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USA Lysine®: Bioavailability That Matters

Increasing MP Lysine While Lowering CP Improves Milk Protein Production in Mature Cows

Introduction

Research indicates increased lysine bioavailability improves diet formulation and milk component production[1,2,3]. The bioavailability of USA Lysine has been validated by blood plasma lysine levels.

Materials & Methods

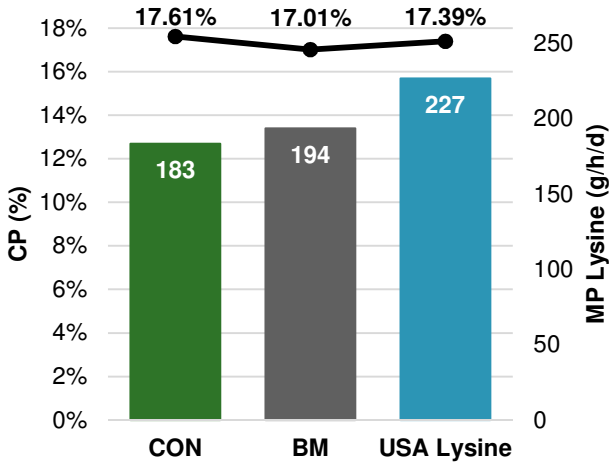
Kemin and Purina Animal Nutrition conducted the study in which 16 multiparous Holstein cows were fed one of three diets formulated with the Purina formulation software (Dynamic Nutrition System, Purina Animal Nutrition, Gray Summit, MO) (Appendix A). The three diets were:

- A control diet (CON) formulated to provide between 160-180 g of metabolizable lysine (MP lysine).
- A diet (BM) formulated with a higher level of blood meal (BM) to provide similar grams of MP lysine as the CON diet.
- A diet (USA Lysine) containing blood meal levels similar to the CON formulated with USA Lysine to provide approximately 20 g of additional MP lysine than the CON or the BM diet.

The cows were blocked by parity, days in milk (DIM) and milk yield. The cows were fed a TMR ad libitum for 28 days using a Calan Broadbent Feeding System (American Calan, Northwood, NH) and milked 3X per day, milk yield was recorded daily. Production and dry matter intake (DMI) data from days 5-28 were used in the statistical analysis.

Mixed procedures of SAS with repeated measures were used for the statistical analysis. Model included fixed effects of diets, parity, day, and all interactions with random effect of cow nested within the diet. Significance was determined as $P \leq 0.05$ and trends were defined as $0.05 < P < 0.20$.

Figure 1. CP % and MP Lysine Levels



Results

Post hoc analysis of the diets using animal performance was performed with AMTS. Ingredients and estimated metabolizable protein is listed in Appendix B. DMI differences resulted in different estimates of MP lysine; however, the objective of increasing MP lysine with blood meal and USA Lysine was achieved. The differences in MP Lysine between the CON and BM diets and of the USA Lysine diet were much higher than intended, the CP % of the USA Lysine diet was lower than the CON (Figure 1).

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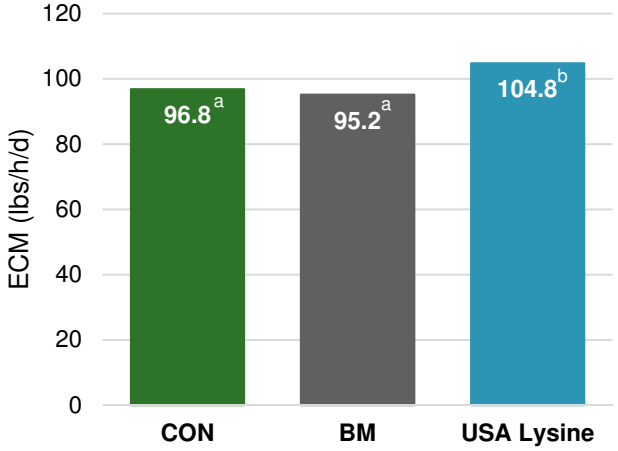
Energy Corrected Milk (ECM) production in the USA Lysine treatment group was 104.8 lb/h/d. This was 8.0 and 9.3 lb higher than the CON and BM diets respectively (Figure 2). At $15 CWT, this relates to an additional $1.20 to $1.40/h/d in milk income.

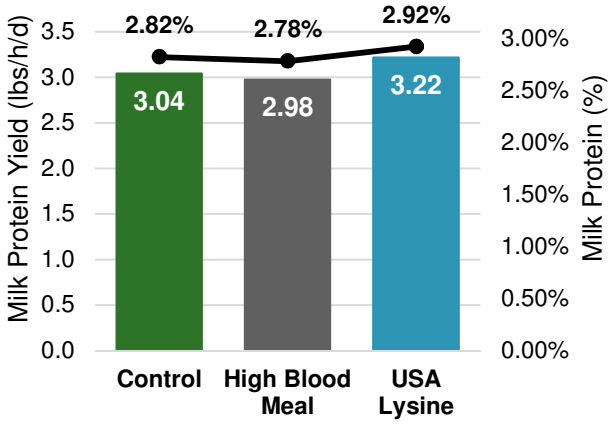
Figure 2. ECM Production



Differing letters in superscripts indicate significant difference, P < 0.20

The milk protein yield and percentage for the USA Lysine treatment group outperformed the other diets. The protein percentage for the USA Lysine group was 0.10% and 0.14% higher than the CON and BM diets respectively. The combination in milk yield and protein percentage resulted in greater protein yield in the USA Lysine treatment with 0.32 and 0.24 lb/h/d higher than the CON and BM diets respectively (Figure 3).

Figure 3. Milk Protein Yield and Percentages



References

1. National Research Council. 2001. Nutrient Requirements of Dairy Cattle. 7th rev. ed. Natl. Acad. Sci. Washington D.C.
2. Rulquin H, Piselewski PM, Ve´rite´ R and Guinard J 1993. Milk production and composition as a function of postruminal lysine and methionine supply: a nutrient-response approach. Livestock Production Science 37:69–90.
3. Schwab, C. G., L. D. Satter, and A. B. Clay. 1976. Response of lactating dairy cows to abomasal infusion of amino acids. J. Dairy Sci. 59:1254-1270.
4. Kemin Internal Document, 15-00080.

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Appendix A. Ingredient composition of formulated diets

Ingredient	CON	BM	LYS
	% of Diet Dry Matter		
Corn Silage	34.2	34.1	34.1
Alfalfa Hay	18.9	19	19
Ground Corn	14.1	13.94	14.4
Soybean Hulls	8.38	8.4	8.58
Soybean Meal	5.59	4.6	5.69
Dried Distillers Grains	3.79	3.8	3.79
Sodium Bicarbonate	1.12	1.13	1.12
Propel Energy Nugget	2.94	2.54	2.94
Calcium Carbonate	1.04	1.04	1.04
Vitamin/Mineral Mix	1.57	1.57	1.57
Rumen Protected Soybean Meal	3	3.8	1.8
Wheat Midds	3.2	3.1	3.5
Animal Fat Blend	0.95	0.95	0.95
Calcium & Potassium Carbonate	0.38	0.38	0.38
Blood Meal	0.57	1.71	0.57
USA Lysine	-----	-----	0.29
Smartamine® M	0.09	0.09	0.14
Urea	0.29	-----	0.29

Appendix B. Ingredients, analyzed nutrient composition, and estimated metabolizable protein intakes of treatment diets based on performance

Ingredient	CON	BM	LYS
	% of Diet Dry Matter		
Corn Silage	34.4	35.65	35.16
Alfalfa Hay	19.11	20.31	19.54
Ground Corn	14.2	14.88	14.8
Soybean Hulls	8.41	8.94	8.79
Soybean Meal	5.62	0.82	5.86
Dried Distillers Grains	3.83	4.06	3.95
Sodium Bicarbonate	1.12	1.12	1.12
Propel Energy Nugget	2.96	1.63	1.08
Calcium Carbonate	1.04	1.04	1.04
Vitamin/Mineral Mix	0.79	0.8	0.6

PRO-LAK	2.98	4.06	1.85
Wheat Midds	3.25	3.36	3.56
Animal Fat Blend	0.96	1.02	0.97
Calcium & Potassium Carbonate	0.38	0.38	0.38
Blood Meal	0.57	1.84	0.59
USA Lysine	-----	-----	0.29
Smartamine M	0.09	0.09	0.15
Urea	0.3	-----	0.29
Parameter	**Nutrient Composition**		
Dry Matter Intake (kg/d)	24.53	24.44	27.12
Crude Protein (% of Dry Matter)	17.61	17.01	17.39
NDF (% of Dry Matter)	32.9	34.55	33.52
NFC (% of Dry Matter)	34.5	35	35.4
Fat (% of Dry Matter)	7	5.9	5.3
Metabolizable Protein (MP, grams)	2847	2986	3144
MP Lysine (grams)	183.3	193.5	226.7
MP Methionine (grams)	66.1	68	80.5
MP Lysine (% of MP)	6.44	6.52	7.21
MP Methionine (% of MP)	2.32	2.29	2.56
MP Lysine:Methionine	2.78:1	2.84:1	2.82:1