Effects of rumen acid load from feed and forage particle size on ruminal pH and dry matter intake in the lactating dairy cow.

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Abstract

The objective of this study was to evaluate the effects of level of concentrate acidogenic value (AV) and forage particle size on ruminal pH and feed intake in lactating dairy cows. Two isoenergetic (net energy for lactation = 1.5 +/- 0.01 Mcal/kg) and isonitrogenous (crude protein = 17.4 +/- 0.1% dry matter) concentrates with either a low AV or high AV were formulated and fed in a total mixed ration with either coarsely or finely chopped corn silage and alfalfa haylage ad libitum. Four rumen-fistulated cows (114 +/- 14 d in milk) were randomly assigned to 1 of the 4 treatments in a 4 x 4 Latin square with a 2 x 2 factorial treatment arrangement. Each period consisted of 3-wk (14-d treatment adaptation and 7-d data collection). Increasing the concentrate AV decreased the mean pH (from 6.07 to 5.97) and minimum pH (from 5.49 to 5.34). Cows fed high-AV diets spent a longer time below pH 5.6 (135.1 vs. 236.7 min/d; low-AV diet vs. high-AV diet, respectively) and pH 5.8 (290.0 vs. 480.6 min/d; low-AV diet vs. high-AV diet, respectively) than cows fed low-AV diets. Increasing forage particle size had no effect on the mean and minimum ruminal pH. There was an interaction between concentrate AV and forage particle size on maximum ruminal pH. Increasing forage particle size increased the maximum pH for cows fed the high-AV concentrate (6.69 vs. 6.72; low-AV diet vs. high-AV diet, respectively) and had no effect on the maximum pH for cows fed the low-AV concentrate (6.98 vs. 6.76; low-AV diet vs. high-AV diet, respectively). Increasing the concentrate AV did not affect dry matter intake but reduced neutral detergent fiber intake from 9.7 to 8.8 kg/d. Milk fat content was negatively correlated with time and area below pH 5.6 (time below, r = -0.51; area below, r = -0.56) and pH 5.8 (time below, r = -0.42; area below, r = -0.54). These results suggest that coarse forage particle size can attenuate drops in ruminal pH. However, the ameliorating effects of forage particle size on drops in ruminal pH were more apparent for high-AV diets than for low-AV diets. The AV approach combined with physically effective neutral detergent fiber would therefore improve the formulation of diets and help to mitigate subacute ruminal acidosis in dairy cows.