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AminoShure®-XM

Precision Release Methionine

Balchem Research Summary

Lactational performance of cows fed AminoShure®-XM in university settings

This is a review of two lactation studies that were conducted to demonstrate the efficacy of feeding AminoShure®-XM for milk and milk protein production when fed at recommended feeding rates. Study 1 was conducted by Dr. Mark Hanigan at Virginia Tech (Fleming et al., 2019) and study 2 was conducted by Dr. Tanya Gressley at the University of Delaware. Both experiments were presented at ADSA meetings.

Background

To optimize milk and component production, a cow's nutritional requirements must be met with two primary factors: energy and metabolizable protein supply. Amino acids are considered the building blocks of proteins and are required in several bodily processes, including lactation. Methionine is considered one of the first limiting amino acids in lactating dairy cows fed corn-based diets. An inadequacy in methionine supply can stunt lactational performance. An effective method to bridge this deficit is by feeding ruminally protected amino acid products which are resistant to rumen degradation, but release in the small intestine. Rumen protect methionine (RP-Met) products can be supplemented in rations to increase the supply of metabolizable Met (MP-Met), thus maximizing milk and component production. However, not all rumen protected products are created equally. The true measure of a rumen protected amino acid is the cost at which it can deliver a unit of metabolizable amino acid which is a function of price and bioavailability. To maximize a product's bioavailability, it must remain intact during the rigors of mixing and storage, resist degradation by rumen microbes and then release in the small intestine where it can be absorbed and utilized by the cow.

The objective of the two experiments discussed in this summary were to assess the responses in lactation performance and to determine relative methionine bioavailability when feeding a newly developed rumen protected product, AminoShure-XM, compared to Smartamine® M. One study was conducted at Virginia Tech in 2016 and the other was conducted at the University of Delaware in 2017.

Material and Methods

Both experiments were conducted as a 5×5 Latin square design with 5 periods each lasting 14 days. The first 10 days of each period were for treatment adaptation and the last four days were for sampling. Cows were housed in free stall barns equipped with a calan gate feeding system to allow quantification of individual feed intake.

Study 1: Virginia Tech, Fall 2016

Ten multiparous Holstein cows in peak to mid-lactation at the start of the experiment were enrolled in each square (85 ± 6 DIM). One common base ration predicted to be deficient in MP-Met (-14.8 g/d) but sufficient in NRC (2001) energy requirements using the Cornell Net Carbohydrate and Protein System (version 6.55) was fed to all cows daily to achieve 10% refusals. The trial consisted of the base diet supplemented with one of four different RP-Met prototypes, but only the negative control (NC, no RP-Met), Smartamine M and the AminoShure-XM (treatments will be discussed. AminoShure-XM and Smartamine M were supplemented in the ration to provide equal amounts of metabolizable Met (MP-Met).

Study 2: University of Delaware, Spring 2017

To more accurately characterize the bioavailability of AminoShure-XM, a dose titration trial was conducted. Five multiparous (112 DIM) and five primiparous (125 DIM) Holstein cows in mid lactation at the start of the experiment were enrolled in each square. One common base ration predicted to be deficient in MP-Met (-16.2 g/d) but sufficient in NRC (2001) energy requirements using the Cornell Net Carbohydrate and Protein System (version 6.55) were fed to all cows daily to achieve 5-10% refusals. The trial consisted of the base diet (negative control, NC) supplemented with either Smartamine M (SM) or AminoShure-XM supplemented at 67% (XM 67% dose rate), 83% (XM 83% dose rate) or 100% (XM 100% dose rate) of the MP methionine content provided by Smartamine M.

All treatments in both experiments were supplemented with lysine to ensure that there was no Lys deficiency in any of the treatments. Milk samples were collected at each milking (AM and PM) on the last four days of each period and were sent to DHIA (Virginia Tech) or Dairy One (University of Delaware) for fat, lactose, true protein, casein, MUN, and SCC analysis. Milk yields were also recorded at each milking. Energy corrected milk (ECM) and fat corrected milk (FCM) were calculated based on milk yield and composition data.

Results and Discussion

Table 1 and Table 2 shows the production results from the Virginia Tech and University of Delaware trials, respectively. In the Virginia Tech experiment, supplementing the methionine-deficient diet with either AminoShure-XM or Smartamine M resulted in significantly higher milk true protein percent. AminoShure-XM and Smartamine M were equal in performance when fed at recommended feeding rates.

Similar to the Virginia Tech trial, the University of Delaware experiment also showed that supplementing the basal diet with any of the methionine treatments resulted in higher milk true protein percent when compared to the control treatment. AminoShure-XM 83% dose rate and 100% dose rate were equally effective as Smartamine M in raising milk protein percent. AminoShure-XM 67% dose rate was the only treatment that did not significantly differ in milk protein percent from the control treatment but also did not differ from the Smartamine M treatment. Casein percent followed a similar trend where the Smartamine M treatment and both AminoShure-XM 83% dose rate and 100% dose rate treatments resulted in the highest casein percentages over the negative control. Fat yield and fat corrected milk yield did not differ between the control, Smartamine M and AminoShure-XM 83% dose rate and 100% dose rate treatments. However, numerically, AminoShure-XM 83% dose rate resulted in the highest fat yield and fat corrected milk yield. Among the three AminoShure-XM treatments, the 83% dose rate and 100% dose rate performed equal to Smartamine M in milk protein, casein and fat response suggesting that AminoShure-XM 83% dose rate and 100% dose rate supplied the same amount of MP-Met as Smartamine M.

Summary

Based on these two experiments, when AminoShure-XM and Smartamine M are fed to provide the same amount of MP-Met, both products performed equally in lactation performance, including milk true protein percent and yield, milk fat yield and casein percent.

Table 1.

Effects of supplemental RP-Met on milk yield and composition in lactating dairy cows at Virginia Tech.

ITEM	TREATMENTS[1]				
	NC	SM	XM	SEM[2]	P-VALUE
DMI, lbs/d	63.1	64.2	63.1	4.6	0.925
Milk yield, lbs/d	99.6	100.8	99.6	3.1	0.952
Milk Fat, %	3.62	3.50	3.51	0.29	0.255
Milk Fat, g/d	1620	1590	1590	120	0.690
Milk protein, %	3.02[a]	3.11[b]	3.12[b]	0.05	0.024
Milk protein, g/d	1360	1420	1410	50	0.159
Milk Lactose, %	4.84	4.83	4.85	0.12	0.736
Milk Lactose, g/d	2180	2210	2190	70	0.913
MUN[3], mg/dL	11.0	11.2	11.4	1.19	0.440
SCC[4], cells/ml	187	202	174	50.2	0.364
ECM[5], lbs/d	101.6	102.3	101.6	3.6	0.936

[a,b]Means with different superscript letters within the same row are significantly different ($P < 0.05$).
[1]NC=Negative control diet; SM=NC supplemented with Smartamine® M; XM=NC supplemented with AminoShure®-XM at 100% of the MP methionine content provided by Smartamine M
[2]SEM = Standard error of means
[3]MUN = Milk urea nitrogen
[4]SCC = Somatic cell count
[5]ECM = Energy-corrected milk yield lbs calculated as: (12.95 × milk fat (kg/d) + 7.65 × milk protein (kg/d) + 0.327 × milk yield (kg/d)) * 2.20456

Table 2.

Effects of supplemental RP-Met on milk yield and composition in lactating dairy cows at the University of Delaware.

ITEM	TREATMENT[1]						
	NC	SM	XM-67% dose rate	XM-83% dose rate	XM-100% dose rate	SEM[2]	P-VALUE
DMI, lbs/d	58.2	57.5	57.5	57.8	55.1	2.0	0.37
Milk, lbs/d	88.0	88.0	85.5	89.3	86.9	2.0	0.55
Fat, %	3.60	3.51	3.50	3.60	3.59	0.07	0.45
Fat, g/d	1400[a]	1390[a]	1330[b]	1440[a]	1410[a]	30	0.005
Protein, %	2.89[b]	2.98[a]	2.94[a,b]	2.95[a]	2.96[a]	0.03	0.03
Protein, g/d	1140	1190	1130	1190	1160	30	0.29
Casein, %	2.26[b]	2.34[a]	2.31[a,b]	2.32[a]	2.32[a]	0.03	0.05
Casein, g/d	890	930	890	930	910	20	0.29
ECM[3], lbs/d	88.2	88.4	85.3	90.4	88.2	1.5	0.08
FCM[4], lbs/d	88.2[a]	87.7[a,b]	84.7[b]	89.9[a]	88.0[a,b]	1.3	0.04
MUN[5], mg/dL	12.6	12.9	12.9	13.2	13.0	0.4	0.90
SCS[6]	2.75	2.59	3.13	2.61	2.90	0.27	0.33

[a,b]Means with different superscript letters within the same row are significantly different ($P < 0.05$).
[1]NC=Negative control diet; SM=NC supplemented with Smartamine® M; XM-67% dose rate=NC supplemented with AminoShure®-XM at 67% of the MP methionine content provided by Smartamine M; XM-83% dose rate=NC supplemented with AminoShure-XM at 83% of the MP methionine content provided by Smartamine M; XM-100% dose rate=NC supplemented with AminoShure-XM at 100% of the MP methionine content provided by Smartamine M
[2]SEM = Standard error of means
[3]ECM = Energy-corrected milk yield lbs calculated as: (12.95 × milk fat (kg/d) + 7.65 × milk protein (kg/d) + 0.327 × milk yield (kg/d)) * 2.20456
[4]FCM = Fat corrected milk yield lbs calculated as: (0.432 × milk yield (kg/d) + 16.216 × milk fat (kg/d)) * 2.20456
[5]MUN = Milk urea nitrogen
[6]SCS = Somatic cell score

References

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