



Assessment of Lysine Released from Rumen-Protected Lysine Products Exposed to High and Low Moisture TMR over 24 Hours

P. Ji*, C. S. Ballard, R. E. Clark, B. M. Sweeney, C. Kokko
William H. Miner Agricultural Research Institute, Chazy, NY



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INTRODUCTION

- Lysine (Lys) is the first limiting amino acid for lactating dairy cows fed a corn grain-based diet.
- Rumen-protected Lys (RPL) products are commercially available.
- Ruminal bypass rate and intestinal digestion has been studied.
- Little information available regarding potential pre-ingestional Lys loss from RPL products during routine feeding management.

OBJECTIVE

To determine the potential Lys loss of RPL products induced by physical contact with TMR diet varying in moisture content after feed delivery.

MATERIALS AND METHODS

Experimental Design

- Six commercial RPL products:

Table 1. Major composition of RPL products.

RPL	Lys compound	Major coating material	Lys, % as fed
AminoShure-L	Lys-HCl	Vegetable oil	53.6
LysiPEARL	Lys-HCl	Vegetable oil	38.2
MEGAMINE-L	Lys-HCl	Ca salt from vegetable oil	19.4
MetaboLys	Lys-H ₂ SO ₄	Vegetable oil	28.5
USA Lysine	Lys-HCl	Vegetable oil	53.6
AjiPro-L	Lys-HCl	Vegetable oil	40.4

- A split-plot arrangement of treatments in a completely randomized design based on each RPL product.
- Moisture content of TMR is main plot treatment effect (Trt): TMR of 42% DM (LD) and 52% of DM (HD).
- Time of RPL mixed with TMR ingredients is subplot treatment effect (Time): 0, 6, 18, 24 h.

Experimental Procedures

- Three loads of LD and HD diet (350 kg/load) were formulated using the same DM-based proportion of ingredients and mixed in Super Data Ranger.
- 200 ± 1 g of TMR transferred to Ziploc bag and mixed with or without 2 ± 0.05 g RPL product.
- Bags were stored unsealed at 21°C for 0, 6, 18, and 24 h to simulate feedbunk exposure.



- At each time point, content of bags were transferred into strainer bag (< 1.5 mm porosity), soaked in 1 L 500 mg/L L-Arginine solution to solubilize the free Lys (Arginine used as internal control to adjust for addition of TMR-derived water in solution)
- Subsample of filtrate through 0.45-µm filter, diluted and derivatized using AccQ Tag Ultra reagent (Waters Corporation, Milford, MA)
- Lys concentration analyzed by ACQUITY UPLC® system
 - Lys analysis performed by Ajinomoto Bio-Fine Research Laboratories with all samples blindly labeled.
- Lys release calculated as: $TMR_{with\ RPL} - TMR_{without\ RPL}$ at each timepoint



Statistical Analysis

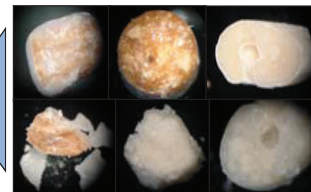
- MIXED procedure of SAS (v. 9.2) with TMR moisture content, mixing time and their interaction as fixed effect and sample in each Ziploc bag as random term.
- PDIF option was used for mean separation.
- Significance was declared at $P \leq 0.05$.

RESULTS

AminoShure-L	MEGAMINE-L	AjiPro-L
MetaboLys	USA Lysine	LysiPEARL



2 g samples of RPL products



Microscopic cross section image of RPL products (15x)

Table 2. Composition and characteristics of TMR diets

Ingredient	LD	HD
	As fed, %	As fed, %
BMR	31	38.0
Haylage	26.9	32.8
Corn meal	4.9	5.9
Grain Mix	19.1	23.3
Water	17.9	0.0
DM, %	40.5	51.8
pH	4.8	4.8

Table 3. Total amount of Lys released from control TMR sample (without RPL) at 0, 6, 18, and 24 h

Time, h	Lysine release, mg		SEM	P-value
	LD	HD		
0	41.89	26.98 ^a	2.02	< 0.001
6	43.25	41.24 ^a	2.02	0.99
18	47.57	41.38 ^b	2.02	0.39
24	49.23	41.04 ^b	2.02	0.13

^{a,b} Least squares means within a column with different superscripts differ ($P \leq 0.05$)

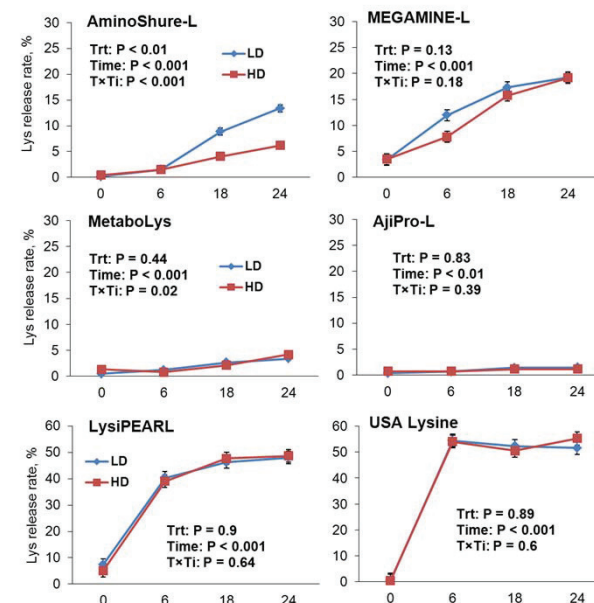


Figure 1. Lys release rate of RPL products in response to physical contact with TMR ingredients during a 24-h period

CONCLUSIONS

- Physical contact with TMR ingredients caused Lys loss from all RPL products at different magnitudes during a 24-h period.
- Increased moisture content of TMR increased AminoShure-L Lys release rate at 18 and 24 h.
- Feeding frequency should be considered to maximize value of RPL products.