Effects of supplementing propionate in a finishing diet on dry matter intake, glucose clearance, and blood metabolites

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Introduction

- Propionate is the primary precursor for gluconeogenesis, supplying 60-74% of the required carbon (Aschenbach et al., 2010).
- Inconsistent results have been found for the effect of propionate on feed intake.
  - Propionate infusions decreased feed intake in dairy cows (Oba and Allen, 2003).
  - Propionate supplementation did not effect intake in cows (Liu et al., 2010)
- Oba and Allen (2003) reported a linear increase in plasma glucose with propionate infusion in cows.
- Others found no change in plasma glucose.
- Past research has been focused in lactating cow diets, where decreased intake is potentially causing a decrease in propionate and glucose production.
- Little is known of the effects of additional propionate in steers on a finishing diet.

Hypothesis & Objective

Hypothesis: Supplementing propionate will increase circulating blood glucose and decrease dry matter intake.

Objective: To determine if supplementing propionate altered DMI, glucose clearance rate, and blood metabolites.

Materials & Methods

- All animal procedures were approved by Oklahoma State University Institutional Animal Care and Use Committee
- 15 Holstein steers (BW: 243 ± 14.03 kg) were used in this study
- Steers were allocated based on BW into 3 treatment groups:

Treatment	g Propionate/d
Control (CON)	0
Low Propionate (LOW)	100
High Propionate (HIGH)	300

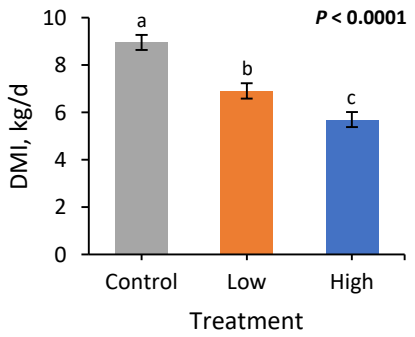
Ingredient	%, DM
Prairie Hay	6
Alfalfa Hay	4
Rolled Corn	60
Sweet Bran, wet	20
Liquid Supplement	5
Mineral	5

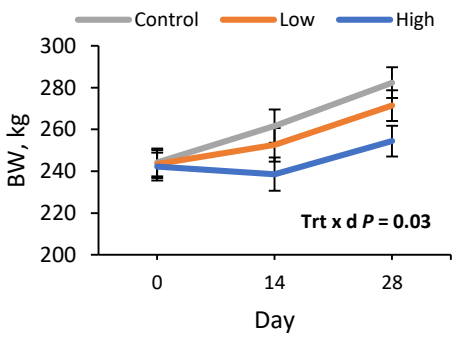
- Steers were individually housed in a temperature controlled barn and fed a finishing diet twice daily at 110% expected intake with half of the treatment top-dressed with each feeding
  - Orts were collected and weighed daily to determine DMI
- Samples were collected on the following timeline:

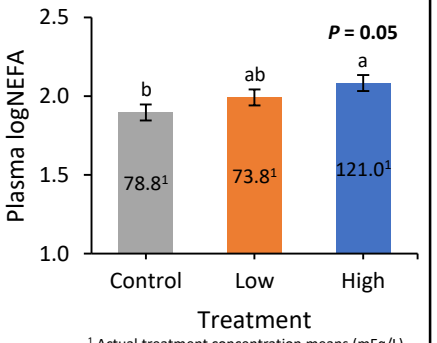
d 0 BW and Blood → d 7 Blood → d 14 BW and GTT → d 21 Blood → d 28 BW and GTT

- Glucose Tolerance Tests (GTT) were conducted by administering 7.57 mmol/kg $BW^{0.75}$ of 2.78 *M* glucose solution (pH 7.2) through a jugular catheter
  - Blood samples were collected at -10, 0, 5, 10, 15, 20, 25, 30, 45, 60, 90, 120 minutes
- Whole blood was analyzed immediately for glucose and lactate, and NEFA were analyzed in plasma at a later date
- Data were analyzed using PROC MIXED of SAS 9.4 with treatment, day and their interaction included with day as a repeated measure

Results







¹ Actual treatment concentration means (mEq/L)

Results

- No trt effect on blood glucose concentrations ($P = 0.58$), glucose peak ($P = 0.19$), plateau ($P = 0.20$), or clearance rate ($P = 0.16$)
- CON had greater ($P < 0.01$) DMI than LOW and HIGH
- CON had greater BW than LOW and HIGH on d 14 and 28 ($P = 0.03$)
- Whole blood glucose tended ($P = 0.09$) to be greater on d 21 than d 0 or 7
- CON had lower ($P = 0.05$) plasma NEFA concentrations than LOW and HIGH
- Plasma NEFA concentrations were greater ($P = 0.002$) on d 0 than d 7 and 21
- Whole blood lactate was greater on d 7 ($P = 0.05$) than d 0 and 21

Conclusions

Further analysis includes plasma insulin concentration and clearance rate and expression of genes involved in glucose metabolism in the liver.

Supplementing propionate may decrease dry matter intake but not increase blood glucose concentrations or glucose clearance rate.

Decreased feed intake could be a result of decreased palatability due to the additional propionate in the LOW and HIGH trt.

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