# Calves suffer from heat stress, too

At a minimum, calves and heifers should have shade in summer.

*by Al Kertz*

THE environment for young calves can vary considerably as it's dependent on housing type, ambient temperature, and humidity. Generally speaking, the zone of thermal neutrality in young dairy calves is between 59°F and 79°F. When temperatures are within this range, calves do not have to expend additional energy to adjust to colder or warmer temperatures.

Kertz

Calves are more susceptible to cold stress than older heifers or cows since they have a greater surface area to body mass, have less fat insulation, and have poorer body temperature regulation. In many regards, young calves are just like human infants.

Housing also affects the calves' environment, and it's impacted by stocking density, insulation, bedding, and ventilation. Wisconsin research has shown that adequate ventilation requires about four air exchanges per hour. That's because elevated humidity raises the bacterial load. Overall, the average moisture content of bedding with indoor calf housing studied was 52%, with a range of 32% to 73%! Bedding on the wetter side exacerbates heat loss as it "wicks" heat from the calf.

## Look at those hutches

Calf hutch systems accounted for approximately 63% of all calf housing in the United States, with 25% indoor and 38% outdoor, according to the most recent NAHMS survey (2014). I am aware of some work to put individual shades over hutches, but cost, types of material, and labor required have kept that from being practical. Shade has also been shown to be useful in reducing ambient temperature for heifers in a California study.

A Washington state study, in which the rear of hutches was propped up with concrete blocks, found that while the normal range for calves was 24 to 36 respirations per minute, this propping reduced respirations from 58 to 44 per minute during heat stress. Respirations climbed by two per each minute for every temperature 2°F increase inside the hutch temperature.

More recently, a Wisconsin study was done during summer with 63 Holstein heifer calves in sand-bedded polyethylene calf hutches. Shade provided by a calf hutch and its rear ventilation were the only heat-abatement factors in this study.

**CALVES BENEFIT FROM SHADE** as summer heat and humidity climb.

Todd Garrett

But Wisconsin has little heat stress among its calves, right? As we often say, "it's not the heat, it's the humidity!" A temperature-humidity index (THI) combines those two factors into one, and when the THI is over about 68 to 70 for cows, significant heat stress occurs. In a prior Florida calf study, THI breakpoints were 65, 67, and 82 for respiration rate, rectal temperature, and dry matter intake, respectively, begin to change.

In the Wisconsin study, calves had a dry bulb temperature breakpoint of 70°F, as that was the threshold when respiration started to climb. At a THI breakpoint of 69, respiration rate began rising above 40 breaths per minute (bpm) at a rate of 1 bpm for every unit rise in THI, or 2 bpm for every unit increase in dry bulb temperature above the threshold. Respective breakpoints for rectal temperature were 70.7°F dry bulb temperature and 69 THI, whereby respiration began rising above 101.3°F at a rate of 0.036 bpm or 0.072 bpm for every unit increase in THI or dry bulb temperature above the threshold, respectively.

## Turning to genetics

Some dairy cattle have a genetic variation called the SLICK1 gene. This gene is associated with a short, fine hair coat phenotype, and cows with this mutation have been reported to have higher milk yield in the summer. There have been no detectable lactation defects in climates with mild winters. Because these mutations act as dominant, heterozygous animals typically show the slick phenotype.

The main measurable effect is that lactating cows with the SLICK1 allele maintained a vaginal temperature approximately 3.4°F lower in summer when compared with their nonslick half-siblings and unrelated counterparts.

This led a team to study the effect of SLICK1 in three herds in California and two herds in southern Florida. Lactating Holstein cows were bred by A.I. with semen from two registered Holstein sires heterozygous for the SLICK1 allele. These calves and heifers were then monitored and measured for heat stress.

The 24-hour mean THI in California during the testing period was 72 (range 61 to 82), whereas in Florida it was 90 (range 83 to 100). The THI was consistently higher in Florida compared with California. The animals in California experienced several hours of THI below 68 overnight. This was largely attributed to the climate in Florida being more humid and not cooling off at night as much as in California.

## Here are some key findings

Regardless of genotype, California animals had lower rectal temperature than Florida animals (102.6°F ± 0.07°F versus 103.5°F ± 0.2°F). This effect was due to differences observed in Florida, where postweaning heifers had higher rectal temperature than preweaning calves.

Genotype did not affect respiration rate. Overall, postweaning heifers had higher respiration rate compared with preweaning calves (78 ± 2 versus 66 ± 4 bpm). Postweaning heifers in Florida had the highest respiration rate, whereas no difference was found between age groups in California.

Genotype had no effect on sweating rate regardless of presence of hair. Overall, California heifers sweated more than Florida heifers in clipped skin areas.

Slick animals kept a more stable rectal temperature as THI rose, whereas nonslick animals experienced a higher body temperature in response to climbing THI.

California had a higher air temperature and lower relative humidity compared with Florida. Another important difference between the two states was that in Florida the animals experienced several more hours of more severe heat stress each day and no relief at night.

Cattle dissipate excess heat load via evaporative heat loss by increasing sweating and respiration rates. The efficiency of these processes is largely dependent on the humidity of the air.

## Practical implications

Even though young cattle have generally been regarded as more resistant than lactating cows to heat stress, recent data showed that preweaning calves can begin showing signs of heat stress at a THI of 65 to 69. It's important to note that this is substantially lower than the previously estimated value of 77 and similar to the value of 68 established for lactating cows.

Thus, heat stress in both calves and heifers is a significant issue, and we know now that they have a lower threshold to heat stress than lactating cows. At the minimum, calves and heifers should have shade. We also know that the greater the ambient temperature above the zone of thermal neutrality (59°F to 79°F), the higher humidity, and the less break at night, particularly in temperature, the more pronounced negative effects on animal performance will be.

The author is the executive vice president for the American Registry of Professional Animal Scientists (ARPAS). Learn more at www.arpas.org.