

## What is the impact of subclinical hypocalcemia diagnosed at four days in milk on reproductive outcomes?

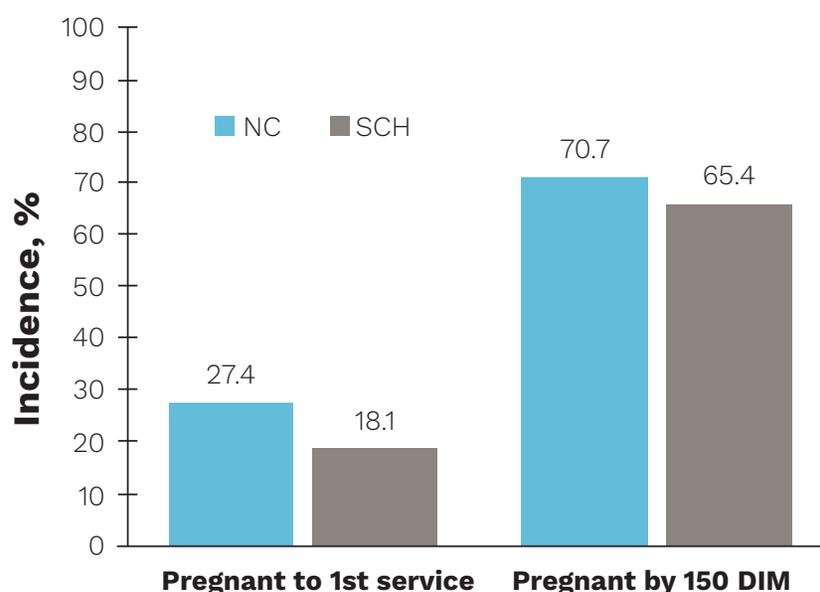
Claira Seely and Jessica McArt

While often undiagnosed due to the absence of clinical signs and the price tag associated with collecting blood samples required for diagnosis, subclinical hypocalcemia (SCH) affects nearly 45 percent of multiparous dairy cows. Traditionally, one day in milk (DIM) was thought to be the opportune time to diagnose SCH; however we have recently discovered that decreases in blood calcium occurring at four DIM are more closely associated with lower milk production, reduced feed intake, and an increased risk for additional disease development. Although we understand the negative effects of SCH, particularly episodes occurring at four DIM, on future health and milk production, its effect on reproductive success is largely unknown. Results from past reports are inconsistent, likely due to the range of days in which SCH was diagnosed, as well as the variation in calcium cutpoints used for diagnosis. As successful and efficient reproduction is critical for the success of dairy operations, we were interested in exploring the association of SCH occurring at four DIM with the odds of pregnancy to first service and the time from calving to pregnancy.

We collected data from four commercial dairy farms in northeastern (farms A and B) and central NY (farms C and D) from September 1 to November 1, 2020 and July 15 to September 25, 2021 (farms C and D) and June 2 to July 10, 2021 (farms A and B). A total of 697 multiparous Holstein cows were enrolled in our study (farm A, n = 65; farm B, n = 30; farm C, n = 87; farm D, n = 515). Each farm was visited daily, and blood samples were collected from all cows at four DIM and analyzed for

**FIGURE 1**

Percent of cows pregnant to first service and pregnant by 150 DIM from 697 multiparous Holstein cows classified as normocalcemic (n = 515) if blood calcium was greater than 8.8 mg/dL at four DIM or SCH (n = 182) if calcium was 8.8 mg/dL or less at four DIM.



total calcium. Cows were then classified as normocalcemic (n = 515) with blood calcium greater than 8.8 mg/dL at four DIM or as SCH (n = 182) with blood calcium 8.8 mg/dL or less at four DIM.

For reproductive management, farms A and B utilized an Ovsynch protocol with a voluntary waiting period of 74 days and average time of first artificial insemination of 78 DIM. Farms C and D utilized activity monitors to detect heat, and cows not detected in heat subsequently underwent an Ovsynch protocol. The average voluntary waiting period for farms C and D were 55 and 47 days, respectively, and the average time of first artificial insemination was 67 and 62 DIM.

The average blood calcium concentration for all cows in our

study at four DIM was  $9.2 \pm 0.7$  mg/dL. Of the 697 cows enrolled in our study, 74 percent were classified as normocalcemic and had a mean calcium of  $9.6 \pm 0.4$  mg/dL, and 26 percent were classified as SCH and had a mean calcium of  $8.4 \pm 0.4$  mg/dL. 18 percent of SCH cows were diagnosed pregnant to first service while 27.4 percent of the normocalcemic cows were diagnosed pregnant to first service (**Figure 1**). Cows with SCH at four DIM had 25 percent reduced odds of being diagnosed as pregnant to first service compared to normocalcemic cows. We also found that SCH cows were 18 percent less likely to become pregnant by 150 DIM compared to normocalcemic cows (**Figure 1**). The

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# “Previous reports have also shown that cows with SCH at four DIM produce less milk, consume less feed, and are at increased risk for additional disease development compared to cows that are normocalcemic at that time.”

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median time to pregnancy for SCH cows was  $119 \pm 16$  days, and 65.4 percent of SCH cows were diagnosed pregnant by 150 DIM. The median time to pregnancy for normocalcemic cows was  $103 \pm 11$  d, and 70.7 percent of normocalcemic cows were diagnosed pregnant by 150 DIM (Figure 2).

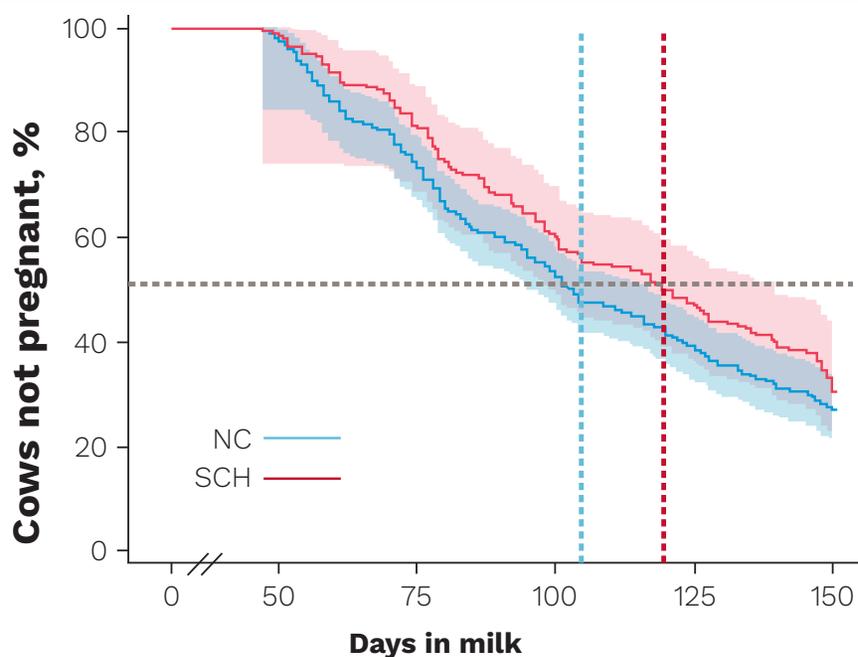
More than being the major mineral in milk, calcium is essential for many cellular actions, and of particular importance to the transition cow is the role of calcium in immune cell function. Subclinical hypocalcemia can compromise immune function, and cows with SCH are at increased risk for developing uterine diseases. As uterine diseases are associated with decreased reproductive success, this might help explain why we saw a reduction in reproductive outcomes in SCH cows.

As a cow begins lactation, her energetic and nutritional demands dramatically increase, and she is not able to consume enough feed to meet the increased demand. Cows with SCH at four DIM also consume less feed than normocalcemic cows and are likely experiencing greater energy deficit than normocalcemic cows. Reduced intake not only puts cows at increased risk for additional metabolic diseases but might also have long-lasting impact on ovarian follicles developing at this time, resulting in reduced capacity to become pregnant at a future date.

The results of our study suggest that SCH occurring at four DIM is

**FIGURE 2**

Percent of cows not pregnant by 150 DIM from 697 multiparous Holstein cows classified as normocalcemic ( $n = 515$ ) if blood calcium was greater than 8.8 mg/dL at four DIM or SCH ( $n = 182$ ) if calcium was 8.8 mg/dL or greater at four DIM. The median time to pregnancy for SCH cows was  $119 \pm 16$  d (dashed red line) and  $103 \pm 11$  d for the NC cows (dashed blue line). The black dashed line indicates when 50 percent of cows became pregnant, and the shaded regions represent 95 percent confidence intervals.



associated with decreased reproductive success in multiparous cows. Previous reports have also shown that cows with SCH at four DIM produce less milk, consume less feed, and are at increased risk for additional disease development compared to cows that are normocalcemic at that time. Taken together, reductions in blood calcium occurring at four DIM might represent a metabolic disruption to the cow, effecting both her future productive

and reproductive potential. ■

**Claira Seely** (crs336@cornell.edu) is a PhD candidate with the Department of Population Medicine and Diagnostic Sciences, Cornell University, College of Veterinary Medicine. **Jessica McArt** (jmcart@cornell.edu) is an Associate Professor with Ambulatory and Production Medicine Clinic, Cornell University, College of Veterinary Medicine.