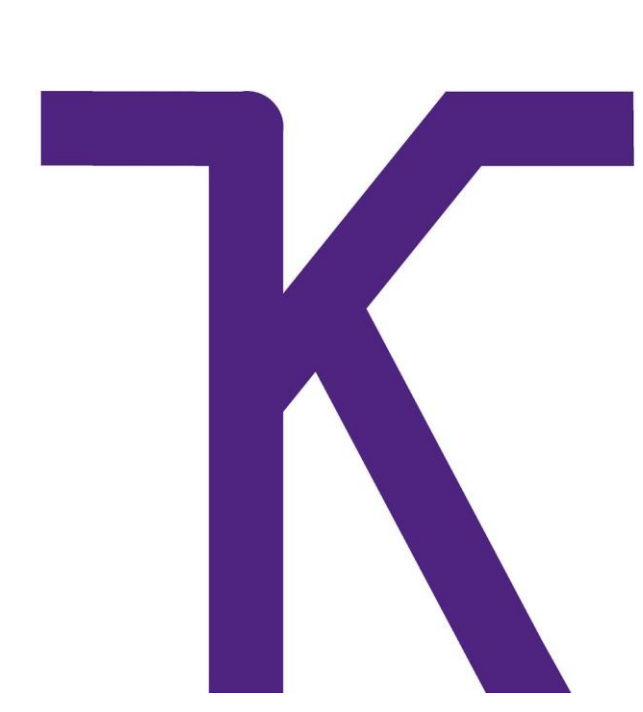




Effects of Protein Source on *In Vitro* Fermentation of Prairie Hay by Mixed Cecal Microorganisms

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Introduction

- Cecal microbes ferment structural carbohydrates, found in forages, to provide energy in the form of VFA to the horse.
- Similar to the host, these microorganisms require nitrogen for activity and growth.
- Previous research has shown that supplementing protein to ruminants consuming a low quality forage improves fiber digestibility.
- Similar results were observed in our lab when sodium caseinate increased the disappearance of NDF and ADF of native prairie hay using an equine cecal inoculum.
- It is unclear if other protein sources would provide a similar effect.

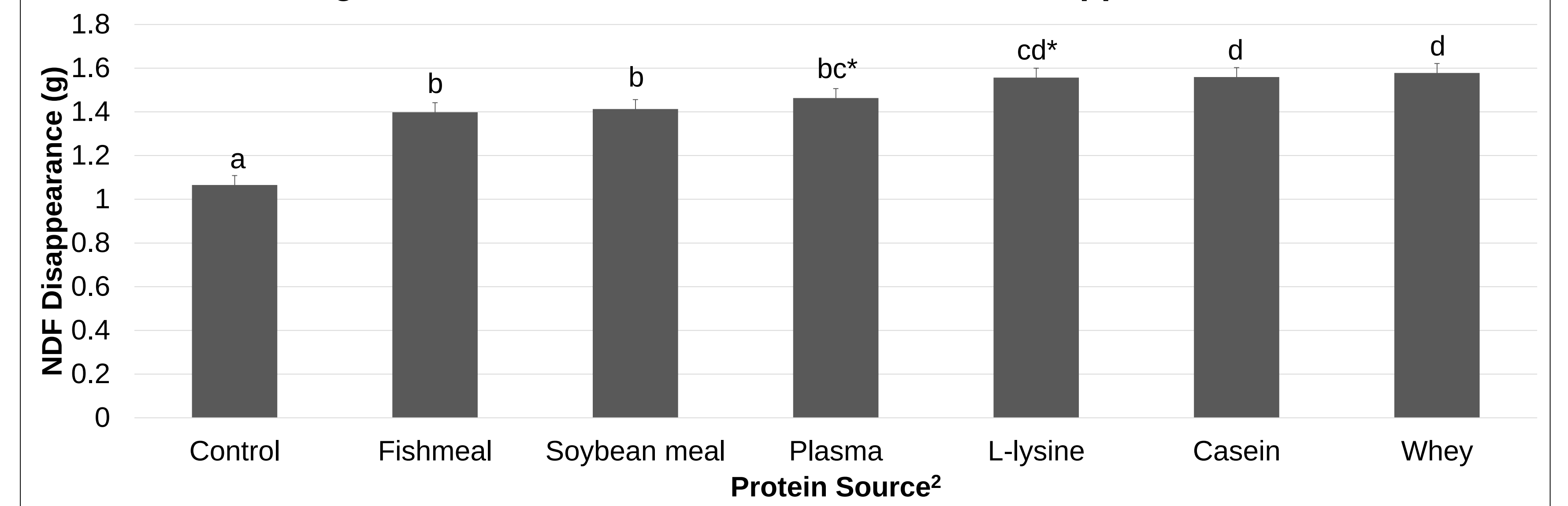
Objective

To determine the effect of common protein sources on the apparent disappearance of NDF and ADF in prairie hay using an equine cecal inoculum.

Materials and Methods

- Four cecally cannulated horses consuming an *ad libitum* diet of native prairie hay were used as donors of cecal fluid.
- Experimental design was a completely randomized design using protein source (control, casein, L-lysine, plasma, soybean meal, whey, and fishmeal) as the treatment with 4 replications (horse) per treatment. Each treatment supplied an additional 2.0% crude protein (DM). The control contained 0.2180 g cellulose to ensure iso-DM between treatments.
- Five g (DM) of prairie hay was added to 250-mL screw top fermentation flasks (#7056; ANKOM Technology, Macedon, NY) containing 140 mL of McDougall's buffer 7 h before addition of cecal inoculum to allow for substrate saturation.
- Ten milliliters of strained and stratified cecal fluid was added to each flask along with their respective treatment, sealed, and placed into a shaking incubator (New Brunswick Scientific Inc., New Brunswick, NJ) at 39°C with moderate agitation for 48 h. Bottles were removed from the incubator and exposed to oxygen to halt fermentation.
- After incubation, flask contents were dried and ground. Contents were then analyzed for NDF and ADF using an ANKOM A200 Fiber Analyzer according to the procedures outlined by Goering and van Soest (1970; ANKOM Technology Corp., Fairport, NY).
- Data were analyzed using the MIXED procedure of SAS (Version 9.4). The model included fixed effect of treatment (protein source) and the random effect of replicate (horse) to determine the least-squares means (LSMEANS). The experimental unit was fermentation flask. Significance was declared at $P < 0.05$, and a tendency was considered to be present when $0.10 > P > 0.05$. Differences among LSMEANS were determined using the PDiff option of SAS.

Figure 1. Effect of Protein Source on NDF Disappearance¹

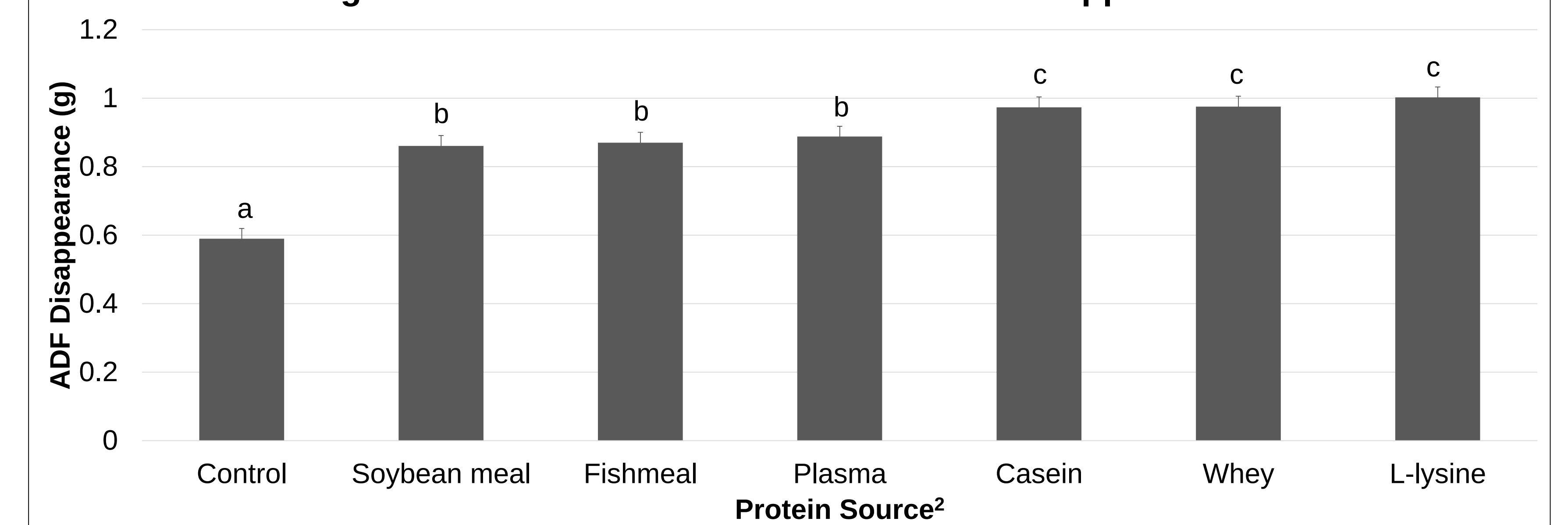


¹ Fermentation cultures containing 10 mL equine cecal fluid, 140 mL McDougall's buffer, and respective treatment were incubated at 39°C for 48 h.

² Treatments provided 2.0% supplemental crude protein (DM). Control contained 0.2180 g cellulose (DM).

^{a-d} Different letters among protein treatments differ significantly ($P < 0.05$). * Bars denoted with * differ with $0.10 > P > 0.05$.

Figure 2. Effect of Protein Source on ADF Disappearance¹



¹ Fermentation cultures containing 10 mL equine cecal fluid, 140 mL McDougall's buffer, and respective treatment were incubated at 39°C for 48 h.

² Treatments provided 2.0% supplemental crude protein (DM). Control contained 0.2180 g cellulose (DM).

^{a-c} Different letters among protein treatments differ significantly ($P < 0.05$).

Results

- All protein sources had greater ($P < 0.001$) NDF and ADF disappearance when compared to the control.
- Whey and casein had greater ($P < 0.05$) NDF disappearance when compared to control, fishmeal, and soybean meal.
- L-lysine, whey, and casein had greater ($P < 0.05$) ADF disappearance when compared to the other treatments.

Conclusions

- 2.0% supplemental crude protein increased NDF and ADF disappearance of a low quality hay in a mixed cecal fermentation culture when compared to the control.
- There was a direct relationship between protein solubility and fiber disappearance.
- Assessment of *in vivo* protein supplementation on fiber digestibility merits further investigation.