RUMINAL DEGRADATION OF PROTEIN AND CARBOHYDRATE IN THE DOMESTIC AND WILD RUMINANT

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ABSTRACT

To optimize growth and health ruminant animals in a confined setting, diets need to be formulated to provide balanced levels of rumen degradable energy and nitrogen (RDN) to maximize microbial growth while also providing adequate rumen undegradable protein (RUP) for the animal. The first experiment in this study examined the level of feed-grade crystalline amino acids (AA) required in a diet to provide appreciable levels of limiting AA as RUP. The solubility of these AA in a mixed rumen culture showed dietary inclusion levels would be required at >12% of the diet on a DM basis. The second study measured the degradability of the starch, neutral detergent fiber (NDF) and protein fractions of common feeds used in a feedlot finishing diet. Degradation rate was measured as the percentage disappearance of the ruminally available nutrient over time. Degradation rates were found to be linear and similar for the feeds tested with the average rates of degradation being approximately 0.0479 h^{-1} for starch, 0.0292 h^{-1} for NDF and 0.0271 h^{-1} for protein. A third study used these rates with an estimated passage rate of 0.06 h^{-1} to formulate diets with varying levels of rumen degradable protein (RDP) and RDN. Resulting diets were applied to continuous culture fermentations to measure fermentation characteristics and microbial efficiency (MOEFF) with the hypothesis that a diet balanced for the proper amount of RDP to rumen degradable energy would increase efficiency. MOEFF proved to be lesser when RDN was limiting and greatest when RDP was provided at less than 100% of requirement. Similar diets with varying RDP and balanced RDN were then applied to crossbred Angus steers to determine effects on growth. The greatest average daily gain (ADG) and feed efficiency was measured when RDP was provided at 115% of the requirement, compared to 95% and 85%. Finally, *in vitro* digestibility characteristics of commercially available pelleted feeds fed to exotic ruminants were measured. These studies included one low starch/high fiber and two different high starch/low fiber feeds. Both batch culture and continuous culture techniques were employed using dairy cow and mule deer rumen fluid. Both studies confirmed differences exist between fermentation characteristics due to species used as inoculum source. Further, greater fiberolytic activity was seen in mule deer inoculum, and greater proteolytic activity was seen in dairy cow inoculum. Also, decreasing starch in diets increased OM digestibility, likely due to removal of negative associative affects on cellulolytic bacteria.