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AminoShure®-XM

Precision Release Methionine

Balchem Research Summary

Estimating relative metabolizable methionine content of AminoShure®-XM and Mepron® by dilution of selenium concentration in milk

A summary of a study conducted by Dr. W.P. Weiss at The Ohio State University (Wooster, OH): “Relative Bioavailability of Experimental Protected Methionine Products”

Background

Methionine is considered one of the first limiting amino acids in lactating dairy cows fed corn-based diets. Ruminally protected methionine products (RP-Met) are supplemented in rations to increase the supply of metabolizable Met (MP-Met), thus maximizing milk and component production. However, to effectively use these products in a diet, the rumen stability, intestinal release and how these products elicit a biological response in the cow must be known.

There are several *in vivo* techniques that can be used to determine RP-Met bioavailability. Commonly, these techniques either measure Met appearance in the blood after feeding/dosing products or milk and component production is measured after feeding. While measuring Met appearance in blood is a measurement of the intestinal absorption of products, one must assume that the Met is then used for milk and component production. Some of these blood response techniques that dose products in large quantities or dose directly into the abomasum can favor RP-Met products with polymer coatings. Feeding RP-Met products and then monitoring production responses directly measures the efficacy of these products in supporting lactation. The seleno-methionine technique is an *in vivo* method that uses changes in milk Seleno-methionine concentration to determine how much of an RP-Met product bypasses the rumen, is absorbed in the small intestine and is then utilized in the mammary gland.

In this technique, milk selenomethionine (Se-Met; provided by dietary Se-yeast) is used as a tracer of Met in milk (Weiss and St-Pierre, 2009). When Se-yeast is fed, milk Se concentrations increase due to the incorporation of Se-Met into milk (Se-Met and Met are indistinguishable by cells). When supply of MP-Met increases, Se concentrations in milk decrease because of competition between Se-Met and Met. This *in vivo* technique has previously been proven accurate in estimating the relative supply of MP-Met by measuring the concentration changes of milk Met relative to milk Se (Weiss and St-Pierre, 2009). The objective of this experiment was to determine the relative MP-Met supplied by AminoShure-XM (Balchem Corp) and Mepron (Evonik, Germany) utilizing the seleno-Met technique.

Material and Methods

Fifteen Holstein cows (averaging 174 DIM and 67.6 lb/d milk) housed in tie stalls were fed a basal diet that was formulated to be deficient in Met and contained 0.3 mg/kg added selenium from Se-yeast. The basal diet composition is listed in Table 1. After 10 days, cows were randomly assigned and fed the basal diet plus one of three treatments in 5 replicated 3×3 Latin squares with 10 day periods: 1) Mepron fed at 19 g of Met/d; 2) AminoShure-XM fed at 19 g of Met/d and 3) AminoShure-XM fed at 38 g of Met/d (2X). Immediately following the last treatment period, cows were fed the basal diet again for 9 d. Cows were milked twice daily and fed a total mixed ration once daily. Milk yield was measured electronically, and milk samples were collected during the last 4 milkings of each period. Milk samples were then composited by cow-period, assayed for nitrogen (N, proxy for Met) and Se (proxy for Se-Met), and the Se/N ratio was calculated. Because diets remain the same between treatments except for the addition of an RP-Met source, any change in milk N can be attributed to a change in milk Met uptake. Thus, milk N becomes a proxy for milk Met. Data from both basal periods were averaged within cow to represent an average response when cows were fed the basal diet. The relative increase in MP-Met when treatments were fed was calculated as a ratio of the basal Se/N to the treatment Se/N (Figure 1).

Results and Discussion

As expected, treatments did not affect DMI or milk production due to the short treatment period length (10 days; see Table 2). Milk N% remained consistent across treatments, but milk Se concentration decreased when treatment dose increased. Based on the Se dilution, Mepron and AminoShure-XM at a feeding rate of 19 g of Met/d increased supply of Met to the mammary gland by 13% when compared to the basal diet. This technique determines relative metabolizability versus actual, so it can be concluded that AminoShure-XM and Mepron provide equal MP-Met concentrations when fed at equal Met feeding rates.

AminoShure-XM fed at double the dose (38 g of Met/d) significantly increased Met supply by 25%, which was approximately double that observed with the lower dose. This consistent increase in Met supply from the 2X dose of AminoShure-XM further validates the product's ability to provide an available supply of Met.

Table 1. Formulated ingredient and chemical composition of the basal diet

ITEM	% of DM
Ingredient	
Corn silage	37.0
Alfalfa silage	20.0
Corn grain, ground	25.0
Soybean meal-48%	12.3
Soybean hulls	3.57
Animal-vegetable fat	0.36
Limestone	0.55
Dicalcium phosphate	0.33
Trace mineral salt	0.43
Vit/TM premix[1]	0.46
Nutrient Composition	
DM	57.4
NDF	29.6
CP	14.8
Ca	0.83
P	0.40
Mg	0.25
K	1.61

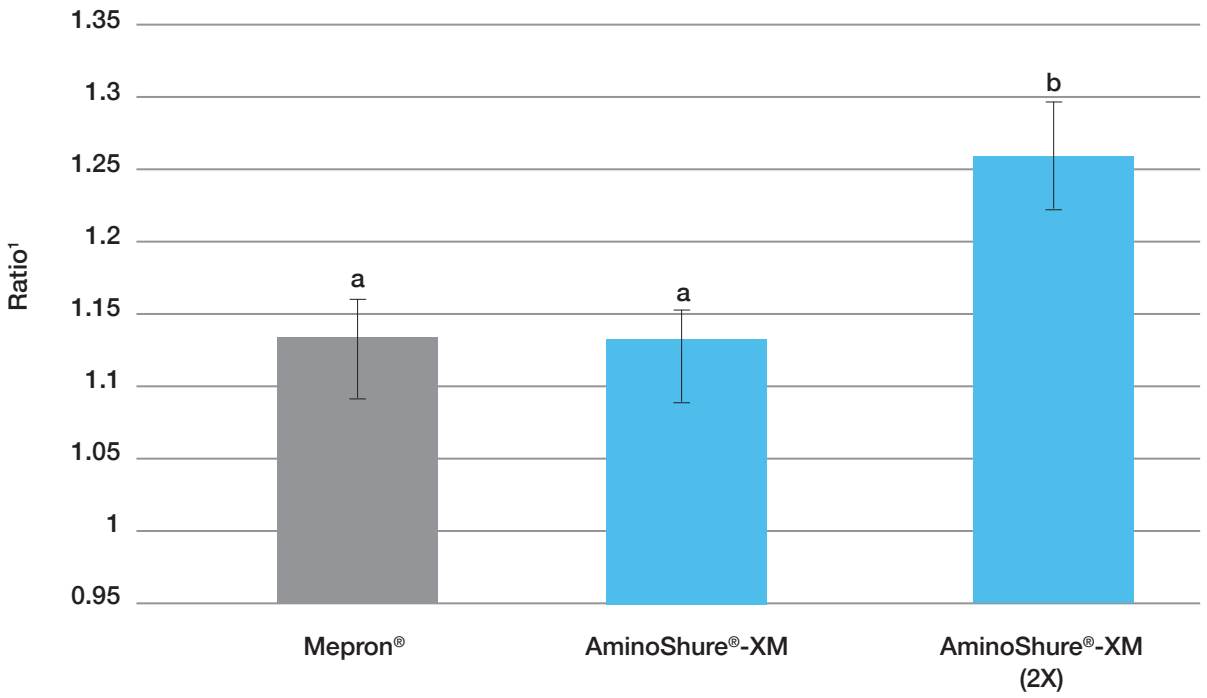
[1] Premix was comprised of 0.36% copper sulfate, 1.09% zinc sulfate, 12.15% vitamin E (44 kIU/kg), 3.16% vitamin A (30 kIU/g), 7.30% vitamin D (3 kIU/g), 72.9% biotin (220 mg/kg), and 3.04% Selenosource 3000 (Diamond V, Cedar Rapids, IA).

Table 2.
Effect of rumen-protected methionine source on experimental measures

	TREATMENT[1]				
	Mepron	AminoShure-XM	AminoShure-XM (2X)	SEM	P-VALUE
BW, lbs	1548	1594	1609	84.0	0.72
Milk yield, lbs/d	60.2	60.0	60.4	2.51	0.92
DMI, lbs/d	50.0	48.9	49.8	2.29	0.27
Milk N, %	0.547	0.539	0.540	0.012	0.15
Milk Se, mg/L	0.054[a]	0.053[a]	0.048[b]	0.0015	0.001

[a,b]Values with differing superscripts differ (P < 0.05)
[1] Mepron fed at 19 g of Met/d; AminoShure-XM fed at 19 g of Met/d; AminoShure-XM (2X) fed at 38 g of Met/d

Figure 1.
Effect of rumen-protected methionine supplementation on metabolizable methionine supply in milk relative to the basal treatment



[b]Values with differing superscripts differ (P < 0.05)
[1]Calculated as {(Milk Se/Milk N)$_{Basal}$}/{(Milk Se/Milk N)$_{Trt}$} and represents the change in MP-Met relative to the basal period.

Summary

The milk selenium dilution technique can directly measure the efficacy of an RP-Met product in supporting milk and component production by quantifying the changes in milk Se and Met pools. Based on concentration changes of milk N relative to milk Se, AminoShure-XM and Mepron provide equal MP-Met concentrations when fed at equal Met feeding rates. The consistent response observed in this experiment when feeding AminoShure-XM at two feeding levels illustrates the product's ability to provide a consistent supply of MP-Met to the mammary gland.

References

Weiss, W.P., A.W. Tebbe, K. Estes, and C. Zimmerman. 2019. Metabolizable methionine content of rumen protected products using the seleno-methionine technique [abstract]. In: American Dairy Science Association Annual Meeting; 2019; Cincinnati, OH.

Weiss, W.P., and N.R. St-Pierre. 2009. A method to quantify changes in supply of metabolizable methionine to dairy cows using concentrations of selenium in milk. J. Dairy Sci. 92:2835-2842.

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