Gastrointestinal Barrier Function in Holstein Calves

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Ruminal acidosis (RA) and low feed intake (LFI) both negatively affect the productivity of dairy cattle. It has been reported that RA and LFI affect barrier function of the gastrointestinal tract (GIT). Barrier function facilitates nutrient absorption while preventing harmful molecules and pathogenic organisms from entering circulation. Understanding the regions of the GIT affected is needed to develop strategies to mitigate the negative impact or hasten recovery.

The objective of this study was to identify the whether RA and LFI have differential effects on barrier function of the GIT and to determine which regions of the GIT are impacted. Twenty-one Holstein steers were randomly assigned to 1 of 3 treatments. Treatments included a control (CON), an acidosis challenge (ACID), and a group exposed to feed restriction (FR). All steers were fed a common diet and had a 14-d adaptation and a 5-d baseline period. Rumen acidosis was induced by restricting feed to 25% of voluntary intake for 1 d and subsequently offering pelleted barley (30% DMI:BW) the following day. Steers on the FR treatment were restricted to 25% of intake for 5 d. Rumen pH was recorded throughout the study. All steers were killed and tissues were collected from the rumen, omasum, duodenum, jejunum, ileum, cecum, and proximal and distal colon were mounted in Ussing chambers to determine the flux of ^{14}C-mannitol and ^{3}H-inulin as indicators for barrier function.

During baseline, there were no differences for DMI averaging 7.1 kg/d but during the challenge DMI was 1.7 kg/d and 7.9 kg/d for FR and ACID calves, respectively. Mean pH did not differ during baseline, but pH was 6.94 and 6.20 for FR and ACID during the challenge compared to 6.6 for CON. There were no differences ($P > 0.05$) among treatments for inulin or mannitol flux. However, inulin flux was greater ($P < 0.01$) in the rumen, omasum, and duodenum than the ileum, cecum, and distal colon. Mannitol flux was greater ($P < 0.01$) in the rumen, duodenum, jejunum, and proximal and distal colon relative to the ileum.

Implications. Low feed intake and ruminal acidosis do not appear to differentially affect barrier function of the GIT. However, this study shows that the duodenum and rumen are regions with lower barrier function.