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DAIRY CATTLE REPRODUCTION COUNCIL

Q&A: New Research Links the Leptin Gene and Perinatal Mortality

Replacement heifers play an integral role in the success of a dairy operation. Too often heifers are lost to perinatal mortality, which can make meeting replacement goals difficult. New research conducted by Dr. Jessica Brickell at the Royal Veterinary College in London evaluated the association of single nucleotide polymorphisms (SNP) in the leptin gene with perinatal mortality. This research includes analyzed data from 385 Holstein heifers on 18 United Kingdom dairy farms.

In order to better understand this research, we talked with Dr. Brickell about her research and how the discovery has the potential to reduce perinatal mortality within the dairy industry.

Tell us a little about your work with the leptin gene.
The interest on this topic came along with my position in the Department of Veterinary Basic Sciences at the Royal Veterinary College in London. The dairy heifer calf is a potential herd replacement; tackling herd reproductive performance assessment should start with the heifer calf. Most studies focus on the lactating dairy cow and few study heifers during the heifer rearing period. My research focused primarily on the growth, development and survival of dairy heifers during the rearing period and throughout first lactation.

Rearing the required numbers of heifer replacements annually is a key factor in profitable dairy operations. Perinatal mortality—defined as stillbirths and mortality within 24 hours of parturition—is a major contributing factor to heifer losses in the dairy industry. We and others have previously estimated perinatal mortality in Holsteins to be at 6 to 8 percent. These levels are often twice as high in heifers at first calving compared with multiparous cows (12 – 13 percent vs. 6 percent). Thus, perinatal mortality in dairy cattle is clearly a challenge for dairy producers today.

Calf survival is influenced by many different factors, but it seems likely that there is a genetic basis for some of the mortality. There has been intense genetic selection in Holstein populations, and there is some evidence to suggest that the prevalence of perinatal mortality has increased in these populations. Perinatal mortality has large economic consequences both directly through the loss of a potential heifer, and indirectly through the subsequent performance of the dam giving birth to a dead calf. Because of this, the long-term goal of my research is to identify genes that are contributing to poor calf survival.

Dr. Brickell received her Ph.D. from the Royal Veterinary College in London. Her research has focused primarily on the growth, development and survival of dairy heifers from rearing to first lactation. Her work with the Royal Veterinary College involves identifying genetic markers associated with fertility and longevity traits in dairy cows.

The Royal Veterinary College is one of the world's leading specialist veterinary institutions, bringing together many talented individuals, all of whom share a passion for human and animal health and welfare.

What has been your latest genomic work with the leptin gene and perinatal mortality?
We have identified an association between the leptin gene and perinatal mortality in Holstein heifers. Leptin has been implicated as a key regulator of placental and fetal development in several mammalian species; dysregulation in leptin function during human pregnancy has been associated with a variety of pathological conditions. We found that the incidence of perinatal mortality was two-fold higher for heifers with a particular leptin genotype. It can be speculated that this genotype has a detrimental impact on placental growth and fetal survival.

What impact will this genomic breakthrough have on future reproductive performance?
The potential exists to use this genetic information as a tool to aid in selection, with the aim of reducing perinatal mortality.

What do you foresee as potential opportunities related to genomics and reproduction that may be coming in the future?
It would be beneficial to dairy producers to be able to identify and select, early in life, the best replacement heifers in terms of their subsequent productivity, fertility and longevity. In the future, farmers may be able to use genetic information to make informed decisions, such as only rearing the top 50 percent of heifers for replacements. It will also enable them to achieve better matching of dams to sires to avoid unfavorable genotypes.

What advice do you have for dairy producers considering the use of genomic technology to improve herd reproduction?
Genomic technology does offer exciting opportunities to improve dairy selection in the future. However, we still have much to learn about the way different genes interact to influence the final Phenotype. In the meantime, good management and herd health plans are still of key importance. If these are not right, genomics will not improve herd reproduction.

To learn more about Dr. Brickell's research click here.