

Recovery of the ruminal epithelium after acidosis

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Ruminal acidosis is known to cause damage to the ruminal epithelium that can reduce nutrient absorption, induce systemic inflammation, and predispose cattle to secondary disorders such as laminitis. The objective of this experiment was to evaluate the expression of genes involved in local inflammation in the ruminal epithelium following an acidosis challenge.

Seven ruminally-cannulated heifers were used in a crossover design with two periods and two treatments (acidosis induction or control). Heifers were fed a TMR with a 50:50 forage-to-concentrate ratio and DMI was recorded daily. The acidosis induction consisted of 1 d of feed restriction (25% of DMI) followed by a grain challenge (30% of baseline DMI) and provision of the TMR to achieve voluntary DMI. Ruminal pH was measured using indwelling probes to verify induction of acidosis and ruminal papillae biopsies were collected on d 2 and 6 following the induction of acidosis for RNA extraction. Genes associated with regulation of specific aspects of activation and mediation of the immune response were selected. These included: PTGS1 and PTGS2 (facilitate prostaglandin synthesis), ALOX5, ALOX5AP, LTA4H and LTC4S (intermediates in leukotriene synthesis), TNF α and IL1 β (pro-inflammatory cytokines), and toll-like receptors-4 (TLR4) and TLR9 (receptors for molecules such as lipopolysaccharide). Gene expression was measured by quantitative real-time PCR, normalized to the geometric mean of three housekeeping genes within period. Statistical analysis was performed using the MIXED procedure of SAS 9.4, with treatment and period as fixed effects. A pH threshold of 5.6, for > 3h/d, was used to define the occurrence of ruminal acidosis.

During the day of the grain challenge, ruminal pH for acidosis cows was below pH 5.6 for 336 min; whereas, pH of controls did not fall below 5.6 ($P=0.02$). On d 2 after acidosis induction, transcriptional abundance decreased for PTGS2 (2-fold; $P=0.03$), ALOX5 (1.5-fold; $P=0.02$), ALOX5AP (1.5-fold; $P=0.01$), TLR4 (1.6-fold; $P=0.01$), TNF α (2-fold; $P=0.004$) and IL1 β (3.5-fold; $P=0.01$) in acidosis animals compared to the controls. When evaluated at d 6 no differences were observed.

Implications: The results of this study provide evidence for an acute anti-inflammatory response and suggest that it is tightly regulated, allowing for recovery of the tissue following acidosis.