Abstract Summary

Title: Effects of *in utero* choline exposure on growth and metabolism in weaned Angus X Holstein calves

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Objective: Investigate rumen protected choline (RPC) dose and formulation on calf growth and feed efficiency from 2 to 9 months of age.

Treatments:

- Multiparous Holstein cows pregnant with male (n=17) or female (n=30) Angus-sired calves were randomly assigned to receive one of the following treatments prepartum:
  - 0 g RPC (control; CTL)
  - 15 g of choline ion from RPC2 (recommended dose; RD)
  - 22 g of choline ion from RPC2 (high dose; HD)
  - recommended dose of choline ion from ReaShure
- From 2 to 6 months, calves were group housed and offered 2.3 kg (5 lbs) grain/h/d (42% CP) with *ad libitum* access to grass hay, and stepped up to a complete finishing diet from 7 months (12.0% CP).

Results:

1. Feeding $RPC2_{RD}$ increased hip height vs. CTL
2. Overall, RPC increased hip and wither height compared with CTL, and increasing RPC dose increased hip and wither height.
3. Treatment and sex interacted on DMI whereby increasing RPC intake linearly increased DMI for male, but not female.
4. Increasing RPC intake linearly decreased plasma insulin and tended to decrease glucose.
5. There was no effect of dam choline intake on offspring feed efficiency at 8 months of age.

Take Home Message: RPC supplementation in gestating cows positively influenced the growth of beef x dairy calves born to those cows from 2 to 9 months of age. However, mechanisms of action for intrauterine choline exposure on offspring growth and metabolism should be explored further.

Full Abstract

Effects of in utero choline exposure on growth and metabolism in weaned Angus X Holstein calves

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Feeding rumen protected choline (RPC) to late gestation dairy cows has potential to affect growth in offspring, which may enhance profitability. Our objective was to investigate RPC dose and formulation on calf growth from 2 to 9 mo of age, and feed efficiency (FE) at 8 mo. Multiparous Holstein cows with male (M; n=17) or female (F; n=30) Angus-sired calves were enrolled 21 d prepartum and randomly assigned to treatment (trt): 0g (control; n=12; CTL), 15g (recommended dose; n=10; RD), or 22g (high dose; n=12; HD) of choline ion from a concentrated RPC prototype (n=13; RPC2; Balchem Corp.) or the RD of choline ion (RPC1; ReaShure, Balchem Corp.; positive control). Calves were individually-housed and fed milk replacer 2x daily at 0.8 kg DM/d until 2 mo. From 2 to 6 mo, calves were group housed and offered 2.3 kg grain/hd/d (42% CP) with ad libitum grass hay, and stepped up to a complete finishing diet from 7 mo (12.0% CP; 1.4 Mcal/kg NEg). Weight and height were measured monthly. FE was measured in individual pens for 35d at 8 mo. Feed offered and orts were measured daily and blood sample obtained on d18 during FE period. Mixed models were used in PROC MIXED (SAS v 9.4) with the fixed effects of trt, sex, time and their interactions, and the random effect of calf. Month was the repeated measure using spatial powers covariance with preplanned orthogonal contrasts. FE and blood data were analyzed with the fixed effect of dam choline intake as a continuous variable (g choline/kg dam metabolic body weight). Feeding RPC2RD increased hip height vs. CTL (114 vs. 111 cm, $P<0.05$). Overall, RPC increased hip and wither height compared with CTL ($P<0.001$), and increasing RPC dose increased hip and wither height ($P=0.03$). Trt and sex interacted on DMI ($P=0.02$) whereby increasing RPC intake linearly increased DMI for M, but not F. Increasing RPC intake linearly decreased plasma insulin ($\beta = -10.1$ µg/L; $P<0.01$) and tended to decrease glucose ($\beta = -89.2$ mg/dL; $P=0.06$). There was no effect of dam choline intake on FE at 8 mo. Mechanisms of action for intrauterine choline exposure on offspring growth and metabolism should be explored.

Keywords: beef, developmental programing, feed conversion