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Calf Note 190 – Season of birth and heifer milk production

Introduction

My last Calf Note (#189, "Prepartum stress and calf productivity") described research from the University of Florida that reported the negative effect of prepartum heat stress on first lactation milk production in Holstein heifers. This research showed clearly that cows exposed to summer heat stress in Florida without additional cooling gave birth to calves that produced less milk in their first lactation compared to calves born from cows that were cooled.

An intrepid reader forwarded me an interesting question based on research conducted at the University of Minnesota Southern Research and Outreach Center (**SROC**) in Waseca, Minnesota. These data suggested that, contrary to the Florida data, calves born in the summer actually produced *more* milk compared to calves born in other seasons of the year. The reader asked the question "if summer heat stress is a problem, wouldn't it be more likely that calves born in the summer would make less milk than calves born in other seasons?". An interesting question, and worth some consideration.

So, what gives? Is there an explanation for these apparently contradictory findings? To understand potential differences, let's begin by reviewing the research.

The Research

Researchers from the University of Minnesota monitored the growth and performance of 2,880 Holstein calves born from 2004 to 2012. Calves were from 3 different dairies and were enrolled in 37 separate trials at the SROC at the University of Minnesota in Waseca. Calves were raised at the SROC from 3 to 195 days of age; thereafter, they were returned to their local farms until calving. Milk production records were obtained from farm records.

Calves were assigned to various nutritional experiments while at the SROC. The researchers accounted for the effects of experimental design and treatments by using appropriate statistical models. They compared effects of season of birth (spring, summer, fall, winter) on first lactation 305-day milk production obtained from farm records. Most calves were weaned at 6 weeks of age and most were fed a 20% CP, 20% fat milk replacer at 0.57 kg of powder/calf daily. No information was provided about starter composition, grower composition or nutrition in later life. The average heifer calved at 715 days of age (23.5 months) and produced an average of 10,959 kg of 305-day milk.

Calves born in fall and winter had greater starter intake, BW and daily gain at 8 weeks. However, calves born in summer produced more milk in their first lactation compared to those born in fall and winter (Table 1).

Interpretation

We can conclude from table 1 that calves born in summer produced more milk than fall- or winter-born calves. Thus, we might conclude that summer is a superior season to winter for calves to be

born. This would not support the finding from the University of Florida that summer born calves (exposed to heat stress) produce less milk.

Item	Spring	Summer	Fall	Winter	P-value
305-d milk (kg)	11,033[ab]	11,145[a]	10,875[b]	10,863[b]	0.02
305-d fat (kg)	401[ab]	409[a]	401[ab]	397[b]	0.05
305-d protein (kg)	336[ab]	340[a]	333[ab]	332[b]	0.03

Table 1. Production in the first lactation of Holstein heifers that were born in each of the four seasons in Minnesota. From: Heins et al. 2014.

[a,b]$P < 0.05$.

There are a couple of possible theories we can propose to explain differences between the two studies.

First, consider that calves born in fall and winter at the SROC produced less milk than summer-born calves. That is, summer-born calves did not produce more; calves born in winter produced less. The SROC is located in Waseca, Minnesota. It is possible that differences in climate between Minnesota and Florida could explain some of the differences between studies.

Table 2 contains the average seasonal temperatures for Gainesville, Florida and Rochester, Minnesota (the closest commercial airport to Waseca). I downloaded data from the Weather Underground website and averaged by season (winter = Dec, Jan, Feb; spring = Mar, Apr, May; summer = Jun, Jul, Aug; fall = Sep, Oct, Nov).

Season	Gainesville	Rochester
Winter	15.3	-6.3
Spring	21.7	9.0
Summer	27.7	21.7
Fall	21.3	8.7

Table 2. Average daily temperature (°C) for seasons of the year in Gainesville, FL and Rochester, MN. Source: www.weatherunderground.com

There are clear differences in temperatures from the two regions of the U.S. Average winter temperatures in Rochester were below zero on average throughout the winter and less than 10°C in the spring. We expect that a significant number of days (indeed, most days) in winter and spring would be below the lower critical temperature for young calves. Therefore, calves would use additional energy to support maintenance energy requirements and less toward growth during the cold months in Minnesota. The researchers reported that calves raised in the winter had greater starter intake, BW and ADG to 8 weeks of age compared to calves born in summer or spring. It is possible that increased starter intake supported maintenance energy requirements, as calves were generally fed 0.57 kg/d of milk replacer powder. Greater BW and ADG might have been due to increased gastrointestinal mass and possibly gut fill. Distribution of nutrients to support growth of the gastrointestinal tract might impact availability of nutrients for growth of other tissues, including mammary tissue.

Conversely, average temperature in Florida during the summer was about 6°C higher than in Rochester. The high humidity in Florida could also contribute to heat stress. It is clear that calves born in Florida were exposed to significant heat stress. We do not know whether calves born in Minnesota would be exposed to a similar stress. The data in Table 2 suggest that heat stress in MN would be less severe than in FL.

A second consideration in comparing studies is that we don't know what would happen in MN if the dry cows were cooled prior to calving, as was done in FL. It is possible that dry cows in MN were also heat stress (to some degree) and their calves would produce more milk if their dams were cooled. However, there is no way to determine this, because this wasn't tested in the MN study.

Summary

It is difficult to say unequivocally that differences in milk production due to season of birth from this research refutes the research from the University of Florida. Indeed, the Florida study was carefully controlled and tested an experimental vs. a control group. This study tells us that reducing heat stress on dry cows in a hot environment (Gainesville, Florida in summer) can improve milk production from calves after birth. On the other hand, the retrospective study from Minnesota tells us that calves born in summer made more milk than calves in fall and winter. But we don't know whether the actual issue is due to much colder temperatures in winter in Minnesota compared to summer coupled with the nutritional plan employed at the SROC.

The question is a bit of apples and oranges – we are looking at two different questions that give us interesting, but different, insights into the effects of early life nutrition and management on future milk production. Much more work is needed to more completely understand these implications.

References

Heins, B. J., D. Ziegler, D. Schimek, S. E. Schuling, B. Ziegler, H. Chester-Jones, M. B. De Ondarza, C. J. Sniffen and N. Broadwater. 2014. Relationships between birth season versus early life starter intake and growth and first lactation performance of Holstein dairy cows. J. Dairy Sci. 99: E-Suppl. 1: 589.

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