

Calf Notes.com

Calf Note 210 – Methionine in the dry cow diet

Introduction

Back in 1997, I had the honor to make a symposium presentation at the American Dairy Science Association annual meeting. In this presentation and in the subsequent manuscript ([link](#)), I focused primarily on the effects of dry cow nutrition and management on colostrum quality and quantity and the ability of the calf to absorb IgG from colostrum. At that time, I had no idea of the profound effects of dry cow nutrition, management and stress on the physiology of the calf after birth – and, indeed throughout its productive life. Effects of the dry cow diet – beyond concentration of energy or crude protein – have been investigated more intensely in the past several years. And, instead of simply looking at these effects on cow health or production, we're learning much more about how the dry cow affects the CALF, and its ability to absorb IgG, use nutrients, and even produce milk after they become milking animals.

In the past several years, research has been conducted with supplementation of methionine in dry cow diets and its effect on the young calf. Rumen protected methionine fed during the dry period has been shown to be important to support the metabolism of the cow – improving immune status and indicators of oxidative stress, reduced incidence of metabolic diseases such as ketosis and retained placenta, and increasing milk production in the subsequent lactation. However, until recently, few studies have evaluated effects of methionine on the calf prior to birth. Researchers at the University of Illinois have published a series of studies that document some important effects of protected methionine on calf metabolism that are worthy of evaluation.

The Research

Two research reports (Jacometo et al., 2016; 2018) reported on cows assigned to receive a control diet without added methionine (n = 20) or added rumen protected methionine (Smartamine M, Adisseo NA) from -21 days prior to expected calving to 30 days in milk. The methionine (0.08% of DM) was mixed with 50 g of corn and top-dressed every day to ensure complete consumption. The close up diet consisted of corn silage (36% of ration DM), wheat straw (16%), alfalfa silage (8%), and alfalfa hay (4%). Remaining portion of the ration provided protein, energy, vitamins and minerals to meet NRC requirements for dry cows. After birth, calves were housed in hutches bedded with straw and fed milk replacer (at 520 g/d to 10 d of age, 680 g/d to 20 d of age, 840 g/d from 35 d of age, and 420 g/d from 36 to 42 d of age fed 1X/day. Starter (20% CP, 14% NDF) and water were available at all times. Calves were monitored until 7 wk of age.

There was no effect of methionine treatment on colostrum quality, absorption of IgG, initial body weight, growth or intake during the trial. Health measurements (rectal temperatures, respiratory scores, fecal scores) were also unaffected.

The researchers did, however, report changes in indices of metabolism and immune response. Figure 1 shows changes in glucose in calves after birth. Other changes included insulin (higher in calves from dams fed methionine, Figure 2), urea N and several other indices of metabolism. The authors also evaluated expression of a number of genes during the study. Changes in gene expression were complex and, while pointing out areas for future research, did not clearly delineate pathways affected by maternal methionine supplementation. There was evidence, however, of improved gene expression related to important aspects of immunity, suggesting that calves supplemented with methionine were more immune competent. The lack of difference in health measures in the study were likely due to the minimal health challenges the calves experienced during the study.

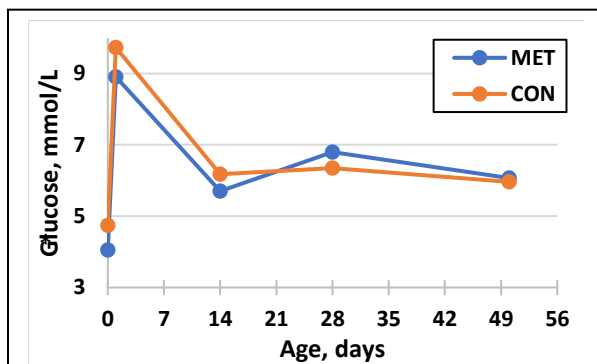


Figure 1. Blood glucose concentrations in calves born from cows fed diets without (CON) or with (MET) methionine. From: Jacometo et al., 2016.

The 2018 manuscript (Jacometo et al., 2018) reported on the effects on maternal methionine supplementation on immune cell function. The researchers evaluated several parameters related to the ability of [polymorphonuclear leukocytes](#) (white blood cells that are a critical part of the immune system) to mount immune response against pathogens. Although changes in gene expression were subtle, overall the evidence suggested that supplementation of the dam with methionine during the late dry period could positively influence the activity and maturation of the calf's immune cells, pointing to improved immune competence.

In a subsequent study by the same research group (Alharthi et al., 2018), Holstein cows were fed a basal control diet without or with added methionine at 0.09% of the ration during the last 28 days of pregnancy. A total of 39 calves were in the control and 42 in methionine treatments. Calves were further divided within maternal diet to be fed colostrum from control cows (control dam and fed control colostrum, n = 21), control dam but fed colostrum from a cow fed methionine (CON-MET; n = 18), methionine dam but fed colostrum from a control dam (MET-CON; n = 20) or methionine dam and calf fed colostrum from a methionine cow (MET-MET; n = 22). All calves were housed, managed and fed similarly during the first 9 wk of life.

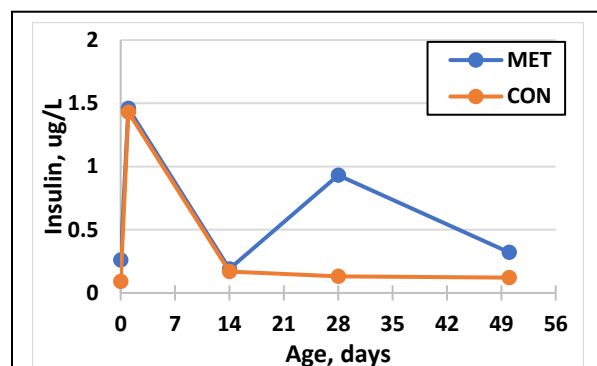


Figure 2. Blood insulin concentrations in calves born from cows fed diets without (CON) or with (MET) methionine. From: Jacometo et al., 2016. Calves from dams fed methionine were higher overall.

Results differed somewhat from the previous studies. Like the studies by Jacometo, colostrum quality and quantity produced were unaffected by maternal diet. However, calves born from cows fed methionine were heavier (44.1 vs. 42.1 kg), and larger (hip height = 81.3 vs. 79.6 cm, and wither height = 77.8 vs. 75.9 cm) at birth. The greater weight and size of calves born from cows fed methionine persisted through 9 wk of age. Respiratory scores were normal and did not differ due to maternal Met supply or colostrum source. However, fecal scores tended to be lower in calves from dams fed methionine regardless of colostrum source. There was no effect on feed intake or feed efficiency. It is likely that additional methionine in utero increased growth of calves before calving so that, at birth, calves were heavier and larger – and this difference was maintained through the remainder of the study.

Summary

Back in 1997, I began my symposium presentation with the simple statement “What you do to momma, you do to baby”. This appears to be more and more true as we understand the important effects of dry cow nutrition and management on development, health and growth of the young calf. Clearly, addition of rumen protected methionine to the close up diet has some potentially important economic effects on the calf. Future research will determine if the subtle differences in signals of immunity are manifested in improved health in calves exposed to greater stress.

References

- Alharthi, A. S., F. Batistel, M. K. Abdelmegeid, G. Lascano, C. Parys, A. Helmbrecht, E. Trevisi, and J. J. Loor. 2018. Maternal supply of methionine during late pregnancy enhances rate of Holstein calf development in utero and postnatal growth to a greater extent than colostrum source. *J. Anim. Sci. and Biotechnol.* 9:83. <https://doi.org/10.1186/s40104-018-0298-1>.
- Jacometo, C. B., A. S. Alharthi, Z. Zhou, D. Luchini, and J. J. Loor. 2018. Maternal supply of methionine during late pregnancy is associated with changes in immune function and abundance of microRNA and mRNA in Holstein calf polymorphonuclear leukocytes. *J. Dairy Sci.* 101:8146–8158. <https://doi.org/10.3168/jds.2018-14428>.
- Jacometo, C. B., J. S. Osorio, M. Socha, M. N. Correa, F. Piccioli Cappelli, E. Trevisi, and J. J. Loor. 2015. Maternal consumption of organic trace minerals alters calf systemic and neutrophil mRNA and microRNA indicators of inflammation and oxidative stress. *J. Dairy Sci.* 98:7717–7729. <https://doi.org/10.3168/jds.2015-9359>.
- Jacometo, C. B., Z. Zhou, D. Luchini, M. N. Correa, and J. J. Loor. 2017. Maternal supplementation with rumen-protected methionine increases prepartal plasma methionine concentration and alters hepatic mRNA abundance of 1-carbon, methionine, and transsulfuration pathways in neonatal Holstein calves. *J. Dairy Sci.* 100:3209–3219. <https://doi.org/10.3168/jds.2016-11656>.
- Jacometo, C. B., Z. Zhou, D. Luchini, E. Trevisi, M. N. Correa, and J. J. Loor. 2016. Maternal rumen-protected methionine supplementation and its effect on blood and liver biomarkers of energy metabolism, inflammation, and oxidative stress in neonatal Holstein calves. *J. Dairy Sci.* 99:6753–6763. <https://doi.org/10.3168/jds.2016-11018>.

Written by Dr. Jim Quigley (07 August 2019)
© 2019 by Dr. Jim Quigley
Calf Notes.com (<https://www.calfnotes.com/new>)