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Monday June 26th: Ruminant Nutrition 2 - Protein and Amino Acids

Amino acid supplementation as a potential strategy to mitigate milk fat depression

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In dairy cows, a shift in rumen biohydrogenation of dietary polyunsaturated fatty acids (PUFA) leads to milk fat depression (MFD). The objective of this study was to determine the effect of increasing metabolizable Met and Leu supply on milk fat production in control (high-palmitate fat source) and MFD-induced (soy oil) cows. The study was designed as a replicated 4x4 Latin square with four 28-d periods and 4 treatments arranged as a 2x2 factorial. All diets included high starch (28%). Factors were fat source (FS): soybean oil (SBO; 1.83% DM) or a 80% palmitate fat supplement (CTL; 1.89% DM); and AA level (AAL), either 5% metabolizable protein deficient (AAD), or sufficient, balanced for Leu and Met with corn gluten meal and rumen protected Met (AAS). Fifty-six Holstein cows (71 DIM), housed in tie stalls and fed 1x/d and milked 2x/d were enrolled as two cohorts and grouped within cohort by DIM into 14 squares. Cows were weighed weekly, and DMI and milk yield and composition were measured on d 23-26 of each period. Data were analyzed with a mixed model containing FS, AAL, FSxAAL, period, and square within cohort as fixed effects and cow within square as random. There was no significant interaction between factors for any reported variables. Body weight change was not affected by either factor (P>0.10). Dry matter intake was not affected by FS (P=0.52) but was decreased by AAS (-1.6 kg/d, P<0.001). Milk and lactose yield were not affected by either factor (P>0.21). As expected, compared to CTL, SBO decreased (P<0.001) fat yield (-150 g/d) and percent (3.32, 3.69 ± 0.06%), and AAS tended to increase fat yield compared to AAD (+43 g/d, P=0.09), but not percent (3.54, 3.48 ± 0.06%; P=0.30). Protein yield was not affected by fat source (P=0.44) but was increased by AAS (+69 g/d, P<0.001). Milk urea nitrogen decreased with SBO vs CTL (13.0 vs 13.7 mg/dL, P=0.01) and tended to increase with AAS vs AAD (13.6 vs 13.1 mg/dL, P=0.08). Overall, AA supplementation tended to increase milk fat yield; however, the effect of AA supplementation was not sufficient to overcome the differences in milk fat production between dietary fat sources.

Keywords: Milk fat depression, amino acids

Adisseo Message:

Methionine and leucine are two amino acids (AA) that stimulate the mechanistic target of rapamycin complex 1 (mTORC1), a master regulator of nutrient metabolism that controls milk protein and fat synthesis. In line with this, methionine and leucine supplementation has been shown to increase milk and milk components production. This study was designed to evaluate if balancing lactation diets for those AA could mitigate the deleterious effects of milk fat depression induced via dietary polyunsaturated fatty acids. As expected, supplying dietary soybean oil (linoleic acid) decreased milk fat percentage and yield compared to the control (palmitate fat supplement). While AA supplementation was not able to completely overcome the milk fat depression induced by soybean oil, it increased milk fat content and tended to increase milk fat production under both fat sources, partially mitigating the milk fat depression. These results further underscore the beneficial effects of AA supplementation on increasing milk fat production.