

Effect of forage type on cecal and fecal fermentation parameters in the horse



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Introduction

- In order to support a healthy gastrointestinal tract and minimize digestive upsets horses should consume 2.0 to 3.0% of their BW/d in a long-stem forage.
- Microbial fermentation of these forages can provide 65 to 80% of a horse's daily energy requirements through production of VFA.
- Previous studies have not directly compared the effects of legumes and grasses on hindgut fermentation parameters of the horse

Objective

The purpose of this study was to evaluate the effect of forage type (legume vs grass) on fermentation parameters in the cecum and rectum of horses.

Materials and Methods

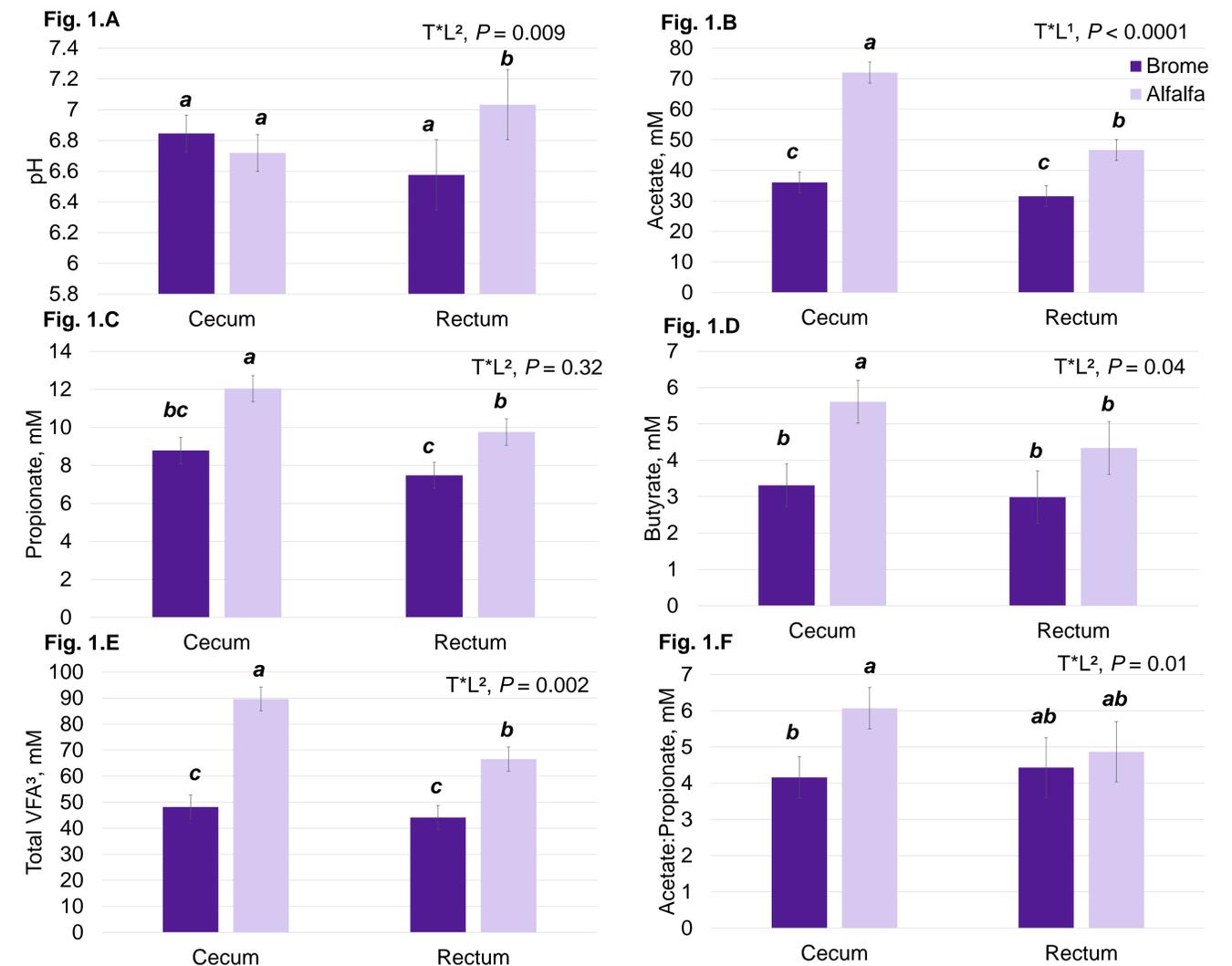
- Six cecally-cannulated horses (527 ± 56.6 kg BW; 12 ± 2.04 yr) were used in a crossover, split plot design with a whole plot treatment of *ad libitum* access to Smooth Bromegrass hay or alfalfa (Table 1). Subplots consisted of sampling hour and sampling location.
- Horses were housed in adjacent pens (21.6 x 22.6 m) each equipped with an automatic waterer, free choice feeder, and salt block.
- Study timeline consisted of a 21-d diet acclimation period followed by a 24-h collection period. Horses were then switched to their subsequent treatments and the protocol was repeated.
- Cecal and fecal samples were collected every 3-h during the collection period via gravity flow through a cecal fistula and rectal-grab, respectively. Cecal and fecal samples were strained through 4 layers of cheesecloth into 180-mL containers and pH was determined using a portable pH meter.
- From each strained sample, three 1-mL aliquots of fluid were transferred by pipette into microcentrifuge tubes containing 0.25 mL of 25% metaphosphoric acid (wt/vol). Volatile fatty acid concentrations were determined using an Agilent 7890 gas chromatograph.
- Data were analyzed utilizing the GLIMMIX procedure of SAS 9.4 (SAS Institute Inc., Cary, NC). Main effects and interactions between treatment and location on VFA concentrations and pH were determined and differences were defined at $P \leq 0.05$; a tendency was determined at $0.05 < P \leq 0.10$.

Table 1. Dietary composition (Dry Matter Basis)

Item	Smooth Bromegrass ¹	Alfalfa ¹
Dry matter, %	93.90	90.30
Crude protein, %	7.10	19.30
Crude fat, %	3.60	2.30
Neutral Detergent Fiber, %	62.30	47.20
Acid Detergent Fiber, %	38.90	38.70
Digestible Energy, Mcal/lb	0.99	0.94
Calcium, %	0.40	1.63
Phosphorus, %	0.10	0.29
Magnesium, %	0.12	0.22
Potassium, %	1.43	2.39
Iron, ppm	147.00	730.00
Zinc, ppm	11.00	24.00
Copper, ppm	5.00	10.00

¹Fed *ad libitum* to horses

Figure 1. Effect of forage type and sample location on pH and Volatile Fatty Acids¹



^{a-c} Bars with different letters differ from one another ($P \leq 0.05$).

¹Forage type (alfalfa or brome) was fed *ad libitum* to horses; sampling location includes the cecum or rectum

²T*L = Treatment by location interaction

³Total volatile fatty acid (VFA) concentration includes acetate, propionate, butyrate, isobutyrate, isovalerate, valerate, isocaproate, caproate, and heptanoate.

Results

- Acetate, propionate, butyrate, and total VFA concentrations were greater ($P < 0.05$) in both the cecum and rectum of alfalfa-fed horses compared to the cecum and rectum of brome-fed horses
- There was no effect ($P > 0.10$) of location on VFA concentration or pH in horses consuming brome. Horses consuming alfalfa had greater ($P < 0.05$) VFA concentration in the cecum compared to the rectum
- Fecal pH of alfalfa-fed horses was greater ($P < 0.05$) when compared to fecal pH of brome-fed horses and the cecal pH of alfalfa-fed horses
- Forage consumption did not vary by treatment ($P > 0.05$).

Conclusions

As expected, alfalfa provides greater VFA production when compared to brome. Alfalfa appears to be fermented more in the cecum while brome has more of an equal distribution between cecum and colon.