Cold stress, heat stress affect dairy calves greatly

LET me begin by stating what could be obvious: Ruminants handle cold much better than heat. In fact, I think all larger animals living in cold climates that do not hibernate in the winter are ruminants, like deer, elk, moose, bison, yak, musk ox, etc.

Of course, they try to go into the winter in a fatter condition, which provides insulation and also a reservoir that can be depleted as needed during the winter. They browse and feed on very low-quality fiber sources that provide even more heat of rumen fermentation than high-quality forages.

Hotter ambient temperatures are a bane for ruminants. Their response is to then reduce that rumen fermentation heat by eating less and producing less, too.

In the April *Journal of Dairy Science*, there was an excellent invited review related to this subject area (Roland et al., 2016) and another focused on what heat stress does to calves (Dahl et al., 2016). I will highlight some aspects of the review and then discuss a few key findings about the heat response in calves.

Thermoregulation in calves is maximized if calves are healthy, because that enables them to be more physically active, which produces more body heat. Calves have disadvantages because they have a high surface area proportionate to their body mass, have a thinner skin and usually have low subcutaneous adipose tissue for insulation and mobilization. They are more cold tolerant if their hair coat is dry and not matted down, if they have dry bedding (in a study by Lago et al. in 2006 [*Feedstuffs*, Jan. 8, 2007], the average bedding moisture content in 13 calf barns was greater than 50%), if the lying area is protected from drafts and if additional dietary energy is provided.

Calves born in New Zealand during cold (less than 68°F), wet and windy weather had lower rectal temperatures and took a longer time to stand up than calves born during warm, dry weather.

Cold stress generally results in greater feed intake (depending on what is available), and this will generally be directed towards heat production. Digestive processes may be reduced during cold

Bottom Line

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stress, with an accompanying decrease in metabolic heat generated. Since standing during cold stress can increase body heat loss, calves will prefer to lie down and burrow into the bedding if it is deep, dry straw. High relative humidity, wind speed and barometric pressure result in decreased rectal and nasal submucosal temperatures.

The predominant housing is calf hutches or individual pens in the U.S. (68%) and Canada (88%). Shelter from wind in cold weather and shade in hot weather mitigates respective ambient stresses. In a winter study in Japan, while temperatures in hutches were only about 5°F warmer than ambient temperatures, wind speed was reduced considerably. Also, the occupancy rate (time spent inside versus outside) increased to 85-90%. Occupancy rates in hutches were also highly correlated with wind speed.

There is a dearth of information on how heat stress affects calves. Previously, I have reviewed studies on how a lack of shade affects heifer growth (Marcillac-Embertson et al., 2009; *Feedstuffs*, July 13, 2009) and the negative effects of heat stress on calves born during periods of heat stress (Montiero et al., 2014; *Feedstuffs*, May 11, 2015).

In the latter reference, which covered two studies, the cows in late gestation during heat stress had both shorter dry period length and gestation length, whereas rectal temperatures and respiration rates increased. Cows were exposed to an ambient temperature-humidity index of 78, which the evaporative cooling system ameliorated enough that the cooled treatment cows exhibited less heat stress. There was no treatment effect on the colostrum quantity and quality.

Calves born to cooled cows weighed more at birth and at weaning, were taller at birth and tended to gain more and get taller than calves from heat-stressed cows. Calves did not differ by treatment for fecal score or health score but tended to have greater respiratory scores ($P < 0.11$) and rectal temperatures ($P < 0.10$) when dams had been heat stressed during their dry period.

In experiment 2, calves fed colostrum from heat-stressed cows in experiment 1 did not differ significantly from calves fed colostrum from cooled cows in the cat-

egories of birth weight, weaning weight, weight gain, weaning height and height gain, but they had a tendency (P = 0.12-0.30) to do better in these performance categories.

Data collection subsequent to that reported from a study by Montiero et al. (2014) found that not only did heat stress cause lower bodyweights in calves at birth, but these calves continued to have lower bodyweights until after the yearling stage. However, that similar bodyweight at calving is misleading because the heifers were shorter and fatter. So, it appears that lower birth weights due to the dams' heat stress altered calves' energy utilization so they were shorter and fatter by their first calving. Even more significantly, they averaged 11.2 lb. per day less milk production for the 35 weeks of their first lactation.

The Bottom Line

Calves may be the most efficient at converting nutrients to growth, but they are the most susceptible animals on a dairy operation. Consequently, cold stress and heat stress more greatly affect their performance than any other animal on a dairy. More is known about cold stress effects on calves and being able to mitigate those effects through increasing energy intake, providing shelter from wind and keeping calves dry and well-bedded.

On the other hand, heat stress is not as well recognized or documented. More recent studies conducted in Florida show that when cows are in late gestation during heat stress, they have a shorter pregnancy and lower-bodyweight calves. These calves do not get as tall as calves from cooled cows and are fatter when they have their first calf. However, the largest impairment is that they produced an average of 11.2 lb. less per day over the first 35 weeks of that lactation.

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