EFFECTS OF SUPPLEMENTAL DEGRADABLE INTAKE PROTEIN ON INTAKE AND DIGESTIBILITY OF BERMUDA HAY

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Summary

A study with 16 ruminally fistulated beef steers fed Bermuda hay ad libitum showed that the intake and digestibility of hay was not influenced by increasing levels of supplemental degradable intake protein (DIP). However, the hay used in this study was of medium quality; lower quality Bermuda hay with lower CP may respond to supplemental DIP.

(Key Words: Steers, Forage, Intake, Digestion, Degradable Intake Protein.)

Introduction

Over the last decade, the approach to protein nutrition in ruminants has shifted from the traditional crude protein (CP) system to a metabolizable protein (MP) system described by the Natural Research Council in the 1996 Nutrient Requirements of Beef Cattle. Metabolizable protein is defined as the true protein absorbed by the small intestine. It is supplied by microorganisms passing out of the rumen and by undegradable intake protein (UIP) that escapes ruminal degradation. The MP system accounts for the degradation of protein in the rumen and separates protein requirements into degradable intake protein (DIP) which is needed by ruminal microorganisms and that needed by the animal (UIP). Crude protein = DIP + UIP.

Bermuda hay is a common roughage source for beef cattle in the southern United States, including portions of Oklahoma and Kansas. It typically contains 7 to 12% CP. Previous research on low-quality (CP<7%), tallgrass-prairie forage has demonstrated that DIP is the first-limiting nutrient for optimal forage utilization, and that DIP supplementation dramatically improves forage intake and digestion. Although the amount of DIP needed to maximize total digestible forage intake has been defined for tallgrass-prairie forage, information on the effects of DIP supplementation on medium-quality hay such as Bermuda is limited. Our study was conducted to determine the impact of DIP supplementation on Bermuda hay intake and digestion.

Experimental Procedures

Sixteen ruminally fistulated beef steers (average body weight, 653 lb) were blocked by weight and assigned to one of four treatments with increasing levels of DIP. Each steer was offered Bermuda hay at 130% of the average voluntary intake for the preceding 5 days. Supplemental DIP (sodium caseinate; 91.6% CP, 100% DIP) was infused ruminally at 7:00 AM, immediately prior to feeding forage. The forage contained 70.8% NDF and 8.2% CP, of which 60% was DIP. DIP was estimated using an in situ technique. The levels of supplemental DIP infused were .041, .082, and .124% BW/day. Controls received none. Following a 10-day adaptation, feed offered, feed refused, and total fecal output were measured for 7 days, in order to calculate intake response and digestibility coefficients.

Results and Discussion

Supplemental DIP exerted essentially no effect on forage or total OM intake, total OM digestion, or total digestible OM intake. Similarly, neither total NDF intake nor NDF digestibility were altered. We conclude that DIP was not significantly limiting the utilization of the Bermuda hay used in this study, in spite of the fact that the DIP in the Bermuda (about 8.3% of total digestible OM intake) was considerably less than the 11% previously demonstrated to maximize intake and digestion of lower quality (CP<7%) forages (such as winter tallgrass-prairie forage). The low level of DIP intake at which total diet intake and digestion were maximized is surprising and deserves additional evaluation. The Bermuda hay used in our study was of medium quality. Feeding Bermuda hay of lower quality (particularly with lower CP) might elicit a response to supplemental DIP.

Table 1. Effect of Increasing Amounts of Degradable Intake Protein on DM and OM Intakes and Digestibility in Beef Steers Fed Bermuda Hay

	DIP (% BW)					Contrasts[a]		
Item	0	.014	.082	.124	SEM[b]	L	Q	C
Dm[c] intake	- - - - - - - - - - % BW - - - - - - - - -							
Forage	2.45	2.21	2.28	2.27	.15	.45	.39	.50
Total	2.45	2.25	2.37	2.40	.15	.96	.39	.50
DM intake	- - - - - - - - g/kg $BW^{.75}$ - - - - - - - - -							
Forage	101.1	91.6	94.9	93.3	6.0	.43	.47	.46
Total	101.1	93.5	98.6	98.8	6.1	.94	.48	.45
Om[d] intake	- - - - - - - - - - % BW - - - - - - - - -							
Forage	2.30	2.06	2.33	2.11	.14	.41	.38	.48
Total	2.30	2.11	2.21	2.24	.14	.94	.38	.49
OM intake	- - - - - - - - g/kg $BW^{.75}$ - - - - - - - -							
Forage	94.4	85.7	88.7	86.9	5.5	.41	.49	.45
Total	94.4	87.5	92.3	92.2	5.5	.94	.49	.44
Total DOMI[e]								
% BW	1.45	1.27	1.42	1.43	.09	.84	.27	.21
g/kg $BW^{.75}$	59.8	52.5	59.1	58.7	3.9	.84	.35	.19
Total OMD[f], %	63.2	60.0	64.2	63.9	1.5	.35	.31	.07
Total NDFD[g], %	65.9	62.2	64.3	63.5	1.7	.49	.36	.20
Total DIPI[h]								
% BW	.120	.156	.193	.233	.008	<.01	.35	.37
g/kg $BW^{.75}$	4.83	5.98	7.96	9.50	.29	<.01	.47	.27

[a]L = Linear, Q = Quadratic, C = Cubic.
[b]Standard error of the mean (n=3).
[c]DM = dry matter.
[d]OM = organic matter.
[e]DOMI = digestible organic matter intake.
[f]OMD = organic matter digestion.
[g]NDFD = neutral detergent fiber digestion.
[h]DIPI = degradable intake protein intake.