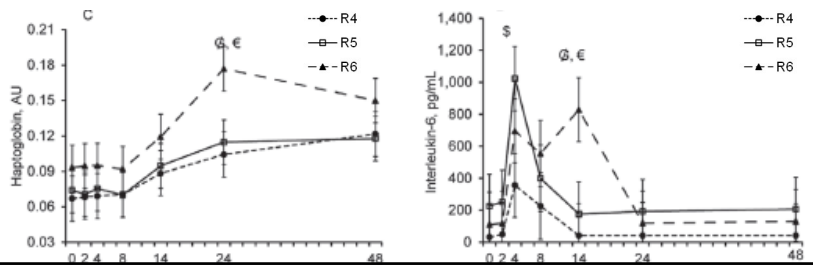
Dietary Ratio of n6 and n3 Fatty Acids

Starting on d 14 postpartum, diets were supplemented with a mixture of Ca salts of fish, safflower, and palm oils (1.4% of DM) to create 3 ratios of n-6 to n-3:

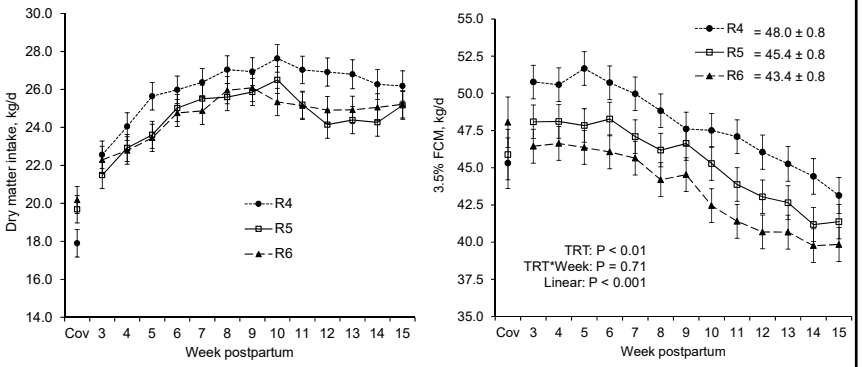
- R6: 6 parts of n-6 to 1 part of n-3 FA
- R5: 5 parts of n-6 to 1 part of n-3 FA
- R4: 4 parts of n-6 to 1 part of n-3 FA

Greco et al. (2015) J. Dairy Sci. 98 :602–617

Inflammatory responses to an intramammary LPS challenge:



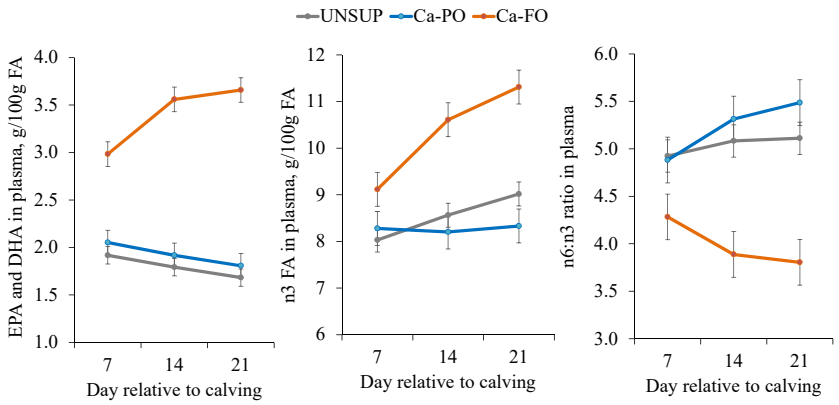
Effect of Dietary n6:n3 Ratio on DMI and FCM



Greco et al. (2015) J. Dairy Sci. 98 :602–617

Omega-3 Fatty Acids Can Be Enriched in Circulation

n = 8 cows per group – supplementation started on d 2 – inclusions of 0.8% of DM



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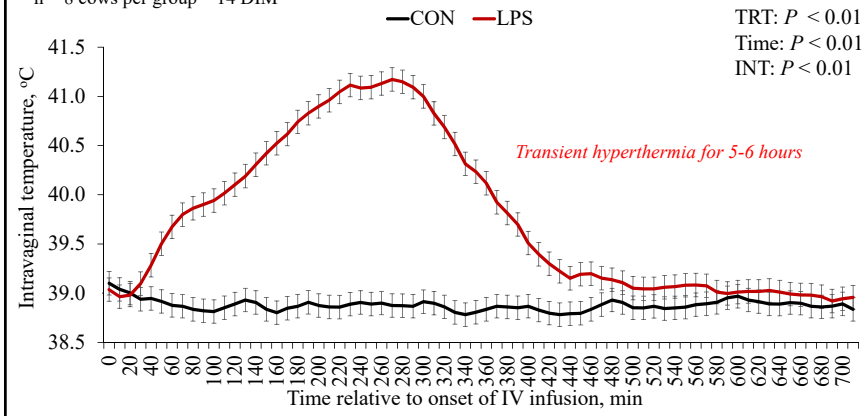
Induced Systemic Inflammation in Healthy Postpartum Cows

n = 8 cows per group – 14 DIM



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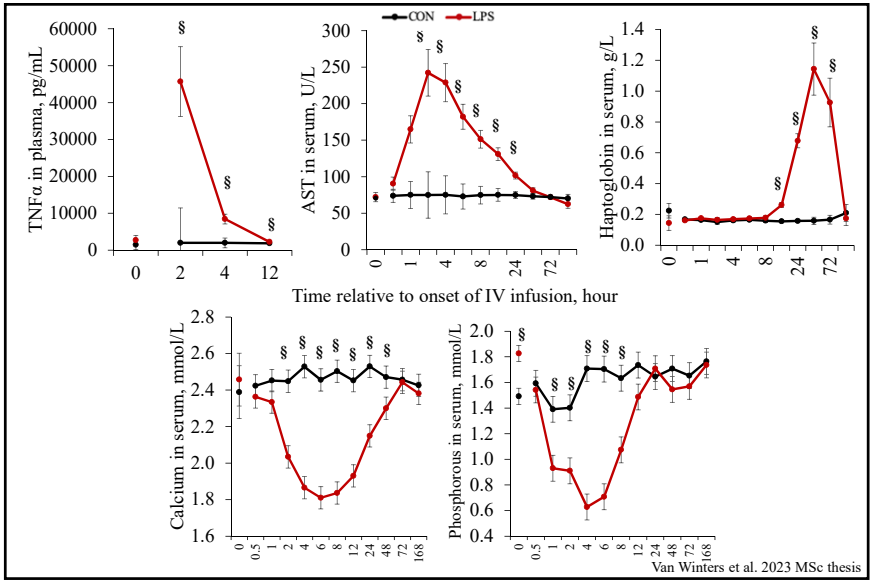

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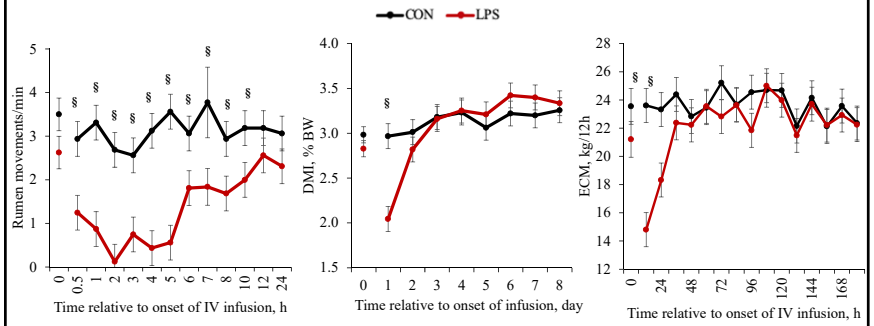

TRT: $P < 0.01$
Time: $P = 0.07$
INT: $P = 0.06$

TRT: $P = 0.67$
Time: $P < 0.01$
INT: $P < 0.01$

TRT: $P = 0.28$
Time: $P < 0.01$
INT: $P < 0.01$

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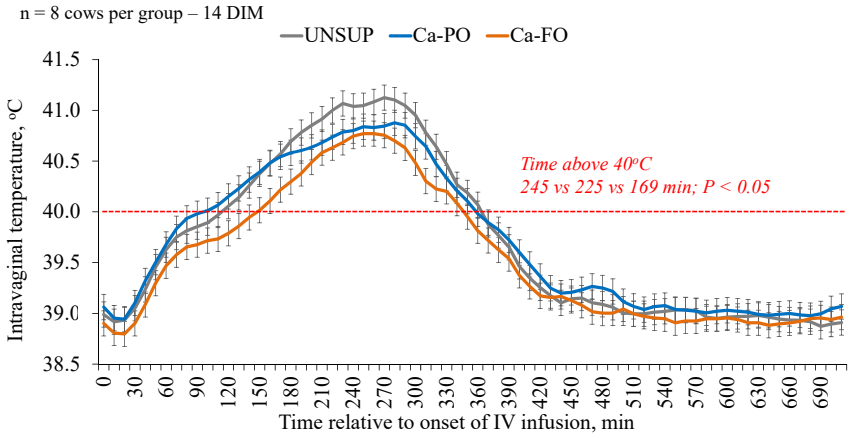
Omega-3 Fatty Acids as Regulators of Inflammation



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Take Home Messages

- ClinD limits the cow's ability to manifest her genetic potential to produce milk and to reproduce, and exacerbated inflammation seems to be at least part of the problem;
- Variability in inflammation markers of postpartum cows without ClinD, & the induced inflammation model in healthy postpartum cows demonstrate that inflammation by itself can cause major changes in cow metabolism, behavior, and performance;
- Long-acting NSAIDs (e.g. meloxicam) have been used successfully as part of ClinD treatment protocols or as blanket intervention shortly after calving;
- Polyunsaturated fatty acids are important precursors of lipid mediators, can be enriched in circulation/tissues through the diet, and affect postpartum inflammatory responses.

Acknowledgments

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Collaborators

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OCE Where Next Happens
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University of Guelph
Food from Thought

Thanks for your attention!
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