

# Increasing Diet Fermentability Increases Urea Recycled To the Rumen

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Increasing diet fermentability has been shown to increase nitrogen (N) efficiency in dairy cattle as well as promote microbial protein synthesis. Previous studies have shown that boosting fermentable carbohydrate levels in dairy rations has reduced the concentration of ruminal ammonia and decreased the amount of N excreted in the urine and feces. Urea transport across the ruminal wall has been shown to be an important route in the recycling of urea back to the rumen microbes. The objective of this study was to determine the change over time in urea transport across the ruminal wall induced by an increase in diet fermentability. Twenty-five weaned Holstein bull calves were randomly assigned to 1 of 5 treatments, fed at 2.25% of body weight (0800 h). Calves were fed a control diet (CON; 91.5% hay and 8.5% vitamin and mineral supp.) or a diet consisting of 41.5% barley grain, 50% hay, and 8.5% vitamin and mineral (DM) for 3 (G3), 7 (G7), 14 (G14), or 21 d (G21). Calves were killed at 1000 h and ruminal tissues were collected for measurement of in vitro urea transport, and gene expression of key urea transport proteins (UT-B and AQP).

Ruminal ammonia concentration increased quadratically ( $P = 0.004$ ) to G14, but decreased thereafter. Blood urea N was unaffected by dietary treatment. Urea transport across the ruminal wall tended to increase linearly from CON to G21 ( $P = 0.075$ ). Both UT-B and AQP played significant roles in urea transport across the ruminal wall; however, their functionality was not affected by diet. Gene expression of urea UT-B ( $P = 0.007$ ) and AQP3 ( $P = 0.005$ ) increased linearly from CON to G21.

**Implications:** This study demonstrates that with a change in diet fermentability adaptation of the ruminal wall (secretion of urea) may take up to 21 days. During this time bypass protein may be more effective in stimulating production responses.