**Table 12. Comparison of ruminating with non-ruminating penmate steers**

| Item | Non-ruminating | Ruminating |
|---|---|---|
| Daily gain | 3.38[a] | 3.30[b] |
| Abscess incidence, % | 6.7 | 7.4 |
| Marbling score | 14.3 | 14.2 |
| Cutability, % | 48.7 | 48.9 |
| Fat thickness | .62[c] | .58[d] |
| Choice, % | 76 | 76 |

[ab]Means differ at the 5 percent probability level.
[cd]Means differ at the 10 percent probability level.

Higher roughage rations will simplify management, but, again, the type and form of roughage may be more important than the level of roughage in the ration. Some recent trials with high intakes of high-concentrate rations indicate that no fiber is digested in the rumen. If roughage simply dilutes grain in the rumen to prevent acidosis, the amount of roughage needed depends primarily on the residence time of the roughage. If roughages are fed as a safety factor, price premiums for more digestible forage for feedlot cattle are not justified. Instead, factors influencing ruminal retention time, such as particle size, density and bulk of the roughage, are of major interest.

## Literature Cited

Teeter, R. G. *et al.* 1980. Okla. Agr. Exp. Sta. Res. Rep. MP-107:156.

# Influence of Level of Feed Intake on Digestive Function. I. Nitrogen Metabolism

**R. A. Zinn and F. N. Owens**

## Story in Brief

Four Angus steers (568 pounds) equipped with "T" cannulas in the proximal duodenum and distal ileum were used to study the influence of feed intake level on nitrogen metabolism. Treatments consisted of an 80-percent concentrate diet fed at 1.6, 1.8, 2.0 and 2.2 percent of body weight. Increasing level of intake from 1.6 to 2.2 percent resulted in a 52-percent increase in bypass and a 59-percent increase in metabolizable protein content of feed. There was an apparent curvilinear relationship between level of feed intake and bypass which led to the following conclusions: 1) under the given conditions of this study, the break point at which feed intake is directly related to rumen retention occurs in the neighborhood of 1.8 percent body weight; 2) as feed intake

approaches those typically encountered under feedlot conditions (>2.6 percent body weight), simple nitrogen solubility estimates may adequately reflect ruminal digestion. In a practical sense it was further surmised that microbial protein synthesis and, thus, net protein nutrition would be optimized in diets containing .6 to .65 percent soluble or otherwise available N.

## Introduction

Aside from any associative effects on general fermentation and subsequent digestion, the value of feed protein for ruminants is directly related to the amount of protein which escapes breakdown in the rumen and still is digested and absorbed from the small intestine. The effect of feed intake on bypass has not been studied.

Recent trials (Zinn and Owens, 1980) have indicated that increasing feed intake from 1.5 to 2.0 percent of body weight increased bypass of feed N by 45 percent. Since this N represents an otherwise degradable fraction, percent uptake of N reaching the small intestine was also increased (13 percent), which increased metabolizable nitrogen (intestinal supply of digestible crude protein) content of the feed by 88 percent. As level of feed intake increases, the time for rumen digestion decreases, and bypass increases (Zinn *et al.*, 1981). Thus, metabolizable N content of the feed will increase.

The objective of this research was to determine the influence of level of feed intake on site of N digestion.

## Materials and Methods

Four Angus steers (568 pounds) with "T" cannulas in the proximal duodenum and distal ileum were used in a 4 by 4 Latin square design experiment to measure the influence of feed intake level on nitrogen metabolism. Treatments consisted of an 80-percent concentrate ration (Table 1) fed at 1.6, 1.8, 2.0 and 2.2 percent of body weight. Steers were fed at 8 a.m. and 8 p.m. Experimental periods consisted of 10 days for ration adjustment followed by 2 days for collection of fecal and intestinal samples. All estimates of digestion were based on analysis of composites of intestinal or fecal material samples obtained simultaneously. Chromic oxide was fed as a digestive marker.

## Results and Discussions

The influence of level of feeding on nitrogen metabolism in the rumen, small intestine and cecum plus large intestine is presented in Table 2. Increasing feed intake

**Table 1. Ration composition**

| Ingredient | % |
|---|---|
| Dry rolled corn | 62.6 |
| Dehydrated alfalfa pellets | 6.0 |
| Cottonseed hulls | 14.0 |
| Soybean meal | 10.0 |
| Cane molasses | 5.0 |
| Trace mineral salt | .5 |
| Limestone | .5 |
| Dicalcium phosphate | .5 |
| Aurofac-10 | .1 |
| Ammonium chloride | .5 |
| Urea | .1 |
| $Cr_2O_3$ | .2 |

**Table 2. Influence of level of feed intake on apparent nitrogen metabolism in the rumen, small intestine and cecum plus large intestine**

| Item | Treatments 1 | 2 | 3 | 4 | (CV) |
|---|---|---|---|---|---|
| Intake, g/day | | | | | |
| N | 61.8 | 83.6 | 100.4 | 117.4 | |
| Pepsin insoluble N | 13.2 | 17.8 | 22.6 | 26.4 | |
| Leaving abomasum, g/day | | | | | |
| N | 57.8 | 82.1 | 119.0 | 141.5 | (8.9) |
| Non-ammonia N | 52.6 | 74.7 | 109.8 | 132.4 | (9.3) |
| Nucleic acid N | 5.1 | 6.9 | 9.5 | 9.9 | (9.3) |
| Microbial N | 25.5 | 34.6 | 47.8 | 49.5 | (9.3) |
| Bypass of feed N, % | 43.8 | 48.0 | 61.9 | 70.6 | (18.3) |
| Leaving ileum, g/day[a] | | | | | |
| N | 17.6 | 26.6 | 31.2 | 38.8 | (14.7) |
| Pepsin insoluble N | 14.4 | 21.3 | 25.8 | 32.6 | (11.7) |
| Nucleic acid N | .6 | 1.0 | 1.1 | 1.2 | (26.2) |
| Digestion in small intestine, % | | | | | |
| N | 65.9 | 64.1 | 71.4 | 70.8 | (7.6) |
| Nucleic acid N | 88.2 | 85.5 | 88.4 | 87.9 | (4.8) |
| Bypass feed N | 64.5 | 62.3 | 74.8 | 73.1 | (14.1) |
| Fecal excretion, g/day | | | | | |
| N | 18.3 | 24.0 | 33.1 | 29.0 | (11.5) |
| Pepsin insoluble N | 12.7 | 17.2 | 22.5 | 24.1 | (9.8) |
| Digestion in large intestine, % | | | | | |
| N leaving ileum | −3.7 | 8.7 | −7.5 | 21.5 | (441) |
| Total tract digestion, % | | | | | |
| N fed | 70.3 | 71.2 | 67.0 | 75.3 | (2.5) |
| Pepsin insoluble N fed | 3.7 | 3.4 | .4 | 8.7 | |

[a]Treatment 4 ileal estimates were corrected for recovery of duodenal ADF.

from 1.6 to 2.2 percent of body weight increased bypass of feed nitrogen by 52 percent. This increase is similar in magnitude to that observed in previous experiments (Zinn and Owens, 1980) where increasing level of feeding from 1.5 to 2.0 percent body weight increased bypass by 45 percent. The increase in bypass appeared curvilinear (Figure 1). The greatest increase occurred between 1.8 and 2.0 percent level of feeding. This range may be considered the breakpoint above which feed intake more greatly influences retention time. Further extrapolating our data to a feedlot plane of nutrition (2.6 to 3.0 percent body weight), results would suggest only the soluble or immediately available nitrogen fraction will reflect nitrogen digestion in the rumen. This observation suggests that protein solubility may be a useful indicator of protein value for feedlot steers. Indeed, the proportionately reduced microbial growth occuring at the highest level of feeding may reflect a deficiency of available nitrogen for optimal rumen fermentation.

While differences in apparent digestibility of N in the small intestine were not significant ($P>.05$), digestibility tended to be higher for the 2.0 and 2.2 percent level of feeding. Thus, net metabolizable nitrogen content of the diet was increased by 59 percent. Neither the crude protein nor the digestible protein system reflects the importance of feed intake on protein supplementation though intake appears extremely important, and new protein systems will need to be structured around this factor also.

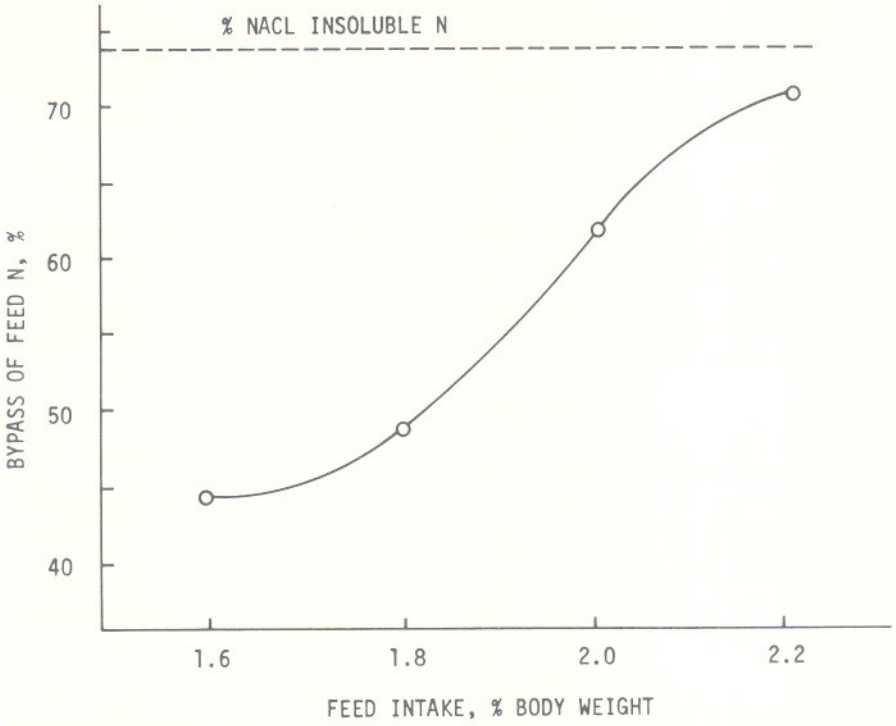


**Figure 1. Feed intake versus bypass of feed N.**

This and previous studies also suggest that for feedlot cattle consuming predominantly corn-based high concentrate diets, optimal performance should occur (particularly early in the finishing period) with diets containing .6 to .65 percent soluble or otherwise readily available N.

## Literature Cited

Zinn, R. A. and F. N. Owens. 1980. Okla. Agr. Exp. Sta. Res. Rep. MP-107:150.
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# Captan and Ruminal Metabolism

**R. G. Teeter and F. N. Owens**

## Story in Brief

Four ruminally and abomasally cannulated growing steers, each weighing 783 lb, were fed four different dietary concentrations (0, 160, 320, and 640 ppm) of Captan mixed in an 85-percent concentrate ration. The purpose was to determine the influence of Captan on ruminal and total-tract digestibility of dry matter, starch and protein and on the retention of nitrogen. Captan tended to linearly increase ruminal starch and dry