Metabolism of dairy cows as affected by dietary starch level and supplementation with monensin during early lactation

M. M. McCarthy[1], T. Yasui[1], C. M. Ryan[1], S. H. Pelton[1], G. D. Mechor[2], and T. R. Overton[1]

[1]Department of Animal Science, Cornell University, Ithaca, NY, 14853

[2]Elanco Animal Health, Greenfield, IN, 46140

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Introduction

- Insufficient energy intake and metabolic imbalance in early lactation have been associated with an increased risk of metabolic disease (Ingvartsen et al., 2003; Ospina et al., 2010)
- Feeding diets of increased propiogenic capacity may be one means of improving early lactation energy metabolism
  - Propionate produced via fermentation of starch in the rumen is the main precursor for hepatic glucose production
  - Monensin is a commonly used feed additive that increases ruminal propionate production (Armentano and Young, 1983)

Objective

- To determine if increasing starch level and/or feeding monensin postpartum would improve energy metabolism during early lactation through increased hepatic capacity to utilize propionate for gluconeogenesis

Materials & Methods

- Holstein cows were fed a high starch (26.2%) or low starch (21.5%) diet from calving through 21 DIM with 0 or 450 mg/d monensin topdress in a 2 × 2 factorial arrangement
  - Multiparous (n=49) and primiparous (n=21)
  - Prepartum controlled energy diet with either 0 or 400 mg/d monensin topdress, depending on early lactation treatment assignment
- Plasma samples were collected 3× per wk and liver tissue was sampled via percutaneous trocar biopsy (Veenhuizen et al., 1991) from cows on d 7 ± 4 postpartum
- Plasma concentrations of glucose, NEFA, and BHBA were determined by enzymatic analysis and plasma concentrations of insulin were determined by double antibody RIA

Statistical Analysis

- Statistical analysis was conducted using the MIXED procedure in SAS
- All 2 way interactions analyzed

Results and Implications

- Cows fed high starch diets in early lactation had higher plasma concentrations of glucose and insulin, and lower NEFA and BHBA compared to cows fed low starch diets in early lactation
- Cows fed monensin had higher plasma concentrations of glucose and lower BHBA compared to control cows
  - Driven by monensin × parity interactions; primiparous cows fed monensin had higher glucose and lower BHBA than primiparous control cows
- Primiparous cows fed monensin had increased liver triglycerides compared to control, and multiparous cows had decreased liver triglycerides compared to controls
- Overall, animals fed more propiogenic early lactation diets had improvements in energy metabolism during early lactation

Results

High Starch (26.2 % starch) | Low Starch (21.5 % starch) | No monensin | Monensin

Figure 1. Effect of early lactation starch and monensin treatment on plasma glucose concentration

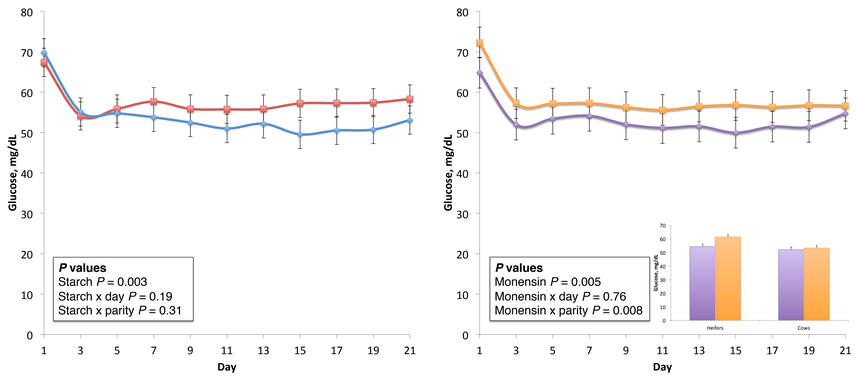


Figure 2. Effect of early lactation starch and monensin treatment on plasma insulin concentration

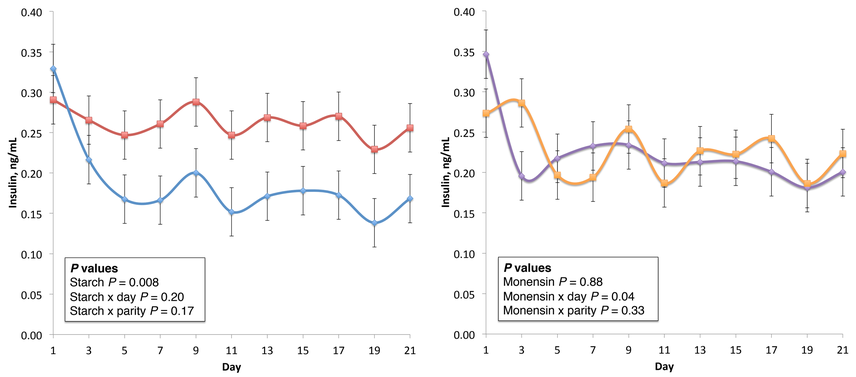


Figure 5. Effect of early lactation starch and monensin treatment on liver glycogen and triglyceride content

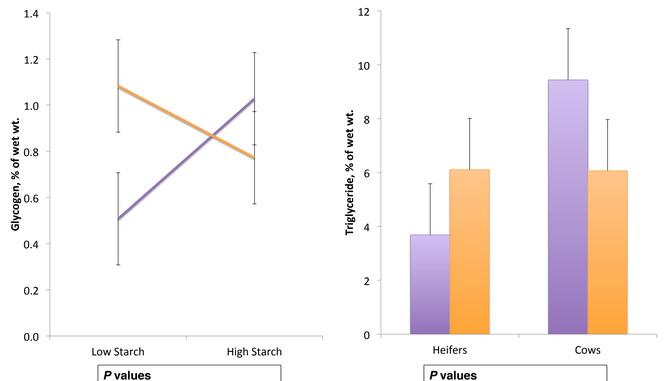


Figure 3. Effect of early lactation starch and monensin treatment on plasma NEFA concentration

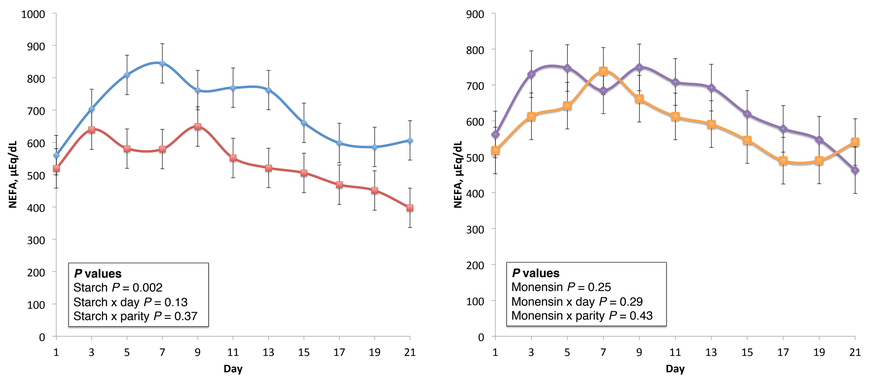
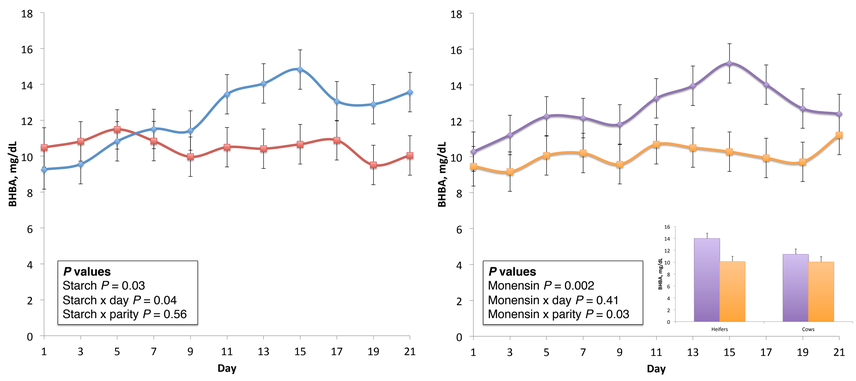


Figure 4. Effect of early lactation starch and monensin treatment on plasma BHBA concentration



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