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DAIRY RESEARCH RESULTS
from the Agriculture and Agri-Food Canada Research Centre, Lethbridge

Rumen-Protected Amino Acids

2. Alimet® – unprotected but highly effective

In the first article in this series (**1A3**) we referred to trials where methionine hydroxy analog (MHA®) had been fed to lactating cows as a source of supplemental methionine. The use of MHA in early trials was based on the premise that the analog was less rumen degradable than methionine itself. And MHA absorbed in the small intestine would presumably be converted to methionine in the liver, increasing the supply of methionine to the mammary gland.

Although few of these early trials were able to demonstrate improved yields of milk or milk protein, several resulted in higher milk fat production. Others demonstrated a role for MHA in reducing the incidence of ketosis. These observations led researchers to the conclusion that the primary action of MHA took place in the rumen – altering microbial fermentation patterns. When a report appeared in 1988 suggesting that virtually no MHA would reach the small intestine intact, interest in its potential as a source of 'bypass' methionine faded and subsequently, manufacture of MHA was terminated.

Renewed interest

Although MHA is no longer available, a similar methionine analog is routinely used in diets for swine and poultry. Where MHA was a solid powder, Alimet® is a liquid feed supplement. A few years ago, we looked at Alimet as a possible source of 'bypass' methionine in dairy diets. But we also concluded that little Alimet would reach the small intestine intact. More recently, we found reason to question these results and we decided to give Alimet another try.

In our second trial, 90 grams of Alimet were mixed with 2 kg of ground corn and fed to each of 4 cannulated, early lactation cows. If any of the Alimet/corn mix was left after 20 minutes, it was administered through the rumen cannula. Concentrations of Alimet in the rumen and duodenum as well as blood plasma methionine levels were monitored for the next 24 hours. Results are shown in figure 1.

In our earlier trial, we had measured Alimet concentrations in the duodenum starting at 16 hours after administering Alimet into the rumen. As the data in figure 1 clearly demonstrate, by this time duodenal concentrations would have returned to basal levels. So we had 'missed the boat' and incorrectly concluded that little or no Alimet had reached the small intestine.

How do we account for the rapid movement of Alimet from rumen to duodenum? Where MHA is an insoluble salt, Alimet is a liquid. We know that the liquid portion of rumen contents pass out of the rumen much more rapidly than the solids. Although both forms of the analog are degradable by rumen microbes, the rapid passage of Alimet out of the rumen reduces its degradation.

Results of this trial indicated that 50% of the 90 gram dose of Alimet disappeared in the rumen. Although most of this was due to microbial degradation, it is likely that some Alimet was absorbed directly into the bloodstream through the rumen wall. Of the 45 grams which escaped from the rumen; 4.9 grams were absorbed through the walls of the omasum (the third compartment of the ruminant stomach) with the remainder almost completely absorbed in the small intestine. We estimated that, under the conditions of this trial, the 90 gram dose of Alimet increased tissue availability of methionine by about 10.6 grams – enough to eliminate the methionine deficit in most typical dairy rations.

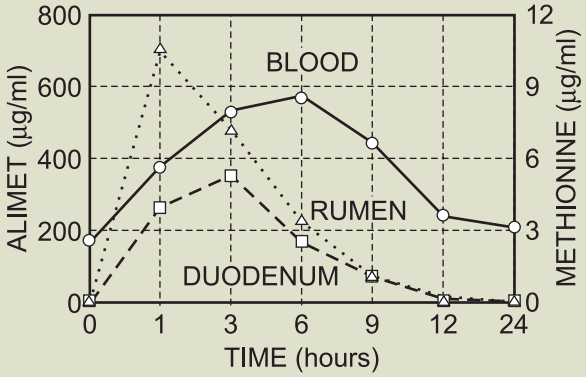

Figure 1 : Alimet concentrations in rumen and duodenum and blood plasma methionine levels after a 90 gram dose of Alimet.

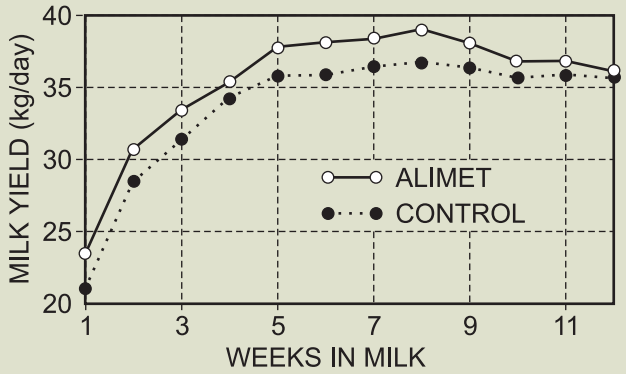

Figure 2 : Combined average milk production curves for first and second+ lactation cows fed diets with or without supplementary Alimet.

Production effects

Will increased methionine availability improve production? To find out, we fed Alimet to a group of primiparous (first lactation) and mutiparous (second and greater lactations) cows from 2 weeks before to 12 weeks after calving. Prepartum, the cows received 8 grams of Alimet per day; postpartum they were fed 45 grams per day. In both periods the Alimet was incorporated into the concentrate portion of a total mixed ration (TMR).

Figure 2 shows the effect of Alimet on milk yield. Over the 12 week lactation period, supplemented cows produced an average 33.9 kg per day compared with 31.3 kg for the control cows. At their peak, multiparous cows fed Alimet produced 7.9 kg per day more milk than their unsupplemented herdmates.

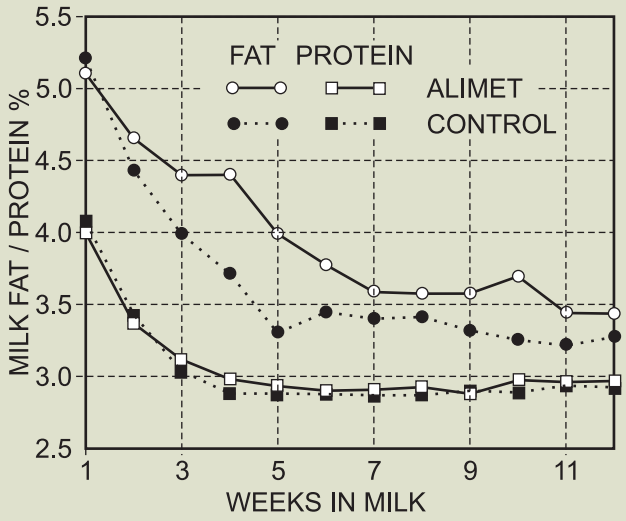

Figure 3 : Average fat and protein content of milk from first and second+ lactation cows fed diets with or without supplementary Alimet.

Alimet also increased milk fat content – to 4.0% from 3.7% for the control cows (figure 3). Combined increases in milk yield and fat content resulted in average daily fat yield rising from 1.16 to 1.36 kg.

Protein content in the milk from cows fed Alimet was not significantly different from that for the control cows (figure 3). However, milk protein yields increased as a result of increased milk yields.

We now recognize that dry matter intake (DMI) often declines in the last week to 10 days before calving. As shown in figure 4, DMI of the multiparous control cows in our trial dropped 23% between the second and first weeks prepartum. That of the primiparous control cows decreased by 10%. In both groups, Alimet significantly reduced the decline in DMI. This effect likely contributed to the higher production achieved by cows fed Alimet.

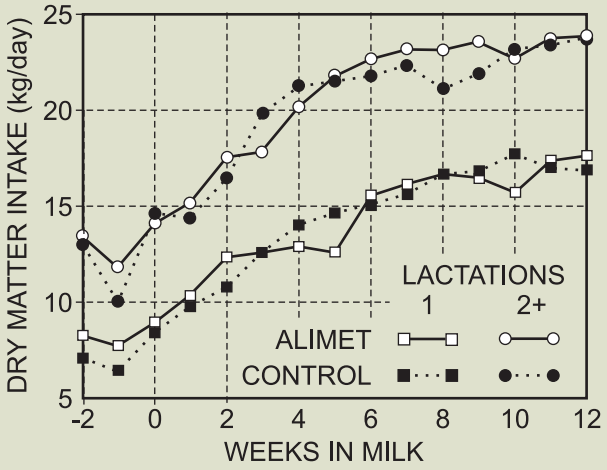

Figure 4 : Prepartum and postpartum dry matter intakes for first and second+ lactation cows fed diets with or without supplementary Alimet.

Conclusion

In high producing cows, the rapid passage rate of liquid through the rumen allowed a significant amount of supplemental Alimet to escape microbial degradation. Subsequent absorption and conversion to methionine likely reduced the production-limiting effect of inadequate methionine in the control ration. Higher fat levels in the milk of Alimet-supplemented cows may have been due to direct effects on fat metabolism, as reported in earlier trials with MHA.

researchers: Lyle Rode and Karen Koenig at the Lethbridge Research Centre and Limin Kung, Jr. at the University of Delaware.