

Rumen Epithelial Gene Expression in Response to Oral NaHCO₃ Treatment in Holstein Bull Calves

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While common, concern exists that low rumen pH in periruminant calves should be avoided. Oral NaHCO₃ can increase rumen pH. The objective was to study effects of oral administration of NaHCO₃ on expression of select genes in the rumen epithelium at 49 d of age. Genes included in the investigation encode for proteins that are used for volatile fatty acid (VFA) absorption, pH regulation, and NaHCO₃ transport. Neonatal Holstein bulls (n=12) were randomly assigned to one of four treatments, arranged in a 2x2 factorial design. Factors were treatment (control (con) or NaHCO₃ (bicarb)) and oral route of delivery (water-based drench or gelatin-filled capsule). Administration of NaHCO₃ dose was adjusted weekly and reached a maximum of 48 g/d. Treatments were administered before each of 2 daily feedings. Calves were fed 543g DM/d of a 22% CP, 20% milk fat replacer, had access to a 20% CP starter and water. At wk 8, rumen tissue was obtained from the cranial ventral region of each calf. Total RNA was extracted from the epithelial portion of rumen tissue, reverse transcribed into cDNA, and used in quantitative reverse transcription PCR assays. Relative abundance of 10 VFA transporters, pH regulators, anion exchangers and cotransporters were quantified. Rumen pH was not increased by NaHCO₃, (measured 2, 4, and 6 h post-dosing) but urine pH was. This observation went against past findings regarding ruminal pH with oral NaHCO₃ administration but generally supports the notion that post-ruminal, rather than ruminal, NaHCO₃ absorption and metabolism occurs in young calves. In support of this, NaHCO₃ had no effect on expression of any ruminal gene measured here. Findings suggest that in young calves, low rumen pH is part of the developmental process and regulatory mechanisms associated with non-diffusional VFA transport, rumen pH, and NaHCO₃ transport are not affected by supplemental NaHCO₃.