TITLE: Identification of predictive disease indicators for dairy cows

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SUMMARY: Cows are most susceptible to diseases in the first days after calving. As result, a large proportion of dairy cows are diagnosed with infectious and metabolic diseases in the first weeks after calving; 5-10% of cows do not respond to treatment and are so seriously ill that they die or have to be sent to slaughter. Therefore, early disease detection for prevention and early treatment is a priority. Our objective was to identify in blood predictive indicators of disease. We compared serum markers of immune function, inflammation, stress, energy status, lipid metabolism, carbohydrate metabolism, and amino acid metabolism, and concentrations of antioxidants and other nutrients (4 weeks before and after calving) between cows that remained healthy and those that developed diseases in the first 4 weeks after calving. We identified novel early predictor of acute (haptoglobin, serum amyloid A, and percentage of non-esterified forms of the major fatty acids C16:0%, C18:0%, C18:1% and C18:2%) and chronic (visfatin and vitamin E) inflammation and tissue damage that detect early those risk factors and thereby opens opportunities for prevention and early treatment.

OBJECTIVES: The objective of this study was to compare serum markers of immune function, inflammation, stress, energy status, lipid metabolism, carbohydrate metabolism, and amino acid metabolism, and concentrations of antioxidants and other nutrients (4 weeks before and after calving) between cows that remained healthy and those that developed diseases in the first 4 weeks after calving. Diseases were classified according to severity (i.e., subclinical, mild clinical, moderate clinical), time of clinical diagnosis (0-3 days, 4-7 days, 8-28 days after calving), and disease class (i.e., metabolic, infectious, both types).

PROCEDURES: In the first step, milk production, health, and economic return were monitored from 4 weeks before until 100 days after calving in 161 3+ year-old dairy cows In the second step, markers of immune function, inflammation, stress, energy status, lipid metabolism, carbohydrate metabolism, and amino acid metabolism, and concentrations of antioxidants and other nutrients were measured in blood samples obtained between 4 weeks before and after calving were compared between cows that remained healthy and those in cows that became sick during the first weeks after calving.

SIGNIFICANT ACCOMPLISHMENTS: We identified novel early predictor of acute (haptoglobin, serum amyloid A, and percentage of non-esterified forms of the major fatty acids C16:0%, C18:0%, C18:1% and C18:2%) and chronic (visfatin and vitamin E) inflammation and tissue

damage that detect early those risk factors and thereby opens opportunities for prevention and early treatment.

BENEFITS & IMPACT:
In the U.S. approximately 3 million cows every year become ill in the first weeks after calving, approximately 300,000 cows die or have to be sent to slaughter shortly after calving, and approximately another 600,000 cows have to be sent in the following months to slaughter because of chronic diseases and/or infertility. Early culling is estimated to cost between 500 and 1,000 dollars per cow. Identification of early indicators in blood for early disease detection will not only improve treatment outcome and cow welfare but will also positively impact public perception of the dairy industry and reduce their economic losses (approximately 0.5 billion dollars per year).

ADDITIONAL FUNDING RECEIVED DURING PROJECT TERM:
Oregon Beef Council: "Identification of predictive metabolomics marker of disease in dairy cows"

FUTURE FUNDING POSSIBILITIES: USDA-NIFA
The results of this study will provide the basis for a USDA-NIFA-funded study that uses vitamin E alimentation for prevention of periparturient diseases in dairy cows.

The results of this study will be published in a format accessible to Oregon dairy producers for information and implementation, if appropriate for their production strategy.