Epidemiology of subclinical hypocalcemia in early-lactation Holstein cows

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Abstract #: M91

Introduction

- Multiple studies have explored the categorization of blood Ca concentrations in early-lactation dairy cows (Oetzel et al., 1988; Oetzel et al., 1996; Martinez et al., 2012).
- However, only recently have studies attempted to improve the characterization of subclinical hypocalcemia (SCH) by analyzing its association with detrimental health and production outcomes (Chapinal et al., 2011; Rodríguez et al., 2017; Wilhelm et al., 2017).
- As risk factors for SCH development vary based on DIM at diagnosis (Neves et al., 2017), timing of blood sample collection relative to parturition might be an important factor when assessing the association between SCH and subsequent disease and production outcomes.

Objectives

To describe the temporal associations of plasma total calcium (tCa) concentrations in the first 4 days in milk (DIM) with:

1) The risk of cows diagnosed with metritis +/- displaced abomasum in the first 60 DIM
2) Milk production across the first 15 wk of lactation

Materials & Methods

Data collection:

- Prospective cohort study on 2 commercial herds in New York State
- 396 cows enrolled between February and November 2015
- Blood sample collected daily for first 4 DIM for plasma tCa determination
- Health disorders [retained placenta, metritis, displaced abomasum (DA)] collected from DairyComp 305

Statistical analysis [SAS version 9.4 (SAS Institute INC, Cary, NY)]:

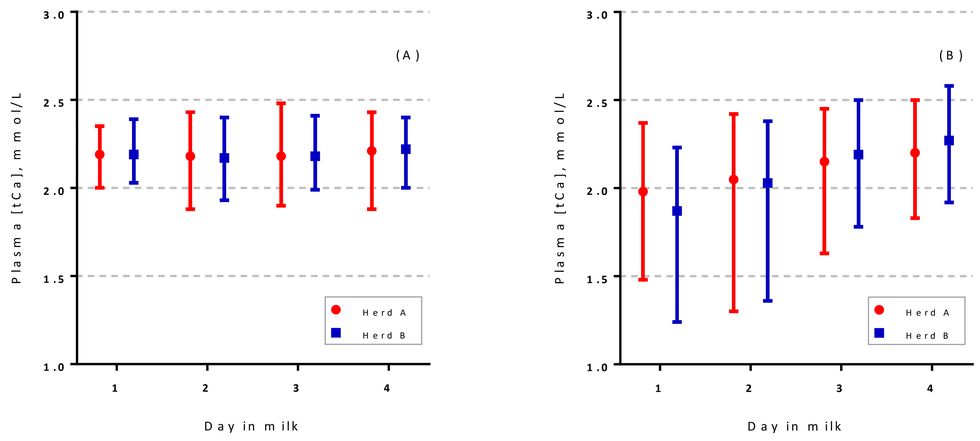
- Separate primiparous and multiparous models
- Multivariable Poisson regression models to evaluate disease outcomes
- Generalized linear mixed models to evaluate milk production outcome
- Potential covariates included calving-related disorders, calving season, and body condition score, locomotion score and blood β-hydroxybutyrate concentration at DIM 3
- Cows were removed from analysis if diagnosed with clinical hypocalcemia or if the outcome of interest occurred prior to or on the d of Ca determination

Conclusions & Implications

- In primiparous cows, reduced tCa concentration at 2, 3, or 4 DIM were associated with an increased risk of metritis.
- For multiparous cows, reduced tCa concentration was associated with an increased risk of metritis +/- DA at 2 DIM for parity 2 cows and 4 DIM for parity 3+ cows.
- Primiparous cows with reduced tCa concentration at 1 DIM produced more milk across the first 15 wk of lactation.
- In multiparous cows, reduced tCa at 1 DIM was associated with increased milk production whereas reduced tCa at 4 DIM was associated with reduced milk production.
- **This study highlights the importance of considering DIM and parity when evaluating tCa concentrations of early-lactation cows for SCH assessment.**

Results

Figure 1. Mean plasma tCa concentration (mmol/L) and 90% range at 1 through 4 DIM by herd for (A) primiparous and (B) multiparous cows



Disease incidence. 19 (13.9%) primiparous cows and 22 (8.5%) multiparous cows were diagnosed with metritis. 0 (0.0%) primiparous cows and 12 (4.6%) multiparous cows were diagnosed with a displaced abomasum.

Table 1. Pearson correlation coefficients of plasma tCa concentrations measured at DIM 2, 3, and 4, in relationship to DIM 1 by parity group

	DIM			
Plasma [tCa] at 1 DIM	1	2	3	4
Primiparous cows (n = 137)				
r	1.00	0.52	0.48	0.32
P-value	–	<0.001	<0.001	<0.001
Multiparous cows (n = 259)				
r	1.00	0.49	0.24	0.07
P-value	–	<0.001	<0.001	0.24

Table 2. Association of plasma tCa concentration at 1 to 4 days in milk assessed in the continuous scale, and receiver operator characteristic curve determination, if applicable, of critical tCa thresholds associated with the with the risk of primiparous cows being diagnosed with metritis and multiparous cows being diagnosed with metritis and/or displaced abomasum

Parity	DIM of plasma [Ca]	n	*P*-value	AUC[1]	Cut point, mmol/L	% of cows below cut point	RR[2]	95% CI
1	1	137	0.22	–	–	–	–	–
	2	137	0.001	0.78	≤2.15	36.5	4.0	2.0 to 8.0
	3	137	<0.001	0.80	≤2.10	26.3	5.2	2.6 to 10.3
	4	134	<0.001	0.80	≤2.15	25.4	6.1	3.0 to 12.2
2	1	105	0.17	–	–	–	–	–
	2	105	<0.001	0.67	≤1.97	20.0	4.1	1.8 to 9.5
	3	104	0.24	–	–	–	–	–
	4	103	0.25	–	–	–	–	–
3+	1	151	0.17	–	–	–	–	–
	2	151	0.50	–	–	–	–	–
	3	151	0.60	–	–	–	–	–
	4	148	0.04	0.70	≤2.20	43.2	3.1	1.4 to 6.8

[1] Area under the curve; [2] Relative risk

Table 3. Important associations of plasma tCa concentration at 1 to 4 DIM with milk production during the first 15 wk of lactation

Parity	DIM of plasma [tCa]	n	*P*-value	AUC[1]	Cut point, mmol/L	% of cows below cut point	Milk yield, kg
1	1	137	0.01	0.57	≤2.15	40.0	2.9 (±0.8)
2+	1	256	0.002	0.61	≤1.77	23.5	2.6 (±0.8)
	4	251	0.04	0.52	≤2.20	39.0	-1.8 (±0.8)

[1] Area under the curve

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Acknowledgements This study was funded in part by Boehringer Ingelheim Vetmedica Inc. (St. Joseph, MO). The authors would like to thank the participating herds and the significant efforts and instrumental help of Anne Borkowski, Kaitlyn Briggs, Danielle Harris, Jamie Horstmann, Isabelle Louge, Morgan Robinson, Charlene Ryan, and Claira Seely (Cornell University, Ithaca, NY) during data collection.

References Chapinal et al. J Dairy Sci. 2011:94:4897; Martinez et al. J Dairy Sci. 2012:95:7158; Neves et al. J Dairy Sci. 2017:100:3796; Oetzel et al. J Dairy Sci. 1988:71:3302; Oetzel et al. JAVMA. 1996:209:958; Rodriguez et al. J Dairy Sci. 2017:100:7427; Wilhelm et al. J Dairy Sci. 2017:100:3059