Ruminal peptide and ammonia nitrogen concentrations in steers fed diets with different concentrate to lucerne hay ratios

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Introduction In ruminants, as much as 50% of the dietary crude protein can be converted to ammonia by ruminal microorganisms. A part of ammonia can be utilized as a bacterial nitrogen source; however, rates of ammonia production often exceed rates of ammonia utilization. Peptides are intermediates in the conversion of ingested protein to ammonia in the rumen and their accumulation depends upon the nature of diet (Mesgaran & Parker, 1995). The objective of the present experiment was to investigate the effect of diets differing in concentrate: lucerne hay ratios on the ruminal pH, ammonia-nitrogen concentration and ruminal peptide nitrogen concentration in Holstein steers.

Materials and methods Four Holstein steers with initial body weight of 300±15 kg fitted with ruminal Fistulae were used in a 4×4 Latin square design (28 days of each period). Animals were fed 7 kg of DM of diets differing in concentrate [155 g CP kg^{-1} of DM; consisted of maize, barley, soybean meal, sugar beet pulp, wheat bran, cottonseed meal, $CaCo_3$, mineral and vitamin premix, salt (30, 34, 8, 5, 10, 12, 0.3, 0.5, and 0.2 g/100g DM; respectively)] to lucerne hay ratios as 60:40 (C_{60}:L_{40}), 70:30 (C_{70}:L_{30}), 80:20 (C_{80}:L_{20}) and 90:10 (C_{90}:L_{10}). Steers fed the experimental diets as total mixed ration twice daily at 0800 and 2000 h. At day 24 of the each experimental period, ruminal fluid samples were collected, by suction, before the morning feeding, 4 and 6 h post feeding. The pH of the ruminal fluid samples was measured immediately with a portable pH meter (Metrohm 744). Ruminal fluid samples were prepared for peptide-N using sulphate-tungstate method described by Chen *et al.* (1987). The percoloric and tugstate acid-precipitates nitrogen were assayed by a standard macro-Kjeldahl procedure. For samples designated for NH_3 analysis, 10 ml of ruminal fluid from each collection were acidified with 10 ml of 0.2 N HCl. Samples were analyzed for NH_3-N using distilation method (Kjeltec 1030 Analyzer tecator). Data were analyzed using the GLM procedure of SAS (y = Mean + Treatment + Animal + Period + Time + Time × Treatment + residual) and the means compared by the Duncan test ($P<0.05$).

Results The ruminal pH and ammonia-N and peptide-N concentrations at different sampling time are shown in the Table 1. Results indicated that the ruminal peptide-N was not significantly influenced by the diets and sampling time. Ruminal pH and ammonia-N concentration decreased from 6.54 (C_{60}:L_{40}) and 17.95 (C_{70}:L_{30}) to 5.87 (C_{90}:L_{10}) and 11.44 (C_{90}:L_{10}), respectively, ($P<0.05$). ruminal pH and ammonia-N concentration were significantly affected by the treatments and sampling time ($P<0.05$).

Table 1 The ruminal pH, and ammonia-N and peptide-N concentrations (mg/dl) in the rumen fluid of Holstein steers fed diets differing in concentrate: lucerne hay ratios

Item	Time (h)	Concentrate: lucerne hay ratio				Treatment effect		Time effect	
		60:40	70:30	80:20	90:10	SEM	*P*	SEM	*P*
pH	0.0	6.91	6.76	6.52	6.50	0.09	0.01	0.07	0.01
	4.0	6.30	6.20	5.94	5.50				
	6.0	6.43	6.51	6.21	5.63				
NH_3-N	0.0	12.48	19.48	15.75	12.97	1.54	0.03	1.33	0.01
	4.0	18.87	19.98	13.87	15.42				
	6.0	13.74	14.41	10.52	5.94				
peptide-N	0.0	5.67	4.92	1.49	0.18	1.30	0.15	1.12	0.98
	4.0	2.07	0.13	0.07	8.97				
	6.0	6.95	3.23	0.24	1.66				

Conclusions Results showed the ruminal peptide-N concentration typically increased at 6 hours after feeding. When animals fed a high concentrate: lucerne hay ratios (C_{80}:L_{20}), ruminal peptide-N concentration was significantly lower than those fed C_{60}:L_{40} and C_{70}:L_{30}. The results of the present study demonstrated that the increasing of concentrate in diets caused to decrease the ruminal pH and ammonia-N concentration. The increasing of concentrate may reduce proteolysis in the rumen. Furthermore, provided ruminal energy facilitates microbial yield and the demand for ruminally available nitrogen. Ruminal pH decreased continuously until 4 h after feeding. In overall, the results of the present experiment suggested that the diets containing higher concentrate had a significant effect on ruminal pH and ammonia-N concentration.

References

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