UNIVERSITY of GUELPH

ONTARIO AGRICULTURAL COLLEGE

DEPARTMENT OF ANIMAL BIOSCIENCES

PhD Defence

Relationships between maternal nutrition, colostrogenesis, and neonatal physiological and metabolic development in cattle

Koryn Hare

Date: August 11th 2023 at 9:00am

The PhD Defence for Koryn Hare has been scheduled for August 11th, 2023 at 9:00am. The defence will be held online via Teams and in room 102: https://teams.microsoft.com/l/meetup-join/19%3ameeting_NjIyNDFiZjUtZjBhNi00MzlkLTg3NDctY2VmNWU5ZWQ3NTlh%40thread.v2/0?context=%7b%22Tid%22%3a%22be62a12b-2cad-49a1-a5fa-85f4f3156a7d%22%2c%22Oid%22%3a%22fbd28915-dda5-478f-8ecb-a3682dcf0c3a%22%7d

The exam committee will consist of:

Examining Chair: Dr. Kate Shoveller

Advisor: Dr. Mike Steele

Advisory Committee Member: Dr. Katie Wood (co advisor)

Additional Committee Member: Dr. John Cant

External Examiner: Dr. Sabine Mann

Abstract:

Maternal nutrition might affect colostrum yield and composition, and nutritional modulation of colostrogenesis could be used strategically to improve neonatal calf physiological and metabolic development. Studies were conducted to investigate how nutrition prior to calving can indirectly influence neonatal calf physiology and metabolism through colostrum composition. Late gestation cattle were fed rations formulated to supply 80 (LME, n = 52), 100 (CME, n = 51), or 120% (HME, n = 49) of predicted metabolizable energy requirements for 52 d before calving. Feeding HME increased colostrum yield and insulin concentration relative to LME, while CME colostrum yield was similar to both LME and HME, but they produced colostrum with greater insulin concentration than LME. Colostrum composition was also affected by LME, CME, and HME consumption. A subset of LME and HME (n = 19/treatment) cattle underwent an intravenous glucose tolerance 7 d prior to calving, and while HME cattle had less adipose-specific insulin responsiveness than LME cattle, antepartum glucose-insulin kinetics were not associated with colostrum insulin concentration. When neonatal dairy calves (n = 48) were fed colostrum with insulin increased to 5 and 10× the basal colostrum insulin concentration, they had minor improvements in small intestinal histomorphology and linearly increased proximal jejunal lactase activity. These intestinal ontogenic improvements caused plasma glucose to increase at a quicker rate and serum non-esterified fatty acids to decrease faster after the second colostrum meal, suggesting that intestinal glucose absorption was improved from consuming higher insulin colostrum. However, blood glucose and insulin concentrations did not differ for 7 d after birth in beef calves that consumed colostrum from their dams that had greater insulin concentrations. The corresponding shifts in colostrum composition when HME instead of LME was fed confounded direct responses to changes in colostrum insulin concentration. In this thesis, it was demonstrated that prepartum nutrition can be used to modulate colostrum production in cattle and increase compounds that promote intestinal development, such as insulin. Changes to the bioactive fraction does not occur in isolation, but independently greater colostrum insulin concentrations appear to improve neonatal intestinal ontogenesis.