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EFFECT OF RUMINAL NH3-N ON TOTAL VOLATILE FATTY ACID, BACTERIAL POPULATION AND DIGESTIBILITY IN SWAMP BUFFALOES

S. Suwanlee and M. Wanapat
Ruminant Nutrition Laboratory, Department of Animal Sience,
Faculty of Agriculture, Khon Kaen University, Thailand

Abstract

Four rumen-fistulated swamp buffaloes were used in a 4x4 latin square experiment. The experiment was designed to determine the effect of ruminal ammonia concentration (NH3-N) on production of total volatile fatty acid (TVFA) concentration, bacterial numbers and digestibility of feed. Buffaloes were given 1 kg/d of concentrate diet containing 11 %CP and 75 %TDN (DM basis) and rice straw ad lib. once daily at 0800 h. Urea solution was intraruminally infused for 9 hr/d into the rumen at levels of 0, 20, 40 or 60 g/d. Infusion of urea solution linearly increased (P<.05) the concentrations of ruminal ammonia N from 1.7 to 5.6 mg%. At ruminal NH3-N concentration 5.1-5.6 mg%, DM, NDF, ADF digestibilities, TVFA and bacterial count(5.6 mg%NH3-N) tended to be higher as compared to the control (P>.05). It is reccommended that further studies to investigate on ruminal optimal NH3-N concentration need to be conducted.

Introduction

Ammonia is an important source of nitrogen for fiber-digesting bacteria (Hungate, 1966) and also is required by energy source such as starch and sugar for protein synthesis. In vitro studies (Satter and Slyter, 1974) reported that no more than 5 mg% of ammonia is required for microbial growth. In contrast, Boniface et al.(1989) and Perdok et al.(1988) reported that maximizing of bacterial growth rate and feed intake of ammonia cocentration in excess of 20 mg% ruminal fluid were obtained. Data on ruminal responses to relatively low ruminal ammonia concentrations in swamp buffaloes are limited. Therefore, the objective of this study was to determine the effect of low ruminal ammonia concentration on ruminal fermentation patterns, bacteria population and digestibility.

Materials and Methods

Four buffaloes (319+28.7 kg) fitted with ruminal cannulas were maintained in individual pens and fed 1 kg/d of concentrate and rice straw ad-lib. The concentrate mixture consisted of 11 %corn meal, 46 %cassavaship,10 %rice bran, 16 %broken rice, 2 %fishmeal, 2 %soybean, 1.6 %limestone, 1.2 %dical p., 1.2 %salt, 9 %peanut. This diet contained 11 %CP(DM basis) and 75 %TDN

Buffaloes were assigned to receive four treatments in a 4x4 latin square.

Four different amounts of urea (0, 20, 40 or 60 g/d) dissolved in distilled water to a total volume of 1 liter were intraruminally infused for 9 hr/d from 0800 to 1700 h., through the ruminal cannula, using a catheter with plastic tubing. Between each treatment, there was a three-day transition period for the first nine days of each treatment required to achieve stable ruminal ammonia concentration (9 h/d).

Digestion coefficients were determined by using acid-soluble-ash (AIA) as an internal indicator.

Total direct counts of bacteria were determined by phase contrast microscopic, dilutions of 10_{-10}. Sample of ruminal fluid was conducted 10 times on the final day of each period.

Samples of ruminal fluid were taken through the ruminal cannula at 1 h before feeding and at 1 through 10 h after the 0800 hr feeding. Ruminal pH was measured immediately after ruminal fluid sampling and then added 5 ml of 6N HCl in 100 ml rumen fluid for further TVFA and NH3-N analyse. Total VFA concentration in rumen fluid was determined by procedure of Gray et al. (1960). Ammonia concentration in ruminal fluid was determined by ammonia electrode (model 95.12) with ORION digital ionalyzer (Model 501).

All data were subjected to ANOVA with treatment infusion level of urea solution), animal, time and period as factors. The response to level of urea solution infusion were tested at a probability level of 5 % as described by Steel and Torrie(1980) using(SAS, 1982). The different of treatment means were tested by Orthogonal polynomial.

Results and Discussion

Ammonia concentration in ruminal fluid clearly reflected infusion levels of urea (Table 2). Ruminal ammonia concentration appeared to peak at 2 h post feeding for 20 and 60 g. urea level infusion and at 1 h post feeding for 0 and 40 g. urea level infusion. Similarly, this patterns have been reported by Perdok et al.(1988) and Song and Kennelly (1990).

Total VFA concentration in ruminal fluid was not different (P>.05) with level of urea solution infusion (Table 2), although many researchers have confirmed that NH3-N cocentration closely associated with TVFA cocentration, total VFA tended to reach highest level at 1 h after 0800 feeding for all treatments.

Infusion of urea solution tended to increase bacteria count (P>.05) in ruminal fluid (Table 2).

Infusion of urea solution increased apparent DM, NDF, ADF digestion coefficient as level of urea increased(P>.05) (Table 1) particularly ADF. Similarly, Song and Kennelly(1990) suggested that the rang of ammonia concentration 2.6-15.7 mg% did not influence degradation characteristics of fish meal and barley grain. However, Hart and Wanapat (1992) found that when swamp buffalo fed with untreated straw and urea, their apparent DM digestibility, NDF and ADF were 55, 56 and 60 %, respectively. They were slightly higher than those in this study, perhaps NH3-N level might have affected on the results.

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Table 1. Urea supply and effect of urea infusion on digestion

Item	Infusion of urea, g/d				SE	Sig.
	0	20	40	60		
N supply						
Dietary N intake, g/d	272	262	272	282		
Urea N infused, g/d	0	9.2	18.4	27.6		
Total N, g/d	272	271.2	290.4	309.6		
Digestion						
Voluntary DM intake(kg/d)	5.1	4.8	5.1	5.2	0.7	NS
App. DM digestibility(%)	53.7	52.6	54.1	54.4	1.2	NS
NDF(%)	57.6	57.8	58.3	58.9	0.5	NS
ADF(%)	55.8	55.6	57.3	57.4	1.0	NS

Table 2. Mean value of ruminal ammonia, VFA concentration and Bacterial counts of all time as influenced by urea infusion

Time h, post feeding	Urea infusion, g/d				SE	Sig.
	0	20	40	60		
pH	6.6	6.6	6.6	6.7	0.2	NS
Ammonia N, mg%	1.7	3.8	5.1	5.6	0.3	**
Total VFA, mM	81.8	78.3	85.3	91.8	3.5	NS
Bacterial Count, $x10^8$/ml	14	14.2	13.6	16.9	5.5	NS