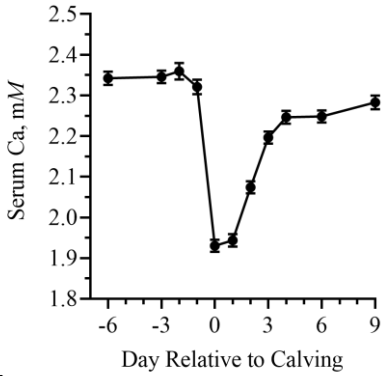
Prevention of Hypocalcemia and Associations with Health and Production

Florida Ruminant Nutrition Symposium
February 27, 2024



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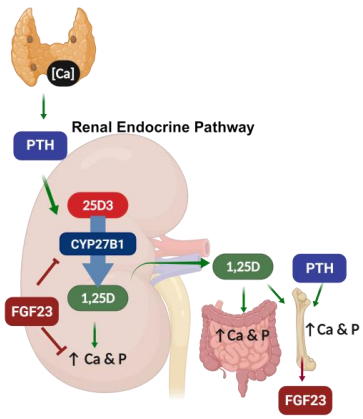
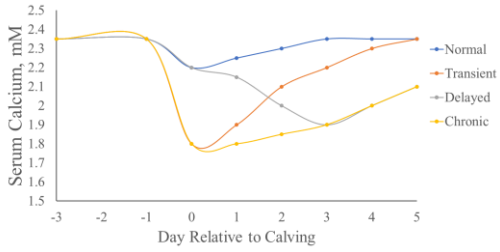
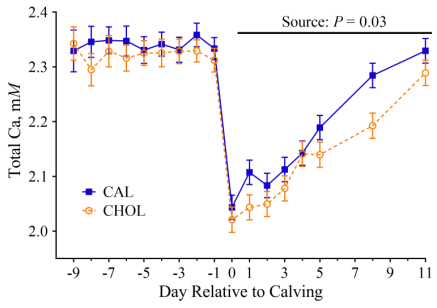
1

Additional Strategies to Control Post-Calving Calcium

1. Endocrine control of Ca and P
2. Dynamics of periparturient Ca
3. Effective control strategies







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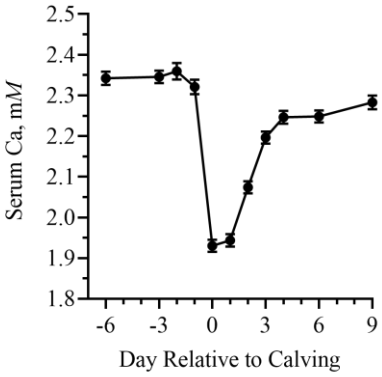
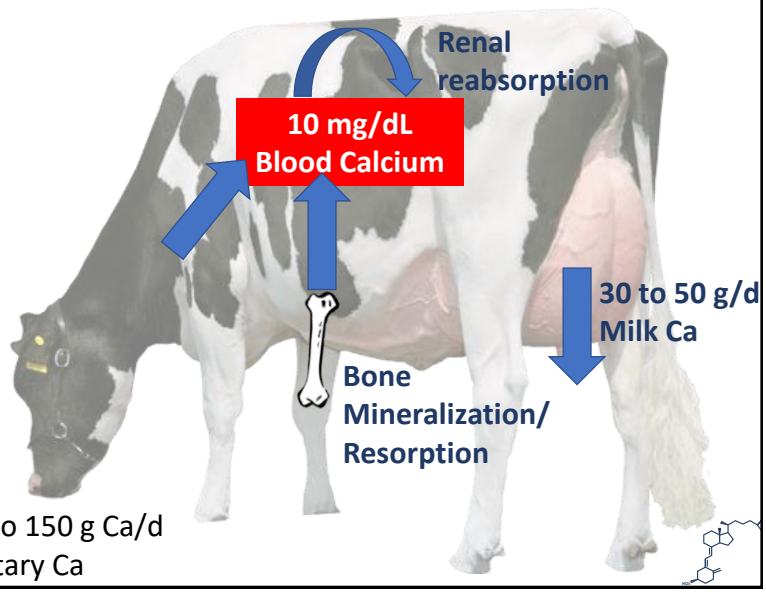
Calcium Economy at the Onset of Lactation





50 to 150 g Ca/d
Dietary Ca

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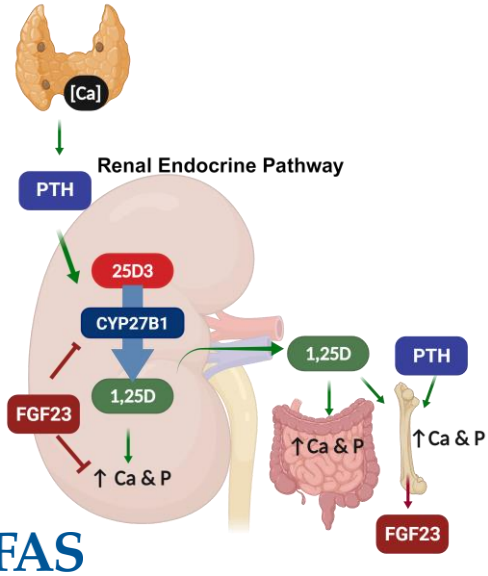
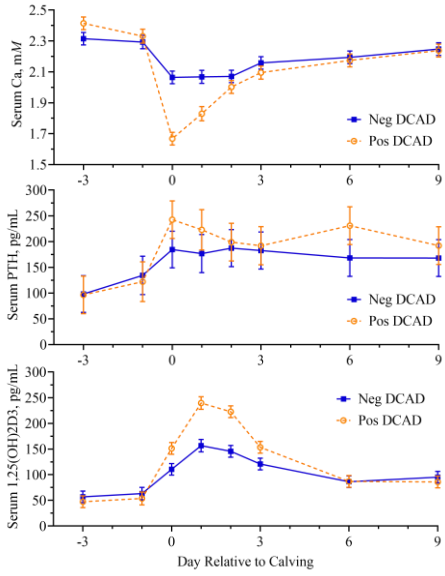
3

Hormonal Control of Calcium





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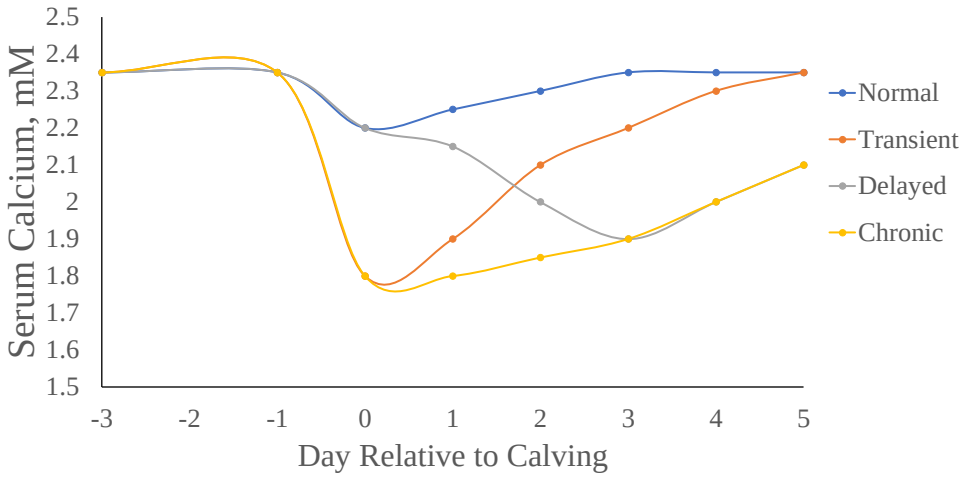
Dynamics of Serum Calcium



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Association Between Hypocalcemia & Productivity

	Classification of Hypocalcemia				
Variable	Normal	Transient	Delayed	Chronic	SEM
Cows, n	575	239	228	432	
Day 1 Ca, m*M*	2.14	1.70	2.06	1.63	0.02
Day 3 Ca, m*M*	2.37	2.32	2.02	1.95	0.01
Metritis, %	11.0	10.5	26.3	26.2	
Milk Yield, kg/d	53.5	55.1	51.6	54.1	0.6

Plasma Ca and production data from 1,474 multiparous cows

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Nelson, CD unpublished data.

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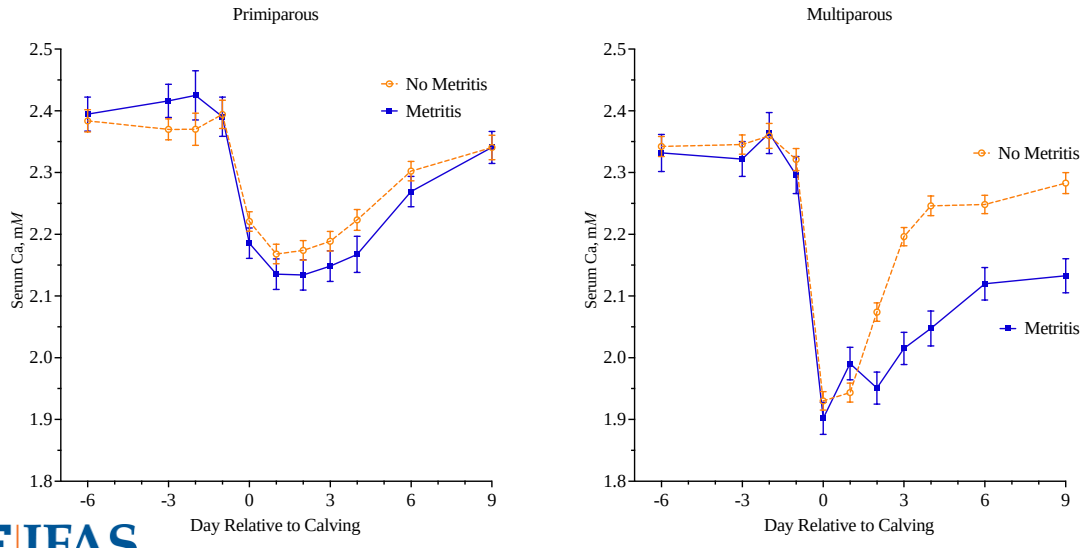
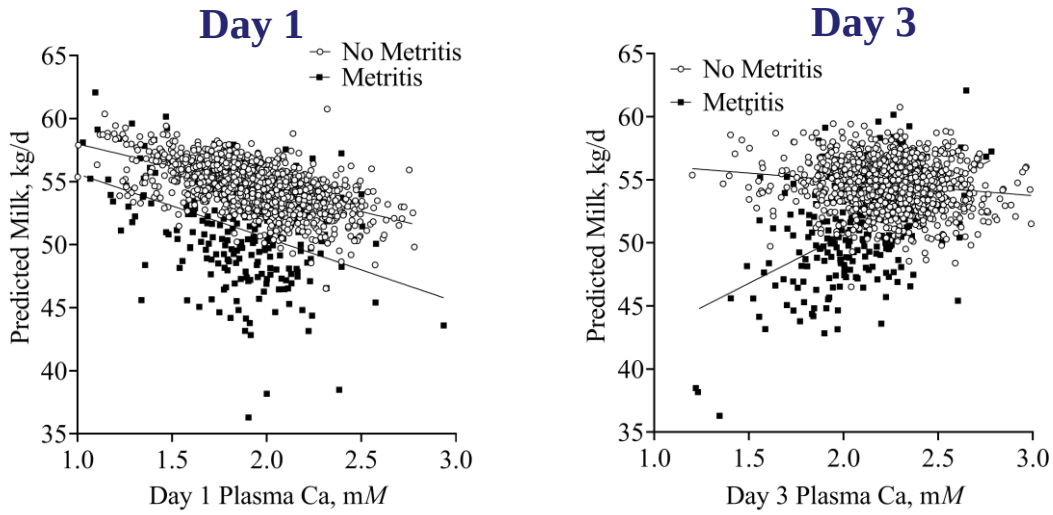
Association of Metritis and Delayed Hypocalcemia



Nelson, CD unpublished data.

7

Relationship Between Ca and Milk – Effect of Day and Metritis



Day 1 Ca, $P < 0.001$; Day 3 Ca, $P < 0.001$; Metritis: $P = 0.007$
Met*Day 1 Ca, $P = 0.003$; Met*Day 3 Ca, $P < 0.001$

Nelson, CD unpublished data.

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Relationship Between Day 1 Ca and Milk Yield

Table 1. Effect of plasma Ca concentration <1.9 mM at day 1 postpartum and incidence of metritis on production of multiparous cows.

	Plasma Ca ≥ 1.9 mM		Plasma Ca < 1.9 mM			*P*-values[1]		
Measure	No Met	Met	No Met	Met	SEM	Ca	Met	Ca × Met
Cows, n	687	124	538	139				
Colostrum								
Yield, kg	7.0	7.3	8.0	7.8	0.3	0.01	0.95	0.36
NE, Mcal	9.4	9.5	11.1	10.8	0.5	<0.001	0.86	0.63
Brix, %	23.6	24.0	24.8	24.8	0.3	<0.001	0.66	0.27
Milk yield								
Day 1 to 7, kg/d	44.8	39.9	46.1	40.0	0.5	0.10	<0.001	0.21
Day 1 to 70, kg/d	54.1	50.8	56.1	52.7	0.6	<0.001	<0.001	0.91

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Nelson, CD unpublished data.

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Relationship Between Day 3 Ca and Milk Yield

Table 2. Effect of plasma Ca concentration <2.2 mM at day 3 postpartum and incidence of metritis on production of multiparous cows.

	Plasma Ca ≥ 2.2 mM		Plasma Ca < 2.2 mM			*P*-values[1]		
Measure	No Met	Met	No Met	Met	SEM	Ca	Met	Ca × Met
Cows, n	735	89	501	178				
Colostrum								
Yield, kg	7.4	7.7	7.7	7.5	0.3	0.71	0.88	0.45
NE, Mcal	10.0	10.4	10.6	10.3	0.5	0.67	0.91	0.45
Brix, %	23.8	24.5	24.8	24.4	0.3	0.14	0.59	0.06
Milk yield								
Day 1 to 7, kg/d	45.6^{a}	42.2^{b}	45.4^{a}	39.0^{c}	0.5	<0.001	<0.001	<0.001
Day 1 to 70, kg/d	55.0^{ab}	53.2^{bc}	55.4^{a}	51.3^{c}	0.6	0.15	<0.001	0.02

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Nelson, CD unpublished data.

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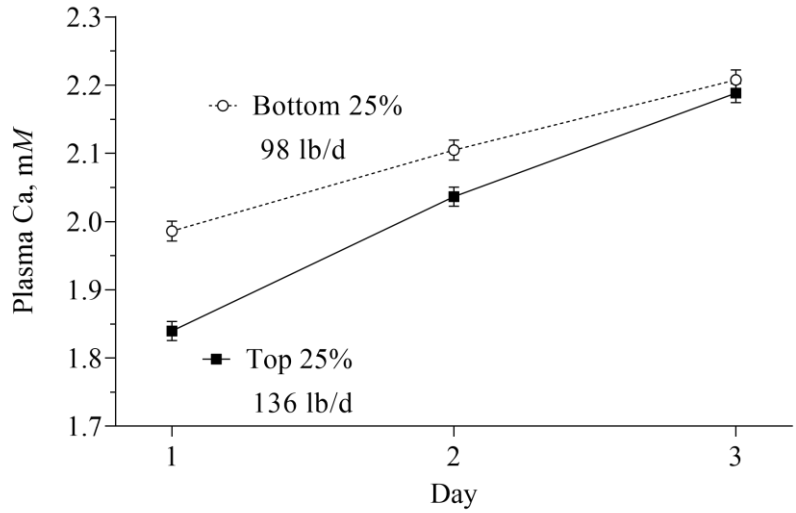
Plasma Ca by Milk Production, Top 25% vs. Bottom 25%



Nelson, CD unpublished data.

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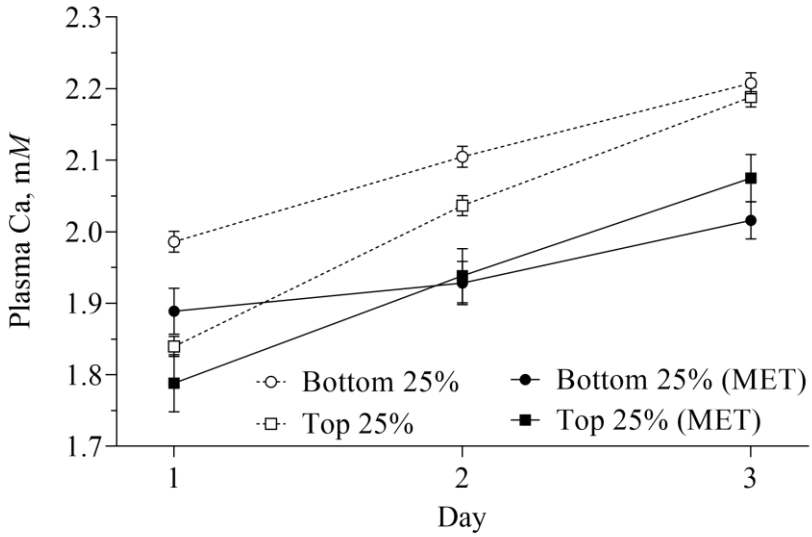
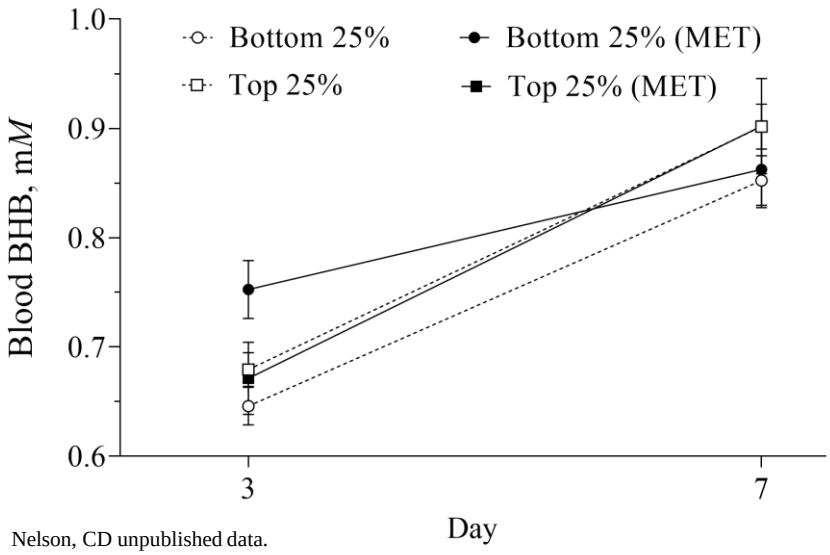
Plasma Ca by Milk Production and Metritis



Nelson, CD unpublished data.

12

Blood BHB by Milk Production and Metritis



Nelson, CD unpublished data.

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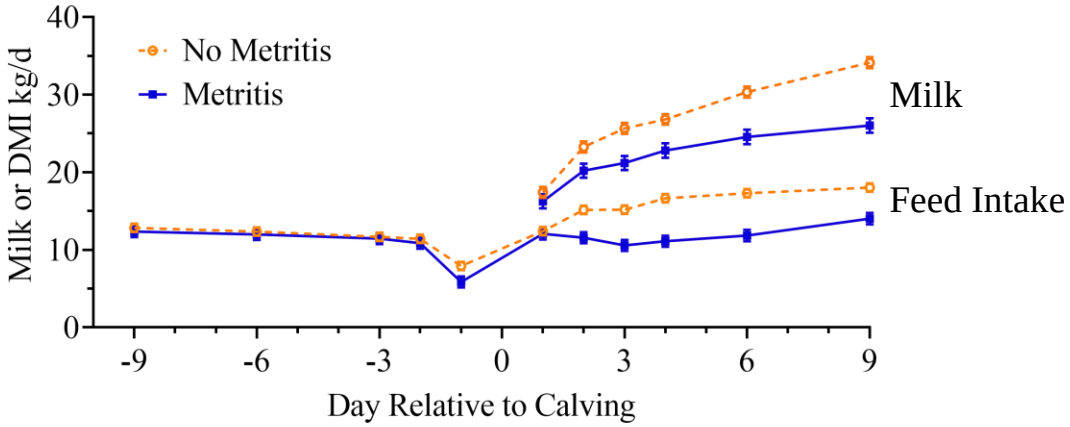
Effect of Metritis on Milk and Feed Intake in Week 1



Nelson, CD unpublished data.

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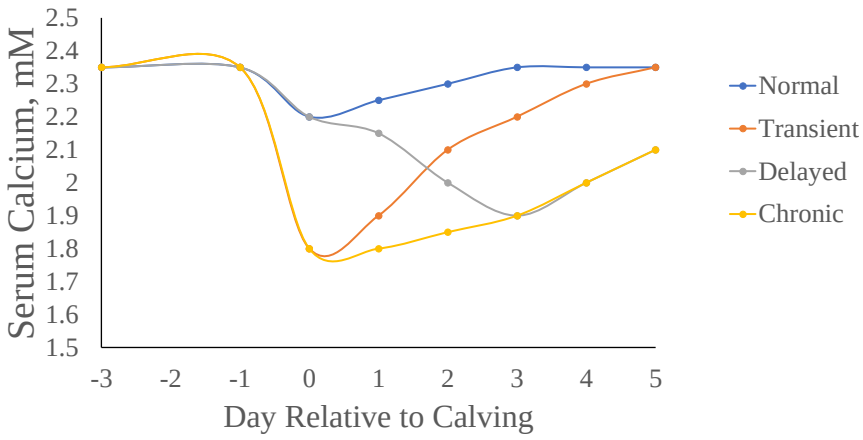
Strategies to Improve Calcium Dynamics

- Low DCAD
- Low dietary P
- Zeolite products

- Intravenous Ca
- Oral Ca bolus
- Calcitriol injection



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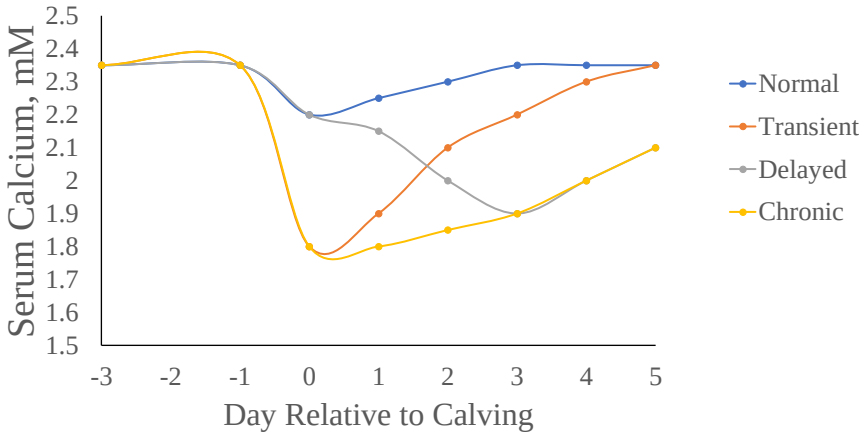

Blanket postpartum Ca treatment **DOES NOT** improve **herd** health and production

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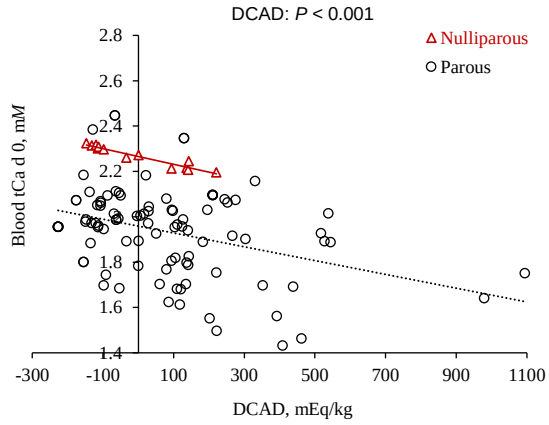
Prevention of Postpartum Hypocalcemia with DCAD



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

Meta-analysis of 42 experiments

Feeding multiparous cows -100 vs +200 mEq/kg DM prepartum:

- **Increased milk yield by 2.4 lbs/d**
- **Decreased serum BHB**
- **Decreased incidence of RP and metritis**

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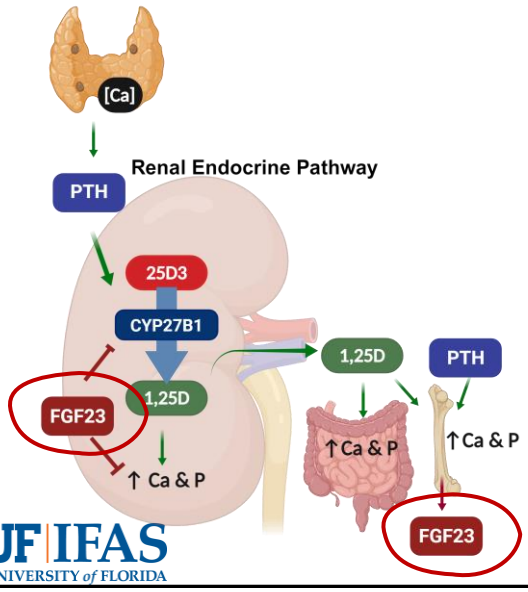
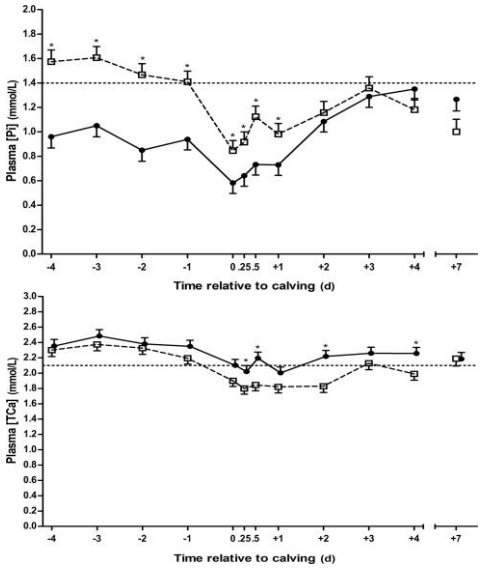
Prevention of Postpartum Hypocalcemia with Low P





Wachter et al. 2022. J. Dairy Sci. 105748-760DOI: (10.3168/jds.2021-20726)

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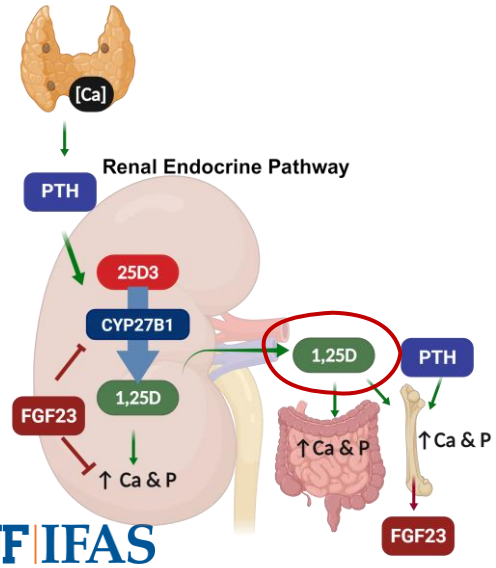
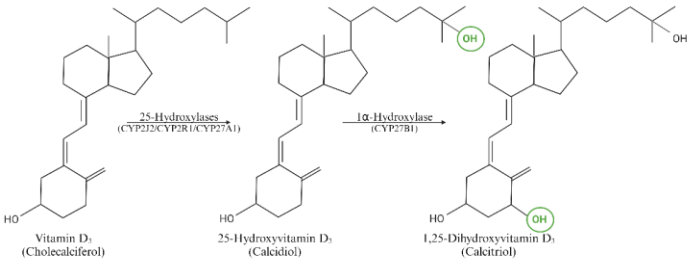
Prevention of Hypocalcemia with Vitamin D





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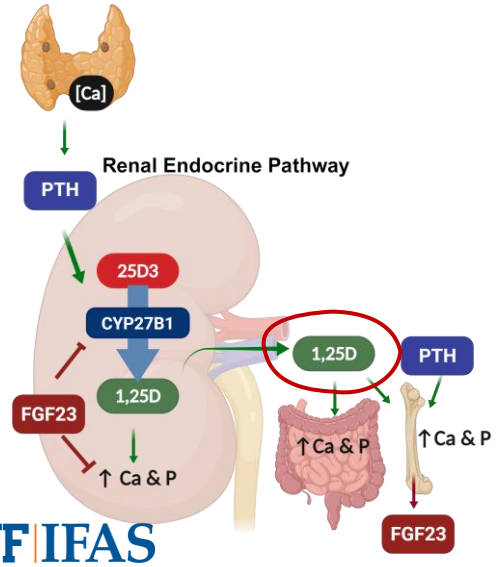
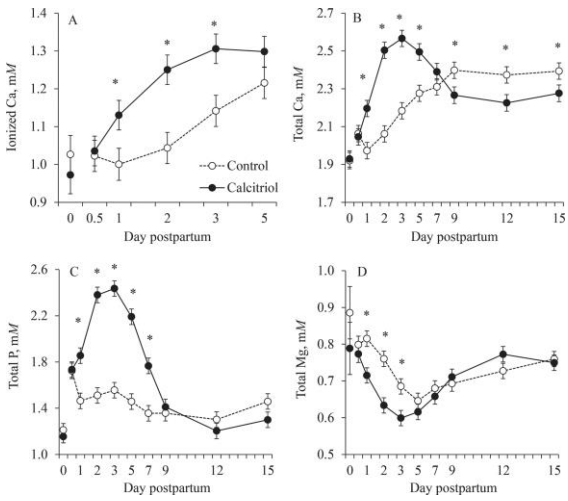
Prevention of Postpartum Hypocalcemia with Calcitriol





Vieira-Neto et al. (2018) J. Dairy Sci. 100:5805–5823

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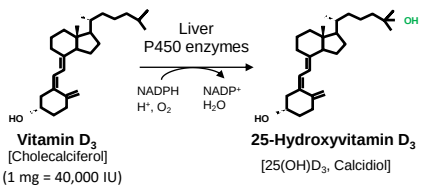
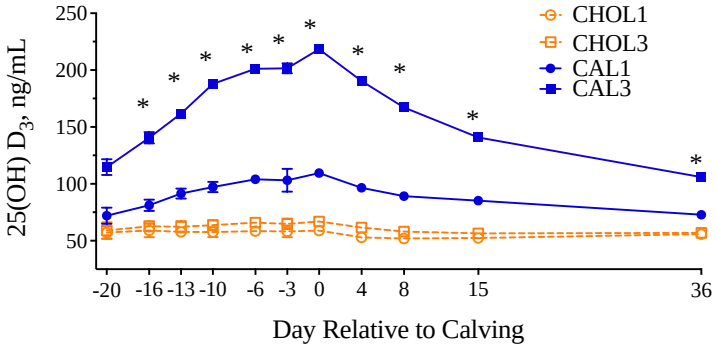
Calcidiol: An Alternative and Effective Vitamin D Source



1 vs. 3 mg/d

1 vs. 3 mg/d

Treatments fed 4 weeks prepartum



Adapted from Poindexter et al., 2023. J. Dairy Sci. 106:954-973.

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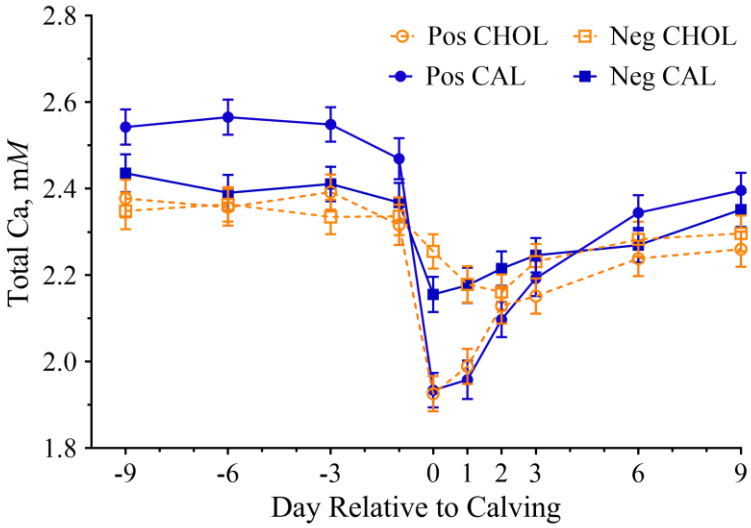
Prepartum DCAD is More Effective Than Calcidiol at Preventing Postpartum Hypocalcemia



Rodney et al. 2018. J. Dairy Sci.

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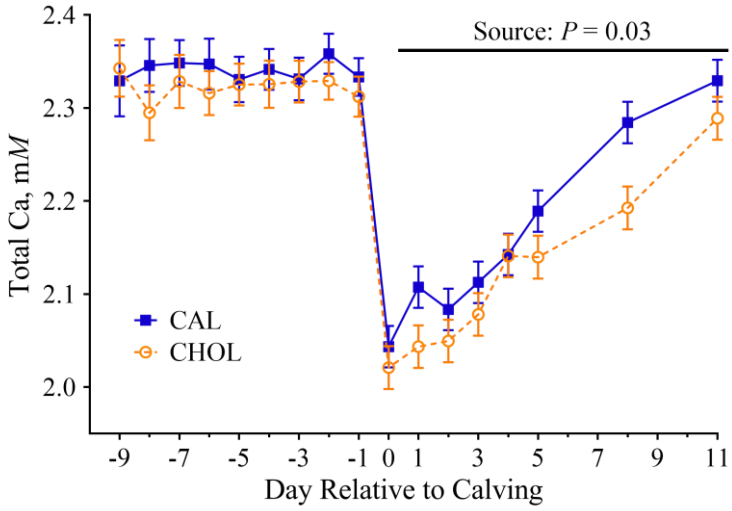
Prepartum Calcidiol Did Not Prevent Hypocalcemia but Restored Postpartum Ca Faster



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Adapted from Poindexter et al., 2023. J. Dairy Sci. 106:954-973.

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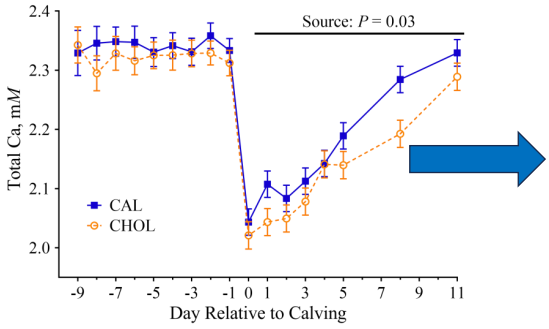
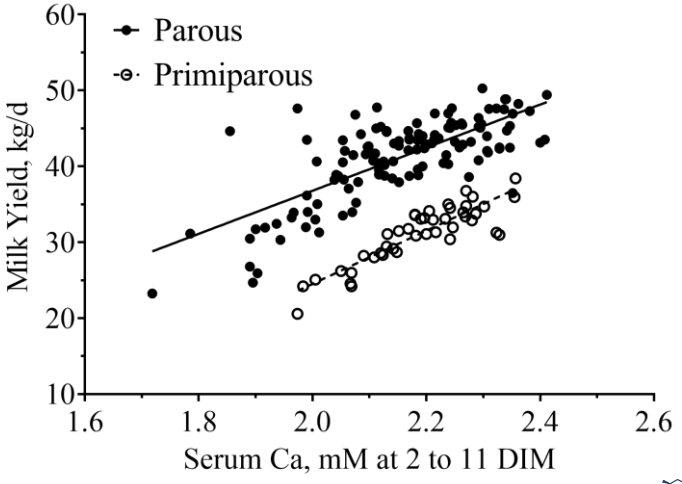
Prepartum Calcidiol Restored Postpartum Ca Faster: Associated with More Milk





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Adapted from Poindexter et al., 2023. J. Dairy Sci. 106:954-973.

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Effect of Prepartum Calcidiol on Energy Corrected Milk, kg/d

Experiment	Cholecalciferol	Calcidiol	*P*-value
Martinez, 2018	35.8	39.5	0.03
Poindexter, 2023	36.3	39.0	0.06

Experiment	Control	Calcidiol	*P*-value
Silva, 2021	29.3	32.4	0.03
Holub, 2023	54.9	56.7	0.04

Martinez et al. 2018. J. Dairy Sci. 101:2544-2562.
Poindexter et al., 2023. J. Dairy Sci. 106:974-989.

Silva et al., 2022. J. Dairy Sci. 105:5796-5812.
Holub, et al., 2023. J. Anim. Sci. 101(Suppl. 3):632-633.

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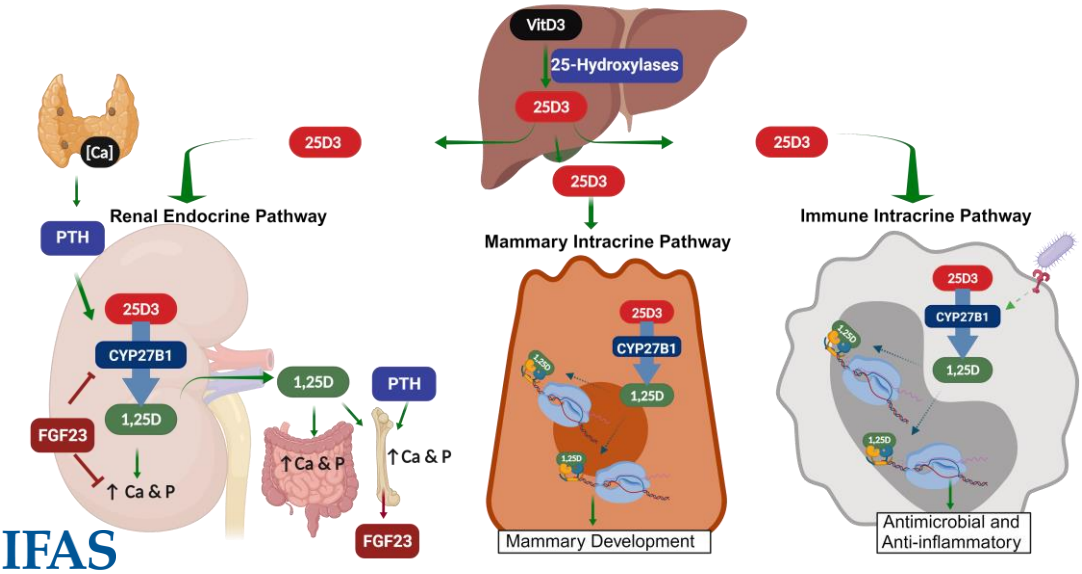
Vitamin D Physiology



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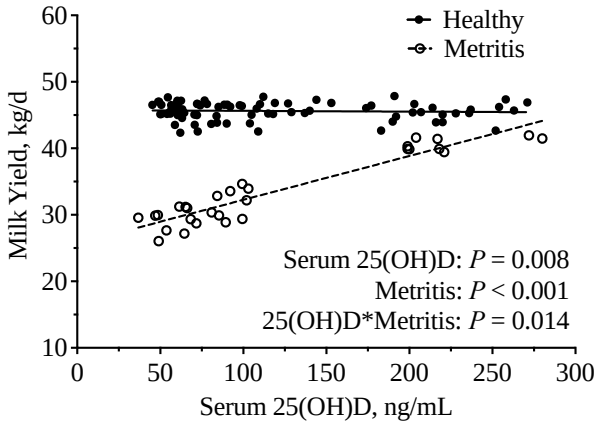
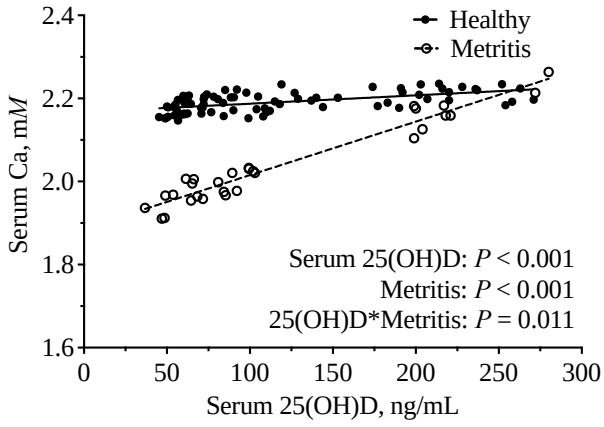
Interaction Between Calcidiol and Metritis





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Adapted from data in Poindexter et al., 2023. J. Dairy Sci. 106:974-989.

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Summary & Conclusions

- **Interaction between metritis and day 3 postpartum SCH is associated with decreased milk yield**
- **Feeding a low prepartum DCAD prevents milk fever and decreases risk of uterine diseases**
- **Feeding calcidiol prepartum:**
  - **Increased serum Ca from 2 to 9 DIM but not 0 and 1 DIM**
  - **Increased milk yield by 3 to 4 kg/d in first 42 DIM**

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Acknowledgements

University of Florida
- Michael Poindexter
- Achilles Vieira-Neto

- Ana da Silva
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- Roney Zimpel
- Jose Santos

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- Pietro Celi
- Mark Engstrom

Southeast Milk Checkoff

Contact: cdnelson@ufl.edu
https://animal.ifas.ufl.edu/people/corwin-d-nelson/

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