How Cold Stress Affects Newborn Calves

By Heather Smith Thomas

Calves that are chilled at birth, without immediate assistance to warm/dry them and make sure they ingest colostrum in a timely manner, have poor survival rates. If a calf's mouth gets cold before he suckles, he may not be able to get the teat in his mouth and suck, and therefore does not obtain crucial energy (for keeping warm) and the antibodies he needs—to protect him against disease. Also, his ability to absorb the antibodies from colostrum diminishes as he becomes colder.

As stated by Dr. Robert Callan (Colorado State University), calves born in cold weather may suffer adverse effects if they don't get right up and nurse before they chill. "The first thing to understand about body temperature in newborn calves is that they start out with a high temperature, about 103 degrees F. After they're born it starts to drop and is down to 101.5 or 102 within a few hours (which is normal temperature for cattle). But if weather is cold and it drops below 100, this means the calf is not able to thermo-regulate and keep himself warm," says Callan.

"A normal, healthy calf has a tremendous ability to thermo-regulate, especially if the cow licks him off quickly and helps dry him." A wet calf will continue to chill if weather is cold and windy, due to rapid evaporation of moisture and subsequent heat loss.

"High risk calves also chill quickly. These include calves that suffer prolonged birth, twins, calves born to sick or thin cows," explains Callan. "Cows deficient in

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energy and protein may give birth to weak calves that don't have much reserve and their colostrum will have less energy and fewer antibodies. If the calf doesn't nurse soon, he'll start depleting his blood glucose within about 30 to 60 minutes. The body tries to replenish this from liver glycogen stores but these can be used up within 4 to 6 hours and the calf then becomes hypoglycemic. If he fails to receive proper nutrition, he'll deplete his brown fat reserves in 1 to 6 days and starve." Calves born to undernourished cows have less reserve than cows born to well nourished cows. In cold weather a newborn calve requires extra energy to keep warm, above the normal maintenance requirements.

"The general consensus is that the cold calf does not have energy for the cellular functions to work properly," says Dr. James England (University of Idaho, Caine Center). "A cold calf has used up all his brown fat, and what little bit of protein was left in the stomach (in the amniotic fluid), trying to keep warm. There isn't enough energy for the cellular functions to work in transporting things back and forth in and out of the cells. The motility of the GI tract is also impaired. There is also a direct correlation between suckle reflex and uptake of antibodies. Studies have shown that suckling makes the calf several times more able to absorb the globulins than if you give the colostrum via tube, bypassing the suckle," he explains.

If you can get the calf to nurse the cow or suck a bottle of warm colostrum, this is best, but if he's too cold to suck, the next best thing is to give colostrum via tube. "In that situation you are trying to warm him up and get some energy into him so he can start generating his own body heat. The problem with a chilled calf is that he's used up all his energy and has nothing left to operate on. The cellular functions are not working to transport fluids across membranes or move the intestines. Everything is shutting down. You have to get some energy into him, and even though colostrum is the best, regular milk is better than nothing," says England. The calf will benefit from the nutrition and also the warmth. Warm milk can help warm him internally.

"The ideal situation is fresh warm colostrum from the dam, because this contains viable immune cells that help populate the immune system. The big drawback to using frozen colostrum (that you've thawed and warmed) is that it is devoid of these living cells. The white cells obtained directly from the mother help establish the newborn calf's immune system," he explains.

Colostrum has a much higher protein level and more digestible protein and fat than regular milk, and the proteins handle freezing quite well, but the white cells in fresh colostrum are more functional. "Some people also feel that these cells go into the lymph nodes of the calf and establish a population, but the general consensus is that these are functioning cells that can produce antibodies, eat up bacteria, and give additional protection beyond just the antibodies present in the colostrum," says England. Some of these stay in the gut awhile, rather than being absorbed through the intestinal lining, and while in the gut can neutralize ingested pathogens and protect the calf from scours and other diseases early in life. "The key is to get colostrum into the calf as early as possible, to give the calf a jump-start," he says.

In years past, some herds had problems with what was loosely termed "weak calf syndrome" and a number of studies were done. Calf survivability was poor, especially in cold weather. "A lot of the problem was nutritional, and some of it was due to selenium deficiencies or protein deficiencies. For a long time we were looking for an infectious cause, and for a while we tried to blame it on BVD, but that didn't pan out as the cause. A lot of what we described as weak calf syndrome was actually trace mineral based, particularly selenium. When ranchers started supplementing the cows and providing adequate protein and trace minerals, these problems diminished," explains England.

IMPORTANCE OF GOOD NUTRITION FOR THE DAM – Studies at Miles City, Montana a couple decades ago looked at importance of fat in the cow's diet. Researchers found that during the last 50 to 60 days of gestation, the fat content of the diet is crucial in terms of rebreeding ability and calf survival. Other studies had shown that pregnant cow diets low in energy have a detrimental effect on calf viability at birth as well as reduced ability of the dam to recover and rebreed quickly. Various studies showed a 10 percent reduction in newborn calf survival if the dam's diet was low in energy. Insufficient energy may also alter the gamma globulin levels of colostrum or hinder the calf's absorption of colostral antibodies. Energy level (and how much brown fat the dam puts into that calf) also has an effect on the calf's ability to generate body heat.

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The Montana study showed that adding unsaturated fat to the pregnant cow's diet in late pregnancy significantly affected her calf's response to cold stress. The researchers put newborn calves in controlled temperature rooms and measured their response in maintaining body temperature, and how long the calves were able to maintain body temperature in cold conditions. The calves' blood glucose

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levels were also affected, being much higher in calves born from cows that had been supplemented with fat. The researchers' conclusion was that fat fed to cows in late gestation had a definite positive effect on their calves' response to cold. In the studies, feeding 4.9 percent dietary fat during the last 53 days of gestation improved cold tolerance in the newborn calves and increased their plasma glucose concentrations.

"Supplementing cows with fat is commonplace in the dairy industry, because it has a direct effect on milk quality. Beef cows normally tend to have more fat in their milk than Holsteins, but certainly nutrition for the beef cow is important, regarding quality of the milk and colostrum and the immune system," says England.

If a cow is thin and weak at calving, it takes longer for her to deliver the calf even if it's a normal birth. "That calf will be stressed, and so is the cow. Research has shown that as a rule of thumb, every 10-minute delay in calving equates to an extra day for the cow to recover reproductively to start cycling again, and every 10 minutes of extra time in the birth canal for the calf (with prolonged pressure and oxygen deprivation) decreases his survivability by about 15 percent," explains England. Therefore it is wise to assist a cow or heifer if she's taking too long to deliver her calf. The calf will be less stressed, more able to get up quickly and nurse. If he is exhausted, weak and oxygen-deprived from a long birth, he is much more likely to chill before he can get up.

Dick Fredrickson, DVM (Grandview, Idaho) says nutrition of the cow makes a big difference in calf survival. "In one study they fed one group of 2 year olds heifers adequate protein and another group received a restricted protein diet. They milked the heifers after they calved, to evaluate colostrum. The heifers that received adequate protein had 2.75 quarts of colostrum and the heifers with low protein intake produced 2 quarts. Then they measured the heat production produced from the colostrum. The colostrum from heifers that received adequate protein produced 118 kilocalories of heat, while the colostrum from restricted diet heifers produced only 104 kilocalories," he says.

"The also measured the time elapsed from time of birth until the calf was standing up and looking for the udder. It took 66 minutes for calves from heifers that had adequate colostrum and 97 minutes for calves from deficient heifers," says Fredrickson. In cold weather, this could make the difference between whether or not the calf is able to nurse before he gets too chilled, or even life or death for the calf.

"When talking about ways of avoiding cold stress in calves, nearly everything boils down to nutrition of the dam during the final 3 months of pregnancy, and body condition of the cow. If they are not fed adequately during that time, you'll have more scours, respiratory disease and other illnesses in the calves, and they won't do as well," he says. CJ