Fetal Programming in Dairy Cows
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One of the primary goals in most dairies is to get cows pregnant. Without pregnancy there is no parturition and without parturition no reset of the lactation process that drives dairy profitability. Once cows are pregnant our nutritional concern is often to maintain a high level of milk production while largely ignoring the developing fetus. A recent article in the journal of Dairy Science indicates that heat stress on cows during the first trimester can affect productivity of their offspring throughout their productive life. Environmental stressors in the dam are believed to activate specific genes in the fetus in utero in response to stress. The mechanisms are not clearly understood but this recent article would indicate that we should pay more attention to the care of the cow during gestation.

Fetal development is a very complex process and one that has largely been ignored in farm animals. There has been extensive research on human fetal development that has proven without a doubt that fetal programming does occur in humans. If a mother consumes too much alcohol during pregnancy, the baby can be born with fetal alcohol syndrome. Exposure to certain environmental toxins can also have an effect on the neonate. It would be naïve to think that fetal programming does not occur in a similar manner in livestock.

The recent study published in the Journal of Dairy Science and conducted in Florida dairy cows indicates heat stress to be a major source of fetal influence. The study was conducted on cows that were exposed to heat stressors with only shade and compared them to cows that had fans and evaporative cooling. Calves from these cows were all managed the same and weaned at 49 days of age. The experiment revealed that calves born to the heat stressed cows had a 4% stillborn rate while the calves born to the cooled cows had no still born. The heat stressed heifer offspring had more calves that did not get pregnant or were culled due to lack of performance than the heifer calves from cooled dams. The heifers from the cooled dams had a higher percentage that completed their first lactation. Reproductive performance was not different but heat stressed heifers required more services to become pregnant compared to the heifers from cooled dams and were older at the time of parturition.

Milk production in the heifers from the two groups of females was very revealing and likely the most impactful for dairy productivity. The heifers from cooled dams had higher overall production, higher energy corrected milk, higher fat content, higher lactose, and higher protein content than the heifers from the heat stressed females. All of these categories were statistically significant for this study. The results of this study would clearly indicate that heat stress mitigation could be very profitable for a dairy in areas where heat stress is a significant problem. Increased production from the heifers alone would likely pay for fans and other opportunities for cooling.

The data from the Florida study suggest that late-gestation maternal heat stress does alter expression of the fetal genome and does have lifelong consequences. It is evident that heat stress during gestation results in a metabolically different offspring when compared to offspring from cooled dams.

This study also creates more questions in my mind for future research. What other stressors in many dairy environments could contribute to fetal changes that would result in changes in productivity and/or lifespan in the female offspring. Are we affecting the fetus with dry cow and close up diets that are designed to minimize metabolic disorders after calving? Should we be more concerned with managing the developing fetus in these cows? I am positive that as more information becomes available, we will develop a better understanding of fetal development and how we can better manage the pregnant female for better producing offspring.