High-Density Lipoprotein as a Novel Means to Decrease Production-Related Diseases in the Dairy Cow

Principal Investigator: Erica Behling Kelly, Assistant Professor

The Need: In the dairy industry, production-related diseases decrease animal well-being and increase the cost of dairy production. Changes in lipid metabolism are thought to promote inflammation and the development of these costly diseases. High density lipoprotein (HDL) is well-recognized as an anti-inflammatory lipoprotein in people. A profound decline in HDL has been documented during the transition period (spanning three weeks before to three weeks after calving) in cows. New data suggests that this decline in HDL is pro-inflammatory. This is important to the dairy industry, as many infectious diseases are caused by the gram negative bacteria that cause inflammation. In human medicine, it is well-established that the quality, not just the quantity of HDL, is important. The same may be true in cows under metabolic stress, but no studies have addressed this question.

The Approach: This study investigated the immunomodulatory functions of HDL from dairy cows throughout a period spanning three weeks before to three weeks after calving. HDL was isolated from 23 cows throughout the six-week transition period and examined to evaluate the ability of HDL to decrease activation of immune cells. Specifically, the approach sought to characterize the protein composition of the HDL; determine the ability of bovine HDL from healthy cows in the transition period to decrease neutrophil and endothelial cell activation; and correlate changes in protein composition of the HDL to the ability to modulate neutrophil and endothelial cell activation, in order to identify novel therapeutic targets.

The Impacts: This research has critical production implications as dietary supplements, such as niacin – which is inexpensive and can be given orally in a rumen-protected form – can increase the production of functional HDL in the liver. This novel area of investigation may transform how producers can control inflammation in dairy cows. Longer term, this project will support the dairy industry by helping to identify inexpensive, practical treatments that increase HDL and/or improve its anti-inflammatory function, as a way to decrease production-related diseases.