

Performance and amino acid utilization of early lactation cows fed NovaMeal

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A lactation study was conducted to evaluate milk production, milk composition, plasma metabolites and the mammary uptake of amino acids in cows fed distillers grains as the primary protein supplement in early lactation. Distillers grains were fed as DDGS (10.8% fat, 31.3% CP) or NovaMeal (3.5% fat, 34.0% CP).

KEY STUDY RESULTS

- Cows fed NovaMeal had similar dry matter intake and milk yield, and increased milk protein percentage and yield ($P = 0.03$ and $P = 0.05$, respectively) compared with those fed soybean-based diets.
- Cows fed NovaMeal have a greater plasma methionine concentration ($P < 0.001$) and a tendency for greater mammary uptake of methionine ($P = 0.07$) vs. cows fed soybean-based diets.
- While cows fed NovaMeal have a lower plasma lysine concentration ($P < 0.01$), the mammary uptake of lysine was similar to cows fed soybean-based diets, which is due to greater extraction efficiency of lysine in cows fed NovaMeal ($P < 0.001$).

MATERIALS & METHODS

Study length:

- 2 week covariate period
- 12 week experimental period

Diets formulation:

- Similar in nutrients (protein, energy, fiber)
- Contain 50:50, forage to concentrate ratio, with the forage being split evenly between alfalfa silage and corn silage on a DM basis.
- Metabolizable protein balance was 471, 470, and 464 g/d for diets of control, DDGS and NovaMeal, respectively.
- Lysine supply was 6.32, 5.69 and 5.60 as %MP and methionine supply was 1.73, 1.86, and 1.84 as %MP for control, DDGS, and NovaMeal, respectively. These values were all below the breakpoints of 6.8% Lysine as %MP and 2.4% Methionine as %MP that are published in NRC (2001).

Assumptions made to determine mammary uptake of amino acids:

- Mammary plasma flow = $[(\text{milk Phe} + \text{Tyr}) \times 0.965 / (\text{arterio-venous (AV) difference of (Phe} + \text{Tyr)})]$, where estimates of milk Phe = 4.9g/100 g milk and milk Tyr = 5.1g/100 g milk
- Extraction efficiency = AV difference/arterial concentration x 100
- Mammary uptake = AV difference x mammary plasma flow

TRIAL DESIGN

- Cows were randomly assigned to one of 3 treatments (12 cows/ treatment; 8 multiparous, 4 primiparous)
 - Control – soybean meal and expellers soybean meal were the protein sources fed.
 - DDGS – Distillers dry grains with solubles was the primary protein source fed at 22% inclusion.
 - NovaMeal – NovaMeal was the primary protein source fed at 20% inclusion.
- Cows were blocked by day in milk and parity.
 - DIM was 19.7 at the beginning of the covariate period.
- Cow was the experimental unit.

STATISTICS

- Data were analyzed using the MIXED procedure of SAS.
- Week was the repeated measure. Every 4th week was the repeated measure for blood metabolites, BW, BCS and energy balance values.
- Covariate values were used for all repeated measurements.
- Plasma AAs, were evaluated at a single time point. Thus, time was not evaluated.



NOVAMEAL

STUDY RESULTS

- Dry matter intake and milk yield were similar for all diets (Table 1).
- Milk fat percentage and yield tended to be greater for cows fed NovaMeal vs. DDGS ($P < 0.15$; Table 1).
- Milk protein percentage and yield were greater for cows fed NovaMeal and DDGS vs. Control ($P < 0.05$; Table 1).
- Milk urea nitrogen was lower for cows fed NovaMeal and DDGS vs. Control ($P < 0.05$; Table 1).

Table 1. Production data of cows fed control diet or supplemented with 20% NovaMeal or 22% DDGS¹

	Control	NovaMeal	DDGS	SEM
DM Intake (lb/d)	54.6	54.1	54.3	1.12
Milk Yield (lb/d)	86.2	87.6	85.6	1.83
Milk Fat (%)	3.63	3.57 ^y	3.24 ^x	0.15
Milk Fat Yield (lb/d)	2.93	3.08 ^y	2.95 ^x	0.18
Milk Protein (%)	2.82 ^a	2.89 ^b	2.88 ^b	0.03
Milk Protein Yield (lb/d)	2.35 ^a	2.51 ^b	2.53 ^b	0.07
MUN (mg/dL)	11.8 ^a	10.1 ^{by}	10.9 ^{bx}	0.30

¹Statistical comparisons were Control vs. DDGS and NovaMeal and DDGS vs. NovaMeal. In some cases, it may appear that the Control value is different from DDGS or NovaMeal. This comparison was not the objective of the experiment, so statistics were not conducted on that comparison.

^ab Values with different superscripts differ by $P < 0.05$.

^y Values with different superscripts differ by $P < 0.15$.

- The cows fed NovaMeal and DDGS had a greater plasma methionine concentration and lower plasma lysine concentration than the cows fed the control diet, which utilized soybean meal as the primary protein source ($P < 0.05$; Table 2).
- The arterio-venous difference for methionine was greater for cows fed NovaMeal and DDGS vs. Control ($P < 0.05$; Table 2). The arterio-venous difference for lysine was similar amongst all treatments.
- Extraction efficiency for methionine tended to be greater for cows fed the control diet vs. those fed NovaMeal and DDGS ($P < 0.15$; Table 2). Extraction efficiency for lysine was greater for cows fed NovaMeal and DDGS vs. control ($P < 0.05$; Table 2).
- Mammary uptake for methionine tended to be greater for cows fed NovaMeal and DDGS vs. Control ($P < 0.15$; Table 2). Mammary uptake for lysine was similar amongst treatments.
- Thus, high demand for metabolizable amino acids to synthesize milk and milk protein in early lactation was not limited when NovaMeal was fed as the primary protein source. This was demonstrated by the similar mammary uptake for lysine, and tendency for greater mammary uptake of methionine by cows fed NovaMeal.

Table 2. Measures of amino acid utilization for methionine and lysine for cows fed control diet or supplemented with 20% NovaMeal or 22% DDGS¹

	Control	NovaMeal	DDGS	SEM
Arterial Plasma Concentration (uM/L)				
Methionine	14.9 ^a	21.4 ^b	21.1 ^b	1.11
Lysine	70.4 ^a	55.8 ^b	58.6 ^b	3.55
Arterio-venous Difference (uM/L)				
Methionine	10.3 ^a	13.3 ^b	12.7 ^b	1.06
Lysine	45.8	44.4	43.1	3.11
Extraction Efficiency ² (%)				
Methionine	68.7 ^x	62.6 ^y	59.6 ^y	3.89
Lysine	65.4 ^a	79.1 ^b	73.2 ^b	2.40
Mammary uptake ³ (g/kg of milk)				
Methionine	0.58 ^x	0.81 ^y	0.83 ^y	0.11
Lysine	2.52	2.68	2.49	0.78

¹Statistical comparisons were Control vs. DDGS and NovaMeal and DDGS vs. NovaMeal. In some cases, it may appear that the Control value is different from DDGS or NovaMeal. This comparison was not the objective of the experiment, so statistics were not conducted on that comparison.

²Extraction efficiency = arterio-venous difference / arterial concentration x 100.

³Mammary uptake = arterio-venous difference x mammary plasma flow.

^ab Values with different superscripts differ by $P < 0.05$.

^xy Values with different superscripts differ by $P < 0.15$.

SUMMARY

- Cows fed NovaMeal had similar dry matter intake and milk yield, and improved milk protein compared with those fed soybean-based diets.
- Cows fed NovaMeal had a greater plasma methionine concentration and a tendency for greater mammary uptake of methionine vs. cows fed soybean-based diets.
- While cows fed NovaMeal had a lower plasma lysine concentration, the mammary uptake of lysine is similar to cows fed soybean-based diets, which is due to greater extraction efficiency of lysine in the cows fed NovaMeal. This finding, in addition to the increased milk protein, suggests that the lower lysine in NovaMeal has no substantial physiological effect.