Abstract Summary

Title: Changes in plasma and milk choline metabolite concentrations in response to the provision of various rumen-protected choline prototypes in lactating cows.

Authors: T.L. France, W.A. Myers, A. Javaid and J.W. McFadden
Cornell University, Ithaca, NY

Objective: Characterize changes in plasma and milk choline and choline metabolite concentrations in response to increasing ruminal spot-doses or different types of rumen-protected choline (RPC) in cows.

Treatments:

- Experiment 1:
  - 12 mid-lactation Holstein cows were assigned to 1 of 3 lipid-encapsulated RPC products in a sequence of 4 doses:
    - P1 (59% CC) at 0, 18, 36, or 54 g choline chloride (CC)
    - P2 (56% CC) at 0, 18, 36, or 54 g CC
    - P3 (30% CC) at 0, 18, 36, or 54 g CC
- Experiment 2:
  - 12 late-lactation Holstein cows were assigned to 1 of 4 treatments:
    - Control (0 g CC)
    - P2 (56% CC) at 36 g CC
    - P4 (60% CC) at 36 g CC
    - P5 (62% CC) at 36 g CC

Results:

1. Plasma responses:
   a. TMAO concentrations increased with RPC dose
   b. Methionine and sphingomyelin concentrations were not modified
2. Milk responses:
   a. TMAO concentrations increased with RPC dose
   b. Choline and betaine yields increased with RPC dose in a quadratic manner (dependent upon RPC dose and type)
   c. Phosphocholine (PCho) and glycerophosphorylcholine (GPC) yields were modified by select RPC dose
   d. Methionine, PCho, GPC, phosphatidylcholine, and total choline concentrations were not modified

Take Home Message: This technique shows promise as a relatively quick and easy methodology to determine the relative bioavailability of RPC products.

Full Abstract

Changes in plasma and milk choline metabolite concentrations in response to the provision of various rumen-protected choline prototypes in lactating cows.

T.L. France, W.A. Myers, A. Javaid and J.W. McFadden
Cornell University, Ithaca, NY

The objective was to characterize changes in plasma and milk choline and choline metabolite concentrations, including microbial-derived trimethylamine *N*-oxide (TMAO), in response to increasing ruminal spot-doses or different types of rumen-protected choline (RPC) in cows. For Experiment (EXP) 1, 12 mid-lactation Holstein cows (121 ± 16.3 days in milk [DIM]) were balanced by total plasma choline concentrations and milk yield. Cows were assigned to 1 of 3 lipid-encapsulated RPC products (main plots): P1, P2, and P3 containing 59, 56, and 30% choline chloride (CC), respectively. Within each main plot, cows were assigned to a sequence of doses in a 4 × 4 Latin square design: 0, 18, 36, or 54 g CC. Treatments were preconditioned with ground corn and administered as a single ruminal bolus 1-h post-feeding of a total mixed ration (TMR). For EXP 2, we compared a control (0 g CC) vs. P2, and P4 and P5 RPC (60 and 62% CC, respectively). EXP 2 followed a similar design as EXP 1 with modifications: 12 late lactation Holstein cows (228 ± 7.10 DIM) were used; treatments were administered as part of a pre-meal; and cows received a daily allowance of a TMR as equal provisions every 4 h. For both experiments, plasma and milk samples within 24 h of treatment were collected for metabolite quantification. Data were analyzed using a mixed model including fixed effects of treatment, period, and time. Contrast statements were utilized to test for linearity of dose and differences between prototypes for EXP 1 and 2, respectively. Plasma and milk TMAO concentrations increased with RPC dose (peak by h 4; $P < 0.01$). Milk choline and betaine yields increased with RPC dose in a quadratic manner ($P = 0.04$); albeit, dependent upon RPC dose and type. Milk phosphocholine (PCho) and glycerophosphorylcholine (GPC) yields were modified by select RPC dose ($P < 0.05$), however milk Met, PCho, GPC, phosphatidylcholine, and total choline concentrations in milk, and plasma Met and sphingomyelin concentrations were not modified. We conclude that plasma or milk choline, betaine, and TMAO concentrations are responsive to RPC type and dose.

Keywords: choline, TMAO