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Abstract
Increasing the amino acid supply to the small intestine of growing cattle can increase performance, if specific amino acids are limiting. Although this can be accomplished by feeding rumen undegradable protein, a more economical approach may be supplementing only those amino acids that actually limit performance, but in a form that will bypass the rumen. Methionine (MET) is thought to be a limiting amino acid for growing cattle. DL-MET, a 50 :50 mixture of natural methionine (L-MET) and the unnatural optical isomer (D-MET) is used widely in monogastric rations. Ruminally protected DL-methionine is also available for cattle; however, little information is available about its utilization by growing steers. We studied the efficiency of utilization of D- vs L-MET by growing steers by measuring nitrogen retention of steers postruminally supplemented with graded levels of D- or LMET. Nitrogen retention increased linearly in response to infusion of both L-MET and D-MET, with similar responses for the two isomers. The efficiency of utilization of DMET relative to L-MET was estimated to be 95.5%. In conclusion, D-MET was similar to L-MET in increasing nitrogen retention of growing steers.

Keywords
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D- VS L-METHIONINE UTILIZATION BY GROWING STEERS

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Summary

Increasing the amino acid supply to the small intestine of growing cattle can increase performance, if specific amino acids are limiting. Although this can be accomplished by feeding rumen undegradable protein, a more economical approach may be supplementing only those amino acids that actually limit performance, but in a form that will bypass the rumen. Methionine (MET) is thought to be a limiting amino acid for growing cattle. DL-MET, a 50 : 50 mixture of natural methionine (L-MET) and the unnatural optical isomer (D-MET) is used widely in monogastric rations. Ruminally protected DL-methionine is also available for cattle; however, little information is available about its utilization by growing steers. We studied the efficiency of utilization of D- vs L-MET by growing steers by measuring nitrogen retention of steers postruminally supplemented with graded levels of D- or L-MET. Nitrogen retention increased linearly in response to infusion of both L-MET and D-MET, with similar responses for the two isomers. The efficiency of utilization of D-MET relative to L-MET was estimated to be 95.5%. In conclusion, D-MET was similar to L-MET in increasing nitrogen retention of growing steers.

(Key Words: Methionine, Growing Steers, Nitrogen Retention.)

Introduction

Current research has looked at rumen undegradable protein sources as ways to increase the amount of amino acids available to the small intestine of growing cattle. An increase in amino acid availability should result in greater protein deposition by growing cattle, if specific amino acids limit performance. Alternatively, supplying only those limiting amino acids could be a more economical means of increasing performance. The swine and poultry industries currently supplement methionine (MET) as DL-MET, a 50:50 mixture of the natural L-MET and the unnatural D-optical isomer. Monogastric animals can convert D-MET to L-MET fairly efficiently. However, despite the fact that ruminally protected DL-MET is now commercially available for cattle, there is little information regarding the utilization of the D-MET by ruminant animals. Our objective was to determine whether D-MET was as efficiently utilized as L-MET by growing cattle.

Experimental Procedures

Five ruminally cannulated Holstein steers averaging 396 lb were utilized in a 5 × 5 Latin square and kept in individual metabolism crates in an environmentally controlled room. Each period lasted 6 days; the first 2 days for adaptation to treatments and the last 4 days for total collection of feces and urine to measure nitrogen retention. Treatments were no MET (control) or continuous abomasal infusion of 2 g/day of

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L-MET, 4 g/day of L-MET, 2 g/day of D-MET, or 4 g/day of D-MET. To be sure that only MET limited steer performance, a diet low in ruminal undegradable protein was fed. The diet contained 84.7% soyhulls, 6.7% wheat straw, 8.2% mineral mix (minerals, vitamins, Bovatec, and molasses), and .5% urea and was fed twice daily at 6.6 lb/head/day. Because of the restricted intake, 150 g acetate, 150 g propionate, and 37.5 g butyrate were infused daily and continuously into the rumen to ensure that energy would not limit performance. Dextrose also was infused into the abosmaum continuously at 300 g/day to increase energy availability. To ensure that amino acids other than methionine would not limit nitrogen retention, 15 g of L-valine, 20 g of L-leucine, 15 g of L-isoleucine, 23.6 g of L-lysine, 7.4 g of L-histidine, 15 g of L-arginine, 14.7 g of L-threonine, 25 g of L-phenylalanine, 4.9 g of L-tryptophan, 75 g of L-glutamate, and 25 g of glycine were infused into the abomasum daily.

Results and Discussion

Nitrogen retention increased as the amount of infused MET increased (Table 1). This response was similar between D- and L-MET, with D-MET being 95.5% as efficient as L-MET. As expected, the differences in nitrogen retention among treatments were due to changes in urinary nitrogen; no significant differences occurred in fecal nitrogen. A regression model, used to estimate nitrogen retention from MET supplementation, showed nitrogen retention (g/day) equal to 19.2 + (1.81*D-MET) + (1.90*L-MET).

A major requirement of nitrogen in the body is for muscle protein synthesis, so we would expect skeletal muscle deposition to parallel as nitrogen retention. Previous work has estimated nitrogen content of tissue gain at 3.26%. Using that value, each gram of extra MET per day of treatment should lead to .25 lb of tissue, if all the nitrogen retained went for tissue protein gain, up to the point where MET is no longer limiting. These high levels of potential protein deposition relative to the small amount (4 and 2 g) of MET demonstrate the potential that exists for rumen-protected amino acids.

In conclusion, D-MET appears to be as efficient as L-MET in supporting nitrogen retention in growing steers. Ruminants apparently convert D-MET to the L-isomer as efficiently as monogastrics. Therefore, growing cattle diets that utilize a ruminally protected form of DL-MET should respond as favorably as those postruminally supplemented with L-MET.

Table 1. Effect of Postruminal Supplementation of D- or L-Methionine (MET) on Nitrogen Retention of Growing Holstein Steers

		L-MET		D-MET		
Nitrogen (g/d)	Control	2 g	4 g	2 g	4 g	SEM
Intake + infused	86.8	86.8	87.3	86.1	87.1	.6
Fecal	24.1	24.5	25.1	24.7	25.5	.6
Urinary[ab]	43.4	38.9	35.5	38.8	35.0	1.4
Retained[ab]	19.2	23.3	26.6	22.5	26.6	1.6

[a]Linear effect of L-MET (P<.05).

[b]Linear effect of D-MET (P<.05).