



The Rewards of AA Balancing and Ration Formulation

Production | Health | Reproduction

Reproduction: Roles of Methionine and Lysine

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Answers to Questions Asked, Courtesy of Dr. Cardoso



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Q: Is the reason the rat embryo developed normally with only methionine due to methionine being the chain initiating amino acid (AA) in protein synthesis?

A: That is a reasonable thought along with the idea that methionine (MET) was the amino acid limiting embryo protein formation.

Q: In theory, would you get stronger heats with methionine added?

A: "Stronger" can have different meanings. However, one could expect estrus to be more visualized due to increased estradiol in the follicle. This hypothesis is still to be tested.

Q: Could we have better results if we combine rumen protected methionine+protected colin+organic selenium? Do you have any trials on this combination similar to the ones that were presented?

A: We don't have any trials in isolating these components by themselves. However, all the diets showed in the webinar had organic Se. It is clear the requirements (NRC, 2001) for MET and Se, and still to be seen for choline.

Q: What was the control level of lysine pre-calving and how much metabolizable LYS was added in the treatment?

A: Prepartum, cows in control had 80.4 g/day of predicted metabolizable lysine (LYS) and cows receiving rumen protected lysine (RPL) had 98.1 g/day; based on AMTS (v6.5) predictions.

Q: If you imagine commercial IVF / MOET, would you recommend having rumen protected MET / LYS fed to the recipients as well as the donor, considering the effects of circulating lipids, etc. in the uterus?

A: Definitely. Effects of lipids in the uterine tissue and embryos would justify that recommendation.

Q: Are there any results on the preg rate index?

A: No statistical differences were observed for conception rate or pregnancy rate.

Q: How about cow longevity in the herd?

A: Very good point that should be evaluated in the future.



Q: Where does Interferon Tau exercise its main effect: Uterine wall or brain or both?

A: The brain does not appear to be directly involved, and the interferon tau (IFNT)-induced cell signaling mechanism in the uterine tissue is not known. IFNT, the pregnancy recognition signal secreted from trophoblast cells of ruminant conceptuses (embryo) blocks the uterine luteolytic mechanism. The uterine tissue blocks estrogen receptors and the mechanism that otherwise results in pulsatile release of luteolytic prostaglandin F_{2a} (PGF) that would induce regression of corpora lutea and prevent their production of progesterone (P₄). Additionally, arginine, and possibly methionine, activates the mechanistic target of rapamycin (MTOR) nutrient sensing cell signaling pathway to stimulate proliferation, migration, differentiation, and translation of mRNAs essential for growth and development of the conceptus (embryo).

Q: How long does it take the PMNs to increase post calving?

A: Interesting question. The answer may vary according to not only the cow's nutrition but also environment (i.e., comfort). It is fair to assume that as soon as the estrogen concentrations decrease after calving (around 1 to 2 days after calving), inflammation and PMN surge.

Q: Thinking about reproduction only, when should I start to feed methionine?

A: From pre-fresh until pregnancy reconfirmation (~150 DIM) is a fair recommendation.

Q: In the Toledo study, why would the multiparous Control cows have smaller embryos than the MET cows fed MET and both the Heifer groups?

A: Most likely, MET output through milk protein has a role in it.

Q: How does methionine affect cholesterol metabolism for the follicular development? Is it just an increase of the genes that codifies for estradiol production? Could it decrease/increase another gene's expression?

A: There is an indication of it due to the higher expression of 3 β -HSD. The assumption is that cholesterol is being better metabolized. This data needs to be taken into account with the results from the uterine tissue and embryo, indicating improved packaging and exportation of fatty acids (apob100).

Q: Is lysine important prepartum for mammary cell proliferation?

A: We believe so. However, we still need to confirm that hypothesis.



Q: What is the specific role of methionine on postpartum inflammation?

A: Methionine seems to reduce oxidative stress in the uterine tissue and liver. Also, a greater influx of PMN in the uterus at day 15 but not 73 can be associated with improved uterine involution.

Q: Do we need to consider different target pregnancy rates and embryonic deaths between first calving vs multi?

A: I think that is a fair thought. Independently, conception rate at first breeding should be targeted to over 40%.

Q: Do MET and LYS have some effect on reproductive issues such as placenta retention and metritis?

A: We have no data on retained placenta. However, we know that the placenta (collected at calving) is different from cows that received MET than the ones that did not receive MET. In the placenta of cows that received MET before calving, we observed more activation of the mTOR pathway (it is responsible for protein synthesis). We do have strong data supporting the purulent vaginal discharge (PVD) and endometritis (PMN) is alleviating when cows received rumen-protected MET during the transition period.

Q: Professor, do you think the improvement in reproduction is both by the direct action of the methionine or also by the effect it has on the heat stress? And how do you imagine supplementation with methionine will affect the cow in warm countries?

A: We do have information on rumen-protected MET alleviating heat stress. I will talk about it during the 4-State Dairy Nutrition and Management Conference on June 10th. Check it out.

Q: If we target 30g of MET and 90g of LYS pre-fresh, do we even need to worry about MP?

A: Good point. Even though MET and LYS are the most limiting AA, other indispensable and dispensable AA are required. Therefore, I would still keep an eye on MP.

Q: What mechanism could MET be initiating to ensure the other amino acids also are concentrated in the uterus?

A: The mTOR and glutathione pathways seemed to be more active in cows receiving MET than not. The activation of those pathways would require other AA to be provided as well as micro minerals (Se) and vitamins (E).



Q: Between the two types of endometritis described by Leblanc, is one more prevalent than the other?

A: This difference was not reported. However, in herds where cows are well fed, the excessive response should be the most prevalent.

Q: Was the HIS to MET ratio of 0.93 a target or a consequence of the ingredients in the diet?

A: It was a target.

Q: Do you think Met can decrease the severity of diseases postpartum?

A: Yes. Our research on endometritis along with Dr. Juan Loo's group at the University of Illinois on improved liver functionality index would suggest that.

Q: If I need to choose one option - feeding RPM prepartum or early postpartum - which do I choose for a better response on cow's reproduction?

A: Both.

Q: How can MET alter lipid metabolism at the uterine level?

A: The most direct association is by allowing for the improved transport of fatty acids (apob100) from body reserves and the liver, but also with cholesterol utilization.

The answers to these questions are provided in good faith and are the scientific opinions uniquely of Dr. Phil Cardoso, Department of Animal Science, University of Illinois.

