

Effect of iodochlorhydroxyquin on the large intestinal microbiota of horses

Mikaila Z. Smith¹, Aaron C. Ericsson², Lynn M. Martin¹, Kile S. Townsend¹, Philip J. Johnson¹

¹Departments of Veterinary Medicine and Surgery and ²Veterinary Pathobiology, College of Veterinary Medicine, University of Missouri

Abstract

Fecal Water Syndrome (FWS) is a condition in which incontinent fecal water contaminates the tail and legs and may cause dermatitis. Etiology is identified in only ~20% of horses affected with FWS and diarrhea in general. Colonic bacterial dysbiosis is presumed to play a role in both conditions. Whereas treatment with iodochlorhydroxyquin (IQ) is often helpful, its mechanism of action is unknown, especially regarding its effects on the colonic microbiota. Consequently, our objective is to investigate the effect of IQ on fecal bacterial microflora in healthy adult horses. We hypothesize that orally administered IQ treatment elicits changes in colonic microbiota that benefit fecal consistency in affected horses. Following 7 days of acclimation, 8 horses will be treated with IQ at a standard dose (10 g, PO, daily for 7 days). Feces will be obtained daily (frozen until analyzed as a batch) for DNA extraction and characterization of bacterial composition using next-generation sequencing (NGS) before, during, and for 7 days after discontinuation of treatment. Bacteria will be classified using NGS data based on specific amplicon sequence variant (ASV) designation. We do not anticipate adverse health effects or changes in stool consistency during the treatment of healthy horses with IQ. We expect that IQ treatment will cause alterations in specific bacterial communities of the colon and that there will also be an effect (on colonic bacteria) resulting from treatment discontinuation. Identification of bacterial populations that are affected (increased or decreased) by IQ treatment will help to inform broader studies (focused on specific taxa) in the future, especially pertaining to horses affected with FWS and diarrhea.

Introduction

- Fecal water syndrome (FWS), characterized by two distinct phases of defecation, including a liquid phase, is frustrating because it results in contamination of the skin of the pelvic limbs, dermatitis, discomfort while defecating, and sanitary concerns for owners.
- Proposed risk factors for FWS include dietary factors, dysbiosis, status within the herd, age, and gender.
- Colic and colitis are prevalent conditions with high mortality and a diagnosis is only achieved in ~20% of horses with diarrhea.
- Iodochlorhydroxyquin (IQ) is an antimicrobial with antiprotozoal properties that has been used for treatment of FWS and CD in horses for decades, but efficacy in these regards has not been studied extensively.
- It has been suggested that IQ may influence bacterial microflora in the large intestine helping to normalize fecal consistency.
- The objective of this project is to investigate the effects of IQ on the large intestinal bacterial microbiota through sequencing analysis.

Methods

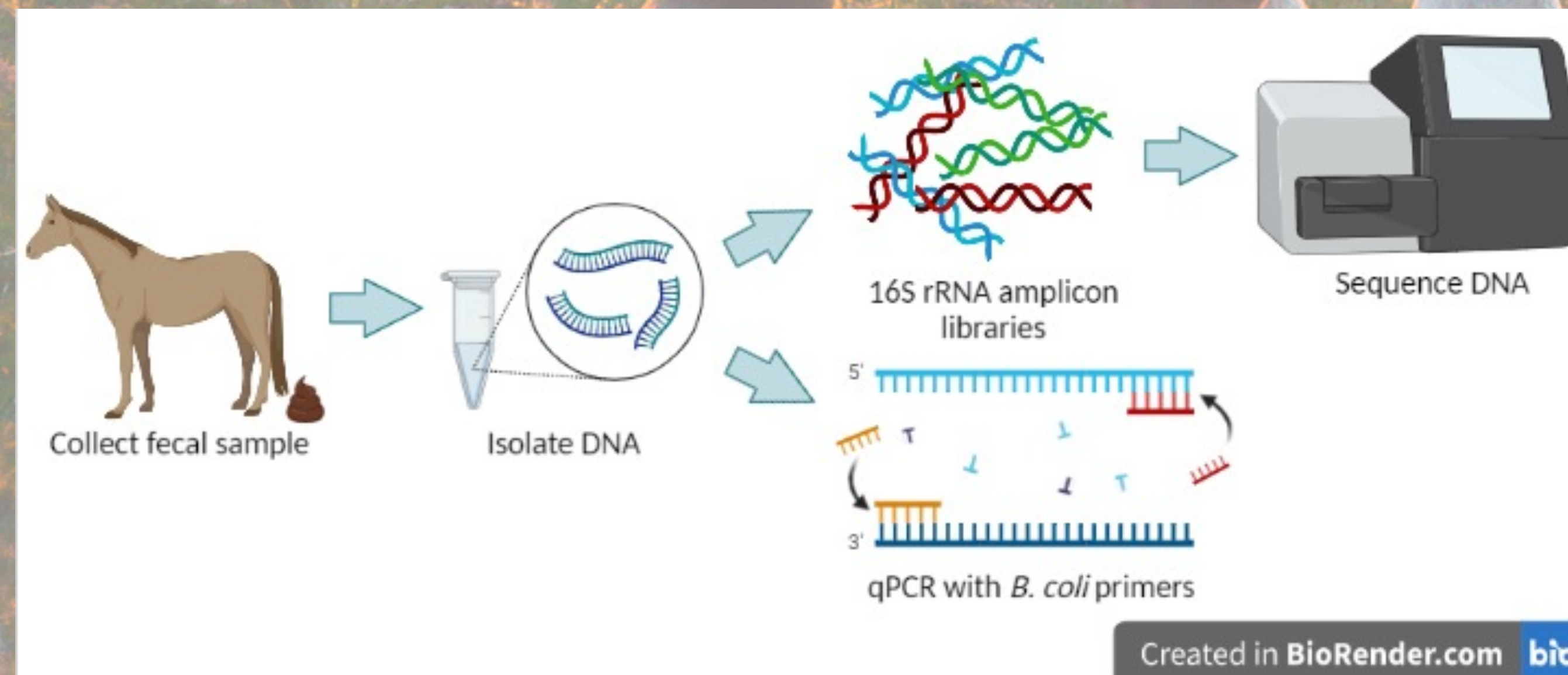


Figure 1. Process of DNA extraction

Colic and colitis often defy diagnosis

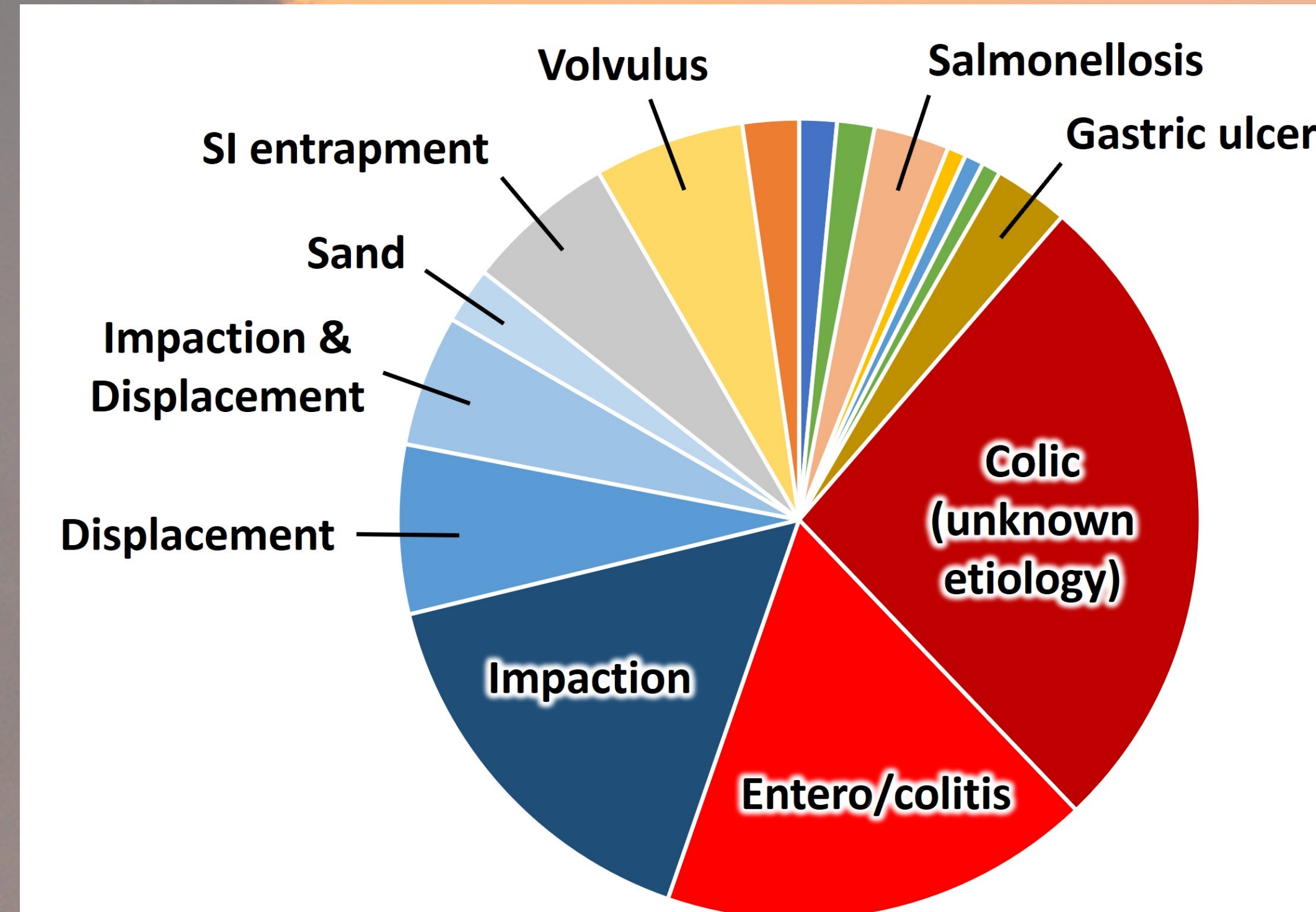


Figure 2. Pie chart showing diagnoses/etiologies identified in horses admitted to MU VHC Equine Clinic for colic (n = 136) from 2017 to 2019.

Variability in equine fecal microbiome pre- and post-removal from pasture

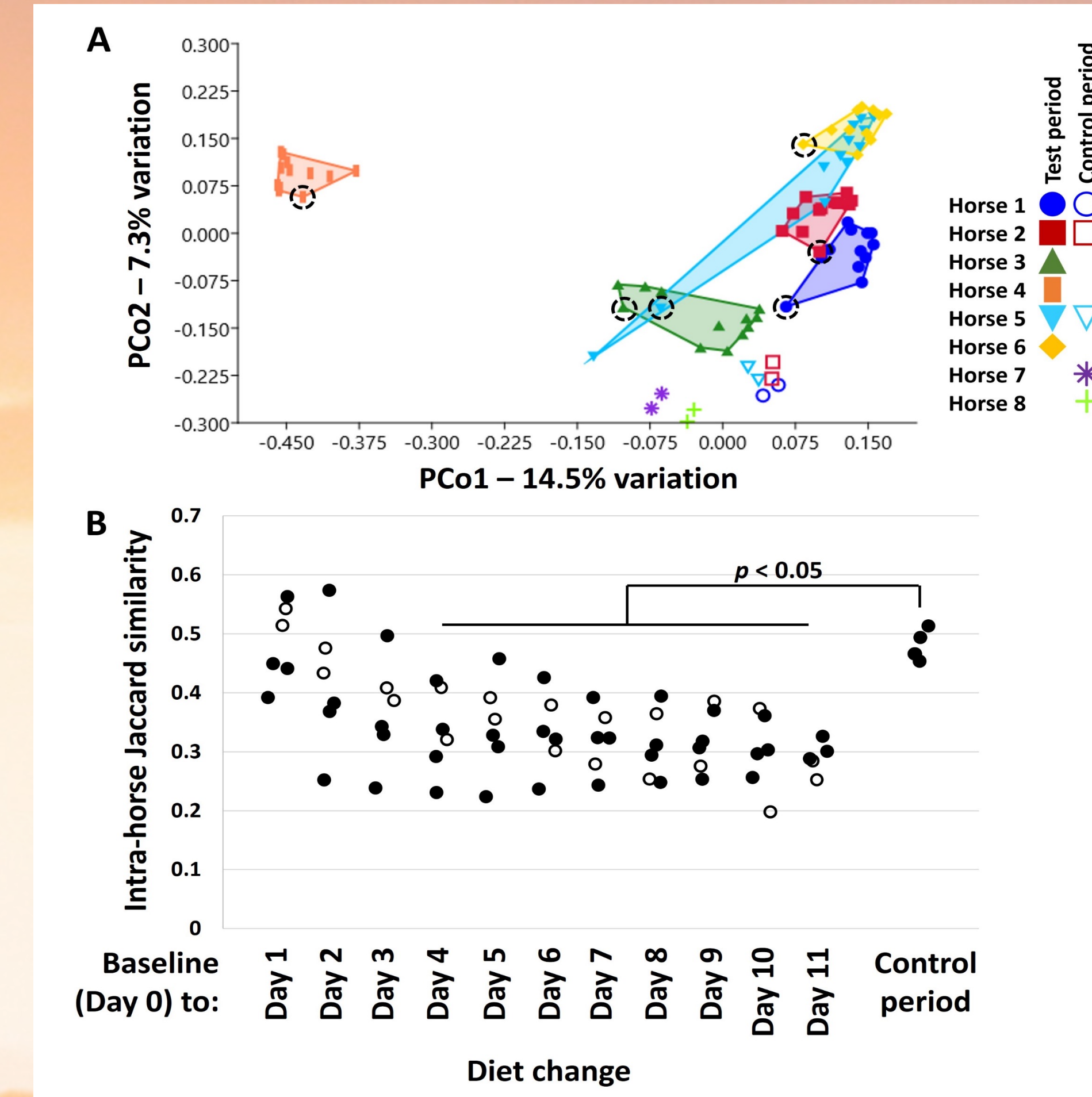


Figure 3. Inter-horse variability in the fecal microbiome of healthy horses and changes following removal from pasture. (A) Principal coordinate analysis (PCoA) based on fecal samples collected daily for 12 days from horses (n = 6) that moved on Day 0 (dashed line circles) from pasture to indoor stalls and fecal samples collected 8 days apart from 5 horses that remained on pasture (controls). (B) Dot plot showing intra-horse similarity between baseline (Day 0) and days in the barn (all-hay diet) (n = 6).

Alterations in fecal microbiome in individual horses over 12 days following removal from pasture

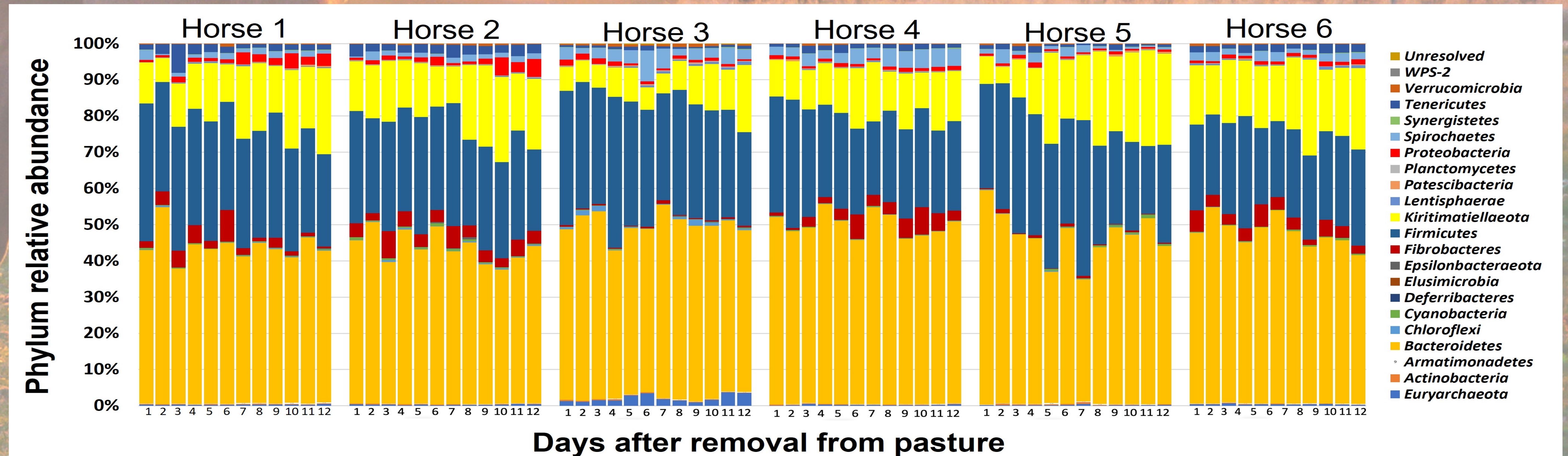


Figure 4. Alterations at the phylum level of the microbiome in individual horses over time following removal from pasture and change in diet (switched to an all-hay diet). Certain phyla of bacteria decreased over time as others increased. Predominant modifications occurred between days 0 and 4.

Expected Outcome

Detection of differences in the abundance of certain taxa and the global community structure of the microbiome may be attributed to the effects of iodochlorhydroxyquin. If there is no significant change in the bacterial component of the microbiome, we will investigate drug action on the protozoal component.

Acknowledgements

Funding was provided by the University of Missouri College of Veterinary Medicine Office of Research and the Animal Health Foundation of St. Louis. We also acknowledge Rebecca Dorfmeier for her help with the project. Figure: Ericsson AC, Johnson PJ, Gieche LM, Zobrist C, Bucy K, Townsend KS, Martin LM, LaCarrubba AM. The Influence of Diet Change and Oral Metformin on Blood Glucose Regulation and the Fecal Microbiota of Healthy Horses. *Animals* 2021, 11, 976. <https://doi.org/10.3390/ani11040976>