IN VITRO AND IN VIVO EFFECTS OF SOLUBLE CRUDE PROTEIN, YUCCA SCHIDIGERA EXTRACT AND SACCHAROMYCES CEREVISIAE ON RUMEN METABOLISM

Ruiz-Moreno, M[1]., M.D. Stern[1], A. Bach[2], M. Thrune[1] and J.G. Linn[1]
[1]University of Minnesota, Saint Paul, MN
[2]Institució Catalana de Recerca I Estudis Avançats, Barcelona, Spain

Effects of monensin (MO) and *Yucca schidigera* extract (YSE) on fermentation were evaluated using 8-dual flow *in vitro* continuous culture fermenters. A 58:42 forage:concentrate diet provided substrate for microbial metabolism. The study was designed as a 2 x 2 factorial arrangement of treatments with 0 or 5 ppm MO or 0 or 80 ppm YSE. Monensin at 5 ppm increased ($P < 0.05$) total VFA from 102.7 to 140.9 m*M* and molar proportions of propionate and branched-chain VFA from 21.2 to 36.9 and 0.7 to 1.8 mol/100 mol, respectively and decreased A:P ratio from 3.11 to 1.48. YSE at 80 ppm increased ($P < 0.05$) molar proportions of isovalerate and isobutyrate from 0.13 to 0.29 and 0.20 to 0.36 mol/100 mol, decreased ($P < 0.05$) 2-methylbutyrate from 0.37 to 0.16 mol/100 mol and reduced ($P < 0.05$) maximum pH from 6.32 to 6.14 compared with 0 ppm. In another experiment, the fermenters were used to assess microbial degradation of the soluble CP fraction of canola meal (CM), soybean meal (SBM), fish meal (FM) and a solution of tryptone as a control treatment in a completely randomized design with two 9-d experimental periods. All fermenters received the same basal diet (58:42 concentrate:forage) and on the last 3 d of each period, 90-mL doses containing soluble CP were infused into the fermenters 30 min after feeding. Soluble CP supplied by the infusions of FM, CM, and SBM represented 24% of daily dietary CP intake. Infusion of FM resulted in the greatest ($P < 0.05$) NH_3-N concentration (4.6 ± 0.40 mg/dL) among treatments (0.5 ± 0.40 mg/dL) while microbial N flow (g/d) from fermenters was also greatest ($P < 0.05$) with FM. Efficiency of microbial protein synthesis tended to be lowest with the control diet and efficiency of N utilization was lowest with the FM treatment. Degradation of the soluble CP fraction from FM, SBM, and CM meal was 99, 30, and 37% of soluble CP, respectively. Results indicate that soluble CP is not 100% degraded in all feeds. Assuming a high extent of degradation of the soluble CP fraction from soybean meal and canola meal may result in an underestimation in supply of undegradable protein from these protein sources. In another experiment, 8 ruminally-canulated cows in late lactation fed a 60:40 forage:concentrate diet, received either 0 or 0.5 g/hd/d of *Saccharomyces cerevisae* in a crossover design with two periods. Ruminal pH was monitored every 22 min using a pH probe placed in the ventral sac of the rumen during 6 days while ruminal VFA and NH_3-N concentrations were measured on days 5 or 6 of each period. Mean ruminal pH was greater ($P < 0.05$) when yeast was supplemented (6.53 ± 0.07) compared with the control (6.32 ± 0.07). Average maximum and minimum ruminal pH were also greater ($P < 0.05$) when yeast was supplemented (7.01 ± 0.09 and 5.97 ± 0.08, respectively) compared with the control (6.80 ± 0.09 and 5.69 ± 0.09, respectively). Time spent under the subacute acidosis threshold (pH less than 5.6) was lower ($P < 0.05$) with yeast supplementation compared with control cows. No difference was observed for ruminal NH_3-N concentrations (14.0 ± 1.2 mg/dL) between treatments. Total VFA (m*M*) in the rumen tended to be lower ($P = 0.10$) in yeast-supplemented cows (107.3 ± 6.4) than in control cows (122.4 ± 6.4). In the final experiment, *in vitro* effects of *Saccharomyces cerevisiae* using a diet for high lactating dairy cows were evaluated. A 60:40 concentrate:forage diet with 0 or 0.98 mg yeast/d provided substrate for microbial metabolism in a completely randomized design. No differences ($P > 0.05$) in true OMD, total VFA (m*M*) or VFA (mol/100 mol) were detected. Minimum and maximum pH of fermentations (5.68 ± 0.13 and 5.75 ± 0.14, respectively), and time spent under subacute acidosis threshold or in marginal subacute acidosis (between 5.6 and 5.8) did not differ ($P > 0.05$) between treatments. Addition of yeast resulted in a lower ($P < 0.05$) NH_3-N concentration and a lower NH_3-N daily flow than control at 6.26 vs 3.85 mg/d and 0.19 vs 0.12 g/d, respectively. In conclusion, YSE elicited only minor effects on rumen fermentation. In contrast, various soluble CP fractions exhibited different fermentation dynamics, contrary to several ruminant nutritional models where 100% degradability of the soluble CP fraction is assumed. Any beneficial effects of *Saccharomyces cerevisiae* on rumen pH and NH_3-N concentration appear to be dependent upon diet type.