**AB1132 Which are the key essential amino acids needed to**

**maintain milk production in the dairy cow?**

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**November 2011 – December 2013**

**AM Funding: $53,840 Total Funding: $133,960**

**Funding Partner: AFC**

Background: To optimize the biological and economic efficiency of the lactating dairy cow, we need to define the key essential amino acids (AA) needed to support milk production and understand better the link between lactose output and protein supply. Protein and energy metabolism are so closely linked that it is imperative that we integrate both their supply and requirements in our predictive models used to balance rations.

Objectives:

1. How milk and components change when the supply of specific AA (phe, thr, trp) is decreased
2. How net mammary uptake of AA and energy substrates changes in response to variable AA supply
3. The relationship between AA deficiencies and glucose availability and mammary uptake and utilization for lactose synthesis

Methods: 5 early lactation cows were fed a metabolizable protein deficient diet and during the experimental days were infused with AA. The 5 treatments were control – water, all AA supplied at 110% of requirements (TAA), all AA excluding thr, all excluding trp, and all excluding phe. Glucose was infused into the jugular vein and blood samples were taken to determine mammary uptake.

Outcome:

1. Milk yield tended to be lower for control, no-phe and no-thr cows than for TAA cows. Milk protein was lower for control and no-phe than for TAA and tended to be lower for no thr. Milk fat, lactose, and DMI was not affected.
2. Plasma urea-N concentration was increased with TAA compared with CTL, but was lower for TAA than for No-Phe. Arterial concentrations of acetate and BHBA were lower for No-Thr than for TAA whereas concentration of glucose was higher with No-Thr. Mammary uptake of acetate was higher for No-Thr and No-Trp relative to TAA, whereas uptake of BHBA and lactate was not different among the treatments. In terms of mammary AA uptake, histidine, isoleucine, leucine and valine were lower for CTL than TAA; there was no effect of treatment for lysine, phenylalanine+tyrosine, threonine and tryptophan; and methionine was reduced by the No-Phe treatment. Total essential AA-N uptake was lower for CTL than TAA, and total non-essential AA-N was reduced by the No-Phe treatment (P = 0.06) and the No-Thr treatment (P = 0.08) relative to TAA.
3. We have determined the relationship between AA deficiencies and glucose availability and mammary uptake and utilization for lactose synthesis. Glucose whole-body rate of appearance was lower for No-Thr than for TAA but was not different between TAA and the other treatments. Mammary uptake of glucose was lower for CTL compared to TAA but was not different between TAA and the other treatments.

Recommendations: ?

Benefits to Industry: These results will be used in conjunction with those of other studies on energy and protein metabolism in lactating dairy cows to modify the currently available feed formulation models to improve the accuracy of dairy ration balancing and maximize the efficiency of nutrient use in the cow. These models will begin to be updated as part of a 5-year research program involving the University of Calgary and several other research institutes across Canada and the USA. Updating these models will have 2 impacts on Canada’s agricultural, economic and environmental sustainability: increased feed efficiency with a resultant reduction in feed costs and decreased nutrient excretion into the environment.

KTT:

* Presentations at WCDS and the International Symposium on Energy and Protein
* Manuscript submitted to scientific journal