EFFECT OF FEEDING RANGE PROTEIN SUPPLEMENT ON RUMINAL METHYLGLYOXAL PRODUCTION

S. L. Lodge-Ivey, R. L. Endecott, K. D. Richardson, and M. K. Petersen

When ruminants are consuming dormant range, the ruminal microbes may experience growth conditions where carbohydrate is supplied in excess of microbial needs and nitrogen is limiting to fermentation. Under these conditions ruminal bacteria have developed strategies involving futile cycles to spill energy until the carbon to nitrogen ratio favors the synthesis of microbial crude protein. To overcome dietary inadequacies, cattle are supplemented with protein supplements formulated to meet their nutrient requirement. These protein supplements may contain ruminally degradable protein, undegradable protein, or combinations of both. However, prediction of the effectiveness of the supplementation program, in regards to the degradable protein requirement of the microbial population, is based partially on ammonia (NH_3) concentration in ruminal contents. Ammonia in the rumen is a pool of several inputs and outputs. Ammonia is derived from degradation of dietary protein and dietary NPN, from the hydrolysis of urea recycled to the rumen, and from the degradation of microbial crude protein. Ammonia disappears from the rumen pool due to uptake by the microbes, absorption by the microbes, absorption through the rumen wall, and flushing to the omasum. Changes in any of these factors will alter NH_3 concentration in the rumen. Thus, NH_3 concentration is too dynamic to be a good indicator of the nitrogen status of the ruminal environment. The idea of using methylglyoxal as a marker for effectiveness of protein supplementation under a typical range supplementation protocol has not been investigated. Therefore, an experiment was conducted at the Corona Range and Livestock Research Center to determine the influence of protein supplementation on ruminal production of methylglyoxal, ammonia, pH and blood ketones by cows grazing dormant winter range. Treatments consisted of no supplementation (n=4) or 36% CP cottonseed meal based supplement (n=3) fed at 1lb per·cow per day fed three times per week. Supplementation regimen had no effect on ruminal ammonia ($P = 0.13$), pH ($P = 0.99$), methylglyoxal (P = 0.63) or blood ketone ($P = 0.42$). Blood ketone concentrations were different depending on day, ($P < 0.01$) with detectable ketones increasing as the trial progressed. Ruminal pH decreased ($P < 0.01$) over day during the length of the experiment. Ruminal ammonia tended to decrease by day ($P = 0.06$) with lower values at the completion of the experiment compared to the start. Methylglyoxal increased (P = 0.05) during the duration of the experiment being highest on d 5 and undetectable on d 1. This experiment is the first attempt to quantify ruminal methylglyoxal in cows under winter range conditions. Ruminal methyglyoxal concentration may be a more sensitive to ruminal nitrogen and carbohydrate imbalances than the measurement of ruminal ammonia.

Key Words: methylglyoxal, protein, ruminal bacteria